Negative Monetary Policy Rates and Systemic Banks' Risk-Taking: Evidence from the Euro Area Securities Register*

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Abstract

We show that the introduction of negative monetary policy rates induces risk-taking in the securities portfolio of large, systemic banks in the euro area. Banks that are more reliant on customer deposits are more affected by the introduction of negative rates, as these banks do not pass negative rates to their customers. Affected banks retain assets yielding higher returns compared to the other banks. For identification, we exploit the introduction of negative deposit rates by the ECB in June 2014 in conjunction with a novel securities register for the 26 largest euro area banking groups. Our results hold when controlling for security characteristics like maturity and ratings, which are the main determinants of capital regulation, as well as security and bank fixed effects.

Keywords: Negative policy rates, non-standard monetary policy, search for yield, banks.

JEL Codes: E43, E52, G01, G21, G11.

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1 Introduction

Central banks have implemented a series of unconventional monetary policy measures during the last decade. An important difference in the implementation of monetary policy between the euro area and the US has been the use of negative policy rates. In the euro area negative policy rates were introduced by the ECB in June 2014, when the deposit rate for commercial banks with an account at the central bank was lowered to −10 basis points. Negative rates have also been introduced by the central banks in several other jurisdictions (Japan, Denmark, Sweden and Switzerland). Other central banks, in particular the Federal Reserve, and also the Bank of England, have been somewhat critical of the use of negative rates (see Bernanke, 2016). Negative policy rates currently represent an important policy tool. Given today's rather low level of policy rates, negative rates may become even more important in the future. Thus, the effects of negative policy rates on banks are a key question for academic researchers and policy makers alike. There is evidence that, at least in the medium term, banks do not pass through the negative rates to their depositors, in particular to retail customers. This, in turn, lowers bank net worth and increases risk-taking (*search for yield*) incentives. Generally, low interest rates may drive 'reach for yield' behaviour by financial intermediaries (Rajan, 2005; Taylor, 2009; Allen and Rogoff, 2011; Martinez-Miera and Repullo, 2017), consistent with a risk-taking channel of monetary policy (Adrian and Shin, 2010; Borio and Zhu, 2012). Given the importance of banks as financial intermediaries in several regions of the world (e.g. the euro area is a bank dominated economy), there might be important aggregate consequences for the economy from the introduction of negative rates. The aim of this paper is provide evidence on changes in the risk-taking behaviour of large euro area banks in response to the introduction of negative rates.

The transmission of monetary policy at the "zero lower bound" and below has become a topic of particular interest for researchers and policy makers since several central banks have chosen this path in the last years (Brunnermeier and Koby, 2017; Eisenschmidt and Smets, 2018). There is also a very recent literature assessing how negative policy rates (NPR) are transmitted through the banking sector and how they affect credit supply to the economy and the equity valuations of banks (see for example Ampudia and Van den Heuvel, 2018; Basten and Mariathasan, 2018; Heider, Saidi, and Schepens, 2019). However, to the best of our knowledge, ours is the first paper to analyze how negative policy rates affect investment choices in the securities portfolios of banks.

Securities represent around 20% of banks' assets, and in Europe the holdings of sovereign debt in particular have reinforced the *diabolic loop* between sovereign debt and banks, and the risks associated with the so-called sovereign-bank nexus (Acharya and Steffen, 2015; Brunnermeier et al., 2016). We exploit a new dataset covering the securities holdings of the 26 largest euro area banking groups. The overall holdings are around 3 trillion euros. Reaching for yield through changes in securities holdings can be easier and faster for banks compared to changes in their loan portfolio. Therefore policy makers concerned with financial stability need to turn their attention also to the analysis of risk-taking in securities. Banks may engage in risk-taking more easily through adjustments of the liquid securities holdings rather than the illiquid loan portfolio (this is related to the concept of "transformation risk" in Myers and Rajan, 1998).

The deposit ratio denotes the extent to which bank fund themselves using customer deposits. We argue that banks with different deposit ratios are affected differently when policy rates reach negative territory and this provides a way to identify the effects of negative policy rates on the security portfolio and isolate them from other forces that shape both monetary policy and the investment behaviour of large euro area banks (Heider et al., 2019).

Finding evidence of *search for yield* is challenging, as it requires to observe micro-level information on the riskiness of all securities, e.g. the yield or the rating of a security. Access to comprehensive, granular banking data is thus crucial to identify phenomena of 'reach for yield'. The security register that we use in this analysis contains — at the security (ISIN) level – all securities investments of each of the 26 largest banking groups in the euro area[1]. We restrict our analysis to the holdings of debt securities. For each security we have information on the yield, issuer, multiple ratings, price and remaining maturity. This allows us to: (i) test whether the reaction to the introduction of negative policy rates differs with certain (observed) bank characteristics; (ii) control for unobserved security characteristics that affect the supply of a particular security via security (or other related) fixed effects ; and (iii) identify search for yield, in particular whether banks with different characteristics (deposit ratio) change their holdings of securities with different ex-ante yields.

The introduction of negative policy rates was accompanied by an overall deleveraging in the securities portfolio of the large euro area banking groups. We identify the effects of negative rates via the deposit ratio. Banks that are more reliant ex-ante on customer deposits retained assets yielding higher yields compared to other banks, also when controlling for security risk characteristics, like maturity and ratings, which are the main determinants of capital regulation, or security fixed effects. Our results suggest that negative policy rates led to search for yield behaviour in the securities portfolio of more exposed banks. We find no evidence of a similar relationship in the period before the introduction of negative rates. Before the introduction of negative rates, the response of banks' portfolios to changes in security yields for different levels of deposit ratio would not differ. The size of the effects is also economically significant: a difference in the deposit ratio of 10% (approximately one standard deviation) would imply a 1–2 percentage points increase in the sensitivity of holdings of a particular security in response to a 1% change in the adjusted current yield (ACY). Finally, results based on a sample of syndicated loans suggest that more exposed banks increase their risk also in loans. Therefore, 'reach for yield' takes place in both securities and loans.

1.1 Related Literature

Our results are complementary to the results of Heider et al. (2019). We broadly share their identification strategy, based on the banks' reliance on deposits. They look at the risk profile of the syndicated loan portfolio of banks during the period of the introduction of negative interest rates and disentangle bank specific determinants using multiple different banks within a loan syndicate (see also Aramonte et al., 2015). They analyze the impact of negative policy rates on the loan supply of banks and show that banks with more deposits tend to lend less and to

[1]This dataset encompasses datasets used in other studies including for example only holdings of government bonds and/or securities that banks pledge as collateral to borrow liquidity from the ECB

riskier borrowers. Using loans provided to the same firm by different banks and a differences-in-differences strategy via the deposit ratio Schelling and Towbin (2018) find that banks with a lot of deposits offer more generous lending terms in order to capture market shares. We provide complementary evidence to these studies based on the analysis of holdings in the securities portfolio of banks and in particular of different banks holding the same security. Taken together, the results of these studies suggest that banks that are more affected by negative policy rates through the negative impact on profit margins increase their risk in both their loans and securities portfolios. In the last part of the paper, we also run a robustness analysis using syndicated lending data for the banks in our sample that confirms these findings.

Our study is also related to the analysis of Demiralp, Eisenschmidt, and Vlassopoulos (2017), who assess the impact of negative policy rates on lending volumes and holdings of government bonds. Their identification strategy is based on banks' excess liquidity deposited at the ECB. They find that more exposed banks increase their overall holdings of non-domestic government bonds: however, their dataset does not have the granularity to control for risk at the security level nor the exhaustive analysis of heterogeneous effects across different securities with different risk levels (i.e., we exploit a securities register). In our sample we do not find significant effects when we restrict our analysis to sovereign bonds. Using a similar identification strategy — central bank reserves at the Swiss National Bank – Basten and Mariathasan (2018) show that, in aggregate, more affected banks are lending more and invest more in financial assets. Arce, Garcia-Posada, Mayordomo, and Ongena (2018) rely on bank's ex-post self-reports of the degree to which negative interest rates affect their net income for identification of the effects of negative interest rates on credit. They use banks that report their profits to be unaffected by negative policy rates as the control group in a differences-in-differences analysis on the bank- and the loan-level. Finally, Bottero, Minoiu, Peydró, Polo, Presbitero, and Sette (2019), exploiting administrative data from Italy, find that negative rates have expansionary effects on credit supply (and the real economy) through a portfolio rebalancing channel, rather than a 'deposit ratio channel', that identifies margin pressures via the reliance of banks on deposit funding.

