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## Unconventional Monetary Policy, Bank Lending, and Security Holdings: The Yield-Induced Portfolio Rebalancing Channel

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# Unconventional Monetary Policy, Bank Lending, and Security Holdings: The Yield-Induced Portfolio Rebalancing Channel\*

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## Abstract

This paper studies the impact of unconventional monetary policy on bank lending and security holdings. I exploit granular security register data and use a difference-in-differences regression setup to provide evidence for the presence of a yield-induced portfolio rebalancing channel: Banks experiencing a larger average yield decline in their securities portfolio – induced by unconventional monetary policy – increase their real sector lending more strongly relative to other banks. The effect is stronger for banks facing many reinvestment decisions. Moreover, I find that banks with larger yield declines reduce their investment in securities more intensely, especially in securities with large valuation gains. These new findings suggest that banks target a specific yield level and shift their investments from the securities to the (higher-yielding) credit portfolio. Making use of data on bank-specific TLTRO uptakes, my results do not seem to be driven by alternative, liquidity-driven transmission channels.

**Keywords:** Unconventional Monetary Policy, Quantitative Easing, Portfolio Rebalancing.

**JEL classification:** E44, E51, E52, E58, G21.

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# 1 Introduction

After reaching the zero lower bound on interest rates many central banks, such as the Federal Reserve (Fed), the Bank of England (BoE), the Bank of Japan (BoJ), and the European Central Bank (ECB) embarked on a course of unconventional (non-standard) monetary policy measures to stimulate their economies. Such measures included new communication strategies, negative interest rates, liquidity injections, large-scale asset purchases (LSAP), and they have indeed been sizable. Since their introduction in the eurozone, the balance sheet of the ECB increased from approximately EUR 1.1 trillion in January 2007 to EUR 4.5 trillion in January 2018 and, unlike the Fed’s balance sheet, is still growing. The question that has been at the center of the debate among policymakers, investors, and academics is whether these measures are effective in stimulating economic activity and through what channels the transmission mechanism works. For instance, in the words of Ben Bernanke, Chairman of the Federal Reserve, in January 2014: *“The problem with Quantitative Easing (QE) is it works in practice, but it doesn’t work in theory.”*

I contribute to this debate by documenting how QE can affect economic activity via the banking sector. I empirically test whether banks react to a yield compression of their security holdings by (a) reducing their bond holdings and (b) investing in alternative assets with a higher expected return, such as loans to the real sector. For the empirical analysis I consider Germany, which is the largest eurozone economy. The eurozone has a bank-dominated financial system and banks are key for the transmission of monetary policy.<sup>1</sup>

Economic theory yields different predictions of how QE can work. In their seminal work [Eggertsson and Woodford \(2003\)](#) develop the famous irrelevance result of QE. Accordingly, in a standard New Keynesian model open market operations that result in an increase in central bank reserves are ineffective at the zero lower bound. Market prices are left unchanged since they depend on the future path of consumption rather than on their relative supply. Thus, unconventional monetary policy measures like asset purchases or the change in the composition of the central bank balance sheet are not expected to have direct real effects. In this model, it is only a commitment about the future path of interest rates that is a powerful way to stimulate the economy. [Bhattarai, Eggertsson, and Gafarov \(2015\)](#) show that LSAP can act as a commitment device by generating a credible signal about the future path of interest rates. Also, in finance theory, signaling

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<sup>1</sup>ECB Chief Economist Peter [Praet \(2016\)](#) argues that: *“This crucial role of the banking system explains why many of our monetary policy interventions during the crisis were aimed at repairing the bank lending channel.”*

is one channel through which QE can influence asset prices. LSAP can cause a change in the expectations of the future path of short-term interest rates, thus, affecting the risk neutral component of bond yields (see, for example, [Bauer and Rudebusch, 2014](#)).

The introduction of market imperfections can lead to deviations from [Eggertsson and Woodford \(2003\)](#)'s irrelevance result. Under the assumption of imperfect substitutability between central bank money and financial assets, investors faced by lower yields on securities purchased by the central bank may turn to higher-yielding alternatives. This idea of a portfolio rebalancing channel was developed in early studies such as those of [Tobin \(1969\)](#) or [Modigliani and Sutch \(1966\)](#). More recently, [Vayanos and Vila \(2009\)](#) provided a formalization of the imperfect substitutability assumption: LSAP can affect the term premium of long-term securities if investors have maturity-specific bond demands (see also [Krishnamurthy and Vissing-Jorgensen, 2011](#)). There exists a vast empirical literature which analyzes the impact of QE on prices and finds that, by and large, asset purchases positively affect asset prices and decrease bond yields.<sup>2</sup>

In my study, I take the result that QE affects bond yields negatively as given and ask whether there are second-round effects that result in a portfolio reallocation by banks. Banks might be faced with different incentives to rebalance their portfolio composition. First, such incentives might stem from additional liquidity emerging at banks' balance sheets, i.e. an increase in central bank reserves. When the banks' depositors sell securities to the central bank, the resulting reserve increase might induce banks to increase loans to restore their optimal balance sheet composition ([Christensen and Krogstrup, 2016](#)). Second, the impact that the numerous unconventional monetary policy measures exert on *yields* (or prices) of securities might lead to a rebalancing motive. On the one hand, the increase in the value of securities held by banks can raise their net worth and cause a rebalancing due to a "stealth recapitalization" ([Brunnermeier and Sannikov, 2014](#)). On the other hand, the change in the relative price between assets more or less affected by QE can induce banks to adjust their portfolio composition. A rebalancing can result either between short-term and long-term assets ([Gertler and Karadi, 2013](#); [Chen, Cúrdia, and Ferrero, 2012](#)) or between differently affected asset classes ([Dai, Dufourt, and Zhang, 2013](#); [Jouvanceau, 2016](#)).

There is a growing body of empirical literature which examines the liquidity-driven rebalancing motive by banks (see, for example, [Christensen and Krogstrup, 2018](#); [Kandrac and Schlusche, 2016](#); [Butt, Churm, McMahon, Morotz, and Schanz, 2014](#)) or the net worth

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<sup>2</sup>See, for example, [Altavilla, Carboni, and Motto \(2015\)](#) for the ECB's Asset Purchase Program, [Krishnamurthy, Nagel, and Vissing-Jorgensen \(2018\)](#) on the ECB's Outright Monetary Transactions and the Security Markets Program, [Krishnamurthy and Vissing-Jorgensen \(2013\)](#) for the Fed's Quantitative Easing, and [Joyce and Tong \(2012\)](#) for the Bank of England's asset purchase program.

channel of QE (see e.g. [Rodnyansky and Darmouni, 2017](#); [Koetter, Podlich, and Wedow, 2017](#); [Chakraborty, Goldstein, and MacKinlay, 2016](#)).<sup>3</sup> However, little work has been done on a rebalancing which is driven by a relative price change between different asset classes, i. e. loans and bonds.<sup>4</sup> My goal is to contribute to this strand of literature by analyzing both banks' credit and security holdings behavior.

My study is motivated by the following descriptive findings in Germany (see [Figure 1](#)). Throughout 2014 and 2015 there was a huge decline in yields of all types of fixed-income securities in the eurozone which coincided with the expectation, announcement, and implementation of various unconventional monetary policy measures (Panel a). This yield decline led to a compression of bond yields which was stronger than the decline in interest rates on newly issued loans. Consequently, there was an increase in the spread between the average interest rate that German banks charged on loans to the non-financial sector and the average yield of banks' securities portfolio (Panel b). At the same time, the volume of credit supplied by German banks increased in relation to the nominal value of securities held (Panel c). These stylized facts raise the question of whether the larger credit quantity was driven by the change in the relative price between book credit and bonds. In other words, did the expectation and announcement of unconventional monetary policy measures which increased the relative return of book credit in terms of bond yields lead to a rebalancing from security holdings into credit?

Motivated by these stylized facts, I develop the following hypotheses to test for the presence of a yield-induced portfolio rebalancing channel: **(Hypothesis i)** Banks facing a larger compression of yields in their securities portfolio increase their book credit more strongly because they target a specific yield level. **(Hypothesis ii)** Banks with a larger average yield decline of their securities portfolio reduce their overall securities holdings more intensely, especially selling those securities with the largest drop in yield and realizing valuation gains. Thus, I analyze whether, against the background of a change in relative price between book credit and bonds, there is a rebalancing between the securities portfolio and the credit portfolio of banks that are more affected by the monetary policy-induced yield decline.

In order to test empirically for these hypotheses, the German security register proves particularly useful. First, the granular information about the security-level holdings of German banks allows exploiting the impact that the expectation and announcement of

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<sup>3</sup>In addition to the net worth channel [Chakraborty et al. \(2016\)](#) also analyze an origination channel.

<sup>4</sup>Exceptions are [Albertazzi, Becker, and Boucinha \(2018\)](#), who mainly focus on the rebalancing of various economic sectors (i.e. non-financial corporations, insurance companies, investment firms, households, banks etc.) and not primarily on banks, and [Tischer \(2017\)](#), who mainly focuses on credit and not on security holdings.

various unconventional monetary policy measures – most importantly the Expanded Asset Purchase Program (APP) of the European Central Bank (ECB) – had on the yield of each security. More specifically, following [Albertazzi et al. \(2018\)](#), I use the cross-sectional heterogeneity in the composition of each bank’s securities portfolio by calculating a bank specific “yield-decline” variable. For each security that a bank held in January 2014, one year before the APP was announced by the ECB in January 2015 and well before investors started to expect and price in this measure, I calculate by how much the specific yield changed between January 2014 and June 2015. In other words, in order to rule out endogeneity stemming from reverse causality I hold the composition of securities fix at its January 2014 level and take the impact of monetary policy on prices as given. Aggregating this information on the bank level, this yield-decline variable is characterized by substantial cross-sectional variation.

Second, the securities register includes information about the maturity date of the securities held by banks. This provides another source of heterogeneity that I exploit for identification of Hypothesis (i): From the January 2014 perspective, the amount of securities maturing between January 2014 and June 2015 is predetermined.<sup>5</sup> This allows me to test whether the rebalancing arising from a large decline in yields is stronger for banks with many reinvestment decisions. Faced with compressed yields and the freed-up liquidity resulting from the maturing securities, these banks might step up their granting of credit more strongly in order to restore the targeted yield of their portfolio.

Third, when analyzing banks’ securities holdings (i.e. Hypothesis (ii)) I exploit the exhaustive detail of the security register for identification. I analyze the data at the security-bank-month level. The inclusion of security\*time fixed effects in my baseline regressions allows me to compare the level of holdings in the same security and the same month across banks more and less affected by unconventional monetary policy measures. Thus, I can account for any observable or unobservable time-varying heterogeneity across securities, such as liquidity, credit risk, and the level of issuance (credit demand by the securities’ issuers).

Armed with the two sources of heterogeneity, i.e. yield decline and maturing assets, I use a difference-in-differences estimation technique and find significant and sizable effects on credit supply for banks with a larger decline in yields when compared with their counterparts. On average, banks with a decline in yield of one standard deviation increased the quantity of newly issued loans to the real sector by 4.8% between 2013 and 2015, i.e. over a two-year period surrounding the monetary policy-induced yield decline and reduced their

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<sup>5</sup>Among others, the maturity structure has been exploited for identification by [Almeida, Campello, Laranjeira, and Weisbenner \(2012\)](#) to study the real effects of the 2007 crisis and by [Tischer \(2017\)](#), who exploits banks’ maturity structure to identify the effect of QE on lending using a similar dataset.

overall holdings of securities by 5.1%. I find that the effect of credit supply is particularly pronounced for banks with many maturing assets, i.e. banks facing many reinvestment decisions. Moreover, I find that banks with a larger decline in yields reduce their holdings of securities characterized by the largest valuation gains (i.e. with the largest decline in yield) more strongly, thus, realizing the gains from these security holdings. The results suggest that banks target a specific yield level and, facing an average yield decline in their securities portfolio, actively rebalance towards higher-yielding book credit.

