Monetary Policy at Work: Security and Credit Application Registers Evidence

José-Luis Peydró **Andrea Polo** **Enrico Sette**[*]

Abstract

Monetary policy transmission may be impaired if banks rebalance their portfolios towards securities to pursue e.g. risk-shifting or liquidity hoarding. We identify the bank lending and risk-taking channels by exploiting – Italian's unique – credit *and security* registers. In crisis times, with softer ECB's monetary policy conditions, less capitalized banks increase securities over credit supply, with associated firm-level real effects. However, less capitalized banks buy securities with lower yield (haircuts), even within securities with identical regulatory risk weights, thus reaching-for-safety/liquidity. Results are only present in marked-to-market portfolios. The evidence suggests that liquidity and risk-bearing capacity – rather than risk-shifting or regulatory arbitrage – are key drivers of banks' behavior. Differently, in pre-crisis times, securities do not crowd-out loan application granting by less capitalized banks.

Keywords: monetary policy, Euro Area Sovereign Debt crisis, Lehman crisis, securities, credit, bank capital, reach-for-yield, held to maturity, available for sale, trading book, haircuts.

JEL Codes: E52, E58, G01, G21, G28.

[*] José-Luis Peydró: ICREA-Universitat Pompeu Fabra, Imperial College, CREI, Barcelona GSE and CEPR, jose.peydró@upf.edu; Andrea Polo: Universitat Pompeu Fabra, Barcelona GSE, CEPR and ECGI, andrea.polo@upf.edu; Enrico Sette: Bank of Italy, enrico.sette@bancaditalia.it. This draft is from August 2018. We thank Bo Becker, Patrick Bolton, Markus Brunnermeier, Douglas Diamond, Mark Flannery, Jordi Galí, Emilia Garcia Appendini, Peter DeMarzo, Filippo De Marco, Victoria Ivashina, Marco Pagano, Huw Pill, Soledad Martinez Peria, Ricardo Reis, Stefano Rossi, Tano Santos, Amit Seru, Sylvana Tenreyro, Annette Vissing-Jorgensen, and seminar and conference participants at Berkeley, Stanford, Copenhagen Business School, University of Copenhagen, CREI, Zurich, LSE, Bocconi, Cattolica Milan, IESE, ECB, the Barcelona GSE Summer Forum, St. Gallen, Sciences Po-Banque de France-Bank of England "Empirical Monetary Economics Workshop", the ECB conferences on "Non-Standard Monetary Policy Measures" and on "Monetary Policy Pass-Through and Credit Markets", Simposio de Análisis Económico and the DNB-CEPR Conference on "Bank Equity over the Cycle" for helpful comments and suggestions. The views of this paper are those of the authors and do not represent the views of Banca d'Italia or of the Eurosystem. This paper has been developed through CEPR's Restarting European Long-Term Investment Finance (RELTIF) Programme, which is funded by Emittenti Titoli. Peydró acknowledges financial support from the Spanish Ministry of Science, Innovation and Universities (Grant No. ECO2015-68182-P and through the Severo Ochoa Programme for Centres of Excellence in R&D, SEV-2015-0563) and from the European Research Council Grant (ERC) under the European Union's Horizon 2020 research and innovation programme (grant No. 648398).

"*With an impaired bank lending channel, monetary policy may lose its handle on the real economy.*"
Mario Draghi, President of the European Central Bank (2014)

1. Introduction

Central banks have massively expanded their balance sheet since 2008, with main monetary rates around zero. However, the large injection of liquidity to banks may not have reached the real sector by means of expanded supply of credit. The potency of the bank lending channel of monetary policy may be limited if banks rebalance their portfolio towards securities holdings to pursue e.g. liquidity hoarding or risk-shifting as opposed to lending to the real sector.[1] For instance, in the words of Jeremy Stein (2013), Governor of the Federal Reserve Board: "*A credit crunch may arise as other financial intermediaries (e.g., banks) withdraw capital from lending, so as to exploit the now-more-attractive returns to buying up fire-sold assets. Ultimately, it is the risk of this credit contraction, and its implications for economic activity more broadly, that may be the most compelling basis for regulatory intervention.*" Moreover, the impairment of the bank lending channel of monetary policy may be especially strong for the less capitalized banks (Bernanke, 2007; Draghi, 2014; Shin, 2016).

Softer monetary policy may also have unintended consequences, in terms of financial stability. Draghi (2015) argues that: "*Our monetary policy measures are necessary to achieve our primary objective of maintaining price stability. But we are nevertheless aware that they may have unintended side effects on the financial system.*" Low interest rates have been suggested as a driver of reach-for-yield, thereby contributing to the credit boom leading to the 2008 financial crisis (Allen and Rogoff, 2011; Rajan, 2005; Stein, 2013; Becker and Ivashina, 2015), consistently with a risk-taking channel of monetary policy (Adrian and Shin, 2011; Borio and Zhu, 2008). Loan level data support this view prior to the crisis (Jiménez, Ongena, Peydró and Saurina, 2014).

[1] Securities holdings are a sizable fraction of bank balance sheets, around 20% of assets in the US and Europe (e.g. in Italy and Germany), and recent policy initiatives aim at limiting security trading by banks (Volker Rule in Dodd-Frank in the US, Likaanen Report in EU and Vickers' report in the UK).

Yet, in crisis times, risk-taking incentives may be stronger, notably for less capitalized banks (Freixas and Rochet, 2008), which, given the large expansion of central banks' balance sheets, may have reached-for-yield more easily, quickly, by adjusting their liquid securities holdings rather than illiquid credit (Myers and Rajan, 1998). Previous evidence, in part because of lack of data, has entirely focused on analyzing GIIPS sovereign debt, which indeed became risky during the crisis, and on the sovereign-bank nexus (Acharya and Steffen, 2015; Brunnermeier et al., 2016). However, GIIPS *non*-sovereign securities and loans may be riskier, offering higher yields, and are quantitatively more important (Bocola, 2016).

We test for the bank lending and risk-taking channels of monetary policy by studying banks' securities trading, in addition to credit supply, and evaluate the potency of monetary policy via banks and the channels through which it operates. Analyzing banks' reactions in security trading and credit supply, including the heterogeneous effects, also sheds light on the empirical relevance of theories of banking and macro-finance.[2] For identification, we exploit the unique security and credit application registers owned by the central bank of Italy in its role of bank supervisor, at monthly frequency since the creation of the euro in 1999. As a byproduct, we analyze the impact of non-standard monetary policy via banks during the Euro Area Sovereign Debt (and Lehman) crises with (unique) granular information.

While a large empirical literature on the bank channels of monetary policy analyzes credit, including risk-taking, there is no micro evidence on the impact of monetary policy on banks' securities holdings.[3] In addition to potential policy restrictions to banks' security trading (e.g. U.S. Volcker rule), as we argue in the paper, and as theory shows, it is key to analyze the impact of monetary policy (expansion of central bank liquidity) via *both* banks' securities holdings and

[2] For the bank lending and risk-taking channels, see e.g. Bernanke and Blinder (1988, 1992), Kashyap and Stein (2000), Bernanke (2007)'s reinterpretation of the traditional bank lending channel, Adrian and Shin (2011), Chodorow-Reich (2014), Bruno and Shin (2015), Brunnermeier and Sannikov (2013, 2017) and Brunnermeier and Koby (2017). Theory also links lending and securities trading: e.g. Shleifer and Vishny (2010) and Diamond and Rajan (2011) show that in crises banks may prefer buying securities rather than providing credit. See more below.

[3] See more below on our differences with the literature in general, and also with Carpinelli and Crosignani (2018), who analyze the impact of LTRO on credit supply but also on aggregate amount of government bonds.

credit supply as (i) it may be easier to reach-for-yield with liquid securities rather than with illiquid loans (Myers and Rajan, 1998); and (ii) bank security trading can crowd out loans to the real sector (Shleifer and Vishny, 2010; Diamond and Rajan, 2011).

We show that securities do matter. In crisis times, with softer monetary policy conditions, less capitalized banks increase securities over credit supply, with associated firm-level real effects. This result also holds on the sub-sample of securities that are not issued by non-financial firms, and on foreign-issued securities, which do not directly fund the local economy. Importantly, less capitalized banks buy securities with lower yield (also lower haircuts), even within securities with identical regulatory capital risk weights, thus reaching-for-safety/liquidity. Effects are only present in marked-to-market portfolios. Results suggest that liquidity and risk-bearing capacity – rather than risk-shifting or regulatory arbitrage – are key drivers of banks' behavior due to monetary policy conditions. Overall effects are economically significant, too. Differently, in pre-crisis (normal) times, when financial frictions are limited, as monetary policy conditions become softer, less capitalized banks do not expand securities over supply of credit. Finally, by exploiting more comprehensive datasets than the existing literature, our results also give a new perspective on the Euro Area Sovereign Debt crisis. In particular, we find that less (compared to more) capitalized banks take less risk when monetary policy conditions are softer, which does not support the hypothesis of higher risk-shifting by less capitalized banks due to the ECB expansion of liquidity.

Identifying the bank lending and risk-taking channels of monetary policy is especially challenging. First, a portfolio rebalancing towards securities, especially during a recession, may be due to a credit *demand* problem, with few lending opportunities (Summers, 2014) and in the presence of risky, highly leveraged borrowers (Rogoff, 2015), which may induce a non-random matching between risky securities or loans and banks. Second, to identify reach-for-yield (or risk-taking) it is necessary to observe micro-level information on riskiness on all securities and loans, e.g. the yield or the rating of a security (sovereign or not) or of a corporate loan.

Access to comprehensive and granular banking data is thus crucial to identify the monetary policy transmission channels and phenomena of reach-for-yield. The security register contains – at the security (ISIN) level data – all securities investments for each bank in Italy (not just government bonds, or just securities that banks pledge as collateral to borrow from the ECB). We analyze bonds (81% of holdings), and, for each security, we obtain yields, issuer, rating, haircuts applied by the ECB in repo loans, prices and remaining maturity. Even within an issuer (e.g. the Italian sovereign), our data include all the securities with different yields, maturities, haircuts held by banks every month. Moreover, differently from other registers, the Italian one records whether a security is in the trading book, available for sale or held to maturity.

In addition, the credit register allows us to observe information on loan applications and borrower identity, thanks to which we can identify credit supply. We further match the security and credit register data with the official balance sheet data deposited by firms to the Chambers of Commerce, as required by the Italian law. Thanks to the firm-level data, we obtain both a measure of ex-ante default probability (in addition to loan rates) for the analysis of the risk-taking channel, and measures of firm-level real effects associated with the bank channels of monetary policy. Finally, we match the registers with supervisory banks' balance sheet data.

We first analyze the data at the *security-bank-month* and at the *(firm)application-bank-month* level, since this allows us: (1) to test, whether the effects of softer monetary policy conditions on banks' securities holdings is heterogeneous across banks and across securities (e.g. banks with low capital change their holdings of securities depending on yield, haircut, maturity, rating, risk-weight); (2) whether the effects of monetary policy on the granting of loan applications is heterogeneous across bank and firm (applicant) characteristics (e.g. banks with low capital grant relatively more loan applications to firms with different ex-ante loan rates and default probabilities proxied by z-scores); (3) in the most demanding specification to saturate the model with security*time and firm*time fixed effect. The former helps us to control – in each month – for how much of each security is issued and outstanding, fully controlling also for unobserved time-varying risk at the security level (ratings, price or maturity), thus isolating the demand of securities by banks. When we analyze loan applications, we include firm*time fixed effects, which implies that we analyze the granting of applications by different banks to the same firm in the same period, thus fully controlling for unobserved and observed time-varying borrower fundamentals in loan applications, thereby identifying credit supply.

As far as we are aware, ours is the first paper using a comprehensive security register for banks and a credit register with loan applications and rates.[4] This is especially important in a bank dominated economy where banks are the main providers of finance to firms and are key players in securities markets. We also test whether, at the bank level, the relative weight of all securities holdings compared to all loans changes heterogeneously across banks. Finally, we test for spillovers to the aggregate economy, by analyzing firm-level real effects.

To identify the bank lending and the risk-taking channel of monetary policy, we exploit bank capital heterogeneity, controlling for other bank variables. The bank capital ratio is a sharp measure for both the intensity of the agency conflicts between bank shareholders and their financiers (including depositors, debtholders and tax payers) and the strength (net-worth) of bank balance sheets, so bank capital is a key driver of both the risk-taking and the bank lending channels (Holmstrom and Tirole, 1997; Bernanke, 2007; Freixas and Rochet, 2008; Adrian and Shin, 2011; Admati and Hellwig, 2014; Brunnermeier and Sannikov, 2013 and 2017). As Hyun S. Shin remarked on a speech on "Bank capital and monetary policy transmission" in 2016 as BIS Chief Economic Adviser: "*For most central banks, discussions of bank capital crop up most often in connection with their financial stability mandate or perhaps with their financial supervision mandate, if they have a role there. But having soundly capitalised banks turns out to*

[4] As far as we are aware, Italy is the only country with both a credit register that records loan applications and rates, and a security register that records whether a security is in the trading book, available for sale or held to maturity. There are credit registers in most countries around the world; however, there are only few countries with exhaustive security registers, or with credit registers with information on loan applications or rates. See also below the subsection on contribution to the literature. Note also that in most countries around the world, banks are not only the core, but – quantitatively – the largest part of the financial system.

be vital for the transmission of monetary policy, also. In this sense, bank capitalisation ought to be a key concern for central banks in fulfilling their monetary policy mandate, as well as for their financial stability mandate."

We focus on the crisis period, when financial frictions are strong and thus substitution between securities and loans may be more prevalent (see Shleifer and Vishny, 2010; Diamond and Rajan, 2011). We exploit the time series of unconventional monetary policy measures taken by the ECB after the Lehman default, which we proxy by the size of the ECB balance sheet (subtracting the autonomous factors that are beyond ECB's direct control), deflated by nominal GDP (which is similar to Taylor-residuals, i.e. monetary activity over and above economic conditions). This measure (see ECB (2015) on the role of the central bank balance sheet as a monetary policy tool) reflects the series of unconventional monetary policies undertaken by the ECB that provided liquidity after the start of the financial crisis in September 2008 (main refinancing operations (MRO) with fixed rate full allotment, different long-term refinancing operations (e.g. 3 and 6 months, 1- and 3 years LTROs), buying of securities as e.g. the Security Market Programme and Covered Bonds Purchase Programme, and others).

As monetary policy reacts to economic activity, we also control for other key macro variables by including time fixed effects and interactions of bank capital (and key security and loan variables) with current economic activity (Taylor, 1993), with the forecast of future economic activity (Romer and Romer, 2004) and with financial uncertainty (Freixas, Laeven and Peydró, 2015), among other variables. We also look at alternative measures of monetary policy by using shadow rates (Wu and Xia, 2017) or analyzing just the largest quantitative policy changes (the two initial 3-year LTROs on December 21, 2011 and February 29, 2012). We also study conventional monetary policy in the pre-crisis period (January 1999 to August 2008), where we proxy monetary conditions by a measure related to Taylor-residuals.

In crisis times, we find robust evidence that, when monetary policy conditions become softer, banks increase their holdings of securities.[5] And, moreover, less (compared to more) capitalized banks increase their securities holdings even more.[6] However, the *opposite* happens on credit supply – banks with less (compared to more) capital grant fewer loan applications to the same firm in the same quarter when the ECB expands liquidity (i.e., less capitalized banks rebalance their portfolios from loans to securities, and this is not because of lack of good loan applications). Differently, in pre-crisis (normal) times, as monetary policy conditions become softer, less capitalized banks do not expand securities holdings over supply of credit to firms.

The differential result on securities holdings versus lending is moreover confirmed by *aggregate* bank level data, analyzing all securities and all loans held by banks. An increase in one standard deviation of the unconventional monetary policy variable makes banks in the 25 percentile of bank capital, as compared to the 75 percentile, increase securities holdings over lending with a semi-elasticity of 5.85 percent.[7] Hence, both at the micro-level and at the more aggregate bank-level, we find that banks with capital below the mean cut credit supply (and also all loans over all securities) when monetary policy conditions are softer, opposite than what banks with capital higher than the mean do.

Results suggest that the bank behavior has real effects at the firm level. After an increase of one standard deviation in unconventional monetary policy, firms ex-ante exposed to banks with less (as compared to more) capital (25 vs. 75 percentile) receive less credit overall, invest less, reduce the wage bill and decrease sales (the semi-elasticities are respectively 11 percent, 9 percent, 20 percent and 8 percent).

---

[5] With both conventional and unconventional policy, we find that when monetary policy becomes softer, banks increase their holdings of securities. Results suggest that effects are stronger for securities rather than for lending.

