Does a Larger Menu Increase Appetite? Collateral Eligibility and Bank Risk-Taking*

Sjoerd Van Bekkum Marc Gabarro Rustom M. Irani

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Abstract

This paper examines the effects of non-traditional monetary policy tools on bank lending and risk-taking in the Netherlands. We focus on a change in the European Central Bank's collateral policy, which significantly lowered the rating requirement for eligible residential mortgage-backed securities (RMBS). Banks most affected by the policy change price mortgage originations at lower interest rates. These loans serve as collateral for newly-issued RMBS with lower-rated tranches and subsequently experience worse repayment performance. We find the deterioration of repayment performance is only present for loans with state guarantees, which suggests looser collateral requirements may lead to undesired credit risk transfer to the sovereign.

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*Van Bekkum (vanbekkum@ese.eur.nl) and Gabarro (gabarro@ese.eur.nl) are with the Erasmus School of Economics. Irani (corresponding author, rirani@illinois.edu) is with the College of Business at the University of Illinois at Urbana-Champaign. For helpful comments and suggestions, we thank Andreas Fuster, Steven Ongena, Richard Rosen, and seminar participants at the Erasmus School of Economics.

"Favoring illiquid collateral in the collateral framework may then lead to an overproduction of illiquid real assets" Nyborg and Östberg (2014)

In the wake of the 2007–2008 financial crisis, central banks around the world took dramatic steps to provide liquidity to financial intermediaries with the goal of stabilizing the financial sector and stimulating the economy. Such liquidity provision took place against collateral of lower quality as requirements loosened in response to deteriorating market conditions.[1,2] Central bank collateral policy and its potential distortionary impact on financial markets and the real economy has thus become a controversial aspect of monetary policy (Nyborg, 2015a,b).[3]

In this paper, we argue that the loosening of collateral policy has produced significant real effects in terms of bank lending and risk-taking decisions. Conceptually, when high quality collateral is scarce and constraints on collateralized borrowing in private funding markets bind, lower collateral requirements across (or broadening the scope of) eligible assets in central bank credit facilities can alleviate banks' funding constraints and increase lending (e.g., Koulischer and Struyven, 2014). Based on such reasoning, this paper empirically assesses the real effects of central bank collateral requirements on bank lending and risk-taking behavior.

We focus on the ECB's relaxation of criteria for collateral eligibility in response to dislo-

[1]Asset-backed securities and non-marketable assets made up the lion's share of collateral pledged in the Federal Reserve's lending facilities in 2008 and 2009. In contrast, before 2007 the Fed's open market operations centered on buying and selling of liquid government securities in line with Walter Bagehot's celebrated recommendation: "to avert crisis, central banks should lend early and freely (i.e., without limit) to solvent firms, against good collateral, at high rates" ("good collateral" is recognized as "everything which in common times is a good 'banking security'" (Bagehot, 1873; Bank of England, 2009).

[2]In Europe, the European Central Bank (ECB) removed credit rating thresholds for distressed government debt securities once private lenders refused to accept them as collateral (Drechsler et al., 2013). In the United States, the Federal Reserve began to accept illiquid asset-backed securities (ABS) in their credit operations once liquidity in private markets evaporated.

[3]Central bank collateral requirements that favor illiquid collateral may reduce discipline in money and asset markets, which could spill over to the real economy through an overproduction of illiquid real assets (Nyborg and Östberg, 2014).

cations in financial markets during the recent recession, which, in 2012, allowed residential mortgage-backed securities (RMBS) rated as low as BBB- to be eligible as collateral for the first time.[4,5] Our main hypothesis is that by lowering the eligibility requirements of RMBS, the ECB increased the liquidity of these securities. In turn, this relaxed the funding constraints of banks—particularly those more likely to pledge these assets in collateralized borrowing from the central bank—and indirectly lowered the cost of mortgage debt for households.

Our empirical tests are based on proprietary loan-level data for a large fraction of the mortgage market in the Netherlands. Our unique data set allows us to observe the terms of originations and subsequently track whether a given loan is securitized or retained on the balance sheet, as well as loan repayment performance. Our main empirical approach exploits both time-series and cross-sectional variation in the data using a difference-in-differences analysis around the ECB's decision to lower collateral requirements on RMBS. These decisions were unlikely to be driven by the state of the mortgage market or the behavior of banks in the Netherlands and therefore provide a plausibly exogenous shock. We exploit the granularity of our data to compare changes in banks' interest-rate setting, securitization activity, and risk-taking (defaults) within a postal code and origination month controlling for a host of loan, borrower, and bank characteristics.

In line with our main hypothesis, our findings are as follows. First, we find banks more likely to be affected by the lower collateral requirements—those more likely to pledge newly-eligible RMBS in collateralized borrowing from the central bank—increase the share of Class 2 and Class 3 rated assets in RMBS issuance following the policy change, as compared to the

[4]The ECB uses two types of credit operations, the main and long-term refinancing operations, to allocate funds of various maturities to commercial banks. A wide range of assets have been eligible as collateral for these operations, including several types of bonds (corporate, government, etc.). Before 2012, RMBS were eligible but these had to have a credit rating of at least AA-. See Section 1 for details.

[5]More precisely, the ECB began to accept Class 2 and 3 quality assets under their harmonized rating scale in their credit operations. Section 2.1 and Appendix B provide the necessary details.

period before and also to other banks. This gives us some confidence that the effect of the policy change operates through incentives to securitize. Turning to the loan-level analysis, we find that these affected banks price originations more competitively, reducing interest rates. The size of this reduction is large in terms of economic magnitudes: on average, affected banks reduce rates by about 5% of the mean (4.33%) and 30% of the standard deviation (0.66%) in the period following the rule relative to other banks.

We next examine the impact of collateral eligibility on securitization to better understand the mechanism underlying the results. We compare securitization patterns of mortgage loans originated in the period following the rule change and, in line with our main hypothesis, we find that affected banks are more likely to securitized originations with lower interest rates.

We analyze the repayment performance of these loans to assess whether the change in collateral requirements on RMBS led to a deterioration of underwriting standards or allowed banks to pursue investment opportunities without any increase in risk. Using our difference-in-differences regression framework with payment arrears as our dependent variable, we find evidence that the more competitive pricing strategy of the affected banks translates into a considerable deterioration in repayment performance.

In falsification tests, we show none of these results are present for small banks that are naturally more funding constrained nor was it present in the previous recession and thus unlikely to reflect cyclical differences in lending between banks.

We then explore heterogeneity among loans to further understand the change in behavior and two important results emerge. First, we rerun our analysis for a set of non-standard loans that are ex ante unlikely to be securitized. We find no difference in behavior between affected banks and other banks in terms of interest rates on originations as well as subsequent repayment performance. We interpret this finding as evidence that banks do not take additional risk in loans likely to remain on-balance sheet; reinforcing the empirical evidence in support of the securitization channel. Second, we examine loans originated with state

guarantees and find the worse repayment performance is concentrated among these loans. Loans originated without guarantees, on the other hand, tend to perform as well as similar loans originated by other banks. This latter finding suggests that additional bank risk-taking induced by the collateral policy change could spill over to the state through loan guarantees.

Overall, our results highlight an important channel for transmission of central bank collateral policy to the real economy. We interpret our findings as a decline in lending standards (or willingness to tolerate additional risk) in response to the greater incentives to securitize in order to capture the liquidity benefits of lower-rated RMBS. This additional credit risk is not compensated for, at least not in terms of direct interest payments from borrowers, and often ends up transferred to the state through loan guarantees. This latter effect suggests a potential undesirable consequence of this non-traditional monetary policy tool.

Our findings contribute to a recent literature on the financial and real outcomes of policy interventions during financial crises, particularly the outcomes of non-traditional central bank activities. Duchin and Sosyura (2014) show banks receiving equity capital injections as part of the Troubled Asset Relief Program increased risk-taking in the U.S. mortgage market. Drechsler et al. (2013) examine central bank borrowing and collateral pledged to the ECB from 2008 until 2011 and find evidence consistent with risk-shifting by banks. Foley-Fisher et al. (2014) show that the Federal Reserve's Maturity Extension Program increased valuations and long-term debt funding of corporations that traditionally relied on long-term debt. These authors conclude that the program may have helped to relax financing constraints for some firms. Acharya et al. (2015b) examine the bank deposit rates and corporate loan spreads, as well as subsequent real effects for firms, following the ECB's decision to switch to unlimited lender-of-last-resort lending on October 8, 2008 (see also, Acharya et al., 2015a). Fuster and Willen (2010) find a positive mortgage market reaction in terms of applications and originations for refinance mortgages in response to the Federal Reserve's $1.25 trillion large-scale asset purchase program from 2009 until 2010 (see also

Gagnon et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011).

The remainder of this paper is organized as follows. Section 1 describes the ECB's collateral framework and our basic hypothesis. Section 2 summarizes the data and the empirical approach. Section 3 presents the results. Section 4 concludes.

1 Institutional Setting and Theoretical Framework

In this section, we provide background on the ECB's collateral framework and also relate our analysis to the literature on collateralized borrowing and financial institutions. Our discussion is in the spirit of Nyborg (2015a,b) and references therein.

1.1 ECB Collateral Policy and the Dutch Mortgage Market

The ECB allocates liquidity to financial institutions through repurchase agreements, i.e., exchanging collateral for loans. As part of this process, the ECB uses a collateral framework consisting of a list of eligible securities that banks can post as collateral and corresponding "haircuts"—margins imposed on the collateral seller—that determine the amount that can be borrowed per unit of collateral. Typically, the ECB allocates a fixed quantity of liquidity through an auction taking place on a weekly basis and loans of maturities between one week and three months are granted.[6]

The ECB is authorized to change the list of eligible securities and haircuts. When European interbank lending market came under stress in 2008, the ECB started allocating liquidity to fully meet banks' demands ("full allotment"). In addition, the ECB began to accept AAA-rated RMBS as collateral. As the eurozone sovereign debt crisis unfolded and conditions in financial markets worsened, collateral eligibility requirements on RMBS were

[6]Before 2008, the ECB followed a "liquidity neutral allotment concept," whereby the total quantity of liquidity provided is determined by its assessment of the liquidity needs of the entire banking system (Acharya et al., 2015b).

further relaxed. As of December 2011, the ECB made single-A rated RMBS at issuance temporarily eligible as collateral (ECB, 2011/25). Shortly thereafter, in June 2012, the ECB made triple-B RMBS temporarily acceptable (ECB, 2012/11). These decisions were formally repealed and replaced on August 2, 2012, making single-A RMBS permanently eligible and keeping triple-B RMBS temporarily eligible (ECB, 2012/17). In September 2012, these temporary measures were once again extended and have since been in place and have no formal expiration date (Eberl and Weber, 2014).

