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The Limits of a Negative Interest Rate Policy (NIRP)

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Abstract

The paper analyzes the experience with unconventional measures to cope with the Zero Lower Bound. It argues that forward guidance and quantitative easing are the natural extension of optimal monetary policy within the New Keynesian Framework, facing a Lower Bound. Unconventional policy had significant effects on financial variables and contributed to stabilizing the real economy. Negative rates have been successful in pushing the effective lower bound below zero. But given the risk of damaging side effects on financial stability and on central bank independence, these policy tools are likely to be less powerful and shorter-lived compared to standard tools. In view of the long-term decline of the natural rate of interest, raising the inflation target up to 3–4 percent appears to be the most promising way to relax the constraint imposed by the lower bound, providing a resilient buffer for effective stabilization.

Die Grenzen einer Geldpolitik mit negativen Zinsen

Zusammenfassung

Die Arbeit untersucht die Auswirkungen unkonventioneller Geldpolitik. Sie zeigt, dass Forward Guidance und Quantitative Lockerung als Anwendung optimaler Geldpolitik im Rahmen Neu-Keynesianischer Modelle angesichts einer effektiven Zinsuntergrenze zu verstehen sind. Unkonventionelle Geldpolitik hat erfolgreich zur Stabilisierung von Finanzmärkten und Realwirtschaft beigetragen. Auch wenn sich die Zinsuntergrenze in gewissem Rahmen unter null senken lässt, ist die Wirkung unkonventioneller Maßnahmen – im Vergleich zu Standard-Instrumenten – jedoch kurzlebiger und weniger schlagkräftig, unter Berücksichtigung der Risiken für Finanzmarktstabilität und Zentralbankunabhängigkeit. Angesichts des nachhaltigen Rückgangs des "natürlichen" Realzinses erscheint eine Abhebung des Inflationsziels auf 2–4 % der geeignetste Weg, um einen robusten Mechanismus effektiver Stabilisierung zu erreichen.

Keywords: Natural rate of interest, unconventional monetary policy, zero lower bound, negative interest rate policy, inflation target, financial stability

JEL Classification: E43, E52, E 58

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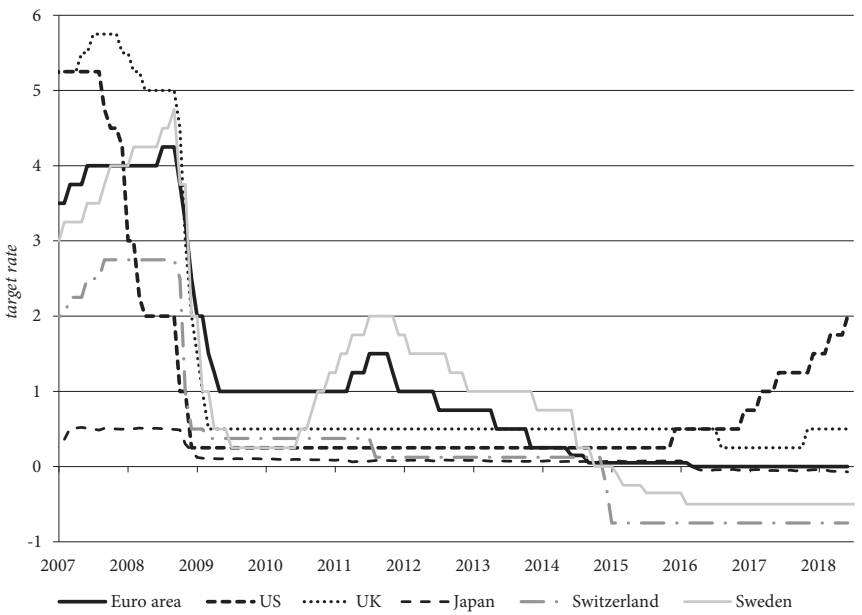
"Negative interest rates in *Japan* is blowing my mind,"
Jose Canseco (retired baseball player) on Twitter. 4.2.2016

I. Low Nominal Interest Rates – A Limiting Factor for Monetary Policy as Stabilization Tool

After the outbreak of the financial crisis in 2008, most central banks worldwide responded with unprecedented monetary policy easing. Some – such as the Fed and the Bank of England – acted quite aggressively right from the beginning, cutting down interest rates very fast close to Zero. But they deliberately shied away from charging negative rates. Instead, they engaged in unconventional policy measures, starting forward guidance and quantitative easing with an aggressive expansion of their balance sheet. Other central banks – in particular the ECB or the Sveriges Riksbank – hesitated initially; they even tried to raise rates before cutting them down not just to zero. In the end, some moved even into negative territory (see Figure 1).

The unconventional policy responses have been highly controversial, causing deep rifts among proponents and critics. Some critics voiced strong warnings when these unconventional measures have been introduced about the risk in-



Source: National Central Banks

Figure 1: Central Bank Target Rates Since 2007

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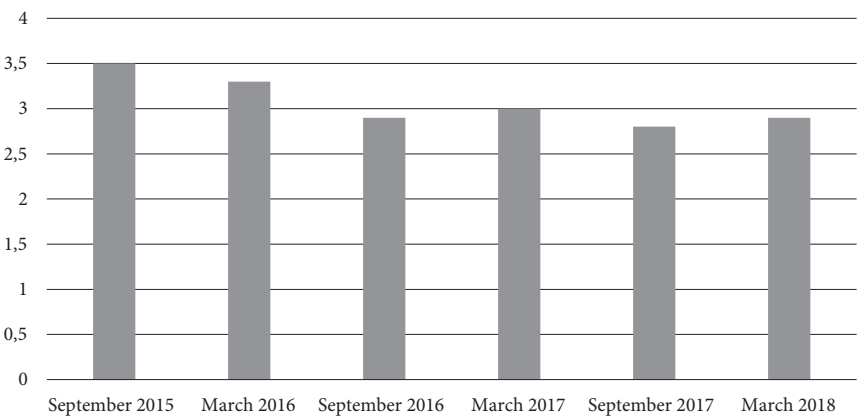
volved – such as triggering high inflation and negative impact for financial stability. They questioned the effectiveness of these measures and called for an immediate reduction in central banks' balance sheets and an increase in policy rates right from the beginning. At least in the US, however, the new tools introduced seem to have effectively contributed to a recovery – up to now without adverse side effects. In October 2014, the Fed started to unwind its QE program. At first, it just kept the size of its balance sheet constant, buying just enough to replace maturing securities. Then, it started to raise interest rates gradually. Finally, at the end of 2017, it also began to reduce its balance sheet slowly by no longer replacing maturing securities.

Despite rising short-term interest rates, however, average expected long-term rates have been steadily declining. The median projections of the longer run level of the short-term policy rate (the federal funds rate) made by Fed policy makers themselves (the members of the Federal Open Market Committee (FOMC)) remain below 3 percent. These longer-run projections are the rates to which the "policymaker expects the economy to converge over time – maybe in five or six years – in the absence of further shocks and under appropriate monetary policy." Whereas the long-term rate has averaged more than 7 percent between 1965 and 2000, these FOMC projections have declined from 3.5 percent in September 2015 to around 2.8–2.9 percent in September 2017/April 2018 (see Figure 2) despite the Fed raising its short-term rates gradually but steadily during that period.