Instead of increasing their book loans, banks more affected by monetary policy could seek to increase their investments in higher-yielding securities. Following [Albertazzi et al. \(2018\)](#), I investigate this alternative potential rebalancing opportunity but do not find evidence in favor of it. I follow an argumentation similar to that of [Albertazzi et al. \(2018\)](#) and argue that yields were already so compressed in Germany that, given a home bias, a rebalancing into securities with a relatively high yield would make it necessary to heavily restructure the composition of the portfolio. This highlights the economic plausibility of my findings: given the relative price change between securities and book credit, banks favor a rebalancing towards lending.

I do not find robust evidence that the above effects are more pronounced for weakly capitalized banks. One potential explanation for this might be that, outside times of crisis, equity does not constitute a constraint for comparatively well-capitalized German banks. This confirms the findings of [Timmer \(2018\)](#), who shows that, outside times of crisis, the securities trading behavior of banks does not depend on their equity ratio.

There are three potential concerns for identification. I address these in the following way: First, the treatment intensity created by the monetary policy-induced decline in yields could potentially be correlated with other events that simultaneously affect a bank's loan issuance through other channels. Between September 2014 and March 2017 the Targeted Longer Term Refinancing Operations (TLTROs) were implemented in the eurozone with the aim of fostering credit supply. They offer central bank refinancing on favorable conditions, which are tied to a bank's net credit supply. Using detailed proprietary data on the bank-specific TLTRO uptakes, I show that there is no differential drawing on this specific credit facility between banks more and less affected by the treatment. Thus, the bank-specific yield decline is not simply proxying for the TLTRO uptakes and does not capture a liquidity-driven rather than a yield-induced rebalancing motive.<sup>6</sup>

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<sup>6</sup>Note that I am allowing the TLTROs to affect a banks' credit supply through their overall effect on yields, but I want to rule out the possibility that my treatment intensity is picking up the TLTROs' effect on banks' credit granting through liquidity channels.



Second, an important prerequisite for my estimates to be attributable to the monetary policy-induced decline in yields is that the treatment intensity (i.e. by how much the average yield of a bank’s securities portfolio declined) is unrelated to other bank characteristics that might influence lending behavior. To address this issue, I carefully adjust the data by means of a matching approach in addition to controlling for a number of covariates. I effectively select a control group that has characteristics similar to those of the treated banks. This weighting approach takes care of the parallel trend assumption.

The third concern is that of distinguishing between supply and demand effects, which are mostly unobserved. The portfolio rebalancing channel analyzed in this paper is a notion involving a supply-driven credit increase. As my credit data is at bank level, I follow the bank lending channel literature (see, for example, [Kashyap and Stein, 1995](#); [Kishan and Opiela, 2000](#); [Worms, 2001](#)) when analyzing Hypothesis (i). Accordingly, I focus on groups of banks for which, economically, the supply-driven effect should be stronger. I robustly find that the yield-induced rebalancing motive towards granting more credit is especially pronounced for banks facing many reinvestment decisions. This result reinforces the notion of a supply-driven credit expansion.

Various robustness checks support the presence of my findings. Most importantly, a falsification test finds no significant differences in lending behavior between 2011 and 2013 among banks with diverse valuation gains, i.e. in a period prior to the onset of the treatment. Thus, the observed change in lending outcomes is most likely attributable to the monetary policy-induced decline in yield, as opposed to an alternative unobservable bank-specific force.

The rest of the paper proceeds as follows. [Section 2](#) describes how this paper fits into the existing literature. [Section 3](#) presents the data used for the analysis and the empirical design. [Section 4](#) reports the empirical results and [Section 5](#) concludes.

## 2 Related Literature

My paper contributes to the growing literature which assesses the effectiveness of unconventional monetary policy at the bank level. Many papers in this group study liquidity-driven channels. Papers such as [Carpinelli and Crosignani \(2017\)](#), [Garcia-Posada and Marchetti \(2016\)](#) or [Andrade, Cahn, Fraisse, and Mésonnier \(2015\)](#) analyze the effect of the three-year Longer Term Refinancing Operations (3y-LTROs) that were implemented in the eurozone in 2011 and 2012 in the wake of the eurozone sovereign debt crisis in order to prevent a funding squeeze in the banking sector. [Butt et al. \(2014\)](#) focus on



banks' deposits as the key pass-through variable of assets sales by the banks' deponents (e.g. institutional investors etc.). They show that the Bank of England's asset purchases had no impact on bank lending through this channel. [Kandrac and Schlusche \(2016\)](#) test for the existence of a reserve-induced portfolio rebalancing channel, where the sale of securities increases banks reserves, thus, disturbing the banks' optimal balance sheet composition. The authors exploit a regulatory change in the US which influenced the reserve distribution and find that banks increase their lending and risk-taking activity to reinstall the optimal asset and liability structure.

Other papers like [Koetter et al. \(2017\)](#), [Chakraborty et al. \(2016\)](#), and [Rodnyansky and Darmouni \(2017\)](#) focus on a net worth channel of QE. [Koetter et al. \(2017\)](#) analyze the effect that the Eurosystem's Securities Markets Program (SMP) had on competition in the banking market. The authors exploit the heterogeneity in bank-level holdings of securities that were purchased under the SMP and find positive effects on loan and deposit market shares. [Chakraborty et al. \(2016\)](#) analyze MBS and Treasury purchases by the Fed and find a crowding out of commercial lending in favor of mortgage origination following MBS sales. In addition, they find that firms' borrowing from MBS selling banks reduce their investments. They distinguish between a net worth channel and an origination channel, according to which banks with a focus on MBS origination are more affected by the Fed's purchases. [Rodnyansky and Darmouni \(2017\)](#) study the effect that the three rounds of QE in the US had on lending. They mainly focus on mortgage lending and exploit the heterogeneity in the MBS holdings of banks. In contrast to these papers, I do not consider banks' holdings of a particular asset class in order to define the treatment status, but rather exploit the heterogeneity in the impact that unconventional monetary policy had on yields of all fixed-income securities held by banks in their own accounts. Furthermore, the above papers do not study banks security holdings behavior.<sup>7</sup>

Overall, my contribution consists of taking the result that asset purchases affect bond yields negatively as given and asking whether banks that face larger yield reductions have stronger incentives to (a) reduce their securities holdings and (b) increase bank lending. The two papers closest to my analysis are [Albertazzi et al. \(2018\)](#) and [Tischer \(2017\)](#). [Albertazzi et al. \(2018\)](#) also study the yield-induced rebalancing motive using the heterogeneity in the APP-induced yield decline. However, they mainly focus on different

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<sup>7</sup>Further papers studying the effects of unconventional monetary policy include: [Grosse-Rueschkamp, Steffen, and Streitz \(2017\)](#), [Arce, Gimeno, and Mayordomo \(2017\)](#), and [Abidi, Miquel Flores, and Eterovic \(2018\)](#) all analyze the effects of the ECB's Corporate Bond Purchase Program. [Acharya, Eisert, Eufinger, and Hirsch \(2017\)](#), and [Ferrando, Popov, and Udell \(2016\)](#) study the announcement effects of the ECB's Outright Monetary Transaction Program. [Eser and Schwaab \(2016\)](#) study the transmission of the Securities Markets Program (SMP) on bond yields. [Heider, Saidi, and Schepens \(2017\)](#) analyze the transmission of negative policy rates via banks.

sectors (e.g. households, firms, pension funds, money market funds, banks etc.) and analyze whether those sectors have a motive to rebalance into newly issued riskier securities. They also give suggestive evidence in favor of a yield-induced rebalancing motive of banks from countries less affected by the sovereign debt crisis by studying the credit granting behavior of the largest 25 European institutions. As acknowledged by the authors “(...) *the small number of banks represents a constraint for the econometric analysis (...)*.” Further, they do not analyze the security holdings behavior of these banks as an outcome variable. In contrast, my study explicitly focuses on banks and tests for the hypotheses developed above, which are motivated by the stylized fact that the relative price between credit and securities has changed in Germany. As opposed to [Albertazzi et al. \(2018\)](#), I find that banks with greater yield declines reduce their security holdings (besides increasing their granting of credit). Additionally, I intend to shed more light on the underlying bank-specific mechanisms as well as heterogeneities of the yield-induced portfolio rebalancing channel. Furthermore, by making use of data from monetary policy operations, in particular bank-specific TLTRO-uptakes, I can control for alternative, liquidity-driven transmission channels.

[Tischer \(2017\)](#) also analyzes the effect of QE on the bank lending supply in Germany. To this end, he exploits the maturity structure of banks’ bond holdings and finds that more exposed banks increase their loan growth during QE relative to other banks. This result supports my main finding that banks with stronger yield compressions increase assets with a higher expected return, i.e. book credit, and reduce their securities holdings at the same time. In addition, it is consistent with the finding in this paper that the rebalancing motive is stronger for banks with many maturing assets which are simultaneously experiencing a strong decline in yields in their securities portfolio. In contrast to [Tischer \(2017\)](#), who primarily focuses on maturing securities for identification, my main source of heterogeneity stems from the intensity of the average decline in yields in a bank’s securities portfolio. Furthermore, I analyze the security holdings decision of banks on a security-level as an outcome variable, which allows for a rich identification. Understanding the securities holdings behavior of banks affected by unconventional monetary policy is a key contribution of this paper. Additionally, using bank-specific TLTRO uptakes allows me to directly control for this potentially contaminating unconventional monetary policy instrument without the need to use proxy variables for this purpose.

Another paper related to my study is [Peydró, Polo, and Sette \(2017\)](#). They also analyze banks investment behavior due to monetary policy using credit and securities register data from Italy. They find that, in times of crises, less capitalized banks prefer buying securities rather than increasing credit supply in response to a softer monetary

policy. One key difference from my paper is the monetary policy indicator they examine. They mainly focus on the central bank balance sheet, which incorporates the monetary policy measures which are actually implemented. In contrast, I use the impact that the anticipation and announcement of unconventional monetary policy had on yields. Additionally, [Peydró et al. \(2017\)](#) study crisis and non-crisis times, whereas I focus on a time period that spans the implementation of the APP and the TLTROs.

Another group of papers uses VAR models to study the effects of asset purchases on macroeconomic variables. Their main focus is on the effects of QE on output and prices. [Weale and Wieladek \(2016\)](#) rely on Bayesian inference and use a combination of zero and sign restrictions to identify an asset purchase announcement shock. They find a positive effect on output and prices for the US and UK. A similar approach is taken by [Gambacorta, Hofmann, and Peersman \(2014\)](#), who estimate a Panel VAR for eight advanced economies and focus on the aggregated central bank balance sheet as the main policy variable. [Lewis and Roth \(2017\)](#) also estimate a Bayesian VAR and identify an asset purchase shock by using different aggregated items from the ECB's balance sheet. The authors find a positive effect of asset purchases on output for both Germany and the eurozone as a whole. They also analyze the response of bank lending to firms following the asset purchase shock and find no reaction of this variable in the German economy. All these papers have the advantage that the exploitation of the time series variation enables them to study the transitional dynamics of asset purchases. However, it is hard to draw conclusions about the heterogeneous reaction of various agents to the asset purchase shock. Furthermore, most of these papers use aggregate central bank balance sheet items which include the actually purchased amounts of securities or they construct an asset purchase announcement series. Therefore, they do not fully incorporate the effects stemming from the anticipation of asset purchase programs by investors. Especially in the case of the eurozone, there is evidence that the APP was anticipated by market participants, thus, positively affecting prices well in advance of the actual implementation. I explicitly incorporate this anticipated reaction in bond prices into my analysis.