[6] Results are very similar if we only analyze foreign issued securities (which do not directly support the Italian economy) or if we exclude securities issued by Italian non-financial firms (which are a tiny amount). The amount of these securities in Italian banks is less than 1 percent of bank loans to firms (similarly in other bank-dominated countries). SMEs are in general financially constrained, with lack of market access and strong bank dependence even in non-bank dominated countries. See e.g. Allen, Chui and Maddaloni (2004).

[7] The differential impact of a one standard deviation change in the unconventional monetary policy variable on securities holdings over lending at the mean, in percent.

Based on theory, when central bank liquidity increases, less capitalized banks may prefer securities over credit in crisis times to hold more liquid assets (which could be pledged as collateral to obtain additional funding), to economize on regulatory capital, and/or to obtain a higher yield (or even risk-shift) with securities. Therefore, to further understand the different drivers of our results, and to also test for the risk-taking (reach-for-yield) channel, we analyze heterogeneous effects across different yields, haircuts, maturities, regulatory capital risk weights, portfolios depending on the accounting treatment, and securities classes (e.g. government debt).

We find robust evidence that less capitalized banks buy securities with lower ex-ante yield in crisis times, when monetary policy conditions are softer, even within securities with identical regulatory risk weights. Results are very similar after controlling for the correlation of securities traded with the existing entire bank portfolio, which therefore suggest changes in bank risk-taking. Moreover, we do not detect differences in risk-taking on loans by banks with different capital ratios in crisis times. Our results are therefore inconsistent with weaker capitalized banks taking on more risk when the ECB expands liquidity. Results are economically significant: a 24 percent semi-elasticity of an increase in one standard deviation of monetary policy on the net purchases of securities; the increase in securities with lower yield (one standard deviation) by banks with low vs. high capital (25 vs. 75 percentile), after an increase in one standard deviation in monetary policy, is 39 percent of the increase due to the softer monetary policy.

The reach-for-safety by less capitalized banks is confined to securities in the available for sale and trading portfolios, and not in the held to maturity one. If a security is in the former portfolios, the unrealized changes in fair value (e.g. losses in crisis times when security prices decline) are recognized in the income statement (trading portfolio) or in the comprehensive income (available for sale portfolio); however, this does not happen if a security is in the held to maturity portfolio. These differential findings suggest that less capitalized banks have lower risk-bearing capacity during crisis times, as the potential reduction in securities prices via mark-to-market could further erode their already fragile balance sheet.

We also obtain very similar results when analyzing only Italian government bonds (all government bonds have zero regulatory capital risk weights), or when analyzing all securities with the same rating and maturity in the same month (which are the determinants of regulatory capital). Therefore, our monetary policy results are not explained by differences in regulatory capital risk weights, and hence pure regulatory capital arbitrage cannot explain the reach-for-safety by less capitalized banks (due to monetary policy).

Finally, we find that less capitalized banks buy more securities with lower (ECB) haircut (or lower yield or shorter maturity) that can be used to borrow at better conditions in repo loans, which suggests that access to liquidity is another key driver of the monetary policy results.[8] Therefore, less capitalized banks do not reach for yield but reach for liquid assets.

Contribution to the literature

Our two main contributions are to the literatures on the transmission of monetary policy via banks, and on the analysis of the Euro Area Sovereign Debt crisis.[9] Despite a large literature analyzing the effects of monetary policy on bank lending, there is no empirical evidence on banks' security trading and credit supply. We show that this does matter. In addition, due to exploiting more comprehensive datasets than the existing literature, our results give a new perspective on the Euro Area Sovereign Debt crisis.

Our findings show that analyzing whether (and the different drivers through which) monetary policy affects banks' security trading is crucial (i) for credit supply, and thus for the bank lending channel of monetary policy (Bernanke and Blinder, 1992; Bernanke and Gertler,

[8] For liquidity, it may also be key to deposit excess reserves at the ECB; however, based on supervisory reports this phenomenon is not large in Italy (the percentage of total reserves out of bank total assets during the crisis is 1.71, but most reserves are required, with the *excess* ones close to 0; e.g. in December 2013 the median of excess reserves is only 0.02%); nevertheless, results are very similar if we include as securities the excess reserves at the ECB.

[9] Our results also relate to the literature on bank capital. Capital crunches can lead to credit crunches, as shown e.g. by Bernanke and Lown, 1991; Peek and Rosengren, 2000; and papers after the last global financial crisis, including the macroprudential role of bank capital (Jiménez, Ongena, Peydró and Saurina, 2017). Our results show that for banks with less capital, softer monetary policy conditions in crises affect more securities rather than credit supply.

1995; Stein, 1998; Kashyap and Stein, 2000; Bernanke, 2007; Brunnermeier and Sannikov, 2013 and 2017; and Brunnermeier and Koby, 2017),[10] and (ii) for reach-for-yield incentives, and thus for the risk-taking channel of monetary policy (Adrian and Shin, 2011; Chodorow-Reich, 2014; Bruno and Shin, 2015).[11] Moreover, we analyze the impact of non-standard monetary policy via banks during the Euro Area crisis and, thanks to a more complete analysis and more granular data (first paper analyzing the time series of the Euro Crisis with securities and credit applications registers), we reach a different conclusion with respect to the existing literature, with different implications for theory and policy. Furthermore, we analyze the largest GIIPS country during the Euro crisis.

With respect to our first, main contribution to the literature (on monetary policy and banks), there are several theoretical studies on the transmission of monetary policy via banks,[12] and there is evidence of the impact of monetary policy on only bank loans (e.g., Bernanke and Blinder, 1992; Kashyap and Stein, 2000; Jiménez, Ongena, Peydró and Saurina, 2012 and 2014; Di Maggio, Kermani and Palmer, 2016; Chakraborty, Goldstein and MacKinlay, 2017; Dell'Ariccia, Laeven and Suarez, 2017; Rodnyansky and Darmouni, 2017).

---

[10] Bernanke (2007) reinterprets the traditional bank lending channel (of Bernanke and Blinder, 1992; Bernanke and Gertler, 1995; Stein, 1998; Kashyap and Stein, 2000). Bernanke also argues that the theoretical underpinning of unconventional monetary policy is not yet fully developed, e.g. Bernanke (2014), Chairman of the Federal Reserve, remarked that: "*The problem with QE is that it works in practice, but it doesn't work in theory.*"

[11] Adrian and Shin (2011) in the latest *Handbook of Monetary Economics* discuss the risk-taking channel of monetary policy. See also Allen and Rogoff (2011) (which summarizes different models by Franklin Allen and Douglas Gale), Chodorow-Reich (2014), Diamond and Rajan (2012), Borio and Zhu (2008) and Rajan (2005), among others. The idea that the liquidity provided by central banks is important in driving excessive risk-taking is not new however: *"Speculative manias gather speed through expansion of money and credit or perhaps, in some cases, get started because of an initial expansion of money and credit"* (Kindleberger (1978), p.54).

[12] In addition to the recent theoretical literature on monetary policy and banks (e.g. Diamond and Rajan, 2006 and 2012; Freixas and Bolton, 2006; Gertler and Kiyotaki, 2010; Freixas, Martin, and Skeie, 2011; Allen, Carletti, and Gale, 2014; Dell'Ariccia, Laeven and Marquez, 2014; Stiglitz, 2018; Coimbra and Rey, 2017), our results can shed light on theories on banking. Results suggest that the main drivers at work in crisis times are access to liquidity (banks with less capital have more liquidity needs, see e.g. Rochet and Vives, 2004; Diamond and Rajan, 2011; Cornett, McNutt, Strahan, and Tehranian, 2011) and risk-bearing capacity (banks with less capital have lower risk-taking capacity, see e.g. Adrian and Shin, 2010 and 2011; Bruno and Shin, 2015; and Coimbra and Rey, 2017), rather than regulatory capital arbitrage or risk-shifting by less capitalized banks (see e.g. Freixas and Rochet, 2008, and the references therein). In crisis times, when financial frictions are important, results suggest that less capitalized banks increase securities over credit supply, which is consistent, among others, with Shleifer and Vishny (2010) and Diamond and Rajan (2011). There is also evidence of crowding-out in good times (during house price booms), but between mortgage and commercial lending (Chakraborty, Goldstein and MacKinlay, forthcoming).

However, despite the fact that security holdings by banks are a large share of their portfolio, may affect credit supply (and associated real effects), and there may be reach-for-yield in banks' security holdings, as far as we are aware, there is no empirical evidence on the bank lending and risk-taking (reach-for-yield) channels of monetary policy analyzing banks' security trading, and on the relation between securities holdings and credit supply.[13]

Two recent papers also work on credit and securities registers, but their main questions are different from ours, and in addition, differently from our work, none of these papers analyze loan applications nor the real effects of credit, which are crucial to assess aggregate effects in the overall economy, and neither the reach-for-yield associated to softer monetary policy. Abbassi, Iyer, Peydró and Tous (2016) use the security register in Germany to analyze bank trading in fire-sold assets during the Lehman crisis, and its effects on credit granted.[14] Importantly, they do not analyze the transmission of monetary policy, which is the focus of our paper.[15] In a contemporaneous paper, Carpinelli and Crosignani (2018) focus on credit granted by banks with different wholesale funding around the 3-year LTRO. Apart from analyzing a different question, our work differs along several dimensions, in particular: i) we focus on securities trading by banks (analyzing granular data at the security-bank-month level);[16] ii) we study risk-taking (in both securities and loans); iii) we study the evolution of monetary policy conditions over time.[17]

---

[13] A related paper, Albertazzi, Becker and Boucinha (2018), analyzes the impact of the Asset Purchase Programme of the ECB in 2015 exploiting bank-level information on security holdings for a sample of the 25 largest banks in the euro area but, unlike our paper, they cannot match this information with loan-level data.

[14] Banks with higher capital reduce granted credit to buy more fire-sold securities. In our case, we find that – when the ECB expands its balance sheet – banks with higher capital grant more loan applications, not less. Our results are different, but we analyze a different question, i.e., the effects of an expansion of the ECB balance sheet.

[15] In one regression, Abbassi, Iyer, Peydró and Tous (2016) analyze the endogenous bank-level borrowing from the central bank, but they do not analyze how this (or different monetary policy conditions) affect trading and credit supply (including risk-taking) depending on bank capital (or balance sheet strength), which is our main question.

[16] Carpinelli and Crosignani (2018) have data on the aggregate amount of government bonds at bank level so they do not distinguish between different yields or different accounting treatment in their analysis of sovereign debt, and they also do not analyze *non-sovereign* debt securities.

[17] Our work differs from Carpinelli and Crosignani (2018) also along other dimensions: we exploit bank capital as a key source of heterogeneity, consistently with the theoretical literature of monetary policy; we analyze loan applications to identify credit supply rather than the change in existing credit; we also extend our analysis to the pre-crisis period when financial frictions are limited.

As a consequence, our findings are different: banks with stronger balance-sheets (more capitalized) grant more loan applications and buy less securities (albeit bearing higher risk), whereas in Carpinelli and Crosignani (2018), banks with stronger balance-sheets (less dependent on wholesale funding) rebalance their portfolio relatively more from loans to government bonds after the 3-years LTRO.

As in Becker and Ivashina (2015), who show evidence on reach-for-yield in bonds by insurance firms over the credit cycle, we also analyze reach-for-yield in our paper (banks with less capital expand into securities with lower yield, even for securities within the same regulatory capital risk weights),[18] and extend their findings by studying banks and the transmission of monetary policy. Moreover, we also analyze whether security risk-taking differs depending on the correlation with the existing entire bank portfolio and find similar results.[19] Our paper also finds different risk-taking results in good than in crisis times. In crisis times with softer monetary policy, we find that the banks with the higher capital are the ones that take on higher risk. This is the opposite of what we find in normal times in lending (consistently with Jiménez, Ongena, Peydró and Saurina (2014), which analyze Spain for the time period before the 2008 crisis).[20]

Our paper also contributes to the recent literature on banks' investment behavior in the Euro crisis. Acharya and Steffen (2015), Drechsler, Drechsel, Marquez-Ibanez and Schnabl, (2016) and Altavilla, Pagano and Simonelli (2017), using Euro area data, argue that risk-shifting and moral suasion by governments lead weaker capitalized banks to buy more risky GIIPS

---

[18] Chodorow-Reich (2014) studies the effect of unconventional monetary policy on reach-for-yield incentives by different financial institutions (banks, pension funds, insurances, mutual funds); Lian, Ma and Wang (2017) study the effect of low interest rate on reach-for-yield incentives by individuals.

[19] Our results allow to better understand Stein (2013)'s quote that we use in the first page of our paper, which claims that a credit contraction may arise because banks withdraw capital from lending to buy risky assets. We show that bank capital heterogeneity is crucial. When the central bank expands its balance sheet, banks that buy riskier securities provide relatively more, not less, credit to the real sector. These banks are better capitalized with higher risk-bearing capacity and less need of buying securities with lower central bank haircut. Differently, for less capitalized banks, which are more financially constrained, results show that these banks expand on securities but reduce the granting of loan applications (which is indeed consistent with Stein (2013)).

[20] Jiménez, Ongena, Peydró and Saurina (2014) only analyze loans and only in good times; whereas our paper analyzes securities and loans and in crisis and good times.

public debt. We instead analyze only the largest GIIPS country – Italy – but enlarge the dataset to include the granular security and credit registers. We find that, when the ECB provides high liquidity, less capitalized banks do indeed buy more GIIPS (Italian) public debt; however, we also find that these banks (i) also buy more non-government bonds (including foreign bonds) with equal or higher intensity, and (ii) – within sovereign debt (and in general) – buy securities with *lower* – not higher – yield.[21] Therefore, thanks to more granular data, we reach a different conclusion: less (in comparison to better) capitalized banks take less risk in securities.

The rest of the paper is organized as follows. Section 2 describes the main datasets and explains the empirical strategy. Section 3 presents and discusses the results. Section 4 concludes, highlighting some implications for public policy and for finance-macro models.

2. Data and Empirical Strategy

We exploit several (matched) administrative datasets from Italy, as well as public datasets. We use the Security Register, which is a supervisory centralized dataset managed by the Bank of Italy that includes microdata on *all* securities investments – at the *security-level* (ISIN code) – for *each* bank in Italy (bonds, ABS, equities, derivatives and shares of mutual funds). Data are available at monthly frequency from 1999.

For each security, banks must report the notional amount they hold at the end of each period (stock of individual securities). We use the unique International Security Identification Number (ISIN) associated with every security to merge the data on holdings with: a) Datastream to obtain the monthly time series of prices and yields; b) FactSet to get additional information

[21] According to the political economy hypothesis (Drechsler, Drechsel, Marquez-Ibanez and Schnabl, 2016), less capitalized banks are relatively closer to financial distress, thereby potentially needing more guarantees by the government in a crisis, hence they can be more influenced by the government. On the other hand, Becker and Ivashina (2018), who also explore financial repression as a main driver of the purchases of government bonds during the crisis, claim that this explanation does not necessarily imply a cross-sectional prediction (a correlation between bank health and purchases of home government bonds). However, our evidence that less capitalized banks also buy more non-government bonds (including foreign bonds) with equal or higher intensity does not seem consistent with moral suasion or financial repression driving our main findings.

regarding the issuer, the residual maturity and the time series of ratings (in case of bonds); and c) the haircuts of marketable assets applied to each security in each point in time by the ECB.[22] We compute the quantity of securities in banks' portfolio by dividing the notional amount by the market price at the corresponding date (banks are required by the regulation to report the market value of the securities they hold using the closing market price of the last working day of the month). This is crucial to control for changes in values which may be caused by changes in monetary policy. The register also records whether a security is in the trading book, in available for sale or in the held to maturity portfolio.

We also use the Central Credit Register which is a supervisory, centralized dataset managed by the Bank of Italy that records the credit exposure of resident banks to non-financial firms. The data include loan applications, credit volumes and rates. We merge the credit register with (i) the official balance sheet data deposited by non-financial firms to the Chambers of Commerce (as required by the Italian law) to obtain firm-level probability of default as well as firm investment, wage bill and sales, and (ii) with the Bank of Italy Survey of Industrial and Service Firms (SISF) to obtain additional information on time-varying firm expected demand. SISF is a panel representative survey administered to approximately 3,000 Italian firms (with at least 20 employees), designed to obtain firm-level detailed information on firms' economic activity.[23] Finally, we use the Italian Supervisory Reports to obtain data on individual and consolidated balance sheets for banks in Italy.[24]

As of 2013, the average bank has 59 percent of its assets in credit (two thirds to firms and one third to households) and 17 percent in securities. The composition of securities during the crisis period on average is the following: 81 percent are bonds, out of which 58 percent are

---

[22] We do not observe haircuts applied in private repo markets (Gorton and Metrick, 2012).