Evidently, with average rates expected to stay below 3 percent, the scope to respond to future recessions without hitting the lower bound will be rather limited. Following *Wicksell* (1898), optimal monetary policy should adjust the



Source: Economic projections of Federal Reserve Board members and Federal Reserve Bank presidents

Figure 2: FOMC Median Projection for Federal Funds Longer Run Rate

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nominal short-term rate – given the expected rate of inflation – such that the real interest rate corresponds to the natural real rate. The fact, that average nominal rates are expected to stay rather low in the longer-run, raises strong concerns that traditional monetary policy tools will not leave sufficient room for stabilizing the economy against future shocks when the nominal rate hits the Lower Bound. During former recessions the Fed has cut policy rates on average by 5.5 percentage points in the US. As long as both expected inflation and the expected long-term real rate will stay at current low levels, monetary policy is bound to be constrained more frequently in the future by the effective lower bound. The same argument applies to the Euro area, UK and Japan. This is even more worrying, taking into account that the economy is likely to exhibit higher volatility compared to past episodes characterized by the "great moderation".

If central banks are not able to generate more accommodation by cutting rates sufficiently in a downturn, recovery may be substantially delayed, triggering contractions in a liquidity trap. A key lesson from the recent financial crisis is that the lower bound for nominal rates imposes serious limitations to monetary policy as stabilization tool. The challenge for monetary policy design is to set up a robust environment, allowing for a flexible response to stabilize against future shock. There are essentially 3 options for improving effectiveness of monetary policy:

(1) Use unconventional tools (use quantitative easing and forward guidance) as standard tools.

(2) Lower or even eliminate the lower bound, extending the negative interest rate policy (NIRP) implemented by various central banks recently.

(3) Raise the inflation target or switch towards a strategy of price level targeting.

After discussing the reasons underlying the low expected long-term nominal rates, this paper analyses the various options.

II. The Decline in Long-Term Nominal Rates

Low long-term rates are driven both a reduction in inflation and a secular decline in the real (inflation-adjusted) "natural rate of interest." In the US, 10 year averages of the estimate for the natural real rate by *Laubach/Williams* (2003) declined from 4.45 % during the 1960s to 0.23 % in the 2010s (Figure 3a). The estimates for US, Canada, Euro area and UK provided by *Holston/Laubach/Williams* (2016) – see Figure 3b – illustrates that this trend is not limited to the US.

Among others, factors causing this downward trend are aging population in advanced economies, slowing productivity growth, falling prices of investment goods, cuts in public investment, the so called "global savings glut" and prefer-

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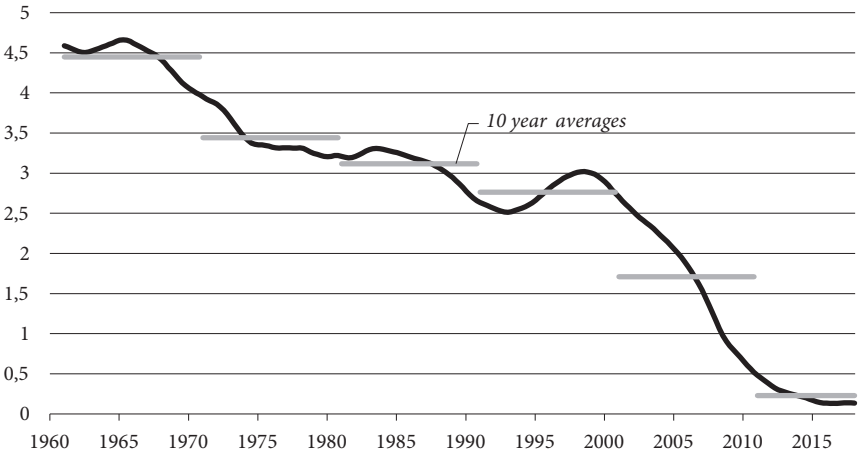
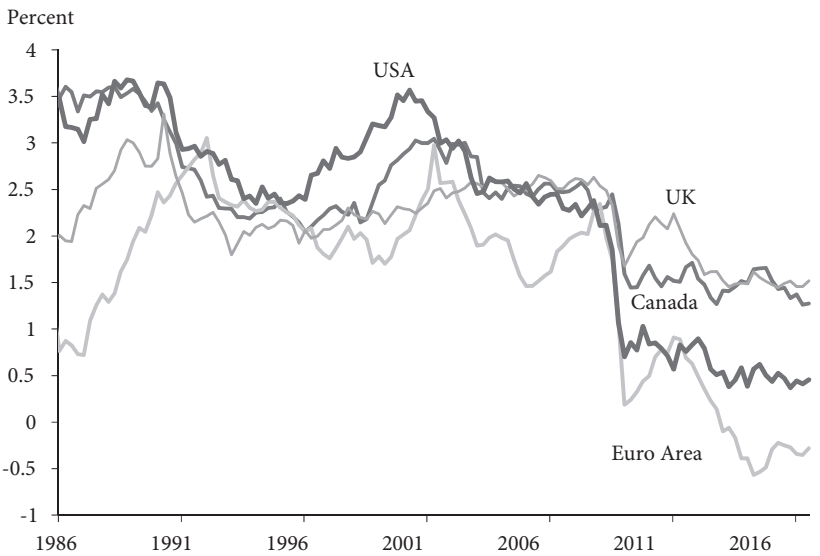


Source: by Laubach/Williams (2003), updated at http://www.frbsf.org/economic-research/economists/LW_replication.zip

*Figure 3a: Two-Sided Estimates of the Natural Rate of Interest r**



Source: Holston/Laubach/Williams (2017)

Figure 3b: Estimates of the Real "Natural Rate of Interest" for Canada, Euro Area, US and UK

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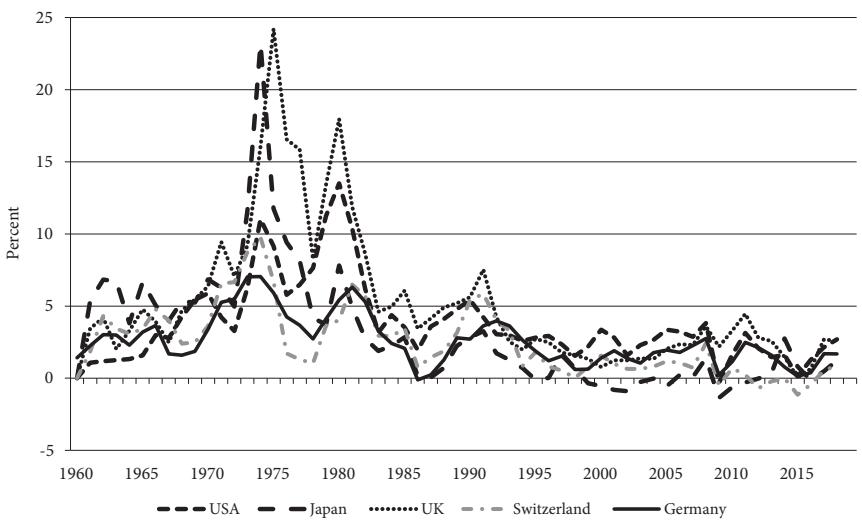
ences shifting in favor of "safe assets" like government bonds and, finally, accumulation of wealth due to relative status preferences, combined with debt-burdened consumers. With the natural rate being unobservable, estimates of the "true" rate are bound to be fairly unreliable. But the downward trend turns out to be robust across different methods used (see *Kiley* 2016; *Del Negro* et al. 2017).

