Monetary Stimulus and Bank Lending*

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Abstract The U.S. Federal Reserve purchased both agency mortgage-backed securities (MBS) and Treasury securities to conduct quantitative easing (QE). Using micro-level data, we find that banks benefiting from MBS purchases increase mortgage origination, compared to other banks. At the same time, these banks reduce commercial lending and firms that borrow from these banks decrease investment. The effect of Treasury purchases is different: either positive or insignificant in most cases. Our results suggest that MBS purchases caused unintended real effects and that Treasury purchases did not cause a large positive stimulus to the economy through the bank lending channel.

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1. Introduction

The recent crisis and recession has led central banks to conduct unconventional monetary policy in continuous attempts to revive their economies. Quantitative easing (QE) was a prominent tool used in the U.S., Japan, Europe, and elsewhere in this spirit. With this tool, central banks purchase financial assets such as Treasuries or mortgage-backed securities (MBS), hoping to reduce yields, boost lending, and stimulate economic activities. Banks and their lending decisions are thought to play a key role in the transmission mechanism. A key question in academic and policy circles following these events is whether QE was successful in its stated goals. Some think that QE helped revive the economy, and the recession would have been much worse without it. Others think that QE might have had no effect. Others still even consider the possibility that it had negative effects by inflating bubbles and distorting the allocation of resources.

Over the years, a large literature attempted to identify the impact of traditional monetary policy via the bank lending channel. While the effects of QE may be similar in some respects, there are also meaningful distinctions given the unprecedented magnitude of intervention and the nature of the tool. Like traditional monetary policy, identifying the effect of QE is difficult because changes that follow the intervention could be attributed to other changes in the economy around the same time. In this paper, we follow the logic of Kashyap and Stein (2000) and others by exploiting the heterogeneity across banks to assist with identification. The usual idea is that some banks are expected to be more affected by the policy than others, and so their different actions following monetary policy shocks can speak to the causal effect of monetary policy.

This idea is sharpened in the context of QE. In the U.S., the Federal Reserve bought particular types of assets (specifically Treasury and MBS) in varying quantities in multiple rounds of QE. Within the bank lending channel, the typical mechanism through which this policy is thought to have an effect is through capital gains. Specifically, the large-scale asset purchases (LSAPs) lower yields and increase prices of banks' current asset holdings, thereby improving the condition of their balance sheets and leading to more lending in multiple sectors. Indeed, Fed officials often framed the impact of QE through these price effects (Yellen, 2012; Bernanke, 2012). Thus, one would expect that banks that held more of the purchased assets (Treasury and MBS) and related securities benefitted more from such asset purchases.

A less discussed but related mechanism within the bank lending channel is the origination channel in the

specific context of MBS purchases: banks that securitize mortgages into agency MBS are strongly affected by these asset purchases because these banks directly sell such products to the Federal Reserve as a part of QE. The Federal Reserve chose to implement the MBS purchases through the to-be-announced (TBA) market. In this market, the main parameters of the contract (coupon, maturity, issuer, settlement date, face value, and price) are agreed upon in advance. However, the exact pool of mortgages satisfying these terms is determined at settlement, which is typically one to three months in the future. As the TBA market primarily focuses on new mortgages, banks have a strong incentive to originate and securitize mortgages to fulfill these contracts. Existing legacy MBS or mortgage holdings on the banks' balance sheet will not be a candidate for selling to the Federal Reserve via these asset purchases.

We use two measures to capture the exposure of banks to these MBS purchases and the underlying mechanisms: (1) the amount of MBS holdings on the banks' balance sheet and (2) those high-MBS banks which actively securitize other assets. Ideally, we would disentangle banks that are only exposed to MBS-related capital gains from those which are also affected by the origination incentive. In practice, we cannot completely do so. While the banks which actively securitize assets and have high MBS holdings undoubtedly are strongly incentivized by the origination channel, many high-MBS banks may still be active originators without participating in securitization. Balance sheet data does not provide a way to separate these banks further. However, we can compare these banks to banks which are more exposed to Treasury purchases, as there is only a capital gains mechanism in that case. As a measure of exposure to Treasury purchases, we use the amount of Treasuries and other non-MBS securities on the banks' balance sheet.

To shed light on the effects of QE, we analyze the behavior of banks after rounds of asset purchases and compare it to that of banks that were expected to be less affected by these two components within the bank lending channel. Moreover, our richly detailed data enables us to track the effect from asset purchases, through the affected banks, to the firms that are connected to these banks, and thereby directly examine the real effects of QE. Given that firms are sometimes connected to different banks, this also allows for clean identification. In particular, we inspect the borrowing of a given firm from different banks which are differentially affected by QE. This approach removes any concerns that the effects might be driven by firms' demand for borrowing instead of banks' lending decisions.

Asset purchases in the U.S. had three different rounds. In QE1 and QE3, the Federal Reserve bought

MBS and Treasuries. In QE2, it bought primarily Treasuries. Although these three rounds were the impetus for much of the asset purchases, the Federal Reserve also made purchases between rounds of QE in response to maturing securities and to maintain the size of its balance sheet. A related program, the Maturity Extension Program (MEP), consisted of buying long-maturity Treasuries and selling short-maturity Treasuries. This program occurred between QE2 and QE3.

We start by investigating the patterns in bank mortgage lending following MBS purchases by the Federal Reserve. In this case, both capital gains and origination components of the bank lending channel have effects in the same direction. As expected, we show that banks that were more exposed to the MBS market increased their mortgage lending following MBS purchases more than the less exposed banks. For every dollar of MBS purchased, these banks loaned 3.63 cents more in terms of mortgages. For the total purchase of approximately \$1.75 trillion worth of MBS, this suggests additional lending of \$63.53 billion. This is a reassuring confirmation that QE indeed had a direct, positive effect. As intended, the Federal Reserve improved the attractiveness of mortgage lending, inducing banks exposed to this market to increase their activity in it.

More surprisingly, however, we show that the more exposed banks slowed their commercial and industrial (C&I) lending following these MBS purchases. Hence, there seems to be a negative indirect effect, which amounts to the crowding out of other types of loans not directly targeted by the MBS purchases in QE. As QE1 and QE3 focused on the housing market by purchasing large amounts of MBS assets, they indeed encouraged exposed banks to lend more in this market. However, this came at the expense of other types of lending, such as C&I lending for those affected banks. The magnitude of this crowding out is large: for every dollar of additional MBS purchases under QE, we estimate a reduction of 1.22 cents in C&I lending. Scaled in terms of additional mortgage lending stimulated by QE, this is a 34 cent reduction in commercial lending for each dollar of additional mortgage lending. The mechanism is likely a result of a substitution effect: while banks benefit from capital gains, the origination component dominates, and good opportunities for banks in one line of business (mortgages) shift resources away from other lines of business (C&I loans). While it is likely that such crowding out took place in other markets as well (e.g., consumer credit), this paper focuses on C&I lending. Consistent with this argument, we find a larger effect for the more financially constrained banks within this group. This reduction is strongest in the period through QE1, where the banking sector as a whole was most constrained. In line with a crowding-out effect, we find that the profitability of those commercial loans extended by the exposed banks increases in response to MBS purchases. The logic behind the crowding-out behavior resembles that featured in the internal-capital markets literature (e.g., Stein, 1997; Scharfstein and Stein, 2000), where constrained firms are expected to shift resources across divisions to respond to the most attractive investment opportunities.

Investigating further the implications of the crowding-out behavior following MBS purchases, we use DealScan and Compustat data to trace the behavior of firms connected to affected banks. We demonstrate the real effect of crowding out of C&I loans by banks affected by MBS purchases. In particular, firms that have relationships with these banks had to cut their investment following these rounds of QE. For every dollar of additional mortgage lending stimulated through MBS purchases, firms reduce investment by 12 cents. As expected, this behavior is observed mostly for more financially constrained firms. In interpreting these results, one might be concerned that the decrease in C&I loan growth and investment reflects a decrease in demand from firms rather than a decrease in supply from banks. We address this issue in several ways. Most notably, we conduct analysis for firms that borrow from multiple banks, some of which are strongly affected by MBS purchases and some of which are not. We show that, after controlling for firm-time fixed effects, a given firm saw a decrease in loan size from affected banks relative to the loan size from non-affected banks. We also do not find evidence that firms are able to obtain sufficient substitute capital from other sources of financing such as equity markets or non-bank sources of debt.

While MBS purchases increased mortgage origination and decreased C&I lending for affected banks, Treasury purchases did not have a negative effect on C&I lending or firm investment. This is important because, in the case of Treasuries, only the capital gains mechanism is at work. The relatively insignificant real effects of Treasury purchases suggest that the capital gains mechanism is relatively weak compared to the origination mechanism.

Overall, our paper demonstrates that the type of asset being purchased is very important in designing QE. Through its choice of assets purchased, beyond providing overall stimulus, the Federal Reserve directly affected credit allocation within the economy. The unintended negative consequences of MBS purchases on C&I lending and, ultimately, firm investment are due to the less-discussed origination mechanism. This general message has broader implications, given that other countries have experimented with purchases of

other assets: the European Central Bank has been purchasing corporate debt, while the Japanese Central Bank has purchased equities. It would be interesting to investigate their differential effects as well.

Our results contribute to the debate about which channels were most salient for the transmission of QE. Krishnamurthy and Vissing-Jørgensen (2013), for example, discuss several channels through which QE could have had a role. Our paper shows that the incentive of banks to originate mortgages (the origination channel) is particularly important. Indeed, it appears to dominate any positive spillovers from the capital gains channel in markets, such as commercial lending, where the effects are opposite in direction. In general, the capital gains channel, whether for MBS or Treasury securities, appears to be relatively weak.

There is a recent small literature on QE and bank lending. The closest paper to ours is Rodnyansky and Darmouni (2017). They also exploit heterogeneity at the bank level due to differences in holdings of MBS in order to investigate the effect of QE on bank lending. Their main focus is on mortgage lending. While C&I lending is not central in their paper, their analysis does touch on it and does not uncover the crowding-out effect that MBS purchases had on the C&I lending of exposed banks, which we show here. This is because of key differences in the research design. Rodnyansky and Darmouni (2017) utilize the timing of QE rounds as the only source of exogenous variation by using three time dummies for the QEs. In other words, they compare lending patterns before and after the three QE rounds, effectively assuming that the only aggregate variation during and after the financial crisis was the introduction of the three QE episodes. This leads to the commingling of the effect of a QE round with that of any policy or aggregate variation that coincides with that timing. For example, the Federal Reserve also maintained extremely low interest rates during the entire period. Further, since they do not separate the effects of Treasury and MBS purchases, the stimulus effects of these two types of asset purchases are also commingled. In contrast to time dummies for the QEs, we use quarter-by-quarter observations of monetary stimulus so that we can control for unobserved aggregate economic conditions and changing regulatory policy during the period by including quarter fixedeffects. In addition, we explicitly use the amount of MBS purchases and the amount of Treasury purchases by the Federal Reserve in every quarter as the direct measure of monetary stimulus and its intensity.¹ These two differences in our research design allow us to tease out the effects of monetary shocks from other confounding policy changes and economic conditions. We find that MBS purchases crowded out C&I

¹See, for example, Morais, Peydró, and Ruiz (2017) who use the amounts of assets purchased to measure the effects of QE.

lending, while Treasury purchases led to a potential increase in C&I lending. Rodnyansky and Darmouni (2017) may be picking up the effect of Treasury purchases in their results. Finally, a fundamental difference between our papers is that we explore the truly real effects of QE by looking at firms' investments and bank-firm specific lending relationships, whereas Rodnyansky and Darmouni (2017) only look at banks' general lending patterns.

In addition to Rodnyansky and Darmouni (2017), two other contemporary papers investigate separate aspects of QE and bank lending and complement our findings. Di Maggio, Kermani, and Palmer (2016) examine how unconventional monetary policy affected the volume of new mortgages issued. They find that financial institutions originated more mortgages of the type that were eligible for purchase by the Federal Reserve (GSE-eligible mortgages), which led to additional mortgage refinancing and consumption. Kandrac and Schulsche (2016) find that bank reserves created by the Federal Reserve led to higher total loan growth and more risk taking within banks' loan portfolios. There is also evidence that some firms, depending on their capital structure, may have obtained advantageous financing due to QE. Foley-Fisher, Ramcharan, and Yu (2016) find that the Maturity Extension Program allowed firms dependent on long-term debt to issue more such debt as well as expand employment and investment.