Ampudia and Van den Heuvel (2018) look at the effects of ECB monetary policy announcements on bank equity, measured by a bank's stock market capitalization, including during periods of low interest rates. They find that when interest rates are positive, an unexpected decrease in policy rates raises bank equity – as in English, Van den Heuvel, and Zakrajšek (2018). However, when rates are negative, the impact can be reversed and further rate cuts lower bank equity, a result consistent with the notion of a reversal rate as in Brunnermeier and Koby (2017). Moreover, Altavilla, Boucinha, and Peydró (2018) analyse the impact of conventional and non-standard monetary policy measures on bank profitability. They find that monetary policy easing (a decrease in short-term interest rates and/or a flattening of the yield curve) is not associated with lower bank profits once they control for the endogeneity of the policy measures to expected macroeconomic and financial conditions, even though accommodative monetary conditions asymmetrically affect the main components of bank profitability.

Our work is also close in spirit also to the analysis of Koijen, Koulischer, Nguyen, and Yogo (2018) which use a security-level dataset covering the holdings of all euro area sectors

(e.g. the cumulative holdings of all banks in a certain country). We use the holdings of a limited sample of euro area banks (albeit covering a large majority of the assets of the euro area banking sector), but we can disentangle the holdings at the level of single banking groups. Abbassi, Iyer, Peydró, and Tous (2016) find evidence of search for yield behaviour in a sample of German banks in response to the shock of the bankruptcy of Lehman Brothers. Banks with higher trading expertise increased their investments in securities, especially in lower-rated and long-term securities. At the same time, these banks reduced their credit supply, suggesting a substitution from loans to securities yielding higher returns. Our results complement these findings, since we find evidence related to banks' portfolio holdings related to changes in monetary policy as opposed to the financial crisis. Finally, we corroborate some of the findings by Peydro, Polo, and Sette (2017). Using the Italian securities register during the recent crisis period, but before the introduction of negative rates, they show that in response to a monetary policy loosening bank risk-taking is proportional to a particular bank's risk-bearing capacity (i.e. bank leverage) – a result inconsistent with the risk-shifting hypothesis which would apply to banks with low levels of capital ('gambling for resurrection'). We confirm their findings for the period in which negative policy rates were introduced by the ECB, showing that this relationship holds for a sample of banks incorporated in both core and periphery euro area countries.

2 The Effects of Negative Policy Rates

There is a wide literature on the impact of policy rates on banks' balance sheets. Lower policy rates decrease the cost of funding for the banks and this generally translates in higher bank net worth, because of the maturity transformation operated by banks (see for example Dell'Ariccia et al., 2014). However, negative policy rates add an additional dimension to the analysis, because deposit rates are sticky when reaching the zero lower bound and therefore negative policy rates are not fully passed through.

2.1 The Transmission of Negative Policy Rates

In general, a reduction in the policy rate transmits to short-term rates first. Since banks' balance sheets tend to consist of longer-term assets and shorter-term liabilities, a rate cut should generally result in increased bank net worth. This is based on the assumption that banks can immediately pass-through the rate cut on their liability side — and therefore fund themselves at lower rates, while the asset side remains largely unaffected at first – leading to an increase in the value difference between assets and liabilities, and hence in the net worth of banks. This should relax financial constraints and increase lending and investment in securities. Given a fixed capital structure, the overall effect of a decrease in policy rates on banks' risk

taking will depend on their leverage (Dell'Ariccia et al., 2014) and hence indirectly on banks' net worth.[2]

However, lowering rates into negative territory may result in a somewhat different outcome, since banks may be unwilling to pass-through negative rates to their customer deposits – fearing the withdrawal of deposits. Banks may be reluctant to charge negative rates to depositors for several reasons, at least over shorter horizons. Indeed, banks may not want to jeopardize long-term customer relationships, and depositors can just decide to hold currency and/or move deposit to another bank that doesn't charge negative rates. This seems to be especially true for customer deposits that are typically smaller in size. There may also be legal constraints in charging negative deposit rates, due to the institutional setting of some deposit-taking corporations (like cooperative banks for example).

Therefore, the degree to which banks are affected by the introduction of *negative* rates in particular, depends on their funding structure. A cut that brings policy rates into negative territory should have a stronger positive effect on the net worth of banks largely funded by wholesale debt, as opposed to customer deposits. Similarly, operating in a negative interest rate environment is likely to put negative pressure on the net worth of banks with a high customer deposit ratio, and could even induce a *reversal rate* such that lower monetary rates could become contractionary, rather than expansionary (see Brunnermeier and Koby, 2017; Eggertsson et al., 2019). Banks more negatively affected (lower net worth due to higher reliance on customer deposits) may take risk by reaching for higher yields (Freixas and Rochet, 2008; Heider et al., 2019). Hence, with the degree to which they are funded by customer deposits, the *intensity of the treatment* induced by the introduction of negative policy rates varies across banks. This enables us to identify the effect of negative interest rates on the securities holdings of banks.

2.2 Identification Approach

Policy rates in the euro area moved into negative territory in June 2014, when the ECB lowered the deposit facility rate to -0.10%. Three further reductions in the policy rate brought the rate on the deposit facility to -0.40% by March 2016 (see Figure 3 for the evolution of the policy rates in the euro area). In the current economic and institutional environment central bank liquidity is allocated on a full allotment basis and a series of non-standard monetary policy measures are in place. In aggregate, commercial banks hold a substantial amount of excess liquidity at the central bank, i.e. more liquidity than what they need in order to fulfil reserve requirements. The deposit facility rate has therefore become the relevant policy rate in the euro area.

Our main identification argument is based on the limited pass-through of negative policy rates to the rates paid on bank deposits of households and firms. For systematic evidence on

[2] Additionally, a decrease in the yield on safe assets will generally increase banks' demand for risky assets (*portfolio reallocation effect*). There is evidence that a low interest rates environment increases bank risk-taking (Dell'Ariccia et al., 2017), consistent with a *risk-taking channel* of monetary policy (Adrian and Shin, 2010; Borio and Zhu, 2012; Maddaloni and Peydro, 2011) and may put pressure on bank profitability in the long term (Altavilla et al., 2018).

this, we refer to Heider et al. (2019) as well as Eisenschmidt and Smets (2018).[3] Figure 3 shows that the average deposit rates paid on deposits of households and firms in the euro area remained positive even after the introduction of negative policy rates.

Insert Figure 3 about here.

At the same time, the rate on overnight interbank lending in the euro area — EONIA – turned negative during the third quarter of 2014. Therefore, the ability of banks to pass-through negative interest rates depended on the composition of their liabilities and in particular on the relative importance of deposit funding. Figure 4 shows that the large euro area banks in our sample fund between 20% and 60% of their balance sheet via customer deposits. It is remarkable that there is an ample variation in terms of deposit ratios even across this limited set of large banking groups.

Insert Figure 4 about here.

Both the supply and the demand of securities should respond to changes in policy rates. We use a differences-in-differences specification in order to analyze how the holdings of a particular security change in response to the introduction of negative policy rates, differentiating between high-deposit ratio banks and low-deposit ratio banks. We argue that banks with different deposit ratios are affected differently when policy rates reach negative territory and this provides a way to identify the effects of negative policy rates on the security portfolio and isolate them from other forces that shape both monetary policy and the investment behaviour of large euro area banks (Heider et al., 2019).

By compressing margins negative rates may affect negatively profitability . This may induce banks to invest in higher yielding assets in order to make up for the losses in profitability – i.e. *search for yield*. We investigate if banks with a larger depositor base are systematically investing in higher yielding securities. We analyse the data at the security-bank-quarter level. This allows us to: (1) test whether the reaction to the introduction of negative policy rates differs with certain (observed) bank characteristics controlling for unobserved bank heterogeneity; (2) control for unobserved security characteristics that affect the supply of a particular security via security (or other related) fixed effects (e.g. issuance of some securities); and (3) identify search for yield, in particular whether banks with different characteristics (deposit ratio) change their holdings of securities with different ex-ante yields. The benchmark specification that we consider has the following form:

$$ln(holdings)_{ijt} = \beta_0 \times Post_t \times Deposit\_ratio_{jt} \times ACY_{it} + \beta_1 X_{ijt} + \mu_j + \eta_\diamond + \varepsilon_{ijt}$$

The dependent variable is the holdings of the security i, held by banking group j at time t. $Deposit\_ratio_{jt}$ is the ratio of customer deposits over total assets. $Post_t$ is a dummy variable equal to one for the period June 2014 onwards. The variable ACY_{it} is a risk measure based

[3] Eisenschmidt and Smets (2018) show that by the end of 2016, in some core European countries, banks started to charge negative deposit rates but only to corporations (-0.02% on average as of July 2017 in Germany for example), while rates for households deposits remained positive. This suggests that eventually the pass-through of negative rates takes place, but it is more sluggish than with positive rates and it may affect only some customers.

on the adjusted current yield of a security (please refer to Section 2.3 for details on how we compute the ACY_{it}). The vector X_{ijt} contains control variables and their interactions with our variables of interest. We include the log of total assets and the ratio of equity over total assets (i.e. the leverage ratio of the bank) as controls. The fixed effects term $\eta_{\diamond}$ includes bank fixed effects in all specifications. We add time, security and maturity-rating-time fixed effects in some of the specifications. In all our specifications we cluster standard errors at the bank- and the security-level.