There are heated debates about the relevance of the various underlying reasons, about the validity of extrapolating this trend into the future and about the policy challenges involved. Some factors may reverse in the future: Once an aging population is forced to dis-save, the "savings glut" may turn into a drought. Some see an imminent rise of real rates around the corner, either as a result of a productivity burst or of a secular decline of savings and shortage of labor in a senile society. A rise may also be the result of sparking inflation risk premiums once central banks succeeded in triggering inflation with helicopter money. On the other hand, economists such as Larry *Summers* (2014) or Carl Christian *von Weizsäcker* (2018) gloomily predict a new area of secular stagnation. Obviously, the future is unknown. But when thinking about how to design a prudent policy framework, it makes good sense to be prepared for the possibility that real rates in advanced economies will stay as low as current rates or may even get lower over the next decades.

During the last decades, there has not only been a downward trend in natural rates, but at the same time also a secular decline in inflation rates across advanced economies (Figure 4). Central banks worldwide have been extremely



Source: OECD Economic Outlook

Figure 4: Secular Decline in CPI Inflation Rates Across Advanced Economies

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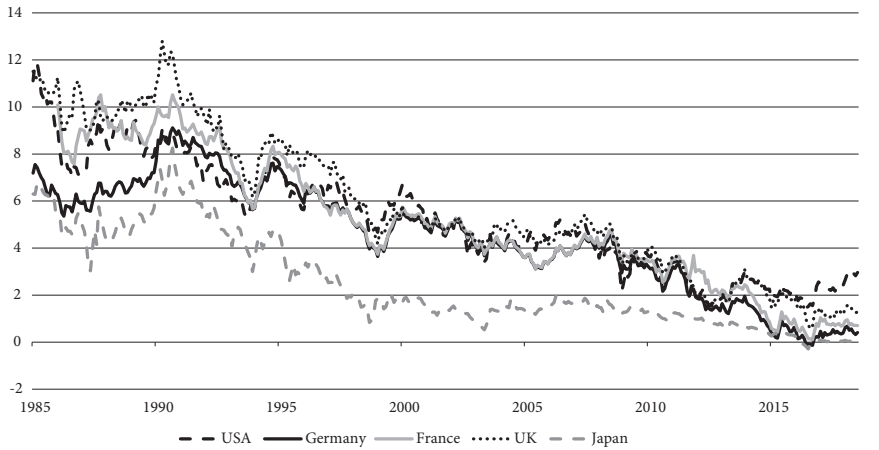

Source: OECD Economic Outlook

Figure 5: Ten Year Government Yield: Secular Decline in Long-Term Bond Yields Across Advanced Economies

successful in bringing inflation down to a target rate of around 2 percent. During the last decade, there has even been a substantial undershooting of that target: After the financial crisis, inflation rates persistently stayed below target. With nominal bond yields essentially being determined by the expected real rate and expected inflation (apart from risk premiums), both short-term and long-term average nominal bond yields have been declining as well. In many countries yields on long-term government bonds have been declining for 25 years (see Figure 5). These low rates pose a challenge for monetary policy: Low long-run rates reflect both low expected inflation and low real growth. With overall rates already being fairly low, central banks are seriously limited in using their traditional tools for fighting recessions: As a response to the financial crisis, policy rates have been set at record low levels in nearly all advanced economies.

The options to improve effectiveness of monetary policy for fighting future recessions turn out to be rather limited. Essentially, there are 3 options:

(1) The main route taken by nearly all central banks in developed countries up to now has been to follow the advice of modern New Keynesian models at the ZLB and resort to unconventional tools such as large-scale asset purchases and to rely on explicit forward guidance in order to reduce risk and term-premiums for long-term expected interest rates.

(2) An alternative or complement is to take measures aiming at lowering the effective lower bound. Some central bank experimented with slightly negative nominal rates. An extreme version is to follow the suggestion of *Gesell*

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(1911) and introduce measures to further extend or even abolish the effective lower bound on interest rates. In a cashless society, standard stabilization tools would no longer be constrained.

(3) Finally, the third option is to raise the inflation target, aiming to bring inflation back up to a level closer to the historical range. Switching towards a strategy of price level targeting may also bring more scope for stabilization at the lower bound.

All policy options involve trade-offs and risks with potential benefits and costs.

III. Unconventional Monetary Policy as an Extension of the New Keynesian Framework

Responding to the financial crisis, the Fed was the first to aggressively use the option of unconventional monetary policy measures. Many other central banks followed that route later. In contrast, for quite some time, there has been strong reluctance to cut interest rates even further into negative territory.

In the New Keynesian framework, unconventional policy measures are the natural extension of standard monetary policy at the Zero Lower Bound (ZLB). Stimulated by the experience in Japan during the 90's last century, the ZLB has become a fascinating focus for academic research for a long time. *Eggertsson/Woodford* (2003) characterize optimal monetary policy in the face of such a Lower Bound. Taking the non-negativity constraint serious introduces a challenging non-linearity into the optimization problem. *Eggertsson/Woodford* show that at the ZLB constraint, the central bank is facing a deflation bias. To cope with that bias the central bank should aim to keep interest rates low for a long period, in order to stimulate current demand by committing to low long-term rates. This research provides an impressive example how insights obtained from theoretical models can have a strong impact on actual policy in practice. For a long time, studies of the ZLB have been seen as a pure academic exercise, carried out more for intellectual curiosity interested in exotic outliers such as Japan seemed to be at that time. But the research led to a number of specific policy prescriptions that influenced policymaking during and after the global financial crisis.

Key lessons are that short-term rates (1) should be cut aggressively down to the lower bound when deflation or a severe downturn threatens and (2) they should also be kept "lower for longer" as the economy recovers. The intuition underlying this insight is straightforward: The expectation of an extended low level of future short-term interest rates helps to compress longer-term yields and so eases financial conditions more broadly. Optimal policy is facing a problem of dynamic inconsistency: The optimal control path requires a commitment to overshoot the target later, when the economy is back to normal. At that stage,

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however, there is a strong incentive for policy to renege on the promised path. This creates a deflation bias, resulting in sub-optimal outcome.

The attempt to communicate and commit in a transparent way to keep the path of short-term interest rates low for an extended period far into the future is a key element of optimal interest rate policy at the Zero Lower Bound. Even though central banks worldwide have been quite hesitant to make a commitment for temporary overshooting of the inflation target, they experimented with a wide range of different commitment mechanisms aiming to implement optimal policy at the lower bound. These measures range from pure verbal "forward guidance" stating the intention to keep rates at "exceptionally low levels for an extended period" to taking real actions to make forward guidance more credible. The announcement of large scale asset purchases with a dramatic expansion of the balance sheet with quantitative and qualitative easing can be seen as a commitment device to enhance the impact of forward interest rate guidance. It signals the intention to reduce both expected future level and volatility of interest rates.

Econometric research indicates that the new measures had indeed quite significant effects at least on financial variables (such as asset prices, long-term yields and spreads), and also some positive yet mostly small effects on output and inflation. In the US, QE lowered long-term Treasury bond yields substantially. The cumulative effect of QE is estimated to have had quite a strong impact on nominal yields, reducing the 10-year Treasury yield by about 100 basis points. With lower treasury yields, overall financial conditions eased more generally, also reducing risk premia on equity and private credit (*Borio/Zabai* 2016). The transmission mechanism can work through a signaling channel (affecting market expectations about the future policy path) and a portfolio-balance channel (affecting relative prices of imperfectly substitutable assets, such as long- and short-term Treasury debt). Most of the measured impact seems to have been on announcement dates, rather than on dates of actual purchases, emphasizing the importance of the signaling channel. The impact seems to be strongest with initial announcements, with further extensions having diminishing effectiveness.

