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The Economic Consequences of Negative Interest Rates¹

In normal times, central banks react to a subdued economic outlook or recessions by providing accommodation through substantial policy interest rate cuts. During the last 40 years, central banks in industrialized countries – such as the Fed, the ECB, and the Bank of Japan – have usually cut rates by around 4 percent in response to recessions. The long-lasting downward trend in real equilibrium interest rates (visible since the 1980s) together with the central banks' attempt to provide monetary accommodation to recoup the ample output losses associated with the last global financial crisis have pushed policy rates close to zero in many advanced economies. This has stimulated a lively debate on whether monetary authorities should, if necessary, provide further stimulus by lowering policy rates into negative territory (Rogoff 2016 and 2017; Rostagno et al. 2019; Altavilla et al. 2019; Demiralp et al. 2019; Bottero et al. 2019; Heider et al. 2019; Eggertsson et al. 2019). Starting from 2012, central banks in Switzerland, Sweden, Denmark, Japan, and the euro area have moved their key policy rates below zero. Yet, there is no agreement in the economic profession on the effectiveness of negative interest rate policies.

This article provides an assessment of the impact of negative interest rate policy (NIRP) on banks and on its transmission to the real economy. We start by discussing the channels of transmission and describing some meaningful stylized facts. These include the impact of the policy on the yield curve, on market participants' assessment of bank valuations and risk, as well as on the remuneration of corporate deposits. We then assess the impact of negative interest rates on bank lending conditions and, finally, on firms' investment.

CHANNELS OF TRANSMISSION AND STYLIZED FACTS

Negative policy rates are a relatively new tool for central banks and it is therefore important to understand their implications for the transmission of monetary policy to the real economy.² Negative rates

have been recently adopted by a number of central banks, e.g., Switzerland, Japan, Denmark, and Sweden, to exert (additional) monetary policy accommodation in situations where policy rates reach zero. In the euro area, the five equally sized rate cuts – on 5 June and 4 September 2014, 3 December 2015, 10 March 2016, 12 September 2019 – have taken the DFR to –50 bps.

There are multiple channels through which negative rate policy transmits to financial and economic conditions. First, negative interest rates remove the non-negativity restriction on future expected short rates. NIRP not only shifts down short rates to negative territory, but also keeps open expectations of possible further rate cuts. As a result, the forward curve becomes flatter than it would be if short rates were expected to be constrained by a zero lower bound, and monetary accommodation propagates over the entire term structure (Figure 1). Second, the incentive for investors to move to longer dated assets increases the demand for these securities relative to their supply. This ultimately exerts an extra downward pressure on the term premium, which compensates investors for the risk of holding bonds with longer duration. The lower yields also translate into higher asset valuations with associated capital gains in the bank security book. Third, commercial banks are encouraged to expand lending to escape the excess liquidity charge (credit channel). More specifically, the charge on excess liquidity shifts the risk-adjusted return assessment of banks' portfolio allocation and makes loans more attractive. The attempt by individual banks to escape the charge results in balance sheet adjustments, whereby banks react to the mechanical absorption of their excess liquidity by creating new (riskier) loans or by purchasing securities. This portfolio rebalancing therefore reinforces the risk-taking channel.

The typical footprint that NIRP leaves on the yield curve is concentrated on rates with short- and medium-term maturities. The impact of NIRP on the yield curve has a different footprint compared to the APP, which exerts the strongest impact on longer



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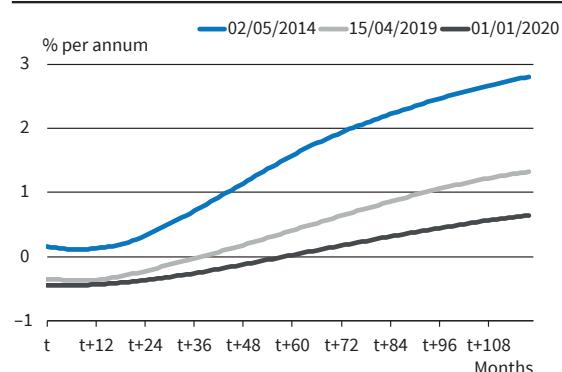


