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Banks' Non-Interest Income and Securities Holdings in a Low Interest Rate Environment: The Case of Italy

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Abstract

Using a sample of 440 Italian banks over 2007-2016, we find low interest rates motivate banks to expand their fee and commission income and to restructure their securities portfolios. A granular breakdown suggests banks grow non-interest income in various ways including portfolio management, brokerage and consultancy services and increase fee income from current account and payment services. In addition, banks re-balance securities portfolios away from those 'held-for-trading' to securities 'available-for-sale' and 'held-to-maturity'. Our findings allude to different behaviour between large and small banks: while larger banks increase brokerage, consultancy and portfolio management services, smaller banks generate fees from customer current accounts.

Keywords: Fee and Commission Income; Securities; Low Interest Rates; Unconventional Monetary Policy; Italian Banking Sector

JEL: E43; E44; E52; G21; F4

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1. Introduction

Since the peak of the global financial crisis in 2008 and the ensuing economic downturn, the European Central Bank (ECB) (and other central banks) has implemented a range of unconventional monetary policy (UMPs) measures to boost national economies. The measures include non-standard monetary policies including large-scale asset purchases (LSAP); quantitative easing (QE); forward guidance (FG) and the negative interest rates policy (NIRP) and the outcome has been historically low policy and/or official interest rates.[2] This has led policymakers to express concern at the negative impact on bank margins and profitability (Alessandri and Nelson, 2015; Molyneux et al., 2019).[3]

The impact of low interest rates on bank profitability is ambiguous because low rates realise opposite effects on various income statement items (Riksbank, 2016). *Ceteris paribus* low policy rates increase the demand and supply of credit that positively affect bank interest revenues. Other expansionary monetary policies boost bank reserves, therefore, increasing the quantity of available funds (Bernanke and Gertler, 1995). The reduced cost of capital can improve creditors' ability to repay loans and, in turn, lessen loan losses (Altavilla et al., 2019). Lower interest rates could generate gains on fixed-income securities[4] but it depends whether securities are held-for-trading, held-to-maturity or available-for-sale. For trading book securities, gains feed directly to the income statement whereas available-for-sale securities are classified as equity, and the effect of interest rate changes is zero if securities are held-to-maturity. In low interest rate environments, banks may decide, on the one hand, to increase securities held-for-trading to exploit interest rate cuts and realise gains on their trading portfolios. However, protracted periods of low interest rates exhaust the possibility to cut rates further, and this, concomitantly with compressed margins and profits, may motivate banks to re-shuffle their securities portfolio from held-for-trading towards available-for-sale and/or held-to-maturity.

In low interest rate environments, banks might also try to expand fee and commission income. Since fees and commissions are earned from a diversified array of services – such as, non-interest income derived from transaction and credit services to brokerage and portfolio management, identifying the link between interest rates and these items can be challenging. There are two possible channels through

[2] See Gertler et al., 2011; Bowdler and Radia, 2012; Cour-Thimann and Winkler, 2013; Gambacorta et al., 2014; Chen et al., 2016; Eser et al., 2016 and Heider et al., 2019 for an overview of the unconventional monetary policy literature.

[3] Official rates in Italy are set by the ECB. The two main official rates are the marginal lending rate (the rate at which banks can borrow from the ECB overnight) and the rate on the deposit facility (this is the interest banks receive – or have to pay in times of negative interest rates – for depositing money with the ECB overnight). The marginal lending rate has fallen from 5.25% in July 2008 to 0.4% by June 2014 and has gradually continued to fall to 0.25% by September 2019. The deposit facility rate has reduced from 3.25% in July 2008, first went negative at -0.1% in June 2014 and has remained negative since then standing at -0.5% by September 2019. The Euro interbank rate Eonia (Euro OverNight Index Average) is the average interest rate for interbank 1-day lending in euros. This has fallen from 3.72% in January in 2008 to -0.079 % in January 2015 and has stayed negative (-0.451%) up to September 2019.

[4] This effect is just temporary. It reflects interest rate changes and disappears when the change is over.

which the interest rate environment influences fee and commission income. Low yields can cause bank customers to demand more professional services for the purpose of portfolio management (Albertazzi and Gambacorta, 2009). On the supply side, low interest rates boost asset prices and volumes, which positively impacts fees directly linked to servicing such business. Furthermore, in a low interest rate environment banks' incentive to search for yield is stronger (Rajan, 2006; Borio and Zhu, 2012), which influences banks to sell more services to customers to boost fee and commission income.

Low interest rates, however, can negatively affect net interest margins (Borio et al., 2017; Claessens et al., 2018; Altavilla et al., 2019). Low rates compress margins due to an imperfect pass-through to deposit rates. Banks are reluctant to impose negative rates on depositors because of fears of creating adverse effects on deposit balances (Jobst and Lin, 2016; Borio et al., 2017). This downward stickiness in deposit markets means that any reduction in lending rates exceeds deposit rates, which ultimately compresses margins. A contraction in net interest margin, absent a compensating increase in other sources of revenue can cause reductions in earnings, capital and credit growth. In such an environment, banks may be encouraged to adapt their business model by switching from interest to non-interest income in order to maintain profitability.

In this paper, we investigate the effect of low interest rate environments on non-interest income and securities. Whereas the impact of low interest rate on bank net interest margins is well documented, its effect on non-interest income has, so far, received less attention. To examine this relationship, we use a granular dataset of 440 Italian banks between 2007 and 2016 provided by the Italian Banking Association (ABI). The granularity enables us to investigate bank income structures by examining specific balance sheet and income statement items alongside detailed notes to the accounts. Indeed, while recent studies consider aggregate non-interest income (Borio et al., 2017; Altavilla et al., 2019), we can disentangle effects into various sub-categories. Specifically, we differentiate fee and commission income by three activities: first, portfolio management, brokerage and consultancy services; second, collection and payment services; third, current account services. In addition, we examine changes in the composition of bank securities holdings and differentiate between securities held-for-trading, available-for-sale and held-to-maturity. Overall, we find a negative relationship between the level of interest rates and fee and commission income and total securities. A granular breakdown of bank income statements suggests that banks grow non-interest services in various ways, namely, by enhancing fee income from: portfolio management, brokerage and consultancy; collection and payment services; and current account charges. Our analysis shows banks re-balance their securities portfolios away from held-for-trading to available-for-sale and held-to-maturity securities. Our findings identify different behaviour between large and small banks. While larger banks boost income from increased brokerage, consultancy and portfolio management services, smaller banks focus more on

increasing customer current account fees. We find also that lower capitalised banks hold more securities (as a % of total assets) compared to well capitalised banks.