In response to the ECB's change in collateral eligibility of RMBS, beginning in 2008 banks began to securitize mortgage loans and retain the newly-created RMBS *on their own balance sheets*, a process commonly referred to as "self-securitization" or "retained securitization." Its purpose is to increase the liquidity of assets on the balance sheet as illiquid mortgage loans are now replaced by RMBS that can be posted to the ECB when the bank experiences an adverse liquidity shock (Loutskina, 2011; Nyborg and Östberg, 2014). Recent data suggests that about two thirds of all issued RMBS are retained (AFME, 2014). Thus, such activity consumes a significant fraction of outstanding RMBS issuances in the eurozone, and represents an important liquidity management technique among some European banks.

This paper focuses on a change in the ECB's collateral policy and the response of domestic banks active in the mortgage market in the Netherlands. This is an attractive setting for our empirical analysis for at least three reasons. First, the ECB's decisions regarding collateral policy during this period were made at the Eurosystem level and directed towards the struggling economies of Portugal, Ireland, Italy, Greece, and Spain. It is therefore unlikely that the fundamentals or risk-taking opportunities of Dutch banks were central to the policy change. Second, banks play an important role in credit intermediation in the Netherlands: domestic credit provided by Dutch banks (excluding credit to the government) amounts more than 200 percent of GDP, and bank deposits are over 300 percent of GDP. Third, the extent of securitization activity is the highest in Europe, with the ratio of securitized assets to GDP

equal to 16.15 and 7.47 percent in 2007 and 2012, respectively (AFME, 2014).

The mortgage market in the Netherlands has some additional features worth noting at this point. Mortgage originators are typically banks and insurance companies. Mortgages are usually fixed rate with a maturity of 30 years and interest rates reset every 10 years. Lenders can repossess and sell properties by public auction without a court order. They also have full recourse to the borrower, whereby any leftover debt (after foreclosure) remains enforceable until fully discharged. Consequently, mortgage foreclosures amount to a mere 0.046 percent in 2013. Finally, high LTVs, often exceeding 100 percent, are the result of favorable interest deductibility from taxable income on the mortgage loan on a borrower's primary residence.

1.2 Conceptual Framework

The classic literature on credit constraints provides a connection between collateralized borrowing, asset prices, and investments (Bemanke and Gertler, 1990; Benanke and Gertler, 1989; Kiyotaki and Moore, 1997). Many of the same ideas also apply to repurchase transactions by financial institutions, where the form of collateral is a security, as opposed to physical asset or real estate. The basic conclusion of this work for the purpose of this paper is that the investment capacity of a firm is closely related to the net worth of collateral (i.e., after applying any haircuts).

In the context of financial institutions, Nyborg et al. (2002) find that the central bank's collateral framework affects the willingness of financial institutions to pay for liquidity. Indeed, Buiter and Sibert (2005) argue that haircuts in repurchase agreements with the central bank are inversely related to the secondary market prices of the underlying collateral (see also, Ashcraft et al., 2011). By distorting prices in money and assets markets changes collateral eligibility may influence the investment and lending decisions of financial institutions (Nyborg and Östberg, 2014). In particular, when haircuts on collateral are too small, over-

investment in the underlying real asset can arise (Chapman et al., 2011).

On the empirical front, Ashcraft et al. (2011) provide evidence consistent with collateral haircuts in Eurosystem operations impacting market values. Nyborg (2015a) shows that the proportion of ABS that is used as ECB collateral has increased from 5 to almost 30 percent moving from 2004 to 2008, and remained at 15 percent in 2013. Thus, these securities, which consist primarily of RMBS, have become increasingly attractive to use in collateralized borrowing with the ECB. Furthermore, as described above, looser eligibility requirements on RMBS have led to self-securitization becoming an increasingly common practice.

The significant changes in RMBS collateral eligibility criteria studied in this paper increases the liquidity benefits of self-securitization. Thus, our basic hypothesis is that financial institutions respond to the change in RMBS eligibility criteria by expanding lending—to attract new mortgage loans to serve as collateral in RMBS—through a lowering of mortgage interest rates.[7]

2 Data and Empirical Methodology

We now describe our data sources, construction our key variables, summary statistics, and our empirical methodology.

2.1 Data Sources and Sample Selection

In this section, we describe our data sources on mortgages and banks.

Our data on mortgage originations comes from a software engineering company based in the Netherlands. This company provides software that helps banks manage their loan portfolios. The software enables banks to identify pools of loans that they would like to

[7]Our paper is silent on whether relaxed collateral requirements are socially optimal or not. Intuitively, collateral can be expected to have a stabilizing effect (Ewerhart and Tapking, 2008; Heider and Hoerova, 2009). However, in principle, collateral could be destabilizing when it is combined with credit limits and shocks to asset values (Brunnermeier and Pedersen, 2009; Kiyotaki and Moore, 1997).

remove from their balance sheet. When this takes place through a securitization program, the software automatically generates periodic investor reports on performance and payments associated with the newly-created securities. These reports are generally issued at monthly or quarterly frequency. More recently, the software has begun facilitating compliance with the ECB's Loan-level Initiative to ensure that banks' securities are eligible as collateral in Eurosystem credit operations.[8] This requires transmitting detailed loan-level information on a regular basis in a standardized format provided by the ECB. When a bank first begins working with the company, all mortgage loans are read into the software program. These generally consist of two types of loans. First, loans retained on the balance sheet. Second, the set of securitized loans that have been removed from the balance sheet but remain in the system so that RMBS investor reports can be generated.

We download this data directly from the company, collecting loan data from banks' loan portfolios and RMBSs as of January 2014.[9] The data contain loan-, property-, and borrower-level identifiers, as well as related characteristics. These are loans to individuals for residential mortgages. The loan characteristics include the origination date, mortgage size, loan-to-value ratio, interest rate, payment type, purpose, and whether the loan has a state guarantee or not. The data also indicate whether the loan is currently in payment arrears or not.[10] The main property characteristic is its location (two-digit postal code) and no further information about the features of the property are given.[11] The borrower characteristics

[8]Loan level information has been required for RMBSs since January 2013; see `https://www.ecb.europa.eu/paym/coll/loanlevel/html/index.en.html`.

[9]We do not disclose the names or accounting information of any individual bank in our sample. Also, to ensure anonymity we were given permission to download complete loan data for a subset of banks.

[10]Arrears are measured at the end of the sample in January 2014. We do not observe loans in arrears (and eventual default) dropping out of our sample. This occurs for two reasons. First, reporting requirements of the Dutch Central Bank and the ECB's Loan-level Initiative, which require that the defaulted loans remain in the asset pool underlying RMBS. Second, the length of time to conduct a repossession in the Netherlands long relative to our event window. Finally, the national mortgage default rate during our event window is roughly the same as our in-sample default rate (less than 0.05%) confirming that sample selection is unlikely to be an issue.

[11]Postal codes in the Netherlands are longer, but for anonymity the data only show the first two digits.

include, for example, the primary income and employment status. The identifier of the originating bank is also provided, which we use to merge the mortgage data onto bank characteristics. We restrict the sample to loans with positive interest rates and non-zero mortgage balances after origination.

We focus on fixed-rate mortgage originations. The typical mortgage in the Netherlands is a 30-year fixed rate mortgage, comprising 81.33% of the sample. These fixed interest rate mortgages usually reset the interest rate every 10 years. No loan originated in our event window has been reset. Thus, the current interest rate as of January 2014 is a close approximation of interest rate at origination. In contrast, variable rate and hybrid rate mortgages (9.31 and 9.33% of the sample, respectively) have interest rates that depend on the reference rate, the reset periods, and other factors. Thus, our choice ensures the initial interest rate on the mortgage contract is correct and avoids potential ambiguities arising from resetting rates over the tenure of the loan.

Our second source of mortgage data is drawn from the European Datawarehouse (ED), the repository of all loan level information under the ECB's Loan Level Initiative.[12] The ED provides data under the same format as the software company for securitized loans that may be eligible collateral. This data identifies RMBS issuance as well as the characteristics described above for securitized loans. While the ED does not contain information on balance sheet loans, the ED provides snapshots of the data over time. We use the time series to form an approximation of the loan portfolio over time for a given bank. In particular, loans originated prior to securitization are assumed to be retained in the loan portfolio. We reconstruct the loan portfolio back to January 203, the beginning of the Loan-level Initiative. Thus, our second source covers the year 2013 only.

We obtain data on banks accounting variables and securitization activity from Bureau van Dijk's Orbis database and Concept ABS, respectively. Orbis provides balance sheet and

[12]These data are available at `https://eurodw.eu`.

income statement information collected from annual reports on Dutch banks from local registry filings. In terms of coverage, the market for Dutch mortgage suppliers is concentrated: in 2012, the five largest banks held 85% of the market. Our sample contains three banks of the four largest banks and other smaller players. Concept ABS provides data on RMBSs drawn from individual deal prospectuses. This includes information on the size and credit rating of each tranche (newly-created security), and whether a given issue is retained by the issuing bank or sold.

Based on this data, we construct two samples. First, a sample of mortgage originations, which we shall sometimes refer to as the "Originations" sample. This sample consists of a list of matched mortgage loan, property, borrower, and bank characteristics at the time of origination. This sample contains new originations for the period from January 2011 until December 2013. In terms of coverage, the 277,038 originations cover approximately €5.25 billions of assets, roughly 45% of total originations in the Netherlands during this period. Figure 1 shows the geographical distribution of mortgage originations across two-digit postal codes across the Netherlands. The majority of originations occur in the densely populated center and west of the country, which we will account for in our regressions through inclusion of postal code fixed effects. We call our second sample the "Loan Portfolio" sample. This data set classifies the stock of loans (591,033 loans) previously originated into two groups depending on whether the loan is securitized or not, as of January 2014. In terms of coverage, the €25 billions of securitized loans in our sample constitute 64% of RMBS collateral from 2011 until 2013.

2.2 Variable Construction and Summary Statistics

In this section, we describe the main variables used in our empirical analysis.

Our main dependent variable is the interest rate in new mortgage originations and is provided directly in our mortgage data at the loan-level. This variable captures an important

dimension of the competitiveness of new loan originations, since most loans have a 30 year tenure and are fixed rate. We consider two other dependent variables in our analysis. First, an indicator variable equal to one if a loan is securitized and zero otherwise. This variable is used to corroborate our main hypothesis that banks affected by the policy change securitize the new originations that are competitively-priced. Second, an indicator variable equal to one if a loan is in payment arrears and zero otherwise. We use arrears to measure loan repayment performance (e.g., Keys et al., 2010), as foreclosures and repossessions occur infrequently on the loan originations in our short event window (less than 0.5%).

To understand the impact of the change in collateral eligibility on bank lending and risk-taking behavior, we will use a difference-in-differences methodology. This requires a suitable definition of an event window and a classification of banks.