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Figure 1
Eonia Forward Curve

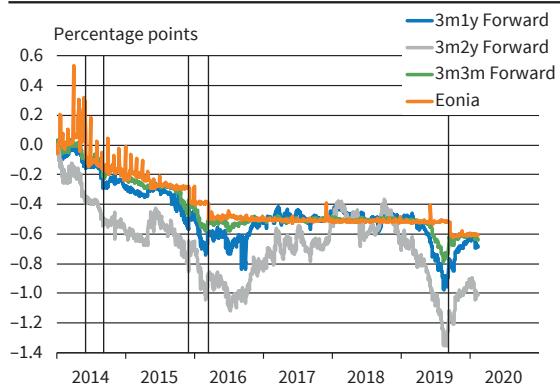


Source: Thomson Reuters; Bloomberg; authors' calculations. © ifo Institute

¹ The opinions in this paper are those of the authors and do not necessarily reflect the views of the European Central Bank or the Eurosystem.

² A comprehensive discussion on the role, the effectiveness, and the various channels through which non-standard measures, including NIRP, transmit to financial conditions and ultimately affect the real economy is available in Rostagno et al. (2019).

Figure 2
Cumulated Change in Eonia and Forward Curve since the NIRP Announcement



Note: The vertical grid lines represent the five dates of negative interest rate cuts, i.e., 5 June and 4 September 2014; 3 December 2015; 10 March 2016; and 12 September 2019.
Source: European Central Bank.

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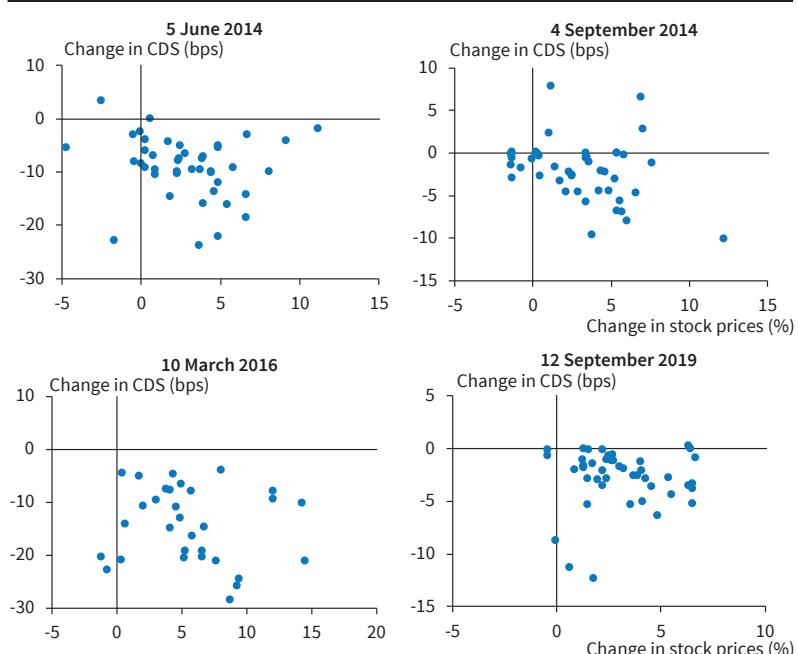
maturities and compared to standard interest rate policy, which affects primarily the short- to mid-maturity range of the risk-free yield curve (mainly on account of the expectations component of future rates). This is clearly visible in Figure 2.

Banks' equity valuations and their perceived credit quality improved following NIRP announcements (Figure 3). The reaction of bank stock returns and CDS to the announcements of NIRP is obtained by using high-frequency information available at the individual bank level. Bank equity valuations reflect all the information currently available to stock market participants thereby representing an important summary indicator of future profitability. The results

indicate that financial market participants reacted positively to the announcement of the NIRP: stock prices increased and CDS spreads narrowed following all policy announcements. The only exception is the announcement of the recalibration of the APP scheme in December 2015, which is associated with a fall in stock prices (not reported in the figure). This is, however, easy to understand, as financial market participants interpreted the December policy decision as delivering lower-than-expected accommodation compared with what they had anticipated and factored into stock prices. The policy decision therefore elicited an opposite reaction in financial markets when announced. Importantly, the event of September 2014 is the more prominent, as it is the only one where there were no other concomitant policy announcements during the same GovC meeting.