My paper also relates to the literature analyzing the bank lending ([Bernanke and Blinder, 1988](#); [Bernanke and Blinder, 1992](#)) and risk-taking channels ([Borio and Zhu, 2012](#); [Adrian and Shin, 2011](#)) of monetary policy during normal times. In their seminal paper, [Kashyap and Stein \(1995\)](#) exploit bank-level data and identify the bank lending channel by showing that small banks, i.e. banks facing greater frictions and having difficulties in saturating their funding needs, contract their lending activity stronger after a tightening of monetary policy. In a similar vein, [Kishan and Opiela \(2000\)](#) and [Gambacorta and Mistrulli \(2004\)](#) focus on weakly capitalized banks instead of the banks' size. More recent contributions analyze the bank lending and risk-taking channel using loan level data

(Jiménez, Ongena, Peydró, and Saurina, 2012; Jiménez, Ongena, Peydró, and Saurina, 2014).

This paper also contributes to the literature studying securities holdings of banks and institutional investors at the securities level. Abbassi, Iyer, Peydró, and Tous (2016) also use the German securities register in conjunction with lending data. However, they do not study monetary policy, but are interested in securities trading by banks with trading expertise in the crisis. Timmer (2018) studies securities trading of institutional investors. Contrary to my results, Timmer (2018) finds that banks respond pro-cyclically to price changes, i.e. they sell securities when prices are falling. In contrast to Timmer (2018), I focus on banks with large credit and securities portfolios and focus on a time period characterized by a huge decline in the general yield level induced by monetary policy.<sup>8</sup>

### 3 Data and Empirical Setting

I focus on Germany in order to analyze the yield-induced portfolio rebalancing channel. Germany's financial system is bank-dominated and the largest in the EMU making it an ideal candidate for studying the effects of unconventional monetary policy on bank lending and securities holdings. Further, the availability and combination of the securities register with balance-sheet information and data from monetary policy implementation provides a comprehensive view on banks' balance sheets. In this section, I first describe the data used in this paper. Then, I turn to the stylized facts about the credit and securities market in Germany during the time period of investigation, i.e. from January 2013 until December 2015, which provide descriptive evidence for the potential presence of a yield-induced rebalancing channel. Finally, I describe the identification strategy and the empirical setup.

#### 3.1 Data

To construct the dataset used for the empirical analysis I use the German securities register, the balance sheet statistics, the interest rate statistics, and the income statement statistics of German banks compiled by the Deutsche Bundesbank. This dataset is augmented with data on the refinancing operations of German monetary policy counterparties. The baseline time period under consideration is January 2013 until December 2015.

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<sup>8</sup>Timmer (2018) analyzes the time period 2005 Q4 - 2014 Q4 and focuses on all German banks.

The securities register includes the nominal amounts of the security holdings of each German bank on a *security level* for the end of each month. I merge this dataset with the centralized securities data base to obtain additional securities-specific information such as the yield, price, maturity date, security type, and issuer sector. I complement this data with monthly *bank-level* balance sheet information like total assets, equity capital, central bank reserves, saving deposits, and yearly income statement items such as net profits and net interest received. The data on monetary policy refinancing operations includes the bank-specific TLTRO uptakes.

My bank-level loan data comes from the interest rate statistics, composed of a sample of above 200 deposit-taking and loan-granting credit institutions. The sample is selected using a stratified sampling procedure according to the categories of banks, regional criteria, and size. In terms of coverage, around 70% of the total German loan business is captured by this dataset.<sup>9</sup> Thus, the sample includes German banks with a strong focus on granting credit. The unique feature of the MFI interest rate statistics is that, along with the interest rates on loans, it includes the monthly volumes of *new business* at the end of each month for loans to households and non-financial corporations.

As I focus on newly issued loans, my final sample after merging the loan data with the above datasets consists of 204 banks. This sample is interesting for the following reasons: First, these are the banks most active in granting credit and, therefore, they are particularly important for the transmission of those unconventional monetary policy measures that target an expansion of credit. Second, as described in the following section, a difference-in-differences regression setup is used and the treatment intensity of a bank's average drop in yields is exploited for identification. This requires ensuring that the banks from the control group are similar to the treated banks in terms of observable and unobservable characteristics. As described in the following section, I deal with the observable characteristics by means of a matching procedure. However, it is more challenging to handle unobservable characteristics. Choosing banks with a similar business model, i.e. a strong focus on granting credit, can help in this respect.

## 3.2 Stylized Facts

One prerequisite for the presence of the yield-induced portfolio rebalancing channel is that of a yield decline which can be attributed to unconventional monetary policy. Panel a of [Figure 1](#) shows the evolution of 10-year government bond yields for selected eurozone

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<sup>9</sup>Details on data used are available at: [http://www.bundesbank.de/Redaktion/DE/Standardartikel/Statistiken/einlagen\\_und\\_kreditzinssaetze.html](http://www.bundesbank.de/Redaktion/DE/Standardartikel/Statistiken/einlagen_und_kreditzinssaetze.html).

countries. Between January 2014 and June 2015, yields of government securities declined substantially. The decline in yields is not specific to government securities but can also be observed among other fixed-income securities, such as corporate or covered bonds. Along with the government bond yields, the graph shows various unconventional monetary policy measures that are indicated by vertical lines. In June 2014 the deposit facility rate was lowered by 10 basis points into negative territory, i.e. to -0.10%. In September 2014 the first tender of the first TLTRO series was implemented, in January 2015 the APP was announced, and in March 2015 the APP was implemented. It is challenging to quantify how much of the yield decline between January 2014 and June 2015 was due to the specific unconventional measures, especially because, throughout 2014, there was a huge discussion among investors whether the ECB would announce an asset purchase program. [Appendix A.1](#) contains a compilation of newsletter articles highlighting speculation on the part of investors throughout 2014. As I want to capture this anticipation effects, in this paper I take the impact of monetary policy on asset prices as given by calculating the drop in yields between January 2014 and June 2015.

A further indication of the presence of a yield-induced rebalancing motive towards more credit supply is that granting credit becomes more attractive relative to security investments. Panel b of [Figure 1](#) illustrates the spread between the average interest rate that German banks charge on loans to the non-financial sector and the average yield of banks' securities portfolios. This figure increases over time, driven primarily by a decline in securities' yields which is stronger than the fall in interest rates on loans. This spread gives rise to the presence of a potential rebalancing motive towards more lending. In other words, panel b shows the change in the relative return of bank loans in terms of bond yields, which is a prerequisite for the existence of a rebalancing motive, whereby the compression of yields on securities held by banks induces them to invest in assets with a higher expected return, i.e. loans.<sup>10</sup>

The next piece of evidence is provided by panel c of [Figure 1](#), which depicts the evolution of the ratio of the average credit volume extended to the non-financial private sector in the numerator and the average nominal value of securities held by all German banks in the denominator. Similarly, this ratio, too, increases over time.

[Figure 1](#) provides first descriptive evidence in favor of a yield-induced portfolio rebalancing channel. This needs to be formally tested at the bank level to gauge the causal effect of unconventional monetary policy on bank lending and securities holding behavior.

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<sup>10</sup>One potential criticism of using this spread might be that the series increases because banks take on more risk in the credit portfolio (see, for example, [Borio and Zhu, 2012](#)). [Tischer \(2017\)](#) calculates a risk-adjusted spread based on loans underlying asset-backed securities in Germany for a similar time period and shows that the evolution of the risk-adjusted spread is similar to that of the unadjusted spread.

### 3.3 Empirical Strategy

The identification strategy exploits differences in banks' exposure of their securities portfolio to unconventional monetary policy measures. To this end, I construct a bank-level variable indicating by how much the average yield of the securities portfolio declined between 2014:M1 and 2015:M6 in the following way. I consider fixed-income securities, as they account for more than 95% of all securities holdings of German banks. Furthermore, debt securities are most comparable in terms of their structure to bank loan contracts. Therefore, a rebalancing motive into more loan supply should be most pronounced for this asset class. For each security I calculate by how much its yield declined between 2014:M1 and 2015:M6. I exclude all securities that mature in this time window in order to rule out the possibility that my final variable picks up any mechanical change in yield stemming from a possible pull-to-par effect<sup>11</sup>. Finally, I weight each security by its nominal amount. I label the resulting variable "MP", which denotes monetary policy.

Holding the composition of securities fixed at its level in January 2014, well before investors started to anticipate the asset purchase program,<sup>12</sup> I can rule out any endogeneity stemming from reverse causality. Additionally, by calculating the drop in yield between 2014:M1 and 2015:M6 irrespective of whether the security is actually still held in 2015:M6 helps me to prevent endogeneity arising from the decision by banks to sell a security due to unconventional monetary policy. The choice of June 2015 as the end date of the window for the yield decline calculation is driven by the following trade off decision. First, enlarging the window, such as choosing 2015:M12 as the end date, would result in a smaller fraction of securities that are actually still held at the end date. Second, picking a smaller window, e.g. 2014:M12 as the end date, would result in capturing a smaller amount of unconventional monetary policy measures.<sup>13</sup> Nevertheless, in [Section 4.3](#) I show that results are robust to choosing 2014:M12 as the end date of the window for the yield decline calculation.

Although yields might have declined for reasons other than unconventional monetary policy, I follow [Albertazzi et al. \(2018\)](#) and argue that both anecdotal evidence (see [Appendix A.1](#)) and the empirical literature (e.g. [Altavilla et al., 2015](#)) demonstrate that the announcement and anticipation of the APP by financial market participants was the

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<sup>11</sup>Pull-to-par describes the situation that the bonds price will gradually converge to par when maturity approaches.

<sup>12</sup>To my knowledge, the first newsletter article that mentions speculation about an asset purchase program was published in March 2014 (see [Appendix A.1](#)).

<sup>13</sup>The APP was implemented in March 2015. I choose June 2015 to also capture some of the effects of the actual implementation of the APP on yields.



most important driver of asset prices in the eurozone in the period examined in this paper.<sup>14</sup>

**Summary Statistics** Table 1 shows the summary statistics of all variables used in the empirical analysis. Most importantly, the MP variable is characterized by substantial cross-sectional variation. While the securities portfolio of the lower quartile bank faced a decline of 0.47 percentage points, the average decline in yields of the upper quartile bank was 0.79 percentage points. The ratio of maturing securities to total assets also displays considerable cross-sectional variation: the lower quartile bank has securities that mature between 2014:M1 and 2015:M6 accounting for 1.5% of the total balance sheet, while this figure amounts to 4.7% for the upper quartile bank. Interestingly, the median bank holds approximately 17% of its total assets in fixed income securities and for the lower quartile bank the figure is at approximately 10%. This illustrates that the banks in my sample are characterized by a fairly large fraction of fixed-income securities on the asset side of their balance sheet.

Table 2 displays additional descriptive statistics. Given the total securities holdings in 2014:M1 the table shows that 62% of these securities were still held in 2015:M6, whereas 22.5% were maturing and 15.5% were sold in between. It is crucial to emphasize that banks would not have a rebalancing motive if they held all assets until maturity, as, in this case, their eventual yield would be determined at the moment of the security's purchase. However, as Table 2 shows, banks are selling a substantial fraction of their overall securities. Additionally, they face reinvestment decisions whenever a security matures. Thus, it is an empirical question whether they continually target a specific yield level and whether the change in relative price between book credit and securities drives their granting of credit and their security holdings decisions.