Event studies of the impact of the ECB's unconventional programs come to similar conclusions. The study of *Andrade* et al. (2018) shows that announcements of the ECB's asset purchasing program also raised market expectations about long-term inflation towards the ECB's medium-term inflation objective (see Figure 6). The study provides evidence for a "re-anchoring channel," enhancing the effectiveness of the program by removing uncertainty about the central bank's actual inflation target.

Despite the encouraging econometric evidence provided, it is hard to evaluate the effectiveness of these unconventional monetary policy tools convincingly – given the paucity of data and the challenge how to properly take into account the

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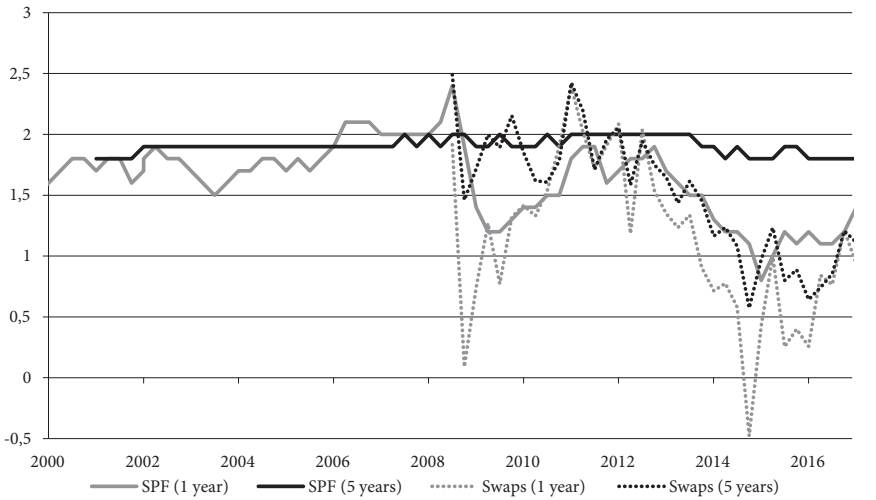

Source: ECB, Thomson Reuters

Figure 6: Expected Inflation in the Euro Area – Euro Inflation Linked Swaps and SPF

problem of missing counterfactuals. It is doubtful that these news tools can be so powerful that they can provide sufficient resilience against future shocks. Experience in Japan suggests that even though QE policy leads to a significant decrease in long-term interest rates and increase in output and prices, the effects have been transitory to a large extent. In their VAR analysis of the case of Japan, *Schenkelberg/Watzka* (2013) show that QE shocks at the ZLB are weaker, shorter-lived, and statistically less significant compared to traditional expansionary interest rate innovation during normal times. So it seems unlikely that unconventional policy tools at the ZLB can be as powerful as standard monetary policy.

The scepticism is reinforced when taking into account the risk of damaging side effects. As long as sufficient experience about a smooth unwinding of unconventional policy is lacking, doubts about adverse impact on market effectiveness need to be taken seriously. The strategy of forward guidance poses financial stability risks. First, lowering long-term yields results in a compression of the yield curve. This compresses banks' profitability margins between lending and borrowing rates. Of course, the central bank's task is not to subsidize banks' profits by keeping long-term yields artificially higher than the rate appropriate according to optimal policy. But the promise to keep rates low for long may encourage banks to excessive risk taking.

Along the discretionary path, interest rates will be rising steadily at a measured pace to fight inflationary pressures. Along the commitment path, interest rates instead will be kept lower for longer, requiring rates to rise faster than un-

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der discretion once inflationary pressure sets in. If the promise to keep rates low for long encourages financial intermediaries to engage in carry trades, an abrupt policy change is likely to trigger fire sales and financial disruption. Being afraid of turmoil, the central bank may be caught in an "interest rate trap," being forced to keep interest rates low for too long to prevent triggering crises. As shown in *Cao/Illing* (2016), the adequate response to this risk is to combine monetary policy tools with proper macro-prudential regulation, making the banking sector more resilient by imposing stronger capital and liquidity requirements.

Large scale asset purchases are bound to remain controversial, since they inevitably involve redistribution issues. A key transmission mechanism works via lowering long-term rates, boosting asset prices. As *Adam* et al. (2016) show, capital gains from bond and equity price increases are concentrated among relatively few households. They study the distributional consequences of asset price increases for Euro Area households using data from the Household Finance and Consumption Survey. Equity price increases largely benefit the top end of the net wealth (and income) distribution, thus amplifying net wealth inequality. For housing price increases, the picture is more nuanced with the median household strongly benefitting, but there is considerable heterogeneity across Euro Area countries. Even though stabilizing effects of low rates for the real economy (boosting output, employment and wages) helps to dampen inequality, the perceived distributional impact on asset prices provides tough challenges for public support of unconventional policies. Furthermore, decisions about which assets to purchase have strong political impact, again running the risk to threaten central bank independence. Since unconventional policy tools provide no panacea, it seems advisable to take other options into account. Natural candidates are measures to reduce the lower bound. As the next section shows, however, NIRP policy is facing very similar challenges.

IV. Strategies to Lower the Effective Lower Bound – NIRP

The Zero Lower Bound has fascinated economists for a long time at least since the Great Depression. At that time, the standard argument was that people rather prefer to withdraw all money from bank accounts and hoard it in cash as soon as central banks are charging negative rates. John *Hicks* (1937) phrased this argument in the following way: "If the costs of holding money can be neglected, it will always be profitable to hold money rather than lend it out, if the rate of interest is not greater than zero. Consequently the rate of interest must always be positive."

But the value of the lower bound on nominal interest rates is not precisely zero. Obviously, costs prevent people from withdrawing all their funds from bank deposits even at slightly negative rates. There is the risk of being robbed

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when putting paper money under the pillow at home; there are costs of renting, maintaining and securing storage facilities such as vaults to store piles of bank notes; there are costs of shipping cash around – be it by mail or by horse – in a safe and timely manner. Settling payments electronically definitely provides substantial convenience.

Rognlie (2016) studies optimal monetary policy with negative rates for electronic transactions for the case that imposing negative rates on holding cash is not feasible. In that case, the following tradeoff arises: Negative rates can help to stabilize the economy, but at the same time, they imply an inefficient subsidy to paper currency. Just as – following *Friedman* (1969) – money holding is inefficiently low when interest on cash i_m is lower than on short-term government debt i_d ($i_d > i_m$), the reverse is true for the opposite case $i_d < i_m$. Implementing negative rates on electronic deposits ($i_d < 0$) gives agents incentives to hold too much cash as long as there return to cash is not negative (with $i_m = 0$).

So effectively, the central bank subsidizes cash holdings, generating negative seigniorage revenue. But when rates get modestly negative, there will be no abrupt change in the effectiveness of monetary policy, provided banks and their customers will not hoard paper currency, urgently seeking to avoid the levy from negative rates, making money demand infinitely elastic at zero. If there is no stampede into paper currency, there is no clear discontinuity. As long as currency demand is not highly elastic, slightly negative rates may be used as stabilizer for shocks. *Rognlie* (2016) argues that the positive stabilizing effect always dominates close to 0 %. Negative rates are generically optimal whenever output averages below its efficient level. In his benchmark scenario, breaking the ZLB with negative rates can be sufficient to undo most welfare losses relative to the first best (in the absence of any lower bound). More generally, the gains from negative rates inversely depend on the level and elasticity of currency demand.