Our findings have important policy implications in terms of both financial stability and monetary policy transmission. First, an excessive reliance on non-interest income could render bank revenues less stable (DeYoung and Roland, 2001). Moreover, regulators do not require directly banks to hold regulatory capital against most fee and commission-related products, so in a tougher regulatory regime and faced with a low interest rate environment, this could motivate a switch to non-interest income-related business, which potentially exacerbates stability concerns.[5] Second, since held-for-trading securities are reported at fair value and unrealised gains/losses feed directly to the income statement, a reduction in these securities may imply lower earnings volatility and, consequently, greater stability (Stiroh, 2004). In addition, if banks try to maintain profits in low interest rate environments by shifting to non-interest income activities, this will not increase bank lending to the real economy. As such, the latter limits the effectiveness of monetary policy.

Recently, a growing body of research has examined how monetary policy affects bank performance in low interest rate environments. Our study builds on this literature by investigating the effect of a protracted period of low interest rates on the detailed components of bank non-interest income. While much of the literature evaluates the effect of monetary policy on net interest margins and bank profitability (return on assets),[6] there is scant literature to link monetary policy and non-interest income. Albertazzi and Gambacorta (2009) study the relationship between bank profitability and the business cycle by using data from 10 industrialised economies. They uncover a negative relationship between fee and commission income and long-term interest rates, which they interpret as implying: (a) when interest rates are low, savers demand more professional services from banks to manage their portfolios; and (b) a fall in rates squeezes interest margins and orientates bank attention towards fee-earning activities. Borio et al. (2017) investigate the link between the level of interest rates and the slope of the yield curve on non-interest income. Employing a sample of banks from 14 countries from 1995 to 2012, they identify a negative relationship that they attribute to two possible effects. First, that lower interest rates generate gains on bank securities portfolios. However, the effect on income statements depends on the conventions under which banks book securities (as available-for-sale, held-for-trading or held-to-maturity). Second, at low rates asset prices and volumes are higher, hence, the search for yield is stronger, which motivates banks to sell more securities service-related products (for instance, portfolio

[5] The Regulation on prudential requirements (CRR) require – even if indirectly through operational risk – own funds for fee and commission-related services. Indeed, as these services may originate operational risks, the Basic Indicator Approach (BIA) requires banks to set aside capital for operational risk that is equal to 15% of the average of the total revenues over three years. This includes also fees and commissions income.

[6] See, for instance, Flannery (1981); Hancock (1985); Angbazo (1997); Demirgüç-Kunt and Huizinga (1999); English (2002) and Alessandri and Nelson (2015).

management services) to customers. Using a cross-section of 47 countries, Claessens et al. (2018) investigate the impact of low interest rate environments on bank margins and profits between 2005 and 2013. Their results show the impact of low interest rates on NIMs is greater than on RoA since banks realise valuation gains on fixed-income securities, which mitigates the overall adverse impact of reduced margins on overall profitability. In contrast to previous studies and based on a sample of 288 large euro area banks from 2000 to 2016, Altavilla et al. (2019) fail to find any relationship between the level of interest rates or the slope of the yield curve and non-interest income. Indeed, they suggest that banks hold relatively small amounts of mark-to-market securities to realise substantial capital gains. Heider et al. (2019) study the effect of negative interest rates on bank credit and risk-taking for a sample of euro area banks from 2013 to 2015 finding that high-deposit banks offset the negative shock on their net worth by charging higher fees. Kok et al. (2019) also find a negative relationship between short-term interest rates and fee and commission income. They suggest that lower short-term rates are usually associated with higher business volumes, and in a low interest rate environment banks refocus their strategies from activities generating net interest income towards higher fee and commission income. Brei et al. (2019) investigate the effect of low interest rate environments on bank intermediation activity by employing a sample of 113 large international banks in 14 major advanced economies over 1994-2015. They discover a statically significant negative relationship between the level of interest rates and fee and commission income. Specifically, they find that a decrease from 3% to 0% in interest rates increases fee income in the short-term from 14.2% to 15.2% of total income. Finally, Molyneux et al (2019) show that when NIRP compresses bank margins and profits, large banks modify their business model and expand fee and commission income.

We contribute to the extant literature by providing a greater level of granularity and detail into the relationship between low interest rates, non-interest income and securities holdings. Indeed, Brei et al. (2019) claim the need to provide more details into this relationship highlighting that:"…the database does not allow us to decompose this income in more detail" as a limitation of their study. Hence, while the established literature employs aggregate non-interest income and securities information, this paper is the first to disentangle the effect of low interest rates by considering specific fees and commissions reported in notes to the accounts and securities holdings divided by accounting classifications. The rest of the paper proceeds as follows. Section 2 introduces data and methodology. Section 3 discusses empirical results. Section 4 presents several robustness checks and Section 5 concludes.

2. Data and Methodology

2.1 Methodology

Our empirical strategy seeks to identify the effect of low interest rates on bank non-interest income and securities holdings. For this purpose, we follow Claessens et al. (2018), Altavilla et al. (2019) and Lucas

et al. (2019) and apply a dynamic panel fixed effects methodology. Equation [1] shows the specification of our baseline empirical framework:

$$Y_{it} = \beta_1 Y_{it-1} + \beta_2 STrate_{t-1} + \beta_3 GR\_CB_{t-1} + \varphi Z_{it-1} + \varphi_i + \sigma_t + \varepsilon_{it} \quad [1]$$

Where *Y* represents our main dependent variables; non-interest income (fee and commission income-to-total revenue (FEE)), and securities-to-total assets (SEC)). We use two indicators to proxy the low interest rate environment, the three-month EONIA (STrate) rate, and the growth in assets of central bank balance sheets (GR_CB)[7] to account for the effect of unconventional monetary policies.[8] A vector Z specifies various lagged bank-specific variables: bank size (Size); capitalisation (E/TA); asset quality (NPLs); liquidity (Liquidity); and cost-to-income ratio (Cost-to-income).[9] Equation [1] includes time effects (σ_t) to control for the effect of crises and regulatory changes that have affected bank performance. We also include bank fixed effects (φ_i) to control for time-invariant bank-specific factors that shape bank performance. We estimate all regressions using bank-level clustering to allow for correlation in the error term and use robust standard errors to address heteroscedasticity issues (Petersen, 2009). In addition, we use the variance inflation factor (VIF) to check for multicollinearity amongst covariates in the baseline regression. A mean VIF of 1.13 suggests that our covariates are not highly correlated (Table A in the Appendix shows a correlation matrix).