The event window is defined as follows. In December 2011, the ECB declared that RMBS rated single-A at issuance were temporarily eligible as collateral for Eurosystem credit operations, in addition to triple-A rated RMBS (ECB, 2011/25). In June 2012, the ECB ruled that triple-B RMBS will temporarily be accepted (ECB, 2012/11). Therefore, we define the "Before" period as the period from January 2011 until December 2011, when only triple-A RMBS are eligible. The "After" period starts in July 2012. At this point both single-A and triple-B RMBS are eligible. The After period ends in December 2013, which is the last month we obtain loan information from the software company. Due to policy uncertainty, we exclude from the analysis any loans originated during the period from December 2011 until the end of June 2012.[13]

Next, we classify banks. The rule change relaxes eligibility criteria for RMBS with credit quality Class 2 or 3, which were previously not accepted as collateral in Eurosystem credit operations.[14] We assume changes in eligibility requirements matter more for banks if they

[13]Due to data restrictions associated with the ED data, our analysis of securitization focuses on a shorter post-event window from January 2013 until December 2013.

[14]Under the ECB's harmonized rating scale, every external rating is mapped into a credit "Class". Class 1,

satisfy two criteria. First, they have fully retained at least one RMBS deal in the five years prior to the rule change. Such behavior is commonly referred to as self-securitization among practitioners and its purpose is to increase the liquidity of assets on the balance sheet, i.e., it is a bank liquidity management technique. The rule change directly affects the liquidity of retained RMBS and not marketed RMBS. Second, at least one of these fully retained deals must contain a security of Class 2 or 3 rating. These lower-rated securities were explicitly targeted by the rule change, as opposed to Class 1 rated securities that were always eligible. We use issuance and distribution information gathered from Concept ABS to classify banks as "Class 2/3 Retained" if they satisfy these criteria and "Other Banks" otherwise.[15]

To account for observable differences among loans in our regressions, we control for standard loan-, property-, and borrower-level characteristics commonly used in the mortgage lending literature. These variables are described here and precisely defined in Appendix A. We consider the following continuously-measured characteristics: loan-to-value, debt-to-income, mortgage size. These variables are winsorized at the 1 and 99 percent level to eliminate the influence of outliers. We consider the origination month of the mortgage and the location (postal code) of the property. We also consider categorical variables for the borrower's employment status, payment type, and mortgage purpose. The employment status categories include whether a borrower is employed or the loan is fully guaranteed, unemployed, self-employed, and so on. The payment type categories indicate whether the loan repayments are made during the life of the loan (annuity or linear) or at maturity (bullet). The mortgage purpose categories include whether the loan was made for purchase, remort-

2, 3 assets correspond to AAA/AA+/AA/AA-, A+/A/A-, BBB+/BBB/BBB- rated securities, respectively, under the Standard and Poor's long-term credit rating schedule (see Appendix B).

[15]We do not observe any banks self-selecting after the rule change, i.e., self-securitizing mortgage loans, and thus selection bias is unlikely to drive our results. There are at least two explanations for this. First, regulated Dutch mortgage originators may have a strong preference for AAA-rated securities due to severe differences in capital charges between AAA- and lower-rated securities. Second, originators may be reluctant to self-securitize out of concerns that regulators, depositors, creditors, or analysts could interpret it as a sign of financial weakness (e.g., Armantier et al., 2015).

gage, renovation, or less common purposes including equity release or debt consolidation.

Our classification of banks might simply capture ex ante differences among banks that might drive lending and risk-taking behavior irrespective of the collateral eligibility rule change. To limit such concerns, we control for the following bank fundamentals: bank size, leverage (the equity ratio), and return on equity. We also conduct falsification tests that we describe in detail in the next section.

The unit of observation in our analysis is always a mortgage loan. In the Netherlands, a property is often financed with multiple smaller mortgage loan parts.[16] For simplicity, we aggregate these smaller loans and define a loan as the set of loans on a single borrower and property, originated at the same date (to avoid bundling together subsequent refinancing or second-lien mortgages by the same borrower). We aggregate loans two ways. For mortgage size, debt-to-income, and loan-to-value, we take the sum across loan parts at origination. Other loan variables, for example, the interest rate, are all mortgage balance-weighted averages. We do not observe any instance of a multiple banks funding a given mortgage, so we assign the characteristics of the single lending bank at time of origination to the loan observation.

In Table I, we present summary statistics of the variables used in the analysis. We find significant variation in all the key variables. Panel B shows the average interest rate on mortgage originations of all banks in the after period is 4.33%, with a standard deviation of 0.66%. The fraction of mortgages in payment arrears in the after period is 2%, with a standard deviation of 15%. Panel D shows that around one fifth of loans are securitized and these loans tend to have more state guarantees (57% versus 31%) and better repayment performance (2% versus 5% of loans in arrears). Panels F and G indicate that mortgages for purchase with a single final payment ("bullet") structure are most common. Finally, panel

[16]Due to generous tax treatment of mortgage interest in the Netherlands, mortgages usually have bullet repayment with funds for the final payment accumulating in a separate savings or investments account.

H indicates that affected banks (Class 2/3 Retained) are comparable with the other banks in terms of size, however they tend to have lower leverage (Equity Ratio) and performance (as measured by Return-on-Equity) in both periods. On average, these banks appear to grant new loans at lower interest rates and these loans subsequently have worse repayment performance (panel A).

2.3 Empirical Strategy

We assess the impact of the collateral eligibility rule change on bank lending and risk-taking using a difference-in-differences (DiD) methodology.

Our approach compares the effect of the rule change on banks likely to be affected by the change with a suitable control group. Since we want to evaluate the effect of the change on interest rates on mortgage originations, we calculate average interest rates after the rule change and subtract from it interest rates on new loans beforehand. This first difference gives us the effect of the rule change on the interest rates at affected banks. However, other possibly unobservable factors that could influence interest rates may have moved through the event window as well. To eliminate the bias associated with such common shocks, we select a control group and compare the difference among affected banks with the difference in the control.

The change in collateral eligibility affects all Eurosystem member banks, so we do not have a natural partition of banks in our analysis. Nevertheless, since the reform does not impact all banks in the same way, it is possible to construct affected and control groups. Under the assumption that banks using self-securitization as a liquidity management technique are more likely to be affected, we can classify banks into affected and control groups. Specifically, banks that have fully retained at least one RMBS deal containing a security of Class 2 or 3 in the five years prior to the rule change are affected group ("Class 2/3 Retained Banks")

and others form the control group ("Other Banks").[17]

To examine the effect of the collateral eligibility rule change, we estimate the following cross-sectional regression using OLS on loan originations data:

$$y_{ijklt} = \alpha_k + \alpha_l + \alpha_t + \beta \text{ After}_t \times \text{Class 2/3 Retained Bank}_k + \theta' \mathbf{X}_{ijkt} + \epsilon_{ijklt}, \quad (1)$$

where i indexes loans, j indexes borrowers, k indexes banks, l indexes locations (postal codes), and t indexes time (months). The dependent variable is y_{ijklt}, which will mostly be interest rates on new originations and subsequent payment arrears. After_t is an indicator variable equal to one in the months in our sample following the rule change (July 2012 until December 2013), and zero otherwise (January 2011 until December 2011). Class 2/3 Retained Bank_k is an indicator variable equal to one if the bank belongs to the affected group and zero if it belongs to the control group. The α_k, α_l and α_t denote bank, location, and time fixed effects, respectively. The bank fixed effects control for time-invariant differences between the treated and the control group, the location fixed effects control for regional differences, and the time (origination month) fixed effects control for aggregate economic shocks. $\mathbf{X}_{ijkt}$ is a vector of control variables (e.g., mortgage size, bank return-on-equity, etc.) and ϵ_{ijklt} is the error term. Since individual loans only appear in the sample once in a cross-sectional regression, we cluster all our standard errors at the origination month level (Petersen, 2009).

The main coefficient of interest, β, measures how affected banks respond to the change in central bank collateral requirements. If some banks have incentives to expand lending and price mortgages more competitively, the coefficient β will be strictly negative. The null hypothesis that collateral policy is irrelevant for bank lending behavior (say, because banks can easily restructure RMBSs without changing lending) corresponds to expecting that β

[17] While our main approach partitions the set of banks, in some tests we partition the *set of loans* within-banks on the basis of ease of securitization into those likely to be affected and other loans.

will be zero.

This specification adequately controls for unobservables that might influence loan pricing of affected and control groups in a similar fashion. However, identification of β requires controlling for any variation in the characteristics of the affected group that systematically correlate with the rule change. Put differently, we need to control for other shocks that might be correlated with the choice to self-securitize RMBS and the changes in central bank collateral policy. To illustrate, it might be the case that risk-taking opportunities of different banks changed around the time of the rule change. This is potentially a concern if these banks are also more likely to be among the set of affected banks.

We address such concerns in several ways. First, to control for changes in risk-taking opportunities we account for a large number of loan, borrower, and property characteristics in $\mathbf{X}_{ijkt}$. These include standard controls such as loan-to-value, debt-to-income, and mortgage size, but also categorical variables for borrower employment status, payment type, and mortgage purpose. In our preferred specification, we additionally include the interaction term $\alpha_l \times \alpha_t$ to control for local market conditions at the location-month level. We therefore compare the lending behavior of affected and other banks in very similar geographical and product markets. Second, we include bank-level control variables for size, profitability, and leverage to account for additional heterogeneity. Third, we conduct two falsification tests. We first reassign the event date to a prior recession to check whether affected banks simply respond differently in bad times. In the second falsification test, we redefine the affected group to be the set of small banks to check whether we are merely capturing their behavior. Finally, we restrict the analysis to the set of non-standard loan types that are ineligible for securitization and examine the differential lending behavior for affected and control banks. We discuss the falsification tests and non-standard loan types tests in more detail later.

3 Empirical Results

This section provides estimates of the collateral eligibility rule change on bank lending and risk-taking. In Section 3.1, we conduct an analysis of interest rates on mortgage originations. In Section 3.2, we shed light on the underlying economic mechanism and examine whether affected banks were more likely to securitize these new originations. Section 3.3 examines the repayment performance mortgage loans issued before and after the rule change. Section 3.4 provides additional analysis of non-standard loans as well as loans with state guarantees.

3.1 Interest Rates on Mortgage Originations

We first provide a graphical summary of our main results. First, in Figure 2 we plot the kernel density estimates of interest rates on mortgage originations for both the affected and control groups before and after the change in collateral policy. The figure depicts a leftward shift of the kernel density for the affected group after the rule. There kernel density of the control group exhibits no such shift. Second, in Figure 3 we separately plot the time series (monthly) average of interest rates for both groups. It can be seen that interest rates for both sets of banks moved roughly together before the rule change, whereas, after the rule change affected banks offered consistently lower interest rates.

We now formally describe the relation between the rule change and interest rates on mortgage originations based on the estimation of equation (1). We show that the findings in the figures are statistically robust to an analysis that accounts for heterogeneity across loans, borrowers, and banks using our DiD regression framework.

Table II shows the results. Column [1] shows the basic result without including any control variables. It can be seen that the average interest rates went down by 0.232% for affected banks relative to the control group after the rule change. The point estimate is highly statistically significant (at the 1% confidence level).

In column [2] we include employment status, payment type, and mortgage purpose fixed effects along with lender and postal code fixed effects to account for loan, borrower, bank, and location heterogeneity. Of particular importance are the lender fixed effects. These control for time-invariant bank factors that may be correlated with affected bank status and ensure our estimates are identified from within-bank changes in behavior around the rule change. The point estimate reduces to -0.168% and remains significant at the 1% confidence level.

