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NEGATIVE INTEREST RATE POLICIES— INITIAL EXPERIENCES AND ASSESSMENTS

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NEGATIVE INTEREST RATE POLICIES—INITIAL EXPERIENCES AND ASSESSMENTS

EXECUTIVE SUMMARY

The depth of the crisis and the weakness of the ensuing recovery led to new ways to implement monetary policy. At the onset of the crisis, central banks in several advanced economies quickly moved policy rates to zero and initiated large-scale asset purchases. In more recent years, with inflation still below target and limited support from fiscal policy, several central banks lowered their policy rates below the previous zero lower bound, embarking on so-called negative interest rate policies (NIRPs).

This paper explores the implications of NIRPs for monetary policy transmission and banks' behavior. It considers potential differences between interest rate cuts in positive versus negative territory on deposit and lending rates, as well as banks' interest rate margins and profitability, and market functioning. The paper focuses on the bank transmission channel, where differences between positive and negative policy rates could arise. Finally, the paper reviews cross-country experiences through case studies.

Experience is limited, but so far NIRPs appear to have had positive, albeit likely small, effects on domestic monetary conditions, with no major internal side effects on bank profits, payment systems, and market functioning. There is some evidence of declines in loan and bond rates associated with NIRPs. Banks' profit margins have been mostly unchanged, with no notable shifts to physical cash.

Though relatively effective, practical limits to pushing policy rates further down are likely to emerge. When rates approach the point at which most agents switch into cash, further cuts will become ineffective, or counterproductive if they hinder financial intermediation. Also, should rates remain negative for prolonged periods, markets could develop mechanisms to reduce the costs associated with switching to cash. Pressures could then grow on banks' business models, profits and charter values, with negative consequences for financial stability.

Monetary policy should thus be complemented by other policies to support recoveries. In principle, the "effective lower bound" could be reduced through reforms aimed at lowering the nominal yield on cash holdings. But these are untested and politically controversial. Thus, a lower bound constraint continues to exist on policy interest rates; finding means to avoid hitting it in the future remain relevant. Other policies—fiscal policy, structural and financial sector reforms—should pick up some of the burden that since the crisis has rested almost exclusively on monetary policy.

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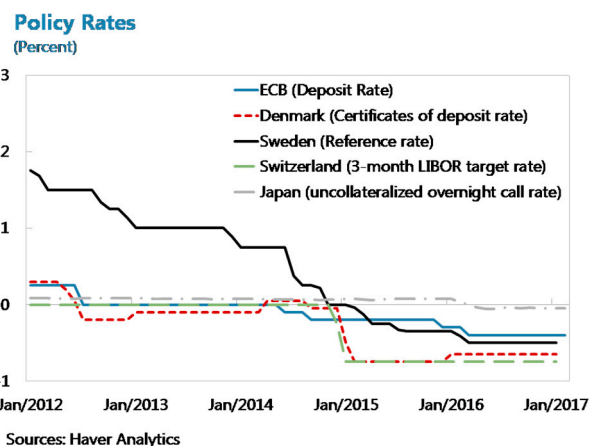
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INTRODUCTION

1. The depth of the crisis and the weakness of the ensuing recovery have seen monetary policy implemented in new ways.

In several advanced economies, central banks quickly moved policy rates to zero (the so-called zero lower bound, or ZLB) and initiated large-scale asset purchases, dubbed quantitative easing (QE); in some cases including purchases of private assets, such as corporate bonds, asset backed securities, and equities. Fiscal policy was at first expansionary but then settled into consolidation mode where it has remained, in many countries, for most of the post crisis period.



2. Seven central banks have recently lowered policy rates below zero. With inflation remaining below target and little appetite for coordinated fiscal expansions, central banks in Bulgaria, Denmark, the euro area, Hungary, Japan, Sweden, and Switzerland have all adopted (with different stated motivations) a negative interest rate policy (NIRP). These moves have been testing the effective lower bound for policy rates and pose difficult evaluation challenges. Existing models do not provide much guidance. In standard calibrated models, sufficiently low rates can always deliver full employment. Yet, these models focus on real interest rates and abstract from the limit physical cash may impose on nominal rates. More recent models point to potential negative side effects of NIRPs or more generally low policy rates in the form of reduced banks' profitability and charter value (Brunnermeier and Koby, 2016). But these models are still untested and lack the calibration of traditional macro models. The relative shortage of clear theoretical guidance is compounded by the fact that there is little past experience to provide guidance. Empirical investigation has been limited so far. Bech and Malkhozov (2016) is one exception, detecting no change in the transmission of negative rates to money market and other market rates, and little effect on deposit and mortgage rates. An assessment of countries' experiences so far can therefore provide significant value added to policy analysis.

3. In this paper, we analyze the implications of NIRPs for monetary policy transmission and banks' behavior, with some discussion of financial market implications.¹ We begin with some theoretical considerations, used to lay out the hypotheses of interest. We consider potential differences between interest rate cuts in positive versus negative territory in terms of their impact on money market and bond rates, deposit and lending rates, exchange rates, as well as on banks' interest rate margins and profitability. A major focus of the note is on the bank transmission channel. We also briefly discuss the implications of NIRPs for market functioning and non-bank

¹ For an earlier set of considerations see Viñals and others (2016) "The Broader View: The Positive Effects of Negative Nominal Interest Rates": <https://blog-imfdirect.imf.org/2016/04/10/the-broader-view-the-positive-effects-of-negative-nominal-interest-rates/>.

financial institutions. Lastly, we evaluate these theoretical predictions by reviewing evidence from detailed country-case studies.² Econometric evaluations of the transmission of policy rate cuts in negative territory at the current juncture are complicated by the lack of data: events are few (each country has cut rates below zero two or four times at most); and publicly available data on bank lending rates and profits are infrequent and limited. Further, rate cuts often coincided with other announcements, regarding asset purchases or foreign exchange interventions, making it difficult to isolate the effects of NIRPs.³ Note that we limit analysis in this paper to the effects of negative interest rates on reserves. However, negative central bank's lending rates are briefly discussed in Annex III.

4. So far, NIRPs have facilitated some easing of financial conditions, with limited side effects. There is some evidence of a decline in loan and bond rates following the implementation of NIRPs. Banks' profit margins have remained mostly unchanged. And there have not been significant shifts to physical cash. That said, deeper cuts are likely to entail diminishing returns, as interest rates reach their "true" lower bound (at which point agents shift into cash holdings). And pressure on banks may prove greater; especially in systems with larger shares of indexed loans and where banks compete more directly with bond markets and non-bank credit providers.

5. On balance, the limits to NIRPs point to the need to rely more on fiscal policy, structural reforms, and financial sector policies to stimulate aggregate demand, safeguard financial stability, and strengthen monetary policy transmission. Other unconventional monetary policy measures can also complement the overall policy mix, to the extent they remain effective. While NIRPs should, all else equal, support demand in a similar manner to conventional monetary policy easing, transmission through the financial sector may be less effective. Indeed, there are practical limits to pushing policy rates much further below zero, such as the difficulty to pass on negative policy rates to deposit rates due to the potential for switches to cash. Policy room could be increased through reforms aimed at lowering the nominal yield on cash holdings. But these are untested and politically controversial.

THEORETICAL AND OPERATIONAL PERSPECTIVES

The basic question is why interest rate cuts might have a different effect on banks and asset prices, the monetary policy transmission mechanism, and eventually output when they occur in negative as opposed to positive territory. One key asymmetry is associated with the role of cash. The existence of physical cash establishes an "effective lower bound" for interest rates which may compress intermediation margins and hinder the transmission mechanism.

² A discussion of the effectiveness of monetary policy when policy interest rates are very low but still positive, including of unconventional monetary policies, and of their domestic and cross-border side-effects, can be found in IMF 2013a and 2013b.

³ A thorough analysis of spillovers is all the more difficult, as only two of the countries engaged in NIRPs are of systemic proportions (euro area and Japan).

A. What are the effects of conventional interest rate cuts in positive territory?

6. A policy rate cut in positive territory has well known effects on interest rates, including a similar reduction in bank deposit and lending rates. Commercial banks can obtain cheaper short-term funding from the central bank. And competition among banks normally leads them to pass on these lower costs to their clients, through lower lending rates. When the central bank signals further rate cuts—arguably a more powerful channel than a one-off interest rate cut—then short to medium-term bonds also get repriced at lower rates. This induces further competition amongst banks to lower lending rates, to the extent capital markets and retail lending are not entirely segmented. These effects are compounded by the incentive of banks and other investors to rebalance the asset side of their portfolios away from short-maturity liquid assets with lower returns, towards loans and longer-maturity (and riskier) domestic or foreign assets. In turn, this further lowers lending rates, and bond yields, and puts pressure on the exchange rate. In addition, lower policy rates improve the wealth and cash flows of potential borrowers, making these more creditworthy and requiring lower risk premia on loans. The same channel affects the liability side of banks, which pay lower risk premia on uninsured funding, thereby increasing pressure to reduce lending rates. Moreover, banks typically reduce rates on insured deposits, in part due to competition from wholesale funding, and in part to support margins in reaction to lower lending rates.⁴

7. In theory, monetary accommodation at positive rates has ambiguous effects on bank profitability. Banks are risk and maturity transformers that typically issue short-term and relatively safe liabilities and invest in longer-term and riskier assets.⁵ Then, policy-rate cuts will tend to reduce lending margins to the extent that they flatten the yield curve and lower term and risk premia. But they will support profitability to the extent that they stimulate aggregate demand, improve the creditworthiness of borrowers, and lower provisioning needs. Further, banks should incur capital gains from the repricing of assets on their portfolio (although this is a transitional effect). This second set of effects may well offset the first.

8. Existing empirical evidence—outside periods of negative rates—underscores the ambiguous effect of a cut in policy rates on bank profitability. While in the long-run a positive relationship between interest rates and bank profitability seems to exist,⁶ in the short-run the relationship can be negative owing to repricing frictions faced by banks.⁷ Further, some of these

⁴ For further discussion, see Stiglitz and Weiss, 1981; Mishkin, 1995; Bernanke, Gertler, Gilchrist, 1999; Kashyap and Stein, 2000; Van den Heuvel, 2002; Ireland, 2005; and for a particularly clear exposition of the bank lending channel, Bernanke, 2007.

⁵ The presence of a safety net and, in particular, deposit insurance gives banks a comparative advantage in transforming demand deposit into longer term assets.

⁶ Alessandri and Nelson (2015), Borio and others (2015), Busch and Memmel (2015), and Genay and Podjasek (2014). Other studies like Demirguc-Kunt and Huizinga (1999), Albertazzi and Gambacorta (2009), and Bolt et al (2012) investigate the relation between macroeconomic conditions and bank profits. While the focus of these studies is not on the link with interest rates, they all find that bank margins improve as interest rates rise.

⁷ Alessandri and Nelson as well as Busch and Memmel (2015). The short-run relationship is not necessarily negative, such as for banks with a very large share of flexible rate loans.

results should be interpreted with caution due to concerns about endogeneity.⁸ First, the monetary policy stance cannot be assumed to be completely exogenous to banks' performance, since financial sector stability is also a concern for central banks. Second, any correlation between interest rates and bank profits could be driven by the economic cycle and this is typically challenging to adequately control for in empirical analysis. Third, many of the bank characteristics included as controls in empirical analysis—such as bank capital, credit growth, or bank size—are impacted by bank profits.

B. What is special about negative policy interest rates for transmission?

9. From a theoretical perspective, there would be nothing special about negative nominal interest rates in a cashless economy. Real interest rates would be all that matter. And even after the nominal policy rate turned negative, further cuts would translate into lower money market and bond yields; the wealth, and potentially cash flows, of households, firms and banks would improve; and the exchange rate would depreciate. As a result, investment, exports, and to some extent consumption, should increase.

10. Things change once cash is introduced into the framework for analysis. When the nominal interest rate on safe assets turns negative, holding cash becomes attractive. Cash has a fixed zero gross nominal rate of return. And, while it is true that there are costs and inefficiencies associated with holding large amounts of cash in the form of banknotes, these are bounded. It follows that an effective lower bound on interest rates should exist at which agents switch their holdings into cash, making further interest cuts ineffective. Further, even before rates hit this threshold, financial frictions imply that the monetary policy transmission may be altered as the nominal policy rate approaches zero.

11. In particular, several observers have expressed the concern that NIRPs may undermine financial stability and hinder monetary policy transmission. These concerns hinge on three claims: that deposit rates cannot follow policy rates into negative territory; that if deposit rates hit a floor at zero, but lending rates decrease along with policy rates, bank margins will get squeezed; and, consequently, that banks will reduce lending to protect their capital ratios. We examine each of these claims in turn.

C. Can deposit rates go negative?

12. A first question to ask is why deposit rates would go negative. A negative policy rate implies lower returns on banks' reserves held at the central bank (the outside option for banks to invest their assets). If competition from other banks, non-bank credit providers, and credit markets is sufficient, then lending rates should come down. If so, banks would attempt to decrease deposit rates to support margins (see Drechsler and others, 2016, for a discussion of the link between deposit rates and policy rates). However, banks could also seek other means to offset the decline in

⁸ The majority of these studies try to deal with endogeneity concerns by estimating dynamic GMM models a la Arellano and Bond (1991) and Arellano and Bover (1995) and in some cases directly assume that macro conditions are exogenous.

lending rates and implied compression of margins, such as through fees and commissions (more below).

13. A barrier to the transmission of NIRPs to deposit rates is the potential for large cash withdrawals from banks. Cash, as discussed above, offers a zero gross rate of return but its net rate of return could be higher than the return on deposits, if the latter were negative. In theory, several measures could be introduced to impose a de facto negative return on cash holdings, but these are untested and would likely be controversial given their costs (Box 1). Storing, moving, and insuring cash entails non-negligible costs making the net return on cash holdings negative (some costs will be fixed, others variable, depending on the amount of cash stored). Costs are likely to vary across different types of agents depending on cash balances and liquidity needs. Depositors with larger balances and those with more frequent payment needs (such as larger corporations as opposed to households) are likely to tolerate lower rates, as the costs associated with switching to cash grow non linearly (at least initially) with the size and frequency of transactions. Thus, in theory, deposit rates may need to be sufficiently negative, or be expected to remain negative for long, before large-scale switching into cash becomes optimal, at least for some agents (see Annex II for a discussion of the theoretical tipping point at which a move into cash would become worthwhile).

14. But in practice, there are multiple reasons for banks to be wary of imposing negative rates on deposits. First, while the above reasoning would predict a gradual shift to cash as deposit rates are cut, the behavior of agents is hard to predict; non-linear effects on cash withdrawals cannot be ruled out. To avoid risks of a negative impact on banking system liquidity and stability,⁹ banks may be reluctant to pass on negative policy rates to depositors. Second, banks might hesitate to introduce negative rates on deposits, because of market share and reputational concerns. Even moderately negative deposit rates might be considered as taxing savers and generate controversy. More broadly, the first bank to charge negative deposit rates risks losing clients to other banks. Thus, again, competition between banks plays an important role. Banks that face weaker competition for deposits should find it easier to charge negative rates. The same is true of banks that cater to large clients with frequent payment needs (and thus with higher costs of switching to cash, as discussed above). Indeed, the evidence reviewed later reveals some evidence that large institutional clients have been charged negative deposit rates. Were policy rates to remain negative over a longer period, or lowered further, pressure to support profitability could induce larger sections of the banking sector to lower deposit rates below zero. But even in such a case, the cost of switching to cash would continue to determine the effective lower bound.

⁹ Even slightly negative deposit rates may generate a reduction in bank deposits, as households and firms have an incentive to substitute into financial and real assets. However, these effects are at play even under positive rate cuts. Moreover, their effect to boost asset prices and stimulate aggregate demand would be in line with policy objectives of bringing inflation to target.

Box 1. Proposals to Break Through the Zero Lower Bound

The problem with cash—as seen from the perspective of central banks wanting to push policy rates below zero—is that it offers a gross zero nominal rate of return. This is not attractive as an alternative investment, except when all other safe, liquid assets yield negative returns. Then, if banks offered sufficiently negative rates on deposits, over and above cash storage costs (discussed above), clients would simply withdraw their funds and hold cash instead. Similarly, banks may start increasing vault cash holdings rather than holding reserves at the central bank. Monetary policy therefore cannot provide accommodation beyond a certain point.

Things would be different if returns on cash were also negative. Then, in principle, central banks could lower policy rates well below zero. Two broad approaches have been proposed to lower returns on cash: one imposing a cost of holding cash (negative dividend yield), and the other engineering a depreciation of cash (negative capital gains).

Gesell (1906), and, later, Goodfriend (2000), argued for bank notes to be periodically validated by the government, or central bank. Without an official stamp, notes would not be considered legal tender. This would allow the government to withdraw a fraction of notes from circulation each month, thereby imposing a cost on holding cash deposits. These approaches have rarely been adopted—outside of periods of very high inflation--on a large scale due to significant implementation hurdles and possible side-effects.