[23] For a more detailed explanation of this data, see Guiso and Parigi (1999).

[24] In this paper we introduce the securities data. For a detailed explanation of the credit data in the Italian Credit Register, including the firm- and bank-level data, see Bofondi, Carpinelli and Sette (2017) or Ippolito, Peydró, Polo and Sette (2016). Note that neither of these papers analyze monetary policy.

issued by governments, 34 percent by financial firms, 2 percent by non-financial firms and 6 percent by other entities (e.g. international organizations or municipalities); 9 percent are Asset Backed Securities (ABS); 3 percent are shares; and 7 percent are other securities (e.g. shares of mutual funds, derivatives, covered and structured bonds).

We apply the following filters to the securities data. We consider only debt securities as they represent the large majority of securities and we can compare differential reach-for-yield by different banks in a class of very similar securities (bonds and loans), which is one of the two main questions in this paper (reach-for-yield channel);[25] we exclude the holdings of bonds issued by the same bank or by a bank belonging to the same group, as incentives are different in these group of bonds. To reduce the influence of securities of small value, we drop those for which the total notional amount for the entire banking sector are below EUR 10 million and the securities for which the average notional amount across all periods of each bank is below EUR 10 thousands. The resulting set of securities comprises over 95% of the total holdings. We also exclude from the analysis banks with total assets below EUR 1 million and mutual banks, the latter being subject to specific capital regulation. The final sample consists of 1388 securities and 104 banks in the crisis period and of 815 securities and 120 banks in the pre-crisis period. All major banks operating in the country are included in our sample; we use the same sample of banks when we study lending.

As discussed in the Introduction, to identify the bank channels of monetary policy, we analyze securities trading, not just granting of loan applications. Instead of just analyzing the data at the bank level as the literature does (see the references in the Introduction), we mainly

[25] We exclude derivatives and assets backed securities because these are mostly traded over the counter (OTC), hence we do not observe the market price and thus we cannot calculate a measure of net buys. However, a) the profits from trading in securities and the return on assets are positively correlated (which suggests that securities are not used to hedge the risks in the loan portfolio) while the profits from trading in securities and the profits from derivatives are not negatively correlated, thereby suggesting that banks do not use derivatives to hedge the higher risk they get in trading in securities; b) Italian banks have never been significantly exposed to ABS issued by countries with a real estate bubble (US, Spain, Ireland, UK) (for the exposure to asset backed securities, see Bonaccorsi di Patti and Sette (2012) and BIS data, www.bis.org/statistics); c) our results are confirmed when we take out the largest banks which have a higher derivatives exposure. We also exclude two small banks, Ifis and Fonspa, which are specialized in non-performing loans.

analyze the data at the *security-bank-month* and at the *(firm) application-bank-month* level.[26] This is essential for studying heterogeneity, as different securities within a bank have different ex-ante yields, as well as different haircuts, maturity and regulatory capital risk weights, and as different loans to firms have different ex-ante loan rates and default probabilities. Note that even securities within the same issuer (even in the same time period) may have different yields, maturities, haircuts and ratings (for example, Italian government debt).

Moreover, and crucially as well for identification, our micro-level data allow us to control for key unobservables, via security*time and firm*time fixed effects. Security*time fixed effects are a multiplication of a dummy for each security and a dummy for each month of each year (substantially stronger than adding just security and time fixed effects). They help us to control – in each month – for how much of each security is issued and outstanding (e.g. bonds of a particular security may mature), thus isolating the demand of securities by banks, and also to fully control for ratings, price or maturity, unobserved time-varying risk at the security level. For example, we can analyze the reach-for-yield controlling fully for time-varying ratings and maturity, the main determinants of the risk weights used to compute the regulatory capital ratios.

When we analyze the loan applications, we include firm*time fixed effects in the credit applications regressions, which implies that we analyze the *granting of loan applications* by *different banks* to the *same firm* in the *same period*, thus controlling for unobserved and observed time-varying borrower fundamentals in loan applications, thereby identifying credit supply. For loans, we look at quarters instead of months under the assumption that adjusting the loan portfolio to new monetary policy conditions requires more time than simply adjusting the securities portfolio (e.g. screening of opaque SMEs). In addition, as explained below in the results sections, we include other fixed effects and a battery of controls for robustness checks, including different level of clustering of standard errors.

[26] We also analyze aggregate effects at the bank level and at the firm level. See below.

Finally, we also analyze the results at the bank level, aggregating all the securities holdings and all loans for each bank (firms and households) to check aggregate substitution between *all* securities and *all* loans. We also analyze associated firm-level real effects.

For the *security-bank-month* level data, our main dependent variable is *Trading* of security *s* by bank *b* at time *t* (month). We analyze both the extensive and intensive margin using the Davis-Haltiwanger definition (Davis and Haltiwanger, 1992). We define the following:

$$\text{Trading}_{s,b,t}=\frac{\text{Holdings}_{s,b,t}\text{-Holdings}_{s,b,t-1}}{\frac{1}{2}*(\text{Holdings}_{s,b,t}+\text{Holdings}_{s,b,t-1})} \quad (1)$$

$Trading_{s,b,t}$ is the increase in holdings of security *s*, by bank *b* during the month *t*. This variable is symmetric around 0 and it lays in the closed interval [-200, 200] with final sales (initial purchases) corresponding to the left (right) endpoint (we multiply the variable by 100). This measure facilitates the integrated treatment of initial purchases (passing from 0 to a positive number), final sales (passing from a positive number to 0) and continuing trading in the empirical analysis (see the Appendix for an exact definition on all the variables used). In Table A2 (which reports the descriptive statistics of the main variables used in the paper), we report that the average monthly *Trading* in the crisis period is 5.1 with a large standard deviation (79.7) which implies a huge heterogeneity in banks' securities trading. For robustness, we use the change of log holdings as an alternative measure of banks' securities trading (we multiply the variable by 100). In this case, we take care of initial purchases and final sales by adding one to the holdings, such that the logarithm is defined.

For the *(firm) application-bank-month* level data, we analyze the granting of loan applications, where the dependent variable is a dummy variable that equals one if a loan application is granted to firm *i* by bank *b* over the quarter starting in month *t,* when the application was posted. In practice, if we observe a loan application, say, in January 2010, we define it as granted if we observe positive credit granted by the same bank which received the application to the corporate borrower posting the application (identified by the credit register unique identification number) in the same month (January) or in the next quarter (February, March, or April 2010).[27] Table A2 shows that the average probability of obtaining at least a loan for a firm after applying to banks is around 40 percent. In addition, when analyzing the aggregate bank level results, we use as the dependent variable the ratio of all security holdings over the volume of all granted loans (where we either give equal importance to each bank or more importance to the larger banks).

Finally, we also analyze firm-level outcomes to explore whether the bank lending channel of monetary policy has consequences in terms of investments, wage bill and sales (i.e., spillovers to the aggregate economy). Since in the firm-level real effects regressions we cannot control for demand as in the loan level data, we analyze year-over-year *changes* in firm-level sales, fixed assets (investment) and the wage bill (therefore implicitly controlling for time-invariant firm demand) and control for a time-varying firm demand measure by restricting the analysis to the firms included in the Bank of Italy Survey of Industrial and Service Firms (SISF), which provides direct information on time-varying firm expected demand. A crucial feature of SISF is that it contains a set of question that directly elicit expectations on future demand (see e.g. Guiso and Parigi, 1999), as SISF collects information both on the actual level of sales and on its expected levels for the following year. The expected demand is strongly correlated with the ex-post realized demand, so it can be credibly used as a measure of growth opportunities. In addition, apart from analyzing the real effects, we also analyze firm-level total credit (as firms could substitute across different financiers).

[27] We cannot exclude that some firms may not even apply for a loan since they may think that they are too risky and so that the chances of obtaining a loan are too limited. Note, however, that the fact that we cannot observe these firms does not undermine the identification of the credit supply (the coefficient of interest is not affected). First, too risky firms are a demand problem, and we are interested in credit supply. Second, if we were able to include even these observations, our dependent variable (the dummy variable which equals one if a loan application is granted) would be equal to zero for all the bank-firm-time triplets, and therefore the firm*time fixed effects would fully capture it.

As a proxy of monetary policy conditions after the start of the crisis, and to fully exploit the time series, we use the size of the balance sheet of the ECB (after subtracting the autonomous factors which are beyond the direct control of the ECB),[28] deflated by nominal Italian GDP (note that Taylor-rule shocks are based on monetary conditions over and above nominal economic activity, that is prices and real GDP or employment).[29] This monetary policy variable (see ECB (2015) on the role of the central bank balance sheet as a monetary policy tool) proxies for the series of unconventional monetary policies undertaken by the ECB to provide liquidity after the failure of Lehman Brothers in September 2008, such as the main refinancing operations (MRO) with full allotment (at fixed rate), the different LTROs (long-term refinancing operations) with different long-term maturity periods (3 months, 6 months, 1 year, 3 years…), and the purchases of securities by the ECB/Eurosystem such as Security Market Programme or Covered Bonds Purchase Programme. The sample ends in December 31, 2013 because in 2014 the ECB also becomes the supervisor (potentially affecting bank risk-taking behavior) and sets rates at negative values thus making the policy rate an instrument of unconventional monetary policy.

The European Central Bank, as compared to the Federal Reserve or the Bank of England for example, has had a key additional restriction in reacting during the crisis, coming from the presence of a clear, main mandate of pursuing inflation targeting. Nevertheless, as monetary policy reacts to economic activity, we control for other key macro variables by including time fixed effects and interactions of bank capital (and key security and loan variables) with current economic activity (Taylor, 1993), with the forecast of future economic activity (Romer and Romer, 2004) and with financial uncertainty (Freixas, Laeven and Peydró, 2015), among other variables. We also look at alternative measures of monetary policy by using shadow rates (Wu and Xia, 2017), which is highly correlated with our main measure of monetary policy (-0.7), or

[28] These include banknotes in circulation and government balances at central banks.

[29] Results do not change if we normalize the monetary policy variable by euro area nominal GDP or if we take the logarithm of the total assets ECB without any normalization.

by analyzing just the largest quantitative policy changes (the two initial 3-year LTROs on December 21, 2011 and February 29, 2012).[30] See the results sections and Table A3.

We also study conventional monetary policy in the pre-crisis period (January 1999 to August 2008); in this case our proxy for the monetary conditions is the Taylor (2008)-residuals measure obtained by regressing EONIA (the overnight interest rate for the EURO area) on change in Italian GDP and Italian consumer price index (Adrian and Shin, 2011).[31] Note that the monetary policy variables are normalized in both sub-periods by the Italian nominal GDP (real GDP and prices), but results are similar if we normalize by Euro area nominal GDP.

Both monetary policy measures (ECB balance sheet and short-term rates) moreover indicate softer monetary conditions if, given an overall level of economic activity and prices, the size of the central bank balance sheet is high or monetary policy rates are low (note that in addition to current economic and price conditions, we also control exhaustively via time fixed effects and key interactions by other key macro variables as the forecast of future GDP growth or financial risk and uncertainty). Note also that, as the ECB targets Euro area inflation, and Italy is not perfectly synchronized with the Euro area, there is more exogenous variation of monetary policy in a monetary union with imperfect synchronization across different countries than otherwise. In Figure A1 we report the evolution of the total assets of the ECB and the EONIA rate during our sample period. Table A2 and Figure A1 show variability of the monetary policy variables. Note that EONIA is relatively flat during the crisis after the massive reduction following the failure of Lehman Brothers (in fact we show that results are very similar if we control in crisis times for EONIA in the key interactions). In the tables, to ease the comparison of the results with the crisis period, we multiply the Taylor residuals by -1, so that higher values of the monetary policy variable indicate softer monetary policy, as in the crisis period.

---

[30] Note that the correlation is negative because softer monetary policy is either increasing the balance sheet of the ECB or reducing interest rates.

[31] Results are very similar if we directly use EONIA instead of the Taylor-shock residuals based on Adrian and Shin (2011) measure.

We exploit bank capital heterogeneity (controlling for other bank variables) to identify the bank lending and the risk-taking channel of monetary policy. The bank capital ratio is a sharp measure for both the intensity of the agency conflicts between bank shareholders and their financiers (including depositors, debtholders and tax payers) and the strength (net-worth) of bank balance sheets, so bank capital is a key driver of both the risk-taking and the bank lending channels (Holmstrom and Tirole, 1997; Bernanke, 2007; Freixas and Rochet, 2008; Adrian and Shin, 2011; Admati and Hellwig, 2014. As Shin (2016) argues, bank capital is crucial not only for financial stability (and the risk-taking channel of monetary policy, see also Adrian and Shin, 2011), but also for the transmission of monetary policy via bank lending.

We exploit bank capital heterogeneity to identify the impact of softer monetary policy on the behavior of banks, both in terms of trading and lending. We use the capital ratio, defined as the ratio of equity (shares subscribed, book value of equity plus retained earnings) divided by total assets;[32] for robustness we also use alternative proxies of bank capital such as capital in excess of the regulatory minimum (based on Tier 1) or bank net worth (capital ratio plus ROA).[33] Banks with less capital are more liquidity constrained, thereby needing more liquid assets (e.g. securities over loans) to hold them or to repo them (Holmstrom and Tirole, 1997; Rochet and Vives, 2004). Moreover, banks with less capital may prefer securities over loans as the former ones tend to have lower capital requirements (Freixas and Rochet, 2008). Finally, following Myer and Rajan (1998), liquid assets (liquid securities vs. illiquid loans) are easier to change fast thereby potentially taking on additional higher yield (or even risk-shifting).

[32] Bank capital ratio is negatively related to the percentage of bad loans in crisis times, and positively correlated to ROA; both ROA and the percentage of bad loans are also measures related to the net-worth of banks. In addition, bank capital ratio is negatively related to bank size in normal and crisis times, therefore, apart for controlling for time-varying bank controls, in some regressions we also control in interactions of monetary policy and bank size.

[33] Demirguc-Kunt, Detragiache and Merrouche (2013) show that, of the different measures of bank capital, the one that is more associated to higher stock returns during financial crises is the one that we use, rather than the risk-adjusted capital ratio (note also that e.g. Mariathasan and Merrouche (2014) show evidence on manipulation on risk weights for capital regulation in Basel II, and thus on Tier 1 ratio, whereas the measure we use in the main specification is not based on risk weights).

In the firm level regressions, where we analyze whether the preference for securities by less capitalized banks translates into less credit and less real outcomes at the firm level (investment, wage bill and sales), for each firm, we calculate a weighted average of the capital ratio of the banks they are ex-ante exposed to (the weights are the shares of credit in the previous period) following the methodology used, among others, by Khwaja and Mian (2008), Cingano, Manaresi and Sette (2016), Jiménez, Mian, Peydró and Saurina (2017), and Jiménez, Ongena, Peydró and Saurina (2017).[34]

The capital ratio has an average value during the crisis of 7.7 percent. There is a large variability among banks: the interquartile range goes from 6.5 to 8.7 percent. Since trading and lending may vary across banks, we control also for other bank variables, such as time-invariant heterogeneity via bank fixed effects, and time-varying bank controls: *Size* (the logarithm of the total assets), *Liquidity* (cash plus sovereign bonds divided by total assets), *Interbank* (the ratio of total borrowing from other banks to total assets) and *Bad Loans/Total Assets.*

To analyze reach-for-yield we use the yield as a measure of the risk of a security. The size of the yield is a superior measure of risk in comparison with rating since, as shown in Becker and Ivashina (2015), financial institutions may select securities with an ex-ante higher yield, within the same rating category, to increase risk by reaching for higher yield. Our main proxy for security risk, *Yield,* is calculated as the Yield-to-Redemption minus the overnight interest rate for the Euro area. The average yield in the crisis sample is 2.66 percent with a very large standard deviation of 1.9. The average yield within the sub-sample of Italian government bonds is 20 basis points smaller than the average yield in the rest of the sample. Controlling for maturity, the differences in yields significantly increase; for example, for short maturities, the difference between the two types of securities becomes much larger: within securities with residual maturity below two years, the average yield for Italian government bonds is 120 basis points

[34] We use an observable bank measure, capital ratio, for the bank landing channel. In this respect, the employed methodology differs from the one proposed by Amiti and Weinstein (2018) who do not rely on observable bank characteristics.

smaller than the rest of the securities.[35] In some specifications, we also use additional measures of security heterogeneity, like the residual maturity and the haircut applied by the ECB in repo loans. During the crisis, the interquartile range for the residual maturity is between 1 and 4.5 years, and the interquartile range for ECB haircut is between 1.5 and 6.5 percent.