Column [3] further controls for aggregate economic shocks through the inclusion of origination month fixed effects. The results remain unchanged. To further test the robustness of these results, we control non-parametrically for any observed or unobserved location-time-specific shocks that may be correlated with affected bank status. To do so we augment the model with the interaction between postal code and origination month fixed effects. Column [4] shows the estimated impact of the rule change essentially the same at -0.149%.

Column [5] controls linearly for the (log) mortgage size, and loan-to-value and debt-to-income ratios.The latter two ratios are important measures of lending standards. Other things equal, an increase in either ratio would signal a greater risk of default for the borrower. When we include these additional controls we find the point estimate reduces to -0.141% and still significant at the 1% confidence level. The similarity of the point estimate is unsurprising as the affected and control banks are similar along these observable dimensions, at least on average (see panel A of Table I).

Column [6] further adds a control variable for whether the loan receives a state guarantee or not. This is an indicator variable equal to one if any part of the loan has a state guarantee and zero otherwise. Roughly 50% of the loans in the sample are guaranteed. The estimated impact of the rule change on interest rates is essentially unchanged in terms of size and statistical significance. The coefficient on State Guarantee is negative and highly significant, indicating that guaranteed loans have lower interest rates possibly because they have lower

default rates or higher recovery rates in case of default.

Finally, we rerun the analysis with controls for bank size, profitability (return-on-equity), and leverage (equity ratio) to account for observable differences among affected banks and between the affected and control groups. We see in column [7] that the point estimate increases to -0.215% and remains significant at the 1% confidence level.

Overall, the results indicate that there is a reduction in interest rates on mortgage originations following the collateral eligibility rule change and that the size of this reduction is roughly -0.2% in absolute terms. Importantly, in terms of economic magnitudes, this represents a sizable reduction in rates in the period after the rule change, about 4.6% of the mean (4.33%) and 30.3% of the standard deviation (0.66%).

3.1.1 Falsification Analysis

In this section, we conduct two falsification tests for the impact of the collateral eligibility rule change on interest rates of mortgage originations. These tests are designed to rule out the alternative hypotheses that: first, affected banks behave differently during recessions, irrespective of collateral policy; second, our assignment of banks into affected and control groups is merely picking up a small-bank effect. The results of these tests are shown in Table III.

In the first test, we examine the behavior of the Class 2/3 Retained (affected) and the other (control) banks in a prior economic recession in the early 2000s. Since all of the banks in our sample were active, we maintain the same classification as in our baseline analysis. We then falsely assume that the rule change occurred during a prior recession, when the ECB implemented traditional monetary policy measures (i.e., interest rate cuts) but did not alter RMBS collateral eligibility. We redefine the After_t variable to the period of September 4, 2000, to March 12, 2003. During this period the Dutch stock market index dropped from 703 to 218 points. As a before period, we take the period from the launch of the Euro (January

4, 1999) up to the beginning of the after period (August 31, 2000).

Columns [1] to [3] show the results of re-estimating equation (1) with this alternative timing. Column [1] includes no controls in the estimation and find the point estimate of interest on After × Class 2/3 Retained Bank is now positive and small (0.008) and statistically insignificant at conventional levels. In column [2] we add the full battery of fixed effects from our baseline analysis—employment status, payment type, mortgage purpose, lender, and postal code times origination month fixed effects—to test the robustness of this initial finding. The coefficient of interest remains positive (0.065) and is now statistically significant at the 1% level. Finally, in column [3] we further control parametrically for loan-to-value, debt-to-income, and mortgage size and find essentially the same result. Thus, we find evidence that the affected banks *increased* interest rates during the prior recession, casting doubt on the simple alternative that affected banks always cut rates during bad times (i.e., our results reflect a pure selection effect).[18]

In our second test, we examine the behavior of small banks around the rule change. While the summary statistics (panel G of Table I) suggest time-varying unobservables correlated with bank size are unlikely to be driving our results, we formally test this alternative here. In particular, we redefine the affected banks to be the set of banks that have book value of assets less than $100 billion.[19] Banks with assets above this threshold are assigned to the control group.

We rerun our baseline estimation on the full sample of loans under this alternative size-based classification. Columns [4] to [6] present the results. As described above, the columns include a progressively larger set of control variables to account for heterogeneity among loans and allow for tighter identification of β. While, in column [4], the coefficient is negative (-

[18]Figure 3 also shows there were no pre-trends in interest rates prior to the rule change in 2012. Thus, it is unlikely that our estimation is picking up a reversion-to-the-mean among the affected banks, say, because there was a run up in interest rate setting prior to the rule change.

[19]The choice of cutoff used here is arbitrary. Similar results emerge if we use a $50 billion cutoff or the sample median (unreported) in the before period.

0.067) and significant at the 5% level, we see that once we include controls it becomes negligible in size (-0.022) and statistically insignificant. This finding reassures us that we are not simply picking up a small-bank effect, whereby small banks cut rates competitively following the rule change perhaps due risk-shifting incentives.

3.2 Effect of Collateral Eligibility on Securitization

In this section, we develop additional tests to better understand the mechanism underlying the results so far. Our tests center on the idea that if the change in collateral eligibility policy affected the benefits of self-securitization then banks more reliant on this liquidity management technique would be more likely to securitize loans after the rule change relative to other periods. Moreover, these banks would be more likely to issue Class 2 and 3 rated RMBS, as these securities benefited the most from the rule change.

To investigate the rule change's potential impact of the rule change on incentives to securitize, we first provide graphical evidence in Figure 4. This figure shows securitization activity for affected banks—that is, banks that issue and fully retain Class 2 and 3 rated securities—and other banks both before and after the rule change. The figure shows the distribution of assets (securitized mortgages) across the Class 1, 2, and 3 ratings categories aggregated across banks in each group. For the affected banks, two notable facts emerge. First, banks in the affected group have a non-trivial allocation of assets to Class 2 and 3 rated securities, about 3 and 7% of assets, respectively. Second, following the rule change these banks exhibit an increase in the issuance of both Class 2 and 3 rated tranches, notably, the allocation to Class 2 securities nearly doubles to about 12% of issuance. In contrast, issuance of Class 2 or 3 rated securities by the other banks is small and remains constant through the rule change. This evidence therefore suggests that in response to the rule change the set of affected banks increased securitization activity, particularly through issuance of Class 2 and 3 rated securities.

Next, we turn to our loan level data and regression framework to formally investigate the securitization activity of banks around the rule change. We ask whether affected banks were more likely to securitize mortgage originations with low interest rates after the rule change, as compared to other banks. The purpose of this analysis is to corroborate our hypothesis that the additional origination activity by affected banks is funded through low-rated security issuance.

To study the securitization decision of the banks in our sample we now focus on the Loan Portfolio sample. This sample contains the stock of loans and indicates whether they have been securitized into an RMBS issued after the rule change or retained on the balance sheet, as of the end of 2013 (the endpoint of our analysis).[20] We estimate the following cross-sectional linear probability model using OLS:

$$\mathrm{y}_{ijklt} = \alpha_k + \alpha_l + \alpha_t + \gamma \text{ Class 2/3 Retained Bank}_k \times \text{Interest Rate}_i + \theta' \mathbf{X}_{ijkt} + \epsilon_{ijklt}, \quad (2)$$

where, as before, i indexes loans, j indexes borrowers, k indexes banks, l indexes locations (postal codes), and t indexes time (months). The dependent variable, y_{ijklt}, is an indicator variable equal to one if the loan is securitized into an RMBS issued after the rule change and zero otherwise. Class 2/3 Retained Bank$_k$ is an indicator variable equal to one if the bank belongs to the affected group and zero if it belongs to the control group. The α_k, α_l and α_t denote bank, location, and time fixed effects, respectively, $\mathbf{X}_{ijkt}$ is a vector of control variables, and ϵ_{ijklt} is the error term. We continue to cluster all our standard errors at the origination month level.

The main coefficient of interest, γ, measures how the securitization rate of a typical loan originated by affected banks depends on the interest rate, all else equal, as compared to other banks. If the rule change induces affected banks to increase securitization of relatively

[20] As discussed in Section 2.1, we use the ED data to identify securitized loans, which is available for 2013 only.

low interest rate loans then the coefficient β will be strictly negative. The null hypothesis is that collateral policy is irrelevant for securitization activity, which corresponds to expecting that β will be zero.

Table IV presents the results. Column [1] shows the basic result without including any control variables. Two important results emerge. First, the relation between interest rates and securitization is in general positive: loans with higher interest tend to have higher securitization rates, on average. Second, it can be seen that this relation is flipped for affected banks. The point estimate of γ is negative (-0.037) and statistically significant at the 1% confidence level. This indicates that in period after the rule change, affected banks were more likely to securitize loans with relatively low interest rates, as compared to other banks.

Columns [2] to we include employment status, payment type, mortgage purpose and lender fixed effects along with postal code by origination month fixed effects to account for loan, borrower, bank, and location heterogeneity. On inclusion on these controls, the coefficient of interest reduces to -0.018 and remains significant at the 1% confidence level.

Columns [3] and [4] further control for mortgage size, and loan-to-value and debt-to-income ratios and the presence of a state guarantee, respectively. While the debt-to-income ratio and the presence of a state guarantee have a strong association with the likelihood of securitization, we find the point estimate remains essentially the same in size (about -0.020) and is still significant at the 1% confidence level.

In column [5], we rerun the analysis controlling for the interaction of banks' affected status with mortgage size, and loan-to-value and debt-to-income ratios. This test examines whether the interaction of affected status with interest rate is merely proxying for other borrower- or loan-characteristics. The point estimate shows that this is not the case, remaining significant at the 1% confidence level and very similar to previous estimates (-0.016).

Taken together, we find evidence on the securitization activity of affected banks (relative

to a benchmark group of control banks) that corroborates our central hypothesis. Namely, following the collateral eligibility rule change affected banks tend to increase issuance of Class 2 and 3 rated tranches. Moreover, mortgage loans with lower interest rates are more likely to be securitized in the period following the rule change.

3.3 Mortgage Originations and Repayment Performance

The results so far suggest that some banks respond to the change in collateral eligibility by increasing securitization activity and originating mortgages with more competitive pricing. In this section, we analyze repayment performance of these loans to assess whether the policy led to a deterioration of underwriting standards.

It is unclear ex ante whether the lower interest rates on mortgage originations at some banks need reflect additional risk-taking. On the one hand, these mortgages may have been underpriced during the period after the rule change, providing profitable opportunities with relatively low risk. In this case, the collateral eligibility rule change may have freed up capital for affected banks to exploit these opportunities without any increase in risk. On the other hand, affected banks' shift toward competitive pricing on observationally similar loans might reflect an increase in risk tolerance and may result in worse repayment performance down the line.