The analysis is based on a differences-in-differences estimation where we capture the effect of monetary policy through a dummy variable that equals 1 when policy rates are below zero. The ECB deposit facility rate was set to -0.10% effective from June 11th 2014. We classify the period Q4 2013 – Q1 2014 as the pre-NPR period and Q2 2014 – Q4 2014 as the post-NPR period. We stop our analysis at the end of 2014 so that we can interpret our findings as resulting from the introduction of negative policy rates, and we exclude the following period when the ECB announced and then implemented the expanded Asset Purchase Programme (APP).[4] We chose to stop our analysis at the end of 2014 because extending the time period further would overlap with the period in which central bank asset purchases were carried out. Obviously this policy action has a direct impact on the securities portfolio and may have affected banks differently, depending on their ex-ante securities allocation, possibly confounding our results.

We employ fixed effects in order to control for the factors that can explain banks' portfolio investment in certain securities, such as regulatory pressures, strategic buying opportunities or the need to raise funding. A major development in the regulatory landscape during the period that we analyze was the implementation of the Single Supervisory Mechanism (SSM) in the euro area and the transfer of the direct supervision of large euro area banks from the national supervisory authorities to the ECB. All the banks in our sample were affected by this change and their direct supervision was transferred from the national competent (supervisory) authorities to the SSM. The SSM became operational in November 2014, but preparatory work was well undergoing during the period of time that we analyse. Similarly, other regulatory measures were being implemented, in particular the Liquidity Coverage Ratio (LCR), that came into effect in October 2015. Our results may be affected by these developments as long as changes in regulation would have a differential impact across banks with high- and low deposit ratios during our estimation window in the years 2013-2014. Concerning in particular the LCR, it could be argued that the LCR could have created incentives to invest in high quality liquid assets, yielding lower returns, as opposed to riskier and higher yielding securities.

[4]During the period that we consider there were other measures of non-conventional monetary policy that were undertaken.In June 2014 the ECB announced the two targeted longer-term refinancing operations (TLTRO) with allotments taking place in September 2014 and December 2014. Heider et al. (2019) argue that there were significant substitution effects with respect to other types of central bank funding and the 2011 and 2012 LTROs. It is not clear ex-ante, why the TLTRO take-up would differ across large banks with different deposit ratios and therefore affect the results of our analysis. Bottero et al. (2019) construct a bank-level measures of borrowing capacity and show that it does not affect changes in loan supply immediately after the introduction of negative rates. Heider et al. (2019) perform their analysis until the end of 2015 and run robustness checks for the sub period of 2014.

2.3 Data

Securities holdings are an important fraction of bank balance sheets. On average they account for around 20% of total banking assets in the US and Europe. The main database used in the analysis is the new Securities Holdings Statistics by Group (SHSG) database of the Eurosystem. The database contains security-level information on the securities portfolios of 26 reporting banking groups in the euro area (see Table A.8 in the Annex for a list of the banking groups in the sample). It covers the large majority of the euro area banking sector in terms of financial assets. Data are collected on a quarterly basis since 2013Q4. The SHSG database provides information on holdings at the security level as identified by the International Securities Identification Number (ISIN). For the purpose of the analysis in this paper, we focus on the portfolio of debt securities (both short-term and long-term) and enrich the database with security level information from the Eurosystem Centralised Securities Database (CSDB) — like rating and maturity.[5] Data on banks' balance sheets are from SNL Financials.

Using information on the issuer of the debt securities, we classify the assets in four broad categories. Securities are classified as Public Debt if they are issued by the sectors "General Government" and "Central Bank" as well as by certain supranational institutions such as the European Investment Bank (EIB) or the European Stability Mechanism (ESM). Securities from private issuers are grouped into three distinct categories. Securities issued by "Deposit-taking corporations except the central bank" are classified as "Private debt issued by banks". "Asset backed securities (ABS)" includes different types of securitized debt securities: covered bonds, MBS, Pfandbrief, CDOs and other ABS. The asset class "Private debt (other)" is a residual category and includes debt issued by Financial Corporations other than banks and by the corporate sector. Figure 1 shows the evolution of total nominal holdings for the four asset classes considered over the period following the introduction of negative policy rates.[6] The shaded area represents the time frame considered in our analysis (2013Q4 to 2014Q4). Overall, we see that during this period there was a broad disinvestment from debt securities issued by euro area banks and other private issuers, while there were rather stable patterns with respect to public debt securities and asset backed securities (ABS).

Insert Figure 1 or Table 1 about here.

To compare investment in financial assets with different yield patterns, we use the adjusted current yield (ACY) measure as in Abbassi et al. (2016). Differences in risk can explain differences in the ACY of otherwise similar securities. In the SHSG database the banking groups report the value of their holdings both in nominal terms and valued at market prices[7]

[5] The percentage of securities portfolio invested in equities is below 5% for the banking groups in our sample.

[6] The Figure shows nominal holdings in euro but it also includes securities issued in other currencies.

[7] See also Table 2 in "Who holds what – new information on securities holdings" (ECB Economic Bulletin, Issue 2/2015, p. 75).

along with the number of securities held at the end of the quarter.[8] We compute the ACY of security i as using the pricing information of bank j as:

$$\text{ACY}_{it} = 100 \cdot \frac{\text{coupon}_i[\%\text{ ann.}]}{\text{price}_{it}} + \frac{100 - \text{price}_{it}}{\text{residual\_maturity}_{it}/365}$$

Figure 2 shows how the overall distribution of the ACY (weighted by the nominal holding amount) for the securities portfolios in our sample changed between Q4 2013 (the beginning of our sample) and Q4 2014 (the end of our sample period). The cross-sectional distribution shifts to the left, also as a result of lower interest rates. Therefore at the end of 2014 a large fraction of the securities portfolios of the largest euro area banks was yielding a negative return.[9]

Insert Figure 2 about here.

We include in the sample all securities with a nominal holding amount that at some point exceeded 0.5 million euro, summing up the holdings of the 26 reporting banking groups. Furthermore, we trim our data according to the variable ACY and include all securities with an ACY between the 5th and the 95th percentile of the overall distribution. Table 2 shows summary statistics of the variables included in our empirical specification for all ISIN-bank-quarter observations.[10]

Insert Table 2 about here.

3 Results

We show four different sets of results. First, we estimate a baseline model and analyse how securities holdings in the banks' portfolios interact with changes in the adjusted current yield (ACY). We consider the period before and after the introduction of negative policy rates and include different sets of fixed effects. Second, we estimate our benchmark model and interact our coefficient of interest with the deposit ratio. This enables us to quantify the relative impact of negative rates on banks' risk taking via a differences-in-differences approach. Third, we analyse how the effects of negative interest rates evolve over time. This analysis is particularly relevant in the context of the parallel-trends assumption. Finally, we look at the heterogeneity in banks' risk-taking across asset classes and

3.1 Deleveraging in the Securities Portfolio and Risk-Taking

The results in Table 3 show that, overall, the implementation of negative policy rates had a negative impact on securities holdings. Deleveraging was stronger for riskier securities with

[8] In order to obtain prices for all securities in our database we rely on this information as opposed to using external sources. We compute the prices by dividing the reported market value of the holdings of a certain ISIN by the number of securities that the bank holds. The information on coupon rates and residual maturities is obtained from the Centralised Securities Database (CSDB) of the Eurosystem.

[9] Please note that the ACY values securities at current market prices. Banks do not necessarily incur losses on their holdings at negative values of the ACY, e.g. since securities may have been bought earlier at different prices.

[10] The summary statistics are simple (unweighted) averages computed from observations on the ISIN-bank-quarter-level.

a high value of the ACY. This holds both in a specification with bank + time fixed effects (column 2) as well as in specifications with security fixed effects (column 1 and 3).

Insert Table 3 about here.