As for lending regressions, we use ex-ante loan interest rates and default probabilities. The advantage of loan interest rates is symmetric with the yield in the security regressions. However, in the lending to SMEs firms, banks can have market power, so loan rates do not represent only firm risk but also market power (Jiménez, Ongena, Peydró and Saurina, 2017), hence we also exploit default probabilities proxied by the ex-ante z-scores. In particular, following the literature, we use as a proxy for firm risk a dummy that equals to one if the z-score is higher or equal to 7, the threshold which identifies "high risk" (substandard) firms; in the crisis sub-period, 33 percent of the firms applying for credit are high risk.[36]

We also use as a proxy for firm risk *Loan Yield*, which we calculate as the highest interest rate (minus EONIA) paid by the firm in the pre-existing credit relations in the period just before the posting of new loan applications. The use of this measure reduces largely the sample, as in the credit register, interest rates are available for a large and representative sample of bank-firm relationships, but not for the whole population and we are also excluding all those firms who apply for a loan for the first time. In the crisis sub-period, the average loan yield is 7.5 percent with a standard deviation of 3.6 percent. We use this measure as a robustness check.

As we explain in detail in the results section (also in Conclusions and Introduction), our empirical analysis also sheds light on the empirical relevance of some theories which stress different financial drivers and frictions at work. We do so by analyzing the whole sample of securities, and different sub-samples (e.g. government bonds that have regulatory capital weights

[35] Only the very best non-sovereign long-term debt could be issued in crisis times; hence, the summary statistics on average yields between non-sovereign and sovereign debt without adjusting for maturity are biased downwards.
[36] The z-score takes values between 1 (least likely to default) and 9 (most likely to default).

equal to zero, or e.g. held to maturity versus the trading book and available for sale portfolios,[37] which have different accounting and regulatory treatment), and also by exploiting, in addition, other security variables such as e.g. haircuts in repo loans, or different sets of fixed effects (such as e.g. analyzing securities with the same rating and maturity in the same month).

3. Results

In this section we present the estimated specifications and discuss the results, first analyzing the security-level regressions, and then the granting of loan applications, including overall bank changes in all securities over all loans and the associated firm-level credit and real outcomes. We demean all the continuous independent variables to make the interpretation of the coefficients meaningful.

3.1 The Specifications

Our main empirical specification is the following:

$$\text{Trading}_{sbt} = \beta_1 \text{Capital Ratio}_{bt-1} * \text{SofterMP}_{t-1} + \beta_2 \text{Capital Ratio}_{bt-1} * \text{SofterMP}_{t-1} * \text{Yield}_{st-1} + \\ + \text{Controls}_{sbt-1} + \gamma \text{Capital Ratio}_{bt-1} * \text{Yield}_{st-1} + \alpha_{st} + \alpha_b + \varepsilon_{sbt} \quad (2)$$

We analyze *Trading* of security *s* by bank *b* in month *t* depending on the lagged measure of monetary policy, lagged bank capital and lagged security yield. All these measures are defined and explained in the previous section and Table A1 in the Appendix. In the tables, we go from no controls whatsoever to fully saturating the specifications with fixed effects and observable controls. We always include the lower level of interactions (e.g. monetary policy and yield if we analyze the triple interaction), unless they are absorbed by fixed effects (e.g., security*time fixed effects, where time is every month of every year, i.e. year:month; for the sake of brevity we refer to it as month). We include macro controls (e.g., Δ *CPI* and Δ *Unemployment*) and bank controls (*Size, Liquidity Ratio, Interbank, Bad Loans/Total Assets*). In intermediate regressions we replace the macro, bank and security variables by different sets of fixed effects. We also provide comprehensive robustness in the main tables and also in the Appendix (see e.g. Table A3).

As we are interested in the estimated coefficient of the double interaction between bank capital and monetary policy (β_1) and of the triple interaction (β_2), the most demanding specification (Equation 2) includes security*time fixed effects (α_{st}) and bank fixed effects (α_b). We double cluster standard errors at the bank and security-time level, as our main variation is at the bank and time-security level, which also corrects for heteroscedasticity and autocorrelation. We also perform many different permutations of fixed effects and of clustering as robustness checks (see below) and different robustness across further controls and subsamples (see below).

In the last section, we also use a very similar framework to study how monetary policy conditions, bank, and firm characteristics affect the propensity of banks to grant new loan applications to non-financial firms. Moreover, we also analyze whether our micro-level results at the security-bank-month and at the loan application (firm)-bank-month level translate into aggregate bank changes in all securities over all granted loans. Finally, we also analyze the associated firm-level real effects.

3.2 Unconventional Monetary Policy in Crisis times: the Security Portfolio

When monetary policy conditions are softer (ECB provides higher liquidity overall), banks react by increasing their holdings of securities (positive net buy of securities), as the first three columns of Table 1 show. In column 1 we do not control for any macro, bank or security characteristic, whereas in column 2 we control for bank observable characteristics, and in column 3 we additionally control for the changes in Italian unemployment, inflation and for security fixed effects. Note that despite all these macro, bank and security controls, the positive estimated coefficients of ECB's monetary policy (*Softer MP*) on Italian banks' net buys of securities (column 1, 2 and 3) are not statistically different.

We are interested in the reaction of banks with different capital to monetary policy. For this reason, in columns 4 to 7, we add the double interaction of *Softer MP* and *Capital Ratio.* We find that, when monetary policy is softer, banks in general buy more securities but especially banks with less capital (the estimated double interaction *Capital Ratio*Softer MP* is negative). In column 4 we include time fixed effects to control for unobserved macro factors; in column 5, 6 and 7 we include again time fixed effects but restricting the sample to all securities different from either Italian non-financial corporate bonds (column 5) or Italian government bonds (column 6), and to only securities issued by foreign entities (column 7).[38]

In all the specifications, the double interaction of bank capital and monetary policy has a very similar coefficient (not different statistically), although it is statistically insignificant at standard levels of confidence in column 7, but note that the number of observations is reduced by approximately 90% (and the estimated coefficients of column 4 and 7 are respectively -0.63 and -0.59). Therefore, banks with less capital expand more into securities when ECB provides high liquidity, and estimated effects are similar across all securities, government bonds and non-government bonds, and only foreign issued securities; results are also not driven by securities issued by Italian non-financial firms (note that these securities are a tiny percentage from a quantitative point of view, and do not cover SME firms).[39]

We are also interested in the impact of monetary policy on reach-for-yield by banks with different capital. For this, in column 8 we include the triple interaction *Capital Ratio* Softer MP* Yield.* In column 9 we introduce rating*maturity*time fixed effects (to control for the

[38] Results are similar if we also remove foreign government bonds from the sample of column 7, leaving only bonds issued by foreign non-government entities.

[39] In some (two out of six) specifications, the double interaction *Softer MP*Yield* is negative and significant. Being equally lagged with respect to security trading, both variables (*Softer MP* and *Yield*) are contemporaneous; hence the estimated coefficient suggests that when monetary policy is softer, the security yields go down (an intended consequence of unconventional monetary policy).

determinants of regulatory capital) and security fixed effects, in column 10 we include security*time fixed effects (to control fully for all unobserved and observed securities characteristics, including liquidity and risk aspects) and in column 11 we include both security*time and bank fixed effects.

The triple interaction *Capital Ratio*Softer MP*Yield* is always positive and statistically significant (the double interaction *Capital Ratio*Softer MP* is always negative and significant, and the level effect of *Softer MP* is positive and significant).

The results imply that, when monetary policy conditions are softer (ECB provides higher liquidity), banks with less capital buy more securities, but with lower yield in comparison to more capitalized banks (even within securities with the same ratings and maturity in the same month, which are the main regulatory capital risk weights). The estimated coefficients across different specifications are very similar and not different statistically.

The results are also economically significant. One standard deviation increase in unconventional monetary policy is associated with an increase of 1.24 percent in the net buys of securities (based on the coefficient of column 3 of Table 1), which corresponds to a semi-elasticity of 24 percent.[40] For the double interaction *Capital Ratio* Softer MP*, an increase in one standard deviation in unconventional monetary policy leads banks with low capital (25 percentile) to buy 0.42 percent more securities than banks with high capital (75 percentile), which corresponds to 34 percent of the average increase due to softer monetary policy.

Finally, for the triple interaction *Capital Ratio* Softer MP*Yield*, when there is an increase in one standard deviation in unconventional monetary policy, banks with low capital (25 percentile) buy 0.48 percent more securities with lower yield (one standard deviation) than banks with high capital (75 percentile), which corresponds to a 39 percent of the average increase due

[40] The differential impact of a one standard deviation change in the unconventional monetary policy variable on securities trading at the mean of this variable, in percent.

to the softer monetary policy. Note that we calculate the economic significance based on the coefficients obtained in the most demanding specification (column 11 of Table 1).

3.3 Further robustness checks

Table A3 reports several further robustness checks on the main two coefficients of interest, the double interaction (*Capital ratio*Softer MP*) and the triple interaction (*Capital ratio*Softer MP*Yield*), in addition to the main robustness tests in Table 1. In particular, Table A3 shows the results of 21 separate regressions of trading of security *s* by bank *b* at time *t*, as a function of a set of macroeconomic, security and bank variables at time t-1.

First, we want to make sure that that our variables of *Capital Ratio* and *Softer MP* are not proxying for something else. For this reason, we first include a double (and triple) interaction between *Softer MP* and bank *Size* (and *Yield*). Note that bank size is the only bank variable correlated with capital in normal and crisis times. Second, in addition to the interactions with bank *Size,* we include also the double (and triple) interaction between *Softer MP* and bank *Liquidity* (and *Yield*), as bank liquidity is a key variable for the bank lending channel (Kashyap and Stein, 2000; Jimenez et al, 2012). Note that these additional bank controls are over the ones in Table 1, which are bank fixed effects and time-varying bank controls.

Next, we include double (and triple) interactions between bank *Capital Ratio* and changes in VIX, Italian unemployment and forecasted future GDP in Italy (note that these variables may also influence ECB policy, securities trading and risk-taking).[41] Regarding the VIX and the other macro controls, note that we control for unobserved overall time-varying shocks via time (or security*time) fixed effects, where time is year:month; hence with the interactions of VIX and the other macro controls we also control for differential effects of macro-financial shocks across different banks and different securities. Finally, we also add the double (and triple) interactions between bank *Capital Ratio* and EONIA (as the latter variable also has some variation during the

[41] Results are robust if we control for euro area forecasted future GDP growth or employment. Note that in the main Table 1 we also use controls for macro variables and time fixed effects.

crisis, but substantially lower than the variation of the size of the ECB balance sheet). Note that when we control for the double and triple interactions with bank size and liquidity and with other macroeconomic variables, the results of our two coefficients of interest remain strongly statistically and economically significant.

Second, we use different definitions for the two main variables: *Capital Ratio* and *Softer MP*. As for bank capital, we replace the capital to asset ratio with either the capital in excess of regulatory minimum, or a proxy of bank net worth (capital ratio plus ROA). As for the proxy for unconventional monetary policy, we modify the ratio of total assets of the ECB (net of the autonomous factors which are not under the control of the ECB) to the Italian nominal GDP in three ways: a) we include back the autonomous factors; b) we normalize the total assets of ECB by the Euro area GDP; c) we take the logarithm of the total assets of ECB without any normalization; d) we calculate the change in the total assets of the ECB relative to the overall average in the crisis, divided by the nominal Italian GDP. In all these specifications, the two coefficients of interest remain highly statistically significant and also the associated economic effects are very similar (note that the coefficients may change because the standard deviations and averages of the main variables change, but economic effects are similar). Moreover, the coefficients of interest are significant also if we use a completely different proxy for unconventional monetary policy, which is not based on the total assets of the ECB but on the shadow rates (Wu and Xia, 2017).[42]

Third, we assess the robustness of our findings to changing the sample of banks. We exclude from the analysis the largest three banks in our sample in terms of total assets, to confirm that our results are not just driven by a handful of large banks. These are the biggest banks in the country with the largest international presence, they have a large portfolio of securities, and rely more on derivatives. Results are still strong. In addition, we report Weighted Least Squares

[42] Shadow rates data for Europe are downloaded from https://sites.google.com/site/jingcynthiawu/home/wu-xia-shadow-rates. The correlation between the shadow rates and our main measure of monetary policy is very large (-0.7).

estimates where the weight is the level of the holdings of each security at the beginning of the month by each bank to give more weight to the largest holdings. WLS estimates of the coefficients are somewhat larger than the coefficients of the OLS regressions.

Fourth, a further concern could be that the results may be driven by diversification motives, therefore we control for the correlation of securities traded with the existing portfolio. In particular, we control for the existing portfolio of each bank at the beginning of each month, by including the shares of the bank portfolios invested in different type of securities according to the issuer: Italian government, foreign governments, Italian banks, foreign banks, Italian non-financial corporations, foreign non-financial corporations. Results do not change.

Fifth, we include additional fixed effects to control for further unobservables. We include bank*time fixed effects or security*bank fixed effects to control for unobserved time-varying bank heterogeneity, such as for example overall bank expansion, or time-invariant specific security and particular bank matching heterogeneity, proxying for example for different specialization of banks in some particular securities. The inclusion of these additional set of fixed effects do not change the coefficient of the triple interaction (note that when we include bank*time fixed effects, we cannot identify the coefficient of the double interaction *Capital ratio*Softer MP*).

Sixth, we try a different way of clustering the standard errors. Instead of double clustering, we triple cluster at bank, security and time level. Results do not change, as the size of the standard errors in the two specifications is very similar (note also the large set of fixed effects that we control for). We also change the definition of the dependent variable used in the analysis. Instead of the Davis-Haltiwanger definition, we use the difference between the logarithm of (1+ holdings of security *s*, by bank *b* at time *t)* and the logarithm of (1+ holdings of security *s*, by bank *b* at time *t-1)*. Results remain strongly significant.

Seventh, instead of looking at the time series and analyzing the variations of the total assets of ECB as a proxy for the several unconventional monetary policy measures taken by the ECB, in the penultimate row of Table A3 we analyze only one large shock: the first 3-year LTROs, which represents the largest jump in the total assets of the ECB. With this measure in December 2011, the ECB provided more than one trillion of (euro) lending with a 3-year maturity to European banks. The funds were distributed in two allotment dates: December 21, 2011 and February 29, 2012. We analyze the net buys of securities in the month of the first allotment of the 3-year LTRO and the following three months, which also captures the second allotment date (i.e., December 2011- March 2012). Symmetrically to the main specification, we are interested in the coefficient of *Capital Ratio* and the double interaction *Capital Ratio*Yield* to analyze which banks bought which type of securities. We find that the coefficient of *Capital Ratio* is negative and the double interaction *Capital Ratio*Yield* is positive; both coefficients are highly statistically significant.[43] Therefore, consistently with the time series of monetary policy, during the months of the 3-year LTRO, banks with less capital buy more securities, but with lower yield (even with the same regulatory capital risk weights), as compared to more capitalized banks. The results from the largest increase in the total assets of the ECB confirm the results of the main specification across all the crisis period.[44]

Finally, in the very last row of Table A3 we come back to the original specification and show that the coefficients of the double interaction (*Capital ratio*Softer MP*) and the triple interaction (*Capital ratio*Softer MP*Yield*) remain significant also if we exclude, precisely, the four months of the 3-year LTRO (i.e., December 2011- March 2012). This shows that our

[43] Symmetrically to the main sample, in this new regression we control for other bank observable characteristics recorded at time t-1 and include security*time fixed effects (here the standard errors are double clustered at bank and security level, as it is a cross-section).

[44] If we use, as a measure of softer monetary policy, the announcement of Mario Draghi "to do whatever it takes" on 26th of July, 2012, we find similar results (on capital and capital and yield) but only after the release of the OMT implementation rules in early September, not in August.

findings do not come just from the largest increase in the total assets of the ECB (around the LTRO) but hold also in the rest of the crisis periods.

3.4 Understanding the Drivers

In this section, based on Tables 2 and 3, we bring additional evidence to shed light on the channels that could drive the results.

In Table 2 we analyze the possibility that the behavior of banks may be driven by *regulatory arbitrage* (buying of some securities to minimize capital requirements) and *access to public liquidity* (buying of some securities with lower haircuts to potentially borrow at better conditions in repo operations). Table 2 shows estimates of the same regressions as in the baseline model, but restricting the sample to the holdings of Italian government bonds, which all have *zero* risk weights for regulatory capital.

We analyze yield but, here, we also analyze maturity and haircuts applied by the ECB on collateral pledged to borrow money, as measures of security heterogeneity for liquidity purposes. As theory suggests, banks with less capital should have higher incentives to economize on capital, and hence they could buy securities with lower yield not because they are less risky but because they could be associated to lower regulatory capital weights. In addition, banks with less capital may be more liquidity constrained (as theory suggests), hence they may buy securities with lower yield (and risk) to repo them to obtain liquidity at better lending conditions as these securities may have lower haircut (or to hold those liquid assets in case they need to repo them).