We develop our econometric specification by using the granular data to further investigate the effect of low interest rates on bank non-interest income. Specifically, we split fee and commission income into: revenue derived from portfolio management, brokerage and consultancy services (FEEMAN); collection and payment services (FEEPAY); and fees from current accounts (FEEACCOUNT). We construct each measure as a ratio of total revenue. We decompose securities into: available-for-sale (AFS); held-for-trading (HFT); and held-to-maturity (HTM) and express each measure as a ratio of total assets. This granular division should permit a better understanding of non-interest income in an environment characterised by low interest rates.

[7] The Euro interbank rate Eonia (Euro OverNight Index Average) is the average interest rate for interbank 1-day lending in euros. This has fallen from 3.72% in January in 2008 to -0.079 % in January 2015 and has stayed negative (-0.451%) up to September 2019. Lambert and Ueda (2014), Peydro et al. (2017) and Molyneux et al. (2019), among others, use central bank balance sheet size to proxy unconventional monetary policy because quantitative easing and major asset purchases rapidly increase the size of central bank balance sheets.

[8] Although some studies, such as, Borio et al. 2017 and Altavilla et al. 2017, use the slope of the yield curve computed as the difference between the ten- and two-year government bond yield (or the short-term rate), we find short-term rates and the yield curve are subject to multicollinearity. In our case, the correlation coefficient between short-term rates and the slope of the yield curve is 0.98.

[9] The next section will explain and justify our choice of variables.

To control for potential problems arising from endogeneity and simultaneity, we specify one-period lags of the covariates, and in a further check for robustness, employ the dynamic System Generalised Method of Moments (S-GMM) panel methodology (Goddard et al. 2013; Chiaramonte et al. 2015).

2.2 Data

We construct a dataset from various sources. We source bank balance sheet and income statement data from the Italian Banking Association (ABI Banking Data). This novel dataset covers the population of Italian banks. It has a high degree of granularity that allows us to fully investigate bank income structures through detailed analysis of specific balance sheet items, income statement and information in notes to the accounts (typically unavailable in commercial databases). Furthermore, the time series data contains no missing values. We source monetary policy series from Thomson Datastream and the European Central Bank Statistical Data Warehouse. The initial sample includes 734 financial institutions between 2007 and 2016. Whilst several banks exited the market following the global financial crisis and European sovereign crisis, we keep those banks that report data across the sample period; i.e. employing a balanced sample of banks.[10] To deal with mergers and acquisitions, we drop observations that display an excessive annual asset growth rate (exceeding 50%). We winsorize variables at 1% to mitigate the influence of outliers. Our final sample contains 440 banks and 3,960 bank-level observations. Table 1 summarises our variables.

[Insert Table 1 here]

Table 2 shows descriptive statistics for bank fee and commission income, securities, other balance sheet variables, and monetary policy indicators. Panel A displays summary statistics of our dependent variables. Following Busch and Kick (2009), the ratio of fee and commission income-to-total revenue (FEE) indicates bank income diversification toward service-based activities. The evolution of the ratio of securities-to-total asset (SEC) shows if the protracted period of low interest rates motivated banks to enlarge or shrink their securities portfolios.

As noted above, we decompose the dependent variables, FEE and SEC. Specifically, we split FEE into income derived from: portfolio management, brokerage and consultancy fees (FEEMAN); collection and payment services fees (FEEPAY); and current accounts fees (FEEACCOUNT), each as a ratio to

[10] We prefer a balanced rather than an unbalanced panel as the latter can amplify omitted variable bias (Baltagi and Song., 2006). However, survivorship bias could affect a sample comprising only active banks. Therefore, we use the original unbalanced sample as a further robustness check to verify the validity of our baseline regressions.

total revenue.[11] We divide securities into those available-for-sale (AFS), held-for-trading (HFT), and held-to-maturity (HTM) each as a ratio of total assets.

Panel B shows summary statistics of our variables of interest and bank-specific controls. STrate is the three-month EONIA interest rate. The effect of short-term interest rates on fee and commission income is not clear cut. From the perspective of savers, low interest rates should be *ceteris paribus* associated with higher bank business activities as low interest rates exert a positive effect on asset prices and volumes (Brei et al., 2019; Kok et al., 2019). Moreover, at low rates, bank customers may demand more professional services to manage portfolios and search for yield (Albertazzi and Gambacorta, 2009). From the bank side, there may be a rebalancing effect from low interest rate generating activities, such as, loans towards more service-based sources of income. This scenario makes possible a negative relationship between STrate and FEE. Other things equal, lower interest rates should generate capital gains on bank security holdings (Bernanke and Kuttner, 2005; Borio et al., 2017). However, this depends on how banks book their securities. If securities are in the trading book, gains feed directly into the income statement; if available-for-sale they go into equity, and there is no effect if banks hold securities to maturity. Hence, the expected sign of STrate on the overall holdings of securities (SEC) is uncertain.

In accord with Lambert and Ueda (2014), Peydro et al. (2017), and Molyneux et al. (2019) we employ the growth rate of the ECB bank balance sheet (GR_CB) to proxy UMPs. On the one hand, banks benefit from UMPs in terms of lower funding costs and positive valuation effects via increased asset prices. On the other hand, UMPs can flatten the yield curve, which reduces revenues from floating rate and new loans and narrows net interest margins (Alessandri and Nelson, 2015). Hence, a flat yield curve may motivate banks to switch toward a more services-oriented business model. Based on this discussion, we envisage a positive relationship between FEE and central bank asset growth. In contrast to the relationship between STrate and bank securities, the relationship between GR_CB and securities is not clear-cut. On the one hand, by flattening the yield curve, UMPs affect bank securities reinvestment risk, namely, the expected level of earnings of any reinvestment of cash flow during the period. If yields decrease securities values improve, but the rate of return for future investment declines and motivates banks to hold fewer securities as, in general, a flattening yield curve implies that interest rates will stay low for long. On the other hand, a portfolio rebalancing channel toward securities is possible as: a) the current regulatory framework allows banks to hold European sovereign debt without capital charges

[11] We have more than 20 fee and commission variables in our dataset but apart from FEEMAN, FEEPAY and FEEACCOUNT all other components represent less than 5% of total fee and commission income. As such, the aggregate variable FEE includes all components, but for different types of fee income we focus on the aforementioned major three components.