Eisler (1932), instead, introduced the idea of a depreciation rate between cash and central-bank reserves, or electronic money, which would become the unit of account (“bank money”—as Eisler originally called it). The proposal was later refined by Buiters (2009), Kimball (2015), Agarwal and Kimball (2015), and Goodfriend (2016). The depreciation rate would be set so as to replicate the intended negative policy rate.

Approaches differ somewhat on how to operationalize the rate of depreciation. Agarwal and Kimball (2015), for instance, suggest the central bank charge a time-varying deposit fee at its cash window—the facility through which the central bank and commercial banks interact to bring cash in and out of circulation. To the extent banks pass-on this fee to their clients, holding cash would become just as expensive as holding deposits with a negative remuneration rate.

Proponents of this approach argue it would be more politically acceptable than other solutions. Households and firms could continue using cash as legal tender, while paying in the same currency, and the same prices, as before. The policy requires no additional regulation or quantity constraints. Some even argue that similar approaches have been used in the past with success, such as when the gold standard was abandoned—after which local currency no longer traded at par with gold.

Some argue that an important benefit of this approach is the preservation of cash. Though some economies are relatively advanced in their ability to transact electronically, the outright abolition of cash would be highly controversial, leaving some unable or unwilling to transact, and would generate privacy concerns. Not all share this opinion and some have touted the advantages of moving to a cashless economy, not only to pave the way for negative policy rates, but to combat crime and tax evasion (Rogoff, 2014, Yglesias, 2011, and Kaminska, 2009, 2013, 2014). For now, however, breaking through the zero lower bound would likely require an approach in which cash would continue playing a role.

D. If deposit rates remain positive, what would be the effect on bank profitability?

15. Profitability may not be hurt if lending rates remain high. If new loans are priced at lower rates, and deposit rates remain unchanged, banks would face lower intermediation margins. However, banks could support margins by keeping lending rates unchanged. In principle, if lower policy rates do not translate into lower rates on bank liabilities, they might not be passed-through on the rates on their assets either. If this were the case, interest rate margins would be preserved. However, in this case the transmission mechanism of monetary policy would be undermined.

16. Intermediation spreads could be under pressure under certain conditions. Banks may not be able to keep lending rates unchanged. The extent to which they can do so depends on several factors. First, much depends on the contractual details of existing loans, in particular their maturity and degree of interest rate indexation. The shorter the maturity, and the higher the share of flexible rate loans, the more NIRPs may weigh on profits. Second, the degree of competition in loan markets matters; including through potential competition from bond markets. This depends on regulation, the extent to which borrowers are unwilling to move away from existing banking relationships due to brand allegiance or the availability of complementary financial services, and the proprietary information banks accumulate about their customers (allowing them to offer cheaper or more tailored lending options). Third, heterogeneity in funding costs among competing banks may play an important role. If some banks have lower funding costs, or the means to weather losses for longer, they might find it profitable to undercut lending rates in order to gain market share from higher cost banks. Bank liability costs may vary with the composition of funding. For instance, intermediaries that rely more heavily on corporate paper and other wholesale funding sources (whose cost is more likely drop along with policy rates) are more likely to benefit from lower rates than lenders that rely primarily on retail deposits (typically smaller banks). Regulation may also contribute to heterogeneous funding costs; for instance, through different shares of insured deposits. It is then possible that under these conditions banks would lose market share to alternative forms of financial intermediation that rely less heavily on retail funds. In the end, the net effect on the quantity and cost of funds intermediated to the real sector is ambiguous.

17. But even with lower intermediation spreads, banks have other means to support profits. Banks can cut costs, reduce provisioning costs thanks to lower policy rates, increase lending volumes (to the extent this helps cover fixed costs of operation), and charge fees and commissions as a means to bolster profits. For instance, a 5 euro per month fee on a 60,000 euro account is equivalent to 10 bps on deposit interest rates (higher for smaller accounts). However, banks' ability to raise fees and commissions to counter lower lending margins could be curtailed by explicit government regulation (consumer protections acts, for instance). Further, while fees may be less obvious to consumers and hence and less initially controversial than outright negative deposit rates, there still will be a level at which agents would find it optimal to switch to physical cash holdings.

18. The design of NIRPs can also affect bank profitability. The direct impact on bank profits depends on the share of bank assets held as reserves at the central bank. For instance, for every

10 percent of bank assets held as central bank reserves, a charge of 100 basis points would have a direct impact on the overall returns on bank assets of about 0.1 percent. In practice, the share of bank assets held as central bank reserves varies significantly by country. In Japan and Switzerland, shares were around 16 and 14 percent, respectively, in 2016. However, in Denmark, they were just below 3 percent on average. In Denmark, Japan and Switzerland, the central banks have attempted to attenuate the direct impact on bank profits by having a “tiering” system, whereby only a fraction of total reserves held at the central bank are charged the negative policy rate.

19. On balance, the impact of NIRPs on bank profitability may be similar to that of other unconventional policies such as QE and forward guidance. As discussed in Box 2, both policies should support bank profitability by boosting asset prices and strengthening the economic outlook. Borrower creditworthiness should improve, and banks should profit from capital gains and stronger balance sheets. And, as discussed above, both NIRPs and QE can lead to an erosion of intermediation margins, as they exert pressure on lending rates while banks are reluctant to impose negative rates on deposits. Finally, NIRPs and QE (and forward guidance, in particular) can both reduce profits from maturity transformation, by reducing term premia and flattening the yield curve. From this standpoint, a comparison of yield curve effects in the short run in a couple of country cases suggests that NIRPs in these particular situations have affected maturity transformation margins to a lesser extent than QE (Box 2). However, in the absence of empirical evidence on other effects via valuation changes, impact on demand, and intermediation margins of NIRPs vs QE, it is difficult to compare the overall impact of these two policies on bank profitability.

E. If bank profitability declines, what would be the effects on lending rates and volumes?

20. Recent models suggest that a sufficiently large compression in profitability could curb bank lending by interacting with binding leverage constraints. In these frameworks (e.g. Brunnermeier and Koby 2016), lower policy rates (even before they turn negative) compress intermediation margins, as lending rates drop whilst on the liability side banks face a ZLB on deposit rates. In turn, this compression in profitability leads to a reduction in a bank’s capital. And if this reduction pushes capital to its regulatory limit or to the point at which it would be difficult for the bank to access wholesale funding markets, the bank might choose to curb lending supply, as opposed to raise costly equity.

21. However, a system-wide compression of lending is harder to fathom. As discussed earlier, pressure on the profits of certain banks would typically come from competition from lower cost banks and non-bank lenders, as well as capital markets. This competition also means that if high-cost banks curtail lending, other players should be able to pick up the slack. In the end, credit supply to the economy as a whole should remain relatively stable. Alternatively, intermediation margins would compress automatically if indexed loans represent large shares of bank portfolios. Absent these factors, banks should be able to maintain lending rates unchanged. This will not favor lending (undermining monetary policy transmission), but should not cause a reversal of lending. This also means that it is difficult to construct a case where monetary policy transmission is perverse, and in which system-wide financial stability is severely undermined.

Box 2. Monetary Accommodation and Bank Profitability: NIRPs versus QE

This box compares the effects of Negative Interest Rate Policies (NIRPs) and Quantitative Easing (QE) on bank profitability. Bank profitability depends on four main factors. First, banks earn profits by performing maturity transformation, i.e. by obtaining short-term funding (in particular, deposits) while lending and investing at longer maturities with higher rates. Second, they pool and transform credit risk and hence can earn profits by charging intermediation margins between deposit and lending rates at any given maturity. Third, profits are affected by valuation changes on the assets held in banks' portfolios. Fourth, bank profitability depends on the strength of the economy, which in turn impacts loan demand and borrowers' repayment capacity. Here, we consider how NIRPs and QE affect each of these aspects.

On the one hand, both NIRPs and QE support bank profitability as they tend to boost asset prices and strengthen macroeconomic conditions. By reducing yields at various maturities, both policies lead to higher bond prices and positive valuation gains on the banks' holdings of government bonds. This effect appears to have been particularly important in the euro area (see Andrade et al., 2016). The relative price impact of these two policies is difficult to measure. For instance, to the extent that QE concentrates on the purchase of long-term securities, if the two policies were to obtain the same reduction in short-term yields, QE would likely have to have stronger price effects on long term assets. The opposite would be true if the objective were to achieve a reduction in long-term rates. Furthermore, both NIRPs and QE aim to provide monetary stimulus once short-term policy rates have been lowered to zero. As is the case with any monetary stimulus, the beneficial macroeconomic effects from these policies also strengthen the repayment capacity of households and firms, thus reducing NPLs and increasing recovery values. In addition, better growth prospects are associated with higher investment and loan demand by firms.

On the other hand, NIRPs and QE may reduce bank profitability by squeezing intermediation margins when retail deposit rates cannot become negative. Conventional policy rate cuts in positive territory tend to generate a proportional reduction in both lending and deposit rates, thus preserving banks' intermediation margins. However, as QE compresses bond yields towards zero and NIRPs lowers policy rates into negative territory, banks seem reluctant to charge negative interest rates on deposits, presumably because they fear large cash withdrawals. This can reduce intermediation margins and possibly significantly affect bank profitability, even though banks have tried to offset these effects by increasing fees (Couré, 2016). Furthermore, to the extent that lower interest rates through NIRPs or QE compress risk premia, they may reduce the demand for credit transformation and hence bank margins.

Furthermore, QE can substantively erode bank profits from maturity transformation in the short-run. These profits depend on the size of term premia, i.e. the excess returns that can be earned by investing in long-term assets rather than rolling over the same short-term investment. By purchasing government bonds at medium-to-long maturities, QE tends to flatten the yield curve and compress term premia.¹ A similar reduction in term premia may also result from forward guidance. By reducing the uncertainty associated with the future path of interest rates, forward guidance tends indeed to reduce the term premia that investors demand to hold fixed-income assets with medium-to-long maturity.

The profits from maturity transformation may also be reduced by NIRPs in the short-run, but to a lesser extent. While QE tends to flatten the yield curve initially, NIRPs tends to generate a downward shift of the entire

¹This effect is well understood in the short run, see for instance Gagnon et al. (2011) for the case of Large Scale Asset Purchases (LSAPs), and Swanson (2016) for the case of both LSAPs and forward guidance in the United States. For an international comparison, see Andrade et al. (2016). However, it is possible that the yield curve steepens again if QE policies are perceived as being successful in increasing growth and inflation expectations.

Box 2. Monetary Accommodation and Bank Profitability: NIRPs versus QE (Concluded)

yield curve that is likely to have a more muted effect on term premia. Figure 1 shows indeed that the adoption of NIRPs in Switzerland and Denmark led to a reduction of government bond yields across all maturities, if anything supporting a mild steepening of the yield curve (see also the case of Sweden discussed under country cases). Therefore, in principle, NIRPs may leave the maturity transformation margins unaffected. In practice, banks might be unable to fully lower their short-term funding costs in line with negative policy rates. While borrowing rates on the interbank market have followed policy rates into negative territory, banks have been reluctant to pass negative rates to their retail depositors. This incomplete pass-through may lead to some reduction in the earnings from maturity transformation under NIRPs.

Box 2. Figure 1. Yield Curve Movements Around NIRP Announcements

Figure 1A. Switzerland: Yield Curve

(1 month before and after NIRP announcement on Dec 18, 2014)

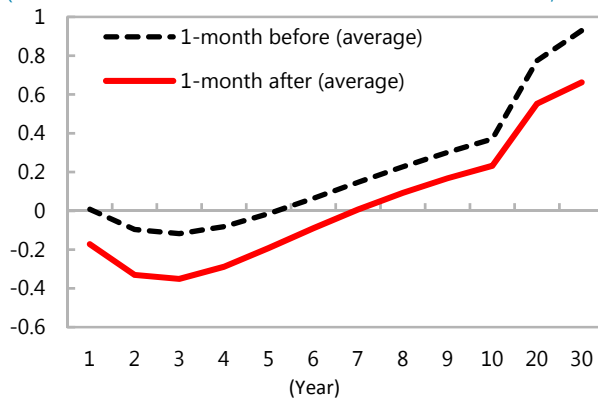
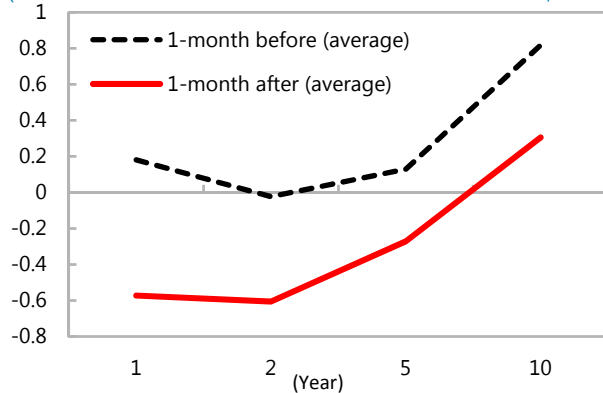


Figure 1B. Denmark: Yield Curve

(1 month before and after NIRP announcement on Jan 20, 2015)



Sources: Haver Analytics, IMF staff calculations

22. It is also unlikely that banks would raise lending rates to compensate for the cost of holding reserves at negative rates alone. First, reserves tend to be a relatively small percentage of bank balance sheets so the direct cost of NIRPs tend to be small as discussed earlier. Second, doing so could be counter-productive to the extent that higher lending rates lead to lower lending and results (everything else equal) in a greater exposure to costly reserve balances. As discussed later, even where some mortgage rates increased somewhat following NIRPs, they quickly corrected thereafter.

23. From a theoretical standpoint, the potential for lower intermediation margins and bank profitability raises concerns about financial stability, should NIRPs remain in place for prolonged periods. First, retained profits are an important avenue for banks to increase and maintain capital. Lower profits mean lower buffers to face negative shocks, unless new equity is raised. Second, to the extent that lower intermediation margins lead to a decrease in a bank's charter value, they may increase risk shifting incentives associate with limited liability and asymmetric information (see for instance, Hellman, Murdoch, and Stiglitz, 2000). Then, the

compression in intermediation margins may induce banks to engage in riskier credit and maturity transformation in an attempt to protect profitability. Similarly, banks could switch from deposit to cheaper—though less stable—wholesale funding (in general equilibrium, costs of wholesale funding could eventually increase thereby offsetting the incentive for further substitution).

F. What about the other financial intermediaries?

24. Outside the banking system, important differences in the transmission of NIRPs could arise as yields become more negative. For example, if nominal returns from money market investments become negative, agents may rebalance their money holdings into bank deposits (so long as banks keep deposit rates above zero; see the discussion above) or physical cash. This substitution could create liquidity management challenges for money market mutual funds (MMFs). Moreover, if agents substitute into other non-money store-of-value assets, such as gold or real estate, overall money demand may decline. As such, NIRPs could have a contractionary effect on credit supply in economies where non-bank funding, or where MMF funding to banks and corporates, is large (in Europe, MMFs provide about 50 percent of bank short-term funding; in the U.S., MMFs fund about 20 percent of the repos and commercial paper markets (IMF (2015))).

25. As with low but positive rates, NIRPs may reduce the profitability of pension and insurance companies. The key vulnerability for pension and insurance companies arises when returns from assets come down below the companies guaranteed returns on their liabilities. NIRPs thus simply exacerbate effects of low (but positive) policy rates and QE. But as rates go from positive to negative territory, there should be no discontinuity in profits of non-bank financial companies. In this context, it is worth noting that some safe haven government bonds—more relevant to non-bank profits than reserves at the central bank—exhibited negative yields even before central banks implemented NIRPs.

EVIDENCE FROM CROSS COUNTRY EXPERIENCE AND CASE STUDIES

This section examines the hypotheses laid out above by looking at the cross-country experience and country case studies since the introduction of NIRPs (as early as July 2012 in Denmark, and later for other countries). As before, we focus on transmission to market interest rates, bank profitability, and market activity and also exchange rates. We look first at cross-country trends, then focus on country case studies.

26. While central banks have different stated motivations for implementing NIRPs, the experience to date has many similarities. Detailed cases of selected countries (presented in Annex I) are summarized below in Table 1 (Table 2 offers further details of the timing and extent of rate cuts across the same countries). The case studies review the goals for NIRPs in each country, and evaluate the policy's success in reaching these goals. They also compare how bank margins and profits have evolved, and point to other side effects of NIRPs.