Outside the recent QE literature, our paper relates to the broader literature that explores the impact of traditional monetary policy on the economy through the bank lending channel. This literature shows that shocks to financial institutions affect their ability to lend and end up impacting the firms that borrow from them (Bernanke, 1983; Stein, 1998; Kashyap and Stein, 2000). The impact of monetary policy on firms assumes that banks and firms are financially constrained to some extent (this literature also includes Kashyap and Stein, 1995; Peek and Rosengren, 1995; Holmstrom and Tirole, 1997; Bolton and Freixas, 2006, among others), which is a basic premise of our paper as well. The phenomenon of the crowding out of bank lending from one sector of the economy by another sector is related to the theory in Farhi and Tirole (2012) and the empirical evidence in Chakraborty, Goldstein, and MacKinlay (2018). Chakraborty, Goldstein, and MacKinlay (2018) find that during the U.S. housing boom, banks in stronger housing markets reduced commercial lending in favor of more mortgage activity, and firms that borrowed from these banks had to reduce investment as a result. Our paper shows that after the boom ended, a different phenomenon crowds out capital from firms: MBS purchases in quantitative easing led benefiting banks to increase real estate lending and reduce C&I lending.

Finally, our paper ties into a far more general literature on the effects of monetary stimulus on the economy.² A recent part of this literature investigates the connection between lower interest rates and bank activity (e.g., Maddaloni and Peydró, 2011; Jiménez, Ongena, Peydró, and Saurina, 2014; Dell'Ariccia, Laeven, and Marquez, 2014), negative interest rates and bank risk (Heider, Saidi, and Schepens, 2018), and pass-through to consumer credit (Di Maggio, Kermani, Keys, Piskorski, Ramcharan, Seru, and Yao, 2017; Agarwal, Chomsisengphet, Mahoney, and Stroebel, 2018). Another related strand looks at the effects of QE on asset prices (e.g., Krishnamurthy and Vissing-Jørgensen, 2011, 2013; Bekaert, Hoerova, and Duca, 2013; Hanson and Stein, 2015).

The remaining sections are organized as follows: Section 2 describes the data used for the analysis and how we determine bank exposure to asset purchases; Section 3 reports the effects of asset purchases on mortgage lending, firm-level loan activity, and overall bank commercial lending. Section 4 investigates the effects of asset purchases on firm investment and firm financing in general. Section 5 discusses potential endogeneity concerns and our methods to address them. Section 6 provides additional evidence in support of the crowding-out effect; Section 7 explores additional effects during the QE period; and Section 8 concludes.

2. Data

This paper considers the effect of asset purchases on the mortgage origination and commercial lending activity of banks, and how changes in bank activity affect lending to firms and their real activity. We combine mortgage origination data from the Home Mortgage Disclosure Act (HMDA) with bank commercial lending data from Call Report. We also use the Call Report data for other information about the bank's balance sheet and to measure its exposure to asset purchases. We supplement this data with information on bank mortgage rates from RateWatch. To establish firm-bank relationships and consider lending to specific firms, we use DealScan data combined with Compustat data for additional firm information. Our asset purchase data comes from the New York Federal Reserve. Given our focus on asset purchases made by the Federal

²Another strand of literature investigates the effects of post-crisis fiscal and regulatory policies on bank lending and the economy (e.g., Duchin and Sosyura, 2014; Chakraborty, Hai, Holter, and Stepanchuk, 2017; Becker and Ivashina, 2018).

Reserve, we consider the period from the fourth quarter of 2005 through the fourth quarter of 2013.³ Section 2.1 covers the Federal Reserve's asset purchase programs in more detail. As our identification strategy utilizes the differential impact of these asset purchases based on bank exposure to them, Section 2.2 discusses some features of the agency MBS market and how we measure bank exposure. Section 2.3 discusses the bank data in more detail and Section 2.4 discusses how we determine firm-bank lending relationships, along with the relevant firm and loan data.

2.1. Federal reserve asset purchases

Critical to our analysis are the amounts of MBS and Treasury securities purchased by the New York Federal Reserve under their permanent Open Market Operations programs. Historical data for these Treasury purchases begin in August 2005. In November 2008, the Federal Reserve announced a plan to purchase up to \$100 billion in direct obligations of government-sponsored or government-owned enterprises (GSEs/GOEs) and up to \$500 billion in MBS purchases, which started in early 2009.⁴ In March 2009, the program expanded with an additional \$750 billion in agency MBS purchases, \$300 billion in Treasury purchases, and continued until June 2010. This initial round of purchases became known as QE1.

In November 2010, the Fed announced a second round of purchases (QE2), totaling up to \$600 billion in Treasury purchases, which concluded in June 2011. The third round of quantitative easing (QE3), ran from September 2012 through October 2014, initially at purchase rates of \$40 billion per month for agency MBS and \$45 billion per month for Treasury securities. The total increase to the Fed's balance sheet after the completion of three rounds of QE totaled about \$1.75 trillion in MBS holdings and \$1.68 trillion in Treasury holdings.

While the net and gross purchases yield similar empirical results, we use gross purchases as a measure of amount of assets purchased each quarter. Using gross purchases allows us to capture the Maturity Extension Program (MEP)—when the Federal Reserve purchased long-term Treasuries and sold short-term Treasuries to reduce long-term bond yields—as part of the treatment. Figure 1 presents the total purchases by the Open Market Operations desk on a quarterly basis. Over this window, there are periods where there are

³The third quarter of 2005 is the first quarter with any asset purchase data, and the fourth quarter of 2013 is the most recent quarter for which all our data sources can be matched.

⁴The Federal Reserve made purchases of GSE/GOE obligations in September and December 2008. We include these purchases in our broader MBS category, but our results are similar if we exclude them from our analysis.

predominantly MBS purchases (e.g., 2008q4 through 2009q3), Treasury purchases (e.g., 2010q3 through 2011q3), and a mix of both security types (e.g., 2012q1 through 2012q4).⁵

2.2. Bank exposure to the MBS and Treasury markets

The agency MBS market is composed of two distinct markets: a specified pool (SP) market, where specific MBS are traded, and a to-be-announced (TBA) market. In the TBA market, the buyer and seller agree on six parameters of the contract: coupon, maturity, issuer, settlement date, face value, and price. The exact pool of mortgages that fits these parameters is determined at settlement, which is typically one to three months in the future (Gao, Schultz, and Song, 2017). The majority of agency MBS purchases undertaken by the Federal Reserve occurred in the TBA market, and the Fed mainly bought 15-year and 30-year MBS at coupons close to current mortgage rates.

Banks have two avenues to transform mortgages into agency MBS: (1) sell the loans individually to the government agency for cash, which the agency may include in an MBS pool, or (2) organize their mortgages into a MBS pool and have the GSE/GOE certify it as an agency MBS. The second method, referred to as a swap transaction, requires the bank to have an additional pool purchase contract with the agency. These swapped MBS remain on the bank's own balance sheet as MBS assets until they are sold or mature.

An important point of differentiation among banks is their level of involvement in the secondary mortgage market. We try to capture this in two ways: the first is a measure of how much of the bank's total assets are MBS. Because MBS holdings arise, in part, as an intermediate step in these swap transactions, banks holding more MBS are more likely to be active in the secondary market. In our analysis, we treat the top tercile of banks by MBS holdings as most exposed to the secondary mortgage market and the bottom tercile of banks by MBS holdings as least exposed. The second variable we use to capture secondary market involvement is a refinement of our MBS holdings variable. Specifically, we focus on the subset of top-tercile MBS banks that report non-zero net securitization income (denoted as *Securitizers*).⁶ Those banks that not only engage in transactions with GSEs/GOEs, but also securitize other non-agency loans, are more likely

⁵In our analysis, we use the log of the dollar amount of MBS or Treasuries purchased in a quarter in millions. Quarters without purchases take on a zero value.

⁶To ensure that we are correctly identifying banks which are large and active enough to participate in the secondary mortgage market, we additionally require the bank to have at least \$100 million in assets and a 0.2 basis-point share of the national mortgage origination market. Our results are similar if we omit these additional filters.

to be involved in the secondary mortgage market. Whereas more than 80% of our bank observations report some MBS holdings on their balance sheets, only 3% of banks in our sample report non-zero securitization income at some point.

Although not our central focus, we construct a similar exposure variable for Treasury purchases. Unlike MBS, banks do not originate new Treasury securities. However, changes in Treasury yields driven by Federal Reserve purchases can affect banks through changes in the value of their own Treasury holdings or related securities. Given the central role of Treasuries in determining the value of many securities, we separate banks into terciles by the amount of non-MBS securities held.⁷ Those banks which are in the highest tercile of securities holdings are likely to be more affected by Treasury purchases than banks in the lowest tercile of securities holdings through this capital gains channel.

2.3. Bank mortgage origination and commercial lending activity

As discussed above, the Federal Reserve conducted their MBS purchases through the TBA market, mainly at 15-year and 30-year maturities and coupons close to current mortgage rates. Such purchases incentivize banks to originate new conforming mortgages which can be packaged and sold in the TBA market. To capture banks' mortgage origination activity, we incorporate data from HMDA. Available on an annual basis, we use the origination data from 2005–2013. Specifically, we calculate the annual mortgage origination growth for each bank, at the holding company level. We use this data as opposed to relying on the bank's balance sheet data because it captures both the mortgages that remain on the bank's balance sheet and those that are sold to other parties. Given the manner in which QE was undertaken, banks most affected by the MBS purchases should be actively selling mortgages or packaging mortgages into agency MBS and subsequently selling them to the Federal Reserve. Disentangling the new origination activity from the subsequent MBS conversions and sales is difficult if only considering the amount of unsecured real estate loans on the bank's balance sheet. Summary statistics are included in Panel A of Table 1.

⁷Non-MBS securities include: Treasury securities, other U.S. government agency or sponsored-agency securities, securities issued by states and other U.S. political subdivisions, other asset-backed securities (ABS), other debt securities, and investments in mutual funds and other equity securities. While the average bank in our sample holds 14.4% of assets in these non-MBS securities, 8.2% of assets on average are held in just Treasury and other U.S. government securities (see Table 1). A possible argument is that Treasury purchases have a larger effect on government securities compared to other asset classes. Hence, as an alternative measure of securities holdings, in Appendix C.1 we restrict securities holdings to Treasury and other U.S. government securities and find similar results.

In addition to national mortgage origination growth, we use the bank's state-level market share in some analysis. Using RateWatch data, we calculate the bank's average state-level mortgage rate for both 15-year and 30-year fixed rate mortgages. These mortgage rates are calculated at a quarterly frequency.

We use Call Report data to construct our measure of commercial and industrial (C&I) loan growth, C&I loan profitability, the exposure measures discussed in Section 2.2, and our other bank-level control variables. These variables include the bank's size, equity ratio, net income, and cost of deposits. Acharya and Mora (2015) show that some banks experienced sizable liquidity shocks during the financial crisis. Hence, we also include loans to deposits and cash to assets as bank controls to absorb differences in liquidity. We calculate the unemployment rate across each bank's counties of operation using county-level unemployment rate data. We weight the unemployment rates by the fraction of total deposits of a bank in each county. We then utilize the change in this unemployment rate as an additional control. We use the bank's amount of demand deposits as a measure of constraints. The summary statistics for these variables are presented in Panel A of Table 1 and specific variable definitions can be found in Table A.1 in the Appendix.

2.4. Banks and commercial lending relationships

An important component of our analysis is the effect of the asset purchases on firm real activity through the bank lending channel. We determine firm-bank relationships using loan-level data from DealScan with firm-level data from Compustat.⁸ The duration of the relationship is defined as follows: it begins in the first quarter that we observe a loan being originated between the firm and bank, and it ends when the last loan observed between the firm and bank matures, according to the original loan terms. Following Chakraborty, Goldstein, and MacKinlay (2018), we use a link table which matches DealScan lenders to their bank holding companies in the Call Report data. In our sample period, we match 555 DealScan lenders to 138 bank holding companies in the Call Report data. These matches are determined by hand using the FDIC's Summary of Deposits data and other available data of historical bank holding company (BHC) structures. Throughout our analysis, all bank activity is investigated at the holding company level, so we refer to BHCs as "banks" for simplicity. Panel B of Table 1 provides statistics on the duration and number of relationships. Additional details on how relationships are determined and on the loan terms are provided

⁸We link borrowers from DealScan to Compustat data using the link file from Chava and Roberts (2008).

in Appendix A.