(zero-risk weights) and exposure limits and;[12] b) deteriorating macroeconomic conditions, higher levels of non-performing loans and tighter prudential regulation may motivate banks to substitute lending for securities for stronger capital positions as well as to "reach-for-yield" (Altavilla et al. 2019).

We measure bank size (Size) as the logarithm of total assets. DeYoung and Rice (2004) suggest size relates positively to fee and commission income and securities holdings because larger banks rely more heavily on non-interest income than small banks. We employ several variables to control for bank risk aversion, asset quality, liquidity and operating efficiency. We use the ratio of equity-to-total assets (E/TA) to proxy bank risk aversion (Altunbas et al.2007). A negative relationship is expected between this variable and service-based activities and securities as less capitalised banks may prefer to expand services and hold more securities due to low (or zero) capital requirements. Furthermore, capital constrained banks may curtail lending and invest more in securities to raise fee and commission income to maintain profits. We employ liquidity and a measure of credit risk to control for bank liquidity and asset quality. We expect illiquid banks and banks with poorer quality loans to charge higher fees and commissions for services. We expect a positive relationship between NPLs and securities because deterioration in the quality of credit worsens both capital ratios and profitability, which motivate banks to cut lending and invest in securities. Finally, we measure the efficiency of bank management through the cost-to-income ratio (Cost-to-income) or the operating cost necessary to generate one unit of income (Altavilla et al. 2019). Since the main input needed to produce more fee-based products is typically fixed or quasi-fixed (labour expenses), we expect a positive relationship between the cost-to-income ratio and fee and commission income (DeYoung and Roland, 1999).

[Insert Table 2 here]

3. Empirical Findings

3.1 Baseline Results

We present baseline results from estimates of equation [1] in Table 3. Columns 1 and 2 report estimates when FEE is the dependent variable while SEC is the dependent variable for columns 3 and 4. All regressions show estimates from models with bank-specific controls, bank fixed effects and time effects. Our main interest is the size, sign and statistical significance of the coefficients of β_2 (STrate) and β_3 (GR_CB). These coefficients signal the effects of low interest rate environments on bank non-interest income and securities holdings.

[12] Although here we are not able to disentangle between government bonds and other securities holdings, in Italy 81% of securities held by the banking sector are government bonds, and the majority are domestic (Peydro et al., 2017).

We find low interest rates realise a negative, statistically significant (at the 1% and 5% level across specifications) effect on fee and commission income (Columns 1 and 2). A one percentage point decrease in the short-term interest rate increases fee and commission income by around 6% relative to the mean. Greater demand for and supply of services in low interest rate environments (see section 1 and 2.2) allow banks to redistribute part of their income from traditional intermediation to fee-based activities (Brei et al., 2019; Kok et al., 2019). FEE is positively and significantly associated to GR_CB (at the 1% level). A 100-basis point increase in central bank asset growth increases fee and commission income by around 18% relative to the mean. The effect is economically more important than the STrate. In the short-term, banks benefit from a funding cost reduction and security gains, which serve to limit incentives for banks to expand service-related activities. However, in the long-run UMPs flatten the yield curve to compress newly issued and floating long-term maturity assets like loans, which offsets lower funding costs and motivates banks to switch into other sources of income.

We discover a negative, statistically significant relationship between STrate and SEC, which infers that banks prefer to hold more securities in low interest rate environments when monetary policy is accommodative (Column 4). A one percentage point decrease in STrate increases bank securities holdings by around 3.4% relative to the mean. Again, as for fee and commission income, we find a positive relationship between SEC and the proxy for unconventional monetary policy (GR_CB). A one percentage point increase in the ECB balance sheet increases bank security holdings by around 16%. This result suggests a portfolio-rebalancing channel toward securities motivated by either banks' risk shifting or liquidity hoarding behaviour. In an economic environment characterised by slow economic recovery and high levels of non-performing loans as in Italy (Accornero et al. 2017), holding liquid securities could be the consequence of a credit demand problem, with few opportunities to lend (Summers, 2014) or a pool of risky borrowers (Rogoff, 2015). Hence, banks could hoard liquid securities rather than issue relatively illiquid loans to small and medium enterprises (SMEs).

The bank-level controls are also statistically significant. Size is positively related to securities suggesting that large banks hold relatively more securities than their smaller counterparts (Column 4). Smaller banks appear to have expanded income more into service-related activities compared to larger banks (Column 1). Credit risk is positively associated to both FEE and SEC which we interpret as indicating that banks with weaker asset quality pass these costs to customers through higher fees, rationing lending, and investing more in securities (Columns 1 to 4). Liquidity is negatively related to FEE (Column 2) as lower bank liquidity encourages a switch towards service-related products.[13] Finally, the cost-to-income ratio displays a positive association to FEE (Column 2). Since fee-related

[13] We remove liquidity from the Security regressions (columns 7 to 9) because it is highly correlated with the lag of the dependent variable. The correlation coefficient is 81.83%.

services are both labour and fixed cost intensive, we contend this explains the positive relation between FEE and cost-to-income.

[Insert Table 3 here]

3.2 Breakdown in Fee and Commission Income

Table 4 presents results from when we breakdown fee and commission income into three constituents: portfolio management, brokerage and consultancy fees (FEEMAN); collection and payment services fees (FEEPAY); and current accounts fees (FEEACCOUNT). As previously, all regressions show estimates from models with bank-specific controls, bank fixed effects and time effects.

As expected, we find each fee sub-category displays negative and positive significant relationships to STrate and GR_CB, respectively (at the 1% level). In low interest rate environments, enterprises are more likely to prefer security issuance and related services because of lower capital costs. Also, investors, both retail and wholesale, are likely to increase demand for professional services to manage portfolios and search for yield (Albertazzi and Gambacorta, 2009). Consequently, banks grow their revenues by placing securities, or underwriting for firms, and managing portfolios for investors. Banks (of course) may simply charge more for non-interest income activities to offset the negative effect of low rates on bank profitability (Altavilla et al., 2019 and Lucas et al., 2019).

[Insert Table 4 here]

3.3 Securities Activity Breakdown

Table 5 shows results when we classify securities as available-for-sale (AFS), held-for-trading (HFT), and held-to-maturity (HTM). As above, all regressions show estimates from models with bank-specific controls, bank fixed effects and time effects.