Table 1. Summary of Country Case Studies

	Euro Area	Japan	Denmark	Sweden	Switzerland
Goal	<ul style="list-style-type: none"> Increase inflation 	<ul style="list-style-type: none"> Increase inflation 	<ul style="list-style-type: none"> Defend peg 	<ul style="list-style-type: none"> Increase inflation 	<ul style="list-style-type: none"> Increase inflation Support growth
Instruments	<ul style="list-style-type: none"> Neg rates No tiering Asset purchases TLTROII 	<ul style="list-style-type: none"> Neg rates Tiering QQE and Yield Control 	<ul style="list-style-type: none"> Neg rates Tiering FX interventions 	<ul style="list-style-type: none"> Neg rates No tiering Asset purchases 	<ul style="list-style-type: none"> Neg rates Tiering FX interventions
Assessment relative to goal	<ul style="list-style-type: none"> Some evidence of higher & easier credits Low, though more stable, inflation outlook 	<ul style="list-style-type: none"> Headline and core inflation has continued to fall Higher corporate issuance 	<ul style="list-style-type: none"> Peg defended successfully Central bank balance sheet expansion fully reversed by end 2015 Policy rates were increased slightly 	<ul style="list-style-type: none"> Higher inflation and inflation expectations Closed output gap Lower unemployment Solid lending 	<ul style="list-style-type: none"> Peak appreciation partially unwound, though currency remains overvalued Improved inflation outlook
Effects on yields	<ul style="list-style-type: none"> Full transmission to money market rates Lower term premia (also due to the Asset Purchase Program) 	<ul style="list-style-type: none"> Full transmission to money market rates Lower and flatter yield curve 	<ul style="list-style-type: none"> Full transmission to money market rates (except when policy rates are their min) 	<ul style="list-style-type: none"> Lower and steeper yield curve 	<ul style="list-style-type: none"> Full transmission to money market rates Entire yield curve turned negative
Effects on exchange rates	<ul style="list-style-type: none"> Depreciation over 2016, but mostly due to other factors 	<ul style="list-style-type: none"> Any potential impact has been overshadowed by other factors 	<ul style="list-style-type: none"> Appreciation pressure on peg has waned 	<ul style="list-style-type: none"> Broad stability of krona in 2015-16 	<ul style="list-style-type: none"> Franc has been relatively stable, Avoided appreciation from safe haven flows
Effects on bank net interest margins	<ul style="list-style-type: none"> Somewhat lower, as lending rates have decreased more than deposit rates 	<ul style="list-style-type: none"> Lower, as lending rates have decreased more than deposit rates 	<ul style="list-style-type: none"> Broadly unchanged as lending rates have not decreased much, And cheaper wholesale funding 	<ul style="list-style-type: none"> Broadly unchanged, aided by cheaper wholesale funding 	<ul style="list-style-type: none"> Slight increase as stable lending rates, while lower average deposit rates

Table 1. Summary of Country Case Studies (Concluded)

	Euro Area	Japan	Denmark	Sweden	Switzerland
Effects on bank profits	<ul style="list-style-type: none"> Lower margins offset by higher lending volumes, fees, cost cuts, capital gains, lower provisioning costs, especially if low share of variable rate loans, and loans with long amortization periods 	<ul style="list-style-type: none"> Impact has differed across institutions depending on share of deposit funding, long-term fixed rate loan, and increased competition 	<ul style="list-style-type: none"> Minimal due to stable net interest margins, higher fees and low loan impairment 	<ul style="list-style-type: none"> Minimal due to limited reduction in margins 	<ul style="list-style-type: none"> Minimal as slight increase in margins combined with stable lending and some capital gains on securities
Effects on cash hoarding	<ul style="list-style-type: none"> None detected 	<ul style="list-style-type: none"> None detected 	<ul style="list-style-type: none"> None detected 	<ul style="list-style-type: none"> None detected 	<ul style="list-style-type: none"> None detected
Other effects/comments	<ul style="list-style-type: none"> Concern with longer term profitability of banks if negative rates persisted, or cut further 	<ul style="list-style-type: none"> Concern with longer term profitability of banks Money markets less liquid Repo markets still liquid 	<ul style="list-style-type: none"> Increase in house prices in some segments due to low mortgage rates 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Concerns about viability of pension funds and life insurance companies if negative rates persist

Table 2. Overview of Central Banks with Negative Interest Rate Policy (NIRP)

	Instrument	Rate
Denmark (two tiers)	Certificates of deposit (CD)	-0.20 percent (July 2012-early 2014) -0.05 percent (Sept. 2014) -0.20 percent (Jan. 19, 2015) -0.35 percent (Jan. 22, 2015) -0.50 percent (Jan. 29, 2015) -0.75 percent (Feb. 5, 2015) -0.65 percent (Jan. 8, 2016)
Euro Area (no tiers) ^{1/}	Deposit rate	-0.10 percent (June 11, 2014) -0.20 percent (Sept. 10, 2014) -0.30 percent (Dec. 9, 2015) -0.40 percent (March 16, 2016); QE increased by €20 billion/month (until March 2017)
Japan (three tiers)	Deposit rate	-0.10 percent (Feb. 16, 2016)
Switzerland (one tier)	Sight deposits at the SNB (with an exemption threshold)	-0.75 percent (Jan. 15, 2015)
Sweden (no tiers)	Repo rate	-0.10 percent (Feb. 12, 2015); QE of SEK10 billion -0.25 percent (March 18, 2015); additional QE of SEK30 billion -0.35 percent (July 2, 2015); additional QE of SEK45 billion -0.50 percent (Feb. 11, 2016): QE continues, based on decisions at other meetings

Source: national central banks. Note: */ in conjunction with the exit from the exchange rate floor; ^{1/} A loosely defined tiered reserve system also applies to the ECB, which remunerates overnight deposits in the current account at the MRO rate of 0 percent (as of March 16, 2016), effectively exempting about one-seventh of current reserves from the marginal policy rate.

27. The stated goals of NIRPs fall into two not-mutually-exclusive categories: to raise inflation, and decrease appreciation pressures. The euro area, Japan and Sweden adopted NIRPs as an additional measure to combat deflationary pressures, and raise inflation from very low levels. The adoption of NIRPs in Denmark, instead, was primarily driven by a concern to

preserve its exchange rate peg. Switzerland's goal was hybrid: NIRPs were introduced to support growth and inflation by reducing the attractiveness of Swiss franc-denominated assets, thereby stemming appreciation pressures.¹⁰

28. The success of NIRPs relative to these goals has been mixed so far. In Sweden, the outlook for inflation has markedly improved, probably in part due to NIRPs, though asset purchases by the central bank were likely also instrumental. In Denmark, appreciation pressures on the krona have dissipated, the central bank has reversed its accumulation of foreign currency reserves. As a result, policy rates have been marginally tightened. In Switzerland, deflation is close to being eliminated and appreciation pressures have eased, although the franc remains overvalued.¹¹ In the euro area, credit conditions have eased and loan growth has turned positive, while the medium-term inflation outlook has improved gradually since the start of NIRPs. In other countries, the jury is still out, as the outlook for inflation and growth remains subdued. Of course, the counter-factual claim cannot be discounted that inflation and growth could have performed even worse in the absence of NIRPs (ECB, 2016).

29. More generally, transmission seems to have worked well to money market and bond yields, though deposit rates mostly remained positive. Figure 1a highlights the positive floor on retail deposit rates. In some cases, however, banks have charged negative rates on large deposits with presumably higher cash storage costs, and where corporate clients have access to money markets, such as in Denmark, Sweden, and Switzerland, as such clients would otherwise be able to make arbitrage profits by depositing funds at banks that had been borrowed at a negative money market rate (Figure 1b). However, in some cases banks have bypassed the effective lower bound on retail deposits by imposing higher fees.

30. Lending rates have declined somewhat. Figure 2a shows that short-term lending rates have declined somewhat in all the countries where NIRPs have been implemented. Within the euro area, countries with relatively higher shares of flexible rate loans (Italy, Spain, and Portugal) saw higher pass-through of policy rates to lending rates. In a few recent instances, longer-term mortgage rates increased, but it is difficult to conclusively ascribe these changes to NIRPs. This was the case in Switzerland, though rates have now reversed. Figure 2b provides some evidence that NIRPs may be inducing banks to search for yield. In the end, while long-term mortgage rates in the euro area have stabilized since the middle of 2015, lending volumes have increased, not contracted.

¹⁰ See Kerbel and Sigmund (2016) for a case study of Austria.

¹¹ Switzerland exited its exchange rate floor vis-à-vis the euro at the same time as it cut the central bank deposit rate from -0.25 to -0.75 percent. Less than a month after cutting the policy rate from 0 to -0.25 percent, a move which had turned out to be insufficient to stem large safe haven flows.

Figure 1. Deposit Rates

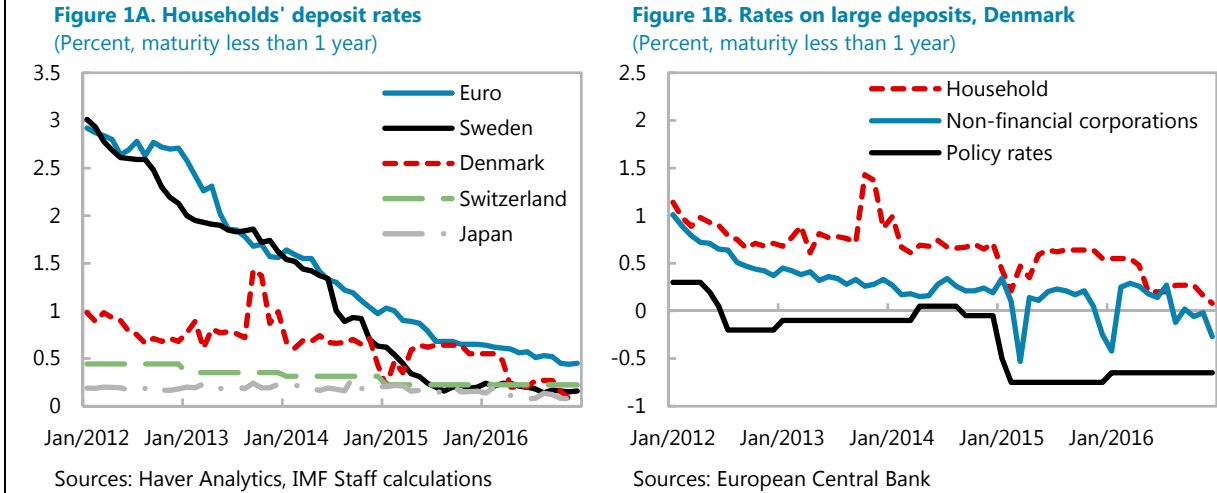
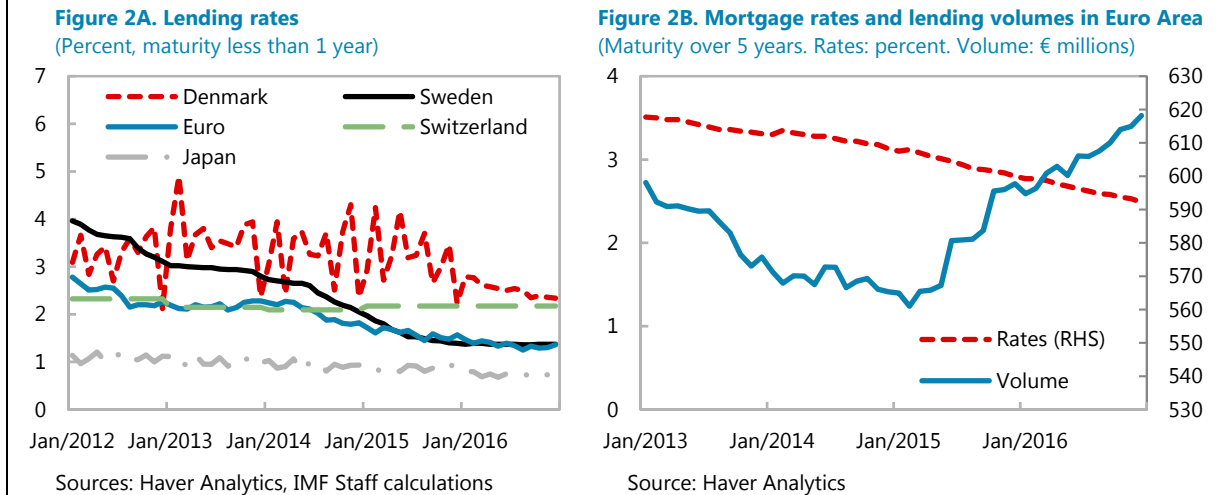
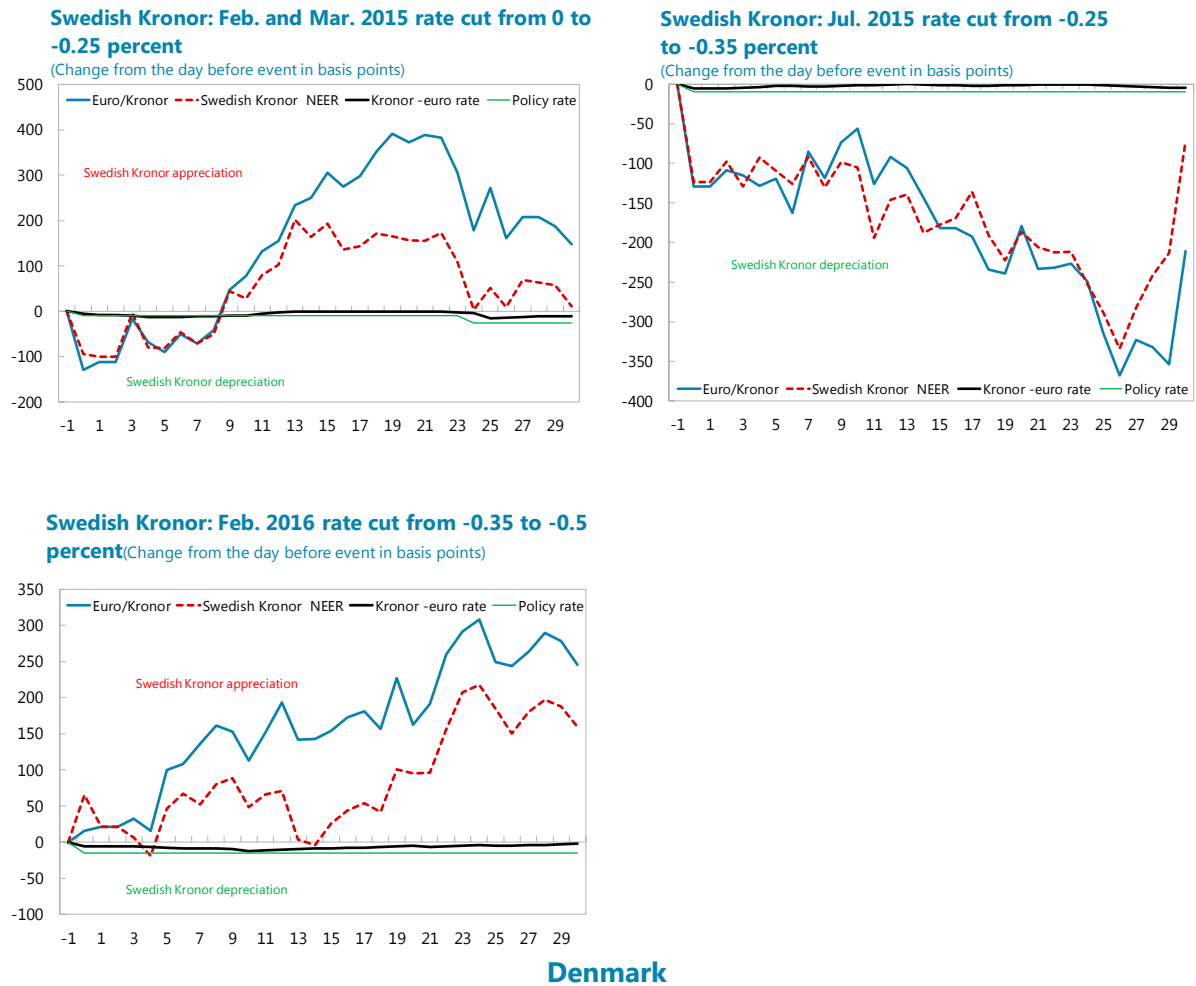


Figure 2. Lending Rates and Volumes



31. The evidence of the impact on NIRPs on exchange rates is mixed. It is worth noting that, in general, measuring the effect of NIRPs on exchange rates is difficult especially as this is also a period when the general global risk environment has undergone substantial swings. Many other factors influence exchange rates and it is difficult to assess the counterfactual to the introduction of NIRPs. Figure 3 illustrates the evolution of exchange rates after the introduction of NIRPs across countries. In many cases, while there does appear to some reduction in the level of the exchange rate, overall movements in the nominal effective exchange rate appear to have been short-lived.