Technically, having made sure that IT systems can cope with negative rates, there is no difference between charging positive or negative rates on bank reserves. In a cashless society, there would be no binding constraint. But as long as hoarding of paper currency is a feasible option, there will always exist an effective lower bound, endangering stability of financial intermediation and thus limiting the efficiency of monetary policy tools. Unless supported by other instruments, the policy rate cannot be too negative without risking hoarding of money. The effective lower bound depends on a variety of institutional factors. Key is the size of costs associated with storing, transferring, and spending large amounts of currency. If all central bank liabilities were electronic, paying a negative interest on reserves (charging a fee) would be trivial. Yet as long as central banks are willing to convert electronic deposits into zero-interest paper currency in unlimited amounts, it is hard to push interest rates below slightly negative levels. Hoarding cash is inconvenient and risky, but if rates become too negative,

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it becomes attractive. It may be inconvenient to hold large amounts of currency, but at a sufficiently negative interest rate, banks or other institutions could profit from holding cash, for a fee, on behalf of their customers. Hoarding of cash itself is an unproductive investment, draining resources away from the financial sector, and consequently, is likely to adversely affect stability of intermediation.

Some argue the effective lower bound can be made arbitrary low by clever policy design (such as abolishing banknotes with large denomination or even more drastically, abolishing all physical cash and replacing it with pure electronic money, so enforcing a cash-less society). Paper currency creates a Zero Lower Bound only as long as banks or private agents can withdraw unlimited quantities of paper currency and redeposit it later on at par at the central bank. Silvio *Gesell* (1916), briefly Minister of Finance in Bavaria in April 1919 during the Räterepublik, already suggested a simple way to get around that constraint. He proposed imposing a stamp duty in order to tax holding paper money. Thus, the money issued by the central bank loses its value over time, thereby encouraging people to spend and invest in real assets instead of hoarding money. During the depression in the beginning of the 30's last century, Wörgl, a small town in Austria, adapted his proposal. In chapter 23 of his General Theory of Employment, Interest and Money, *Keynes* summarized *Gesell*'s idea as follows:

Currency … would only retain their value by being stamped each month, like an insurance card, with stamps purchased at a post office. The cost of the stamps … should be roughly equal to the excess of the money-rate of interest (apart from the stamps) over the marginal efficiency of capital corresponding to a rate of new investment compatible with full employment. The actual charge suggested by Gesell was 1 per mil. per week, equivalent to 5.2 per cent per annum. … *(Keynes 1936).*

The modern equivalent of such a stamp duty would be to let paper currency gradually depreciate against electronic money to ensure that paper money also effectively carries a negative rate of return. In some regions, local community currencies like the Chiemgauer in Upper Bavaria in 2003 are designed to lose 2 % of its value every quarter: The Chiemgauer has to be "topped up" every three months by purchasing a coupon of 2 % (a stamp duty). In its electronic version, the Chiemgauer can be held for 30 days without depreciation, then following a daily depreciation of 0,022 % per day. Such local currencies are, however, mainly a marketing instrument designed for promoting local business. After all, people in these regions still have always the option to switch to central bank currency as substitute as long as there is no stamp duty enforced on that currency. With a stamp duty on national currency, it is an open issue to what extent that currency might be replaced by other substitutes (like international currency).

Some economic theorists have strongly argued in favor of policies implementing gradual depreciation of paper money against electronic money (*Agar-*

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wal/Kimball 2015). *Goodfriend* (2000) suggested to tax paper money in the following way: Whenever circulating paper money returns to a bank, the bank charges the accumulated tax since the note was last turned in, and deducts this from the deposit. *Agarwal/Kimball* (2015) propose to introduce a flexible exchange rate between currency and reserves. During times of negative interest rates, the rate at which reserves can be converted to currency should decline over time to match the negative interest rate on reserves banks that are being charged by the central bank. For some theorists, inventing such schemes might be a rewarding intellectual challenge. But it is obvious that such measures make holding money more cumbersome, introducing frictions.

A more radical proposal is to abolish any paper money as propagated by *Rogoff* (2014). A key issue here is the anonymous nature of cash. Historically, an essential property of money is that neither buyer nor seller requires knowledge of its history, preserving anonymity. In contrast, electronic money leaves electronic footprints and can be traced by authorities. The anonymity of cash facilitates tax evasion and illegal activity; at the same time, it allows to preserve privacy. Rogoff sees significant evidence that in most countries a large share (more than 50 %) of currency is used to hide transactions. He argues that abolishing cash could help both to reduce black market activities and to eliminate the Zero Lower Bound on the nominal interest rate. In many countries (such as Sweden and Norway), the convenience of electronic payments has already resulted in nearly crowding out old-fashioned paper money completely. So people may not consider the lack of privacy as a serious concern. In contrast, proposals to abolish the 500 Euro banknote stirred strong controversies in the Euro area, with defenders of the paper money citing Dostoyevsky with the quote: Money is "coined liberty" in his novel "The House of the Dead." (Dostoyevsky wrote that novel after having stayed 4 years in a prison camp in Siberia.))

V. The Impact of Implementing NIRP

Obviously, there are trade-offs involved with measures aiming to lower the effective lower bound substantially. Nevertheless, within the current institutional set-up, slightly negative policy rates may help to make unconventional policy more powerful. Starting in July 2012 with Danmarks Nationalbank (DNB), some central banks have experimented with negative policy rates. The European Central Bank (ECB) followed in June 2014, the Swiss National Bank (SNB) in December 2014, the Sveriges Riksbank in Spring 2015. The Bank of Japan (BoJ) moved to slightly negative rates in January 2016. The rate set by the Swiss National Bank has been reduced to –0.75 percent for sight deposits in January 2015. The Sveriges Riksbank charges a negative rate (lowered to –1.25 % beginning of 2016) for banks depositing their funds at the central bank. So quite a few central banks implemented slightly negative nominal yields for part of bank de-

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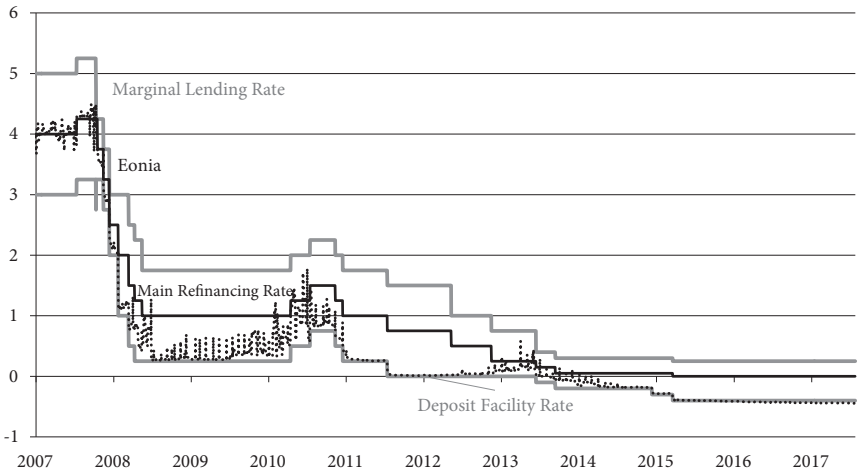

Source: ECB

Figure 7: ECB Monetary Policy Rates

posits without triggering a flight into hoarding cash. Most central banks, however, have been careful in protecting banks' profits by exempting a substantial fraction of bank reserves from the negative rate, aiming to drive a wedge between the marginal and the average rate charged on reserves.

The motivation behind the decisions differed somewhat across regions, leading to differences in policy implementation. Both the DNB and the SNB established negative policy rates primarily to deter capital inflows, aiming to dampen the appreciation pressure on their currencies. In the case of the ECB and the Sveriges Riksbank, negative policy rates were intended to provide additional monetary accommodation to ensure price stability over the medium term and a return of inflation to the central bank objective.