**Credit Analysis** To assess the yield-induced impact of unconventional monetary policy on bank lending, i.e. Hypothesis (i), I employ a difference-in-differences (DID) approach and run the following bank-level regression (**Baseline Model 1**):

$$\Delta \text{Log}(\text{loans})_i = \beta_0 + \beta_1 * MP_i + X_i' \beta_2 + \text{Banktype FE} + u_i, \quad (1)$$

where  $i$  denotes a bank. The dependent variable  $\Delta \text{Log}(\text{loans})_i$  is the change in the logarithm of newly issued loans around the yield decline. To avoid problems of serial

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<sup>14</sup>The anticipation effect on yields of securities makes it challenging to quantify how much of the overall yield decline was due to monetary policy. Considering only securities that were eligible under the APP would introduce an endogeneity concern as the eligible assets were determined on the announcement date of the APP, which was in January 2015, i.e. one year after January 2014.

correlation, I follow [Bertrand, Duflo, and Mullainathan \(2004\)](#) and collapse the monthly observations into pre- (2013:M1-2013:M12) and post- (2015:M1-2015:M12) event averages. Thus, I have one observation for each bank. The alternative to collapsing the data is two-way clustering of the standard errors (see below). The key variable of interest is  $MP_i$ . Control variables are denoted by  $X_i$ . Following the bank lending literature ([Kashyap and Stein, 2000](#))  $X_i$  includes the logarithm of total assets, the equity to assets ratio, and the return on assets. I include the central bank reserves to assets ratio in order to control for any potential sales of securities by the bank to the central bank in the context of the APP and to control for a possible reserve-induced transmission channel ([Kandrac and Schlusche, 2016](#)). The deposit to assets ratio controls for another liquidity-driven transmission channel operating through deposits ([Butt et al., 2014](#)). I further include an interbank lending to assets ratio in order to control for the funding situation of the bank, and the net interest margin to control for the profitability and the importance of credit business. Additionally, bank-type fixed effects (i.e. savings banks, cooperative banks, Landesbanks, big commercial banks, regional banks) are included in the regressions. In this collapsed regression Model 1 all control variables are measured before the yield decline in December 2013. Finally,  $u_i$  is an error term. The coefficient  $\beta_1$  measures the treatment effect of the monetary policy induced yield decline.

As an alternative specification to Model 1, I estimate the following panel equation (**Model 2**):

$$\text{Log}(\text{loans})_{i,t} = \alpha_i + \alpha_t + \alpha_1 (MP_i * POST_t) + X'_{i,t} \alpha_2 + u_{i,t}, \quad (2)$$

where  $\alpha_i$  are bank fixed effects and control for bank-specific time invariant unobserved characteristics.  $\alpha_t$  denote time fixed effects and control for different economy wide developments that change over time.<sup>15</sup> Note that a country-wide change in loan demand is absorbed by the time fixed effects. The dependent variable  $\text{Log}(\text{loans})_{i,t}$  is the logarithm of newly issued loans and  $POST_t$  is a dummy variable that takes the value of one after 2015:M1. The model is estimated with monthly data for the period 2013:M1 until 2015:M12. Time-varying control variables are denoted by  $X_{i,t}$  and include the same variables as above. I follow [Bertrand et al. \(2004\)](#) and avoid problems of serial correlation of the error term by twoway clustering the standard errors at the bank and time levels ([Petersen, 2009](#)) instead of collapsing the data as in Model 1. The key variable of interest is the interaction term  $MP_i * POST_t$ , as I am interested in the differential effect of banks with a large decline in yields versus banks with a low decline in yields comparing the

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<sup>15</sup> Among others, the time fixed effects control for conventional monetary policy, i.e. the main refinancing (MRO) rate of the Eurosystem, as well as economy-wide shock.

pre-MP period (2013:M1-2013:M12) relative to the period after the MP-induced decline in yields (2015:M1-2015:M12). In other words, the coefficient  $\alpha_1$  measures the treatment effect of the monetary policy-induced decline in yields.

**Securities Analysis** To analyze whether banks reduce their security holdings and realize the valuation gains stemming from unconventional monetary policy, i.e. Hypothesis (ii), I estimate the following econometric model at the *security-bank-month* level:

$$\begin{aligned}
\text{Log}(\text{security holdings})_{j,i,t} = & \gamma_1 (MP_i * POST_t * \text{Large-yield-decline}_j) \\
& + \gamma_2 (MP_i * POST_t) \\
& + \gamma_3 (POST_t * \text{Large-yield-decline}_j) \\
& + \gamma_4 (MP_i * \text{Large-yield-decline}_j) \\
& + X'_{i,t}\gamma_5 + \gamma_{j,t} + \gamma_{i,t} + u_{j,i,t},
\end{aligned} \tag{3}$$

where the dependent variable is the logarithm of nominal holdings of security  $j$  by bank  $i$  at month  $t$ .  $X_{i,t}$  includes the bank-specific, time-varying control variables from above.  $POST_t$  is a dummy variable that takes the value of 1 after 2015:M1.  $\text{Large-yield-decline}_j$  is a dummy variable that takes the value of one if a security has a large drop in yield between 2014:M1 and 2015:M6, i.e. when the security is above the 90th percentile of all securities. The model is estimated for the period 2013:M1 until 2015:M12.

For identification, in the strongest specification I include security\*time fixed effects to control for any security-specific time varying observable or unobservable characteristics (e.g. liquidity, risk, issuance amount) and bank\*time fixed effects to control for any bank-specific time-varying observable or unobservable characteristics. In some regressions I am interested in the interaction between  $MP_i$  and  $POST_t$ . I include security, bank, and time fixed effects, or security\*time fixed effects along with bank fixed effects and time-varying, bank-specific control variables in the regression in this case, as otherwise the interaction term would be absorbed by the bank\*time fixed effects. I cluster standard errors at the bank, security, and time levels.<sup>16</sup> The estimated coefficient  $\gamma_2$  then measures the overall securities holdings of banks more affected versus banks less affected before versus after the monetary policy-induced yield decline. The estimated coefficient  $\gamma_1$  measures the differential securities holdings of securities with a large decline in yield by banks more versus banks less affected by monetary policy before and after the unconventional monetary policy-driven decline in yields.

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<sup>16</sup>Results also hold when clustering at the security and bank level.

**Parallel trend assumption** The key identifying assumption is that treatment intensity is unrelated to other bank characteristics which might influence a bank’s lending behavior. In other words, the trends related to granting loans need to be the same among the more and less treated banks before the treatment happens. [Figure 2](#) provides a first test of this assumption. The sample is divided into banks experiencing a large and low drop in yields, respectively, according to the median of the MP variable. Before January 2014 the evolution of new loans looks comparable. In line with the hypothesis of the paper, starting in the middle of 2014 banks more affected by the monetary policy-induced decline in yields increase their new loans much more strongly than less affected banks. This development continues throughout 2015.

In a next step, I assess whether the MP variable can be predicted by various (pre-shock) bank-level characteristics. Column 1 of [Table 3](#) shows the results of a probit regression of the MP dummy on these characteristics. No variable has explanatory power for the treatment status and also the p-value of the  $\chi^2$  test of overall model fit shows that one cannot reject the null hypothesis that all coefficient estimates are zero. Nevertheless, as the p-value is close to the 10% significance level and given the pre-shock evolution of newly issued credit shown in [Figure 2](#), in a careful attempt to ensure that my results are not biased by the potentially endogenous determination of securities holdings (with a large yield-drop), I perform a nearest-neighbor propensity score weighting approach. In a first step, I divide my sample according to the median of the MP variable and regress the resulting treatment status on the pre-shock bank-level characteristics. The propensity scores (predicted values) of this probit regression are used in a nearest neighbor propensity score matching approach with replacement. For each bank out of the group with a large yield drop a control unit is selected out of the "low-yield-drop" group that gives the best match according to the propensity score. In a second step, I use the resulting weights that are calculated based on the frequency of a match in my regressions. This way I discard the observations that are very dissimilar to the "treated" banks by giving them a low weight. Column 2 of [Table 3](#) displays the results of the probit regression with the matched sample. Compared to column 1, the p-value of the  $\chi^2$  test of overall model fit increases to 0.726, which indicates the satisfactory performance of the weighting exercise. I report results based on this matched sample in columns 2 and 4 of [Table 4](#).

## 4 Results

### 4.1 Credit Analysis

Table 4 reports the main estimation results for the credit regressions to test Hypothesis (i). Columns 1 and 2 show the results of the collapsed baseline model 1, where the dependent variable is the change of the logarithm of newly issued loans of bank  $i$  between the pre event average (2013:M1-2013:M12) and the post event average (2015:M1-2015:M12). Bank-type fixed effects are included. The coefficient estimate of the MP variable is statistically significant at the 1% significance level. The positive sign is in line with the presence of a yield-induced rebalancing motive: Banks experiencing a larger average yield decline of their securities portfolio induced by expansionary unconventional monetary policy increase their real sector lending more strongly in response. To illustrate the economic impact of the effect let's consider the coefficient of the MP variable in column 1, which shows the results in a sample without propensity score weighting. A bank with a one standard deviation decrease of the average yield (0.41) of its securities portfolio increases the average newly issued loans by 8.8% between 2013 and 2015 as compared to a bank without such decrease in yield.

In column 2, I report the results with the weighted sample based on the propensity score matching procedure described above. The coefficient in column 2 is only slightly smaller as compared to the unmatched sample. This indicates that it is unlikely that my results in the unmatched sample in column 1 are biased by the potentially endogenous determination of security holdings (with a large yield-drop).

Next, in columns 3 and 4, I present results for model 2, where instead of taking pre and post event averages, the regression is performed using monthly observations with standard errors clustered at the bank and time level. As the dependent variable is the natural logarithm of newly issued loans, the coefficient estimate in column 3 suggests that banks with a decrease of the average yield in their securities portfolio by one standard deviation (0.41) on average increase their newly issued loans by 4.8% between 2013 and 2015 as compared to banks without such decrease in yields. Compared to model 1, the lower magnitude of the effect might be driven by the control variables. Whereas in model 1 the bank-specific control variables are measured before the monetary policy induced yield decline (2013:M12), model 2 includes the time varying values. As before, the coefficient estimate is only slightly changed when using the weighted sample (see column 4). Therefore, for the ease of exposition, in all subsequent regressions I report the results with the unweighted sample.

**Heterogeneities: Maturing Assets** The main hypothesis analyzed in this paper is that banks facing a stronger compression of yields rebalance their portfolio towards alternative assets with a higher expected return. This effect should be particularly strong for banks that hold many maturing securities. Once a security matures and additional liquidity is released, the bank has to make a reinvestment decision. Hence, the yield-induced portfolio rebalancing effect towards loans to non-financial companies and households should be particularly strong for banks with many maturing assets that simultaneously undergo a sharp decline in yields in their securities portfolio. These banks might increase their credit granting more strongly in order to restore the targeted yield of their securities portfolio.