Figure 3a. Interest Rate Differential and Exchange Rate 2011–16: NIRP events ¹
Sweden



Notes: Figures show market reactions for 30 days following a rate cut event (date 0) for rate cut events to negative territory. In some cases, there are multiple policy rate cuts within this window.

Sources: Haver and IMF staff calculations.

Figure 3b. Interest Rate Differential and Exchange Rate 2011–16: NIRP events ²
Switzerland

Swiss franc: Dec. 2014 rate cut from 0 to -0.25 and to -0.75 percent (change from the day before event in basis points)

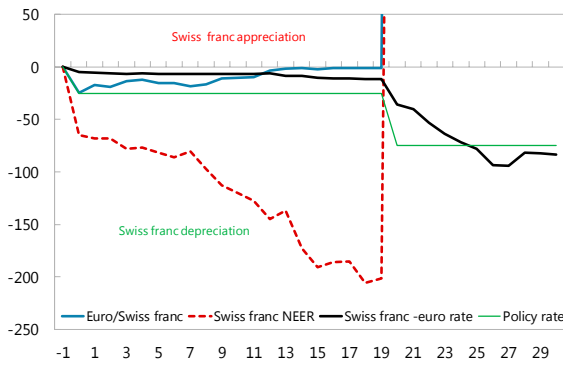
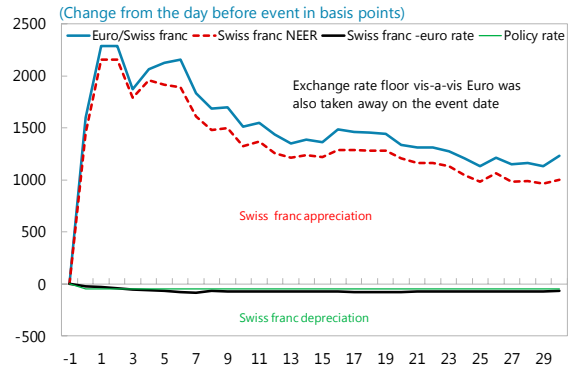
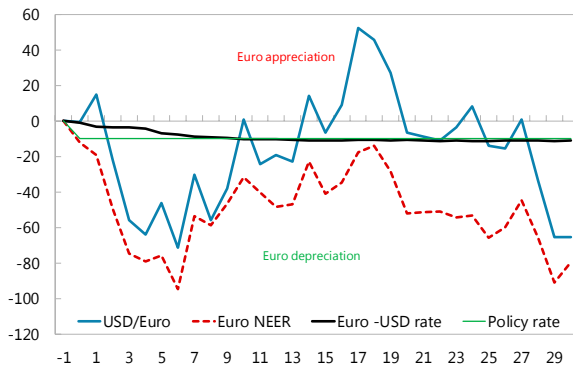


Figure 7G. Swiss franc: Jan. 2015 rate cut from -0.25 to -0.75 percent

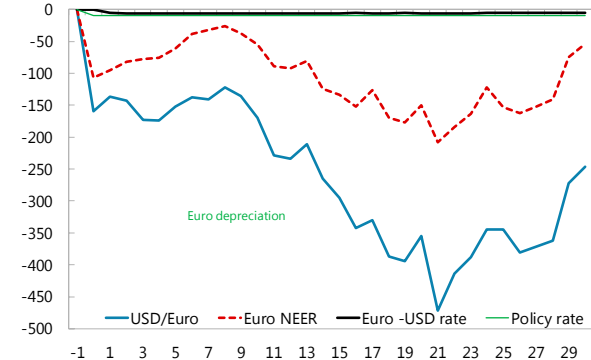


Euro Area

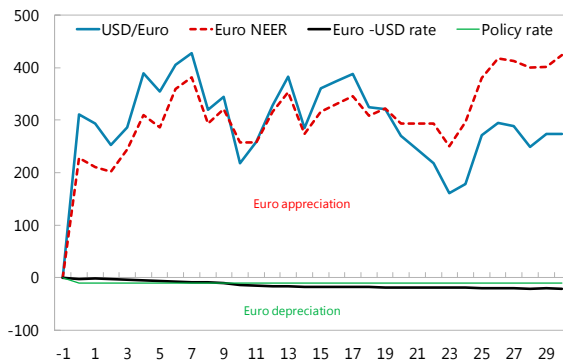
Euro: Jun. 2014 rate cut from 0 to -0.1 percent (Change from the day before event in basis points)



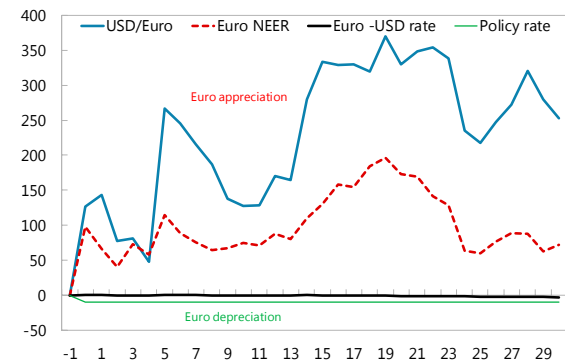
Euro: Sep. 2014 rate cut from -0.1 to -0.2 percent (Change from the day before event in basis points)



Euro: Dec. 2015 rate cut from -0.2 to -0.3 percent (Change from the day before event in basis points)



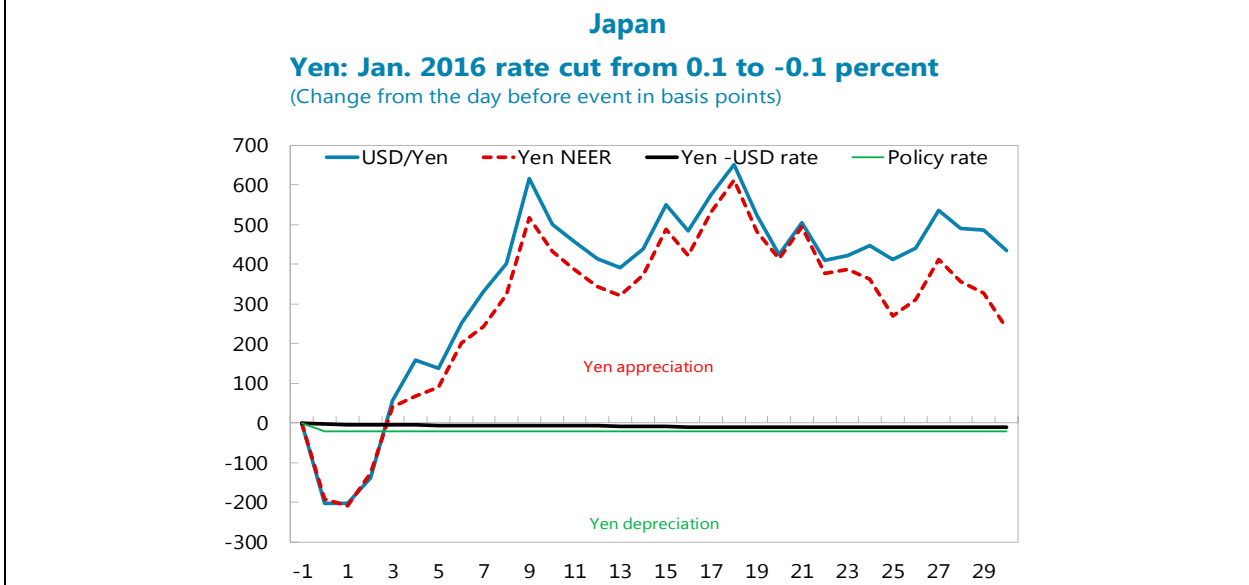
Euro: Mar. 2016 rate cut from -0.3 to -0.4 percent (Change from the day before event in basis points)



Notes: Figures show market reactions for 30 days following a rate cut event (date 0) for rate cut events to negative territory. In some cases, there are multiple policy rate cuts within this window.

Sources: Haver and IMF staff calculations.

Figure 3c. Interest Rate Differential and Exchange Rate 2011–16: NIRP Events ³



32. A consistent pattern emerging from the case studies is the resilience thus far of banks’ net interest margins. In the euro area, and Japan, they have decreased somewhat, though not significantly. In Denmark and Sweden, margins have remained stable, and in Switzerland they even increased somewhat. Reasons differ across countries. As discussed earlier, in Japan and Switzerland, banks benefit from a tiering system aimed at reducing the amount of reserve balances subject to negative rates. In addition, in Denmark, lower policy rates have not been entirely passed through to lending rates while in Switzerland, mortgage lending rates temporarily increased. This has created a cushion on top of equally sticky deposit rates. Finally, across the board, banks have benefitted from cheaper wholesale funding. Overall, no clear relationship is visible between policy rates and banks’ net interest margins over time (Figure 4).

Figure 4. Bank Profitability

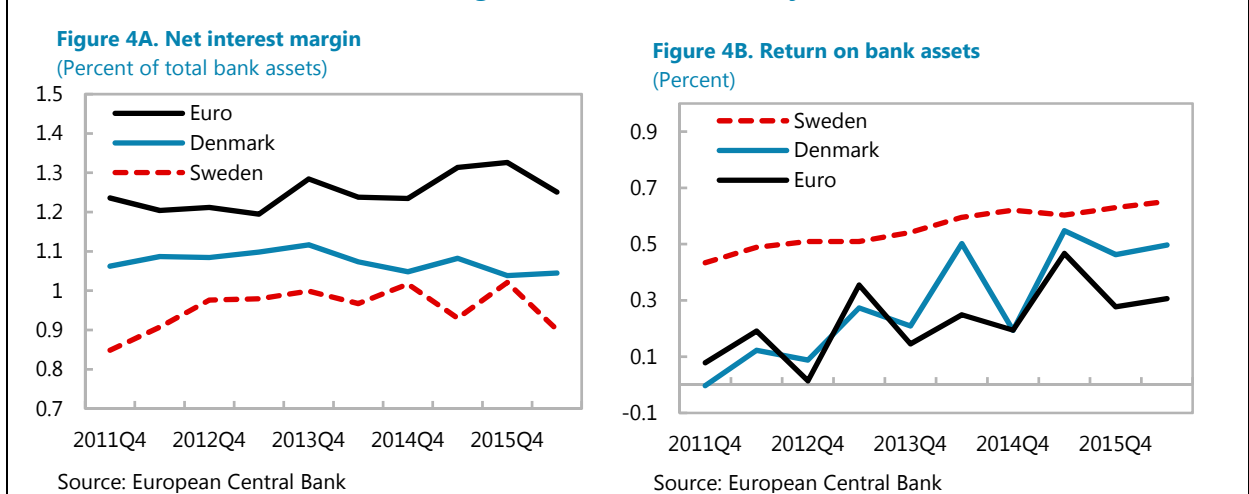
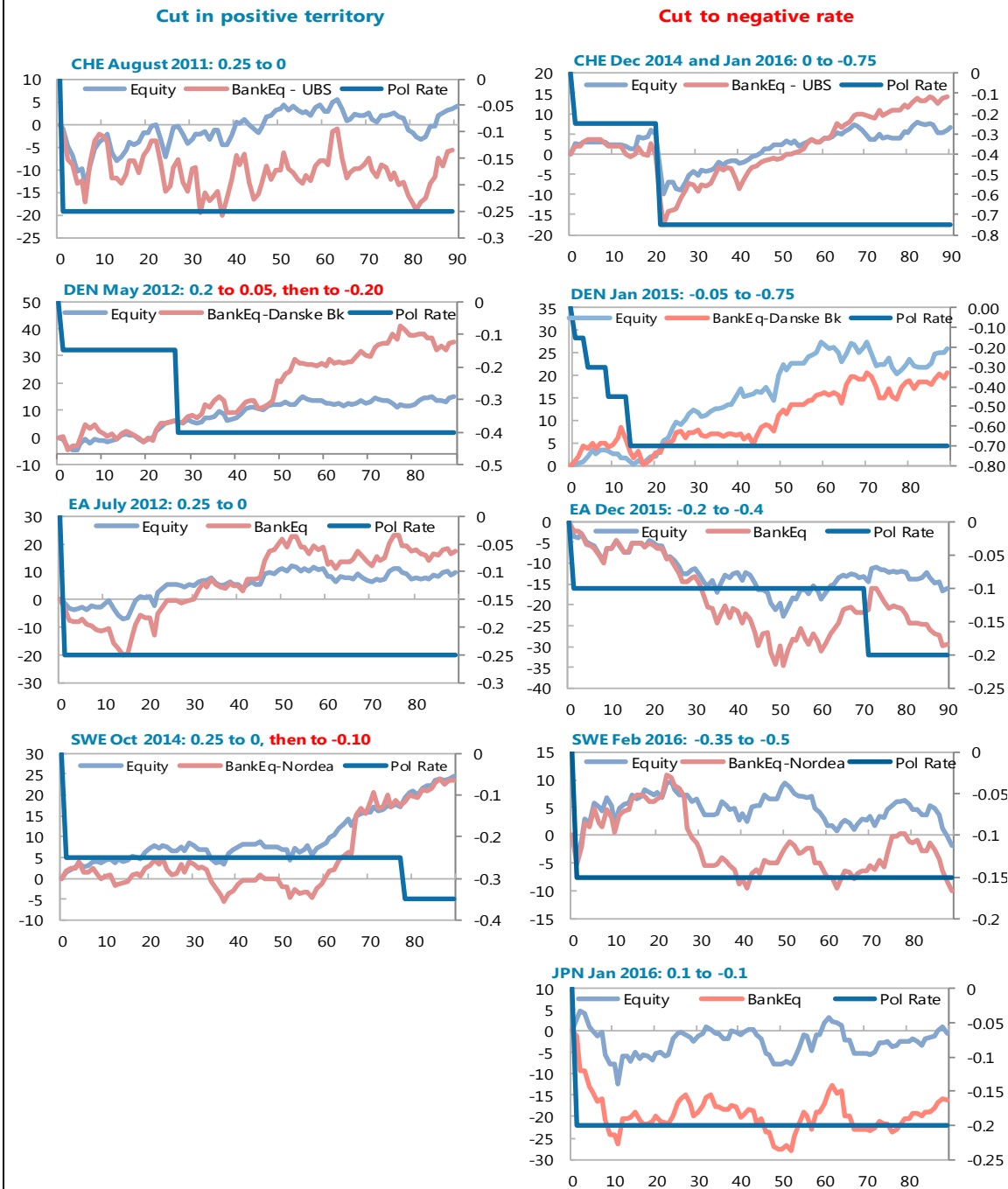


Figure 5. Equity Price Response to Negative Rates
(daily cumulative change)¹



¹Cumulative change in equity and bank equity share prices since the first rate cut displayed in the figure. Equity share prices are market indexes for the respective countries and bank equity share prices are either indexes or individual bank stock share prices as indicated. Source: Bloomberg, Staff calculations.

33. Bank profits have consequently also remained mostly unchanged. Where interest margins have taken a small hit, profits have been buoyed by other factors. These have included a

mix of higher lending volumes, fees and commissions, cost cutting measures, capital gains, and lower provisioning costs warranted by borrowers with improved balance sheets. Indeed, following an initial deterioration around the implementation of NIRPs, bank and other equity prices have recovered and, in some cases, recently rallied (Figure 5).

34. Not all banks have performed equally, though, and for some concerns have arisen over longer term profitability. Banks with higher shares of flexible rate and shorter maturity loans, and with greater reliance on deposit funding have, on average, benefitted the least from lower policy rates. In the euro area, these banks tend to be in countries in southern Europe. In addition, for some banks longer term concerns have emerged, especially in the euro area and Japan. Should NIRPs persist or rates be cut further, bank profits could eventually be constrained. Effects would be amplified as one-off factors such as capital gains tail off, and an increasing share of loans are repriced at lower rates.

35. Finally, other possible adverse side effects have not visibly surfaced to date. There is little evidence of cash hoarding. House price inflation seems under control, except in some segments of the Danish market. And household indebtedness is only reported as a concern in Sweden, and Switzerland where the problem is longstanding, however. In the last two cases, appropriate and targeted macro and microprudential measures, coupled with structural reforms of the housing market where needed, would appear to be the most effective policy options to contain the nascent risks.