On June 5th, 2014 the ECB Governing Council set its Deposit Facility Rate to –0.10 %. In several steps, the rate was lowered even further down to –0.4 % on March 16th, 2016. Because banks had significant amounts of excess liquidity as a result of quantitative easing, short-term money market rates (as measured by Eonia) closely track the Deposit Facility Rate, effectively turning it into the main policy rate (see Figure 7).

In some countries like Switzerland, Japan and Germany, even the yield on long-term government bonds and also corporate bonds fell below zero, forcing investors to pay money for the privilege to lend long-term funds to the government and highly rated firms, turning the familiar features of borrowing and lending upside down (see Figure 8).

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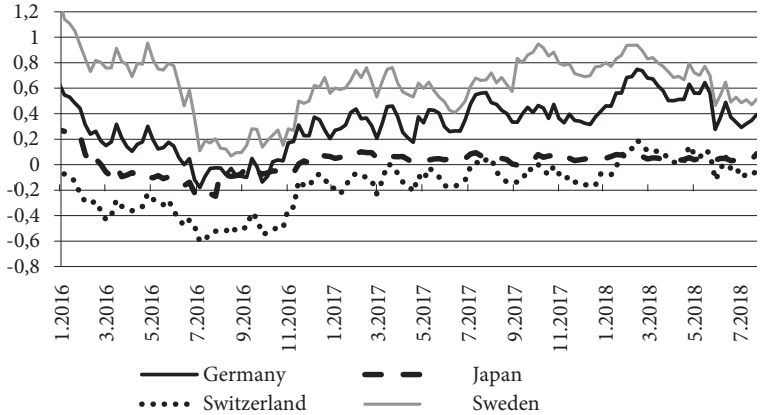
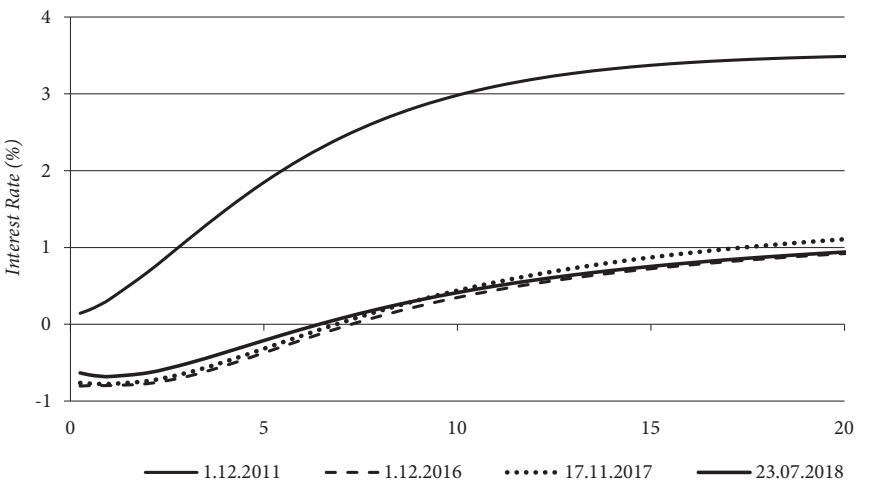


Source: Thomson Reuters

Figure 8: Negative 10 Year Government Bond Yields



Source: ECB

Figure 9: Euro Area Yield Curve, Spot Rate, AAA-rated Bonds, Maturities from 3 Months to 10 Years

The significant shift in the yield curve across time into negative territory in the Euro area (Figure 9) provides evidence that the ECB has been quite successful in shifting not only short-term, but also longer-term rates below zero not just for AAA-rated government bonds. Falling yields for government bonds even across periphery countries, following the announcement of the OMT pol-

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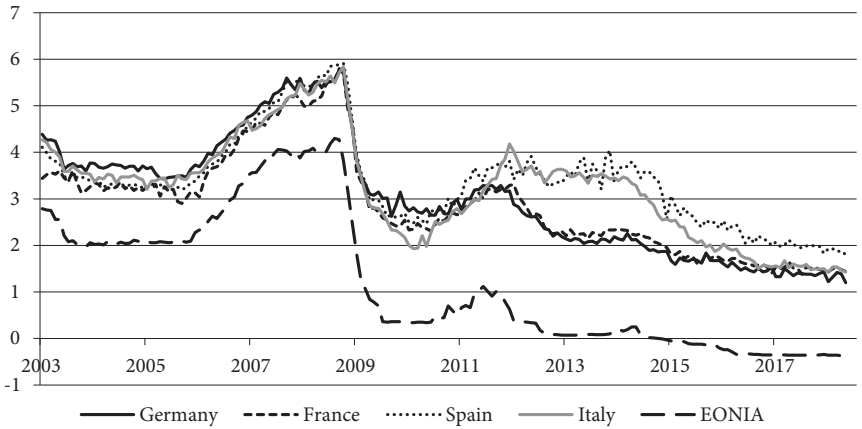

Source: ECB

Figure 10a: Loan Rates to Non-Financial Corporations, Total New Business, for Selected Countries in the Euro Area

icy, helped to stabilize financial markets in the whole Euro area. As shown in Figure 10a, personal lending rates for loans to non-financial corporations converged across core and periphery countries, indicating that the monetary transmission mechanism has partly recovered during the last years, after failing dramatically in the Euro crisis 2012/13.

The interest rate spread between lending rates for loans and the policy rate (represented by EONIA), which spiked during the Euro crisis and stayed high at elevated level, has also slowly declined since mid of 2014 (Figure 10b). Nevertheless, the spread has not yet been brought back to the levels seen before 2009 (see *Altavilla* et al. 2016; *Hristov* et al. 2014). Obviously, despite strong use of unconventional policy measures, the monetary transmission mechanism is still less effective compared to pre-crisis times. As pointed out by the referee, the decoupling of bank lending rates from policy rates may be due to tighter collateral requirements, shocks to bank capital and the cost of restoring regulatory leverage ratios. The tightening of banking regulation, aiming to rebuild a healthy banking sector via enforcing robust capital adequacy requirements and implementing macro-prudential tools, seems to have had – at least in the short run – some countervailing impact relative to unconventional policy measures.

To judge the real effects of specific policy measures is a daunting task, in particular given the fact that in most cases, other unconventional policy measures have been adapted nearly around the same time. Preliminary econometric research indicates that all measures taken together had quite significant effects at