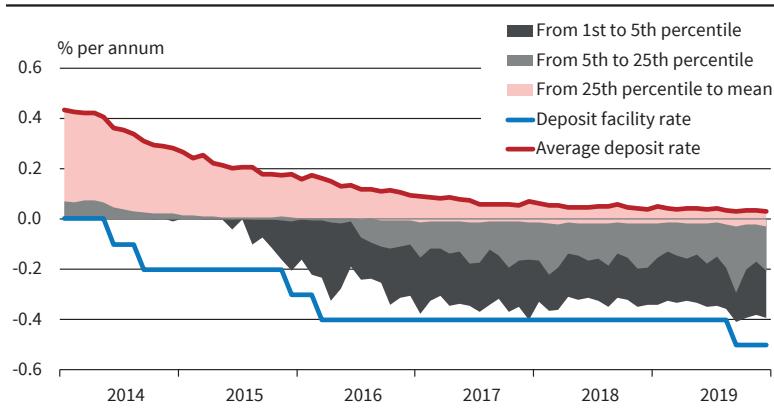
The pass-through of negative policy rates to deposit rates becomes stronger as policy rates move deeper into negative territory (Figure 4). The conventional wisdom that interest rates on deposits do not fall below zero appears to hold for the median bank in the euro area. Nevertheless, there is evidence that interest rates do turn negative on an economically significant fraction of deposits of banks in the euro area. The figure shows the evolution of the ECB's deposit facility rate (DFR) and the interest rates offered by banks on nonfinancial corporations' deposits. We show the evolution of different percentiles of the interest rates on corporate deposits. Figure 4 reports the deposit rates on the outstanding amounts averaged across all deposit segments for vulnerable countries and other countries, respectively. Even though the pass-through of negative rates has increased in the case of large customers (such as institutions and corporate customers), households remain largely shielded from negative rates. Figure 5 shows that the share of banks charging negative rates has been increasing during the NIRP period and is primarily driven by highly rated banks. Initially, negative deposit rates were charged mostly by banks with market power, which is intuitive given that higher market power is normally associated with larger mark-downs on deposit rates. In terms of volumes, the share of deposits with negative interest rates is around 25 percent as of December 2019.

Figure 3
Change in Stock Price and CDS Following NIRP Announcements



Note: The charts report the reaction of bank CDS and stock prices to major policy announcements over a 2-day window.
Source: Updated version of Altavilla et al. (2018).

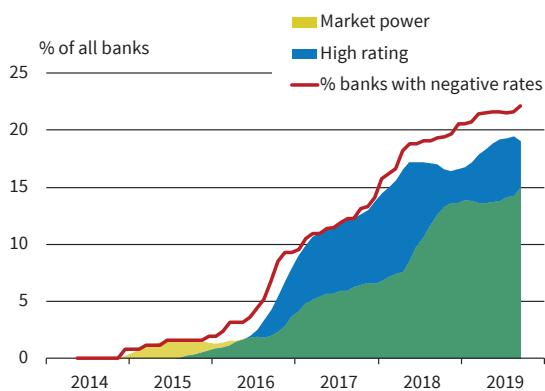
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Figure 4**Evolution of Non-financial Corporations (NFC) Deposit Rates**

Notes: The composite indicator is computed by taking the weighted average of deposit rates on new overnight and agreed maturity deposits, where weights are outstanding amounts of these two categories. Rates on new deposits with agreed maturity are a weighted average of rates on new deposits for each maturity (below 1 year, between 1 and 2, above 2), where weights are the 24-month average of the new business volumes.