Our findings indicate that – also within Italian government bonds – less capitalized banks buy securities with lower yield when monetary policy is softer. Since all Italian government bonds have the *same risk weights – zero –*, this evidence suggests that regulatory arbitrage is not among the main drivers of bank trading due to monetary policy. Importantly also, note that in Table 1 when we analyze *all* securities, we find that within the securities with *identical rating* *and maturity in the same month* (which are the main determinants of regulatory capital weights), we also find that banks with less capital buy securities with lower yield.

Therefore, looking at all securities or at securities with zero regulatory capital weights, results on the bank channels of monetary policy do not support the regulatory capital arbitrage hypothesis.[45] All these results are moreover very similar (not reported) when we use capital in excess of regulatory minimum instead of the capital ratio.

In Table 2 we also look directly at *Maturity* and *Haircut* as measures of security heterogeneity. We obtain from the Eurosystem the eligible marketable assets that can be used as collateral, and for each security, the applied haircut at each point in time.[46] Consistently with the results on yield, the triple interactions of *Capital Ratio*Softer MP*Long Maturity* and *Capital Ratio*Softer MP*Haircut* are positive and statistically significant.[47] Within Italian government bonds, which are the securities that Italian banks tend to use as collateral with the ECB, banks with less capital buy securities with short maturity or with low haircut.[48] Note that results are robust to including bank*security fixed effects, in addition to security*time fixed effects. Note that the inclusion of bank*security fixed effects control for a preference of a bank for a particular security (e.g. a particular maturity horizon). All in all, the hypothesis on reaching for liquid assets is consistent with the results.

In Table 3 we explore the relevance of the *risk-bearing capacity* hypothesis (Adrian and Shin (2010)). To this aim, we exploit information on the regulatory portfolio each security is

---

[45] Recall that less capitalized banks prefer securities over credit when there is overall higher ECB liquidity, which, *prima facie,* without our granular data, could have been suggestive of regulatory capital arbitrage. Given the overall results in Table 2 (see below the results on haircuts), the hypothesis on reaching for liquid assets is overall more consistent with the results.

[46] We do not find that a dummy variable on pledgeability is statistically significant (unreported), probably as most of the securities in our sample can be pledged at the ECB.

[47] Note also that the coefficients of the double interactions have similar magnitude than in the sample for all securities, except for the interactions with haircuts, where they become smaller only because the less capitalized banks buy more securities at the very low haircut level, not at the average level. Note that, within Italian public debt, the securities with shorter maturity also have lower haircuts in private repo markets (we have access to the ECB *individual security* haircut level, but not the private repo market ones at the security level).

[48] Note that banks with less capital do not need to actually access the ECB, but, if in the future they need to access the ECB for additional funding (or potentially also in general markets), they can do it more cheaply or at higher volumes.

held in, and we split the sample into securities placed in the *held to maturity* portfolio and securities placed in the other portfolios. If a security is in the *held to maturity* portfolio, unrealized changes in fair value are not reported.[49] On the contrary, in the other portfolios, the unrealized changes in fair value are recognized in the income statement (*trading* portfolio) or in the balance sheet in the comprehensive income (*available for sale* portfolio).[50]

If risk-bearing capacity drives less capitalized banks to take less risk, e.g. buying securities with lower yield, we should find the results of the triple interaction to be particularly strong in the portfolios where securities are marked-to-market. This is exactly what we find in Table 3. The coefficient of the triple interaction in the held to maturity subsample is not significant (and has even the opposite sign in three out of the four specifications), whereas – in the other portfolios (available for sale and trading book) – the estimated triple interaction has a positive coefficient, which is statistically and economically significant.[51] Results are very similar (unreported) if we use capital in excess of the regulatory minimum instead of the capital ratio.

Our findings suggest that banks with more (not less) capital reach for higher yield; the effects are only present in the available for sale and trading books, but not in the held to maturity.[52] Overall our findings are consistent with risk bearing capacity of banks, which is higher for banks with more capital in crisis times, and also with access to liquidity in crisis times by less capitalized banks, and not with regulatory capital arbitrage.[53] Therefore, our results

---

[49] Unless there is objective evidence of impairment, for instance after a breach of contract, such as default or delinquency in interest or principal.

[50] There are no other significant differences across accounting portfolios; for example, securities in held to maturity and in the available for sale and trading book can be both pledged at the central bank to obtain liquidity. See De Marco (2017) for the relevance of the accounting treatment of securities in the Euro sovereign crisis.

[51] The coefficients of the double interactions are statistically significant and have similar magnitude than in the main sample, except for the last column (with all the fixed effects in) in the held to maturity portfolio.

[52] This also suggests that results are not driven by regulators and supervisors preventing less capitalized banks from taking on higher risk (as compared to banks with high capital), as effects are different in the held to maturity than in the other portfolios. Note that our results are not based on banks at the very left tail of the distribution of bank capital, which could be affected by a stricter oversight by the supervisor, but are for the average banks.

[53] Our results are also not consistent with risk-shifting by less capitalized banks due to ECB expansion of its balance sheet. Risk-shifting by less (compared to more) capitalized banks requires that these banks (apart from taking on negative net present value projects) increase more their risk. Our paper is silent on negative net present value but shows that less capitalized banks take on lower (not higher) risk after ECB expands its balance sheet.

suggest that, with higher central bank liquidity during crisis times, less capitalized banks buy more securities, but with lower yield (thereby reaching for safety and liquid assets), even within securities with the same regulatory capital risk weights.

3.5 Conventional Monetary Policy in Normal Times: the Security Portfolio

Given the theory highlighted in the Introduction, we concentrate the analysis in crisis times when financial frictions are high. However, for robustness, we also analyze the pre-crisis period, from January 1999 to August 2008. The monetary policy in this period is proxied by Taylor-shocks (residuals), as explained in Section 2. We multiply the Taylor shocks by -1, so that higher values of the monetary policy variable imply softer monetary policy, as in the crisis period for the expansion of the ECB balance sheet. We run the same regressions as those shown in Table 1, but on a different sample period (pre-crisis). Following Adrian and Shin (2011), we use the residuals after regressing monetary policy rates on GDP and price changes (note that our crisis policy variable is also related to real GDP and price, as it is normalized to nominal GDP).

Differently from the crisis period, we do not find that banks with less capital buy relatively more securities, as monetary policy becomes softer (Table 4 and A4 contain respectively the results and summary statistics). The double interaction *Capital Ratio*Softer MP* is not statistically significant in any specification. Banks on average react to softer monetary policy by increasing their holdings of securities, but the effect is not heterogeneous across banks with different levels of capital. Therefore, when financial frictions are not strong (normal times), bank capital is not an important driver of the differential expansion of securities as monetary policy becomes softer. Finally, the coefficient of the triple interaction *Capital Ratio* Softer MP* Yield* is positive and significant at 10% in two specifications out of four. This suggests that less capitalized banks do not reach-for-yield in securities either during the crisis or during normal times.

3.6 The Loan Portfolio and Aggregate and Real Effects

In this section we analyze the impact of monetary policy on credit supply, as well as the aggregate bank-level effects on the substitution between all securities and all loans, and the spillovers to the aggregate economy by analyzing firm-level real effects.

We first study the impact of monetary policy on the granting of loan applications by differently capitalized banks, including reach-for-yield in lending. Symmetrically with the specification on the security portfolio, we estimate equation (2) where instead the dependent variable is now *Granting a Loan Application*$_{i,b,t}$ which equals 1 if a loan application is granted to firm *i* by bank *b* over the quarter starting in month *t,* when the application was posted, and the measure of risk is the variable *Firm High Risk* or *Loan Yield* (see Section 2 and Appendix Table A1 for the exact definition of variables). Table 5 shows the results.[54]

As in the securities regressions, the key variables of interest are the double interaction between bank capital and the proxy for monetary policy and the triple interaction between bank capital, the proxy for monetary policy and ex-ante firm risk. In column 1 we do not include any time dimension in the fixed effects (we have firm but not firm*time fixed effects), so that we can estimate the coefficient of monetary policy. We find that the coefficient is not statistically significant here, while it was significant in the security regressions, suggesting that the positive effects of softer monetary policy in the crisis are stronger in securities than in loans.

Importantly, in crisis times, the double interaction *Capital Ratio*Softer MP* is positive and statistically significant, which suggests that banks with less capital grant fewer loan applications to the *same firm in the same quarter* as compared to banks with more capital (which is opposite of what we find for securities trading). Moreover, the coefficient of the triple interaction is never

[54] As in the securities trading regressions, for the crisis sample (column 1 to 4) the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian nominal GDP; for the normal times sample (column 5 to 8), it is the Taylor-residuals, based on EONIA (i.e. cleaned by Italian GDP and prices) and multiplied by (-1).

significant (differently from the securities trading regressions).[55] Note that in column 3, as a robustness check, we exclude firms with very high or very low z-score to test whether results hold around the z-score values which sort firms into safer (performing) and riskier (substandard),[56] and we find that this is the case, indeed.

Regarding economic effects, following an increase in one standard deviation in the unconventional monetary policy variable, banks with low capital (25 percentile) have a 0.81 percentage points lower probability of granting a loan application than banks with high capital (75 percentile) to the same firm in the same period, which corresponds to a semi-elasticity of 3.11 percent.[57] We calculate the economic significance on the basis of the coefficient of the double interaction *Capital Ratio*Softer MP* obtained in the most demanding specification (column 3 of Table 5).

Columns 5 to 8 of Table 5 show estimates from the pre-crisis period. The double and triple interactions are not significant. The double interaction has a negative coefficient (the impact of softer monetary policy on the granting of applications is larger for less capitalized banks), opposite to the results for the crisis, though not statistically significant at conventional levels. The triple interaction with the loan yield is significant in the last column (banks with less capital take on higher risk in loans in normal times when monetary policy is softer), but this result is not confirmed when we use the measure based on z-score.

Importantly, note that with softer monetary policy, banks with capital below the mean cut loan applications to the same firm in the same quarter, which is opposite to banks with capital higher than the mean; and, at the same time, based on previous tables, less capitalized banks increase more their purchases of securities in comparison to more capitalized banks.

[55] In addition, in column 4, we also use as a proxy for firm risk *Loan Yield*, but also in this specification, the triple interaction is not significant.

[56] We restrict the sample to firms with a z-score between 5 and 8. We remind here that our dummy *Firm High Risk* is equal to 1 if the score is larger or equal to 7 (see Section 2 and Table A1 for details).

[57] For each application, the average probability of being granted is 26.17 percent.

In Table 6, we report evidence at the aggregate bank level to confirm the result that less capitalized banks react to softer monetary policy during the crisis by purchasing more securities rather than lending. We report OLS and WLS (with bank size as weight) regressions using data at the bank level, using *all* security holdings and *all* loans by banks, where the dependent variable is the ratio between securities and loans.[58]

The coefficient of the double interaction *Capital Ratio* Softer MP* is negative and statistically significant, which confirms, also with aggregate data (bank-level data with OLS or WLS), that banks with less capital increase overall securities over overall lending volume as compared to banks with more capital, when monetary policy is softer.[59] Results are very similar across different specifications, in particular OLS versus WLS.

Regarding economic effects, in the most conservative specification we find that, an increase in one standard deviation in unconventional monetary policy leads banks with low capital (25 percentile) to increase their securities/loans ratio by 1.29 percent more than banks with high capital (75 percentile), which corresponds to a semi-elasticity of 5.85 percent.

All in all, our results are not only based on granular data, at the loan application level or at the security level, but also on aggregate bank level data, as shown in Table 6, analyzing the ratio between all securities and all loans, either giving equal weight to each bank or giving more weight to larger banks. Before analyzing the real effects at the firm level, it is important to stress that results are identical if we exclude securities issued by non-financial firms, which are tiny quantitatively and only issued by very large firms.

Therefore, our results – at the micro level or at the aggregate level – suggest that, with higher expansion of central bank liquidity in crisis times, securities crowd-out credit supply for

---

[58] This information is reported in the Supervisory Reports every six months and the loans here include both loans to firms and households. The average security/loans ratio in the crisis period is 22.02 percent.

[59] The variable *Softer MP* enters the regression positively, which suggests that during the crisis, softer monetary policy has a stronger positive effect on securities than on loans, though it is not statistically significant at conventional levels.

less capitalized banks. This may be beneficial if credit to non-financial firms during a crisis is risky, and then higher capital banks, thanks to their higher risk-bearing capacity, may be better able to supply credit to the real economy, while less capitalized banks repair their balance sheets.

Finally, in Table 7 we analyze whether the preference for securities by banks with less capital translates into less credit and worse real outcomes (a reduction in investment, wage bill and sales) at the firm level, for firms more dependent ex ante on credit from less capitalized banks. We follow here the same methodology used, among others, by Khwaja and Mian (2008), Cingano, Manaresi and Sette (2016), Jiménez, Mian, Peydró and Saurina (2017), Jiménez, Ongena, Peydró and Saurina (2017): for each firm, we calculate a weighted average of the capital ratio of the banks they are ex-ante exposed to (the weights are the shares of credit in the previous period).

The dependent variables are the change in the log of credit at the firm level, several definitions of firm investment,[60] the change in the log of firm overall wage bill and the change in the log of firm sales by firm *f* at time *t*. Note that the wage bill, sales and investment are the key components of aggregate output (GDP). We are interested in the coefficient of the lagged double interaction *Weighted Capital Ratio*Softer MP*. As we analyze changes in firm-level real effects (how real effects change for a firm), we implicitly control for time invariant firm level risk and demand (fixed effects, which are dropped when taking differences), and moreover we control for time-varying firm (lagged) characteristics including, notably, a measure of expected firm demand obtained from the survey, the self-reported expected sales growth rate for the following period, to proxy for time-varying growth opportunities and overall firm demand, and also include province*time and industry*time fixed effects (see Section 2 and Table 7 for further details).[61]

[60] We present three definitions of investment rate: (a) the first measure is calculated as adjusted total assets$_t$-adjusted total assets$_{t-1}$/ adjusted total assets$_{t-1}$ (where adjusted total assets is equal to total assets - fair value revaluation); (b) the second measure is the same as the first one but without adjusting for the fair value revaluation; (c) the numerator in the third measure is a flow measure of investments from the income statement.

[61] It is worth noticing that the measure of time-varying expected demand is statistically significant at 1 percent and with the expected sign. The problem of analyzing firm-level real effects, except in restrictive settings, is that one

We find that the coefficient of the interaction *Weighted Capital Ratio*Softer MP* is always positive and significant. After an increase in one standard deviation in unconventional monetary policy, firms ex-ante exposed to banks with high capital (75 percentile), in comparison to firms ex-ante exposed to banks with low capital (25 percentile), receive more credit, and increase investment, the wage bill and sales, respectively with the following semi-elasticities, 11 percent, 9 percent, 20 percent and 8 percent. Therefore, the active bank channels of monetary policy on bank credit supply and securities trading during crisis times have also significant spillovers to the real economy.

4. Conclusions

While a large empirical literature on the bank lending channel of monetary policy analyzes credit, including compositional effects with respect to risk, there is no empirical evidence on the impact of monetary policy on banks' securities holdings, in addition to loans. As we argued in the paper, and as theory shows, this is important to analyze the impact of monetary policy (expansion of central bank liquidity) via banks as (i) it may be easier to reach-for-yield with securities rather than with loans; (ii) there may be potential policy restrictions to banks' security trading (e.g. U.S. Volcker Rule); and (iii) bank security trading can crowd out loans.

We are in a unique position to analyze these issues since we have access to the matched security and credit application registers (including comprehensive security, loan, bank and firm characteristics) for banks in Italy, on a monthly basis, since the creation of the euro in 1999. This is especially important in a bank dominated economy where banks are the main providers of finance to non-financial corporations and are also key players in security markets. Moreover, as far as we are aware, Italy is the only country with a comprehensive credit register that records

cannot control for time-varying demand (see e.g. Jiménez, Mian, Peydró and Saurina (2017)). In our case, we control explicitly for time-varying expected demand using survey data (which was also used in other papers, see e.g. Guiso and Parigi (1999)). In addition, since our sample of firms for the real effects comes from a rotating panel, we do not have statistical power to include firm fixed effects. In any case, our model is in differences (firm-level changes), and hence we are implicitly controlling for firm fixed effects.

loan applications and rates, and a comprehensive security register that records whether a security is in the trading book, available for sale or held to maturity portfolio. While there are credit registers in most countries around the world, only few of them also hold exhaustive security registers or include loan applications. The granular data of the credit and security registers allow identification of bank risk-taking, security trading and credit supply, as well as the associated real effects.