We examine the impact of rule change on loan repayment performance by estimating the DiD specification (1) on the sample of loan originations. As before, the unit of analysis is a loan. The dependent variable in the regression is a measure repayment performance, Payment Arrears$_{ijklt}$, which is set equal to one if the loan is in payment arrears at the end of the event window.

In columns [1] to [5] of Table V we report the results from this regression analysis. We find strong evidence that the loans originated by affected banks after the rule change, i.e., the DiD effect, are more likely to enter payment arrears. The point estimate is between 0.007

and 0.009 and statistically significant at the 1% level. This effect is robust to the inclusion of our large array of control variables, including continuously-measured loan and bank characteristics and numerous fixed effects. This indicates that worse repayment performance is unlikely to be explained by observable differences among loans.

Columns [6] and [7] conduct two falsification tests of this analysis, in line with tests conducted in Section 3.1.1. These tests rule out the alternative explanations that our affected banks behave differently in bad times or that this is a small-bank effect, as opposed to the observed risk-taking behavior being induced by the change in collateral policy. In each column, we include the full set of control variables and fixed effects to account for differences among loans, borrowers, and banks. In both cases, the point estimate indicates that the proposed alternative is an unlikely explanation: in column [6], the coefficient is insignificant; in column [7], the point estimate is marginally significant but *negative*, suggesting that small banks originated relatively safe loans ex post.

Note also, the economic magnitudes of the effects estimated in this section are non-trivial: the approximate 0.008 increase in the probability of arrears constitutes about 45% of the unconditional mean (0.02) in the period after the rule change. Thus, we find evidence that the more competitive pricing strategy of the affected banks translates into a meaningful deterioration in repayment performance. We interpret this finding as a decline in lending standards in response to the greater incentives to securitize.

3.4 Exploring Loan Heterogeneity

In this section, we explore the cross-section of loans to further understand how banks affected by the rule change alter lending behavior. In Section 3.4.1 we examine interest rates and repayment performance on a set of loans with a non-standard purpose that are ex ante unlikely to be securitized. In Section 3.4.2 we analyze loans with and without state guarantees and show the relatively worse repayment is concentrated among loans with state

guarantees.

3.4.1 Further Evidence on the Securitization Channel: Non-Standard Loan Purpose

Our evidence thus far suggests that affected banks respond to the change in collateral policy by relaxing underwriting standards and expanding lending. We provide evidence that these banks place these additional loans in newly-created securities, which are now more liquid. In this section we provide further evidence on this behavior by examining bank lending and risk-taking on loans with non-standard purposes that are ex ante unlikely to be securitized. The idea behind this test is that if the rule change operates through incentives to securitize then there should be no change in behavior for loans that are ineligible for securitization.

We first identify the set of loans that are unlikely to be securitized. We focus on the mortgage purpose categorical variable. As detailed in panel F of Table I, about 90% of originations have the stated purpose of a purchase, remortgage, or renovation. We label the remaining purposes (equity release, construction, etc.) as non-standard. Based on loan portfolio sample, columns [2] to [4] indicate that the loans with a non-standard loan purpose have a very low probability of securitization and we therefore focus on this set of loans in our tests.[21]

We implement our test by re-estimating our baseline DiD model (1) on the set of loans with a non-standard loan purpose. The results are shown in Table VI.

Columns [1] to [3] show the results for interest rates on originations. Moving across the columns, we add a progressively large set of controls as in prior tables. Several important results emerge. First, notice that despite the considerable decrease in sample size (by,

[21] We show this formally in a regression framework where we predict loan securitization using our set of loan characteristics, including loan purpose. These results are unreported and available from the authors upon request.

roughly, a factor of ten) the coefficients on the important loan characteristics—loan-to-value, debt-to-income, mortgage size, and the state guarantee indicator—are almost identical to estimates based on the full sample. This reassures us that differences in bank behavior are not driven by different rate-setting relations among the standard and non-standard loans, at least along these dimensions. Second, the coefficient of interest on the After $\times$ Class 2/3 Retained Bank term is statistically indistinguishable from zero, indicating that there is no difference in interest rate setting behavior between affected and other banks in the period following the rule change. Third, this result is robust to the inclusion of a battery of loan, borrower, and property characteristics.[22] Thus, for non-standard loans the affected banks do not appear to charge lower interest rates based on observables, in contrast to the previous results presented on the full sample (of predominantly standard loan types).

We next apply the same analysis to the subsequent repayment performance of these loans. The dependent variable in this analysis is an indicator variable for whether the loan goes into payment arrears or not. It can be seen from columns [4] through [6] that the repayment performance of non-standard loans originated by affected banks is roughly the same as the other set of banks. This contrasts the estimated effect on the standard loan types, for which we found a large and statistically significant increase in arrears.

These results suggest that the interest rate setting behavior and subsequent repayment performance of loans ex ante unlikely to be securitized was similar across banks following the rule change. Our interpretation of this finding is that the increased benefits of securitization following the rule change did not apply to this set of loans. Therefore affected banks were less willing to increase loan supply and lower lending standards accordingly.

[22]Note that the same result holds *within-bank* on the full sample of loans when we allow for heterogenous effects across loans by introducing a triple-interaction After $\times$ Class 2/3 Retained Bank term $\times$ Non-Standard Loan. These results are unreported and available from the authors upon request.

3.4.2 State Guarantees and Repayment Performance

In this section, we investigate whether the impact of the collateral eligibility rule change on bank behavior depends on whether a loan has a state guarantee or not. This test is first motivated by the fact that state guaranteed loans have a higher probability of securitization, all else equal (see Table IV). Thus, affected banks' adjustment in behavior might be more acute on this set of loans. Second, if banks relax lending standards for state guaranteed loans—that is, these loans experience worse repayment performance—then additional credit risk might be transferred to the government in response to the policy change, which may be an important unintended consequence.

To implement this test, we partition the set of loans into two groups: those with state guarantees and those without. We then simply re-estimate our baseline difference-in-differences model for loan originations separately on each sample. The results of this estimation are presented in Table VII.

In columns [1] to [4] we show results of the estimation where the interest rate is the dependent variable, for both guaranteed and non-guaranteed loans. Looking across the columns, we see the coefficient of interest is negative for both loans with and without state guarantees and of a similar order of magnitude (about -0.16 versus -0.24, respectively). In each case, the point estimate is statistically significant at the 1% level.

Turning to repayment performance as a dependent variable, in columns [5] to [8], a clear contrast emerges between the sets of loans. While the DiD estimate for the loans without a guarantee is indistinguishable from zero, it is positive (roughly, 0.013) and highly significant for the state guaranteed loans. The estimated effect on payment arrears for the state guaranteed loans is about 50% larger than the baseline effect (0.009, see Table V).

Our interpretation of the evidence present in this section is that affected banks increased their risk-taking mostly within the set of guaranteed loans. This may have increased the credit risk implicitly transferred to the state and highlights a potentially negative externality

of the change in the ECB's collateral eligibility policy.

4 Conclusion

This paper contributes to a growing literature on the real effects of non-traditional monetary policy measures. We provide evidence on how changes in central bank collateral policy may stimulate bank lending and highlight the underlying mechanism through which the policy works. We focus on a change in collateral eligibility by the ECB that, for the first time, allowed lower-rated (e.g., BBB-) RMBS to be accepted as collateral in central bank credit operations. We study the impact on interest rates and loan performance in the mortgage market in the Netherlands. Consistent with the policy change increasing the liquidity of RMBS, we first document more competitive pricing (lower interest rates) of mortgage originations among banks more dependent on self-securitization (issuing and retaining securities) as a liquidity management technique.

In addition, and consistent with the change in collateral policy operating through incentives to securitize, we find these banks issue more low-rated securities that are more likely to contain these new originations. We also find that these competitively-priced mortgage originations subsequently experience worse repayment performance—as compared to very similar loans originated by other banks and loans ineligible for securitization originated by the same bank—suggesting that banks might be willing to lower underwriting standards to capture these liquidity benefits. Finally, the deterioration of repayment performance is only present for loans with state guarantees, which implies some credit risk may be transferred to the state. Our results suggest that non-traditional monetary policy tools may expand lending, possibly having positive real effects. However, our results also suggest potential negative effects to the extent that bank risk-taking that could spill over to the sovereign via guarantees.

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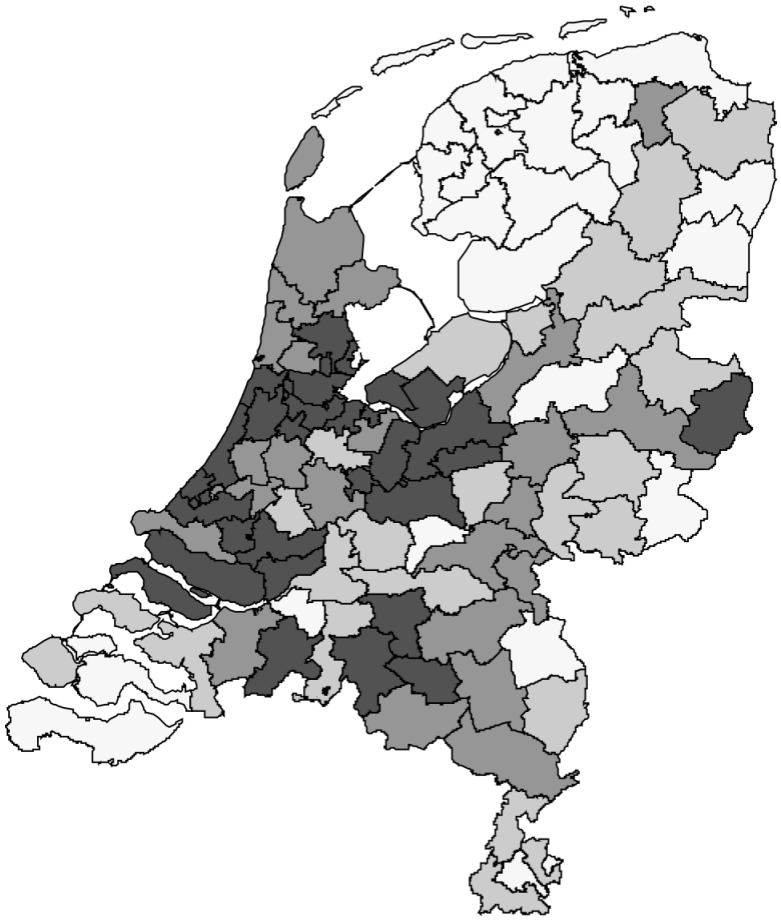
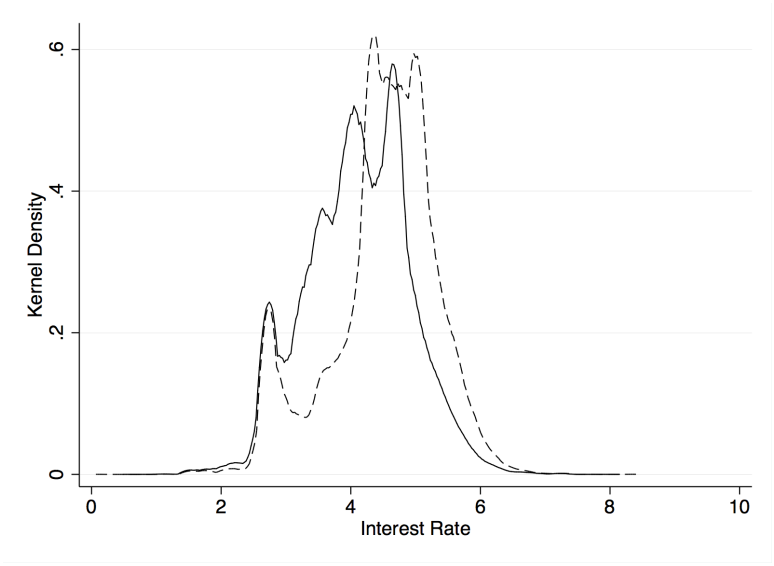
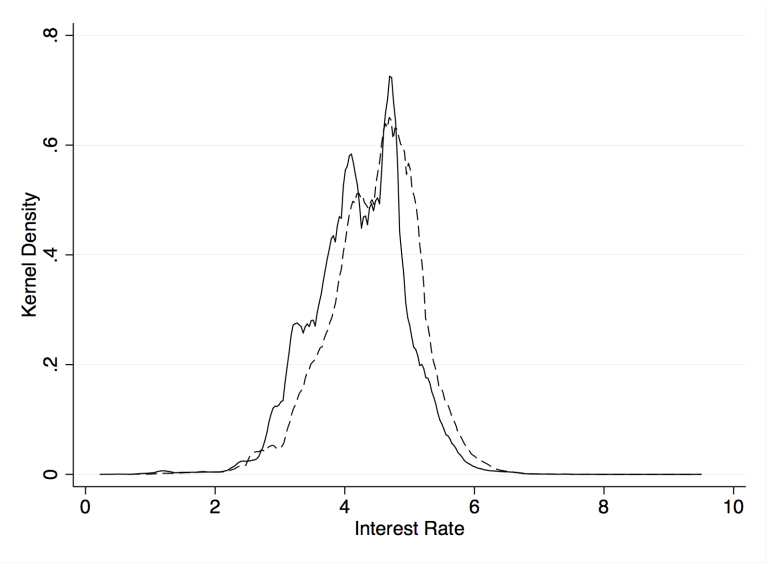