In the fourth column we include fixed effects for securities in the same rating category, and with similar residual maturity. The rationale for these fixed effects is to group securities that need a similar amount of regulatory capital.[11] When estimating this specification, we find that within the same category of risky assets (maturity and rating) banks aim for riskier securities overall (positive coefficient of ACY in column 4), a result similar in spirit to Efing (2014). The limited availability of ratings information, however, restricts our analysis to a smaller subsample in this case.

3.2 Negative Monetary Policy Rates and Search for Yield

In order to identify the link between negative policy rates and search for yield behaviour, we estimate a differences-in-differences specification where identification is provided by banks' reliance on customer deposits. We can then compare banks that were more affected by the introduction of negative interest rates to a control group that was less affected. Thereby we can disentangle the effects that are due to changes in the supply of securities, or driven by other economic developments, from those effects that we can attribute to the introduction of negative interest rates by the ECB.

Results are reported in Table 4 with different specifications of fixed effects. The estimated coefficient for the interaction **Deposit Ratio*Post*ACY** shows that the impact of an increase in the ACY in the post-NPR (negative policy rate) period was significantly different for banks with a higher deposit ratio. This can be interpreted as evidence of (relative) search for yield induced by the introduction of negative policy rates. We find that after the introduction of negative policy rates, a difference in the deposit ratio of 10 percentage points (approximately one standard deviation) would imply a 1–2 % increase in the sensitivity of the holdings of a particular security in response to a change in the adjusted current yield by one percentage point.

Insert Table 4 about here.

Overall, the signs and the significance of the estimated coefficients in Table 4 and Table 3 are broadly similar. The coefficient of the triple interaction **Deposit Ratio*Post*ACY** is positive and significant both exploiting within-security variation and within-maturity-rating-quarter variation. The triple interaction remains significant for the Khwaja and Mian (2008)-estimator (security-quarter fixed effects, p-value: 0.010), security-bank fixed effects (p-value:

[11] We construct these fixed effects as follows: First, we group securities by maturity. We use multiples of 100 days (i.e. the first group contains all securities maturing between 0-99 days, the second group those with 100-199 remaining days of maturity etc.). Based on this we compute a common fixed effect for securities within the same maturity group, that hold the same rating during a certain reporting period.

0.053) and other specifications.[12] The sign of the triple interaction is also robust across subsamples restricted to the bottom, mid and top quartile of the ACY variable.

Insert Figure 5 about here.

Figure 5 shows, that before the introduction of negative policy rates, the sensitivity of banks' portfolios to changes in ACY did not depend on the level of the deposit ratio.[13] Conversely, post-NPR, low-deposit ratio banks disinvest in response to a positive change in the ACY, while high deposit ratio banks disinvest less or not at all. The overall result is that the post-NPR portfolio of high-deposit ratio banks became riskier compared to low-deposit ratio banks. This can be interpreted as search for yield in the securities portfolio of the affected banks caused by the introduction of negative interest rates.

3.3 The Parallel-Trends Assumption

Our identification strategy relies on the assumption that, in the period before the introduction of negative policy rates, risk taking behaviour did not differ systematically across banks with low and high deposit ratios once we control for the patterns captured by fixed-effects and other covariates (parallel-trends assumption). To investigate further on this, we estimate a specification that includes dummies for the lags and leads of the policy change, as in Autor (2003). We estimate

$$\begin{aligned} ln(holdings)_{ijt} &= \beta_{01} \times d2013q4_t \times Deposit\_ratio_{jt} \times ACY_{ijt} \\ &\quad +\beta_{03} \times d2014q2_t \times Deposit\_ratio_{jt} \times ACY_{ijt} + \ldots, \end{aligned}$$

where $d2013q4_t$ is a dummy variable that takes value 1 during the last quarter of 2013 and is 0 for all other quarters. Figure 6 reports the coefficients β_{01}, β_{03} etc. If there is no systematic difference before the policy change, we would expect the pre-treatment interaction of a quarter dummy with ACY and the deposit ratio to be close to zero (not statistically significant). Our data is available from the 4th quarter of 2013 onwards and we use the quarter before the introduction of negative policy rates (2014q1) as our reference period. Figure 6 shows all estimated coefficients of the interaction variable of Deposit ratio, ACY and a dummy for each quarter with 90% confidence bands. Before the policy change, the coefficient of the triple interaction of Deposit ratio, ACY and the dummy variable for 2013q4 is insignificant.[14] Based on this evidence we do not reject the *parallel trend* assumption during the pre-NPR period.

[12] Estimation results for the Khwaja and Mian (2008)-estimator (security-quarter fixed effects) are **Deposit Ratio*Post*ACY**-coefficient of 0.0021 with a p-value of 0.010, and for security-bank fixed effects **Deposit Ratio*Post*ACY**-coefficient of 0.0008 with p-value of 0.053. Output tables are to be updated in a further revision of the paper.

[13] In Figure 5 we visualize the intuition behind our results. We show the coefficients of our model estimated using the specification including bank and security fixed effects. The coefficient of **Deposit Ratio*Post* ACY** determines the pre-NPR vs. post-NPR difference in the slope of the relationship between the deposit ratio and the sensitivity of $Ln(holdings)$ to a change in the ACY. For the left panel we set *Post=0* and for the right panel we set *Post=1*, in order to highlight the differences before and after the introduction of negative policy rates.

[14] Please note that the coefficient for 2014q1 is 0 by construction (reference period, omitted from the regressions). Using 90% percent confidence intervals makes the confidence bands "narrower" and hence a rejection of the "H_0 : *parallel trends during the pre-NPR period*" more likely. Nevertheless, we do not reject H_0 for both graphs displayed in Figure 6.

Insert Figure 6 about here.

Figure 6 also illustrate the effects of negative interest rates over time: the strongest effect is already visible at the end of the 2nd quarter (the negative rates were first announced on June 11 2014). While the subsequent reduction in remuneration of the ECB's deposit facility on September 10 to -0.2 % was perceived by market participants as a "surprise decrease" the estimated coefficients suggest that the differential impact across banks with different deposit ratios was limited.

The results of this test also provide a rationale to define the time frame of our analysis and to pin down the effects of the policy change in the second quarter of 2014. Indeed, if we included this quarter in our pre-NPR period, we would violate the parallel trends assumption, which would prevent us from identifying a causal effect. We end our sample before the implementation of the asset purchases by the ECB in January 2015, which allows to have a window that includes the two quarters before and the two quarters after the introduction of negative policy rates. For robustness, we have carried out our analysis also extending the post-NPR period by up to three quarters in 2015 and our findings still hold. We cannot run a similar exercise for the pre-NPR period, because the database starts in 2013Q4.

3.4 Results by Asset Class

We have shown that banks with different deposit ratios make different choices in terms of their aggregate securities portfolio after the introduction of negative policy rates. Using the granular database at our disposal, we now explore the drivers of these differences. We answer the following question: is the evidence of risk-taking behaviour by high deposit ratio banks particularly prevalent within certain asset classes? We perform the same estimations as in Table 4 restricting our sample across different asset classes.

Insert Table 5 about here.

We find that after the introduction of negative interest rates, there is evidence that high deposit ratio banks take more risks compared to low deposit ratio banks in public and private debt securities, but there is no differential response in the investment behaviour towards asset-backed securities (see in particular the estimated coefficients of **Deposit Ratio*Post**).[15] Looking at the sensitivity of portfolio holdings to changes in ACY, the coefficents of the triple interaction suggest that banks with a higher deposit ratio became more sensitive to changes in the ACY of private debt securities (issued by banks and by non-financial corporations) when reshuffling their portfolios.

Figure 7 reports the triple interaction coefficients **Deposit ratio*Post*ACY** of each separately estimated regression alongside a 95% confidence interval and for different specifications of fixed effects as reported in Table 5. The coefficients from the estimations based on the total sample are reported on the first bar on the left, with the label "All" in order to provide a reference point. The values and the confidence intervals of the coefficients vary across the

[15] Table 5 reports the results of estimations with the specification with bank and security fixed effects. The complete set of results is available from the authors.

different specifications. The positive relationship captured by the coefficient of **Deposit ratio*Post*ACY** is confirmed for all asset classes, albeit for different levels of statistical and economic significance. Evidence for a risk-shifting behaviour of high deposit ratio banks is strongest and statistically significant for private debt securities issued by financial and non-financial corporations. Affected banks seem to have directed their investment more towards the class of private debt securities.

Insert Figure 7 about here.