Our results show that, in crisis times, with softer monetary policy conditions, banks with capital below (as opposed to above) the mean increase their purchases of securities relatively more than higher capitalized banks. At the same time, less capitalized banks are less likely to grant loan applications than better capitalized banks. Results are based both on granular data (at the loan application level or at the security level) and on aggregate bank level data (analyzing the ratio between all securities and all loans, either giving equal weight to each bank or giving more weight to larger banks). We also find that this bank behavior translates into aggregate real effects at the firm level. Differently, in pre-crisis times, when financial frictions are limited, less capitalized banks do not expand securities holdings over credit supply.

Less capitalized banks may prefer securities over credit in crisis times to have more liquid assets, to economize on regulatory capital, and/or to reach-for-yield (or even to risk-shift) with securities. Therefore, to further understand the different drivers of our results, and to also test for the risk-taking (reach-for-yield) channel of monetary policy, we analyze further heterogeneous effects. We find that, while banks with less capital buy more securities when monetary conditions are softer in crisis times, they choose securities with lower yield, and only in portfolios that are marked-to-market. They buy securities with lower ECB haircuts and shorter maturity, and results equally hold within sovereign debt securities with zero regulatory capital risk weights, or in general within securities with the same regulatory risk weights.

Results are informative for theories about the interaction of finance and macro. Our results that more capitalized banks are the ones taking on higher risk in the non-held to maturity accounts (when the ECB expands its balance sheet) suggest that their behavior is mainly driven by risk-bearing capacity rather than risk-shifting. Risk-shifting by less (compared to more) capitalized banks requires (as a necessary condition) that these banks increase more their risk, but we find the opposite (results also hold when we control for the covariance of new net security purchases with the existing bank portfolio). Therefore, our results suggest that, for less capitalized banks, there is reaching for safety rather than reaching for yield (when monetary conditions are softer).

We find the same results across securities with identical risk weights for regulatory capital, and hence pure regulatory capital arbitrage cannot explain the lower reach-for-yield by less capitalized banks. Regulatory arbitrage may be a more structural (low-frequency) rather than a high-frequency phenomenon moving with the monetary cycle (Freixas, Laeven and Peydró, 2015). Moreover, less capitalized banks buy more securities with lower haircut and maturity (reaching for liquid securities) as central banks expand their balance sheets, which suggest that access to liquidity is another key driver of banks' behavior (consistent, among others, with Rochet and Vives (2004) and Cornett, McNutt, Strahan, and Tehranian (2011)). Finally, our findings suggest that, as central banks change their monetary conditions, securities trading by banks reduce the supply of credit to the real sector (for banks with capital below the mean), with significant associated real effects, but we do not find that the banks which take on higher risk in securities are the ones reducing credit the most, i.e. the ones with higher capital (Shleifer and Vishny, 2010; Diamond and Rajan, 2011; Stein, 2013).

Results are also informative on the current debate on public policy regarding the transmission of monetary policy and its interaction with macroprudential policy. We show that there are limits to what softer monetary policy conditions can achieve in crises since our results suggest that banks with low capital use the additional liquidity to invest more in securities rather than to lend to the real economy (see e.g. Shin, 2016; Stiglitz, 2018).[62] In addition, our results suggest that lower bank capital does not imply higher reach-for-yield (or even risk-shift) incentives when central banks provide high liquidity, which is important for the discussion on the interactions between monetary and macroprudential policies (Rajan, 2005; Taylor, 2008; Allen and Rogoff, 2011; Stein, 2013; Acharya and Steffen, 2015). Moreover, since we show that less capitalized banks prefer securities with higher liquidity (low yield and haircut) over other securities and loans, policies aimed at making loans more liquid may increase the potency of the bank lending channel, e.g. via a better market for securitization of SME loans (see e.g. the speech by Yves Mersch (2014) from the Executive Board of the ECB).

Finally, our results are informative also for the policy debate on banks' securities trading. First, there are proposals on limiting sovereign debt in banks on the basis of the recent academic literature on the sovereign-bank nexus (Brunnermeier, Garicano, Lane, Pagano, Reis, Santos, Thesmar, Van Nieuwerburgh and Vayanos, 2016) and the alleged gambling for resurrection with GIIPS sovereign debt by less capitalized banks in the periphery (see e.g. Acharya and Steffen, 2015). In this respect, our results suggest that less capitalized banks took less risk than more capitalized banks during the crisis as monetary policy became extremely expansionary (note that we are making a relative, not an absolute, statement), and that risk-taking may occur via purchases of GIIPS *non*-sovereign securities and loans which are riskier, offering higher yields, and are quantitatively more important, especially loans to firms and households. Second, there are proposals on imposing restrictions to banks' security trading (not specific to sovereign bonds, as the Volker Rule in Dodd-Frank in the US, the Likaanen Report in EU and the Vickers' report in the UK). These may not be warranted since, in the light of our evidence, less capitalized banks do not seem to use security trading to risk-shift, but to increase the liquidity of their asset side.

[62] Note that our results are very similar if we only analyze foreign issued securities (which are not directly supporting the local economy) or if we exclude securities to non-financial firms (which are tiny).

References

Abbassi, P., Iyer, R., Peydró, J.-L., & Tous, F.R. (2016). Securities trading by banks and credit supply: micro-evidence from the crisis. *Journal of Financial Economics*, 121(3), 569-594.

Acharya, V. V., & Steffen, S. (2015). The "greatest" carry trade ever? Understanding eurozone bank risks. *Journal of Financial Economics*, 115(2), 215-236.

Admati, A., & Hellwig, M. (2014). *The bankers' new clothes: what's wrong with banking and what to do about it*. Princeton, NJ: Princeton University Press.

Adrian, T., & Shin, H. S. (2010). Liquidity and leverage. *Journal of Financial Intermediation* 19 (3), 418-437.

Adrian, T., & Shin, H. S. (2011). Financial intermediaries and monetary economics in *Handbook of Monetary Economics*, ed. by Friedman B. M., and Woodford M. Elsevier. Amsterdam: Elsevier.

Allen, F., Carletti, E., & Gale, D. (2014). Money, financial stability and efficiency. *Journal of Economic Theory*, 149, 100-127.

Allen, F., Chui, M. K., & Maddaloni, A. (2004). Financial systems in Europe, the USA, and Asia. *Oxford Review of Economic Policy*, 20(4), 490-508.

Allen, F., & Gale, D. (2007). *Understanding financial crises*. Oxford University Press.

Allen, F., & Rogoff, K. (2011). Asset prices, financial stability and monetary policy. In The Riksbank's Inquiry into the Risks in the Swedish Housing Market, ed. by P. Jansson, and M. Persson. Stockholm: Sveriges Riksbank, 189-218.

Albertazzi, U., Becker, B., & Boucinha, M. (2018). Portfolio rebalancing and the transmission of large-scale asset programmes: evidence from the euro area. European Central Bank Working Paper, No. 2125.

Altavilla, C., Pagano, M., & Simonelli, S. (2017). Bank exposures and sovereign stress transmission. *Review of Finance*, 21(6), 2103-2139.

Amiti, M., & Weinstein, D. E. (2018). How much do idiosyncratic bank shocks affect investment? Evidence from matched bank-firm loan data. *Journal of Political Economy*, 126(2), 525-587.

Becker, B., & Ivashina, V. (2015). Reaching for yield in the bond market. *Journal of Finance*, 70(5),1863-1902.

Becker, B., & Ivashina, V. (2018). Financial repression in the European sovereign debt crisis. *Review of Finance*, 22(1), 1-44.

Bernanke, B. S., & Blinder, A. S. (1988). Credit, money, and aggregate demand. *American Economic Review,* 78(2), 435-39.

Bernanke, B. S., & Blinder, A. S. (1992). The federal funds rate and the channels of monetary transmission. *American Economic Review*, 82(4), 901-921.

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives*, 9(4), 27-48.

Bernanke, B. S. & Lown, C. S. (1991). The credit crunch. *Brookings papers on economic activity*, 1991(2), 205-247.

Bernanke, B. (2007). Speech at the Credit Channel of Monetary Policy in the Twenty-first Century Conference. Federal Reserve Bank of Atlanta, Georgia.

Bernanke, B. (2014). Central banking after the great recession: Lessons learned and challenges ahead: A discussion with Federal Reserve Chairman Ben Bernanke on the Fed's 100th anniversary. Brookings Institution (January).

Bocola, L. (2016). The pass-through of sovereign risk. *Journal of Political Economy,* 124(4), 879-926.

Bofondi, M., Carpinelli, L., & Sette, E. (2017). Credit supply during a sovereign debt crisis. *Journal of the European Economic Association*, forthcoming.

Bolton, P. & Freixas, X. (2006). Corporate finance and the monetary transmission mechanism. *Review of Financial Studies* 19 (3), 829-870.

Borio, C., & Zhu, H. (2008). Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism. Working Paper.

Brunnermeier, M. K., Garicano, L., Lane, P. R., Pagano, M., Reis, R., Santos, T., Thesmar, D., Van Nieuwerburgh, S., & Vayanos, D. (2016). The sovereign-bank diabolic loop and ESBies. *American Economic Review. Papers and Proceedings*, 106(5), 508-512.

Brunnermeier, M. K., and Sannikov, Y. (2013). Redistributive monetary policy. Federal Reserve *Jackson Hole Symposium*.

Brunnermeier, M. K., and Sannikov, Y. (2017). The I theory of money. Princeton mimeo.

Brunnermeier, M. K., and Koby, Y. (2017). The reversal interest rate. Princeton mimeo.

Bruno, V. and Shin, H. S. (2015). Cross-border banking and global liquidity. *Review of Economic Studies*, 82-2, 535-564.

Carpinelli, L. & Crosignani, M. (2018). The effect of central bank liquidity injections on bank credit supply. Working paper.

Chakraborty, I., Goldstein, I., & MacKinlay, A. (2017). Monetary stimulus and bank lending. Wharton Mimeo.

Chakraborty, I., Goldstein, I., & MacKinlay, A. (forthcoming). Housing price booms and crowding-out effects in bank lending. *Review of Financial Studies*.

Chodorow-Reich, G. (2014). Effects of unconventional monetary policy on financial institutions. *Brookings Papers on Economic Activity* (Spring): 155-204.

Cingano, F., Manaresi, F., & Sette E. (2016). Does credit crunch investments down? New evidence on the real effects of the bank-lending channel. *Review of Financial Studies* 29 (10), 2737-2773.

Coimbra, N., & Rey, H. (2017). Financial cycles with heterogeneous intermediaries. NBER Working Paper No. 23245.

Cornett, M. M., McNutt, J. J., Strahan, P. E., & Tehranian, H. (2011). Liquidity risk management and credit supply in the financial crisis. *Journal of Financial Economics*, 101(2), 297-312.

Davis, S., & Haltiwanger, J. (1992). Gross job creation, gross job destruction and employment reallocation. *Quarterly Journal of Economics*, 107(3), 819-63.

De Marco, F. (2017). Bank lending and the European sovereign debt crisis. *Journal of Financial and Quantitative Analysis.* Forthcoming.

Dell'Ariccia, G., Laeven, L. & Marquez, R. (2014). Monetary policy, leverage, and bank risk-taking. *Journal of Economic Theory*, 149, 65-99.

Dell'Ariccia, G., Laeven, L. & Suarez, G. (2017). Bank leverage and monetary policy's risk-taking channel: Evidence from the United States. *Journal of Finance*, 72(2), 613-654.

Demirguc-Kunt, A., Detragiache, E. & Merrouche, O. (2013). Bank capital: lessons from the crisis. *Journal of Money Credit and Banking*, 45(6), 1147-1164.

Diamond, D. W., & Rajan, R. G. (2006). Money in a theory of banking. *American Economic Review,* 96(1), 30-53.

Diamond, D. W., & Rajan, R. G. (2011). Fear of fire sales, illiquidity seeking, and credit freezes. *Quarterly Journal of Economics,* 126(2), 557-591.

Diamond, D. W., & Rajan, R. G. (2012). Illiquid banks, financial stability, and interest rate policy. *Journal of Political Economy*, 120(3), 552-591.

Di Maggio, M., Kermani, A. & Palmer, C. (2016). How quantitative easing works: evidence on the refinancing channel. Columbia Business School Research Paper 16-1.

Di Patti, E. B., & Sette, E. (2016). Did the securitization market freeze affect bank lending during the financial crisis? Evidence from a credit register. *Journal of Financial Intermediation*, 25, 54-76.

Draghi, M. (2014). The path to recovery and the ECB's role. Speech by Mario Draghi President of the ECB. Frankfurt am Main, February 27.

Draghi, M. (2015). Hearing at the European Parliament's Economic and Monetary Affairs Committee. Speech by Mario Draghi, President of the ECB. Brussels, March 23.

Drechsler, I., Drechsel, T., Marques-Ibanez, D., & Schnabl, P. (2016). Who borrows from the lender of last resort? *The Journal of Finance*, 71(5), 1933-1974.

ECB (2015). The role of the central bank balance sheet in monetary policy in *ECB Economic Bulletin*, Issue 4.

Freixas, X., Laeven, L., & Peydró, J.-L. (2015). *Systemic risk, crises, and macroprudential regulation*. Cambridge, MA: MIT Press.

Freixas, X., Martin, A., & Skeie, D. (2011). Bank liquidity, interbank markets, and monetary policy. *Review of Financial Studies*, 24(8), 2656-2692.

Freixas, X., & Rochet J. C. (2008). *The microeconomics of banking*. Cambridge, MA: MIT Press.

Gertler, M., & Kiyotaki, N. (2010). Financial intermediation and credit policy in business cycle analysis economics in *Handbook of Monetary Economics*, ed. by Friedman B. M., and Woodford M. Elsevier. Amsterdam: Elsevier.

Guiso, L., & Parigi, G. (1999). Investment and demand uncertainty. *Quarterly Journal of Economics*, 114(1), 185-227.

Gorton, G. & Metrick, A. (2012). Securitized banking and the run on repo. *Journal of Financial Economics*, 104-3, 425-451.

Holmstrom, B., & Tirole, J. (1997). Financial intermediation, loanable funds, and the real sector. *Quarterly Journal of economics*, 112(3), 663-691.

Ippolito, F., Peydró, J.-L., Polo, A., & Sette, E. (2016). Double bank runs and liquidity risk management. *Journal of Financial Economics*, 122(1), 135-154.

Jiménez, G., Ongena, S., Peydró, J.-L. & Saurina, J. (2012). Credit supply and monetary policy: identifying the bank balance-sheet channel with loan applications. *American Economic Review*, 102(5), 2301-2026.

Jiménez, G., Ongena, S., Peydró, J.-L., & Saurina, J. (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica*, 82(2), 463-505.

Jiménez, G., Ongena, S., Peydró, J.-L., & Saurina, J. (2017). Macroprudential policy, countercyclical bank capital buffers and credit supply: Evidence from the Spanish dynamic provisioning experiments. *Journal of Political Economy*, 125(6), 2126-2177.

Jiménez, G., Mian, A., Peydró, J.-L., & Saurina, J. (2017). The real effects of the bank lending channel. *Journal of Monetary Economics*. Conditionally accepted.

Kashyap, A. K., & Stein, J. C., (2000). What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, 90(3), 407-428.

Kindleberger, C. P., (1978). *Manias, panics, and crashes: A History of Financial Crises*. New York: Basic Books.

Khwaja, A. I., & Mian, A. (2008). Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *American Economic Review*, 98(4), 1413-1442.

Lian, C., Ma, Y., & Wang, C. (2017). Low interest rates and risk taking: evidence from individual investment decisions. Working paper.

Mariathasan, M. & Merrouche, O. (2014). The manipulation of Basel risk-weights. *Journal of Financial Intermediation*, 23(3), 300-321.

Martinez-Miera, D. & Repullo, R. (2017). Search for yield. *Econometrica*.

Mersch, Y. (2014). Banks, SMEs and securitisation. Speech by Yves Mersch, Member of the Executive Board of the ECB. London, 7 April.

Myers, S., & Rajan, R. (1998). The paradox of liquidity. *The Quarterly Journal of Economics*, 113(3), 733-771.

Peek, J., & Rosengren, E. S. (2000). Collateral damage: Effects of the Japanese bank crisis on real activity in the United States. *American Economic Review*, 90(1), 30-45.

Rajan, R. G. (2005). Has finance made the world riskier? Speech presented at Jackson Hole, Federal Reserve Bank, Federal Reserve Bank, August.

Rochet, J.-C. & X. Vives (2004). Coordination failures and the lender of last resort: was Bagehot right after all? *Journal of the European Economic Association*, 6(2), 1116-1147.