Figure 1: Geography of Mortgage Originations. Number of mortgage originations in our sample overlaid on two-digit postal codes in the Netherlands. Darker shading indicates a greater number of originations.



(a) Class 2/3 Retained Banks



(b) Other Banks

Figure 2: Collateral Eligibility and the Distribution of Interest Rates on Mortgage Originations. This figure shows the Epanechnikov kernel density of interest rate on new mortgage originations for both the Class 2/3 Retained and Other Banks groups for the period before (from 01/2011 until 12/2011) and after (from 07/2012 until 12/2013) the 2012 change in ECB collateral eligibility. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3.

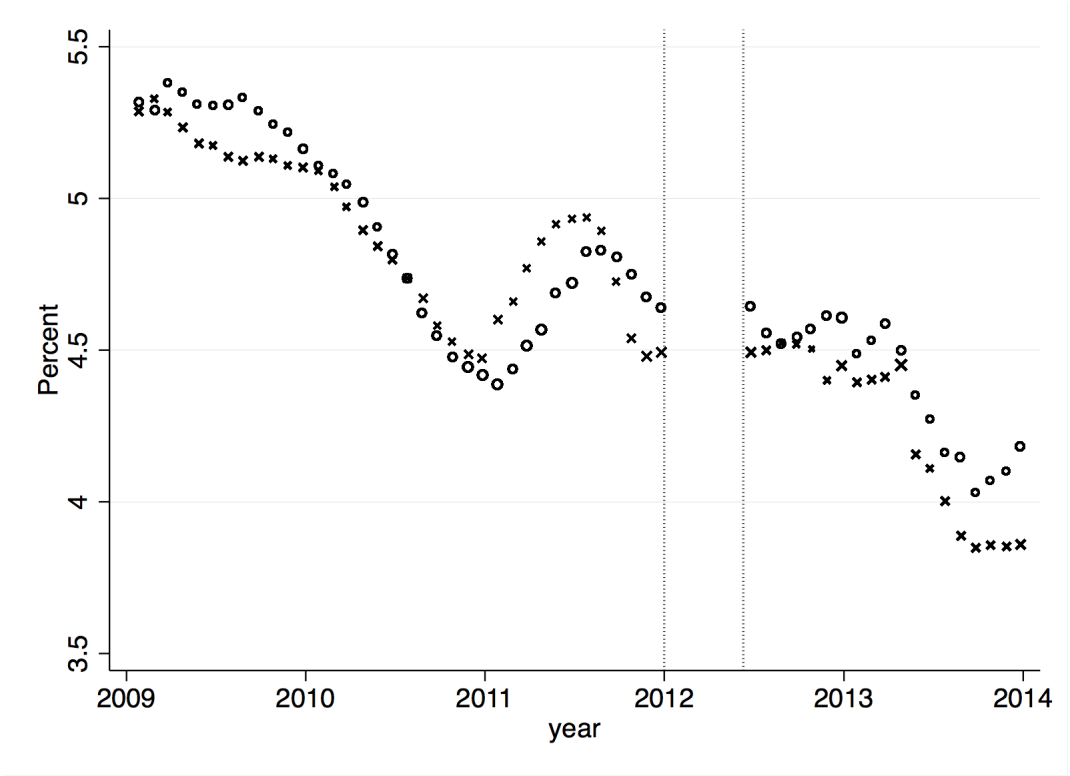


Figure 3: Time Trend of Interest Rates on Mortgage Originations. This figure shows the time series trend of interest rate on new mortgage originations for both the Class 2/3 Retained (circles) and Other Banks (crosses) groups from 2009 until 2013, including the period before (from 01/2011 until 12/2011) and after (from 07/2012 until 12/2013) the 2012 change in ECB collateral eligibility. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3.

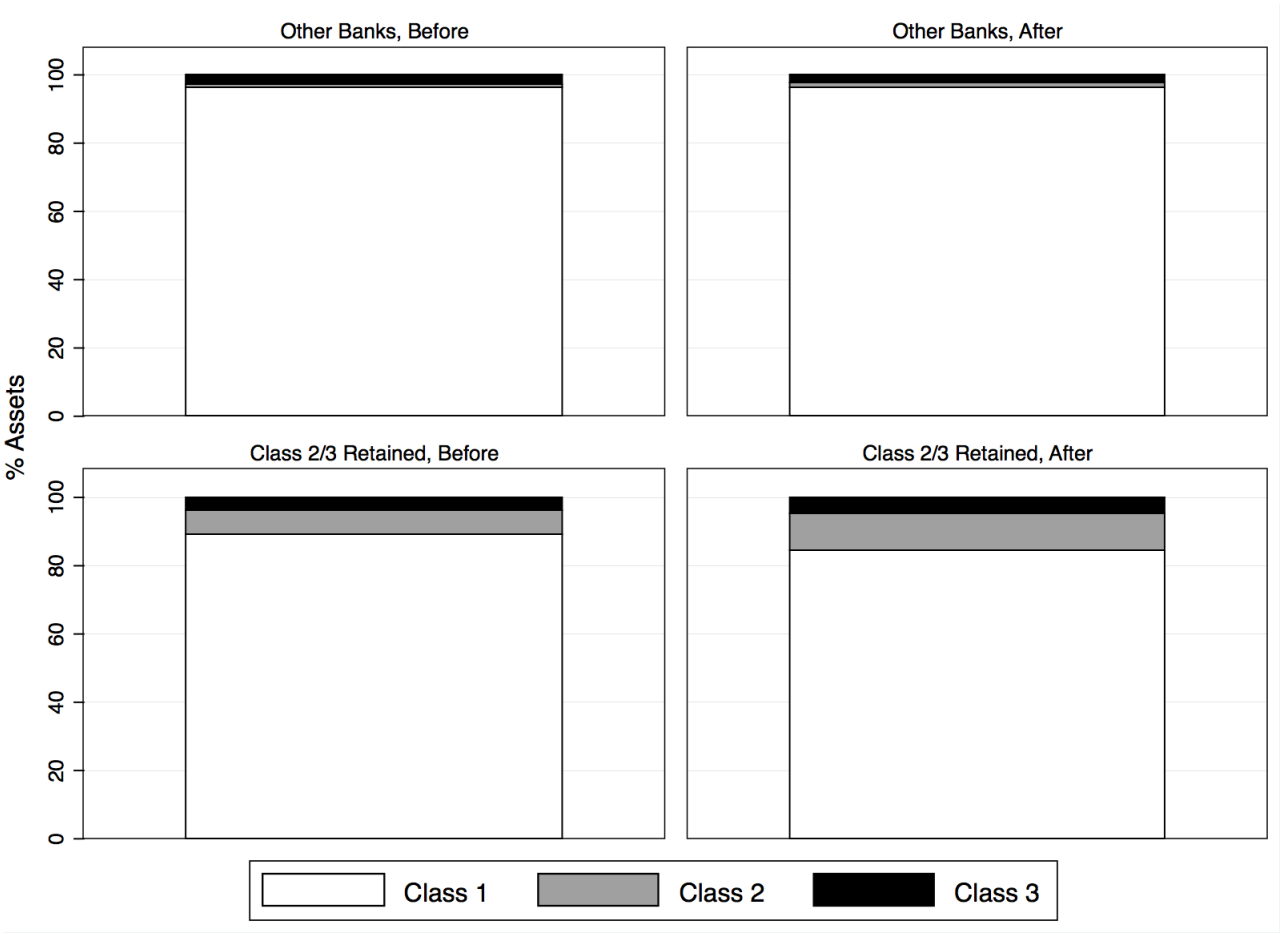


Figure 4: Collateral Eligibility and Securitization Activity. Share of assets in Class 1, 2, 3 ratings tranches of residential mortgage-back securities (RMBS) issued by banks in the Netherlands before (from 01/2011 until 12/2011) and after (from 07/2012 until 12/2013) the 2012 change in ECB collateral eligibility. The share of assets across tranches is value-weighted across issues. Class 1, 2, 3 assets correspond to AAA/AA+/AA/AA-, A+/A/A-, BBB+/BBB/BBB- rated securities, respectively, under the Standard and Poor's long-term credit rating schedule (see Appendix B). Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3.

Table I
Summary Statistics

This table provides sample summary statistics for the mortgage and bank data. Panels A and B provide statistics on mortgage originations. This sample contains loan originations from the before (from 01/2011 until 12/2011) and after (from 07/2012 until 12/2013) periods. Panel C and D provide statistics on the loan portfolio. This sample contains both the stock of loans on banks' balance sheets as of 07/2012 and the flow of loans originated in the after period. The unit of observation in panels A to D is a loan. Panels E to G provide a breakdown of the equally-weighted fraction of mortgage loans in the Originations (column [1]) and Loan Portfolio (columns [2] to [4]) samples across employment status (panel E), payment type (panel F), and mortgage purpose (Panel G). Panel H provides statistics on banks in the before and after periods. The unit of observation in panel H is a bank. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. All variables are measured at time of origination. All variables are defined in Appendix A.