4 Further Robustness Checks

In reaction to the pressures that negative interest rates induce on their balance sheets, banks could further increase risk taking using alternative channels. Banks could seek to increase their exposure to duration risk by increasing the average maturity of their holdings.

4.1 Risk-Taking and Bank Leverage

Peydro et al. (2017) provide evidence that bank risk-taking in response to a monetary policy loosening during a crisis period can be explained by a particular bank's risk-bearing capacity (i.e. bank leverage). They run their analysis using granular data on loans and securities holdings for Italian banks. Next, we investigate how differences in bank leverage affect the allocation of securities portfolios in the context of negative rates. Hence, we interact our coefficient of interest with the leverage ratio (equity divided by total assets) of each bank. We also add all relevant lower-level interaction terms to our regression. The results are displayed in Table 6.

Insert Table 6 about here.

First we observe that the coefficient of **Deposit ratio*Post*ACY** remains positive and significant throughout the different specifications. We find the coefficient of the interaction **Leverage ratio*Deposit ratio*Post*ACY** to be negative and significant. This evidence suggests that our effect of interest (how a bank with a high deposit ratio reacts to changes in the ACY after the introduction of negative policy rates) is weaker for highly capitalized banks.[16]

At this point, one might conclude that our results are evidence of risk-shifting: banks with low levels of capital seem to be more prone to risk-taking in response to monetary policy changes. However, to compute the overall effect we need to take into account also the change in the average effect of leverage on the sensitivity to changes in the ACY, i.e. the sign and significance of the coefficient of **Leverage ratio*Post*ACY**. On average, negative rates do not induce highly levered banks to increase their risk exposure more than better capitalized

[16]We have run a similar analysis by dividing the sample in two groups depending on the leverage ratio (banks that have different levels of capital). Also with this specification we find stronger effects, larger coefficients for the interaction **Deposit ratio*Post*ACY** for the group of banks with a lower leverage ratio. This is consistent with our interpretation of the quadruple interaction term.

banks (risk-shifting). Instead, better capitalized banks increase their holdings of securities with a higher ACY in order to exploit their risk-bearing capacity. This result in particular is consistent with the results obtained by Peydro et al. (2017) during the sovereign debt crisis in the euro area.

The magnitude and the sign of the aggregate change in the sensitivity post-NPR depend both on the level of customer deposits and on the leverage ratio. The deposit ratio channel is active and stronger for less capitalized banks. However we find evidence of a counterbalancing effect that works through the bank's overall risk bearing capacity.

4.2 Risk-Taking via Duration Risk

As in the previous section our identification strategy relies on banks' deposit ratios.We document aggregate shifts in duration risk during our sample period. We measure duration risk via the maturity structure of the asset portfolio. Figure 8 shows the maturity structure of the securities portfolio in our sample before and after the introduction of negative policy rates.

Insert Figure 8 about here.

To further investigate changes in risk exposure linked to duration we have estimated our model using maturity as a measure of risk. Indeed, an empirical specification using the benchmark approach from Table 3 confirms the patterns in the histogram. We find no statistical significant effect of maturity on individual asset holdings.[17]

Overall we don't find a robust evidence that banks that are more affected by the negative interest rates via a high ratio of customer deposits have a different sensitivity to duration risk. Figures 9 plots the coefficient of the triple interaction term in an estimated model with securities holdings grouped by maturity. There are no significant coefficients that are robust across the different specifications of fixed-effects. The only statistically significant result concerns holdings of debt securities issued by banks, for which banks with a high deposit ratio seem to have increased average maturity.[18]

Insert Figure 9 about here.

4.3 Brief Analysis of the Lending Portfolio

In the previous sections we have analyzed the impact of negative policy rates on the securities holdings of large European banks. Securities portfolios are easier to rebalance in response to changes in interest rates, but a large fractions of banks' assets is represented by loans. We provide some complementary evidence on the impact of negative rates on large banks' assets by using data on syndicated lending.[19]

[17] Results are available from the authors by request.

[18] The entire set of estimated results is available from the authors.

[19] Ideally, we would need detailed loan-level data for the banks in the sample in order to properly account for borrower's risk. These data are not available at this level of granularity for banks headquartered in different countries, while similar analysis can be carried out by using data of one country at the time (see for example Bottero et al., 2019).

We use syndicated loans data from Dealogic and we consider only loans where at least one of the banks in our sample was involved. French and Spanish banks are dominanting our relatively small sample of loans. We run differences-in-differences regressions around the introduction of negative policy rates both at the bank-month level (aggregating the volumes of all deals within a month at the level of a bank holding company, and including only banks with the role of "Mandated Arrangers") and on the bank-borrower Level (i.e. looking at single deals, including banks in all roles, but including each bank only once).[20]

Insert Table 7 about here.

Results are shown in Table 7. In our analysis at the bank-borrower level we find evidence that banks with a higher deposit ratio decreased the amounts of syndicated loans. This is consistent with similar results on deleveraging in the securities portfolio during the same period (see negative coefficient of **Deposit Ratio*Post** in column 3 of Table 7). To control for risk on the level of the borrower, we include issuer ratings,[21] in particular the interaction **Deposit Ratio*Post*Rating**. The coefficient of the interaction is positive, suggesting that while banks more dependent on deposits generally shrank also their lending portfolio, they did this at a lower pace in case of riskier borrowers (remember that the coding of the rating is such that a higher value correspond to a riskier rating). We find significant results when restricting the sample to 11/2013-12/2014 in order to exclude the implementation period of the ECB's asset purchases.[22] Overall, this complementary approach confirms the findings of Heider et al. (2019) – the banks in our sample with a higher deposit ratio grant lower loan volumes. We also find some evidence that high deposit ratio banks grant higher volumes to higher-risk (i.e. lower-rated) borrowers compared to banks with a lower deposit ratio.

5 Conclusions

The implementation of negative policy rates in several countries in the last few years constituted an important novelty for policy makers and researchers interested in the effect of monetary policy. We contribute to the ongoing literature on this topic addressing the impact that negative rates have on financial intermediaries, in particular banks. We exploit a new dataset covering the securities holdings of the 26 largest euro area banking groups and evaluate the impact of the introduction of the negative policy rates on these portfolios. The identification relies on a differential effect due to the inability or unwillingness of banks to pass-through negative policy rates to depositors. Indeed, we show that, after the introduction of negative policy rates, the portfolio holdings of banks that are more reliant on deposit funding are more sensitive to changes in yields of securities. These banks are more likely to retain their investments in riskier securities compared to other banks. When considering allocation across asset classes,

[20] According to the Dealogic data it occurs quite frequently that one bank has two roles, e.g. Bookrunner and Documentation Agent.

[21] This restricts the analysis to loans where the rating of the borrower is specified, which further reduce the sample size. Ratings are coded with a numerical variable ranging from 1 for AAA to 16 for B-.

[22] The coefficients of interest loose their statistical significance in regressions we run based on an extended sample covering syndicated loan transactions during the years 2013-2015.

we find evidence that the same banks reallocate more towards private debt securities (issued by the financial and non-financial sector).

Our analysis complements the results obtained by other researchers which mainly focused on the impact of negative policy rates on the lending portfolio of banks. It remains to be investigated how the results of all these studies can be combined to assess the macroeconomic impact of negative policy rates and to evaluate the possible trade-offs between temporary distortions in some part of the financial sector and the effects on the economy at large. Our results also have important implications for the assessment of non-standard monetary policy tools and how these tools can have a heterogeneous impact across financial intermediaries, that is not directly related to the primary objectives of the policy makers.