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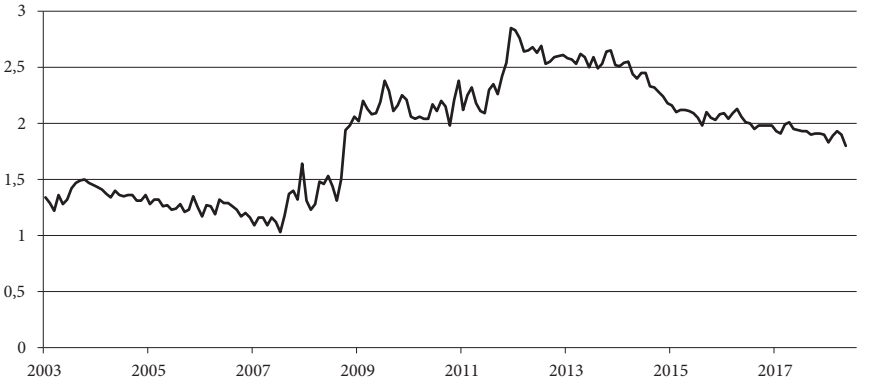
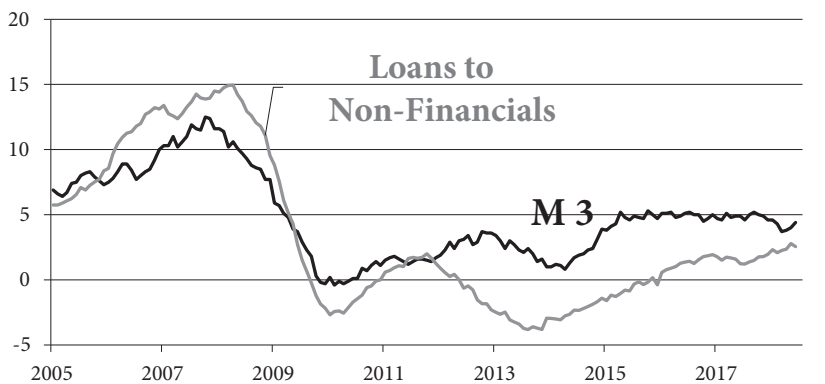


Source: ECB

Figure 10b: Interest Rate Spread – The Difference Between Bank Lending Rates (Loans to Non-Fin. Corporation, Total New Business) and EONIA

least on financial variables (such as asset prices, long-term yields and spreads), and also some positive effects on output and inflation. Judging from financial indicators, the wide range of unconventional policy measures seem to be fairly successful, bringing growth both of money supply M3 and of loans to non-financial corporates to an upward trend (Figure 11). Nevertheless, despite increasing headline inflation across the Euro area (Figure 12), mid of 2018 actual core CPI inflation still hovers around 1 %.

Recent experience suggests there is indeed no clear discontinuity between slightly positive and slightly negative interest rates. Negative deposit rates helped



Source: ECB, Thomson Reuters

Figure 11: Growth Rate of M3 and of Loans to Non-Financials

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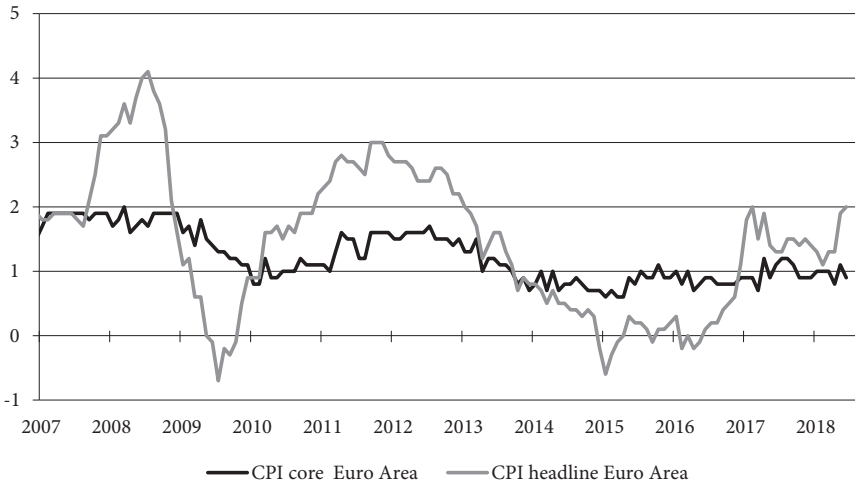

Source: ECB

Figure 12: Headline and Core Inflation Euro Area

to push effective policy rates into negative territory. So the effective lower bound for nominal policy rates turns out not to be zero, but rather slightly negative. It is unlikely, however, that negative rates can become the new normal. The crucial challenge is the impact on financial stability. When the appropriate "Wicksellian" policy rate turns negative, lowering rates should help to stabilize the economy. With banks borrowing short and lending long, in the short run lower rates will benefit financial intermediation: Holdings assets with fixed long-term interest payments, lower deposit rates give an immediate boost. Banks benefit also from lower rates by boosting collateral value of asset prices, lowering default probability, so improving credit quality and preventing economic disruption. Using a large micro-level data set of German banks profitability, *Urbschat* (2018) shows that German banks indeed have initially benefited from lower refinancing costs and shrinking loan loss provisions.

But with increasing duration of negative rates, the impact is bound to reverse, impairing banks' balance sheets: Negative rates squeeze banks' profits when they are not able to transmit the negative rates to deposits. As shown in Figure 13, there is obviously a binding Zero Lower Bound (the black line indicating that bound) for deposit rates in the Euro area. Whereas loans to non-financial corporations and for mortgages have been declining steadily, the negative rate for ECB deposit facility has been transmitted neither to deposit rates for households nor to non-financial corporations. Deposit rates become "downward sticky," staying above zero. The lower bound on deposits puts additional pressure on

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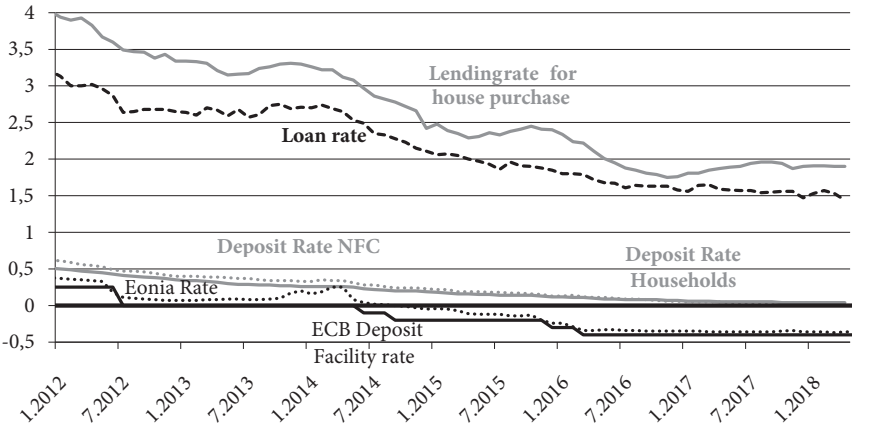

Source: ECB

Figure 13: Euro Area Lending and Deposit Rates Since 2012

bank profitability squeezing the spread between loan and deposit rates, thus aggravating the impact of the compression of the yield curve.

Just as with forward guidance, banks may be encouraged to take excessive risk: Searching for yield, they may increase lending to riskier firms. Furthermore, lending long at currently low rates, they may get exposed to the risk of interest rates rising faster than anticipated. Those risks, being hidden in the current negative rate period, are hard to evaluate. The observed flight into safe assets, driving up prices of those assets, might be seen as a sign that currently there is no underpricing risk. If so, it may be optimal to encourage rather than deter more investment in risky financial assets.

Looking at past bank balance sheet data, *Urbschat* (2018) finds little evidence that up to now German banks have engaged in excessive risk-taking. Analyzing a sample of syndicated loans granted by Euro Area banks between 2011 and 2015, *Heider/Saidi/Schepens* (2016) show that high-deposit banks (banks with a high share of customer deposits relative to total assets) have a greater incentive to (1) increase their risk-taking and at the same time to (2) reduce their lending compared to low-deposit banks. Using supervisory information from Switzerland, *Basten/Mariathasan* (2018) provide evidence that those Swiss banks which Switzerland are more affected by negative deposit rates exhibit higher credit and interest rate risk. Finally, *Eggertsson/Juelsrud/Wold* (2017), use bank-level interest rate data from Sweden and show that – once the deposit rate is stuck at the Zero Lower Bound – there is a collapse in the pass-through of lower policy rates to lending rates. The erosion of bank profits may cause negative interest rates to become contractionary.