Source: Altavilla et al. (2019).

deposits have up to now not experienced deposit outflows compared to other banks. At the same time, these banks extended more loans to the nonfinancial private sector. While this difference in the lending behavior observed in the data can also reflect demand factors, the bulk of the relevant literature concludes that NIRP had a positive impact on credit supply (see, e.g., Bottero et al. 2019; Demiralp et al. 2019; Grandi and Guillé 2020). At the same time, there is also some evidence that NIRP can stimulate banks' risk-taking. This is not necessarily an unintended consequence of the policy as, if not excessive, risk-taking can support the transmission of the monetary policy stimulus to the real economy. Moreover, it is important to note that, at least so far, this increase in risk-taking has not materialized in higher ex post defaults. Crucially, an active banking supervision helps to avoid excessive risk-taking (Altavilla et al. 2020).

Figure 5**Determinants of Negative Deposit Rates**

Note: The red line indicates the percentage of banks that until that month have charged negative deposit rates. We run month-by-month regressions where the dependent variable is the probability to charge negative rates and the regressors are a dummy for having an investment grade rating (high rating) and a dummy for having a share of the domestic market of deposits above the country median (market power). The blue area indicates the coefficient associated with high rating. The yellow area indicates the coefficient associated with market power.

Source: ECB; Moody's; S&P; Fitch.

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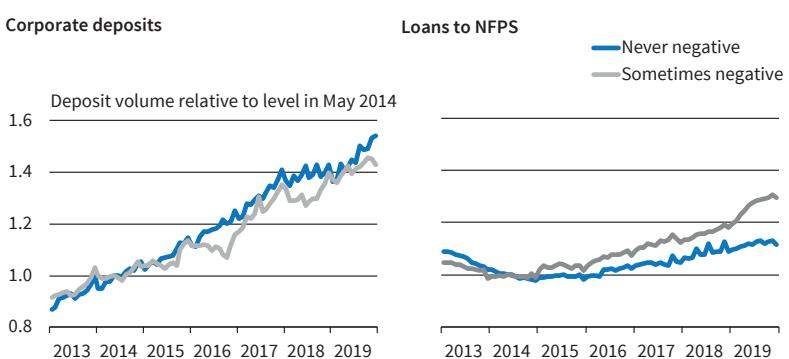
The expansion of loan supply has also translated into lower borrowing costs for firms (Figure 7). The recovery brought forth by the unconventional monetary policy measures adopted since 2014 has stirred an expansion of loan demand. Nonetheless, the rightward shift of banks' supply schedules has resulted into a compression of lending rates by around 1.5 percentage points for the median bank. The decrease was more marked for banks operating in countries more affected by the financial and sovereign crisis, where risk premia were still more elevated. Overall, the full interquartile range of responses was below the decline in the policy rate,

IMPACT OF NEGATIVE INTEREST RATE ON BANK AND FIRMS

Impact on Banks' Lending Conditions

Banks offering negative rates provide more credit than other banks, suggesting that the transmission mechanism of monetary policy is not hampered. Using confidential information at bank-level data on more than 300 MFIs from the IBSI dataset, Figure 6 shows that banks that charge negative rates on corporate

Figure 6 Corporate Deposits and Loans to Households and Firms for Banks That Never Charged Negative Deposit Rates and Other Banks

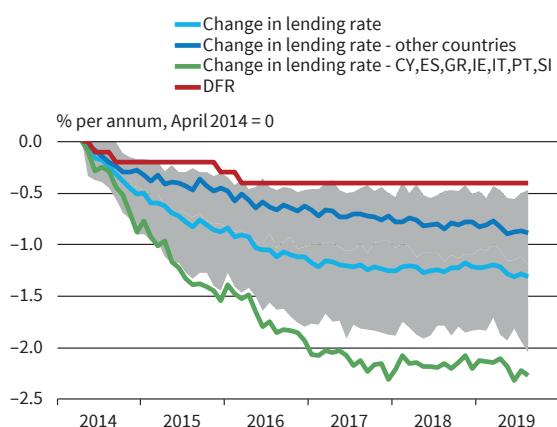


Note: Information on deposit rates charged at the individual bank level is based on iMIR data, while data on loan and deposit volumes are based on IBSI data. Total volumes for loans and deposits are normalized to the level in May 2014.

Source: Update of Altavilla et al. (2019).