In [Table 5](#), I test for this incentive by exploiting the heterogeneity given by the amount of securities that mature between 2014:M1 and 2015:M6 for identification.<sup>17</sup> In column 2 I incorporate the maturing assets ratio along with an interaction term between MP variable and the maturing assets ratio into the regression model 1. I proceed in the same way in column 4 for model 2. As expected, in both cases the interaction term is positive and statistically significant. This means that the treatment effect is larger for banks with a larger maturing assets to total assets ratio. In both models the coefficient estimates of the MP variable remain positive and significant. The marginal effect of the MP variable depending on the maturing-assets-ratio is depicted in [Figure 3](#). Thus, the results seem to confirm the above conjecture that banks facing reinvestment decisions due to many maturing securities increase their (higher yielding) credit granting when they are more severely affected by the monetary policy-induced decline in yields. These findings seem to be in line with banks targeting a specific yield level for their total assets. Furthermore, these findings are consistent with the results in [Tischer \(2017\)](#).

**Heterogeneities: Equity** Now, I turn my attention to analyzing whether the effect of unconventional monetary policy is stronger for weakly capitalized banks. In the presence of funding constraints the monetary policy induced-valuation gains on securities held by banks can potentially improve the banks' capital position and, consequently, their credit-bearing capacity. [Table 6](#) tests for this mechanism. The regression setup remains unchanged from above with the exception that an interaction term between the MP variable and the equity-ratio is included in the regression. Intuitively, because they face more frictions, worse capitalized banks should profit more by the valuation gains as opposed to well-capitalized banks: they are more likely to be constrained by their capital position and they have more problems in attracting funds. Hence, if this form of equity mechanism is

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<sup>17</sup>The maturing-assets-ratio is calculated based on the securities portfolio in 2014:M1.

at work, one would expect a stronger effect of the MP variable on bank lending behavior for banks with a lower equity to assets ratio. The coefficient estimates of the interaction term between the MP variable and the equity ratio is not statistically different from zero in either model. Thus, I do not find evidence for the above conjecture.

**Heterogeneities: Sectors** So far, I have focused on total lending to the private non-financial sector. An interesting question is which sectors receive the additionally issued loans. [Table 7](#) contains the results of regressions with the dependent variable split into loans to non-financial corporations (columns 1 and 3) and loans to households (columns 2 and 4). The results do not show any difference in granting loans to any of the two sectors. Accordingly, both, the non-financial corporations and the household sector face higher loan granting.

**Contaminating Events** One potential concern regarding the identification strategy implemented in this paper is that one of the unconventional monetary policy measures potentially affecting banks through other non-yield-induced channels might be both correlated with the MP variable and linked to banks' lending behavior. One such measure are the Targeted Longer Term Refinancing Operations (TLTROs), which were implemented between December 2014 and March 2017, i.e. during most of the time period analyzed in this paper. The main aim of the TLTROs was to provide banks with liquidity under favorable conditions in order to foster the supply of credit. These refinancing operations have a maturity of up to four years. The amount that a bank is allowed to draw in the numerous tender operations and the interest rate it has to pay for the central bank money are linked to the bank's newly issued loans.

In an initial attempt to eye-ball whether the potential contamination of the TLTROs might bias my results, in panel a of [Figure 4](#) I use data on bank-specific TLTRO uptakes to show the average TLTRO uptake as a fraction of total assets of the two groups of banks divided according to the median of the MP variable. The evolution of the TLTRO ratio is mostly parallel for the two groups, which is a first indication that banks with a larger decline in yields do not use the TLTROs more extensively than banks with a lower decline in yields. Next, in [Table 8](#) I run regressions, where I explicitly control for the bank specific TLTRO uptakes.<sup>18</sup> All previous results hold. Thus, the results suggest

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<sup>18</sup>I use the empirical specification of model 2 in this case because model 1 includes control variables measured in 2013:M12 and the TLTROs were initiated in late 2014. An alternative to reporting the results with the additional control variable separately would be to directly include it in the main specification. However, in this case the TLTRO-ratio could only enter model 2. To ensure comparability of estimates stemming from the model choice and not from different control variables, I chose to report results separately in [Table 8](#).



that the monetary policy-induced yield decline is not simply proxying for TLTRO uptakes. This indicates that my results do not seem to be driven by alternative liquidity-driven transmission channels but rather capture yield-induced rebalancing motives.

Apart from the TLTROs, further potentially contaminating events are the actual purchases of securities by the central banks of the Eurosystem in the context of the APP. When a bank sells eligible securities on behalf of its depositors, the bank's total central bank reserves on its asset side as well as its saving deposits on its liability side might increase. This increase might disturb the bank's optimal balance sheet composition. In order to reinstall the original composition, banks might seek to increase their loan supply. This argument has been made by [Friedman and Schwartz \(1963\)](#) and has recently been empirically tested by [Kandrac and Schlusche \(2016\)](#). In addition to controlling for the deposit-to-assets ratio and the reserves-to-asset ratio in all regressions, panels b and c of [Figure 4](#) show the evolution of those variables for the two groups of banks. Although the central bank reserves ratio increases sharply starting at the beginning of 2015, banks with a larger drop in yields do not face a larger increase compared to banks with a small drop in yields. Similarly, there is no differential pattern for the evolution of the deposit-to-assets ratio. Thus, the MP variable does not proxy for this reserve-induced portfolio rebalancing effect.

## 4.2 Securities Analysis

This section investigates whether banks more affected by the unconventional monetary policy reduce their overall securities holdings and realize the gains from holding securities with a large decline in yields (Hypothesis ii). Before conducting a detailed analysis [Figure 5](#) shows the evolution of the securities-to-total-assets ratio of banks more and less affected by monetary policy. Banks more affected reduce their nominal overall security holdings throughout 2014 and 2015, whereas banks less affected by the decline in yields do not adjust their securities portfolio. A similar pattern emerges when examining the fraction of securities with a large decline in yield to total assets in [Figure 6](#). The Figure shows that banks more affected by the monetary policy-induced decline in yields decrease their holdings of securities with the highest valuation gains. Banks with a lower average decline in yields do not reduce their holdings of these securities.

A more formal analysis, i.e. the results of estimating Equation (3), is presented in [Table 9](#). Column 1 shows that banks more affected by unconventional monetary policy reduce their overall nominal securities holdings after the shock. Economically, banks with a one standard deviation drop in the average yield of their securities portfolio reduce their

overall holdings of securities by approximately 5.5% ( $0.41 \cdot (-0.133)$ ). In column 2 I add security\*time fixed effects and find similar results in terms of significance and magnitude. Banks more affected by monetary policy decrease their security holdings by 5.1%. In column 3 I add the triple interaction term between  $MP_i$ ,  $POST_t$ , and *Large-yield-decline<sub>j</sub>* along with all other double interaction terms between those three variables. I find that after the monetary policy-induced decline in yields, banks more affected by monetary policy (i.e. with a one standard deviation decline) reduce their holdings of securities with the largest decline in yield by 5.6%. The coefficient of  $MP_i \cdot POST_t$  remains largely unchanged in column 3. In columns 4 and 5 I successively saturate the econometric model with bank\*time and security\*time fixed effects. The coefficient estimates of the triple interaction term remain qualitatively similar. All in all, the results suggest that banks more affected by monetary policy reduce both, their overall securities holdings and the holdings of those securities that had the largest drop in yield, realizing the gains from these securities.

Next, I investigate the type of securities that are reduced by banks which are more affected by unconventional monetary policy. Corporate bonds are most comparable in terms of their characteristics to book credit. An interesting question therefore is whether banks reduce their holdings of this particular asset class especially. To this end, I consider corporate bonds, government bonds, and other securities.<sup>19</sup> I repeat the same type of security holdings regressions for the different issuer sectors in Table 10, where I include security\*time fixed effects, bank fixed effects, and time-varying bank-level controls into the regression. Looking only at the size of the coefficient estimates, the results suggest that the rebalancing motive might be largest for corporate securities. However, one has to bear in mind that corporate bonds account for only a small fraction of overall banks' securities holdings.<sup>20</sup> In terms of nominal amounts, the largest reduction concerns the holdings of securities issued by financial institutions.

In unreported regressions I have investigated whether there is a differential heterogeneity in the securities holdings with respect to the equity ratio. I do not find evidence in favor of the hypothesis that banks with a low equity ratio reduce their securities holdings more strongly. One potential explanation might be that, outside times of crisis, equity does not constitute a constraint for comparatively well-capitalized German banks.

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<sup>19</sup>Those include mainly issues of financial institutions and, to a much smaller extent, of public sector entities like agencies etc.

<sup>20</sup>The fraction of the total nominal amount of corporate bonds held by the banks in my sample in 2014m1 amounts to 1.8% of the total securities portfolio.

Following [Albertazzi et al. \(2018\)](#), I have analyzed whether banks more affected by monetary policy rebalance towards securities with a higher yield.<sup>21</sup> I do not find evidence for this kind of rebalancing into higher yielding securities. Like [Albertazzi et al. \(2018\)](#), I argue that one possible explanation for this might be that yields were already so compressed in Germany that, given a home-bias, investing in securities with a relatively high yield would make it necessary to severely restructure the composition of the portfolio. This highlights the economic plausibility of my findings: given the relative price change between securities and bank credit, banks favor a rebalancing towards lending.

### 4.3 Robustness

So far, I have found the monetary policy-induced decline in yields to have significant effects on banks' lending and securities holding behavior. In this section, I test the robustness of these results. Most importantly, to test whether the MP variable picks up any other observable or unobservable traits that might be linked to banks' lending behavior, I run placebo regressions with a different timing of the dependent variable. I regress the change in the logarithm of newly issued loans between 2011 and 2013, i.e. in a period where the differential yield decline should have no effect on bank lending, on all control variables from above. Table 11 shows the results of this falsification exercise. As expected, the MP variable is not statistically significant and has the wrong sign in all regressions. This points towards the exogeneity of the MP variable. Hence, the change in lending outcomes observable in the period under investigation is most likely attributable to the fall in yields as opposed to an alternative observable or unobservable force.

I present additional robustness checks in Table A1 of the Appendix. First, I present results for a group of banks excluding large commercial banks and Landesbanken. Large commercial banks might hedge their interest rate risk exposure.<sup>22</sup> Results remain qualitatively unchanged, which means that the effects are not driven by the behavior of this particular banking group.

Second, I show results for an alternative dependent variable. Instead of newly issued credit, in column 2 of Table A1 I use the outstanding stock of credit as an outcome variable. The previous results hold. As expected, the magnitude of the effect is reduced in this case because the credit stock includes maturing assets, which might lead to a smaller increase in this variable as opposed to the amount of truly newly issued loans.

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<sup>21</sup>This can be tested by the inclusion of an interaction term between  $MP_i$ ,  $POST_t$ , and the time varying yield of the security  $yield_{j,t}$  in the security-level regression equation 3.

<sup>22</sup>[Hoffmann, Langfield, Pierobon, and Vuillemeys \(2017\)](#) show that large european banks use derivatives to reduce their risk exposure by one quarter on average.

Looking at the coefficient of the MP variable in column 2 of [Table A1](#), banks with a one standard deviation decrease in the average yield (0.41) of their portfolio increased their outstanding stock of credit by approximately 3% between 2013 and 2015.

Column 3 of [Table A1](#) shows results with a dummy variable instead of the continuous MP variable. The dummy takes the value of 1 for banks with a yield drop above the median of the MP variable distribution. The baseline result remains qualitatively unchanged.

Next, to further highlight the economic plausibility of my results, in column 4 of [Table A1](#) I weight the MP variable with the securities-to-assets-ratio. The rebalancing motive should be larger for banks that hold a larger fraction of yield-decreasing securities relative to their total balance sheet. As expected, this robustness check indicates that the size of the securities portfolio plays a role in the strength of the rebalancing motive.