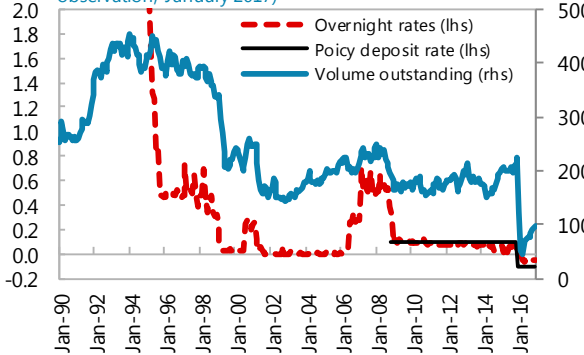
36. The impact of NIRPs on money market activity (including repos) and money market funds has been mixed and warrants monitoring.¹² NIRPs appear to have been associated with reduced money market activity, beyond their already subdued levels (Figure 6). In Europe, gross issuance of shorter-dated Short Term European Papers (STEP) fell sharply, as yields declined below zero. One exception seems to be the repo market in Japan, where volumes recovered after the introduction of NIRPs. Moreover, repo rates were occasionally negative even before the BOJ's policy rate cut. So far, NIRPs do not seem to have reduced investment in MMFs in the euro area despite that the return to MMF investment (measured by changes in net asset value—MMF share price) turned negative, as NIRPs were nearly fully transmitted to money market rates (Figure 7). However, in Japan, MMFs stopped accepting new funds after the BOJ's decision to adopt NIRPs in January. As a result, in March, the BOJ decided to exempt certain short-term funds from negative rates to discourage investors from switching to bank deposits.

¹² Money markets include various markets that trade short-term securities and contracts. Examples are interbank markets (e.g., Japan's call markets, LIBOR, and EONIA); commercial papers, CD, and repo markets. Interbank markets are closely linked to banks' short-term liquidity conditions, as participants are limited to banks. Non-bank financial (security dealers, money market funds, asset managers) and non-financial institutions (such as corporate issuing commercial papers) participate in other types of money markets. Key markets and participants differ substantially across countries.

Figure 6. Money Market Activities

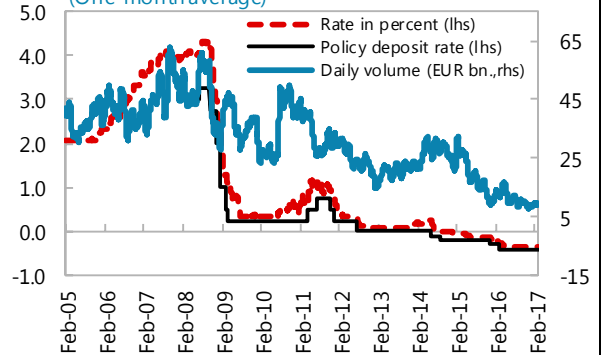
Japan: Uncollateralized Call Money Market

(Left scale, in percent; right scale, in billions of yen; Last observation, January 2017)



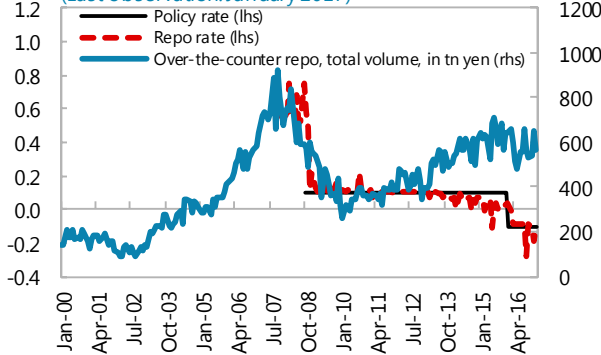
Euro Interbank Market Activities-EONIA

(One-month average)



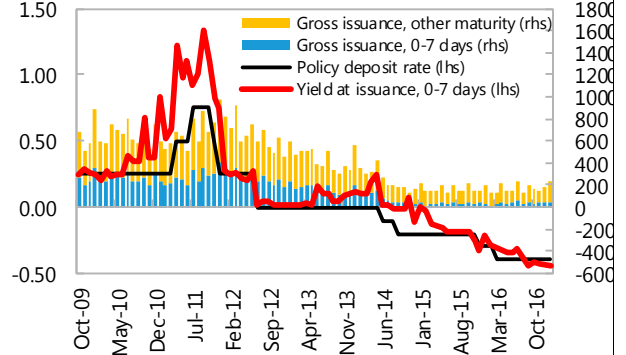
Japan Bond Repo (Gensaki) Market Activities

(Last observation: January 2017)



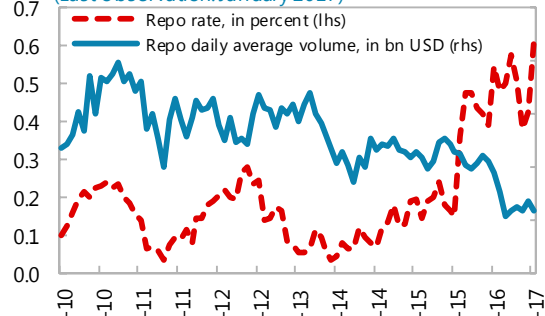
Euro Area Short-term European Paper (STEP) Markets

(Issuance in billions of euro -rhs-; rates in percent -lhs-; last obs: Jan17)



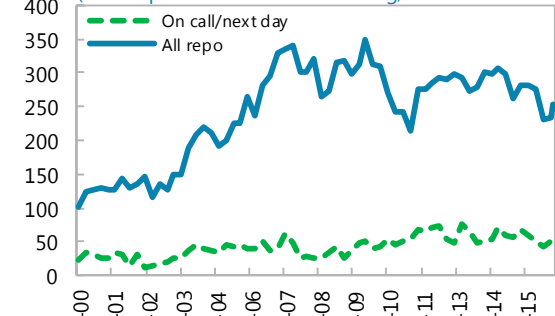
U.S. Treasury Repo Market Activities

(Last observation: January 2017)



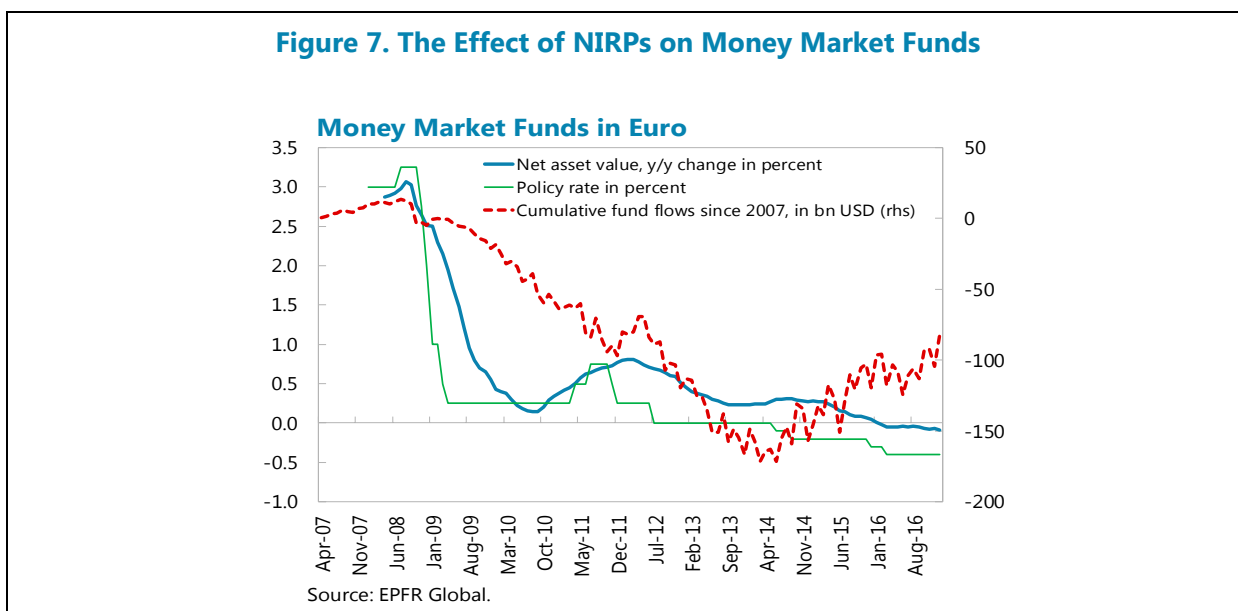
U.K. Gilt Repo Market Activities

(End of period amount outstanding, in billions of GBP)



Sources: Haver Analytics, Bloomberg LP and IMF Staff Estimates

Figure 7. The Effect of NIRPs on Money Market Funds



CONCLUDING REMARKS

The sluggish recovery from the global financial crisis led to much experimentation with monetary policy, including the introduction of NIRPs. Since the onset of the crisis, central banks deployed new tools to support recoveries and price stability, including quantitative easing and forward guidance. And as challenges persisted, in some jurisdictions, monetary authorities introduced NIRPs. A debate then ensued among policy makers and academics alike on the effectiveness and potential shortcoming of these measures. This paper summarizes those arguments and discusses the potential effects of NIRPs on the monetary policy transmission mechanism and financial stability, emphasizing the role of the banking sector. It then reviews how NIRPs have functioned so far through case studies of countries that have introduced such policies.

The main difference between policy interest rate cuts above and below zero, from both a theoretical and operational perspective, hinges on the role of cash. It is generally agreed that policy rate cuts in positive territory reduce market interest rates, as well as bank lending and deposit rates. Their effects on bank profitability are more ambiguous. Banks are risk and maturity transformers. Policy-rate cuts will reduce lending margins to the extent they flatten the yield curve and lower term and risk premia. But they will support profitability to the extent they stimulate aggregate demand, improve the creditworthiness of borrowers, and lower provisioning needs. Further, banks benefit from capital gains from the repricing of assets on their portfolio (although this is a transitional effect). These same effects would hold, in principle, for NIRPs in a *cashless* economy. However, the possibility that agents can switch to cash if returns on other financial assets become sufficiently negative (to offset the cost of holding cash, which may vary across economic agents and jurisdiction), establishes an “effective” lower bound for interest rates

below which further cuts are ineffective (and possibly counterproductive).

The relationship between monetary policy and bank profitability becomes more complex once policy rates turn negative. Banks “compete” with cash to attract deposits. This means they may find it difficult to lower their deposit rates much below zero. In turn, this will lead to a lower pass-through of policy rates on lending rates and/or a squeeze of intermediation margins (though banks benefit from cheaper wholesale funding, and can support profits through commissions and fees). Then, as policy rates approach the effective lower bound, monetary policy transmission will be increasingly hindered. In theory, sufficiently negative interest rates would jeopardize financial intermediation; in which case further cuts would prove counterproductive. In practice, this is unlikely to be the case at moderately negative policy rates.

Against this background, country cases suggest that so far NIRPs have contributed to loosening financial conditions, with no major side effects on banks or market functioning. However, it is more difficult to assess their effect on inflation and growth, for which the outlook remains generally subdued. Transmission to money market and bond yields has worked well. But deposit rates have mostly remained positive and unchanged; with an also limited pass-through to lending rates. And there is little evidence of agents switching to cash holdings. As a result, banks’ net interest margins and profits have remained generally resilient (although not all banks have performed equally reflecting differences in funding structures and competitive pressures).

However, there are practical limits to pushing policy rates much further below zero. As discussed, NIRPs have diminishing returns as rates approach their effective lower bound. In principle, the effective lower bound could be reduced through reforms aimed at lowering the nominal yield on cash holdings. But these are untested and politically controversial. It follows that other policies—fiscal policy, structural reforms—should pick up some of the burden that since the crisis has rested almost exclusively on monetary policy.

Further work is needed to analyze the impact of NIRPs and compare its effects with other monetary policy instruments. As more experience is gained with the implementation of these policies, more systematic cross-country empirical analysis could be undertaken. Key foci here include assessing the relative effectiveness of NIRPs versus other monetary policy instruments, as well as the associated spillovers of each of these different policies. Beyond assessing the implications for banks, further analysis could also be undertaken of the impact on non-banks, markets, and asset prices and broader implications for stability risk in these areas.

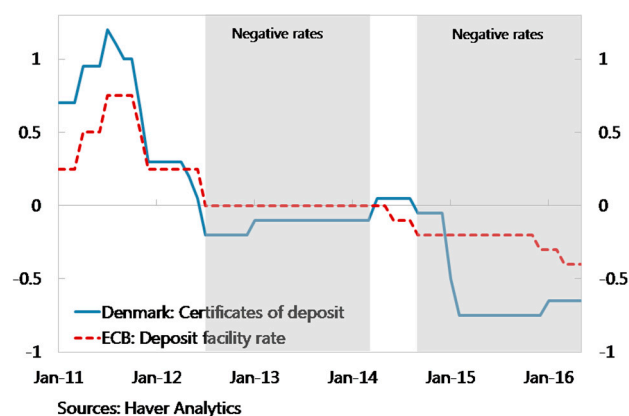
Annex I. Country Case Studies: Denmark, Euro Area, Japan, Sweden, Switzerland

DENMARK: A SUCCESSFUL DEFENSE OF THE PEG

NIRPs to defend the peg

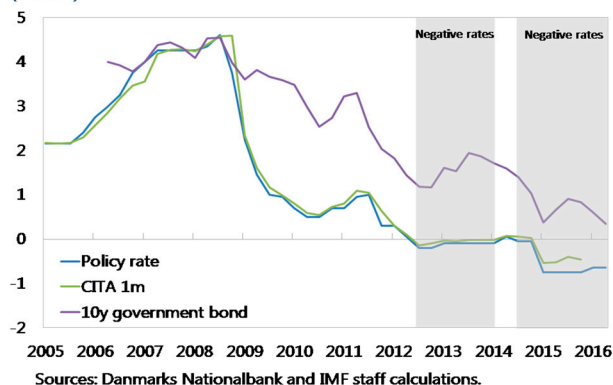
Under growing exchange rate pressure, Denmark was the first country to adopt NIRPs. Denmark experienced a slow recovery from the global financial crisis and still had a significant output gap by 2011. Nonetheless, the Danish krone started to strengthen from mid-2011 when strains in the euro area reached their peak. Market participants increasingly saw the krona as a safe haven currency. To deter speculative capital inflows, and defend the currency peg, the Danmarks Nationalbank (DN) brought its policy rate on certificates of deposit (CD) into negative territory (-0.2 percent) in July 2012 (see IMF 2012 for details)

Negative Policy Rates: Denmark and the ECB (in percent)



Amid intensified pressures, rates were decreased further. The CD rate was initially set at a modest negative 0.2 percent and briefly turned positive during July-September 2014. But capital inflows intensified in early 2015 as the Swiss National Bank abandoned its exchange rate ceiling, and the ECB announced its asset purchases program. To complement heavy intervention in the foreign exchange market to counter krona appreciation pressures, the DN moved the CD rate, to -0.75 percent in early 2015.

Denmark: Interest Rates (Percent)

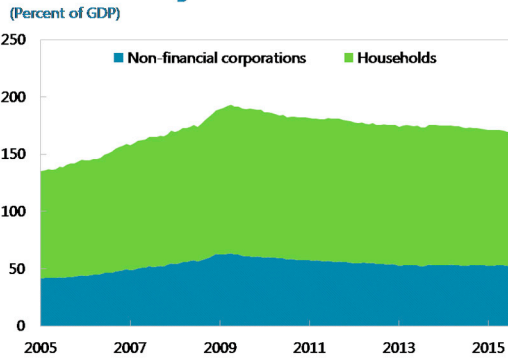


Imperfect transmission but a successful defense

NIRPs helped a successful defense of the peg. Pressures on the krona waned in March 2015. By end 2015, the substantial build-up of foreign exchange reserves by the central bank was fully reversed. In early 2016, the DN even raised the CD rate by 10 basis points.

Market interest rates tended to track the policy rate, but the transmission was weaker than with positive rates. The correlation between policy and market rates was very high until early 2015, when policy rates plunged to their trough. In addition, lower market rates did not translate into higher lending. Lending volumes continued their decline from a peak in 2009, although the counterfactual is difficult to establish.

Denmark: Lending Volume

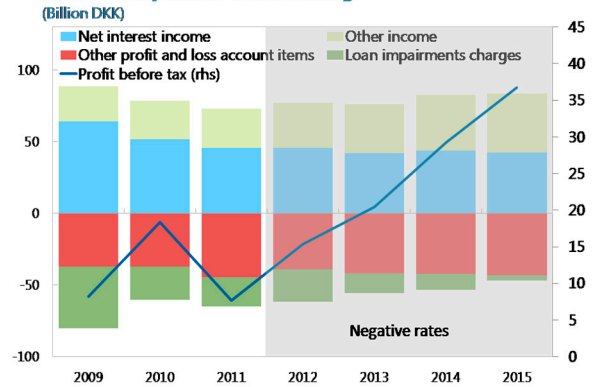


Sources: Danmarks Nationalbank and IMF staff calculations.

Banks appear unscathed

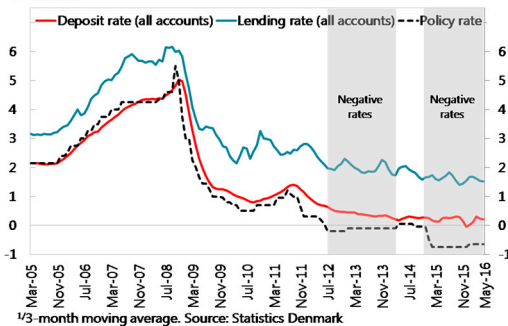
Despite four years of NIRPs, credit institutions appear to be thriving. Average lending-deposit margins have remained steady between July 2012 and May 2016, broadly unchanged from their 2009-2012 mean. Deposit rates did exhibit downward rigidities (only large corporates and institutional clients face negative interest rates). However, market funding (representing about 30 percent of bank liabilities) became cheaper, and cuts in policy rates were not entirely passed through to lending rates. Strong bank profitability was also bolstered by higher fee income and low impairment charges (partly a result of improved borrower debt-servicing capacity in the low interest rate environment). Meanwhile, there has been no evidence of cash hoarding among corporates or households.