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Figure 7
Pass-through to NFC Lending Rates



Note: The figure shows interest rates on new loans excluding overdrafts as deviations from the level observed in April 2014. The mean is the weighted average of lending rates across banks, where weights are the 24-month moving average of new business volumes. Floating (fixed) rate banks are those with a share of loans with duration below 1 year above (below) 50% as of April 2014.
Source: ECB; authors' calculations.

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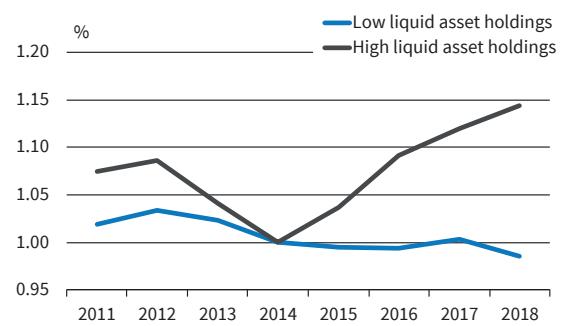
indicating a strong and widespread pass-through of the policy to borrowing conditions.

Impact on Firm's Investment

The negative interest rate policy (NIRP) provides further stimulus to the economy through firms' asset rebalancing. Using confidential information on more than 300 banks from the IBSI dataset matched with information obtained from Bureau Van Dijk's ORBIS database on more than 3 million firms operating in 19 euro area countries, Figure 8 shows a different pattern in the investment of firms exposed to negative deposit rates depending on their cash-holdings. Firms with large holdings of liquid assets subject to negative deposit rates have an incentive to reduce these liquid assets by increasing investment. Therefore, firms that have high liquid asset holdings and have faced negative deposit rates have accelerated their investment growth considerably after the introduction of negative rates, even after we account for their normal level of investment growth (black line). By contrast, firms that have low liquid asset holdings and are therefore not particularly affected by negative deposit rates did not show such acceleration (blue line). These effects are economically significant, and it has been estimated that this effect has boosted corporate investment by about 1 percent point.

These findings are corroborated by the evidence emerging from a recent market study conducted by Com-

Figure 8
Corporate Investment before and after the NIRP for Exposed Firms with Low and High Liquidity



Notes: Average investment for corporate clients of banks whose average NFC deposit rate has been negative at least once, distinguishing between firms with a ratio of current assets over total assets in the top decile (high liquidity, black line) and in the bottom decile (low liquidity, blue line) of the distribution. Investment orthogonal to firm and year fixed effects, normalised to 1 in 2013.

Source: Altavilla et al. (2019).

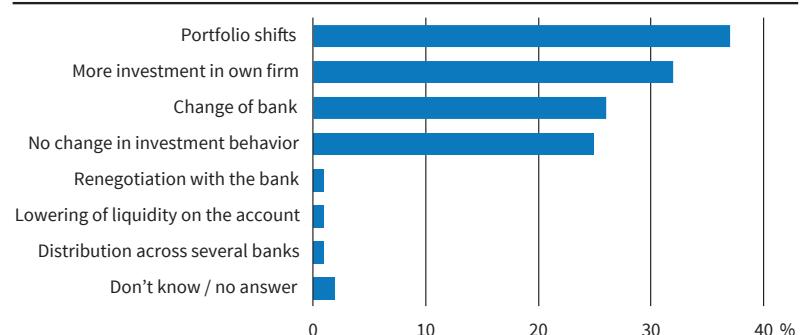
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merzbank in cooperation with Forsa. The study surveys 500 German companies with an annual turnover starting at EUR 15 million over the period 8 July to 9 August 2019. The main results of the survey are depicted in Figure 9, showing that a large share of the firms reported that they reacted to negative interest rates by rebalancing their portfolio or increasing investment.