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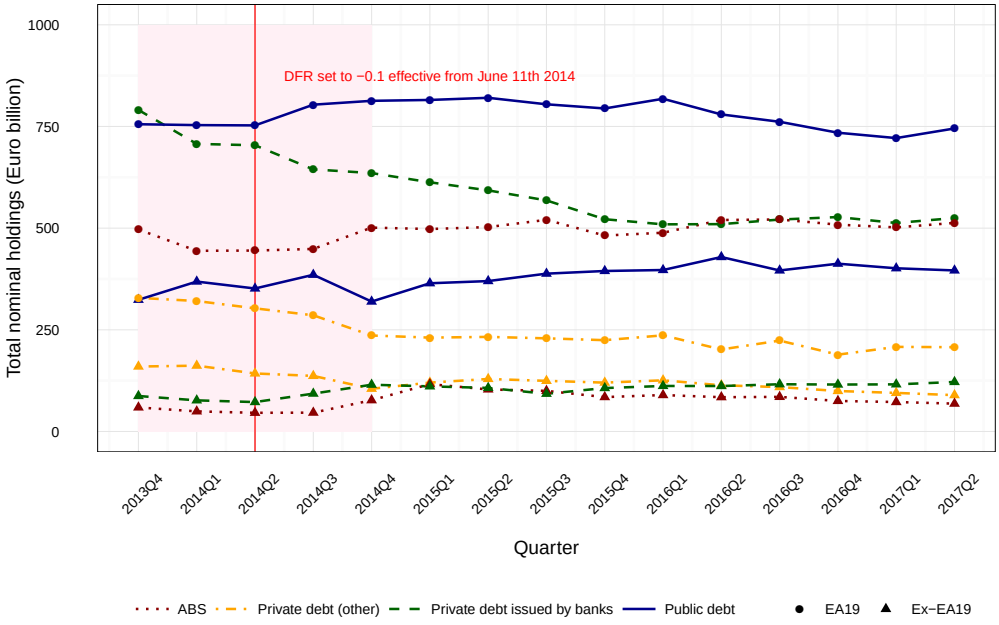
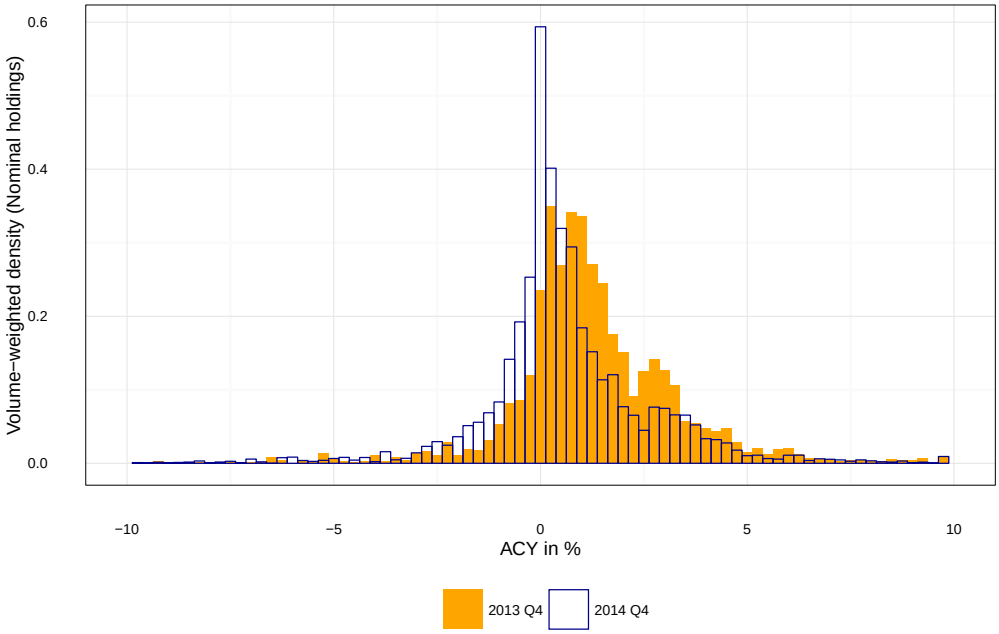
Figures

Figure 1: Evolution of the Holdings of Debt Securities by the 26 Reporting Banking Groups



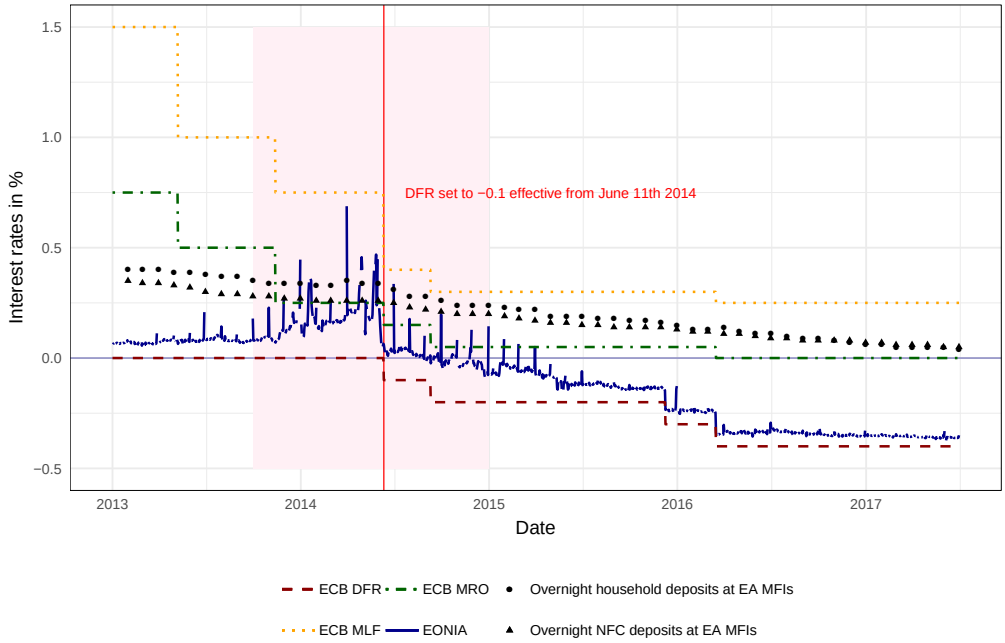
Source: Authors' calculations, SHSG database

Figure 2: Distribution of ACY Pre-NPR vs. Post-NPR



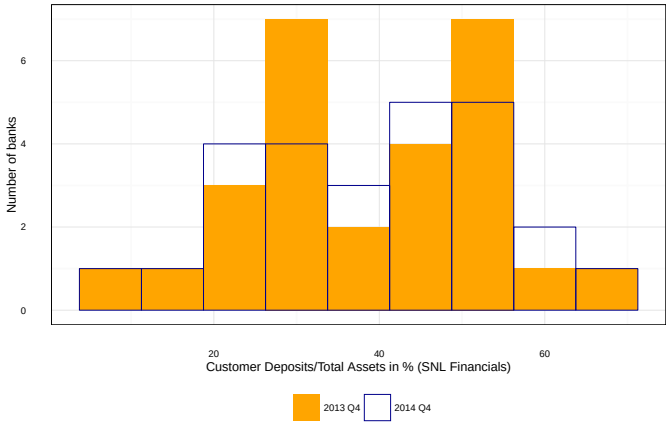
Source: Authors' calculations, SHSG database

Figure 3: Policy Rates and Market Interest Rates in the Euro Area



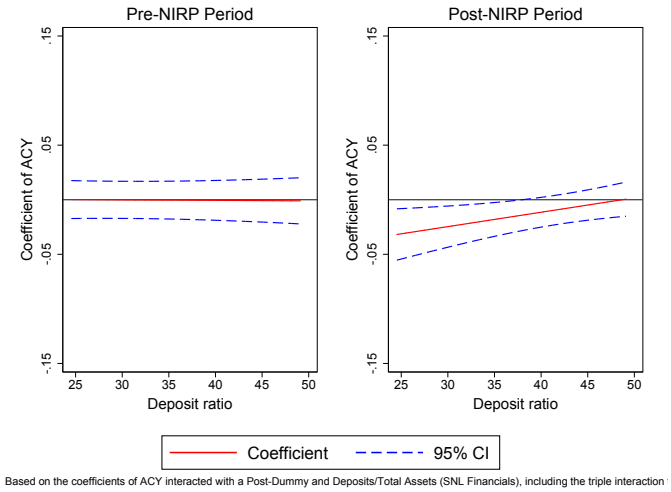
Source: ECB SDW, ECB MFI Interest Rate Statistics

Figure 4: Distribution of the Deposit Ratio Pre-NPR vs. Post-NPR



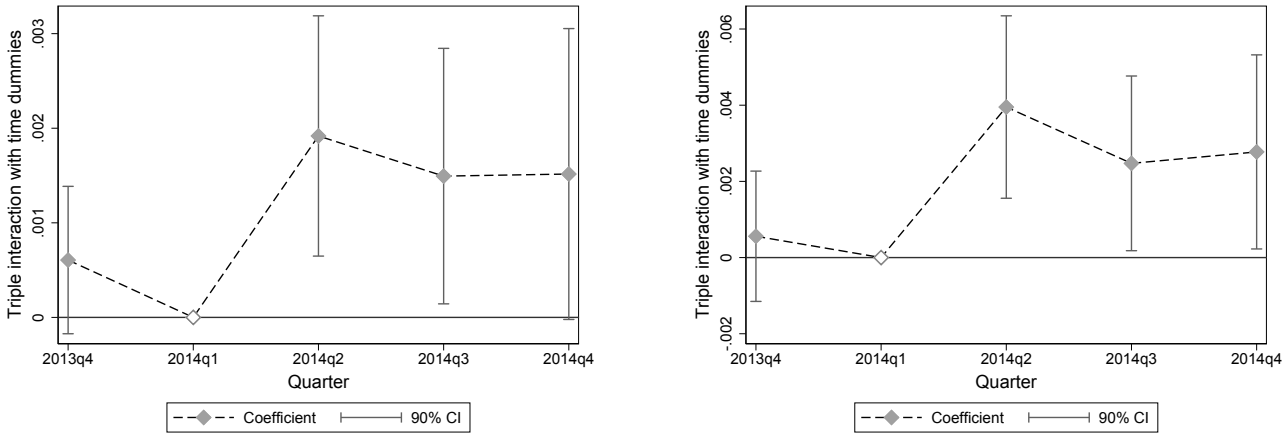
Source: SNL Financials

Figure 5: Marginal Effect of ACY Before and After Negative Policy Rates



Note: Specification with bank and security fixed effects.