We also use DealScan for loan amounts, to calculate loan growth at a firm-bank level, and for other contract terms. From Compustat, we use several firm-specific variables in our analysis. For our investment regressions, we use Tobin's q, cash flow, firm size, and Altman's Z-score. For our analysis of changes in firm's debt and equity, we use market-to-book ratio, profitability, and tangibility in addition to firm size.⁹ As we focus on how financial intermediaries affect borrowing firms' investment and financing decisions, we exclude any borrowing firms that are financial companies. Panel B of Table 1 includes the summary statistics for our loan and firm variables.

3. Bank lending and QE

This section presents our first findings: while QE asset purchases stimulated mortgage lending as intended, they also led banks to reduce their credit supply to firms. Section 3.1 investigates the impact of asset purchases on bank lending in the mortgage market. Sections 3.2 and 3.3 consider how asset purchases affected commercial lending at the firm and bank level, respectively. Section 3.4 discusses our bank lending results in the context of the findings in Rodnyansky and Darmouni (2017).

3.1. Mortgage lending and asset purchases

As discussed in Section 2.2, the Federal Reserve attempted to stimulate new mortgage activity through MBS purchases in the TBA market. In our analysis, we focus on the growth in banks' overall mortgage originations, rather than just the mortgage holdings that remain on banks' balance sheets. This choice is motivated by this origination channel component of QE: banks are incentivized to originate new mortgages, package them as agency MBS, and sell them to the Federal Reserve in the TBA market.

Specifically, we investigate the mortgage origination growth rate of banks in a specific year in response to MBS purchases, depending on the banks' exposure to the MBS market. Our first measure of a bank's exposure is based on the bank's MBS holdings as a fraction of assets: banks in the top tercile of MBS holdings are considered more exposed and are compared to banks in the lowest tercile of MBS holdings.

⁹All firm and bank variables that are ratios are winsorized at the 1 and 99 percentiles. We deflate investment, Tobin's q, and cash flow by lagged quarterly gross property, plant, and equipment (PP&E) (Erickson and Whited, 2012). As gross PP&E is not available every quarter, we impute the missing values using a perpetual inventory identity.

The second measure refines the first measure and classifies the subset of high-MBS banks that securitize assets as the most exposed. We include year and bank fixed effects to ensure that aggregate conditions and bank-specific time-invariant characteristics are not driving the changes in origination activity. The specification for bank j in year t is as follows:

Mort Orig Growth Rate_{jt} =
$$\alpha_j + \gamma_t + \beta_1$$
MBS Purch_{t-1} + β_2 Bank Exposure_{jt-1}
+ β_3 Bank Exposure_{jt-1}×MBS Purch_{t-1} + β_4 Bank Vars_{jt-1} + ε_{jt} . (1)

In this specification, as we are looking at the annual growth rate of mortgages, all lagged variables (t - 1) are from the fourth quarter of the prior year. We specifically focus on β_3 , the interaction of the amount of asset purchases with the exposure of the bank to the MBS market.¹⁰ Throughout our analysis, we use the logarithm of the dollar amount of the purchases. Because we include year fixed effects, the coefficient for the MBS asset purchases (β_1) is absorbed. All specifications include the following bank-level characteristics: size (excluding loans since the dependent variable is based on loan activity), equity ratio, net income, cost of deposits, loans to deposits, and cash to assets. These variables capture differences in the scale and financial position of banks that might affect lending activity.¹¹ We include the change in unemployment rate across a bank's counties of operation based on its deposits, as a measure of local economic conditions faced by the bank.

Table 2 reports the results. Since the growth rate is scaled by 100, Column 1 shows that a 1% increase in MBS purchases increases mortgage origination by about 0.95 basis points (bps). This increase is for the more exposed (high-MBS) banks compared to the less exposed (low-MBS) banks, and the inclusion of year fixed effects removes any other factors that could affect origination activity. A different concern is that banks with high MBS holdings may have other characteristics that drive the response of the banks in terms of mortgage origination. In other words, it is not MBS holdings but—for example—banks with high net income that respond more to the incentives provided by the Federal Reserve through MBS purchases. To address this concern, we next refine our approach of grouping banks based on MBS holdings. We

¹⁰Because we use bank fixed effects in our specifications, the coefficient for bank exposure as a standalone variable (β_2) is not very economically meaningful. This is because not many banks switch between the high and low classifications of the exposure measures.

¹¹See, e.g., Gatev, Schuermann, and Strahan (2009); Ivashina and Scharfstein (2010); Cornett, McNutt, Strahan, and Tehranian (2011); Berger and Bouwman (2013).

estimate the amount of MBS holdings that can be explained by other bank characteristics (specifically size, equity ratio, net income, cost of deposits, loans to deposits, and cash to assets), and then calculate the residual MBS holdings for each bank. This term is thus the bank's MBS holdings orthogonalized to other bank characteristics. We then refine the terciles of banks by MBS holdings, using the orthogonalized MBS holdings. Column 2 reports the results. The coefficient point estimate drops by 39%, but the result remains statistically and economically significant: banks with higher MBS holdings lend more in response to MBS purchases.

Since the mechanism is that MBS asset purchases by the Federal Reserve in the TBA market encourage mortgage lending, we next use our second measure of the exposure of banks to MBS purchases to test the mechanism more directly. Column 3 focuses on the mortgage lending growth rate for high-MBS securitizer banks following MBS asset purchases. We maintain the same sample to compare securitizers to non-securitizers as in columns 1 and 2. Comparing column 3 with column 1, we find that the effects are nearly twice as strong in this case. A 1% increase in MBS purchases leads to an increase of about 1.87 bps in mortgage lending growth for the high-MBS securitizer banks. As a back of the envelope calculation, we determine that for an additional dollar of MBS purchases by the Federal Reserve, high-MBS securitizer banks provide an additional 3.63 cents in mortgage lending. For the \$1.75 trillion increase in the Fed's balance sheet from MBS purchases over the QE period, we estimate approximately \$63.53 billion in additional mortgage lending from these banks. The details of these calculations are provided in Appendix B. Thus, in response to MBS asset purchases, benefiting banks engaged in more mortgage lending. This evidence shows that the mortgage origination channel is significant for the transmission of QE.

3.2. Unintended effects of asset purchases on firm lending

We next discuss the effect of asset purchases by the Federal Reserve on commercial and industrial (C&I) lending. The argument as to why MBS purchases may crowd out C&I lending is as follows: to implement quantitative easing, the Federal Reserve announced its intention to purchase MBS. As discussed in Section 2.2, the majority of the Fed's agency MBS purchases were in the forward (TBA) market. Therefore banks—knowing that the Federal Reserve is purchasing TBA MBS—respond by shifting resources away from new C&I lending into mortgage origination and MBS creation.

To test whether such crowding out indeed took place, we first focus on loan activity at the firm level. By focusing on firm-level lending activity, we are best able to address the concern that firm demand for capital, rather than changes in credit supply, may be driving the results. The identification strategy is to compare the effect of asset purchases on the loan amounts or loan growth from multiple banks to the same firm. While this approach reduces the sample size to a set of firms that borrow frequently from multiple banks, it allows us to most exhaustively control for any firm demand factors. In Section 3.3, we look at the effect of asset purchases on banks' overall C&I lending activity.

3.2.1. Loan amount evidence

We estimate the impact of the asset purchases on the loan amount in quarter t for firm i that borrows from bank j as follows:

Loan Amount_{*ijt*} =
$$\beta_1$$
Asset Purch_{*t*-1} + β_2 Bank Exposure_{*jt*-1} + β_3 Bank Exposure_{*jt*-1}×Asset Purch_{*t*-1}
+ β_4 Bank Vars_{*jt*-1} + β_5 Loan Controls_{*ijt*} + α_j + θ_{it} + ε_{ijt} . (2)

The coefficients of interest are β_3 . We use firm by quarter fixed effects (θ_{it}) to remove any variation specific to a given firm in a given quarter. Any remaining differences in loan sizes, therefore, will not be driven by differences in firm demand for capital. We include bank fixed effects and the same set of bank-level controls as in Section 3.1 to control for other possible factors which might affect bank lending decisions. Although not our main focus, we also include the amount of Treasuries purchased by the Federal Reserve and a measure of bank exposure to these purchases. These additional variables allow us to disentangle the separate effects of MBS and Treasury purchases on bank lending. Finally, the specifications include the following loan-level controls: indicators for whether the facility is for takeover purposes, whether it is a revolving credit line, or whether it is a term loan.

Table 3 reports the results. Columns 1–4 use the exposure variable based on MBS holdings and columns 5 and 6 use the exposure variable based on high-MBS securitizers. All columns which include Treasury purchases use the exposure measure based on non-MBS securities holdings.¹² As discussed in Section 2.2,

¹²Because none of the banks in this subsample switch between the high and low classifications for the MBS and securitizer exposure measures, the standalone coefficients (β_2) are absorbed by the bank fixed effects α_i .

banks with higher securities holdings will benefit more from Treasury purchases lowering yields on these securities.

Column 1 provides the estimate of the impact of MBS purchases by the Federal Reserve on the credit supply of banks with higher MBS holdings. When the lending bank is in the top tercile of MBS holdings, a 1% increase in MBS purchases in the prior quarter leads to 17.6 basis point reduction in the loan amount (as scaled by the firm's assets). Column 2 does not find statistically significant effects for Treasury purchases. Column 3, which includes both types of asset purchases, shows that the negative effect of MBS purchases on loan amounts from banks with higher MBS holdings is present as in column 1. In contrast, loan amounts increase due to Treasury purchases. In column 4, we calculate the MBS and securities holdings for each bank orthogonalized to the bank's characteristics. This alternative method of classifying banks with high MBS or securities holdings leads to a larger effect for MBS purchases. The effect of Treasury purchases is statistically insignificant in this case. Columns 5 and 6 investigate high-MBS securitizer banks and find that MBS purchases led to a negative effect in these cases as well. Column 6 finds that Treasury purchases have a positive effect in the case of banks with high securities holdings. These results support the observation that MBS and Treasury purchases have different effects.

Overall, we find that when controlling for firm demand factors by comparing loans given to the same firm in the same quarter, banks which have higher exposure to MBS purchases (whether measured by high MBS holdings or active securitization) respond by reducing the amount of capital supplied to borrowing firms.

3.2.2. Loan growth evidence

The prior section compared loan amounts from different banks to the same firm in the same period to most exhaustively control for firm-specific demand effects. A complementary approach is to track changes in the individual syndicate loan shares of specific banks to a given firm before and after asset purchases. As in Section 3.2.1, while the sample of firms that borrow from multiple banks over a short period of time is small, this approach allows us to most robustly address firm demand concerns.

Following Khwaja and Mian (2008) and Lin and Paravisini (2012), among others, this section investigates the firm-bank pair loan growth after controlling for firm characteristics and aggregate economic conditions. Using loan-level data from DealScan, we first create a measure for the total supply of credit by each bank to each firm in Compustat, similar to a credit registry. This panel documents the credit supply of banks active in the commercial lending market to the firms in our sample. We then calculate firm-bank pair level loan growth. Specifically, when a new loan is initiated, we compare that amount (including any additional loans in the subsequent three quarters) to the amount borrowed in the prior year.¹³ Aggregating loan data over multiple periods is helpful as new loans are not initiated every period between each bank and firm. The regression specification that estimates the impact of the asset purchases on commercial lending in year *t* for firm *i* which borrows from bank *j* is:

Loan Growth_{*ijt*} =
$$\beta_1$$
Asset Purch_{*t*-1} + β_2 Bank Exposure_{*jt*-1} + β_3 Bank Exposure_{*jt*-1}×Asset Purch_{*t*-1}
+ β_4 Bank Vars_{*jt*-1} + α_j + θ_{it} + ε_{ijt} . (3)

We include bank fixed effects (α_j) in all specifications. We also include firm-year fixed effects (θ_{it}) to control for any firm demand explanations. Identification in this case is obtained over the cross-section of banks lending to the same firm in the same period of time.

Table 4 reports the results. Column 1 shows that syndicate banks that are in the top tercile of MBS holdings have lower loan growth for individual firms in response to additional MBS purchases, suggesting that a reduction in firm demand cannot explain our results. Column 2 considers the impact of Treasury purchases and finds a positive and statistically significant effect. Column 3 includes the interaction terms for the exposure of banks to both types of asset purchases. The point estimate of the interaction of MBS purchases with bank exposure (β_3) remains similar to that in column 1. The effect of Treasury purchases on exposed banks remains positive and significant.