CONCLUSIONS

This article provides an assessment of the impact of negative interest rate policy (NIRP) on banks and on its transmission to the real economy. We start by discussing the channels of transmission and describing some meaningful stylized facts, including the pass-through of the policy on the yield curve. We then show that market participants' assessment of bank valuations and risk reacted positively to NIRP announcements. Moreover, banks are increasingly able to pass on negative interest rates to corporate deposits. Overall, the policy resulted in an easing of funding conditions for firms, both through higher lending volumes and lower lending rates. Finally,

Figure 9
Reaction to Negative Interest Rates



Note: Multiple answers possible, basis: n = 145 respondents who have paid credit or negative interest, Question 4b: "How did you react to this with your investment behavior?"
Source: Commerzbank/Forsa.

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firms' own exposure to negative deposit rates creates incentives to increase investment.

The policy by definition implies a direct cost on the banking system, through the negative remuneration of their holdings of excess reserves. This cost is overall contained in terms of its contribution to overall profitability (close to 30 bps of ROE). Looking ahead, the adoption of the two-tier system for the remuneration of excess reserve holdings will contribute to mitigating this cost. Moreover, against the background of the downward rigidity in retail deposit rates, negative interest rates lead to a compression of banks' net interest margins. However, the policy also supports bank profitability through other factors. Lower interest rates mechanically translate into an increase in financial asset valuations leading to capital gains for banks. More importantly, the policy supports the economic outlook, translating into larger intermediation volumes and into lower credit risk, which feeds into lower loan loss provisions.

REFERENCES

- Altavilla, C., M. Boucinha, S. Holton and S. Ongena (2018), "Credit Supply and Demand in Unconventional Times", *ECB Working Paper* 2202.
- Altavilla, C., M. Boucinha and J. L. Peydró (2018), "Monetary Policy and Bank Profitability in a Low Interest Rate Environment", *Economic Policy*, October, 533–583.
- Altavilla, C., M. Boucinha, J. L. Peydró and F. Smets (2020), "Banking Supervision, Monetary policy, and Risk-Taking: Big Data Evidence from 15 Credit Registers", *ECB Working Paper* 2349.
- Altavilla, C., L. Burlon, M. Giannetti and S. Holton (2019), "Is There a Zero Lower Bound? The Effects of Negative Policy Rates on Banks and Firms", *ECB Working Paper* 2289.
- Bottero, M., C. Minoiu, J. L. Peydro, A. Polo, A. Presbitero and E. Sette (2019), "Negative Policy Rates and Bank Asset Allocation: Evidence from the Italian Credit and Security Registers", *IMF Working Paper* 19/44.
- Demiralp, S., J. Eisenschmidt and T. Vlassopoulos (2019), "Negative Interest Rates, Excess Liquidity and Bank Business Models: Banks' Reaction to Unconventional Monetary Policy in the Euro Area", *ECB Working Paper* 2283.
- Eggertsson, G. B. and M. Woodford (2003), "The Zero Bound on Interest Rates and Optimal Monetary Policy", *Brookings Papers on Economic Activity* 2003(1), 139–211.
- Eggertsson, G. B., R. E. Juelsrud and E. G. Wold (2017), "Are Negative Nominal Interest Rates Expansionary?", *NBER Working Paper* 24039.
- Eggertsson, G. B., R. E. Juelsrud, L. H. Summers and E. G. Wold (2019), "Negative Nominal Interest Rates and the Bank Lending Channel", *NBER Working Paper* 25416.
- Grandi, P. and M. Guillé (2020), *The Upside Down: French Banks, Deposits and Negative Policy Rates*, mimeo.
- Heider, F., F. Saidi and G. Schepens (2019), "Life below Zero: Bank Lending under Negative Policy Rates", *Review of Financial Studies* 32, 3728–3761.
- Rogoff, K. (2016), *The Curse of Cash*, Princeton University Press, Princeton.
- Rogoff, K. (2017), "Dealing with Monetary Paralysis at the Zero Bound", *Journal of Economic Perspectives* 31, 47–66.
- Rostagno, M., C. Altavilla, C. Carboni, W. Lemke, R. Motto, A. Saint-Guilhem and J. Yiangou (2019), "A Tale of Two Decades: The ECB's Monetary Policy at 20", *ECB Working Paper* 2346.
- Summers, L. H. (2014), "U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound", *Business Economics* 49, 65–73.