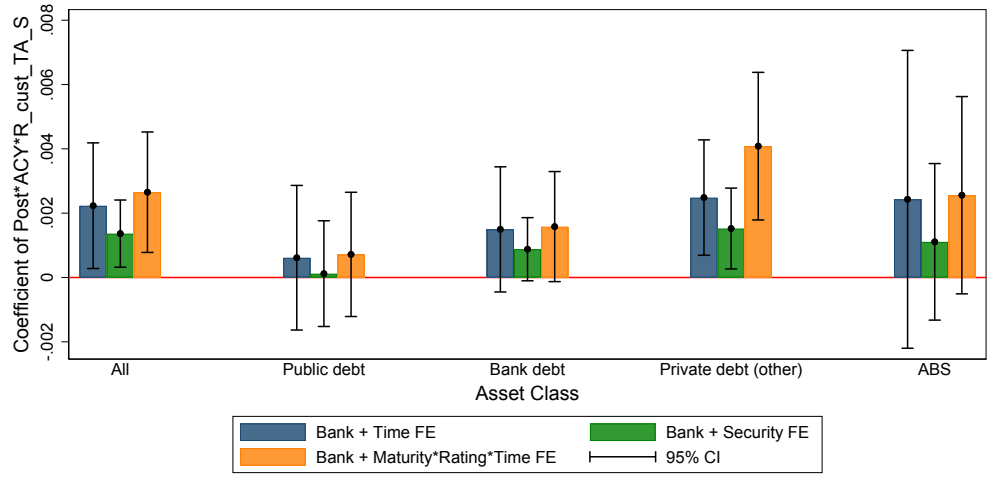
Figure 6: Evidence on the Parallel Trends Assumption



(a) Security Fixed Effects

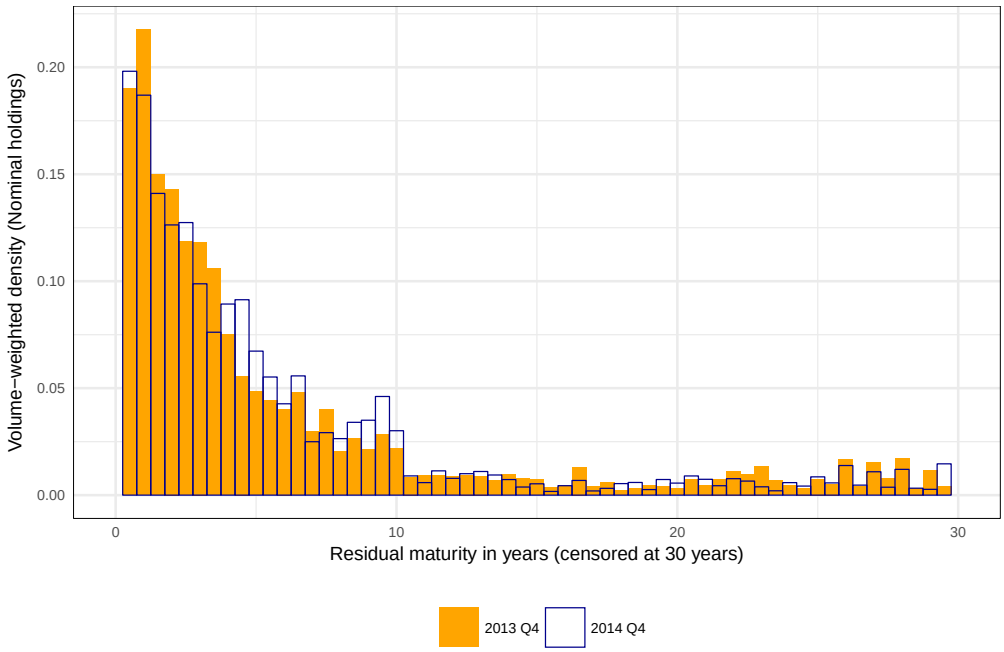
(b) Maturity*Rating*Quarter Fixed Effects

Figure 7: Coefficient of Triple Interaction Term across Different Asset Classes



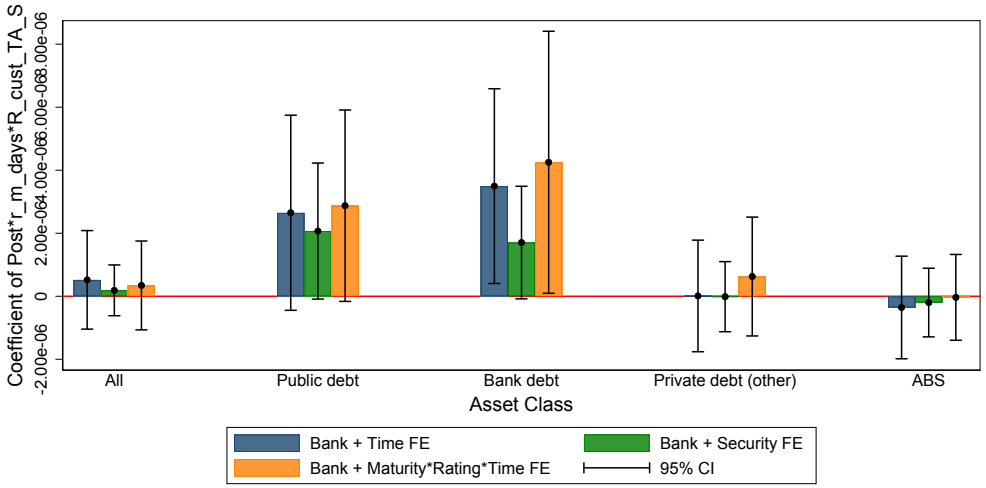
Source: Authors' calculations, SHSG database

Figure 8: Distribution of Residual Maturity in Years Before and After Negative Policy Rates



Source: ECB calculations, SHSG

Figure 9: Coefficients of Triple Interaction Term with Deposit Ratio and Maturity



Source: Authors' calculations, SHSG database

Tables

Table 1: Average Nominal Holdings by Asset Class and Region

	2013q4-2014q1		2014q2-2014q4	
	Euro billion	%	Euro billion	%
Asset Class				
ABS	524.8	17.8%	521.4	18.5%
Private debt (other)	485.5	16.5%	403.0	14.3%
Private debt issued by banks	830.8	28.2%	754.7	26.8%
Public debt	1100.7	37.4%	1141.9	40.5%
Region				
Developed	219.9	7.5%	221.5	7.9%
Other	211.6	7.2%	209.5	7.4%
EU non-EA 19	211.6	7.2%	199.1	7.1%
Euro Area 19	2298.5	78.1%	2190.9	77.7%
Total	2941.7		2821.0	

Table 2: Summary Statistics of the Main Variables of Interest Q4 2013 – Q4 2014

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
ACY	454,534	0.979	4.008	-29.75	14.47
Equity/TA in % (from SNL)	453,144	4.812	1.156	3.109	8.167
Customer deposits / Assets in % (from SNL)	453,144	35.25	13.39	9.943	85.68
Total assets (ln)	453,144	27.48	0.745	25.02	28.36
Nominal holdings (ln)	404,039	14.22	3.619	-4.605	24.57

Source: SHSG database, SNL Financials

Table 3: Baseline Model

	(1) Ln(holdings)	(2) Ln(holdings)	(3) Ln(holdings)	(4) Ln(holdings)
Post	-0.291**		-0.283**	
	(0.136)		(0.136)	
ACY		-0.00934	-0.00150	0.0278***
		(0.00671)	(0.00890)	(0.00870)
Post*ACY		-0.0393***	-0.0173**	-0.0148
		(0.0141)	(0.00719)	(0.0151)
Observations	386,551	402,649	386,551	276,939
R-squared	0.580	0.220	0.580	0.327
Bank Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	–
Security FE	Yes	No	Yes	No
Maturity*Rating*Time FE	No	No	No	Yes
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$				