As in prior sections, we refine the MBS and securities holdings measures by orthogonalizing these holdings to other bank characteristics and ranking them based on the refined measures (Column 4). We find a negative and statistically significant effect. Columns 5 and 6 focus on high-MBS securitizers. Column 5 shows that, similar to banks with high MBS holdings, higher MBS purchases by the Federal Reserve lead to less firm-level loan growth for securitizing banks. Column 6 includes Treasury purchases and reports effects

¹³Here we consider other syndicate banks in addition to the lead agent. The loan allotment is determined using the provided lender share data in DealScan. For those loans without share data, we estimate the share using the bank's role in the syndicate and the syndicate size.

that are similar in magnitude to those in column 5.

3.3. Effects on bank-level commercial lending

Using the sample of borrowers with multiple loans and lenders in Section 3.2, we are able to establish that loan reductions are not driven by a drop in firm demand for capital. We next consider the effect of asset purchases on the bank's overall commercial lending activity. Here, we utilize quarterly C&I loan growth as our measure of interest. As before, specifications include the following bank-level characteristics: size, equity ratio, net income, cost of deposits, loans to deposits, and cash to assets. We address persistent heterogeneity among banks by including bank-level fixed effects. We also include quarter fixed effects to control for changes in aggregate economic conditions, and changes in the unemployment rate across the bank's counties of operation to control for local economic conditions faced by the bank.

Table 5 reports the growth in C&I lending as a response to MBS and Treasury purchases. Columns 1–4 identify the effects on credit supply depending on whether the bank is in the top or bottom tercile of MBS holdings as a fraction of assets. Columns 5 and 6 focus on high-MBS securitizer banks to identify the effect of MBS purchases on credit supply. All columns use the exposure measure based on whether the bank is in the top or bottom tercile of non-MBS securities holdings to identify the effect of Treasury purchases on lending at the bank level.

The variables of interest are the bank-level interaction terms with the amounts of MBS and Treasury purchases. Column 1 shows that banks which are in the top tercile of MBS holdings, and hence benefit more from MBS purchases, have lower C&I loan growth in response to MBS purchases by the Federal Reserve. Since the dependent variable is quarterly and scaled by 100, column 1 reports that a 1% increase in MBS purchases reduces loan growth by about 0.064 bps. Column 2 shows that banks with higher holdings of securities reacted positively to Treasury purchases in terms of C&I lending.¹⁴ A 1% increase in Treasury purchases leads to 0.117 bps additional C&I loan growth. Column 3 includes both MBS and Treasury purchases and finds that the effects from columns 1 and 2 remain similar in magnitude and statistical significance. If a capital gains channel is the main cause for the positive effect of Treasury purchases on C&I lending, this suggests that the negative impact of the mortgage origination channel on commercial lending

¹⁴Table C.2 in Appendix C.1 finds similar results using a narrower definition of securities most likely affected by Treasury purchases.

must dominate any analogous positive capital gains channel for MBS holdings.

As in Sections 3.1 and 3.2, a possible concern is that banks with high MBS holdings may have other characteristics driving their C&I lending. Hence, we calculate the MBS holdings of a bank beyond what is predicted by observable bank characteristics. This orthogonalizes banks' MBS holdings to other bank characteristics. We perform an analogous procedure for the securities holdings as well. Column 4 reports that the results remain statistically and economically significant: banks with higher MBS holdings provide fewer new C&I loans compared to banks with lower MBS holdings. In Section 5.2, we perform two additional robustness tests: (i) we interact MBS purchases with additional bank characteristics; (ii) we repeat our analysis using a matched sample of banks. In both cases we find similar results.

Columns 5 and 6 focus on high-MBS securitizers to confirm that the observed effects are stronger for banks that benefit more from MBS purchases. We find effects approximately six times stronger in column 5 compared to column 1. A 1% increase in MBS purchases leads to about 0.364 bps lower C&I loan growth for securitizing banks. Detailed in Appendix B, we calculate that for each dollar of additional MBS purchases by the Federal Reserve, high-MBS securitizer banks reduced C&I lending by 1.22 cents. Comparing this estimate from column 5 with estimates obtained from column 3 in Table 2 (the corresponding specification), we find that for each dollar of additional mortgage lending due to QE MBS purchases, C&I lending by securitizer banks went down by 34 cents. Column 6 shows that controlling for bank exposure to Treasury purchases does not change the results obtained in column 5.

3.4. Recent work and our results

While it is not the main focus of their paper, Rodnyansky and Darmouni (2017) find some evidence that C&I lending remained flat or grew during Quantitative Easing. Their evidence contrasts with our findings in Sections 3.2.2 and 3.3, which are the closest specifications to those in their paper (specifically, Tables 6 and 7 of Rodnyansky and Darmouni, 2017). The difference in our results is due to key differences in the research design.

The first main difference in our specifications is that our paper utilizes quarter by quarter asset purchases along with time fixed effects in all our specifications (*Difference #1*). In comparison, Rodnyansky and Darmouni (2017) utilize the timing of QE rounds as the source of exogenous variation by using three time dummies for the QEs. Our approach allows us to separate out the effects of asset purchases from other contemporary economic events.¹⁵ Our identification is obtained from within-quarter cross-sectional differences in the response to asset purchases only. Further, we distinguish between MBS purchases and Treasury purchases. As QE1 and QE3 had both MBS and Treasury purchases, it is important to distinguish the impact of each security as they have different effects on lending. This point is lost in a specification that only uses QE indicators, as both types of purchases are commingled. By only using MBS-related treatments for QE1 and QE3, Rodnyansky and Darmouni (2017) assume that MBS purchases are the only channel of note.¹⁶ Indeed, we find that while MBS purchases had a negative effect on C&I lending, Treasury purchases had a positive effect on C&I lending. Thus, one reason that Rodnyansky and Darmouni (2017) find a flat or positive effect on C&I lending during QE1 and QE3 may be due to Treasury purchases during those periods.

There are other key differences in our specifications as well.¹⁷ Appendix C.2 compares our results with those of Rodnyansky and Darmouni (2017) in detail. It also confirms that our results are robust to using their set of controls. Beyond the results in Sections 3.2 and 3.3, the crowding-out effect of monetary stimulus on C&I lending guides our subsequent analysis in general. The rest of the paper seeks to further establish using multiple empirical strategies that MBS purchases led to the crowding out of C&I lending and adversely affected firms.

4. Crowding-out effects on firms

An important question that we address in this paper is whether there are unintended real effects of QE on firm outcomes. Our approach evaluates the impact of monetary policy on the real economy. To do so, we trace the impact of asset purchases by the Federal Reserve through banks' balance sheets onto firms that

¹⁵In addition, we capture the other sizable asset purchases that the Federal Reserve conducted between rounds (Figure 1).

¹⁶The reason the authors suggest that they can ignore Treasury purchases is because banks do not hold as much Treasury securities as MBS. However, they ignore non-Treasury U.S. government agency securities. Our summary statistics (Table I, Panel A) show that banks hold approximately 8.2% of assets in U.S. government securities, which is similar to the average MBS holdings of 7.1% of assets. Further, the total non-MBS securities holdings are approximately 14% of assets, which should also benefit from Treasury purchases through lower interest rates.

¹⁷Another important difference is the choice of outcome variable (*Difference #2*). Rodnyansky and Darmouni (2017) use the total balance sheet amount of loans, whereas we focus on the growth in loans in response to the treatment of asset purchases from the prior quarter. As the Federal Reserve's MBS purchases primarily affect banks' new mortgage origination activity, the principal effect of these new originations is on the crowding out of new C&I lending. We believe this crowding-out effect is better measured by C&I loan growth. In this choice, our approach is similar to Kashyap and Stein (2000) and Khwaja and Mian (2008). Further, we control throughout for heterogeneity across banks using bank-level controls and bank fixed effects (*Difference #3*).

have financing relationships with those banks. Thus, the aggregate impact of asset purchases is identified using micro-data at the firm level. Section 4.1 looks at the impact of asset purchases on firm investment. Section 4.2 considers how the reduction in lending affected firms' other financing decisions.

4.1. Unintended real effects on firm investment

Focusing on the bank lending channel, we consider the investment of firm *i* in quarter *t* which borrows from bank *j*:

Investment_{*ijt*} =
$$\beta_1$$
Asset Purch_{*t*-1} + β_2 Bank Exposure_{*jt*-1} + β_3 Bank Exposure_{*jt*-1}×Asset Purch_{*t*-1}
+ β_4 Firm Vars_{*it*-1} + β_5 Bank Vars_{*jt*-1} + α_{ij} + γ_{sit} + ε_{ijt} . (4)

As before, the coefficients of interest are the interaction variables that capture the heterogeneous impact of MBS and Treasury purchases depending on the exposure of the lending bank to these purchases. We continue to use the exposure measures based on dividing banks into terciles based on MBS and non-MBS securities holdings. We also consider the group of high-MBS banks that report securitization income. These banks, based on our mechanism, should be the most affected by QE.¹⁸

All specifications include the following firm-level characteristics: contemporaneous firm cash flow, Tobin's q, the financial health of the firm as measured by the Altman Z-Score, and firm size. The same bank-level controls as in Section 3 are included as well. The investment regressions include firms that have an active lending relationship with at least one bank in a given quarter. The unit of observation in this panel is, therefore, a firm-bank-quarter observation.

When focusing on firm-level real effects of bank-level shocks, an additional identification challenge arises. Firms with different capital demands may match with banks which have different exposures to these asset purchases. We address this possibility in multiple ways: in all specifications, we include firm-bank pair fixed effects, which remove any time-invariant differences across lending relationships (α_{ij}). Second, in addition to standard firm-level controls, all specifications include firm's state by quarter fixed effects (γ_{sit}).¹⁹ These fixed effects remove any common economic shocks to all firms headquartered in a given

¹⁸We present similar specifications that instead use continuous versions of the MBS and securities holdings variables over the full sample in Appendix C.3.

¹⁹The firm's state by quarter fixed effects absorb the coefficients for MBS Purchases and Treasury Purchases.

state, regardless of their lending banks location. Third, to address time-variant matching between banks and firms, we include interaction terms between firm characteristics and the bank exposure measures.²⁰

Table 6 reports the results. In column 1, the coefficient of the interaction term High MBS Holdings \times MBS Purchases shows that firms that borrowed from banks with higher MBS holdings decreased investment following higher MBS purchases from the Federal Reserve. A 1% increase in MBS purchases leads to a reduction of 0.037 bps of investment as a fraction of PP&E for firms that borrow from the high-MBS banks. The coefficient of the interaction term *High Securities Holdings* × TSY Purchases in column 2 is statistically insignificant. This suggests that the impact of asset purchases on firm investment through the bank lending channel is asymmetric for Treasury and MBS purchases: while MBS purchases have a negative effect, Treasury purchases do not. Column 3 combines the two types of asset purchases and finds similar results. As in previous sections, column 4 calculates the residual MBS holdings and residual non-MBS securities holdings after controlling for other bank characteristics. The coefficient of the interaction term for banks in the highest orthogonalized MBS holdings tercile and MBS purchases is statistically and economically similar to the coefficients in columns 1 and 3. In investment regressions, measurement error of investment opportunities is an important concern (Erickson and Whited, 2000, 2012). We utilize the cumulant estimator from Erickson, Jiang, and Whited (2014) in our column 5 to address the errors-in-variables issue for Tobin's q as a proxy for investment opportunities.²¹ The impact of MBS purchases as part of QE on firm investment remains similar under this approach.

Columns 6 and 7 test our mechanism further by focusing on banks that are securitizers and are in the highest tercile of MBS holdings. In both columns we find that firms which borrow from high-MBS securitizer banks invest less in response to MBS asset purchases. Using the estimates from column 6, in Appendix B we calculate that for an additional dollar of MBS purchases by the Federal Reserve, firms borrowing from high-MBS securitizer banks reduce their investment by 0.425 cents. Scaling the reduction in investment by the additional mortgage lending stimulated through MBS purchases by the Federal Reserve (3.63 cents as discussed in Section 3.1), we find that firms reduce their investment by 12 cents for each dollar increase in mortgage lending by securitizing banks.

These results show the unintended real effects of MBS purchases during QE: there is a negative effect of

²⁰As an additional test, Section 5.3 repeats the analysis of this section on a matched sample of firms.

²¹Specifically, we use a fifth-order cumulant estimator to treat the measurement error in the Tobin's q variables.