Table 5 reveals bank behaviour in terms of securities holdings during episodes of low interest rates. While coefficients for AFS (Columns 1 and 2) and HTM securities (Columns 5 and 6) are negatively related to STrate, we observe a positive relationship to GR_CB. This suggests that in an environment characterised by accommodative monetary policy, banks hold more securities to purse liquidity needs and/or requirements (in the case of HTM) or risk-shifting (for AFS). Indeed, in low interest rate environments, banks seem to prefer holding AFS and HTM securities over HFT. We confirm our interpretation since the coefficient on HFT securities (Columns 3 and 4) shows a positive (negative) relationship with STrate (GR_CB). Indeed, if banks treat securities as HFT, the unrealised changes in fair value (losses or gains realised due to changes in price) feeds directly into the profit and loss statement. Treating securities as AFS means unrealised changes are reported in other comprehensive

income (available-for-sale portfolio) and are booked directly to equity. At first sight, one may expect banks to expand HFT securities to exploit interest rate cuts and realise trading portfolio gains. However, protracted periods of low interest rates exhaust the ability of further cuts and, at the same time, raise concerns about the possibility of tighter monetary policies in the future. This, concomitantly with damper margins and profits, motivates banks to re-shuffle their securities portfolio from HFT to AFS and HTM. As such, our findings indicate risk-shifting behaviour. The magnitude of the effect is economically meaningful. For instance, a one percentage point decrease in STrate decreases HFT securities by 12.17% relative to the mean, while it increases AFS and HTM by 5.82% and 5.26%, respectively.

[Insert Table 5 here]

4. Robustness checks

We present robustness checks and further variations of the baseline model. As suggested in Section 3, banks grow fee and commission income in low interest rate environments in various ways that we describe above: portfolio management, brokerage and consultancy fees; collection and payment services fees; and current account fees. Arguably, FEEMAN (portfolio management, brokerage and consultancy fees), which are investment-banking-related services, require a higher level of expertise and are more likely provided by larger rather than smaller banks (Mercieca et al., 2007; Goddard et al. 2008). Panel A of Table 6 (Columns 1 to 3) shows coefficients on the interaction of bank size and STrate. As expected, the results infer that larger banks focus more on portfolio management, brokerage and consultancy services, while smaller banks focus more on increasing fee income from customer current accounts. This result is consistent with Bottero et al. (2019) who find small retail banks respond to low interest rates by raising fees on deposit account services. We do not find any relationship between bank size and fees from payment services.

Panel B of Table 6 reports results of tests of the regulatory capital arbitrage hypothesis and the risk-bearing capacity hypothesis. The regulatory capital arbitrage hypothesis (Allen and Gale, 2007) suggests that less capitalised banks face difficulties to grow lending, which motivates acquisition of securities (mostly government bonds) given their favourable regulatory capital treatment. The risk-bearing capacity hypothesis (Adrian and Shin, 2011) proposes that lowly capitalised banks assume different risks depending on whether their securities are held-to-maturity, held-for-trading or available-for-sale. In contrast, better capitalised banks can assume greater risks. To test these hypotheses, we interact STrate and capitalisation. The results in Panel B (Columns 1 to 4) show that banks with lower levels of capital hold more securities, which support the capital arbitrage hypothesis. However, we cannot support the risk-bearing capacity hypothesis as interactions are statistically insignificant.

As a third robustness check, we test for the reliability of our measures of conventional (STrate) and unconventional monetary policy (GR_CB) by employing the "shadow rate" as in Wu and Xia (2016).[14] The shadow rate measures the overall stance of monetary policy when conventional monetary policy tools such as short-term rates hit the zero lower bound (ZLB). Since short-term rates become ineffective at the ZLB and central banks resort to UMPs, the shadow rate takes into account the effect of UMPs by allowing short-term rates to fall below zero. The results displayed in Panel C of Table 6 (Columns 1 and 2) are in-line with the baseline results of Table 3. Specifically, the shadow rate shows a statistically significant (at the 1% level) and negative relationship to both FEE and SEC indicating that when the shadow rate decreases banks grow fees and commissions income and securities. This result further validate our choice of the monetary policy variables employed in the baseline regression. As a fourth robustness check, we keep the original unbalanced sample – that includes the overall population of Italian banks (734 financial institutions) – to investigate whether the results are affected by survivorship biases. The results are reported in Panel D of Table 6 (Columns 1 to 4). The coefficients of STrate and GR_CB have sign and statistical significance in-line with the baseline regressions.

[Insert Table 6 here]

Finally, we employ S-GMM estimation to test the validity of our econometric specification. If the estimated coefficients of the dynamic panel fixed effects are of the same sign and significance as the S-GMM results, we can be more confident about the reliability of our baseline results. Table 7 (Panels A and B) reports results from models estimated using the S-GMM. We confirm the coefficients are consistent, which endorses the reliability of our baseline findings.

[Insert Table 7 here]

5. Conclusion

Since August 2007, the ECB has adopted several conventional and unconventional monetary policies aimed at easing tension in the financial sector and boosting credit to the economy. These measures have reduced interest rates to historically low levels raising concerns among policy makers about the effects on bank behaviour. We investigate the effect of low interest rates on bank non-interest income and securities holdings using a granular dataset of 440 Italian banks from 2007 to 2016. While there is a recent literature that analyses the effects of low interest rates on margins and profits (Alessandri and Nelson, 2015; Bush and Memmel, 2017; Claessens et al., 2018), the effect of the low interest rate environment on bank non-interest activities has received less attention. This paper fills this gap by

[14] Data on European Central Bank shadow rate are available at: https://sites.google.com/site/jingcynthiawu/shadowrate_ECB.xls?attredirects=0

investigating the effect of low interest rates on bank non-interest income and securities holdings. Moreover, it adds to the extant literature (Borio et al, 2017; Altavilla et al., 2019) by considering detailed fees and commissions reported in notes to the accounts as well as securities holdings according to specific accounting classifications. This allows us to capture greater heterogeneity of banks behaviour in a low interest rate environment. Overall, we find a negative relationship between the level of interest rates and fee and commission income and securities holdings. A granular breakdown of income statements suggests banks grow non-interest services in various ways, namely, by boosting fees from: portfolio management, brokerage and consultancy services; collection and payment services; and current accounts. Greater demand for and supply of services in a low interest rate environment allows banks to redistribute part of their income from traditional intermediation to fee-based services. Banks also grow their securities portfolio re-balancing them away from held-for-trading towards securities available-for-sale and held-to-maturity. In an economic environment characterised by slow economic recovery and high levels of non-performing loans, as in Italy, banks prefer to hold liquid securities owing to poor credit demand or a pool or risky borrowers (for instance SMEs). Our findings suggest different behaviour between large and small banks. While larger banks increase income from greater brokerage, consultancy and portfolio management revenue, smaller banks focus more on increasing current account fees. We also find lower capitalised banks increase securities holdings compared to well capitalised banks.