Note: Ln(holdings) is calculated on nominal amounts

Table 4: Estimation of Benchmark Model with Deposit Ratio Interaction

	(1) Ln(holdings)	(2) Ln(holdings)	(3) Ln(holdings)	(4) Ln(holdings)
Post	-0.291**		-1.204**	
	(0.136)		(0.494)	
ACY		0.0186	0.00133	0.0640***
		(0.0197)	(0.0133)	(0.0180)
Post*ACY		-0.115***	-0.0655***	-0.112***
		(0.0434)	(0.0206)	(0.0364)
Deposit ratio*Post		0.0317**	0.0251**	0.0379**
		(0.0130)	(0.0104)	(0.0149)
Deposit ratio*ACY		-0.000790*	-4.75e-05	-0.000976**
		(0.000411)	(0.000335)	(0.000402)
Deposit ratio*Post*ACY		0.00223**	0.00136**	0.00265***
		(0.000997)	(0.000533)	(0.000955)
Observations	386,551	402,649	386,551	276,939
R-squared	0.580	0.223	0.582	0.331
Bank Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	–
Security FE	Yes	No	Yes	No
Maturity*Rating*Time FE	No	No	No	Yes
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$				

Note: Ln(holdings) is calculated on nominal amounts

Table 5: Regressions across Asset Classes

	(1) Public debt	(2) Private debt issued by banks	(3) Private debt (other)	(4) ABS
	Ln(holdings)	Ln(holdings)	Ln(holdings)	Ln(holdings)
Post	-0.991***	-0.962**	-1.666**	-0.427
	(0.368)	(0.411)	(0.676)	(0.321)
ACY	-0.0629**	0.00345	-0.0147	0.170***
	(0.0312)	(0.0191)	(0.0155)	(0.0440)
Post*ACY	0.0222	-0.0476**	-0.0727***	-0.0255
	(0.0340)	(0.0221)	(0.0207)	(0.0623)
Deposit Ratio*Post	0.0195**	0.0207**	0.0362**	0.00515
	(0.00793)	(0.00864)	(0.0141)	(0.00676)
Deposit Ratio*ACY	0.000430	-7.04e-05	0.000610	-0.00387***
	(0.000652)	(0.000540)	(0.000498)	(0.00107)
Deposit Ratio*Post*ACY	0.000120	0.000879*	0.00152**	0.00111
	(0.000839)	(0.000501)	(0.000641)	(0.00124)
Observations	96,637	116,750	138,505	32,504
R-squared	0.436	0.601	0.652	0.708
Bank Controls	Yes	Yes	Yes	Yes
Security FE	Yes	Yes	Yes	Yes
Time FE	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes
Maturity*Rating*Time FE	No	No	No	No
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$				

Note: Ln(holdings) is calculated on nominal amounts

Table 6: Regressions with Bank Leverage Ratio Interaction

VARIABLES	(1) Ln(Holdings)	(2) Ln(Holdings)	(3) Ln(Holdings)
Post		-1.852***	
		(0.694)	
ACY	0.393***	0.301***	0.606***
	(0.122)	(0.106)	(0.168)
Post*ACY	-0.769***	-0.531***	-0.883***
	(0.216)	(0.146)	(0.221)
Deposit ratio	-0.0166	-0.0110	-0.0230
	(0.0181)	(0.0127)	(0.0191)
Deposit ratio*Post	0.0177*	0.0140*	0.0235**
	(0.00985)	(0.00802)	(0.0118)
Deposit ratio*ACY	-0.00962***	-0.00810***	-0.0131***
	(0.00280)	(0.00272)	(0.00369)
Deposit ratio*Post*ACY	0.0147***	0.0110***	0.0169***
	(0.00473)	(0.00348)	(0.00488)
Leverage ratio	-1.559***	-1.155***	-1.780***
	(0.571)	(0.418)	(0.648)
Leverage ratio*Post	0.255**	0.209**	0.263**
	(0.113)	(0.0868)	(0.120)
Leverage ratio*ACY	-0.0851***	-0.0666***	-0.127***
	(0.0268)	(0.0244)	(0.0399)
Leverage ratio*Post*ACY	0.155***	0.108***	0.185***
	(0.0450)	(0.0319)	(0.0510)
Leverage ratio*Deposit ratio*ACY	0.00196***	0.00172***	0.00277***
	(0.000605)	(0.000591)	(0.000835)
Leverage ratio*Deposit ratio*Post*ACY	-0.00300***	-0.00225***	-0.00349***
	(0.000959)	(0.000726)	(0.00106)
Observations	402,649	386,551	276,939
R-squared	0.225	0.583	0.333
Bank Controls	Yes	Yes	Yes
Security FE	No	Yes	No
Time FE	Yes	No	–
Bank FE	Yes	Yes	Yes
Maturity*Rating*Time FE	No	No	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: Ln(holdings) is calculated on nominal amounts

Table 7: Table with Syndicated Loans between 1 November 2013 and 31 December 2014 (without APP Period)

VARIABLES	(1) Ln(Amount)	(2) Ln(I-Amount)	(3) Ln(Amount)	(4) Ln(Amount)	(5) Ln(Amount)	(6) Ln(Amount)
Deposit Ratio*Post*Rating					0.00619**	0.00406*
					(0.00304)	(0.00223)
Deposit Ratio*Post	-0.0236	0.00602	-0.0152*	0.00270	-0.0684**	-0.0401*
	(0.0240)	(0.0125)	(0.00797)	(0.00381)	(0.0296)	(0.0213)
Deposit Ratio*Rating					-0.00149	-0.00203
					(0.00219)	(0.00169)
Post*Rating					-0.0366	
					(0.136)	
Rating					-0.192*	
					(0.102)	
Constant	4.015***	4.048***	3.731***	3.299***	6.933***	5.007***
	(0.564)	(0.279)	(0.212)	(0.101)	(0.659)	(0.612)
Observations	60	183	568	530	125	123
R-squared	0.508	0.606	0.197	0.920	0.744	0.906
Lead Arrangers Only	Yes	Yes	No	No	No	No
Bank-Month Level	Yes	Yes	No	No	No	No
Bank-Borrower Level	No	No	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	No	Yes	No
Borrower-Month FE	No	No	No	Yes	No	Yes

A Annex with Additional Tables

Table A.8: List of reporting banking groups

	Country	Code	Short name	Full name
1	AT	AT20100	Erste	Erste Group Bank AG
2	BE	BE0403227515	KBC	KBC Group-KBC Groep NV/ KBC Groupe SA
3	BE	BE0403201185	Belfius	Belfius
4	DE	DE00001	DB	Deutsche Bank AG
5	DE	DE00003	COBA	Commerzbank AG
6	DE	DE00316	LBBW	Landesbank Baden-Wuerttemberg
7	DE	DE00317	BLB	Bayerische Landesbank
8	DE	DE00319	HELABA	Landesbank Hessen-Thüringen Girozentrale
9	DE	DE00320	NORDLB	Norddeutsche Landesbank Girozentrale NORD/LB
10	DE	DE01121	DZ	Deutsche Zentral-Genossenschaftsbank-DZ Bank AG
11	DE	DE03249	PBB	Deutsche Pfandbriefbank AG
12	ES	ES0049	BSCH	Banco Santander SA
13	ES	ES0182	BBVA	Banco Bilbao Vizcaya Argentaria SA
14	ES	ES7865	BFA	BFA Tenedora de Acciones SA
15	ES	ESHO486478	La Caixa	Criteria Caixa Holding SA
16	FR	FR10278	BFCM	Credit Mutuel CM5-CIC
17	FR	FR16188	BPCE	Group BPCE
18	FR	FR30003	SG	Société Générale
19	FR	FR30004	BNP	BNP Paribas
20	FR	FR30006	CA	Crédit Agricole Group-Crédit Agricole
21	IT	IT0000203426147	MPdS	Banca Monte dei Paschi di Siena
22	IT	IT0000102484824	UC	Unicredit SpA
23	IT	IT0000101262255	ISP	Intesa Sanpaolo
24	NL	NL149	ABN	ABN Amro Group NV
25	NL	NL163	ING	ING Groep NV
26	NL	NL600	Rabobank	Rabobank Group-Rabobank Nederland