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Even though current research on the effects of negative rates on bank lending and risk-taking provides only preliminary insights, in the absence of other extreme measures (such as abolishing cash) the effective lower bound cannot be lowered substantially without creating financial stability risks, making monetary policy far less powerful.

VI. Raising the Inflation Target as Resilient Buffer

As outlined in the previous sections, both QE and NIPR policy undoubtedly have contributed to stabilizing Western economies after the financial crises. But given the risks involved with these measures, it seems evident that they can only imperfectly substitute for traditional monetary policy tools. Furthermore, as the experience in Japan illustrates, once the economy is trapped at the Zero Lower Bound, it will be hard to escape stagnation unless aggressive unconventional policy tools are used right from the beginning. There are likely to be multiple equilibria with the risk of getting stuck in stagnation in a low inflation scenario (see *Illing/Ono/Schlegl* 2018),

So the most promising way to relax the constraint imposed by the effective lower bound appears to be an increase in the inflation target $\pi^\star$. If private agents are convinced that the central bank aims for a higher target inflation rate in normal times, they will expect inflation to be higher on average and thus also raise their expected rate of inflation. The Fisher equation suggests that the nominal interest rate adjusts one for one to changes in the expected rate of inflation. A higher inflation target would raise nominal rates on average, thus reducing the risk that the Zero Lower Bound will be binding for policy in the future.

Blanchard et al. (2010) suggest that raising the inflation target from 2 percent to 3–4 percent might be welfare-improving. A careful evaluation requires an analysis of the trade-off between costs and benefits of such a policy. Quantitative conclusions about the optimal rate of inflation are fairly sensitive to the choice of the model used to assess the costs and benefits of inflation (or deflation) in the steady state. The standard welfare cost is the distortion created by the inflation tax, lowering holdings of real money balances. To eliminate such distortions, according to the Friedman rule, a zero nominal interest (setting $\pi^\star = -r_n < 0$) is the optimal policy. Paying interest on reserves and cash would be an equivalent policy. New Keynesian models focus on the costs arising from the need for price adjustments. These costs can be captured by the resulting price dispersion, distorting the allocative role of prices. The higher the average rate of inflation, the larger these distortions, provided the share of firms with sticky prices is not decreasing in the target rate of inflation. So in standard New Keynesian models the optimal target rate turns out to be $\pi^\star = 0$. According to *Nakamura* et al. (2016), however, analyzing data on price dispersion for the US

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since 1977, there is no evidence that prices deviated more from their optimal level during periods with inflation higher than 10 % per year, compared to more recent episodes when inflation was close to 2 % per year. This finding suggests that price stickiness may indeed be decreasing with a higher target, de-emphasizing the relevance of the costs of inflation in standard New Keynesian models.

The benefit of a higher inflation target is to reduce the occurrence of effective lower bound (ELB) episodes. So it is crucial to evaluate the likelihood and the welfare costs of such episodes. There would be hardly any costs if tools from unconventional monetary policy could help to get rid of the ELB constraints. New Keynesian models incorporating the ELB, calibrated prior to the Great Recession concluded that episodes when the constraint will be binding are likely to be both very rare and short-lived. Taking into account both the arguments for the Friedman rule and the role of sticky prices, *Schmitt-Grohe/Uribe* (2010) found the optimal target rate to be a small amount of deflation. In their calibration, the ELB was binding only if the nominal interest rate falls more than 4 standard deviations below its target level. Obviously such calibrations can be quite sensitive to the historical episodes included. For a long time, the mainstream view among empirical research was that the episodes at the ZLB would be relatively infrequent and generally short-lived, typically lasting not more than one year. This research was mainly based on the experience of the tranquil Great Moderation period of the 1980s and 1990s. The experience after the Great Recession suggests that ZLB episodes may be quite costly and more frequently. They may also last much longer than most estimates in the past predicted.

The larger the decline in the natural real rate, the lower the normal nominal rate at unchanged expected inflation. This makes it more likely that the ELB will be binding. An increase in the target rate π^* can help to ensure that policy effectiveness for fighting future recessions will not be impaired. *Coibion/Wieland/Gorodnichenko* (2012) do simulations within a DSGE model allowing for more severe shocks with important effects of the ELB (calibrated to capture features of the data spanning 1947 to 2011). They conclude that the optimal rate of inflation in their preferred specification is around 1½ percent, close to the 2 percent target of many central banks in developed countries. At first sight, this low estimate is puzzling. But as *Kiley/Roberts* (2017) point out, a crucial assumption generating these low estimates for the target rate is their assumption that the central bank is able to commit to deliver substantial accommodation even long after the lower bound would otherwise be binding. Such a strong commitment provides an extremely powerful mechanism against deflation in New Keynesian models. Removing this assumption from their analysis implies the lower bound gets substantially more problematic. The estimates carried out by *Kiley/Roberts* (2017) indicate that the Zero Lower Bound on nominal interest rates will be binding in the US around 20–40 % with a target rate of 2 percent. They show that a steady-state nominal interest rate below 6 percent is bound to introduce strong asym-

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metries: Because in the presence of ELB and in the absence of complementary commitment mechanisms, downside tails are larger than upside tails, output will stay on average below potential and inflation below target.

As alternative to raising the inflation target, some suggest switching to price-level targeting. Since inflation expectations are not constant under anchored price level expectations, targeting a specific price level builds in an automatic stabilization mechanism when reaching the Zero Lower Bound. If the central bank implements some price level target once the ZLB stops being binding, private agents rationally anticipate higher inflation during the stagnation period. Therefore, the stronger the deflation (the undershooting of the price level target) during the liquidity trap period, the higher the rationally anticipated inflation that leads the economy back to target. This reduces the real interest rate and hence output shortfalls. But as shown in *Illing/Siemsen* (2016), at the ZLB optimal monetary policy faces similar problems of dynamic consistency as with inflation target.

VII. Summary

After the financial crisis, most central banks in advanced economies have undertaken unprecedented unconventional policy measures such as quantitative easing (QE) via balance sheet expansion and negative interest rate policy (NIPR). These measures have been attempts to cope with the Zero Lower Bound limiting the scope for traditional stabilization policy. Due to the steady long-term decline of the "natural real rate of interest" and of average inflation during the last decades, central banks are likely to be severely constrained in using standard interest rate adjustment in the future as well.

The paper analyzed the experience with unconventional policy measures. It argues that forward guidance and quantitative easing are the natural extension of optimal policy monetary policy within the New Keynesian Framework, facing a lower bound. NIRP has been successful in pushing the effective lower bound below zero, even though there seems to be a binding Zero Lower Bound for deposit rates. There is strong econometric evidence that both the signaling channel of QE and NIRP had significant effects on financial variables and contributed to stabilizing the real economy.

But given the risk of damaging side effects on financial stability and on central bank independence, unconventional policy tools are likely to be less powerful and shorter-lived compared to standard tools. Even though up to now evidence on negative side effects is rather limited, skepticism seems to be justified about the potency of the new tools as efficient stabilization mechanisms. Given the challenges involved, raising the inflation target up to 3–4 percent appears to be most promising way to relax the constraint imposed by the lower bound, pro-

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viding a resilient buffer for effective stabilization. At the same time, implementing proper macro-prudential regulation is crucial to make the banking sector more resilient in the long run by imposing stronger capital and liquidity requirements, thus eliminating distortions in the monetary policy transmission.

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