	N	Mean	Std.	p25	Med.	p75	N	Mean	Std.	p25	Med.	p75
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Panel A: Originations by Affected Status												
	Class 2/3 Retained Banks						Other Banks					
Interest Rate	126,469	4.41	0.72	3.95	4.45	4.90	150,430	4.51	0.61	4.10	4.56	4.90
Payment Arrears	126,469	0.03	0.16	0	0	0	150,430	0.02	0.16	0	0	0
Loan-to-Value	126,124	80.01	25.76	62.52	86.85	101.70	148,458	88.18	24.20	75.60	95.89	105.00
Debt-to-Income	77,970	1.38	0.62	1.24	1.51	1.75	122,357	1.33	0.59	1.18	1.46	1.62
Log(Mortgage Size)	124,577	11.93	0.70	11.61	12.04	12.38	148,737	12.04	0.61	11.78	12.11	12.41
State Guarantee	125,041	0.43	0.50	0	0	1	141,198	0.56	0.50	0	0	1
Panel B: Originations of All Banks by Time Period												
	Before Period						After Period					
Interest Rate	109,924	4.67	0.62	4.30	4.70	5.05	166,975	4.33	0.66	3.90	4.36	4.75
Payment Arrears	109,924	0.03	0.17	0	0	0	166,975	0.02	0.15	0	0	0
Loan-to-Value	108,710	84.17	24.77	70.34	90.53	102.30	165,872	84.59	25.57	68.53	93.77	104.10
Debt-to-Income	87,488	1.37	0.62	1.26	1.50	1.68	112,839	1.33	0.58	1.16	1.45	1.66
Log(Mortgage Size)	108,211	12.02	0.67	11.78	12.13	12.43	165,103	11.96	0.64	11.67	12.04	12.38
State Guarantee	105,323	0.52	0.50	0	1	1	160,916	0.48	0.50	0	0	1
Panel C: Loan Portfolio by Affected Status												
	Class 2/3 Retained Banks						Other Banks					
Interest Rate	238,137	4.69	0.86	4.15	4.70	5.23	352,896	4.81	0.79	4.35	4.80	5.25
Payment Arrears	238,090	0.04	0.20	0	0	0	352,848	0.04	0.20	0	0	0
Loan-to-Value	234,550	69.22	30.24	43.88	73.10	98.35	338,242	81.88	30.23	60.90	87.27	105.40
Debt-to-Income	97,914	1.40	0.58	1.23	1.51	1.75	229,359	1.41	0.57	1.17	1.50	1.74
Log(Mortgage Size)	230,847	11.78	0.73	11.31	11.88	12.28	347,181	12.01	0.64	11.70	12.10	12.43
State Guarantee	223,286	0.34	0.48	0	0	1	316,929	0.37	0.48	0	0	1
Panel D: Loan Portfolio of All Banks by Securitization Status												
	Loan Securitized						Loan Not Securitized					
Interest Rate	113,824	4.72	0.70	4.30	4.70	5.10	477,209	4.78	0.85	4.26	4.77	5.27
Payment Arrears	113,826	0.02	0.13	0	0	0	477,112	0.05	0.21	0	0	0
Loan-to-Value	113,549	84.66	24.86	68.79	91.50	103.20	459,243	74.73	31.88	49.23	79.75	102.00
Debt-to-Income	83,545	1.55	0.47	1.36	1.57	1.85	243,728	1.35	0.60	1.12	1.48	1.71
Log(Mortgage Size)	112,929	12.06	9.76	11.79	12.11	12.40	465,099	11.89	0.71	11.48	11.99	12.37
State Guarantee	102,880	0.57	0.50	0	1	1	437,335	0.31	0.46	0	0	1

	Originations	Loan Portfolio		
		All	Securitized	Not Securitized
	[1]	[2]	[3]	[4]
Panel E: Employment Status				
Employed or Full Loan Guaranteed	0.64	0.45	0.71	0.38
Unemployment	0.00	0.00	0.00	0.00
Self-Employed	0.06	0.04	0.05	0.04
Student	0.00	0.00	0.00	0.00
Pensioner	0.02	0.01	0.02	0.01
Other	0.09	0.16	0.03	0.19
Unreported	0.19	0.33	0.18	0.33
Panel F: Payment Type				
Annuity	0.16	0.07	0.05	0.08
Linear	0.02	0.01	0.01	0.01
Bullet	0.45	0.49	0.43	0.51
Bullet plus Saving Deposit	0.32	0.26	0.38	0.24
Bullet plus Life Insurance	0.03	0.09	0.08	0.09
Bullet plus Investment Portfolio	0.01	0.06	0.04	0.06
Other	0.01	0.02	0.01	0.02
Panel G: Mortgage Purpose				
Purchase	0.73	0.75	0.81	0.74
Remortgage	0.06	0.07	0.07	0.08
Renovation	0.11	0.09	0.06	0.10
Equity Release	0.03	0.02	0.01	0.02
Construction	0.02	0.02	0.01	0.02
Debt Consolidation	0.00	0.00	0.00	0.00
Remortgage with Equity Release	0.01	0.00	0.00	0.00
Remortgage on Different Terms	0.00	0.00	0.00	0.00
Investment Mortgage	0.00	0.00	0.00	0.00
Other	0.05	0.04	0.02	0.05

Panel H: Bank Summary Statistics

	Class 2/3 Retained Banks				Other Banks			
	Before Period		After Period		Before Period		After Period	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Log(Assets)	11.60	1.59	11.51	2.11	11.85	1.57	11.76	1.66
Return-on-Equity	5.10	2.70	5.50	5.60	11.30	4.60	14.50	1.80
Equity Ratio (%)	4.90	2.40	5.50	3.50	3.40	1.20	3.40	1.00

Table II
Collateral Eligibility and Mortgage Originations: Main Result

This table presents estimates of the impact of the change in European Central Bank collateral eligibility policy on the interest rates of new mortgage originations. The unit of observation in each regression is a loan. The dependent variable is the interest rate. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. The before period is from 01/2011 until 12/2011 and the after period is from 07/2012 until 12/2013. Where indicated, regressions control for loan characteristics at origination and various fixed effects. Regressions containing loan characteristics also include corresponding indicator variables equal to one whenever the characteristic is missing. All variables are defined in Appendix A. Heteroskedasticity-robust standard errors are clustered at the origination month level and shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Interest Rate							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
After × Class 2/3 Retained Bank	-0.232***	-0.168***	-0.146***	-0.149***	-0.141***	-0.163***	-0.215***
	(0.063)	(0.047)	(0.039)	(0.039)	(0.039)	(0.039)	(0.050)
Loan-to-Value					0.003***	0.004***	0.004***
					(0.000)	(0.000)	(0.000)
Debt-to-Income					-0.047***	0.007	0.009
					(0.011)	(0.010)	(0.009)
Log(Mortgage Size)					-0.067***	-0.103***	-0.101***
					(0.006)	(0.006)	(0.005)
State Guarantee						-0.245***	-0.249***
						(0.008)	(0.009)
Log(Assets)							-0.228
							(0.140)
Return-on-Equity							-0.007*
							(0.004)
Equity Ratio							-0.291***
							(0.088)
After	-0.233***	-0.236***					
	(0.064)	(0.049)					
Class 2/3 Retained Bank	0.063						
	(0.059)						
Employment status FE	N	Y	Y	Y	Y	Y	Y
Payment type FE	N	Y	Y	Y	Y	Y	Y
Mortgage purpose FE	N	Y	Y	Y	Y	Y	Y
Lender FE	N	Y	Y	Y	Y	Y	Y
Postal code FE	N	Y	Y	N	N	N	N
Origination month FE	N	N	Y	N	N	N	N
Postal code × Origination month FE	N	N	N	Y	Y	Y	Y
N	276,899	276,899	276,899	276,899	276,899	273,899	273,389
R^2	0.073	0.161	0.233	0.242	0.251	0.269	0.266

Table III
Collateral Eligibility and Mortgage Originations: Falsification of Main Result

This table presents falsification tests for the estimates of the impact of the change in European Central Bank collateral eligibility policy on the interest rates of new mortgage originations. The unit of observation in each regression is a loan. The dependent variable is the interest rate. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. The before period is from 01/2011 until 12/2011 and the after period is from 07/2012 until 12/2013. Columns [1] to [3] consider the previous recession as an alternative timing, where the before and after periods are defined from 1/1999 until 8/2000 and from 9/2000 until 3/2003, respectively. Columns [4] to [6] redefines the affected banks to be the set of banks that have book value of assets less than $100 billion. Where indicated, regressions control for loan characteristics at origination and various fixed effects. Regressions containing loan characteristics also include corresponding indicator variables equal to one whenever the characteristic is missing. All variables are defined in Appendix A. Heteroskedasticity-robust standard errors are clustered at the origination month level and shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Interest Rate						
Falsification Test:	Prior Recession			Small Banks		
	[1]	[2]	[3]	[4]	[5]	[6]
After × Class 2/3 Retained Bank	0.008	0.065***	0.060***	-0.067**	-0.047*	-0.022
	(0.023)	(0.018)	(0.019)	(0.031)	(0.023)	(0.020)
Loan-to-Value			0.002***			0.004***
			(0.000)			(0.000)
Debt-to-Income			-0.045***			0.006
			(0.010)			(0.009)
Log(Mortgage Size)			-0.083***			-0.103***
			(0.011)			(0.005)
State Guarantee			-0.130***			-0.240***
			(0.011)			(0.009)
After	-0.294***			-0.330***		
	(0.034)			(0.070)		
Class 2/3 Retained Bank	0.097***			0.312***		
	(0.015)			(0.025)		
Employment status FE	N	Y	Y	N	Y	Y
Payment type FE	N	Y	Y	N	Y	Y
Mortgage purpose FE	N	Y	Y	N	Y	Y
Lender FE	N	Y	Y	N	Y	Y
Postal code FE	N	N	N	N	N	N
Origination month FE	N	N	N	N	N	N
Postal code × Origination month FE	N	Y	Y	N	Y	Y
N	167,789	167,789	167,789	277,038	277,036	277,036
R^2	0.028	0.112	0.144	0.089	0.239	0.266