This result is important for policy makers because of its implications for financial stability and monetary policy transmission. For instance, revenues from traditional lending activities may be more stable than non-interest income, and greater reliance on non-interest income could render bank revenues and overall performance less stable. Moreover, regulators have provided a generous regulatory treatment for government securities that incentivize banks to hold less capital against these assets, which may have negative repercussions for the stability of the banking sector. Also, and from a monetary policy transmission perspective, if low interest rates and other accommodative monetary policies encourage banks to grow non-interest income activities, it implies that bank lending is not responding as expected to such policy actions.

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Table 1. Variable name, units of measurement, definition and source

Variable	Units	Definition	Source
Non-interest income items			
FEE	ratio	FEE is the ratio of fee and commission income-to-total revenue	ABIFast
FEEMAN	ratio	FEEMAN is the ratio of management, brokerage and consultancy fees-to-total revenue	ABIFast
FEEPAY	ratio	FEEPAY is the ratio of payment services fees-to-total revenue.	ABIFast
FEEACCOUNT	ratio	FEEACCOUNTS is the ratio of current account fees-to-total revenue.	ABIFast
Bank balance sheet & Income statement items			
SEC	ratio	Securities is the ratio of all types of financial assets-to-total assets.	ABIFast
AFS	ratio	AFS is the ratio of available-for-sale securities-to-total assets.	ABIFast
HFT	ratio	HFT is the ratio of held-for-trading securities-to-total assets.	ABIFast
HTM	ratio	HTM is the ratio of held-to-maturity securities-to-total assets.	ABIFast
Size	logarithm	Size is the natural logarithm of bank total assets.	ABIFast
E/TA	ratio	E/TA is the ratio of bank equity-to-total assets.	ABIFast
NPLs	ratio	NPLs is the ratio of non-performing loans-to-total gross loans.	ABIFast
Liquidity	ratio	Liquidity is the ratio of short-term liquid assets-to-total assets.	ABIFast
Cost-to-income	ratio	Cost-to-income is the ratio of operating expenses-to-total revenue.	ABIFast
Macroeconomic Conditions and Monetary Policy			
STrate	percentage	STrate is the three-month EONIA.	Thomson Datastream
GR_CB	growth rate	GR_CB is the logarithm yearly growth rate of the European Central Bank balance sheet size	European Central Bank Statistical Data Warehouse

Table 2. Descriptive Statistics

This table reports summary statistics of the main variables in the regression analysis. The table is divided in two panels. Panel A reports summary statistics of the dependent variables whilst panel B the monetary policy and balance sheet variables. FEE is the ratio of net fees and commissions-to-total revenue. SEC is the ratio of total securities-to-total assets. FEEMAN is the ratio of management, brokerage and consultancy fees-to-total revenue. FEEPAY is the ratio of payment services fees-to-total revenue. FEEACCOUNTS is the ratio of account fees-to-total revenue. AFS is the ratio of available-for-sale securities-to-total assets. HFT is the ratio of held-for-trading securities-to-total assets. HTM is the ratio of held-to -maturity securities-to-total assets. STrate is the three-month EONIA. GR_CB is logarithm yearly growth rate of central bank total assets. Size is the logarithm of bank total assets. E/TA in the ratio of equity-to-total assets. Liquidity is the ratio of liquid securities-to-total assets. NPL is the ratio of non-performing loans-to-total gross loans. Cost-to-income is the ratio of operating expenses-to-total revenue.

	Obs	Mean	St.Dev	p1	p99
Panel A. Dependent Variables					
FEE	4400	0.2201	0.0811	0.1127	0.3780
SEC	4400	0.2241	0.1193	0.0160	0.4061
FEEMAN	4400	0.0592	0.0502	0.0065	0.1713
FEEPAY	4400	0.0552	0.0284	0.0090	0.0980
FEEACCOUNT	4400	0.0836	0.0388	0.0128	0.1408
AFS	4400	0.2007	0.1401	0	0.5843
HFT	4400	0.0115	0.0216	0	0.0670
HTM	4400	0.0076	0.0275	0	0.1060
Panel B. Monetary Policy & Balance Sheet Variables					
STrate (%)	4400	0.9802	1.417	-0.3420	3.730
GR_CB	4400	0.1421	0.2023	-0.2327	.3762
Size	4400	13.3318	1.6901	10.4953	18.6153
E/TA	4400	0.1074	0.0344	0.0598	0.1717
NPLs	4400	0.0180	0.0255	0	0.0726
Liquidity	4400	0.2351	0.1419	0.0001	0.6407
Cost-to-income	4400	0.6705	0.3727	0.3517	1.1741

Table 3. FEEs and Securities holdings in a low interest rate environment

This table reports the estimates of the fixed effects panel regression where the dependent variables are the ratio of fees and commissions to total revenue (FEE) and securities to total assets (SEC). L.FEE is the lag of the ratio of net fees and commissions to total revenue. L.SEC is the lag of the ratio of total securities to total assets. L.STrate is lag of the three-month EONIA. L.GR_CB is the lag of logarithm yearly growth rate of central bank total assets. L.Size is lag of the logarithm of bank total assets. L.E/TA is the lag of the ratio of equity to total assets. L.Liquidity is the lag of the amount of liquid securities to total assets. L.NPLs is the lag of the ratio of non-performing loans to total gross loans. L.Cost-to-income is the lag of the ratio of operating expenses to total revenues. Regressions include fixed bank and time effects as specified. Robust standard errors clustered by bank in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)	(3)	(4)
	FEE	**FEE**	**SEC**	**SEC**
L.FEE	0.4422***	0.4361***		
	(0.0340)	(0.0335)		
L.SEC			0.5922***	0.6186***
			(0.0199)	(0.0179)
L.STrate	-0.0132***		-0.0077**	
	(0.0010)		(0.0034)	
L.GR_CB		0.0266***		0.0236***
		(0.0032)		(0.0043)
L.Size	-0.0073*	-0.0015	0.0077	0.0103*
	(0.0041)	(0.0041)	(0.0062)	(0.0060)
L.E/TA	-0.1222	0.0156	-0.2256***	-0.1703**
	(0.0830)	(0.0822)	(0.0684)	(0.0674)
L.NPLs	0.1593***	0.4428***	0.5301***	0.5832***
	(0.0508)	(0.0575)	(0.0918)	(0.0837)
L.Liquidity	-0.0331***	-0.0222**		
	(0.0113)	(0.0106)		
L.Cost-to-income	0.0105***	0.0106***	-0.0024	-0.0026
	(0.0039)	(0.0038)	(0.0026)	(0.0028)
Observations	3,960	3,960	3,960	3,960
R-squared	0.4213	0.3618	0.6367	0.6390
Number of banks	440	440	440	440
Bank-FE	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES

Table 4. Management, brokerage and consultancy fees; cash receipts and payments fees; and current account fees in a low interest rate environment

This table reports the estimates of the fixed effects panel regression where the dependent variables are the ratio of management, brokerage and consultancy fees to total revenue (FEEMAN), the ratio of payment fees to total revenue (FEEPAY) and the ratio of current account fees to total revenue (FEEACCOUNT). L.FEEMAN is the lag of ratio of management, brokerage and consultancy fees to total revenue. L.FEEPAY is the lag of ratio of payment fees to total revenue. L.FEEACCOUNT is the lag of the ratio of current account fees to total revenue. L.STrate is the lag of three-month EONIA. L.GR_CB is the lag of logarithm yearly growth rate of central bank total assets. L.Size is lag of the logarithm of bank total assets. L.E/TA is the lag of the ratio of equity to total assets. L.Liquidity is the lag of the amount of liquid securities to total assets. L.NPLs is the lag of the ratio of non-performing loans to total gross loans. L.Cost-to-income is the lag of the ratio of operating expenses to total revenues. Regressions include fixed bank and time effects as specified. Robust standard errors clustered by bank in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	FEEMAN	**FEEMAN**	**FEEPAY**	**FEEPAY**	**FEEACCOUNTS**	**FEEACCOUNTS**
L.FEEMAN	0.4152***	0.4331***				
	(0.0462)	(0.0466)				
L.FEEPAY			0.4672***	0.4614***		
			(0.0231)	(0.0233)		
L.FEEACCOUNTS					0.3518***	0.3521***
					(0.0279)	(0.0278)
L.STrate	-0.0042***		-0.0020***		-0.0020***	
	(0.0005)		(0.0002)		(0.0004)	
L.GR_CB		0.0181***		0.0172***		0.0246***
		(0.0021)		(0.0011)		(0.0020)
L.Size	-0.0113***	-0.0099***	-0.0005	0.0001	-0.0010	-0.0009
	(0.0030)	(0.0029)	(0.0007)	(0.0007)	(0.0013)	(0.0013)
L.E/TA	-0.0454	-0.0289	0.0020	0.0092	-0.0847***	-0.0840***
	(0.0461)	(0.0466)	(0.0162)	(0.0166)	(0.0273)	(0.0272)
L.NPLs	0.1157***	0.1613***	0.0277**	0.0527***	0.0273	0.0301
	(0.0383)	(0.0391)	(0.0137)	(0.0138)	(0.0336)	(0.0311)
L.Liquidity	0.0013	0.0105**	-0.0042*	0.0004	-0.0126***	-0.0122***
	(0.0043)	(0.0043)	(0.0024)	(0.0023)	(0.0047)	(0.0044)
L.Cost-to-income	0.0005	0.0007	-0.0006*	-0.0006	-0.0001	-0.0001
	(0.0022)	(0.0021)	(0.0003)	(0.0004)	(0.0005)	(0.0005)
Observations	3,960	3,960	3,960	3,960	3,960	3,960
R-squared	0.3032	0.2875	0.3317	0.3174	0.2261	0.2260
Number of banks	440	440	440	440	440	440
Bank-FE	YES	YES	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES	YES	YES

Table 5. Available for sale, held for trading and held to maturity securities in a low interest rate environment

This table reports the estimates of the fixed effects panel regression where the dependent variables are the ratio of available for sale securities to total assets (AFS), the ratio of held for trading securities to total assets (HFT) and the ratio of held for trading securities to total assets (HTM). L.AFS is the lag of available for sale securities to total assets ratio. L.HFT is the lag of held for trading securities to total assets ratio. L.HTM is the lag of held to maturity securities to total assets ratio. L.STrate is the lag of three-month EONIA. L.GR_CB is the lag of logarithm yearly growth rate of central bank total assets. L.Size is lag of the logarithm of bank total assets. L.E/TA is the lag of the ratio of equity to total assets. L.Liquidity is the lag of the amount of liquid securities to total assets. L.NPLs is the lag of the ratio of non-performing loans to total gross loans. L.Cost-to-income is the lag of the ratio of operating expenses to total revenues. Regressions include fixed bank and time effects as specified. Robust standard errors clustered by bank in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	AFS	**AFS**	**HFT**	**HFT**	**HTM**	**HTM**
L.AFS	0.6385***	0.6634***				
	(0.0196)	(0.0165)				
L.HFT			0.5297***	0.5405***		
			(0.0235)	(0.0231)		
L.HTM					0.5486***	0.5519***
					(0.0468)	(0.0463)
L.STrate	-0.0117***		0.0014***		-0.0004*	
	(0.0040)		(0.0002)		(0.0002)	
L.GR_CB		0.0179***		-0.0045***		0.0128***
		(0.0050)		(0.0011)		(0.0038)
L.Size	0.0101	0.0136*	-0.0001	-0.0013*	0.0014	0.0012
	(0.0072)	(0.0070)	(0.0008)	(0.0008)	(0.0018)	(0.0015)
L.E/TA	-0.2073**	-0.1369*	0.0399**	0.0305**	-0.0310	-0.0374
	(0.0866)	(0.0812)	(0.0158)	(0.0151)	(0.0232)	(0.0236)
L.NPLs	0.4257***	0.5315***	0.0269	-0.0067	0.0995**	0.0842***
	(0.0972)	(0.0819)	(0.0176)	(0.0148)	(0.0505)	(0.0321)
L.Cost-to-income	-0.0031	-0.0031	-0.0008*	-0.0008**	-0.0002	-0.0002
	(0.0027)	(0.0029)	(0.0004)	(0.0004)	(0.0005)	(0.0005)
Observations	3,960	3,960	3,960	3,960	3,960	3,960
R-squared	0.6948	0.6948	0.4911	0.4913	0.3095	0.3054
Number of id	440	440	440	440	440	440
Bank-FE	YES	YES	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES	YES	YES