To rule out the possibility that the results are driven by potential outliers or the level of winsorization applied to the outcome variable in all preceding regressions, I present the results of two additional specifications. In column 5 of [Table A1](#) I winsorize the MP variable at the 1% and at the 99%-levels of the distribution with little impact on the coefficient estimates. I report results without winsorizing the dependent variable in column 6. The findings are confirmed.

Next, instead of estimating an interaction term between the maturing asset ratio and the MP variable, I split the sample according to the median of the maturing assets to total assets ratio in columns 7 and 8. As expected, the statistical and economic significance is larger for banks with a higher maturing-assets-to-total-assets ratio. For banks with below-median maturing assets the coefficient estimate is still significant and positive. Additionally, the difference between the two coefficients of the two groups of banks (with a high or low maturing asset ratio) is also significant for both models.<sup>23</sup>

Eventually, I change the timing of the construction of the MP variable. Instead of calculating the decline in yields between January 2014 and June 2015, I choose a smaller time window, i.e. January 2014 until December 2014. Results are robust to this alternative timing and are displayed in column 9 of [Table A1](#). The coefficient estimate of the MP variable is somewhat smaller in this case. This makes sense economically, as yields declined further after December 2014.

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<sup>23</sup>The p-value of the two-sided t-test of the difference between the two coefficients (with 87 degrees of freedom, i.e. 102 observations-15 controls and fixed effects) is 3.9%. In both cases the t-statistic reads:  $(\hat{\beta}_1 - \hat{\beta}_2) / (\sqrt{se(\hat{\beta}_1)^2 + se(\hat{\beta}_2)^2})$ .

## 5 Conclusion

I have documented new stylized facts regarding the credit and security holdings of German banks. The change in the spread between the average interest rates that German banks charge on loans to the non-financial sector and the yield on securities that they hold increased during a time period of implementation of various unconventional monetary policy measures. At the same time, the volume of credit supplied also increased in relation to the nominal securities holdings.

Building on these stylized facts, in this paper I analyze the following questions: Given the change in relative prices between securities and credit, do banks facing a larger decline in yields in their securities portfolio induced by unconventional monetary policy measures supply more credit to the real sector? Do those banks also reduce their securities investments, thus, changing their portfolio allocation? And if so, are those banks selling the securities with the largest decline in yields, thus realizing valuation gains? Are the effects stronger for less capitalized banks?

The availability and combination of the securities register, bank balance sheet information, and, most importantly, data from monetary policy implementation, provides a comprehensive view on banks' balance sheets and facilitates answering the above questions.

I find that banks experiencing larger drops in yields in their securities portfolio seek to restore their targeted yield level by increasing their higher-yielding credit extension. This effect is particularly pronounced for banks with many maturing assets that have to make reinvestment decisions. At the same time, these banks reduce their security holdings and realize the gains from securities with a large decline in yield. My results suggest that banks actively rebalance their investments from the securities portfolio to the credit book, given the change in the relative price between credit and securities. Thus, this paper sheds additional light on how the transmission of unconventional monetary policy works at the bank level.

My results are informative for the current debate on the effectiveness of unconventional monetary policy. My paper highlights the importance of keeping hold of the impact of these measures on financial markets, as changes in relative prices between bonds and bank credit have implications for bank lending to the real sector.

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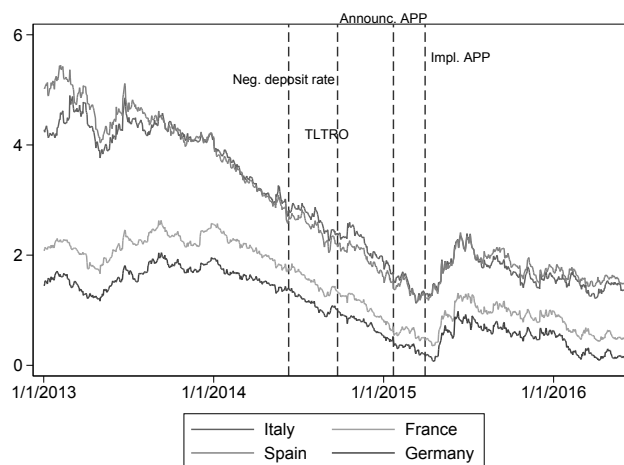
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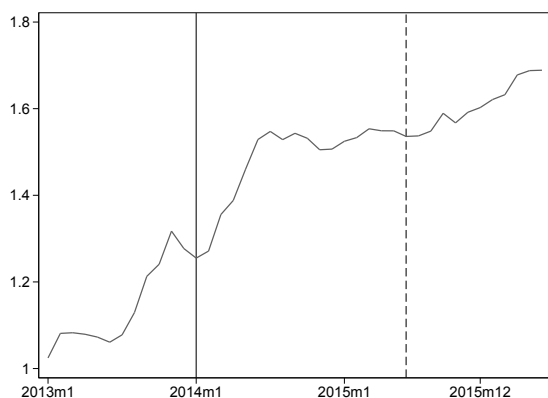
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# Figures and Tables



(a) Government Bond Yields

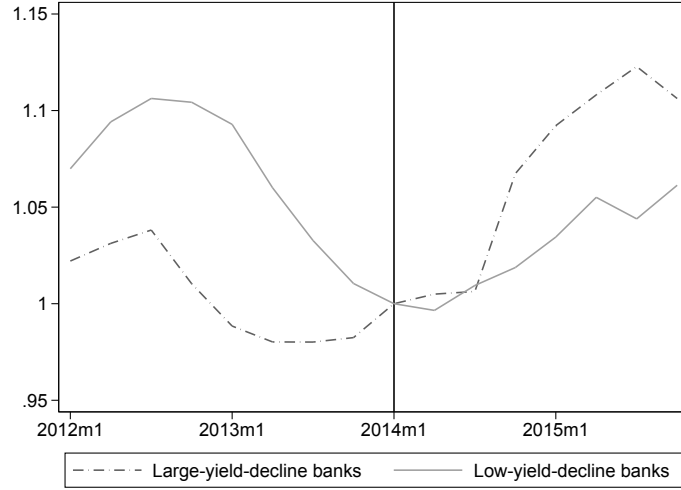


(b) Spread: Interest Rates

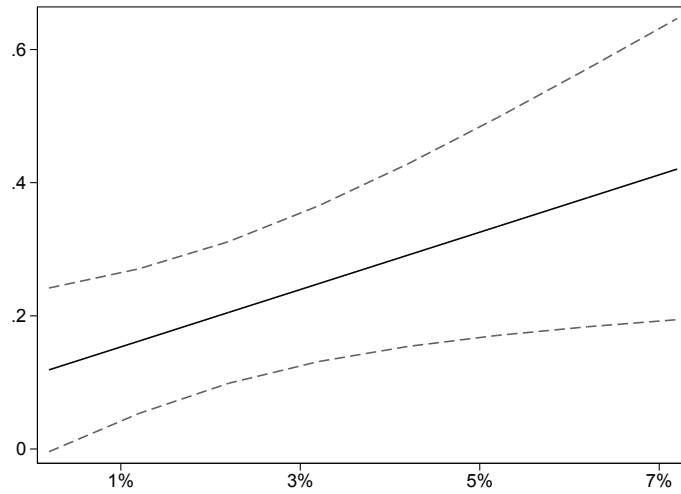


(c) Ratio: Volumes

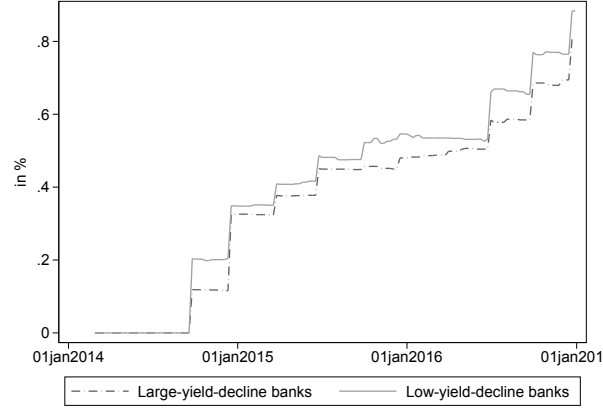
**Figure 1: Descriptive Evidence.** Subfigure 1a shows the evolution of the 10-year government bond yields of Italy, France, Spain, and Germany (%). Subfigure 1b shows the evolution of the spread between the volume-weighted interest rates charged by German banks on loans supplied to the non-financial private sector and the volume-weighted yields from their securities portfolio (moving averages). Subfigure 1c depicts the time series of the ratio of the volume of credit supplied by German banks to the non-financial private sector over the nominal value of the securities held by German banks.



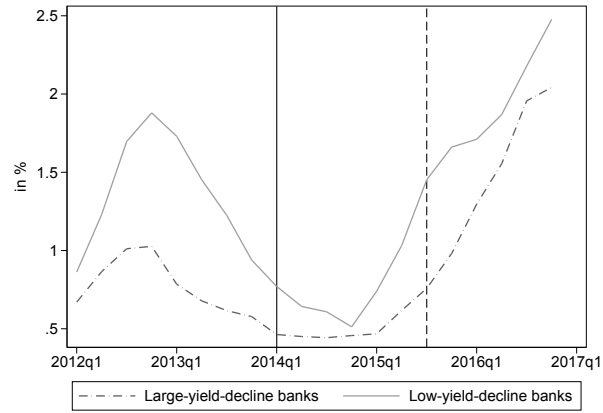
**Figure 2: Evolution of loan granting.** The Figure shows the evolution of newly issued loans over the period 2012:M1 until 2015:M12 (normalized to 2014:M1). The solid line refers to banks in the lower 50%-percentile of the MP variable, whereas the dashed line refers to banks in the upper 50%-percentile of this variable. The bold vertical line denotes 2014:M1, the month when the securities portfolio of the banks is selected for the construction of the MP variable. The graph depicts 4-month moving averages.



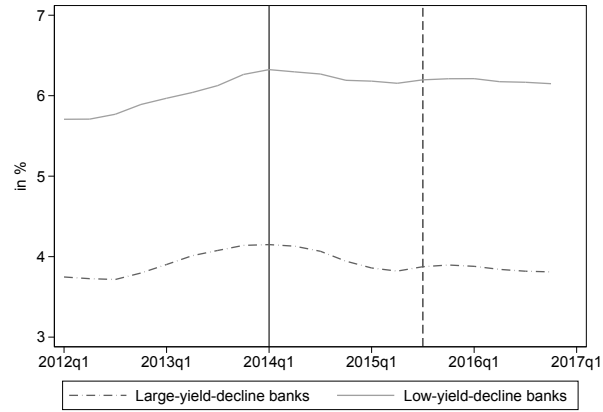
**Figure 3: Marginal Effect of the MP variable.** The Figure shows the marginal effect of MP variable depending on the maturing-assets-to-total-assets ratio based on the coefficient estimates of Table 5.