MBS purchases on firm investment through the bank lending channel. We do not find statistically significant evidence that Treasury purchases affect firm investment through its lending bank, suggesting that Treasury purchases and MBS purchases are dissimilar instruments for transmitting economic stimulus.²²

4.2. Firm financing decisions

This section investigates how firm financing decisions are affected by asset purchases. In particular, we look at how firms with lending relationships change their amounts of debt and equity following the Federal Reserve's asset purchases. The specifications are very similar to the firm investment specifications in Section 4.1. However, as we are looking at firm financing rather than firm investment, we utilize a different set of firm controls. Specifically, we control for the firm's size, market-to-book ratio, profitability, and tangibility. As in the specifications in Table 6, we include firm's state by quarter fixed effects, firm-bank fixed effects, and the same set of bank-level controls. We also interact firm controls with the lending bank's MBS holdings, securities holdings, and securitizer status to help control for possible time-varying matching concerns between firms and banks.

Table 7 reports the results. Columns 1 and 2 focus on the change in debt. The negative coefficient of the interaction term *High MBS Holdings* \times *MBS Purchases* in column 1 suggests that firms that borrow from banks with higher MBS holdings take on less debt following MBS purchases than firms which borrow from banks with lower MBS holdings. It appears these firms do not completely substitute to alternative sources of debt financing when banks reduce lending. Column 2, which uses a bank's status as a securitizer to classify exposure to MBS purchases, finds similar results. Columns 3 and 4 investigate whether these firms obtain more equity financing. We do not find evidence that these firms substituted away from debt financing to equity financing.

In combination with the results in Section 4.1 that document the unintended negative effects of MBS purchases on firm investment, these results help complete the picture: firms do not obtain alternative sources

²²An alternative approach to conduct the analysis in this section is to aggregate the characteristics of all banks lending to a firm in a given quarter into those of one "average" bank. Our results are generally robust in this case as well. We prefer our framework because we can explicitly control for differences in specific lending relationships with firm-bank fixed effects. For example, the nature of a bank's relationship with an established multinational firm may be very different from its relationship with a young smaller firm (see Petersen and Rajan, 1994; Karolyi, 2017, for example, regarding the importance of lending relationships). Our identification is then obtained within a firm-bank relationship: specifically, how the treatment of monetary stimulus affects a firm through a specific bank over the course of their relationship.

of financing to completely compensate for the reduction in C&I lending due to the Federal Reserve's MBS purchases.

5. Other endogeneity concerns

Our analysis in Sections 3 and 4 takes many steps to rule out possible contaminating effects, such as changes in firm demand for capital or other concurrent economic or policy events. Throughout our analysis, our identification strategy assumes the different measures of bank exposure capture the different incentives of banks. Given the importance of the mortgage origination channel for our argument, these measures should be capturing fundamentally different mortgage business models for banks. In other words, the tercile rank of MBS holdings, as well as whether a bank is a securitizer, should not fluctuate with period by period asset purchases. Section 5.1 discusses the source of variation in MBS holdings and its persistence.

Related, Section 5.2 provides additional tests to address concerns that other bank characteristics, and not MBS holdings or securitizer status, are the reason behind the differential response of banks to asset purchases. Section 5.3 addresses concerns that differences in characteristics of firms, not the differences in banks, are driving the differential outcomes of firms.

5.1. Source of variation in MBS holdings

Given our identification strategy uses cross-sectional differences in bank mortgage activity, it is important to better understand the source of variation in the MBS holdings of banks. First, we find that the relative grouping of banks in terms of MBS holdings and securitization status is quite persistent. On average, about 96% of banks remain as a high-MBS bank or a low-MBS bank from quarter to quarter.²³ Second, banks with high MBS holdings have approximately 15% of assets in MBS, while the banks with low MBS holdings holdings have approximately 15% of assets in MBS.

What explains a bank's decision to hold MBS? We find that banks with high MBS holdings are larger and have lower cost of deposits. At the same time, banks with more MBS holdings seem to be exploiting opportunities in the mortgage market more aggressively than the low-MBS holdings banks: these banks are

²³Table C.5 reports the transition probabilities. Table C.6 reports bank characteristics conditional on being included in the High/Low MBS Holdings terciles as well as the Securitizer/Non-Securitizer groups.

growing their mortgage portfolios 3 percentage points (pp) faster (in terms of national mortgage origination growth rate) from a larger base (more than three times higher average mortgage origination market share). In terms of business strategy, they are growing their mortgage portfolio by aggressively competing on interest rates (offering an average of 33 basis points or 89 basis points lower rates for 30-year and 15-year fixed rate mortgages, respectively).

These banks with faster mortgage growth appear to have more financial constraints: banks with high MBS holdings have a 0.6 pp lower average equity ratio and 30% lower cash holdings relative to the average for low-MBS banks.²⁴ The business model of these banks favors investment in mortgages at the expense of U.S. government securities: high-MBS banks hold 50% less U.S. government securities compared to banks with low MBS holdings. On average, banks with high MBS holdings are more involved in mortgage markets. However, in terms of C&I lending, both groups of banks have similar lending growth on average.²⁵

5.2. Heterogeneity across banks

Section 5.1 suggests that banks' MBS holdings and securitization status are quite persistent and likely are not driven by the Federal Reserve's asset purchases. Still, one may be concerned that other channels, and not mortgage activity captured by MBS holdings or securitizer status, are driving the response of banks to asset purchases. To address this concern, we take the following steps. First, throughout the paper, we report a specification in which we utilize a bank's MBS holdings orthogonalized to other bank characteristics (size, equity ratio, net income, cost of deposits, cash to assets, and loans to deposits). In this case, only MBS holdings that are not explained by other bank characteristics are used to identify cross-sectional differences in bank responses.

Second, to address the above mentioned concern in an alternative manner, Table 8 interacts the other bank controls with the Federal Reserve's MBS purchases. Columns 1 and 2 of Table 8 report the effect of MBS purchases on C&I lending (similar to Table 5), and columns 3 and 4 report the effect of MBS purchases on borrowing firms' investment (similar to Table 6). Comparing the coefficient of *High MBS Holdings* × *MBS Purchases* in column 1 of Table 8 with column 4 of Table 5, we find that the point estimate

²⁴Demyanyk and Loutskina (2016) show that temporary mortgage holdings increase capital requirements for banks. Section 6.1 discusses bank constraints in some detail.

²⁵Table C.6 shows no statistical difference in C&I loan growth between banks with high and low MBS holdings, or between securitizers and non-securitizers.

is somewhat reduced. The point estimate in the case of securitizers is also lower compared to its equivalent specification (column 2 versus column 6 of Table 5). Nevertheless, the estimated effects remain statistically and economically significant.

These differences in point estimates suggest that other bank characteristics can explain a small portion of the effects. Larger banks appear to reduce commercial lending more in response to MBS purchases. As banks that are most exposed to the origination channel are of a certain scale to originate sufficient volume of new mortgages to securitize and sell to the Federal Reserve, it is intuitive that bank size captures a piece of the effect. However, the unintended negative consequences of MBS purchases on C&I lending, as captured through the MBS holdings or securitizer classifications, remain statistically and economically significant. In the case of firm investment reported in columns 3 and 4, we find that the point estimates remain similar to those in columns 3 and 7 of Table 6, respectively.

In addition to the approach above, we reproduce our main commercial lending results (Table 5) using a matched sample. This third approach allows us to condition away observed differences across banks to confirm that these differences are not driving our results. In Table 9, we present the analogue of Table 5 using this matched sample. Specifically, we estimate a bank's likelihood of being a high-MBS bank conditional on the set of bank control variables. We take the propensity score from this estimation and perform a nearest neighbor match for each high-MBS bank observation to its closest low-MBS bank observation. To ensure the best possible matches, we choose to match with replacement (Roberts and Whited, 2012). Across the specifications of Table 9, we find estimates of the effect of MBS purchases on more exposed banks to be similar to the results in Table 5.

5.3. Heterogeneity across firms

A different concern is that firms and banks will match for specific reasons, some of which could make it more difficult to disentangle the effect of asset purchases on commercial lending and firm activity. In our sample, firms that are smaller in size, lower in profitability, and have less tangible assets tend to match with banks that have higher MBS holdings. A similar pattern emerges for firms that borrow from securitizer banks compared to non-securitizers.²⁶

²⁶Table C.7 reports the differences in firm characteristics by the type of bank.

To make sure these differences are not driving our results, we take the following steps. First, we control for persistent differences in firms and their relationships with particular banks by using firm-bank fixed effects in the appropriate specifications. Second, in our firm-level results we interact time-varying firm characteristics with our measures of bank exposure to asset purchases. These interactions help control for differences in firm activity that may arise from firms matching with banks based on particular characteristics.

Nevertheless, as an additional robustness check, we reproduce our main results regarding real effects at the firm level (Table 6) using a matched sample. This approach allows us to condition away some of the observed differences across firms to confirm that these differences are not driving our results. In Table 10, we match each firm observation for firms that borrow from a high-MBS bank with its nearest neighbor that borrows from a low-MBS bank. For the purposes of matching, we estimate the propensity score using a probit model with the firm's lagged size, lagged Tobin's q, and lagged Z-score as control variables. We allow matches with replacement. Across the specifications of Table 10, we find estimates that are similar in economic magnitude and statistical significance as in our full sample of borrowers of high-MBS and low-MBS banks in Table 6.

6. Constraints at the bank and firm level

The presence of constraints for firms and banks is an important component of the bank lending channel (Holmstrom and Tirole, 1997). Section 6.1 considers how asset purchases affect commercial lending growth depending on bank-level constraints. Section 6.2 compares more and less constrained firms and how their investment responds to asset purchases. Section 6.3 provides further evidence that the reduction in lending to firms is due to banks cutting lending and not due to firms demanding less credit.

6.1. Commercial lending and bank constraints

This paper argues that the negative C&I growth result is driven by the mortgage origination channel related to QE. Our argument requires us to show that the mortgage originating banks are responding to MBS purchases by increasing mortgage lending activity. The results from Section 3.1 provide evidence of this.

In addition, it is also necessary that the banks were sufficiently constrained that they needed to substitute

away from other types of lending, and C&I lending in particular.²⁷ To test this, in Table 11, we split banks into more constrained and less constrained subsamples based on deposit financing (Ivashina and Scharfstein, 2010). Specifically, if the bank is above the median bank in terms of demand deposits as a fraction of assets, we classify it as less constrained. Banks below the median bank in terms of access to demand deposit financing are considered more constrained.

The coefficient of the interaction term *High MBS Holdings*×*MBS Purchases* in column 1 shows that when the Federal Reserve purchases MBS assets, banks with less access to demand deposit financing and high MBS holdings have statistically-significant lower C&I loan growth. Thus, constrained banks are reducing credit supply to firms in response to MBS purchases. Column 2 reports that less constrained banks with high MBS holdings do not significantly reduce their loan growth in respose to MBS purchases. The difference between the coefficients of the interaction terms in columns 1 and 2 is statistically significant at the 10% level. Column 3 shows that banks that are high-MBS securitizers but have less access to demand deposit financing respond approximately four times more strongly to MBS purchases by reducing C&I loan growth (comparing the interaction coefficients of columns 1 and 3). The less constrained securitizers also have a negative point estimate in column 4, but the larger standard error leads to no statistically significant. This may suggest that even the securitizer banks with more demand deposits were sufficiently affected by the origination channel that the reduction in C&I lending was not confined to the more constrained securitizer banks.

Part of the reason for this reduction is that engaging in additional mortgage lending ties up what capital these more constrained banks have available. Even for banks which are originating mortgages with the sole purpose to quickly distribute them as MBS, Demyanyk and Loutskina (2016) estimate that for more active banks, the temporary mortgage holdings would lead to 1% higher capital requirements. At the same time, Ivashina and Scharfstein (2010) and Cornett, McNutt, Strahan, and Tehranian (2011) find that banks with less demand deposit financing are most likely to be constrained as alternative financing options became more scarce. For banks that cannot access additional financing, it is understandable that they would cut back on other types of lending that carry larger capital requirements. As C&I loans generally carry a 100% risk

²⁷Bernanke (1983), Khwaja and Mian (2008), Paravisini (2008), and Schnabl (2012) provide empirical evidence on financial constraints faced by banks and their effect on lending.

weight, reducing new C&I lending is an effective way to offset the capital costs from new mortgage activity.