Table 6. Robustness checks

This table reports the estimates of the fixed effects panel regression. The table is organised in four panels. FEEMAN is the ratio of management, brokerage and consultancy fees to total revenue; FEEPAY the ratio of payment fees to total revenue; FEEACCOUNT is the ratio of current account fees to total revenue. AFS is the ratio of available for sale securities to total assets; HFT is the ratio of held for trading securities to total assets; HTM is the ratio of held for trading securities to total assets. L.STrate is the lag of three-month EONIA. L.GR_CB is the lag of logarithm yearly growth rate of central bank total assets. L.Size is lag of the logarithm of bank total assets. L.E/TA is the lag of the ratio of equity to total assets. L.Shadowrate is the lag of the shadow rate as defined in Wu and Xia (2016). Regressions include fixed bank and time effects as specified. Robust standard errors clustered by bank in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)	(3)	(4)
	FEEMAN	**FEEPAY**	**FEEACCOUNT**	
Panel A. Bank size and fees and commissions				
L.STrate	0.0050***	-0.0013	-0.0082***	
	(0.0018)	(0.0009)	(0.0017)	
L.STrate*L.Size	-0.0007***	-0.0001	0.0004***	
	(0.0001)	(0.0001)	(0.0001)	
Observations	3,960	3,960	3,960	
R-squared	0.4247	0.3134	0.3319	
Number of banks	440	440	440	
Bank-FE	YES	YES	YES	
Year-FE	YES	YES	YES	
Panel B. Bank capitalization and securities	**SEC**	**AFS**	**HFT**	**HTM**
L.STrate	-0.0125***	-0.0093***	0.0016***	-0.0009
	(0.0024)	(0.0026)	(0.0005)	(0.0007)
L.STrate*L.E/TA	0.0327*	-0.0066	-0.0002	0.0022
	(0.0187)	(0.0210)	(0.0046)	(0.0048)
Observations	3,960	3,960	3,960	3,960
R-squared	0.6177	0.6831	0.4905	0.3030
Number of banks	440	440	440	440
Bank-FE	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES
Panel C. Shadow rate	**FEE**	**SEC**		
L.Shadowrate	-0.0079***	-0.0067***		
	(0.0006)	(0.0007)		
Observations	3,960	3,960		
R-squared	0.4213	0.6364		
Number of banks	440	440		
Bank-FE	YES	YES		
Year-FE	YES	YES		
Panel D. Unbalanced Panel	**FEE**	**FEE**	**SEC**	**SEC**
L.STrate	-0.0144***		-0.0091***	
	(0.0010)		(0.0032)	
GR_CB		0.0264***		0.0245***
		(0.0031)		(0.0040)
Observations	5,325	5,325	5,325	5,325
R-Squared	0.3975	0.3450	0.5917	0.5939
Number of banks	731	731	731	731
Bank-FE	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES

Table 7. Robustness checks

This table reports the estimates of the System Generalised Method of Moments where the dependent variables are the ratio of fees and commissions to total revenue (FEE); securities to total assets (SEC); the ratio of management, brokerage and consultancy fees to total revenue (FEEMAN); the ratio of payment fees to total revenue (FEEPAY); the ratio of current account fees to total revenue (FEEACCOUNT); the ratio of available for sale securities to total assets (AFS); the ratio of held for trading securities to total assets (HFT) and the ratio of held for trading securities to total assets (HTM). L.STrate is the lag of three-month EONIA. L.GR_CB is the lag logarithm of yearly growth rate of central bank total assets. GR_CB is the yearly growth rate of central bank total assets. Size is the logarithm of bank total assets. Windmeijer bias-corrected robust standard errors clustered by bank in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1) **FEE**	(2) **SEC**	(3) **FEEMAN**	(4) **FEEPAY**	(5) **FEEACCOUNT**	(6) **AFS**	(7) **HFT**	(8) **HTM**
Panel A.								
L.STrate	-0.0035***	-0.0056***	-0.0029***	-0.0019**	-0.0028***	-0.0068***	0.0011***	-0.0002***
	(0.0008)	(0.0008)	(0.0009)	(0.0008)	(0.0003)	(0.0009)	(0.0002)	(0.0000)
Observations	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960
Number of banks	440	440	440	440	440	440	440	440
Bank controls	YES	YES	YES	YES	YES	YES	YES	YES
Panel B.								
L.GR_CB	0.0095**	0.0451***	0.0061*	0.0081**	0.0052***	0.0295***	-0.0032***	0.0054***
	(0.0040)	(0.0065)	(0.0028)	(0.0036)	(0.0016)	(0.0053)	(0.0008)	(0.0001)
Observations	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960
Number of banks	440	440	440	440	440	440	440	440
Bank controls	YES	YES	YES	YES	YES	YES	YES	YES

Appendix

Table A. Correlation matrix among the variables used in the baseline regression.

This table reports the correlation matrix among the control variables employed in the panel fixed effects regressions. Correlations that are significant at least at the 5% level are reported using bold italics. The number on the horizontal axis indicates the variables in the vertical axis. STrate is the three-month EONIA. GR_CB is the logarithm yearly growth rate of central bank total assets. Size is the logarithm of bank total assets. Liquidity is the amount of liquid securities to total assets. NPLs is the ratio of non-performing loans to total gross loans. Cost-to-income is the ratio of operating expenses to total revenues. E/TA is the ratio of equity to total assets.

	1	2	3	4	5	6	7
STrate (1)		**0.4753**	**-0.0856**	**-0.2344**	**-0.2208**	**0.0114**	**0.1371**
GR_CB (2)	**0.4753**		**-0.0277**	**-0.0719**	**-0.0487**	**0.0116**	**0.0271**
Size (3)	**-0.0856**	**-0.0277**		**-0.2382**	**0.1112**	**0.032**	**-0.4712**
Liquidity (4)	**-0.2344**	**-0.0719**	**-0.2382**		**-0.0821**	**0.0332**	**-0.1161**
NPLs (5)	**-0.2208**	**-0.0487**	**0.1112**	**-0.0821**		-0.0016	**0.0923**
Cost-to-income (6)	**0.0114**	**0.0116**	**0.032**	**0.0332**	-0.0016		**0.0148**
E/TA (7)	**0.1371**	**0.0271**	**-0.4712**	**-0.1161**	**0.0923**	**0.0148**	