(a) TLTRO Uptake

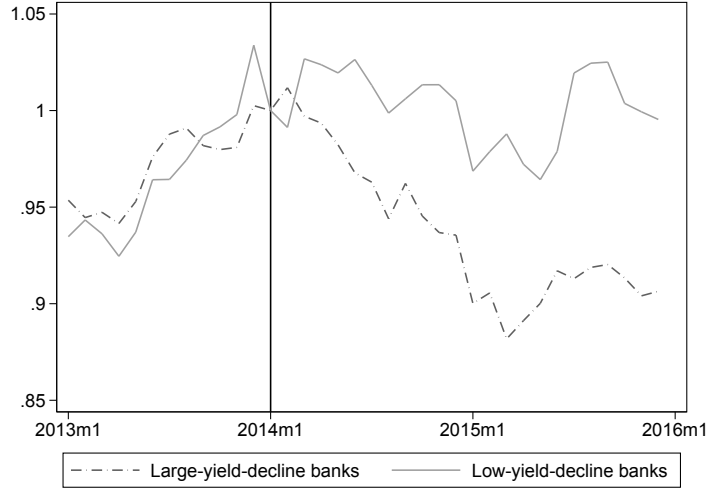


(b) Central Bank Reserves

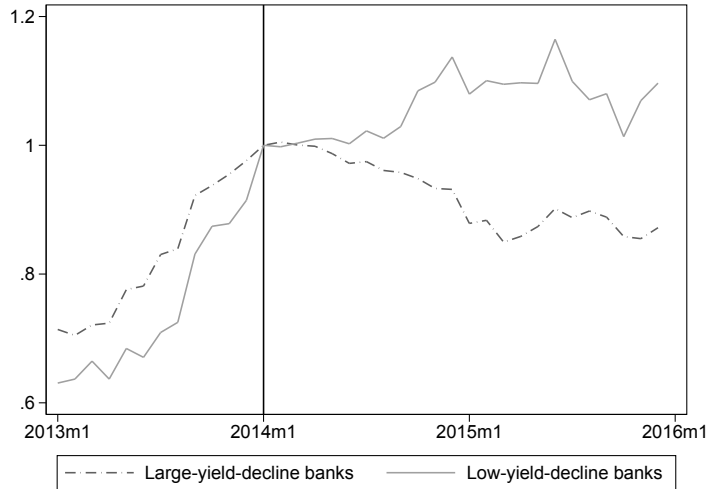


(c) Saving Deposits

**Figure 4: Contaminating Events.** Subfigure 4a shows the evolution of the ratio of the TLTRO uptake to total assets. Subfigure 4b depicts the ratio of reserves held at central banks to total assets, whereas Subfigure 4c shows the saving-deposits-to-assets ratio. The solid line refers to banks in the lower 50%-percentile of the MP variable, whereas the dashed line refers to banks in the upper 50%-percentile of this variable.



**Figure 5: Evolution of Security Holdings.** The Figure shows the evolution of the ratio of nominal security holdings to total assets over the period 2012:M1 until 2015:M12 (normalized to 2014:M1). The solid line refers to banks in the lower 50%-percentile of the MP variable, whereas the dashed line refers to banks in the upper 50%-percentile of this variable. The bold vertical line denotes 2014:M1, the month when the securities portfolio of the banks is selected for the construction of the MP variable.



**Figure 6: Evolution of Security Holdings with High Yield Decline.** The Figure shows the evolution of the ratio of nominal security holdings of securities with a large decline in yield to total assets over the period 2012:M1 until 2015:M12 (normalized to 2014:M1). The solid line refers to banks in the lower 50%-percentile of the MP variable, whereas the dashed line refers to banks in the upper 50%-percentile of this variable. The bold vertical line denotes 2014:M1, the month when the securities portfolio of the banks is selected for the construction of the MP variable.

Variable	Mean	SD	p25	p50	p75	Obs.
MP	0.627	0.410	0.468	0.615	0.791	204
Total securities / Assets	0.186	0.113	0.098	0.171	0.238	204
Maturing securities / Assets	0.038	0.036	0.015	0.029	0.047	204
<u>Credit: model 1</u>						
log(Assets) [in € th.]	16.003	1.279	15.117	15.621	16.604	204
Equity / Assets	0.066	0.026	0.047	0.065	0.079	204
Reserves / Assets	0.012	0.018	0.004	0.008	0.011	204
Interbank / Assets	-0.038	0.160	-0.114	-0.039	0.035	204
Deposits / Assets	0.651	0.215	0.589	0.728	0.794	204
Return on Assets	0.004	0.007	0.001	0.004	0.006	204
Net Interest Margin	0.018	0.009	0.013	0.019	0.022	204
$\Delta$ Log(loans) - new business*	0.109	0.345	-0.015	0.122	0.252	204
$\Delta$ Log(loans) - credit stock*	0.043	0.232	-0.038	0.028	0.105	204
<u>Credit: model 2</u>						
log(Assets) [in € th.]	16.007	1.294	15.117	15.625	16.597	7,173
Equity / Assets	0.068	0.025	0.051	0.068	0.082	7,173
Reserves / Assets	0.010	0.015	0.002	0.007	0.010	7,173
Interbank / Assets	-0.042	0.149	-0.111	-0.039	0.032	7,173
Deposits / Assets	0.656	0.213	0.611	0.731	0.794	7,173
Return on Assets	0.005	0.005	0.002	0.004	0.006	7,173
Net Interest Margin	0.018	0.009	0.013	0.019	0.022	7,173
TLTRO-Ratio (in %)	0.151	0.669	0.000	0.000	0.000	7,173
Log(loans) - new business* - [in € th.]	11.552	1.328	10.678	11.388	12.278	7,173
<u>Securities:</u>						
Log(security holdings)[in €]	14.78	2.69	13.18	15.43	16.81	1,463,750
Large-yield-decline	0.10	0.30	0.00	0.00	0.00	1,463,750
Post	0.35	0.48	0.00	0.00	1.00	1,463,750

**Table 1: Summary Statistics.** This table shows the summary statistics of the variables used in the empirical analysis. In the sample of model 1 of the credit analysis all level variables are measured in December 2013, i.e. prior to the monetary policy-induced decline in yields. Changes indicate the difference between the average for the pre-event period (2013:M1 to 2013:M12) and the average for the post-event period (2015:M1 to 2015:M12). The sample of model 2 of the credit analysis includes monthly observations for the time period analyzed in the regressions, i.e. 2013m1-2015m12. The sample of the security analysis includes monthly observations for the period 2013m1-2015m12. Variables denoted with \* are winsorized at the 1%- and 99%-level.

	Still held in 2015m6	Maturing before 2015m6	Sold
Nominal Amount	62.0%	22.5%	15.5%

**Table 2: Securities held in 2014:M1.** Given the securities held in 2014:M1, this table shows the fraction of securities that are still held in 2015:M6 and the fraction of securities that are sold between 2014:M1 and 2015:M6



	Probit: MP dummy (50th-percentile)	
	(1)	(2)
	Pre-matching	Post-matching
log(Assets)	0.101 (0.105)	0.122 (0.112)
Equity-Ratio	-3.490 (4.073)	6.373 (4.871)
Reserve-Ratio	-4.157 (5.918)	-1.015 (5.796)
Deposit-Ratio	0.030 (0.699)	0.952 (0.839)
Interbank-Ratio	-0.969 (0.671)	-0.655 (0.809)
ROA	15.936 (14.594)	24.198 (18.420)
Net Interest Margin	-12.985 (13.605)	-19.483 (25.226)
Observations	204	204
p-value	0.129	0.726

**Table 3: Propensity Score Weighting.** Column (1) of the table displays the results of a probit regression of the MP dummy (50th percentile) on various bank-level characteristics. Column (2) reports the same regression results for the weighted sample. Weighting is done according to the nearest-neighbor propensity score matching approach with replacement. The p-value refers to the  $\chi^2$  test of the joint significance of all variables. Robust standard errors are reported in parenthesis. \*\*\*, \*\*, and \* denote significance at the 1-, 5-, and 10%-levels respectively.

	Model 1: $\Delta \text{Log} (\text{loans})$		Model 2: $\text{Log} (\text{loans})$	
	(1)	(2)	(3)	(4)
MP	0.216*** (0.057)	0.177*** (0.043)		
MP * Post			0.116*** (0.042)	0.130*** (0.040)
log(Assets)	-0.004 (0.040)	-0.035 (0.039)	0.787*** (0.273)	0.818*** (0.263)
Equity-Ratio	-0.905 (1.581)	1.287 (1.910)	3.775** (1.661)	1.488 (2.057)
Reserve-Ratio	-2.967** (1.292)	-4.953*** (1.517)	-1.109* (0.575)	-1.873** (0.794)
Deposit-Ratio	0.085 (0.243)	-0.197 (0.285)	0.248 (0.530)	0.629 (0.592)
Interbank-Ratio	0.013 (0.185)	0.290 (0.199)	-0.393 (0.358)	-0.753 (0.476)
ROA	10.435** (4.149)	3.247 (3.457)	-0.511 (1.956)	0.026 (2.425)
Net Interest Margin	1.185 (2.481)	-2.090 (6.487)	6.772 (6.884)	0.340 (8.472)
Matching	pre-	post-	pre-	post-
Bank-type FE	YES	YES	-	-
Bank FE	-	-	YES	YES
Month FE	-	-	YES	YES
Two-way clustered S.E.	-	-	YES	YES
Observations	204	204	7,173	7,173
R-squared	0.180	0.184	0.930	0.930

**Table 4: Baseline Regressions.** Column 1 and 2 show the coefficient estimates of the baseline regression (1) pre-matching (column 1) and post-matching (column 2). The dependent variable denotes the change in the logarithm of the pre- (2013:M1-2013:M12) event average and the post- (2015:M1-2015:M12) event average of newly issued loans. All control variables are measured in December 2013 and include the logarithm of total assets, the equity-to-assets ratio, the reserves-to-asset ratio, the deposit-to-assets ratio, the interbank-to-assets ratio, the return on assets, the net interest margin, and bank-type fixed effects (e.g. Landesbanks, cooperative banks, saving banks, regional banks, big commercial banks, mortgage banks). Robust standard errors are reported in parentheses. Columns 3 and 4 show the coefficient estimates of the regression model 2. The dependent variable denotes the logarithm of newly issued loans for the time period 2013:M1 until 2015:M12. Post is a dummy variable taking the value of 1 after 2015:M1. All control variables are measured monthly. Bank and month fixed effects are included. Standard errors are two-way clustered at the bank and time levels and reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively.

	Model 1: $\Delta \text{Log} (\text{loans})$		Model 2: $\text{Log} (\text{loans})$	
	(1)	(2)	(3)	(4)
MP	0.216*** (0.057)	0.110* (0.064)		
MP * Maturing		4.308** (1.902)		
MP * Post			0.116*** (0.042)	0.084** (0.038)
MP * Post * Maturing				1.404* (0.737)
Controls	YES	YES	YES	YES
Bank-type FE	YES	YES	-	-
Bank FEs	-	-	YES	YES
Month FEs	-	-	YES	YES
Two-way clustered S.E.	-	-	YES	YES
Observations	204	204	7,173	7,173
R-squared	0.180	0.202	0.930	0.930

**Table 5: Reinvestment Decisions.** Columns 1 and 2 show the coefficient estimates of model 1. The dependent variable denotes the change in the logarithm of the pre (2013:M1-2013:M12) event average and the post (2015:M1-2015:M12) event average of newly issued loans. All control variables are measured in December 2013 and include the maturing-assets-to-total assets ratio (when interaction estimated), the logarithm of total assets, the equity-to-assets ratio, the reserves-to-asset ratio, the deposit-to-assets ratio, the interbank-to-assets ratio, the return on assets, the net interest margin, and bank-type fixed effects (e.g. Landesbanks, cooperative banks, saving banks, regional banks, big commercial banks, mortgage banks). Robust standard errors are reported in parentheses. Columns 3 and 4 show the coefficient estimates of model 2. The dependent variable denotes the logarithm of newly issued loans for the time period 2013:M1 until 2015:M12. Post is a dummy variable taking the value of 1 after 2015:M1. All control variables are time-varying. Bank and month fixed effects are included. Standard errors are two-way clustered at the bank and time levels and are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively.