Rodnyansky, A., & Darmouni, O. M. (2017). The effects of quantitative easing on bank lending behavior. *Review of Financial Studies*, 30(11), 3858-3887.

Rogoff, K. S. (2015). Debt supercycle, not secular stagnation. Vox http://www.voxeu.org/article/debt-supercycle-not-secular-stagnation.

Romer, C. D., and Romer, D. H. (2004). A new measure of monetary shocks: Derivation and implications. *American Economic Review*, 94(4), 1055-1084.

Shin, H. S. (2016). Bank capital and monetary policy transmission. Panel remarks at The ECB and its Watchers XVII conference, Frankfurt, 7 April 2016.

Shleifer, A., & Vishny, R. (2010). Unstable banking. *Journal of Financial Economics,* 97(3), 306-318.

Stein, J. (1998). An adverse-selection model of bank asset and liability management with implications for the transmission of monetary policy. *RAND Journal of Economics*, 29(3), 466-486.

Stein, J. (2012). Monetary policy as financial-stability regulation. *Quarterly Journal of Economics,* 127 (1): 57-95.

Stein, J. (2013). The fire-sales problem and securities financing transactions. Speech by Governor Jeremy C. Stein at the Federal Reserve Bank of New York. New York, October 4.

Stein, J. (2013). Overheating in credit Markets: Origins, measurement, and policy responses**.** Speech by Federal Reserve Board Governor Jeremy Stein. February 7, 2013.

Stiglitz, J. (2018). The theory of credit and macroeconomic stability. In *Economic Theory and Policy amidst Global Discontent* (pp. 145-201). Routledge India.

Summers, L. H. (2014). Reflections on the new 'Secular Stagnation' hypothesis. Vox http://voxeu.org/article/larry-summers-secular-stagnation.

Taylor, J. B. (1993). Discretion versus policy rules in practice. In Carnegie-Rochester conference series on public policy (Vol. 39, pp. 195-214). North-Holland.

Taylor, J. B. (2008). The financial crisis and the policy responses: an empirical analysis of what went wrong. Working paper.

Wu, J. C., & Xia, F. D. (2017). Time-varying lower bound of interest rates in Europe. Chicago Booth Research Paper No. 17-06.

Table 1: Unconventional Monetary policy, Bank Capital and Reach-for-Yield in the Security Portfolio in Crisis Times

Dependent Variable:	Trading $_{s,b,t}$										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Softer MP	3.562***	4.793***	3.948***					4.459***			
	(0.692)	(0.925)	(1.141)					(1.031)			
Capital Ratio* Softer MP				-0.639**	-0.673**	-0.935**	-0.591	-1.054***	-0.868**	-0.868***	-0.624*
				(0.293)	(0.323)	(0.366)	(1.537)	(0.324)	(0.393)	(0.299)	(0.345)
Capital Ratio* Softer MP*Yield								0.415***	0.409***	0.389**	0.377**
								(0.160)	(0.149)	(0.149)	(0.149)
Capital Ratio*Yield				0.108**	0.123**	0.113	0.255	0.007	0.018	-0.009	0.013
				(0.048)	(0.051)	(0.071)	(0.175)	(0.062)	(0.074)	(0.066)	(0.064)
Softer MP *Yield				-0.296	-0.685*	-0.126	-0.899	0.169	-1.444*		
				(0.397)	(0.412)	(0.439)	(1.127)	(0.364)	(0.823)		
Macro Controls	No	No	Yes	-	-	-	-	Yes	-	-	-
Bank Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	Yes	Yes	Yes	Yes	No	-	-	-
Security Fixed Effects	No	No	Yes	No	No	No	No	No	Yes	-	-
Bank Fixed Effects	No	No	No	No	No	No	No	No	No	No	Yes
Rating*Maturity*Time Fixed Effects	No	No	No	No	No	No	No	No	Yes	-	-
Security*Time Fixed Effects	No	No	No	No	No	No	No	No	No	Yes	Yes
Observations	225364	225364	225364	225364	216535	146114	21224	225364	179501	225364	225364

The table shows regressions of trading of security *s* by bank *b* at time *t*, as a function of a set of macroeconomic, security and bank variables at time *t-1*. Macro controls include changes in Italian unemployment and inflation. Bank controls include capital ratio, interbank debt/total assets, liquidity ratio, bad loans/total assets and size. In this table, the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian GDP. The sample includes monthly observations from September 2008. In column 5 we restrict the sample to securities which are different from Italian non-financial corporation bonds. In column 6 we restrict the sample to securities which are different from Italian government bonds. In column 7 we restrict the sample to securities issued by foreign entities. See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. We always include the lower level of interactions or standalone variables, unless they are absorbed by fixed effects. Fixed effects are either included ("Yes"), not included ("No") or spanned by another set of effects ("-"). Standard errors are double-clustered at bank and security-time level, and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Regulatory Arbitrage or Access to Public Liquidity? The Portfolio of Italian Government Bonds

Dependent variable:	$Trading_{s,b,t}$											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Ratio*Softer MP*Yield	0.710**	0.746**	0.638*	0.979**								
	(0.338)	(0.343)	(0.368)	(0.463)								
Capital Ratio*Softer MP* Long Maturity					1.883**	1.771**	1.517*	1.620				
					(0.754)	(0.756)	(0.835)	(1.110)				
Capital Ratio*Softer MP* Haircut									0.369**	0.451**	0.418*	0.696**
									(0.179)	(0.201)	(0.218)	(0.318)
Capital Ratio* Softer MP	-0.982	-1.065*	-1.042*	-1.656	-0.840	-0.979*	-0.920*	-0.522	-0.147	-0.212	-0.235	0.287
	(0.629)	(0.624)	(0.596)	(1.169)	(0.551)	(0.539)	(0.526)	(0.899)	(0.489)	(0.465)	(0.477)	(0.670)
Capital Ratio*Yield	-0.054	-0.113	-0.098	0.059								
	(0.140)	(0.138)	(0.143)	(0.225)								
Capital Ratio*Long Maturity					-0.377	-0.609	-0.604	-1.157				
					(0.436)	(0.417)	(0.417)	(0.889)				
Capital Ratio*Haircut									-0.128	-0.127	-0.170	-0.312
									(0.110)	(0.120)	(0.123)	(0.194)
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	-	-	Yes	Yes	-	-	Yes	Yes	-	-
Security Fixed Effects	No	Yes	-	-	No	Yes	-	-	No	Yes	-	-
Security*Time Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Security*Bank Fixed Effects	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	79250	79249	79227	78342	79070	79069	79048	78185	76565	76564	76550	75661

The table shows regressions of the trading of security *s* by bank *b* at time *t*, as a function of a set of macroeconomic, security and bank variables at time *t-1*. Bank controls include capital ratio, interbank debt/total assets, liquidity ratio, bad loans/total assets and size. In this table, the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian GDP. The sample includes monthly observations from September 2008. The analysis is confined to the sub-sample of Italian government bonds. See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. We always include the lower level of interactions or standalone variables, unless they are absorbed by fixed effects. Fixed effects are either included ("Yes"), not included ("No") or spanned by another set of effects ("-"). Standard errors are double-clustered at bank and security-time level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Risk Bearing Capacity? Held to Maturity versus Trading Book and Available for Sale Portfolios

Dependent Variable:	$Trading_{s,b,t}$							
	Held to Maturity				Other Portfolios (Trading book and Available for Sale)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Capital Ratio*Softer MP *Yield	-0.034	-0.086	-0.359	-0.286	0.342**	0.359***	0.369**	0.454**
	(0.144)	(0.189)	(0.465)	(0.626)	(0.148)	(0.132)	(0.155)	(0.212)
Capital Ratio* Softer MP	-1.419***	-0.649*	-1.093*	0.439	-0.816**	-0.848**	-0.745**	-1.626***
	(0.402)	(0.380)	(0.599)	(1.106)	(0.398)	(0.372)	(0.367)	(0.609)
Capital Ratio*Yield	0.154	0.013	0.246	-0.260	0.018	0.015	-0.004	0.183
	(0.101)	(0.135)	(0.259)	(0.397)	(0.050)	(0.049)	(0.066)	(0.118)
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	-	-	Yes	Yes	-	-
Security Fixed Effects	No	Yes	-	-	No	Yes	-	-
Security*Time Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Security*Bank Fixed Effects	No	No	No	Yes	No	No	No	Yes
Observations	14563	14559	7920	7905	208970	208955	207794	206880

The table shows regressions of trading of security *s* by bank *b* at time *t*, as a function of a set of macroeconomic, security and bank variables at time *t-1*. Bank controls include capital ratio, interbank debt/total assets, liquidity ratio, bad loans/total assets and size. In this table, the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian GDP. The sample includes monthly observations from September 2008. In this table we split the sample between Held to Maturity (columns 1-4) and Other (Trading Book and Available for Sale) Portfolios (columns 5-8). See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. We always include the lower level of interactions or standalone variables, unless they are absorbed by fixed effects. Fixed effects are either included ("Yes"), not included ("No") or spanned by another set of effects ("-"). Standard errors are double-clustered at bank and security-time level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Monetary Policy, Bank Capital and Reach-for-Yield in the Security Portfolio in Normal Times

Dependent Variable:	Trading$_{s,b,t}$										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Softer MP	1.345***	1.305***	1.534***					1.351***			
	(0.223)	(0.233)	(0.247)					(0.269)			
Capital Ratio* Softer MP				-0.081	-0.099	0.199	0.557	0.044	0.080	0.047	0.078
				(0.099)	(0.108)	(0.135)	(0.367)	(0.104)	(0.122)	(0.098)	(0.104)
Capital Ratio* Softer MP*Yield								0.095*	0.046	0.084	0.103*
								(0.056)	(0.094)	(0.053)	(0.054)
Capital Ratio*Yield				0.075	0.065	0.024	0.037	0.103	0.080	0.069	0.065
				(0.096)	(0.096)	(0.062)	(0.396)	(0.104)	(0.151)	(0.101)	(0.089)
Softer MP *Yield				-0.025	0.053	0.088	-2.536**	0.001	0.265		
				(0.107)	(0.112)	(0.119)	(1.172)	(0.125)	(0.328)		
Macro Controls	No	No	Yes	-	--	-	-	Yes	-	-	-
Bank Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	Yes	Yes	Yes	Yes	No	-	-	-
Security Fixed Effects	No	No	Yes	No	No	No	No	No	Yes	-	-
Bank Fixed Effects	No	No	No	No	No	No	No	No	No	No	Yes
Rating*Maturity*Time Fixed Effects	No	No	No	No	No	No	No	No	Yes	-	-
Security*Time Fixed Effects	No	No	No	No	No	No	No	No	No	Yes	Yes
Observations	335029	335029	335029	335029	329217	71992	12335	335029	194806	335029	335029

The table shows regressions of trading of security *s* by bank *b* at time *t*, as a function of a set of macroeconomic, security and bank variables at time *t-1*. Macro controls include changes in Italian unemployment and inflation. Bank controls include capital ratio, interbank debt/total assets, liquidity ratio, bad loans/total assets and size. In this table, the variable *Softer MP* is the Taylor-rule residuals multiplied by (-1). The sample includes monthly observations up to August 2008. In column 5 we restrict the sample to securities which are different from Italian non-financial corporation bonds. In column 6 we restrict the sample to securities which are different from Italian government bonds. In column 7 we restrict the sample to securities issued by foreign entities. See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. We always include the lower level of interactions or standalone variables, unless they are absorbed by fixed effects. Fixed effects are either included ("Yes"), not included ("No") or spanned by another set of effects ("-"). Standard errors are double-clustered at bank and security-time level, and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Monetary policy, Bank Capital and Reach-for-Yield in the Loan Portfolio

Dependent Variable:	Granting a Loan Application$_{i,b,t}$							
	Crisis times				Normal times			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Softer MP	-1.311				-0.127			
	(1.304)				(0.305)			
Capital Ratio* Softer MP	1.003*	0.902*	1.187**		-0.093	-0.182	-0.086	
	(0.567)	(0.473)	(0.571)		(0.160)	(0.111)	(0.115)	
Capital Ratio* Softer MP *Firm High Risk	-0.849	-0.362	-0.486		0.094	0.131	0.012	
	(0.701)	(0.554)	(0.594)		(0.102)	(0.099)	(0.114)	
Capital Ratio* Softer MP* Loan Yield				-0.067				-0.082**
				(0.352)				(0.036)
Capital Ratio*Firm High Risk	0.672**	0.640**	0.428		0.026	0.070	0.111	
	(0.324)	(0.262)	(0.290)		(0.151)	(0.108)	(0.134)	
Capital Ratio*Loan Yield				0.039				-0.063
				(10.333)				(28.291)
Macro controls	Yes	-	-	-	Yes	-	-	-
BankControls	Yes	Yes	Yes	-	Yes	Yes	Yes	-
Firm Fixed Effects	Yes	-	-	-	Yes	-	-	-
Firm*Time Fixed Effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	-	Yes	Yes	Yes	-
Bank*Time Fixed Effects	No	No	No	Yes	No	No	No	Yes
Observations	377441	377441	238805	20830	746128	746128	529085	47951

The table shows a set of linear probability model regressions of the probability of a loan application being granted by bank *b* to firm *i* over the quarter starting in month *t*, when the application was posted, as a function of macroeconomic, bank and firm variables at time *t-1*. Macro controls include changes in Italian unemployment and inflation. Bank controls include capital ratio, interbank debt/total assets, liquidity ratio, bad loans/total assets and size. In this table the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian GDP in the first four columns (Crisis times- sample period starts in September 2008) and the Taylor-rule residuals multiplied by (-1) in the last four columns (Normal times- sample period is up to August 2008). Data are at monthly level. In columns 3 and 7 we exclude firms with very high or very low z-score, restricting the sample to firms with z-score between 5 and 8. The dummy Firm High Risk is equal to 1 if the score is larger or equal to 7. See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. We always include the lower level of interactions or standalone variables, unless they are absorbed by fixed effects. Fixed effects are either included ("Yes"), not included ("No") or spanned by another set of effects ("-"). Standard errors are double- clustered at the bank and firm-time level, and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Unconventional Monetary policy, Bank Capital and the Choice Between Securities and Loans in Crisis Times: Aggregate Evidence

Dependent Variable	Securities/Loans$_{b,t}$					
		OLS			WLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Softer MP	6.050	5.298		5.619	5.198	
	(8.993)	(8.265)		(8.469)	(8.185)	
Capital Ratio* Softer MP	-2.335**	-2.407**	-1.717**	-2.295**	-2.346**	-1.681**
	(0.921)	(0.975)	(0.715)	(0.903)	(0.970)	(0.694)
Macro Controls	No	Yes	-	No	Yes	-
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	Yes	No	No	Yes
Observations	845	845	845	845	845	845

The table shows regressions of the ratio between securities and loans by bank *b* at time *t*, as a function of a set of macroeconomic and bank variables at time *t-1*. Macro controls include changes in Italian unemployment and inflation. Bank controls include capital ratio, interbank debt/total assets, liquidity ratio, bad loans/total assets and size. In this table, the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian GDP. The sample period starts in 2008 and data are recorded at the end of each semester. The first three columns report OLS estimates. The last three columns report WLS estimates where the weight is the size of the bank. See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. Standard errors are double-clustered at bank and time level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

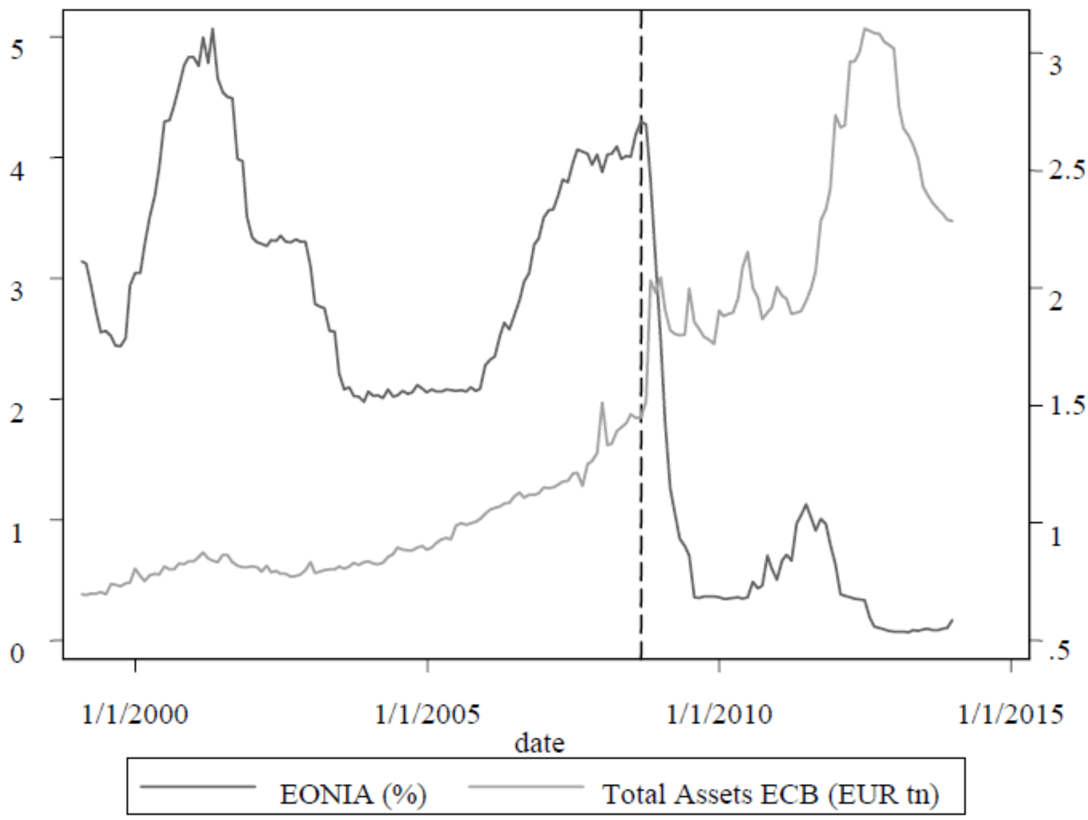
Table 7: Unconventional Monetary policy, Bank Capital and Firm Real Effects