Considering the evidence above, along with the evidence presented in Section 3, the origination channel drives up mortgage lending at the expense of C&I lending. The unintended negative consequence is most significant for the most constrained banks that are active in the mortgage market. Even for the less constrained banks, the net effect of the capital gains channel and the origination channel does not create a positive stimulus to commercial lending,

6.2. Constrained firms and asset purchases

The analysis so far has focused mainly on the heterogeneity among banks. However, for the reduction in firm investment to be driven by banks reducing commercial lending, the firms must face some capital constraints. Otherwise, these firms would simply move to another source of capital, such as another bank or public debt markets. Typically, sufficient frictions exist that firms are not able to fully substitute for lost capital (see, e.g., Faulkender and Petersen, 2006; Sufi, 2009; Leary, 2009; Chava and Purnanandam, 2011).

Table 12 divides firms by their likelihood of facing financing constraints based on size (Hadlock and Pierce, 2010).²⁸ In columns 1 and 2, we split the firms based on firm size and interact the amount of MBS and Treasury purchases with the lending bank's exposure to the respective asset purchases. Column 1 reports the results for the smallest tercile of firms and column 2 reports the results for the largest tercile of firms. We find negative investment effects for smaller firms that borrow from banks with higher MBS holdings following MBS purchases. The effect on larger firms is smaller in magnitude. This is consistent with small firms—which are likely to be more constrained—being less able to replace lost capital from exposed banks and reducing investment as a result.

Columns 3 and 4 focus on the sample of firms that have a relationship with a high-MBS securitizer bank. Again, we note that when the Federal Reserve purchases MBS, firms in the bottom tercile by size that borrow from securitizing banks face large real effects in terms of reduced investment (column 3). Column 4 shows that firms in the top tercile by size which borrow from securitizer banks face a statistically insignificant effect. The point estimate is also smaller in magnitude. The difference in the effect between the two samples

²⁸There is no estimated coefficient for *High MBS Holdings* or *Securitizer* in columns 2 and 4, respectively, because none of these banks move between the highest and lowest MBS terciles or securitizer/non-securitizer classifications in this sample. The variables are absorbed by the firm-bank fixed effect.

is significant at the 5% level.

The impact of Treasury purchases is weak in both categories when we split the sample by firm-level constraints. These result generally suggest that Treasury purchases do not positively affect firm investment decisions and is in line with our investment results in Section 4.1.

6.3. Profitability of commercial lending and asset purchases

Section 3.2 addresses the concern that our results regarding the decrease in commercial lending are driven by a reduction in firm demand for credit. Another approach to address this concern is to consider the profitability of commercial lending in response to MBS purchases. If MBS purchases crowd out commercial lending, then banks should ration the credit supply of the less profitable commercial loans (see, e.g., Stiglitz and Weiss, 1981). In contrast, if firms demand less credit and the reduction in commercial lending is driven by lower firm demand, then the profitability of commercial lending should not increase in response to MBS purchases.

Table 13 reports the results. The dependent variable is the change in quarterly C&I profitability of a bank, in percentage points. Because this analysis is conducted at the bank level, the rest of the specification follows that used in Section 3.3. The coefficient of the interaction term in column 1 suggests that banks which are in the top tercile of MBS holdings experience a higher increase in the profitability of commercial lending in response to MBS purchases than banks in the bottom tercile. Column 2 focuses on Treasury purchases. In this case, we find asymmetric results: the C&I profitability of banks with high securities holdings declines with Treasury purchases by the Federal Reserve. This result is consistent with the evidence in Section 3.3 that also suggests that higher Treasury purchases allow exposed banks to expand their credit supply. Column 3 includes both MBS and Treasury purchases and finds similar results to those in columns 1 and 2. Column 4 utilizes the residual MBS and securities holdings that cannot be explained by other bank characteristics and uses these orthogonalized holdings as measures of the bank's exposure to asset purchases. Results remain similar to those reported for column 3.

Since high-MBS securitizer banks are the biggest beneficiaries of the origination channel and reduce their commercial credit supply the most, we should expect them to experience stronger profitability gains. Column 5 suggests this is the case: comparing the coefficients of column 5 with those of column 1, we note that securitizing banks experience an approximately four times larger increase in C&I profitability for the same amount of MBS purchases. Column 6 includes Treasury purchases and finds similar results.

Taken together, we find banks that are more exposed to MBS purchases increase mortgage originations, decrease commercial lending, and the profitability of the remaining commercial lending increases as a result. This evidence, combined with the loan-relationship level evidence in Section 3.2 and constraint-based subsamples in Sections 6.1 and 6.2, is consistent with MBS purchases crowding out commercial lending and investment through the bank lending channel.

7. Additional discussion

This section provides additional results regarding the QE period. Section 7.1 discusses other monetary and fiscal stimulus actions that overlap with the Federal Reserve's asset purchases. Section 7.2 looks at how commercial lending is affected by asset purchases in the early and later parts of the QE period. Section 7.3 reports the change in the state-level mortgage origination market share of banks in response to MBS purchases as an alternative measure of mortgage lending. Section 7.4 investigates how mortgage rates offered by banks changed in response to MBS purchases during QE.

7.1. Lessons from concurrent events

Two important events during the QE period are the stimulus provided through low interest rates and TARP. TARP authorized the U.S. Treasury to purchase illiquid assets from financial institutions. Duchin and Sosyura (2014) find that banks that received TARP assistance originated more and riskier mortgages. However, the authors do not find any evidence that corporate lending volume increased in response to TARP. In conjunction with the asset purchases of QE, the Federal Reserve also provided monetary stimulus by keeping the federal funds rate low. We estimate the stimulus provided by this action. Figure 2 reports the effective federal funds rate and the interest rate suggested by the Taylor Rule. We consider the gap between the two rates as the net stimulus to the economy through the maintained federal funds rate.

We next conduct an exercise similar to that in Section 3.3 by interacting the new rate stimulus variable with different groups of banks. Table 14 reports the results. We find that there is suggestive evidence that banks with higher MBS holdings provided more C&I lending due to stimulative interest rates. At the same

time, we find that the negative effect of MBS purchases on C&I lending persists and is similar to what we find in Table 5.

Since our paper focuses on the importance of the origination channel, the final two columns of Table 14 consider the high-MBS securitizer banks which are the most exposed to this channel. In these columns, we do not find that the rate stimulus led to more C&I lending. So although we do find evidence of increased C&I lending for the broader measure of exposure based on MBS holdings, the high-MBS securitizer banks do not react to the stimulus in a similar manner. This suggests that the origination channel dominates the other channels for the securitizer banks.

7.2. Commercial lending in different QE periods

In Section 3.3, we show that banks particularly exposed to the Federal Reserve's MBS purchases reduce their commercial loan growth. In Section 6.1, we further find that the effects are strongest for those banks which are the most constrained. A related question is whether the effects varied over the QE period. Specifically, the banking sector as a whole was most constrained during the financial crisis and the period through QE1. While QE2 and QE3 were implemented to further improve economic conditions, the banking sector was no longer in as dire straits.

In Table 15, we split our main interaction variables into two parts: the effect of MBS and Treasury purchases through QE1 and the effect of MBS and Treasury purchases post-QE1. Column 1 presents the MBS and securities holdings terciles and column 2 presents the orthogonalized versions. We find that for banks with high MBS holdings, the effect of MBS purchases is concentrated in the period through QE1. This is consistent with banks being, on average, more constrained during that period and therefore more likely to cut commercial lending when increasing mortgage lending to alleviate capital charges. At the same time, the strongest effects for Treasury purchases on commercial lending appear after QE1. Although banks are benefiting from the capital gains channel across both periods, the banks did not actively convert those gains into more commercial lending through QE1. This may be because from a capital requirements standpoint, Treasuries and other government agency debts carry a 0% risk weight. If banks were already constrained, selling these types of securities and increasing their commercial lending (which carries a 100% risk weight) would be particularly costly.

Column 3 of Table 15 looks at the effect of MBS purchases on high-MBS securitizer banks depending on the time period. In this case, both the period through QE1 and after QE1 show strong negative effects. The origination channel of QE is sufficiently strong for these particular banks such that, throughout the QE period, they see mortgage origination and MBS production as the focus of their additional lending activity at the continued expense of new commercial lending.

7.3. Mortgage lending market share

As an alternative measure for mortgage activity, we consider how the market share of banks changes in response to MBS purchases.²⁹ We investigate the change in mortgage origination market share of banks at a state level. This allows us to more finely control for differences in local economic conditions and confirm that our mortgage loan growth results are not driven by a particular region.

Before reporting the regression analysis, Figure 3 shows the average market share at the state level for securitizer banks in years not following MBS purchases and years immediately following MBS purchases. For the securitizer banks, which are likely to be the most active in secondary mortgage markets, we see significant increases in their average state-level market share following government MBS purchases. This effect is consistent across the majority of states.³⁰

The specification for bank *j* active in state *s* in year *t* is as follows:

Mort Orig Mkt Share_{*jst*} =
$$\alpha_j + \gamma_{st} + \beta_1$$
MBS Purch_{*t*-1} + β_2 Bank Exposure_{*jt*-1}
+ β_3 Bank Exposure_{*jt*-1}×MBS Purch_{*t*-1} + β_4 Bank Vars_{*jt*-1} + ε_{jst} . (5)

To control for local economic factors unrelated to MBS purchases, we include state by year fixed effects (γ_{st}) for each state where the bank has some market share. We also include bank fixed effects (α_j) to ensure that bank-specific time-invariant characteristics are not driving the changes in market share.

Table 16 reports the results. Column 1 shows that an increase in MBS purchases in the final quarter of the prior year leads to a gain in terms of MBS origination market share for a bank with high MBS holdings.

²⁹Recent papers that utilize market share in analysis include Scharfstein and Sunderam (2016), Bord, Ivashina, and Taliaferro (2017), and Cortés and Strahan (2017).

³⁰Figure C.1 in the Appendix repeats the analysis for the non-securitizer banks. In this case, there is no significant difference in average state-level market share in response to MBS purchases.

As in previous sections, we refine the terciles of banks by MBS holdings using the orthogonalized MBS holdings and conduct a similar analysis. Column 2 reports the results. The coefficient point estimate drops but the result remains statistically and economically significant: banks with higher MBS holdings lend more in response to asset purchases. Column 3 focuses on the gain in market share of high-MBS securitizer banks following MBS asset purchases. Comparing with column 1, we find that the effect is approximately eight times stronger in this case. Across all our specifications, we find that in response to MBS purchases, benefiting banks increased their share of mortgage lending.

7.4. Rates for new mortgages

Supporting housing and mortgage markets was a stated objective of QE. Section 3.1 shows that MBS purchases led to more mortgage lending by the banks most exposed to these purchases. We now investigate if banks with higher MBS exposure offered lower rates to consumers.³¹

Here we consider two types of mortgage rates: the 15-year and the 30-year fixed rate mortgage. When looking at the specific types of MBS purchased by the Federal Reserve, about 8.4% were 15-year mortgages and 90.7% were 30-year mortgages.³² The observation unit is at the bank-state-quarter level. Table 17 reports the results. Column 1 considers the impact of the Fed's MBS Purchases on the 30-year fixed rate mortgage rates of banks with high MBS holdings. Column 2 orthogonalizes MBS holdings based on other bank characteristics, so that only the unexplained MBS holdings are used for the analysis. Column 3 considers the securitizing banks. Columns 4–6 repeat the analysis for 15-year fixed rate mortgages. Across all specifications, we include bank fixed effects, state by quarter fixed effects, and the set of bank control variables used elsewhere in the paper.³³

Column 1 reports that banks with higher MBS holdings offered a lower rate in response to MBS purchases. Column 2 reconducts the analysis using the MBS holdings for each bank orthogonalized with respect to other bank characteristics and finds a negative but not statistically significant result. Column 3 finds that

³¹Related, Scharfstein and Sunderam (2016) investigate how the market power of banks affects the transmission of monetary policy.

³²The remaining purchases (less than 1%) were either 20-year MBS or the term information was not provided.

³³We require that the quoted mortgage rate does not include points or other specialized terms and is for a typical 20% down payment. As contracts that include points, lower down payments, or other special features are more prevalent in 30-year mortgages than 15-year mortgages, this helps explain the lower observation count for 30-year mortgages. In unreported analysis, we find that including mortgage rates with points (using a rate adjustment factor of 25 basis points per mortgage point) or including mortgage rates which allow smaller down payments do not significantly affect the results.

high-MBS securitizing banks also lowered their average interest rate following MBS purchases. For 15-year fixed rate mortgages, columns 4–6 report results similar in magnitude to those in columns 1–3. On average, MBS purchases led to lower interest rates for individuals which borrowed from the more exposed banks.