	Model 1: $\Delta \text{Log} (\text{loans})$		Model 2: $\text{Log} (\text{loans})$	
	(1)	(2)	(3)	(4)
MP	0.216*** (0.057)	0.323** (0.142)		
MP * Equity		-1.938 (2.358)		
MP * Post			0.116*** (0.042)	0.120 (0.117)
MP * Post * Equity				-0.069 (1.830)
Controls	YES	YES	YES	YES
Bank-type FE	YES	YES	-	-
Bank FEs	-	-	YES	YES
Month FEs	-	-	YES	YES
Two-way clustered S.E.	-	-	YES	YES
Observations	204	204	7,173	7,173
R-squared	0.180	0.183	0.930	0.930

**Table 6: Heterogeneities: Equity.** Columns 1 and 2 show the coefficient estimates of model 1. The dependent variable denotes the change in the logarithm of the pre (2013:M1-2013:M12) event average and the post (2015:M1-2015:M12) event average of newly issued loans. All control variables are measured in December 2013 and include the logarithm of total assets, the equity-to-assets ratio, the reserves-to-asset ratio, the deposit-to-assets ratio, the interbank-to-assets ratio, the return on assets, the net interest margin, and bank-type fixed effects (e.g. Landesbanks, co-operative banks, saving banks, regional banks, big commercial banks, mortgage banks). Robust standard errors are reported in parentheses. Columns 3 and 4 show the coefficient estimates of model 2. The dependent variable denotes the logarithm of newly issued loans for the time period 2013:M1 until 2015:M12. Post is a dummy variable taking the value of 1 after 2015:M1. All control variables are time-varying. Bank and month fixed effects are included. Standard errors are two-way clustered at the bank and time levels and are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively.

	Model 1: $\Delta \text{Log}(\text{loans})$		Model 2: $\text{Log}(\text{loans})$	
	(1)	(2)	(3)	(4)
	Corporations	Households	Corporations	Households
MP	0.252*	0.197*		
	(0.149)	(0.100)		
MP * Post			0.107*	0.125***
			(0.055)	(0.039)
Controls	YES	YES	YES	YES
Bank-type FE	YES	YES	-	-
Bank FEs	-	-	YES	YES
Month FEs	-	-	YES	YES
Two-way clustered S.E.	-	-	YES	YES
Observations	204	204	6,511	6,969
R-squared	0.275	0.136	0.897	0.902

**Table 7: Sectors.** Columns 1 and 2 show the coefficient estimates of model 1. The dependent variable denotes the change in the logarithm of the pre (2013:M1-2013:M12) event average and the post (2015:M1-2015:M12) event average of newly issued loans to non-financial corporations (column 1) and households (column 2). All control variables are measured in December 2013 and include the logarithm of total assets, the equity-to-assets ratio, the reserves-to-asset ratio, the deposit-to-assets ratio, the interbank-to-assets ratio, the return on assets, the net interest margin, and bank-type fixed effects (i.e. Landesbanks, cooperative banks, saving banks, regional banks, big commercial banks, mortgage banks). Robust standard errors are reported in parentheses. Columns 3 and 4 show the coefficient estimates of model 2. The dependent variable denotes the logarithm of newly issued loans to non-financial corporations (column 1) and households (column 2) for the time period 2013:M1 until 2015:M12. Post is a dummy variable taking the value of 1 after 2015:M1. All control variables are time varying. Bank and month fixed effects are included. Standard errors are two-way clustered at the bank and time levels and are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively

	Model 2: <i>Log (loans)</i>	
	(1)	(2)
MP * Post	0.115*** (0.043)	0.081* (0.040)
MP * Post * Maturing		1.424* (0.738)
TLTRO-Ratio	0.005 (0.017)	0.008 (0.017)
Controls	YES	YES
Bank FEs	YES	YES
Month FEs	YES	YES
Two-way clustered S.E.	YES	YES
Observations	7,173	7,173
R-squared	0.930	0.930

**Table 8: Alternative Events: Controlling for TLTROs.** The Table shows the coefficient estimates of the regression of equation (2), where the dependent variable denotes the logarithm of newly issued loans for the time period 2013:M1 until 2015:M12. Post is a dummy variable taking the value of 1 after 2015:M1. All control variables are measured monthly and include the maturing asset ratio (when interaction estimated) the TLTRO-uptake over total assets, the logarithm of total assets, the equity-to-assets ratio, the deposit-to-assets ratio, the interbank-to-assets ratio, the return on assets, the net interest margin. Standard errors are two-way clustered at the bank and time level and are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels.

	Dependent variable: Log(security holdings)				
	(1)	(2)	(3)	(4)	(5)
MP*Post	-0.133** (0.049)	-0.124** (0.048)	-0.114** (0.045)		
MP*Large-yield-decline			0.468*** (0.160)	0.469*** (0.159)	0.473*** (0.161)
Post*Large-yield-decline			0.049 (0.042)	0.063*** (0.022)	
MP*Post*Large-yield-decline			-0.136*** (0.038)	-0.139*** (0.013)	-0.123** (0.047)
Controls	YES	YES	YES	-	-
Security FE	YES	-	YES	YES	-
Bank FE	YES	YES	YES	-	-
Time FE	YES	-	YES	-	-
Security*Time FE	NO	YES	NO	NO	YES
Bank*Time FE	NO	NO	NO	YES	YES
Observations	1,463,750	1,003,450	1,463,750	1,463,714	1,003,410
R-squared	0.754	0.519	0.754	0.756	0.524

**Table 9: Securities.** The dependent variable is the logarithm of securities nominal holdings by each bank  $i$  of security  $j$  during month  $t$  in the period January 2013 until December 2015. 'Post' is a dummy variable taking the value of 1 after 2015:M1 and zero otherwise. 'Large-yield-decline' is a dummy variable that takes the value of 1 if a security has a large decline in yield between 2014:M1 and 2015:M6 (i.e. above the 90th percentile of all securities) and zero otherwise. Fixed effects are either included (YES), not included (NO), or spanned by other fixed effects (-). A constant is included but its coefficient is left unreported. Standard errors are clustered at the bank, security, and time levels and are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively.



	Dependent variable: Log(security holdings)			
	(1)	(2)	(3)	(4)
	All	Corporates	Government	Other
MP*Post	-0.124** (0.048)	-0.315** (0.116)	-0.143* (0.084)	-0.061* (0.035)
Controls	YES	YES	YES	YES
Security FE	-	-	-	-
Bank FE	YES	YES	YES	YES
Time FE	-	-	-	-
Security*Time FE	YES	YES	YES	YES
Bank*Time FE	NO	NO	NO	NO
Observations	1,003,450	87,009	286,918	629,520
R-squared	0.519	0.564	0.471	0.533

**Table 10: Securities - Issuer Sector.** The dependent variable is the logarithm of securities nominal holdings by each bank  $i$  of security  $j$  during month  $t$  in the period January 2013 until December 2015. ‘Post’ is a dummy variable taking the value of 1 after 2015:M1 and zero otherwise. Fixed effects are either included (YES) not included (NO) or spanned by other fixed effects (-). A constant is included but its coefficient is left unreported. Standard errors are clustered at the bank, security, and time levels and are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively.

	Model 1: $\Delta \text{Log} (\text{loans})$		Model 2: $\text{Log} (\text{loans})$	
	(1)	(2)	(3)	(4)
MP	-0.034 (0.129)	0.023 (0.131)		
MP * Maturing		-2.626 (2.889)		
MP * Post			-0.054 (0.068)	0.013 (0.086)
MP * Post * Maturing				-3.013 (3.546)
Controls	YES	YES	YES	YES
Bank-type FE	YES	YES	-	-
Bank FEs	-	-	YES	YES
Month FEs	-	-	YES	YES
Two-way clustered S.E.	-	-	YES	YES
Observations	204	204	7,336	7,336
R-squared	0.232	0.239	0.877	0.877

**Table 11: Robustness: Placebo Regressions of Loan Growth 2013.** The Table shows the coefficient estimates of the regression of equation (1), where the dependent variable denotes the change in the logarithm of newly issued loans between the averages of 2011 (2011:M1-2011:M12) and 2013 (2013:M1-2013:M12) in columns 1 and 2. The Table also shows the coefficient estimates of the regression of equation (2), where the dependent variable denotes the logarithm of newly issued loans for the time period 2011:M1 until 2013:M12 in columns 3 and 4. Control variables include the maturing-assets-to-total-assets ratio (when interaction estimated), the logarithm of total assets, the equity-to-assets ratio, the reserves-to-assets ratio, the deposit-to-assets ratio, the interbank-to-assets ratio, the return on assets, the net interest margin, and bank-type fixed effects (e.g. Landesbanks, cooperative banks, saving banks, regional banks, big commercial banks, mortgage banks). Robust (model 1) and two-way clustered (model 2) standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%-, 5%-, and 10%-levels respectively.

# A Appendix

## A.1 Newsletter Articles

- Reuters 31.03.2014:  
*“...Speculation has also grown that it [ECB] may employ other easing measures such as...**U.S.-style bond-buying**. ECB President Mario Draghi suggested after the ECB’s March meeting that the bank will either do nothing or take bold action should the outlook deteriorate.”*
- Bloomberg 11.04.2014:  
*“Speculation is a big factor in the latest decline in bond yields in Spain, Italy, Portugal, and Greece. Bond prices rose another notch and yields fell after ECB President [Draghi] said the bank’s Governing Council was “unanimous” on exploring tools including **purchases of debt**, a European echo of the Federal Reserve’s quantitative easing (QE) program.”*
- The Daily Telegraph 29.07.2014:  
*“...investors are starting to price in quantitative easing by the ECB, which would entail **sovereign bond purchases** and potentially push yields lower.”*
- Financial Times 27.11.2014:  
*“Government borrowing rates across Europe fell to historic lows on Thursday as speculation grows that the central bank is on the brink of **buying large quantities of sovereign**.”*

## A.2 Additional Robustness Checks

	(1)	(2)	(3)	(4)	(5)
	Large banks omitted	Alternative Dependent Variable: Credit Stock	MP Dummy 50th Percentile	Weighted MP	Winsorized MP
MP	0.213*** (0.060)	0.075** (0.036)	0.112** (0.051)	1.015*** (0.315)	0.257*** (0.079)
Controls	YES	YES	YES	YES	YES
Bank-type FE	YES	YES	YES	YES	YES
Observations	189	204	204	204	204
R-squared	0.175	0.196	0.140	0.176	0.353
	(6)	(7)	(8)	(9)	
	No winsorization of credit	Low Maturing- Asset-Ratio	High Maturing- Asset-Ratio	Different MP variable Timing: 2014M1-2014:M12	
MP	0.247*** (0.076)	0.116** (0.057)	0.365*** (0.104)	0.187*** (0.069)	
Controls	YES	YES	YES	YES	
Bank-type FE	YES	YES	YES	YES	
Observations	204	102	102	204	
R-squared	0.360	0.140	0.341	0.156	
p-value (group difference)	0.039				

**Table A1: Additional Robustness Checks:** The table shows coefficient estimates of various robustness checks: In column 1 large commercial banks and Landesbanken are omitted from the regression. In column 2 the dependent variable is credit stock. Column 3 shows results with a dummy (above 50th percentile of MP) variable instead of the continuous MP variable. In column 4 the MP variable is weighted with the securities to asset ratio. Column 5 shows results after winsorizing the MP variable at the 1% and 99% levels. In column 6 the dependent variable is not winsorized. Columns 7 and 8 show results with a sample split according to the median of the maturing-assets-to-total-assets ratio along with the p-value of group difference. Column 9 shows the results with a different timing of the MP variable.