Dependent Variable:	Δ Log (Credit)	Investment Rate	Investment Rate (no adjust.)	Investment Rate (flow)	Δ Log (Wage bill)	Δ Log (Sales)
	(1)	(2)	(3)	(4)	(5)	(6)
Weighted Capital Ratio*Softer MP	2.985**	1.746**	2.568***	1.900**	0.844*	1.215**
	(1.361)	(0.722)	(0.972)	(0.950)	(0.500)	(0.559)
Weighted Capital Ratio	1.190***	0.203	0.209	-0.325	0.043	0.221
	(0.460)	(0.370)	(0.454)	(0.442)	(0.202)	(0.226)
Firm Expected Demand	0.146***	0.105**	0.124***	0.143***	0.373***	0.822***
	(0.032)	(0.042)	(0.047)	(0.035)	(0.017)	(0.027)
Firm ROA	0.806***	0.354***	0.170	0.050	0.502***	0.388***
	(0.084)	(0.119)	(0.137)	(0.101)	(0.042)	(0.063)
Firm High Risk	-10.030***	-0.822	-0.888	-0.670	-2.902***	-3.246***
	(1.359)	(1.325)	(1.529)	(1.313)	(0.631)	(0.888)
Firm Size	-0.868***	-1.238***	-1.901***	-3.367***	0.369***	-0.296*
	(0.330)	(0.362)	(0.415)	(0.404)	(0.122)	(0.166)
Industry*Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Province*Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11078	11110	11107	11123	11101	11109

The table shows OLS regressions of the year-over-year change in log credit (column 1), investment rate (columns 2- 4), change in log of wage bill (column 5) and change in log of sales (column 6) at a firm level at time *t*, on a set of macroeconomic and firm variables at time *t-1*. In this table, the variable *Softer MP* is the Total Assets of the ECB minus autonomous factors divided by the Italian GDP. See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. Standard errors are clustered at firm level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

APPENDIX

Figure A1. Conventional and Unconventional Monetary Policy



This figure reports the evolution of EONIA and the Total Assets of the ECB between January 1999 and December 2013. On the left axis is reported the EONIA in percentage. On the right axis is reported the Total Assets of the ECB in trillion euros. The dashed vertical line corresponds to the end of August 2008.

Table A1: Description of Variables

Variable	*Description*	*Source*
Security Holdings		
Trading	Net buys of security *s*, by bank *b* during the month *t*. This growth rate is symmetric around 0 and it lays in the closed interval [-200,200] with final sales (initial purchases) corresponding to the left (right) endpoint (Davis and Haltiwanger, 1992)	Security Register
Log (Holdings)	The difference between the logarithm of (1+ holdings of security *s*, by bank *b* at time *t)* and the logarithm of (1+ holdings of security *s*, by bank *b* at time *t-1*)(multiplied by 100)	Security Register
Loan applications		
Granting a Loan Application	Dummy equal to 1 if a loan application is granted to firm *i* by bank *b* over the quarter starting in month *t,* when the application was posted(multiplied by 100)	Central Credit Register
Firm-level Outcomes		
Δ Log (Credit)	Changes in the log of total credit at firm level	Central Credit Register
Investment Rate	Changes in adjusted total assets at time *t* divided by adjusted total assets at *t-1,* (where adjusted total assets is equal to total assets - fair value revaluation). We use also two additional measures of investment rate. The second measure is the same as the first one but without adjusting for the fair value revaluation. In the third measure the numerator is a flow measure of investments from the income statement.	Cerved
Δ Log (Wage bill)	Changes in the log of wage bill	Cerved
Δ Log (Sales)	Changes in the log of sales	Cerved
Monetary Policy Proxies		
Softer MP (normal times)	Taylor-rule residuals obtained by regressing EONIA (the overnight interest rate for the EURO area) on Italian GDP growth and inflation (Taylor, 2008)	Own Calculations on OECD data
Softer MP (crisis times)	Total assets of the ECB balance sheet minus autonomous factors divided by the nominal Italian GDP, in percentage (ECB, 2015)	ECB and Bank of Italy
Security Characteristics		
Yield	Yield to redemption ("RY" in Datastream) minus EONIA (the overnight interest rate for the EURO area), in percentage	Datastream
Ratings	Ratings issued by Moodys	Factset
Long Maturity	Dummy equal to 1 if the residual maturity is larger than the 75th percentile of the distribution	Factset
Haircut	Haircut applied by the ECB for eligible marketable assets, in percentage	ECB
Firm Characteristics		
Loan Yield	The largest interest rate paid by the firm in the pre-exiting credit relations minus EONIA (the overnight interest rate for the EURO area), in percentage	Central Credit Register
Firm High Risk	This is a dummy equal to 1 if the z-score is larger or equal to 7. With a z-score between 7 and 9 the company is defined as *high risk* (substandard). The z-score measures the likelihood of a firm's default within one year. The score takes values between 1 (least likely to default) and 9 (most likely to default)	Cerved
Weighted Capital Ratio	Weighted average of the capital ratios of the banks the firm is exposed to (the weights are the shares of credit)	Central Credit Register
Firm ROA	Firm Return on Assets	Cerved
Firm Size	Log of firm total assets	Cerved
Firm Expected Demand	Firm self-reported expected sales growth for the following year	Survey of Industrial and Service Firms
Bank Characteristics		
Capital Ratio	Equity (shares subscribed, book value of equity plus retained earnings) divided by total assets, in percentage	Supervisory Reports
Excess Capital	Capital in excess of the regulatory requirement, divided by assets, in percentage	Supervisory Reports
Net Worth	Capital ratio plus ROA, in percentage	Supervisory Reports
Interbank	Ratio of total borrowing from other banks to total assets, inclusive of deposits and repos from other banks, exclusive of deposits from the ECB or other national central banks, in percentage	Supervisory Reports
Liquidity	Sum of cash holdings and sovereign bonds divided by total assets, in percentage	Supervisory Reports
Size	Logarithm of total assets	Supervisory Reports

Bad Loans/Total Assets	Percentage of bad and non-performing loans ('incagli' and 'sofferenze') out of total bank assets, in percentage	Supervisory Reports
Securities/Loans	Ratio of securities holdings to loans (both to firms and households)	Supervisory Reports
Macro Controls		
Δ CPI	Monthly change in the Italian Consumer Price Index	Bank of Italy
Δ Unemployment	Monthly change in the Italian unemployment rate.	Bank of Italy

The table describes the main dependent and control variables we use in the paper.

Table A2: Descriptive Statistics in Crisis Times

Panel A: Crisis Times	Mean	St.Dev.	Median	p25	p75
Security Holdings					
Trading	5.138	79.697	-0.003	-1.309	2.133
Δ Log (Holdings)	22.536	285.673	-0.003	-1.317	2.122
Monetary Policy Proxy					
Total Assets ECB/Italian GDP	1.258	0.315	1.092	1.017	1.538
Bank Characteristics					
Size	10.255	1.984	10.223	8.454	11.824
Capital Ratio	7.718	1.915	7.703	6.489	8.665
Excess Capital	2.532	1.493	2.350	1.550	3.112
Net Worth	7.972	1.984	7.999	6.850	8.972
Liquidity Ratio	10.799	7.496	9.252	5.894	13.055
Interbank	8.488	9.650	6.368	2.950	9.717
Bad Loans/ Total Assets	3.393	1.955	3.446	1.801	4.610
Securities/Loans	22.021	51.288	10.353	5.632	18.132
Security Characteristics					
Yield	2.659	1.873	2.304	1.324	3.698
Yield (Italian Gov.)	2.580	1.758	2.354	1.036	4.008
Yield (Non Italian Gov.)	2.702	1.930	2.279	1.441	3.527
Residual Maturity (months)	46.533	63.067	25.433	11.133	53.267
Rating=AAA	0.077	0.266	0	0	0
Rating>=A	0.651	0.477	1	0	1
Haircut	6.255	6.165	5.500	1.500	6.500
Macro controls					
Δ CPI	0.157	0.219	0.200	0.000	0.300
Δ Unemployment	0.090	0.212	0.000	-0.100	0.300
Loans					
Granting at Least One Loan Application (x100)	39.884	48.966	0	0	100
Firms					
Δ Log (Credit) (x100)	-7.050	37.531	-3.293	-18.688	8.303
Investment Rate (x100)	7.203	49.704	-1.163	-7.798	9.662
Δ Log (Wage bill) (x100)	-1.084	17.492	1.119	-6.143	6.709
Δ Log (Sales) (x100)	-4.228	26.842	-1.091	-13.532	8.786
Loan Yield	7.496	3.587	7.325	4.994	9.685
Firm High Risk	0.329	0.470	0	0	1
Weighted Capital Ratio	7.319	1.128	7.261	6.819	7.725
Firm ROA	-0.490	9.936	0.501	-1.247	2.838
Firm Size	10.049	1.454	9.863	90.271	10.986
Firm Expected Demand	3.627	13.054	2.564	-0.707	8.090

The table shows descriptive statistics of the main variables employed in our analysis for the crisis period (from September 2008)

Table A3: Unconventional Monetary policy, Bank Capital and Reach-for-Yield in the Security Portfolio in Crisis Times - Sensitivity Analysis of Interactions

	Capital Ratio* Softer MP	Capital Ratio* Softer MP *Yield	Observations
Controlling for double (and triple) interaction between Softer MP and bank Size (and Yield)	-0.920***	0.404***	225364
	(0.288)	(0.153)	
Controlling for double (and triple) interaction between Softer MP and bank Size and Liquidity (and Yield)	-1.295***	0.454**	225364
	(0.410)	(0.183)	
Controlling for double (and triple) interaction between bank Capital Ratio and changes in VIX, Italian unemployment and forecasted Italian GDP (and Yield)	-1.065***	0.291**	225364
	(0.310)	(0.137)	
Controlling for double (and triple) interaction between bank Capital Ratio and EONIA (and Yield)	-1.117***	0.532***	225364
	(0.339)	(0.188)	
Different proxy for Capital Ratio: capital in excess of regulatory minimum	-0.989**	0.520**	225364
	(0.423)	(0.224)	
Different proxy for Capital Ratio: net worth (capital ratio + roa)	-0.700**	0.362**	225364
	(0.330)	(0.159)	
Different proxy for Softer MP: inclusion of net autonomous factors in total assets ECB	-0.808**	0.351**	225364
	(0.331)	(0.148)	
Different proxy for Softer MP: normalization of total assets ECB by Euro Area GDP	-0.052***	0.025**	225364
	(0.019)	(0.009)	
Different proxy for Softer MP: Log (total assets ECB)	-1.180**	0.559**	225364
	(0.487)	(0.223)	
Different proxy for Softer MP: change in the total assets ECB relative to the overall time average in the crisis, divided by the nominal Italian GDP	-0.897***	0.401***	225364
	(0.298)	(0.151)	
Different proxy for Softer MP: dummy equal to 1 if shadow rates are negative	-0.526**	0.225*	225364
	(0.226)	(0.116)	
Different proxy for Softer MP: dummy equal to 1 if shadow rates are below 25th percentile	-0.606**	0.298***	225364
	(0.264)	(0.109)	
Exclusion of top three banks	-1.030***	0.419**	171493
	(0.271)	(0.170)	
Weighted Least Squares regressions (weight: level of holdings)	-2.480***	0.921***	225364
	(0.922)	(0.244)	
Controlling for the existing portfolio at the beginning of each month by including the shares of the bank portfolios invested in different type of securities according to the issuer	-0.970***	0.369**	225364
	(0.308)	(0.149)	
Inclusion of bank*time fixed effects	-	0.273*	225347
		(0.164)	
Inclusion of security*bank fixed effects	-1.389**	0.413*	223572
	(0.553)	(0.209)	
Triple clustering of standard errors at security, bank and time	-0.868***	0.389**	225364
	(0.263)	(0.154)	
Different definition of *Trading* (difference between the logarithm of holdings at time t and the logarithm of holdings at time t-1)	-2.922**	1.745***	225364
	(1.291)	(0.607)	
	Capital Ratio	Capital Ratio *Yield	
Using only the 4 months of the LTRO shock (December 11- March 12)	-2.027***	0.481**	17097
	(0.714)	(0.218)	
Excluding the 4 months of the LTRO shock (December 11- March 12) in the main specification	-0.769**	0.220*	208172
	(0.316)	(0.127)	

The table reports several further robustness checks on the main two coefficients of interest, the double interaction (Capital ratio*Softer MP) and the triple interaction (Capital ratio*Softer MP*Yield), in addition to the main robustness tests in Table 1. In particular, it shows the results of 21 separate regressions of trading of security s by bank b at time t, as a function of a set of macroeconomic, security and bank variables at time t-1.The sample period starts in September 2008. Rows correspond to perturbations of benchmark methodology. In the penultimate row, we analyze the net buys of securities in the month of the first allotment of the 3-year LTRO and the following three months, which also captures the second allotment date (i.e., December 2011- March 2012). Symmetrically to the main specification, we are interested in the coefficient of Capital Ratio and the double interaction (Capital Ratio*Yield). Finally, in the very last row we come back to the original specification and show the coefficients of the double interaction (Capital ratio*Softer MP) and the triple interaction (Capital ratio*Softer MP*Yield) if we exclude, precisely, the four months of the 3-year LTRO (i.e., December 2011- March 2012). See Appendix for exact definitions of variables and Section 2 for empirical strategy and data. Security*time fixed effects are always included. Standard errors are double-clustered at bank and security-time level, and are reported in parentheses. In the penultimate row we include security fixed effects and standard errors are double-clustered at bank and security level. *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Descriptive Statistics in Normal Times

	Mean	St.Dev.	Median	p25	p75
Security Holdings					
Trading	1.466	81.370	0.031	-2.071	5.976
Δ Log (Holdings)	6.516	233.694	0.031	-2.073	5.974
Monetary Policy Proxy					
Taylor-rule Residuals	0.759	0.927	0.584	-0.031	1.388
Bank Characteristics					
Size	9.571	1.734	9.499	7.865	10.673
Capital Ratio	7.848	2.302	7.452	6.300	9.035
Excess capital	2.497	2.024	1.867	1.156	3.165
Net Worth	8.391	2.389	7.982	6.725	9.604
Liquidity Ratio	10.361	6.938	8.602	5.220	13.564
Interbank	13.165	9.997	11.95	6.330	17.104
Bad Loans/ Total Assets	2.830	1.958	2.344	1.441	3.795
Security Characteristics					
Yield	0.873	1.429	0.575	0.123	1.336
Yield (Italian Gov.)	0.682	1.020	0.444	0.077	1.052
Yield (Non Italian Gov.)	1.572	2.254	1.261	0.571	2.235
Residual Maturity (months)	53.933	74.767	29.267	10.633	58.300
Rating=AAA	0.012	0.107	0	0	0
Rating>=A	0.910	0.286	1	1	1
Macro controls					
Δ CPI	0.166	0.108	0.200	0.100	0.200
Δ Unemployment	-0.050	0.133	-0.099	-0.100	0.000
Loans					
Granting at Least One Loan Application (x100)	39.099	48.797	0	0	100
Firms					
Firm High Risk	0.412	0.492	0	0	1
Loan Yield	7.364	4.906	6.519	4.540	8.988

The table shows descriptive statistics of the main variables employed in our analysis in normal times (up to August 2008).