8. Conclusion

Much research focuses on the negative effects of large downturns in the economy and the benefits of monetary policy support. In this paper, we consider the impact of quantitative easing on bank lending and firm investment.

We find that banks that benefit from MBS asset purchases increase mortgage lending. However, an important unintended consequence is that these banks reduce commercial lending. The reduced lending has real effects. Firms which borrow from these banks decrease investment as a result. Treasury purchases do not lead to the same response. A separate finding is that the positive impact of Treasury purchases during quantitative easing through the bank lending channel on private investment seems to be small.

Policymakers have argued for the need to support important asset markets in order to increase consumer wealth, consumer demand, and real economic activity. When considering intervention in certain asset markets, such as the housing and Treasury markets, it is important to consider the potential asymmetric effects on banks and firms.
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Fig. 1. Quarterly totals of Treasury (TSY) and mortgage-backed security (MBS) purchases by the Federal Reserve. The MBS purchases include direct GSE/GOE obligations purchased in 2008. Source: New York Federal Reserve.



Fig. 2. Fed Funds Rate and Taylor Rule. The figure plots the effective federal funds rate and the rate implied by the Taylor Rule (Taylor, 1993). Data is from the St. Louis Federal Reserve's FRED database https://fred.stlouisfed.org/graph/?g=cN69. FRED measures the output gap as the difference between potential output (published by the Congressional Budget Office) and real GDP. Inflation is measured by changes in the GDP implicit price deflator and the target inflation rate is 2%. FRED also assumes a steady-state real interest rate of 2%. Interest rate is in percentage points.



Fig. 3. Average state-level mortgage origination market share for securitizer banks, in percentage points. Top panel includes years not following fourth-quarter MBS purchases (2006, 2007, 2008, 2009, 2012). Bottom panel includes years following fourth-quarter MBS purchases (2010, 2011, 2013).

Table 1 Summary statistics

This table presents the summary statistics of the merged sample of bank holding companies and borrowing firms as obtained from Call Report, HMDA, DealScan, Compustat, and RateWatch databases. Our sample period runs from 2005q4 through 2013q4. All variables are at a quarterly frequency, with the exception of the mortgage origination and market share variables, which are at an annual frequency. The variable definitions are provided in Table A.1.

| Panel A: Bank Variable and Asset Purchase Statistics | | | | | | |
|--|--------|---------|-------------|--------|-------------|---------|
| | Mean | Std Dev | 25th Pctile | Median | 75th Pctile | # Obs. |
| Bank Variables | | | | | | |
| MBS Holdings (%) | 7.07 | 8.35 | 0.22 | 4.09 | 10.9 | 155,573 |
| Securities Holdings (%) | 14.4 | 11.5 | 5.72 | 11.8 | 20.4 | 155,573 |
| US Gov. Securities Holdings (%) | 8.18 | 8.89 | 1.67 | 5.41 | 11.6 | 155,573 |
| C&I Loan Growth (%) | 1.43 | 13.4 | -4.90 | 0.28 | 6.24 | 155,573 |
| Change in C&I Loan Profitability (%) | -0.90 | 26.9 | -11.6 | -0.73 | 9.94 | 155,573 |
| Bank's Size | 12.2 | 1.36 | 11.3 | 12.1 | 12.9 | 155,573 |
| Bank's Equity Ratio (%) | 10.3 | 2.74 | 8.60 | 9.83 | 11.5 | 155,573 |
| Bank's Net Income (%) | 0.48 | 0.69 | 0.20 | 0.46 | 0.84 | 155,573 |
| Bank's Cost of Deposits (%) | 1.06 | 0.83 | 0.42 | 0.80 | 1.54 | 155,573 |
| Bank's Cash to Assets (%) | 6.73 | 6.22 | 2.64 | 4.37 | 8.48 | 155,573 |
| Bank's Loans to Deposits (%) | 77.4 | 18.9 | 65.3 | 78.9 | 90.8 | 155,573 |
| Bank's Demand Deposits (%) | 12.0 | 7.03 | 6.85 | 11.0 | 15.6 | 155,573 |
| Securitizer | 0.0077 | 0.088 | 0 | 0 | 0 | 155,573 |
| Change in Unemp. Rate, Bank's Counties | 0.073 | 1.33 | -0.80 | -0.10 | 0.81 | 155,573 |
| Mortgage Origination Growth (%) | 23.3 | 80.8 | -23.2 | 3.20 | 42.9 | 21,882 |
| State-Level Mortgage Orig. Market Share (bps) | 26.0 | 123.1 | 0.16 | 0.98 | 6.42 | 68,951 |
| Average 30-Yr. Rate (bps) | 565.9 | 106.2 | 483.3 | 595.8 | 650 | 7,970 |
| Average 15-Yr. Rate (bps) | 548.6 | 141.4 | 437.5 | 580.1 | 637.5 | 11,605 |
| Monetary Policy Variables | | | | | | |
| TSY Purchases (Bil. USD) | 70.3 | 88.0 | 1.88 | 15.3 | 134.0 | 33 |
| MBS Purchases (Bil. USD) | 95.3 | 142.8 | 0 | 6.65 | 200.8 | 33 |
| Rate Stimulus (%) | 3.34 | 1.23 | 2.58 | 3.64 | 4.41 | 33 |

Table 1—Continued

| Panel B: Relationship, Loan, and Firm Variable Statistics | | | | | | |
|---|-------|---------|-------------|---------|-------------|--------|
| | Mean | Std Dev | 25th Pctile | Median | 75th Pctile | # Obs. |
| Relationship Characteristics | | | | | | |
| Bank Holding Companies per Borrower | 1.59 | 0.91 | 1 | 1 | 2 | 4,361 |
| Duration of Relationship (years) | 6.86 | 4.29 | 4.75 | 5 | 8.50 | 6,925 |
| Number of Loan Facilities | 2.86 | 2.70 | 1 | 2 | 3 | 8,674 |
| Loan Characteristics | | | | | | |
| Loan Amount (%) | 18.4 | 19.0 | 5.82 | 12.1 | 24.9 | 6,568 |
| All In Drawn Spread (bps) | 192.5 | 136.8 | 100 | 175 | 250 | 6,568 |
| Maturity (months) | 51.7 | 19.6 | 38 | 60 | 60 | 6,568 |
| Takeover Loan (indicator) | 0.18 | 0.39 | 0 | 0 | 0 | 6,568 |
| Revolving Credit Line (indicator) | 0.70 | 0.46 | 0 | 1 | 1 | 6,568 |
| Term Loan (indicator) | 0.26 | 0.44 | 0 | 0 | 1 | 6,568 |
| Firm Loan Growth (%) | 3.26 | 23.0 | -7.19 | 3.34 | 16.5 | 2,867 |
| Firm Variables | | | | | | |
| Investment (%) | 2.82 | 2.89 | 1.26 | 2.07 | 3.40 | 64,070 |
| Change in Debt (%) | 0.63 | 5.29 | -0.98 | -0.0030 | 0.95 | 64,070 |
| Change in Equity (%) | 0.67 | 6.41 | -0.025 | 0.082 | 0.39 | 64,070 |
| Cash Flow | 0.058 | 0.12 | 0.019 | 0.041 | 0.085 | 64,070 |
| Lagged Tobin's q | 3.08 | 5.11 | 0.63 | 1.35 | 3.32 | 64,070 |
| Lagged Z-Score | 0.58 | 1.41 | 0.26 | 0.74 | 1.20 | 64,070 |
| Lagged Firm Size | 7.45 | 1.74 | 6.28 | 7.43 | 8.60 | 64,070 |
| Lagged Market-to-Book | 1.65 | 0.88 | 1.12 | 1.41 | 1.89 | 64,070 |
| Lagged Profitability (%) | 3.35 | 2.48 | 2.11 | 3.22 | 4.55 | 64,070 |
| Lagged Tangibility (%) | 31.8 | 24.6 | 12.0 | 24.1 | 47.7 | 64,070 |

Table 2Mortgage origination growth

Columns 1 through 3 are panel fixed effect regressions. *Mortgage Origination Growth* is the annual mortgage origination growth rate for each bank, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the quarterly log-dollar amount of gross Federal Reserve MBS purchases from the fourth quarter of the prior year. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS Holdings* refers to whether the MBS terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | Mortgag | ge Origination | Growth |
|--|-----------|----------------|-----------|
| | (1) | (2) | (3) |
| High MBS Holdings | -8.904* | -5.690 | |
| | (4.557) | (5.386) | |
| High MBS Holdings \times MBS Purchases | 0.953*** | 0.580** | |
| | (0.247) | (0.288) | |
| Securitizer | | | -18 75 |
| Securitzer | | | (19.05) |
| Samuitiaan V MDS Dunchasaa | | | 1 965** |
| Securitizer × MBS Purchases | | | (0.842) |
| | | | (0.642) |
| Bank's Size | -2.494 | 0.241 | -2.523 |
| | (6.189) | (6.886) | (6.213) |
| Bank's Equity Ratio | 4.296*** | 4.210*** | 4.348*** |
| | (0.811) | (0.904) | (0.813) |
| Bank's Net Income | 1.464 | 1.803 | 1.607 |
| | (1.580) | (1.882) | (1.580) |
| Bank's Cost of Deposits | -6.254* | -4.470 | -6.269* |
| ľ | (3.265) | (3.868) | (3.274) |
| Bank's Cash to Assets | 0.680** | 0.855** | 0.606** |
| | (0.270) | (0.365) | (0.270) |
| Bank's Loans to Deposits | -1.301*** | -1.405*** | -1.302*** |
| - | (0.130) | (0.148) | (0.127) |
| Change in Unemp. Rate, Bank's Counties | 1.933* | 0.933 | 1.957* |
| | (1.116) | (1.175) | (1.118) |
| Orthog. MBS Holdings | No | Yes | No |
| Bank Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |
| Observations | 14237 | 10562 | 14237 |
| Adjusted R^2 | 0.0821 | 0.126 | 0.0811 |

Table 3 Firm-level loan amounts

Columns 1 through 6 are panel fixed effect regressions. *Loan Amount* is the dollar amount of the facility divided by the lagged total assets of the firm and scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Loan Controls* include indicators for whether the facility is for takeover purposes, is a revolving credit line, or is a term loan. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | | | Loan A | mount | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings × MBS Purchases | -0.176*** | | -0.374*** | -0.553*** | | |
| | (0.0364) | | (0.0942) | (0.0927) | | |
| Securitizer × MBS Purchases | | | | | -0.224*** | -0.368*** |
| | | | | | (0.0621) | (0.0864) |
| High Securities Holdings | | 1.493* | -1.157 | -2.958 | | -3.329*** |
| | | (0.841) | (1.178) | (5.582) | | (1.050) |
| High Securities Holdings × TSY Purchases | | -0.0193 | 0.314** | 0.0285 | | 0.258*** |
| | | (0.0537) | (0.127) | (0.0573) | | (0.0896) |
| Bank's Size | 4.094 | 3.425 | 2.755 | -32.79** | 2.289 | 1.006 |
| | (2.554) | (2.527) | (2.025) | (13.29) | (2.031) | (1.610) |
| Bank's Equity Ratio | -0.517 | -0.445 | -0.932** | 7.097*** | -0.311 | -0.500 |
| | (0.425) | (0.472) | (0.458) | (0.589) | (0.400) | (0.379) |
| Bank's Net Income | -0.871 | -0.628 | -0.121 | 5.553** | -0.352 | 0.334 |
| | (1.098) | (1.098) | (1.035) | (2.166) | (1.097) | (1.063) |
| Bank's Cost of Deposits | -8.323*** | -7.645*** | -9.347*** | -69.04*** | -8.903*** | -10.02*** |
| | (1.211) | (1.398) | (1.632) | (4.199) | (1.205) | (1.549) |
| Bank's Cash to Assets | -17.89** | -14.28 | 8.391 | -182.6*** | -0.379 | 27.75** |
| | (8.352) | (11.46) | (12.93) | (31.06) | (9.542) | (12.53) |
| Bank's Loans to Deposits | 0.289*** | 0.278** | 0.364*** | 1.370*** | 0.313*** | 0.375*** |
| | (0.0992) | (0.112) | (0.114) | (0.118) | (0.102) | (0.108) |
| Change in Unemp. Rate, Bank's Counties | -0.378 | 0.204 | -0.667 | 11.90*** | -1.337 | -2.197 |
| | (0.843) | (0.767) | (0.886) | (1.006) | (1.202) | (1.390) |
| Loan Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Firm by Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 402 | 402 | 402 | 277 | 402 | 402 |
| Adjusted R^2 | 0.446 | 0.443 | 0.440 | 0.835 | 0.446 | 0.441 |