Table IV
Collateral Eligibility and Securitization

This table presents estimates of the relation between interest rates of new mortgage originations and the securitization rate in the period change in European Central Bank collateral eligibility policy. The unit of observation in each regression is a loan. The dependent variable is an indicator variable equal to one if the loan is securitized and zero otherwise. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. A cross-sectional regression is conducted as of 12/2013. Where indicated, regressions control for loan characteristics at origination and various fixed effects. Regressions containing loan characteristics also include corresponding indicator variables equal to one whenever the characteristic is missing. All variables are defined in Appendix A. Heteroskedasticity-robust standard errors are clustered at the origination month level and shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Loan Securitized					
	[1]	[2]	[3]	[4]	[5]
Class 2/3 Retained Bank × Interest Rate	-0.037***	-0.018***	-0.019***	-0.021***	-0.016***
	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)
Interest Rate	0.006**	0.021***	0.022***	0.028***	0.021***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Loan-to-Value			0.000	-0.000	-0.001***
			(0.000)	(0.000)	(0.000)
Debt-to-Income			0.034***	0.029***	0.029***
			(0.008)	(0.007)	(0.004)
Log(Mortgage Size)			-0.009**	0.005	0.003
			(0.004)	(0.005)	(0.003)
Class 2/3 Retained Bank × Loan-to-Value					0.003***
					(0.000)
Class 2/3 Retained Bank × Debt-to-Income					0.029
					(0.020)
Class 2/3 Retained Bank × Log(Mortgage Size)					-0.038***
					(0.007)
State Guarantee				0.072***	
				(0.010)	
Class 2/3 Retained Bank	0.282***				
	(0.047)				
Employment status FE	N	Y	Y	Y	Y
Payment type FE	N	Y	Y	Y	Y
Mortgage purpose FE	N	Y	Y	Y	Y
Lender FE	N	Y	Y	Y	Y
Postal code FE	N	N	N	N	N
Origination month FE	N	N	N	N	N
Postal code × Origination month FE	N	Y	Y	Y	Y
N	591,033	591,031	591,031	591,031	591,031
R^2	0.020	0.278	0.283	0.292	0.294

Table V
Mortgage Originations and Repayment Performance

This table presents estimates of the impact of the change in European Central Bank collateral eligibility policy on the repayment performance of new mortgage originations. The unit of observation in each regression is a loan. The dependent variable is an indicator variable equal to one if a loan enters payment arrears and zero otherwise. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. The before period is from 01/2011 until 12/2011 and the after period is from 07/2012 until 12/2013. Column [6] considers the previous recession as an alternative timing, where the before and after periods are defined from 1/1999 until 8/2000 and from 9/2000 until 3/2003, respectively. Column [7] redefines the affected banks to be banks with book value of assets less than $100 billion. Where indicated, regressions control for loan characteristics at origination and various fixed effects. Regressions containing loan characteristics also include corresponding indicator variables equal to one whenever the characteristic is missing. All variables are defined in Appendix A. Heteroskedasticity-robust standard errors are clustered at the origination month level and shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Payment Arrears						Falsification Tests	
						Prior Recession	Small Banks
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
After × Class 2/3 Retained Bank	0.009***	0.007***	0.008***	0.008***	0.009***	-0.003	-0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Loan-to-Value			0.001***	0.001***	0.001***	0.001***	0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt-to-Income			0.006***	0.007***	0.007***	0.003**	0.007***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log(Mortgage Size)			-0.010***	-0.010***	-0.010***	0.003***	-0.010***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
State Guarantee				-0.002**	-0.002**	-0.016***	-0.002**
				(0.001)	(0.001)	(0.002)	(0.001)
Log(Assets)					0.072***		
					(0.019)		
Return-on-Equity					-0.001***		
					(0.000)		
Equity Ratio					-0.014		
					(0.011)		
After	-0.011***						
	(0.001)						
Class 2/3 Retained Bank	-0.004**						
	(0.002)						
Employment status FE	N	Y	Y	Y	Y	Y	Y
Payment type FE	N	Y	Y	Y	Y	Y	Y
Mortgage purpose FE	N	Y	Y	Y	Y	Y	Y
Lender FE	N	Y	Y	Y	Y	Y	Y
Postal code FE	N	N	N	N	N	N	N
Origination month FE	N	N	N	N	N	N	N
Postal code × Origination month FE	N	Y	Y	Y	Y	Y	Y
N	276,899	276,897	276,897	276,897	273,389	167,789	277,036
R^2	0.001	0.017	0.024	0.024	0.024	0.048	0.023

Table VI
Collateral Eligibility and Mortgage Originations: Non-Standard Loan Purpose

This table presents estimates of the impact of the change in European Central Bank collateral eligibility policy on the interest rate and repayment performance of new mortgage originations with a non-standard loan purpose. Mortgages with a non-standard loan purpose include all mortgage loans except those for purchase, remortgage, and renovation. The unit of observation in each regression is a loan. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. The before period is from 01/2011 until 12/2011 and the after period is from 07/2012 until 12/2013. Columns [1] to [3] define the dependent variable as the interest rate. Columns [4] to [6] define the dependent variable as an indicator variable equal to one if a loan enters payment arrears and zero otherwise. Where indicated, regressions control for loan characteristics at origination and various fixed effects. Regressions containing loan characteristics also include corresponding indicator variables equal to one whenever the characteristic is missing. All variables are defined in Appendix A. Heteroskedasticity-robust standard errors are clustered at the origination month level and shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable:	Interest Rate			Payment Arrears		
	[1]	[2]	[3]	[4]	[5]	[6]
After × Class 2/3 Retained Bank	-0.158	0.092	0.160	0.005*	-0.011	-0.023
	(0.116)	(0.062)	(0.092)	(0.003)	(0.009)	(0.013)
Loan-to-Value			0.004***			0.000***
			(0.000)			(0.000)
Debt-to-Income			-0.007			0.012***
			(0.011)			(0.002)
Log(Mortgage Size)			-0.134***			-0.009***
			(0.011)			(0.002)
State Guarantee			-0.229***			-0.013*
			(0.036)			(0.007)
After	-0.218***			-0.005*		
	(0.081)			(0.003)		
Class 2/3 Retained Bank	0.850***			-0.027***		
	(0.048)			(0.002)		
Employment status FE	N	Y	Y	N	Y	Y
Payment type FE	N	Y	Y	N	Y	Y
Lender FE	N	Y	Y	N	Y	Y
Postal code FE	N	N	N	N	N	N
Origination month FE	N	N	N	N	N	N
Postal code × Origination month FE	N	Y	Y	N	Y	Y
N	28,610	28,610	28,610	28,610	28,610	28,610
R^2	0.023	0.371	0.395	0.000	0.098	0.106

Table VII
Collateral Eligibility and Mortgage Originations: State Guaranteed Loans

This table presents estimates of the impact of the change in European Central Bank collateral eligibility policy on the interest rate and repayment performance of new mortgage originations with and without a state guarantee. The unit of observation in each regression is a loan. Class 2/3 Retained banks are banks from the Netherlands that have issued and fully retained RMBS of Class 2 or 3. The before period is from 01/2011 until 12/2011 and the after period is from 07/2012 until 12/2013. Columns [1] to [4] define the dependent variable as the interest rate. Columns [5] to [8] define the dependent variable as an indicator variable equal to one if a loan enters payment arrears and zero otherwise. Where indicated, regressions control for loan characteristics at origination and various fixed effects. Regressions containing loan characteristics also include corresponding indicator variables equal to one whenever the characteristic is missing. All variables are defined in Appendix A. Heteroskedasticity-robust standard errors are clustered at the origination month level and shown in parentheses. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable:	Interest Rate				Payment Arrears			
	No Guarantee		State Guarantee		No Guarantee		State Guarantee	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
After × Class 2/3 Retained Bank	-0.267***	-0.211***	-0.184**	-0.121***	0.004	0.003	0.014***	0.012***
	(0.057)	(0.047)	(0.071)	(0.034)	(0.002)	(0.002)	(0.003)	(0.003)
Loan-to-Value		0.004***		0.001***		0.001***		0.001***
		(0.000)		(0.000)		(0.000)		(0.000)
Debt-to-Income		-0.008		0.100***		0.004***		0.015***
		(0.008)		(0.016)		(0.001)		(0.002)
Log(Mortgage Size)		-0.078***		-0.176***		-0.004***		-0.034***
		(0.006)		(0.012)		(0.001)		(0.003)
After	-0.267***		-0.193**		-0.008***		-0.015***	
	(0.059)		(0.077)		(0.002)		(0.003)	
Class 2/3 Retained Bank	0.027		0.091		0.002		-0.009***	
	(0.050)		(0.067)		(0.002)		(0.002)	
Employment status FE	N	Y	N	Y	N	Y	N	Y
Payment type FE	N	Y	N	Y	N	Y	N	Y
Mortgage purpose FE	N	Y	N	Y	N	Y	N	Y
Lender FE	N	Y	N	Y	N	Y	N	Y
Postal code FE	N	N	N	N	N	N	N	N
Origination month FE	N	N	N	N	N	N	N	N
Postal code × Origination month FE	N	Y	N	Y	N	Y	N	Y
N	144,018	144,018	132,983	132,983	144,016	144,016	132,983	132,983
R^2	0.087	0.281	0.063	0.307	0.001	0.033	0.001	0.038

Appendix A: Variable Definitions

This appendix presents the definitions for the variables used throughout the paper. In the source column, "SC" and "ED" stand for software engineering company and the European Datawarehouse, respectively.

Variable	Definition	Source
Panel A: Loan-Level Variables		
Interest Rate	Value-weighted average interest rate across loan parts at origination	SC, ED
Payment Arrears	Indicator variable equal to one if any part of the loan is in payment arrears	SC, ED
Loan-to-Value	Total loan amount divided by total value of the property across loan parts at origination	SC, ED
Debt-to-Income	Natural logarithm of loan balance divided by primary income of the borrower at origination	SC, ED
Log(Mortgage Size)	Natural logarithm of total loan amount summed across all loan parts at origination	SC, ED
State Guarantee	Equal to one if any part of the loan has a state guarantee	SC, ED
Loan Securitized	Indicator variable equal to one if all loan parts are securitized and zero otherwise	SC, ED
Panel B: Bank-Level Variables		
Class 2/3 Retained Bank	Indicator equal to one if the bank has issued and fully retained RMBS of Class 2 or 3	Concept ABS
Log(Assets)	Natural logarithm of book value of assets	Orbis
Return-on-Equity	Net income divided by book value of equity	Orbis
Equity Ratio	Book value of equity divided by book value of assets	Orbis

Appendix B: European Central Bank's Harmonized Rating Scale

This appendix shows how different external long-term credit rating assessments map into Eurosystem rating grades. The mapping for short-term credit ratings are shown in brackets. "DBRS" stands for Dominion Bond Rating Services.

	Credit Quality Steps		
Rating Agency	Class 1	Class 2	Class 3
DBRS	AAA/AAH/AA/AAL	AH/A/AL (R-1H/R-1M)	BBBH/BBB/BBBL (R-1L/R-2H/R-2M/R2-L)
Fitch Ratings	AAA/AA+/AA/AA-	A+/A/A- (P1+/P1)	BBB+/BBB/BBB- (P2)
Moody's	Aaa/Aa1/Aa2/Aa3	A1/A2/A3 (P1)	Baa1/Baa2/Baa3 (P-2)
Standard & Poor's	AAA/AA+/AA/AA-	A+/A/A- (A-1+/A-1)	BBB+/BBB/BBB- (A-2)