Denmark: Systemic Bank Earnings

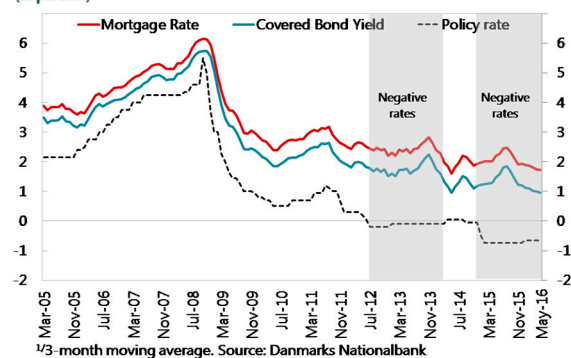


Sources: Danish Financial Supervisory Authority and IMF staff calculations

Denmark: Bank Interest Rates, New Agreements¹
(In percent)



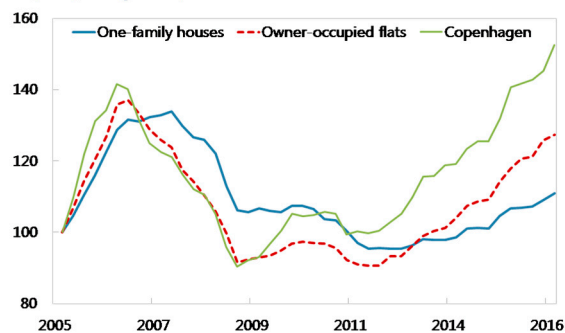
Mortgage Interest Rates, New Agreements¹
(In percent)



Yet, the low interest environment may be contributing to emerging financial stability risks.

Low mortgage rates by historical standards have boosted house prices in some segments of the market. If sustained, highly indebted Danish households may become vulnerable to a reversal in prices. Policy action is warranted to: loosen housing supply restrictions, eliminate tax incentives for housing, and develop and implement targeted macroprudential tools (such as LTV and DTI caps).

Denmark: Real House Prices
(Index, 2005Q1 = 100)



Sources: Statistics Denmark and IMF staff calculations

EURO AREA: BATTLING LOWFLATION

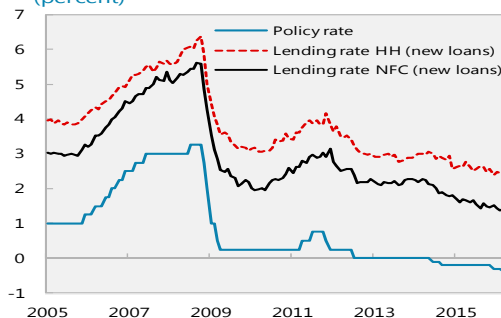
NIRPs part of a package to support price stability

In June 2014, the ECB introduced NIRPs among other policies intended to achieve its price stability objective. Since then, it has lowered the deposit rate to negative 0.40 percent (March 16, 2016), setting the effective marginal policy rate given the excess liquidity in the banking system. Unlike some other central banks, the ECB has not introduced a tiering system to cushion the cost of NIRPs for banks holding excess reserves. More details are available in Jobst and Lin (2016).

NIRP has helped provide needed policy accommodation

Negative policy rates were quickly transmitted to various key rates. Money-market rates have closely tracked the policy rate due to excess liquidity pushing interbank trading towards the deposit rate. Moreover, expectations of future money market rates decreased, in response to the ECB’s forward guidance. Lending rates for both corporates and households also decreased, mostly via a reduction in term premia (text figure). As a result, credit has expanded modestly.¹³ A flatter yield curve has also encouraged banks to invest in riskier assets, reflecting portfolio rebalancing effects.

Euro Area: Marginal Policy Rate and Lending Rates—Households and NFCs
(percent)



Source: Bloomberg, L.P.; and Haver Analytics. Note: Policy rate used for this chart is the ECB’s deposit rate.

¹³ ECB staff estimate that negative rates have contributed about one percentage point to corporate lending growth since July 2014 (Rostagno and others, 2016).

Banks are managing well, though times could get rougher

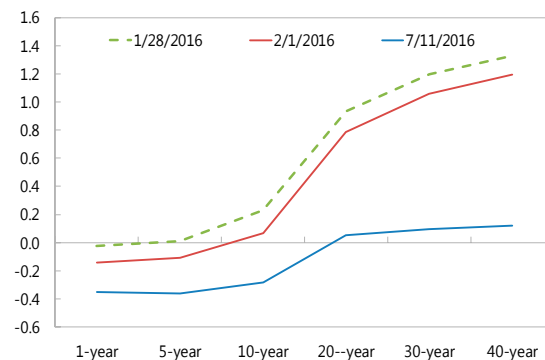
Banks have been able to offset the negative hit to net interest margins. Between June 2014 (when the ECB deposit rate was first cut to negative) and May 2016, average loan rates decreased by around 0.8 percentage points, while average deposit rates only decreased by around 0.2 percentage points, effectively reducing the lending margin. However, the decline in lending margins has been offset by higher lending volumes and lower wholesale funding cost. Net interest income actually increased between 2014 and 2015. Banks also benefited from capital gains¹⁴, lower risk provisioning, small increases in fees and commissions, as well as cost cutting measures (Cœuré, 2016). Finally, Annex III suggests that the ECB's scheme to provide low-cost liquidity to banks (TLTRO II) helped support bank profits.

The direct cost of NIRPs, although small, has been borne disproportionately by banks with excess liquidity at the ECB.¹⁵ Given the heterogeneous distribution of excess liquidity within the euro area, some countries are disproportionately affected by the ECB's negative deposit rate.

Banks in some countries may feel stronger pressure on net interest margins moving forward. In countries such as Italy, Spain, and Portugal, the pass-through of policy rates to lending rates tends to be high due to a high share of variable-rate or amortizing loans. More generally, banks' ability to shift to cheaper (but less stable) wholesale funding is limited by the existing deposit base and the transition to the net stable funding ratio (NSFR) requirement.

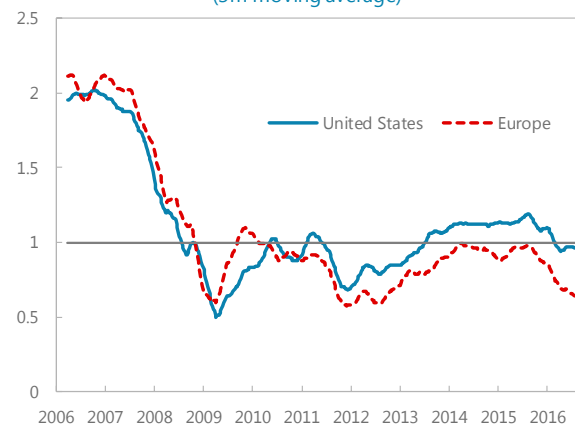
On the whole, banks in the euro area continue to suffer from low profitability. A wedge continues to exist between euro area and U.S. banks' price-to-book ratios (see figure). The subdued profitability outlook has been amplified by structural challenges to

Downward Shift of Yield Curve following NIRP
(In percent)



Source: Haver Analytics.

Banks' Price-to-Book Ratio
(3m moving average)



Sources: Federal Reserve call reports; SNL Financial; and staff calculations.

¹⁴ However, the aggregate bank balance sheet of euro area banks suggests that lending is about 6-7 times more important than investments for bank profitability, limiting the importance of capital gains in offsetting the adverse impact of negative rates on lending spreads.

¹⁵ The direct (annual cost) is estimated to be about €3.2 billion for euro area banks in aggregate, equivalent to 0.1 percent of total consolidated bank assets.

European banks. In some countries, the cost of risk remains elevated due to a still large stock of impaired assets, dampening the profitability prospects of banks. In addition, a number of banks still need to adapt their business models to the new operational environment characterized by stricter regulatory requirements as well as low interest rates (ECB, 2016). Staff analysis suggests that, even with a cyclical recovery where net interest income improves, provision expenses decline, and fee-generating activity boosts non-interest rate income, 30 percent of the European banking system or about \$8.5 trillion of system assets will still remain weak, falling short of meeting a cost of equity of 8 percent (IMF, 2016).

NIRPs faces limits, other policies may need to do more

Given the constraints, further monetary accommodation, if needed, may have to rely more on credit easing measures and a further expansion of the ECB's balance sheet. Additional cuts in policy rates could weaken monetary transmission as pass-through to deposit and lending rates will likely decline, bank profits come under strain, and deposits shift to cash. Instead, asset purchases and credit easing should raise asset valuations and aggregate demand, while also supporting bank lending.

JAPAN: A TENTATIVE VENTURE INTO NEGATIVE TERRITORY

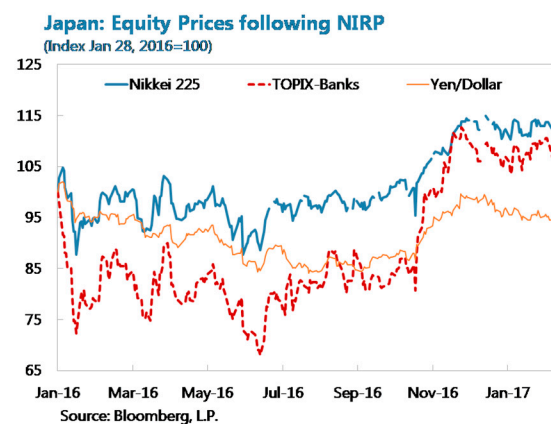
NIRP adds to the measures intended to reflate the economy

The Bank of Japan (BoJ) announced NIRPs at the end of January 2016 amid a weakening domestic outlook and elevated global uncertainty. By the end of 2015, domestic growth had weakened and headline inflation had fallen significantly due to declining oil prices, spilling over to medium and long-term inflation expectations. Moreover, yen appreciation accelerated in early 2016, in part due to safe haven effects triggered by increased global financial market volatility. At the same time, equity prices fell sharply. The BoJ announced on January 29, 2016 that a negative interest rate on excess reserves would be implemented on February 16. The intention was to (i) put downward pressure on short-term interest rates while reinforcing forward guidance, and (ii) raise inflation expectations by dispelling concerns that QQE had reached its limits, and reconfirming the Bank's commitment to its inflation target.

Despite effective transmission, inflation and growth remain subdued

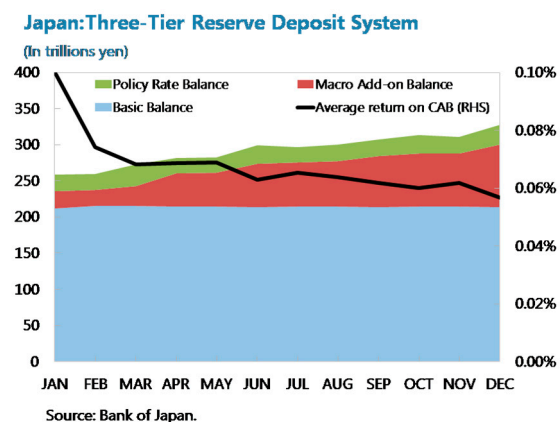
NIRPs helped lower market rates and accelerate portfolio rebalancing. Immediately following the introduction of NIRPs, the yield curve shifted down and flattened, with 10-year benchmark yields falling below zero. Transmission to short-term money market rates was almost complete. The interbank funding rate (3-month TIBOR) fell from 17 bps at the beginning of 2016 to 6 bps after the introduction of NIRPs. Lending and deposit rates also fell, compressing lending margins, but the impact differed across banks. Those with higher dependence on deposit funding or with larger excess reserves at BoJ lowered their deposit rates relatively more.¹⁶ Meanwhile, financial institutions accelerated the rebalancing of their portfolios in search of higher yields. Corporate debt issuance picked up, especially in long maturities, as firms took advantage of low interest rates.

However, NIRP’s impact on the economy has been muted so far. Any positive effects from the NIRPs have likely been overshadowed by rising global growth concerns and financial volatility. In particular, lower stock prices, continued yen appreciation, weak credit demand and persistent doubts about the BoJ’s ability to reflate the economy have made it difficult to assessing the true economic impact of NIRPs given the absence of a counterfactual scenario. In fact, the growth in credit by private financial institutions did not show significant improvement during 2016.



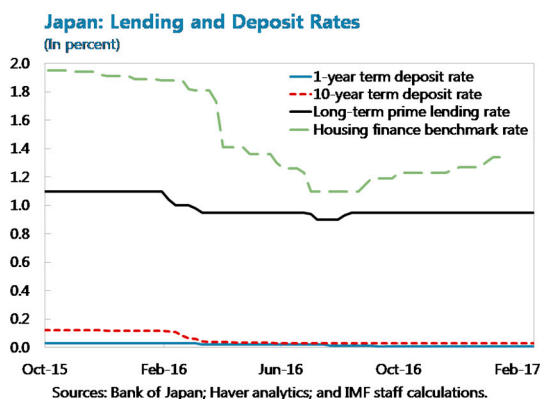
The BoJ has tried to address concerns about NIRP’s impact on bank profitability

A three-tier reserve deposit system was introduced to mitigate the direct impact on financial institutions’ profits. With excess reserves accounting for more than 50 percent of GDP and more than 25 percent of total bank assets, the direct impact of NIRPs on financial institutions’ earnings would have been significant. Hence, the BoJ introduced a three-tier reserve deposit system. The first tier (the Basic Balance) consists of previously accumulated excess reserves which continue to earn 0.1 percent interest. The second tier (the Macro Add-on Balance), earning a zero rate of



¹⁶ See the 2016 Japan Article IV-Selected Issues Paper “Negative Interest Rate Policy and Bank Deposit Rate”.

return, consists of required reserves and an added balance that is revised quarterly in line with the BoJ's monetary base target.¹⁷ Finally, the third tier (the Policy Rate Balance) is subject to the -0.1 percent interest rate, and consists of the difference between total reserves and the two first tiers. The tier system is thus designed to only gradually reduce the average return on excess reserves as the Macro Add-on balance grows (see figure).

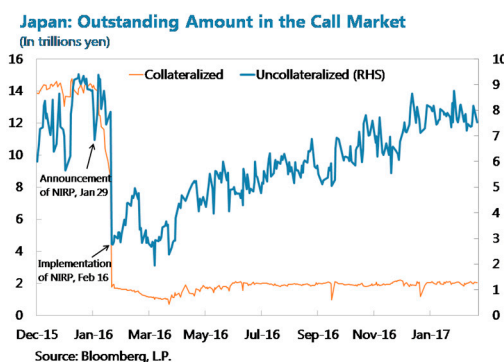


A new monetary framework was introduced by the BoJ in September following a comprehensive assessment of policy effectiveness. Part of the assessment included an analysis of NIRP's potential impact on the functioning of financial intermediation. While pointing out that financial conditions remain accommodative, the report highlighted that Japan's banks are particularly vulnerable to reduced lending margins given that outstanding deposits far exceeds lending and that margins are already very tight.¹⁸ If lending does not pick up, the accumulation of lower profits over a prolonged period of time could hamper financial stability and intermediation. The new monetary framework aims to more explicitly control the slope of the yield curve – through an explicit long-term interest rate target – to maximize the impact of monetary easing while minimizing adverse effect on financial intermediation.

Some markets have suffered, others not

Money markets have been affected. Following the introduction of NIRPs, transactions and amounts outstanding in money markets have declined sharply. In the call markets, investment trusts including money reserve funds and money market funds reduced their lending citing difficulties in managing assets with a negative rate. However, the uncollateralized call market has gradually recovered, possibly reflecting the incentive to trade excess reserves provided by the three-tier system and financial institutions' adaptation to trading with negative rates. In addition, financial institutions on both the lending and borrowing sides experienced IT difficulties in trading assets at negative rates.

Bond and repo markets, instead, appear to be functioning well. While indicators of market liquidity in JGB markets have deteriorated following



¹⁷ The Macro Add-on balance also include the average amount outstanding of various loan support and funds-supplying operations by the BoJ and money reserve funds entrusted to institutions.

¹⁸ Customer deposits account for over 70 percent of banks' total liabilities in Japan but only 40 percent in the euro area.

the introduction of NIRPs, this is more likely to be a consequence of continued BoJ asset purchases. So far BoJ has not encountered any major difficulties in conducting its JGB purchases. The impact on repo markets has been less pronounced; volumes outstanding are now back to levels seen before the introduction of NIRPs.

SWEDEN: SO FAR SO GOOD

NIRPs part of a package to rebuild inflation target credibility

By late 2014, inflation was well below its 2 percent target. The level of Swedish GDP was flat for most of 2011-13, partly reflecting the weak global recovery from the financial crisis. The resulting widening economic slack slowed core HICP inflation to just ½ percent by 2013-14. Inflation expectations declined steadily before falling sharply in late 2014, with unions and employers expecting inflation of less than 1 percent two years ahead.

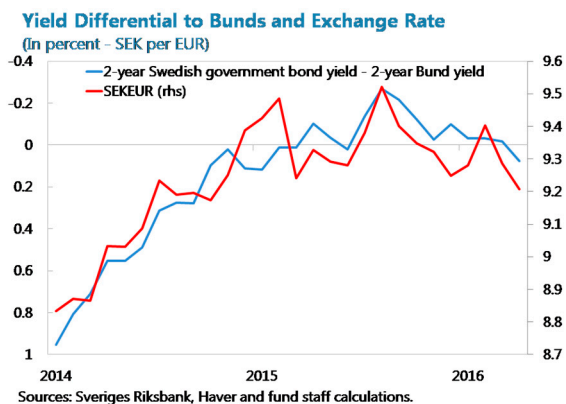
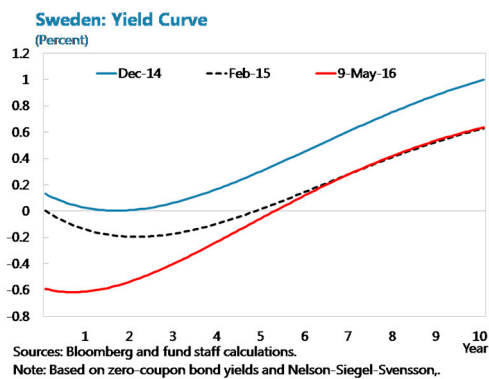
The Riksbank responded by adopting a package of unconventional measures. In February

2015, the Riksbank announced a negative repo rate (initially at -10 bps). In addition, it started purchasing government bonds and firmly stated its willingness to do more as needed to achieve its inflation target. Over the following year, the Riksbank cut the repo rate in a number of steps to -50 bps, while also expanding its bond purchase program, to close to 40 percent of outstanding government debt by end 2016. The Riksbank anticipated that these measures would lower the yield curve on government bonds, and help avoid a rapid appreciation of the Krona in response to the ECB's large scale QE, despite its moderate undervaluation relative to fundamentals.

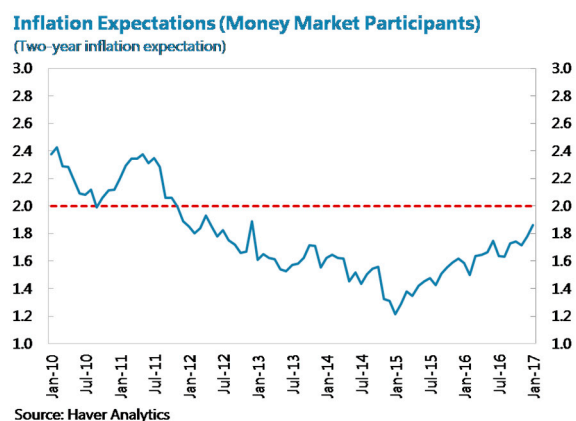
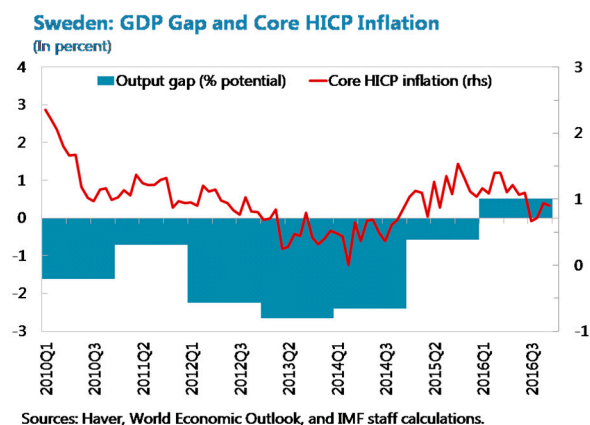
Unconventional Monetary Policy Actions		
Date	Repo rate (basis points)	New QE (SEK bn)
Feb-15	-10	10
Mar-15	-25	30
Apr-15		40-50
Jul-15	-35	45
Oct-15		65
Feb-16	-50	
Apr-16		45

A satisfactory turnaround in financial and macroeconomic conditions

The policy package lowered the yield curve and helped stabilize the exchange rate. The yield curve initially fell by 20-40 basis points, with subsequent repo rate cuts steepening the curve. The krona had already depreciated in 2014, as earlier monetary easing lowered Swedish yields to be roughly in line with those of German Bunds. The February 2015 package and later steps broadly maintained this yield differential despite further loosening of ECB policy. This contributed to the broad stability of the krona in 2015-16. A significant portion of Riksbank purchases of government bonds were initially from nonresident investors, which may also have contained appreciation of the krona.



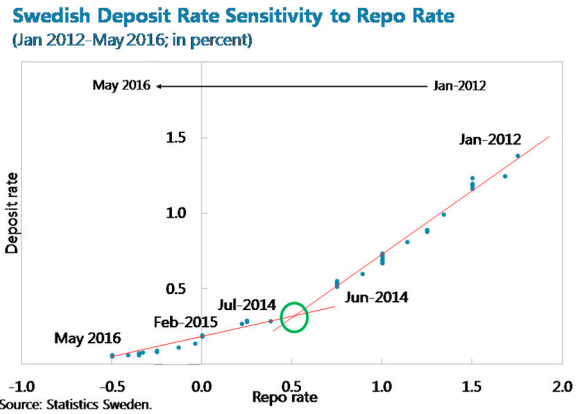
The Riksbank’s policy was transmitted effectively to the real economy, including through inflation expectations. Growth rose to over 4 percent in 2015, and is likely to exceed 3 percent in 2016, helping shave off a full percentage point off unemployment, now running at just under 7 percent. Declining economic slack has boosted services price inflation. Core HICP inflation reached 1.1 percent in 2016, and is expected to continue rising gradually in the next few years. Surveys of inflation expectations two years ahead reached 1.8 percent at end 2016.



Adverse effects on bank profits seem contained, so far, but levels of debt raise some concern

Margins between lending and deposit rates continued narrowing from before the introduction of NIRPs. Lending rates fell broadly in line with the policy rate after February 2015. In contrast, deposit rates remained around zero, except for some large companies, nonbank financial institutions, and municipalities. Margins between lending and deposit rates have fallen to just below 2 percent, down from the relatively high level by historical standards of 2¾ percent.

The decline in pass-through of policy to deposit rates began before policy rates became negative. The turning point was reached in around mid-2014, when the repo rate hit about ½ percent. Further cuts in the repo rate resulted in smaller declines in deposit rates, with no change in slope evident when repo rates turned negative.



However, bank profits have not yet taken a substantial hit.¹⁹ Bank profits were broadly stable in 2015, supported by strong credit growth and low cost wholesale funding, accounting for over half of Swedish bank loans. Investors do not seem particularly concerned with the profitability of Swedish banks, as signaled by relatively stable equity prices of financials. The Riksbank does not apply tiering or other methods to moderate the impact of negative rates on bank profits.

Moreover, NIRP does not seem to have stoked housing prices, although the effects of NIRPs may initially be outweighed by macroprudential measures. Bank lending remains solid, with household credit growth averaging 7½ percent y/y in 2016. However, housing price inflation has slowed to about 8 percent in 2016, from around 15 percent over 2015. This slowing appears to reflect the impact of minimum mortgage amortization requirements that became effective in mid-2016. Nonetheless, households are taking on increasingly large debts, given the rising cost of housing. Limiting debt to income ratios should help contain growing vulnerabilities, but it is also important to raise housing supply to moderate prices and debt in a sustainable manner.

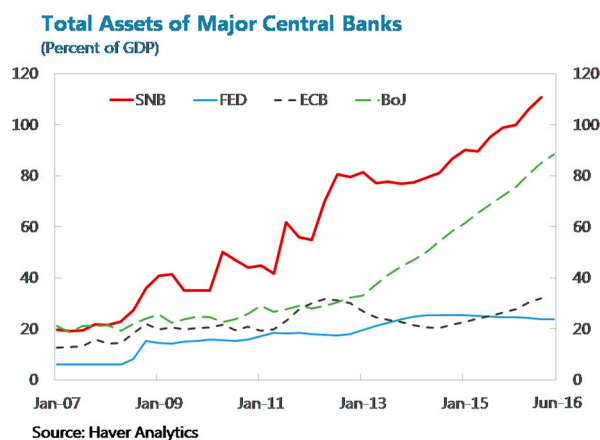
¹⁹ Turk, R., 2016, "Negative Interest Rates: How Big a Challenge for Large Danish and Swedish Banks?" IMF Working Paper 16/198 (Washington: International Monetary Fund).

SWITZERLAND: DEFENDING AGAINST LARGE INFLOWS

NIRPs to boost inflation and counter appreciation.

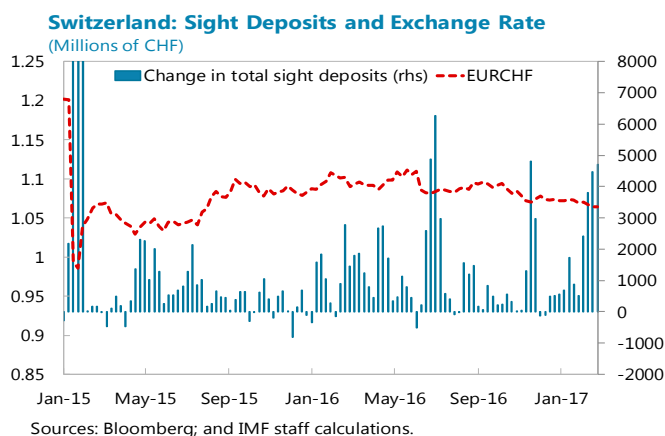
Given its role as a safe haven currency, the Swiss franc has been subjected to strong inflow pressures in recent years. In an attempt to counter these pressures,

Switzerland adopted an exchange rate floor against the euro in September 2011, which afforded it three years of relative respite from large capital inflows. However, inflows once again surged in late 2014, fueled by expectations of QE in the euro area, and requiring the SNB to intervene heavily to defend the exchange rate floor. With significant appreciation pressure on the franc and an already large SNB balance sheet, the floor was no longer seen as tenable.



NIRP was adopted to counter appreciation pressures once the exchange rate floor was removed. While still maintaining the exchange rate floor, the SNB imposed a negative interest rate of minus 0.25 percent on banks' sight deposits at the SNB in December 2014. On January 15, 2015, the SNB discontinued the exchange rate floor and lowered the interest rate to negative 0.75 percent. The further reduction in the interest rate was intended to discourage inflows and prevent an unwanted tightening of monetary conditions following the removal of the exchange rate floor.

The SNB relies on a two-pronged monetary policy that combines NIRPs with foreign currency intervention. The NIRPs helped to partly restore the negative interest rate differential with respect to major currencies that prevailed before the introduction of the exchange rate floor, thereby relieving some pressure on the franc. In addition, the SNB purchases foreign currency, periodically buying sizable amounts in response to capital inflow surges, as well as making more frequent purchases of smaller quantities. As a result, the SNB's balance sheet reached 110 percent of GDP in September 2016.

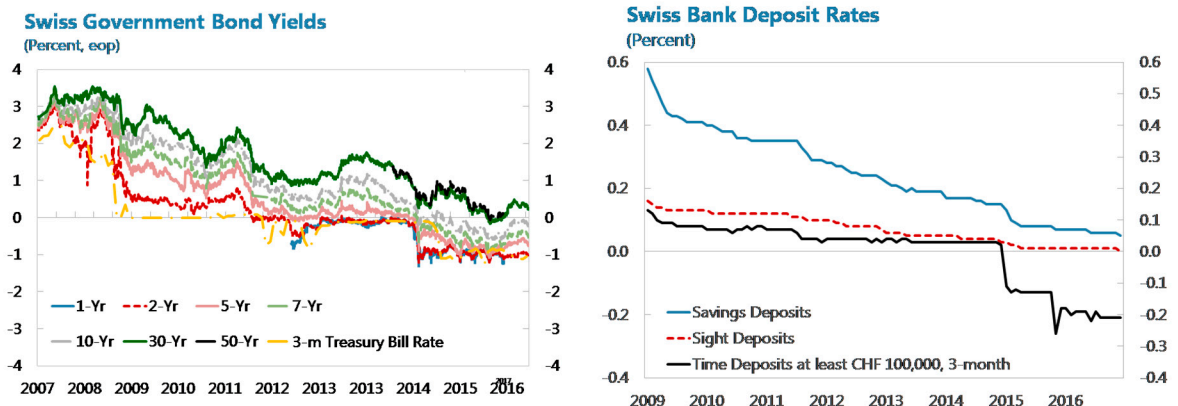


The exemption threshold on NIRPs is intended to support banks' profitability. The SNB applies its NIRPs to sight deposits that exceed an exemption threshold of 20 times each domestic bank's minimum required reserves, minus (plus) the increase (decrease) in cumulative cash withdrawals by the bank. This exemption is intended to discourage banks from transmitting negative rates to retail depositors and, in turn, limiting incentives to hoard cash (which carries a zero interest rate). As a result of this high exemption threshold, the negative policy rate applies mainly to sight deposits constituted after the introduction of the NIRPs, thereby affecting banks' willingness to place additional funds at the SNB.

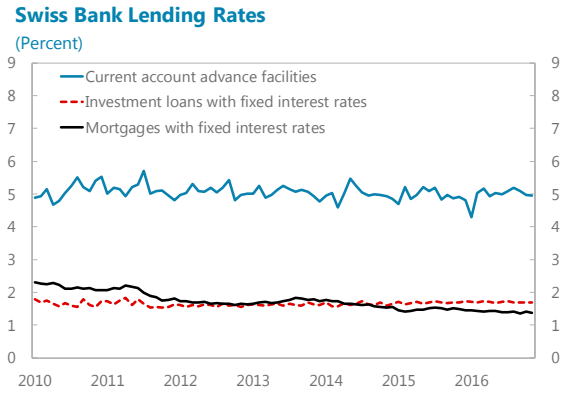
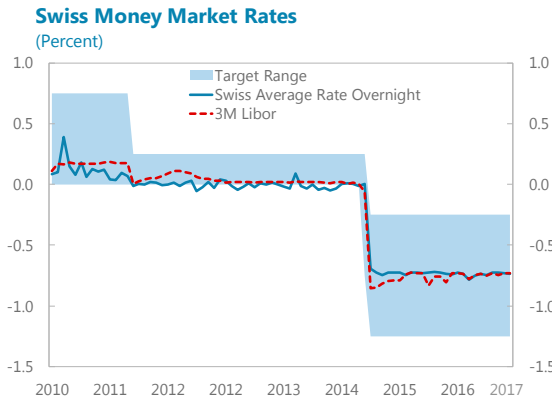
Success in reducing deflation by containing currency appreciation

The two-pronged policy is seen as operating primarily through the exchange rate channel. Removal of the exchange rate floor led the franc to appreciate by 17 percent against the euro. Together with the fall in world energy prices, the appreciation caused prices of imported goods—which have large weight in the consumer basket—to drop sharply, even as prices of domestic goods decreased only modestly, resulting in consumer price deflation of 1.3 percent. The SNB's combined NIRP-fx intervention policy helped the franc gradually moderate, and the franc has been less volatile, including at the time of safe haven inflows triggered by the Brexit vote. Nonetheless, this level remains stronger than the previous floor of 1.20 francs per euro, and the Fund considered the franc to be moderately overvalued in the 2016 External Sector Report.

The NIRPs was transmitted rapidly to market interest rates. The 3-month LIBOR converged quickly to the policy rate. Rates on longer-term instruments also decreased, with the entire yield curve for sovereign paper (through to 50 years) falling into negative territory, although rates at the long end have since climbed above zero. While interest rates on mortgages initially rose somewhat, the cost of borrowing for households and corporates is now lower than before the introduction of NIRPs, although the pace of bank lending has been stable.

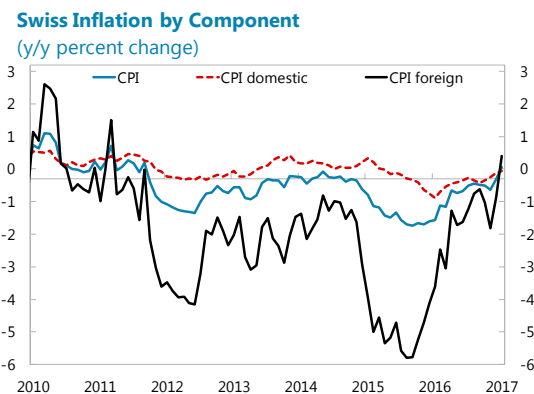
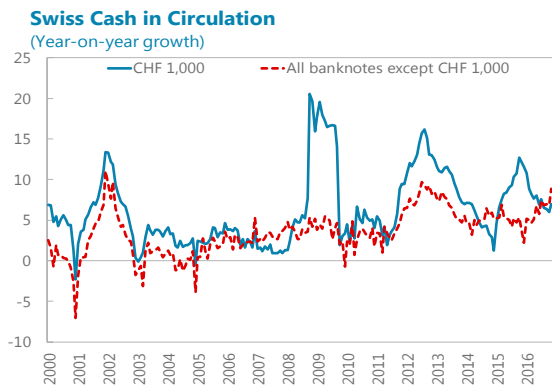
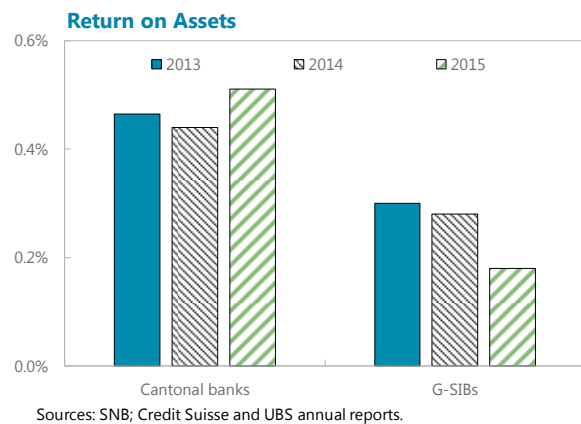


NEGATIVE INTEREST RATE POLICIES



The real economy has recovered quickly.

Output initially fell following the large appreciation, led by a contraction in exports. However, growth resumed in the subsequent quarter and has gradually strengthened alongside the unwinding of the initial appreciation. GDP is expected to have grown by 1.3 percent in 2016, and inflation approached positive territory toward the end of the year. Inflation expectations, which had fallen sharply in response to the appreciation, have since stabilized at (positive) 0.5 percent alongside the pickup in actual inflation.



Side effects have so far been contained

Negative rates, if sustained for an extended period, could strain financial institutions. In 2015, the return on assets for Swiss cantonal banks increased modestly, but remained at a low level (RoA of the Swiss G-SIBs at the consolidated group level moderated during 2015). To some extent, this may reflect that rates on wholesale deposits shifted into negative territory while

deposit rates for retail customers remain bounded by zero and rates on banks' domestic lending have moderated only slightly. Competition from nonbank credit providers could push down bank lending rates in the future. However, pension funds and providers of life insurance are already pressured by fixed nominal interest rate commitments that are out of line with prevailing market interest rates. For banks and other financial intermediaries, the strain is in part due to compressed yield curves, rather than negative rates per se.

Cash hoarding has been limited so far, but could increase if negative rates are prolonged.

The annual growth of currency in circulation increased from 3 percent in December 2014 to near 10 percent in late 2015, but has since moderated. The number of large-denomination banknotes (CHF 1000 notes), which is the most likely vehicle for cash hoarding, has not outpaced the overall demand for cash. In all, demand for cash has increased at a slower pace than at the onset of the global financial crisis.

Annex II. The Threshold for Moving into Cash

Under NIRPs, individuals and corporates could substantially increase the use of cash as a store of value. Indeed, so could banks: instead of working balances held at the central bank to cover interbank transactions, banks could hold vault cash for settlement between each other. (Note that “cash” transactions undertaken with immobilized cash maintain an audit trail, and are thus not so bad from an AML point of view as transactions where cash changes hands physically.)

Some of the costs of using cash as a store of value are of a one-off nature: these might include expanding vault capacity,¹ transporting cash to private sector vaults, and setting up systems. Since these one-off costs would be spread over time, the length of time for which negative rates were expected to endure would be important both in the decision of whether or not to undertake them, and for the interest-rate equivalent added cost to transactions.

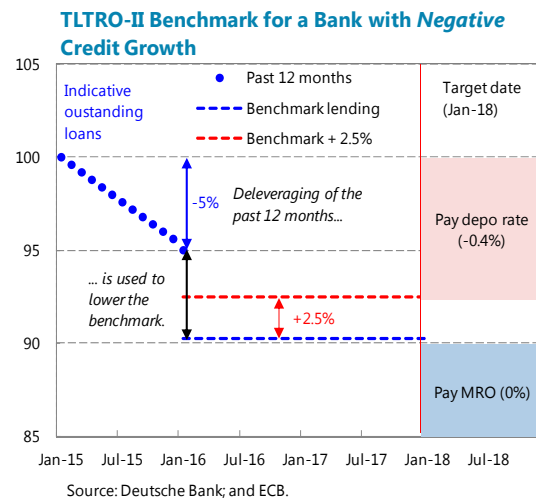
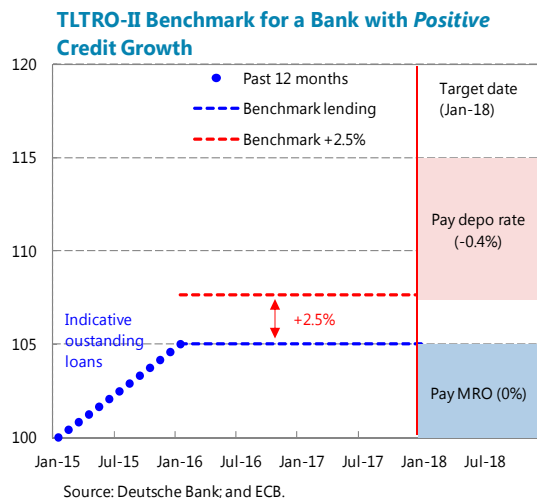
Estimates for the tipping point—at which moving into cash would become worthwhile—range from 75bp to 200bp (see also Viñals and others, 2016). This will vary by country—for instance it may be lower in the euro area than in Denmark or Switzerland, because of the greater potential for market diversification—and would have an unpredictable pass-through. It would be influenced by the value of the highest denomination banknotes. The physical space required for storing US\$1 million equivalent would be similar in Japan and the USA; but lower in the euro area and Switzerland where there are higher denomination notes (EUR500 and CHF1,000). Other country-specific factors that may come into play include the availability of excess vault space, the insurance/transportation costs for cash holdings, availability of alternative money/payment methods (credit cards, e-money and payments), and preference for cash.

Suspending issuance of large denomination notes would increase the cost of using cash as a store of value and presumably allow for a more negative rate. However, the magnitude of this effect (that is by how much this would move the effective lower bound) is difficult to estimate. Central banks could, similarly, charge one-off fee for delivery of cash; again, the pass-through to interest rates would be uncertain.

Theoretical schemes for taxing cash holdings appear impractical (and may be politically impossible). Such schemes would probably need to extend to near cash equivalents; e.g., banker’s drafts, certificates of deposit (which could be issued/used in standardized amounts; e.g., USD100, EUR500). Taxing cash held abroad could be particularly difficult, reducing the effectiveness of such schemes for the US and the euro area. Further, such schemes could also be considered as Multiple Currency Practices under the IMF’s Articles.

Annex III. Euro Area: TLTRO II, Negative Rates on Central Bank Lending

The ECB launched a second series of targeted longer-term refinancing operations (TLTRO II) to support bank lending. Between June 2016 and the March 2017 TLTRO-II operation, banks have been able to obtain funding with a four year maturity for up to 30 percent of their holdings of eligible non-mortgage, non-financial sector private loans at the prevailing MRO rate. TLTRO II has two components to incentivize new lending (see chart below): (i) *conditional liquidity* (at the marginal policy rate, equivalent to the rate on the deposit facility prevailing at the time of the allotment) if banks exceed a benchmark for net lending by January 2018 by at least 2.5 percent, and (ii) *unconditional liquidity* (at the MRO rate of currently zero percent) if banks do not satisfy the lending benchmark.²⁰ The size of the decrease of the interest rate for conditional liquidity is graduated linearly depending on the percentage by which a bank exceeds its benchmark (which is calculated similar to those under TLTRO I). For banks with positive lending growth over the 12 months prior to January 2016, the benchmark is zero net lending. The benchmark is lowered by the decline in eligible net lending in the same period for banks that have seen negative lending benchmark net lending.



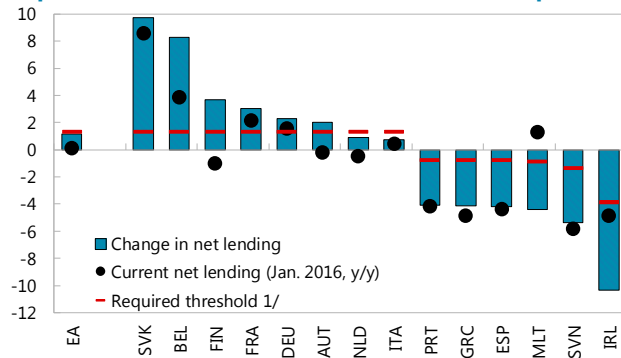
TLTRO II could mitigate the potentially adverse impact of NIRPs on bank profitability.

Realigning the cost of refinancing to the marginal policy rate (if banks meet a defined minimum rate of net lending growth) facilitates the pass-through of improved bank funding conditions to the real economy by encouraging more lending. It may also help strengthening the transmission mechanism in countries where banks face high funding costs and/or would otherwise refrain from lowering lending rates to preserve profit margins (see charts). Meeting the requirements for TLTRO II funding at the marginal policy rate implies at least 1.25 percent annual lending growth over a two-year period for banks with positive net lending over 12 months through January 2016. Other conditions apply to banks that have been de-leveraging over the eligibility period (lower

²⁰ As opposed to TLTRO I, failure to meet the benchmark for net lending does not result in an early repayment of funds after two years.

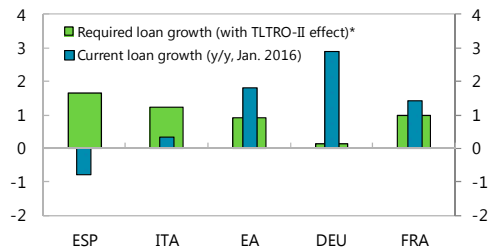
though positive annual lending growth for banks that de-leveraged by less than 1.25 percent, and a continued decline in the eligible loan book for banks that de-leveraged by more than 1.25 percent).

ECB TLTRO-II Benchmarking: Net Lending to Non-Financial Corporates and Households, Dec 2014-Jan 2016 (percent)



Sources: Bloomberg L.P., Haver, and IMF staff calculations. Note: 1/ Annual growth of net eligible lending required to qualify for TLTRO II borrowing at the ECB deposit rate (-0.4%).

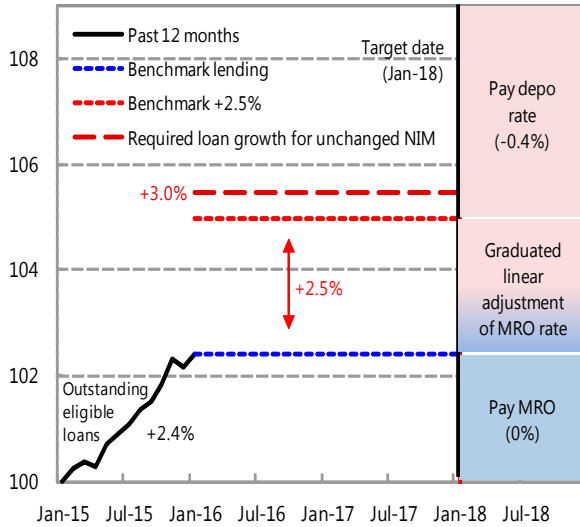
Annual Loan Growth Required to Maintain Net Interest Margin, end-2015 (y/y percent change) 1/



Sources: Bloomberg L.P., EBA Transparency Exercise (2015), ECB, SNL and IMF staff calculations. Note: 1/ based on the historical pass-through of policy rates and the elasticity of net interest margins to changes in term premia between Jan. 2010 and Feb. 2016; total mortgage and corporate loans at end-2015 to EA residents; scenario assumes an increase of monthly asset purchases (until Sept. 2017) by the ECB and a reduction of the deposit rate by 10bps (as per ECB decision on March 10); * / assumes that new lending is fully funded using TLTRO-II funds at a weighted average borrowing rate of -20bps.

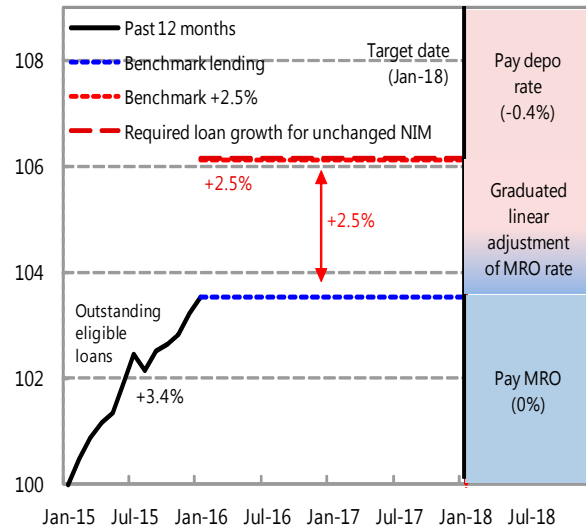
However, in most countries, current lending growth falls below the required benchmark to access TLTRO II funding at favorable terms. The necessary (aggregate) lending growth for German and French banks (see charts below) is lower than current growth (of 2.4 percent and 3.4 percent, respectively, through end-January 2016). Credit growth in Italy (0.4 percent) falls short of the annualized benchmark. Spanish banks, which have cut back their lending by 4.0 percent in 2015, are required to meet a much lower benchmark (-1.6 percent net lending growth), but might struggle to achieve more favorable funding terms under TLTRO II at the current rate of de-leveraging (-4.4 percent). Even if Italian and Spanish banks manage to satisfy the required lending growth under TLTRO-II, it would still be insufficient to offset the negative impact of NIRPs on profitability (as shown by the dotted red line indicating the NIM-preserving loan growth).

Germany: Required Lending for TLTRO-II Benchmark (Jan. 2015=100)



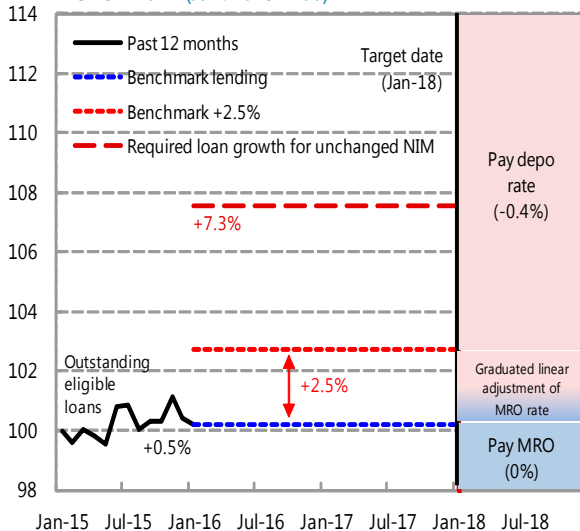
Sources: Deutsche Bank, ECB, and IMF staff calculations.

France: Required Lending for TLTRO-II Benchmark (Jan. 2015=100)



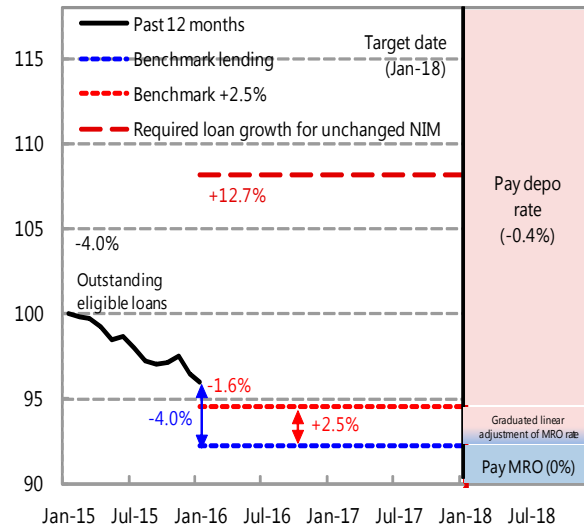
Sources: Deutsche Bank, ECB, and IMF staff calculations.

Italy: Required Lending for TLTRO-II Benchmark (Jan. 2015=100)



Sources: Deutsche Bank, ECB, and IMF staff calculations.

Spain: Required Lending for TLTRO-II Benchmark (Jan. 2015=100)



Sources: Deutsche Bank, ECB, and IMF staff calculations.

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