Table 4 Firm-level loan growth

Columns 1 through 6 are panel fixed effect regressions. *Firm Loan Growth* is the loan growth for a specific bank lending to a specific firm, expressed as a quarterly percentage. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | | | Firm Loa | n Growth | | |
|---|------------------|----------------|-----------|--------------|----------------|----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | | | | -0.142 | | |
| | | | | (7.131) | | |
| High MBS Holdings × MBS Purchases | -1.423*** | | -1.559*** | -1.709*** | | |
| | (0.454) | | (0.455) | (0.466) | | |
| Securitizer | | | | | 2 210 | 0.756 |
| Securitzer | | | | | (3.685) | (3.279) |
| | | | | | 1.002**** | 1.050 |
| Securitizer × MBS Purchases | | | | | -1.993*** | -1.852** |
| | | | | | (0.748) | (0.799) |
| High Securities Holdings | | 17.72*** | 18.79*** | | | 17.52*** |
| | | (5.782) | (5.284) | | | (6.025) |
| High Securities Holdings \times TSY Purchases | | 0.511** | 0.763*** | 1.032*** | | 0.373** |
| | | (0.200) | (0.237) | (0.293) | | (0.189) |
| Bank's Size | -9 919 | -6 094 | -5 346 | -49 48 | -10.42 | -6 233 |
| Duik 6 bize | (12.24) | (13.46) | (13.36) | (39.53) | (12.98) | (14.07) |
| Devil-2- Escriter Detie | 1.020*** | 1.070*** | 1.024*** | 1.022 | 2 000*** | 2 00 4*** |
| Bank's Equity Ratio | -1.839^{***} | $-1.8/8^{***}$ | -1.924*** | -1.933 | -2.090^{***} | -2.084^{***} |
| | (0.074) | (0.020) | (0.038) | (2.107) | (0.701) | (0.082) |
| Bank's Net Income | 2.094 | 0.270 | 0.624 | 3.468 | 1.718 | 0.416 |
| | (1.829) | (1.806) | (1.860) | (4.961) | (1.830) | (1.890) |
| Bank's Cost of Deposits | 0.783 | 1.227 | 1.812 | -0.145 | 0.371 | 1.180 |
| | (2.743) | (3.058) | (2.554) | (4.042) | (3.178) | (3.101) |
| Bank's Cash to Assets | -14.14 | -8.966 | -23.87 | -79.45 | -7.487 | -12.22 |
| | (25.97) | (23.54) | (26.53) | (93.52) | (25.55) | (24.88) |
| Pank's Loons to Denosita | 0.202*** | 0.124* | 0 147** | 0.224* | 0.100** | 0.149* |
| Bank's Loans to Deposits | $(0.202 \cdots $ | (0.0728) | (0.0711) | (0.324) | (0.0815) | (0.0760) |
| | (0.0754) | (0.0728) | (0.0711) | (0.195) | (0.0015) | (0.0700) |
| Change in Unemp. Rate, Bank's Counties | -11.04*** | -11.97*** | -11.23*** | -10.23*** | -11.33*** | -11.54*** |
| | (2.314) | (2.469) | (2.284) | (3.501) | (2.741) | (2.743) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm- rear Fixed Effects | Yes | Yes | Yes | Yes 407 | Yes | res |
| A divisited P^2 | 930 | 930 | 930 | 497 0.746 | 930 | 930 |
| Aujusicu A | 0.755 | 0.749 | 0.754 | 0.740 | 0.750 | 0.750 |

Table 5 Bank-level C&I loan growth

Columns 1 through 6 are panel fixed effect regressions. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | | | C&I Loan | Growth | | |
|---|----------------|----------------|----------------|----------------|-----------------|----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | -0.502 | | -0.412 | 0.0250 | | |
| | (0.467) | | (0.466) | (0.779) | | |
| High MBS Holdings \times MBS Purchases | -0.0642*** | | -0.0609*** | -0.0936*** | | |
| 6 | (0.0201) | | (0.0201) | (0.0321) | | |
| Securitizer | . , | | | | 2 505* | 2 131* |
| Securitizer | | | | | (1.367) | (1.361) |
| | | | | | (1.507) | (1.501) |
| Securitizer \times MBS Purchases | | | | | -0.364*** | -0.360*** |
| | | | | | (0.0940) | (0.0934) |
| High Securities Holdings | | 0.237 | 0.112 | 1.701*** | | 0.223 |
| | | (0.583) | (0.585) | (0.605) | | (0.583) |
| High Securities Holdings \times TSY Purchases | | 0.117*** | 0.115*** | 0.0469 | | 0.117*** |
| 6 | | (0.0299) | (0.0300) | (0.0359) | | (0.0299) |
| Bank's Size | _1 780*** | -1 870*** | _1 038*** | -2 169*** | -1 674*** | -1 851*** |
| Dank S Size | (0.367) | (0.377) | (0.379) | (0.496) | (0.363) | (0.377) |
| | (0.307) | (0.577) | (0.577) | (0.190) | (0.505) | (0.577) |
| Bank's Equity Ratio | 0.912*** | 0.908*** | 0.906*** | 0.8/0*** | 0.918*** | 0.911*** |
| | (0.0627) | (0.0627) | (0.0624) | (0.0862) | (0.0630) | (0.0627) |
| Bank's Net Income | 0.573*** | 0.575*** | 0.581*** | 0.348* | 0.562*** | 0.572*** |
| | (0.140) | (0.140) | (0.140) | (0.192) | (0.141) | (0.140) |
| Bank's Cost of Deposits | -0.651** | -0.709** | -0.711** | -0.473 | -0.663** | -0.724** |
| | (0.312) | (0.312) | (0.312) | (0.404) | (0.312) | (0.311) |
| Bank's Cash to Assets | 0.0341* | 0.0528*** | 0 0448** | 0.0683** | 0.0406** | 0.0518** |
| | (0.0197) | (0.0202) | (0.0204) | (0.0286) | (0.0195) | (0.0202) |
| Dank's Lagns to Danasita | 0.142*** | 0.125*** | 0.140*** | 0.175*** | 0.120*** | 0.125*** |
| Bank's Loans to Deposits | -0.143^{+++} | -0.133^{+++} | -0.140^{+++} | -0.173^{+++} | $-0.139^{+0.1}$ | -0.133^{+++} |
| | (0.0129) | (0.0127) | (0.0150) | (0.0104) | (0.0120) | (0.0127) |
| Change in Unemp. Rate, Bank's Counties | -0.331*** | -0.334*** | -0.334*** | -0.418*** | -0.332*** | -0.335*** |
| | (0.0669) | (0.0669) | (0.0669) | (0.0899) | (0.0669) | (0.0669) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Ubservations | 7/935 | 77935 | 77935 | 45618 | 77935 | 7/935 |
| Adjusted R^2 | 0.0567 | 0.0568 | 0.0570 | 0.0709 | 0.0566 | 0.0569 |

Table 6Impact of monetary stimulus on firms

Columns 1 through 7 are panel fixed effect regressions. *Investment* is the firm's quarterly capital expenditures divided by lagged gross PPE, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Additional Firm Interactions* include the firm variables (*Cash Flow, Lagged Tobin's q, Lagged Z-Score, Lagged Firm Size*) interacted with *High MBS Holdings*, *High Securities Holdings*, or *Securitizer* variables, depending on the specification. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. *Cumulant Estimation* treats the *Lagged Tobin's q* variables as potentially mismeasured regressors. Standard errors are clustered by firm and bank.

| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ |
|--|
| High MBS Holdings -1.422 -1.572 -0.240 -1.067 High MBS Holdings × MBS Purchases -0.0371^{***} -0.0436^{***} -0.0312^{***} -0.0370^{***} Securitizer -0.0371^{***} -0.0436^{***} -0.0312^{***} -0.0370^{***} Securitizer -0.0370^{***} -0.0312^{***} -0.0370^{***} -0.0370^{***} Securitizer × MBS Purchases -0.0355^{***} -0.0355^{***} -0.0355^{***} -0.0372^{**} High Securities Holdings 0.178 0.192 -0.272^{*} -0.0215 0.0113 High Securities Holdings × TSY Purchases -0.00856 -0.00502 -0.0160 -0.00362 -0.00832 (0.0121) (0.00997) (0.0123) (0.0171) (0.0111) |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| High MBS Holdings × MBS Purchases -0.0371^{***} -0.0436^{***} -0.0312^{***} -0.0370^{***} Securitizer (0.00837) (0.0106) (0.0108) (0.0119) -1.249 -1.377 Securitizer × MBS Purchases - - - - - -0.0355^{***} -0.0372^{**} High Securities Holdings 0.178 0.192 -0.272* -0.0215 0.0113 High Securities Holdings × TSY Purchases 0.00856 -0.00502 -0.0160 -0.00362 -0.00832 (0.0121) (0.0197) (0.0123) (0.0171) (0.0111) |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| $ \begin{array}{cccc} Securitizer & & & & & & & & & & & & & & & & & & &$ |
| Securitizer × MBS Purchases (1.111) (1.350) High Securities Holdings 0.178 0.192 -0.025^{**} -0.0372^{**} (0.0137) (0.0147) (0.0147) (0.0147) High Securities Holdings × TSY Purchases -0.00856 -0.00502 -0.000362 -0.00832 (0.0121) (0.00997) (0.0123) (0.0171) (0.0111) |
| Securitizer × MBS Purchases -0.0355^{***} -0.0372^{**} High Securities Holdings 0.178 0.192 -0.272^{*} -0.0215 0.0113 High Securities Holdings × TSY Purchases 0.00856 -0.00502 -0.00362 -0.00832 (0.0121) (0.00997) (0.0123) (0.0171) (0.0111) |
| Securitizer × MBS Futchases -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0352 × -0.0147) High Securities Holdings × TSY Purchases 0.178 0.192 -0.272* -0.0215 0.0113 (0.348) 0.0113 High Securities Holdings × TSY Purchases -0.00856 -0.00502 -0.0160 -0.000362 -0.00832 (0.0121) -0.00832 |
| High Securities Holdings 0.178 0.192 -0.272^* -0.0215 0.0113 (0.348)(0.364)(0.148)(0.388)(0.354)High Securities Holdings × TSY Purchases -0.000856 -0.00502 -0.0160 -0.000362 -0.00832 (0.0121)(0.00997)(0.0123)(0.0171)(0.0111) |
| High Securities Holdings $0.1/8$ 0.192 $-0.2/2^{+}$ -0.0215 0.0113 (0.348)(0.348)(0.364)(0.148)(0.388)(0.354)High Securities Holdings × TSY Purchases -0.000856 -0.00502 -0.0160 -0.000362 -0.00832 (0.0121)(0.00997)(0.0123)(0.0171)(0.0111) |
| High Securities Holdings \times TSY Purchases-0.000856-0.00502-0.0160-0.000362-0.00832(0,121)(0,00997)(0,0123)(0,0171)(0,0111) |
| High Securities Holdings \times TSY Purchases-0.000856-0.00502-0.0160-0.000362-0.00832(0 0121)(0 00997)(0 0123)(0 0171)(0 0111) |
| (0.0121) (0.00997) (0.0123) (0.0171) (0.0111) |
| (0.0121) (0.0077) (0.0171) (0.0111) |
| Cash Flow 1.850*** 0.583 1.480*** 0.571 1.545** 1.342*** 0.826 |
| (0.0678) (0.392) (0.406) (0.389) (0.750) (0.494) (0.791) |
| Lagged Tobin's q 0.214*** 0.133*** 0.185*** 0.204*** 0.209*** 0.223*** 0.203*** |
| (0.0114) (0.0374) (0.0312) (0.0185) (0.0263) (0.0187) (0.0206) |
| Larged 7-Score 0.253*** 0.151** 0.230*** 0.201*** 0.204* 0.189*** 0.162*** |
| (0.0842) (0.0680) (0.0733) (0.0400) (0.124) (0.0560) (0.0412) |
| Lagrad Eirm Size 0.770 0.150 0.227 0.120 0.248 0.190 0.150 |
| Lagged Finn Size $0.279 - 0.139 - 0.257 - 0.120 - 0.246 - 0.169 - 0.150 - 0.251 - 0.276 - 0.169 - 0.150 - 0.251 - 0.276 - 0.306 - 0.351 - 0.3$ |
| |
| Bank's Size $0.146 \ 0.114 \ 0.163 \ 0.82/^{**} \ 0.0820 \ 0.150 \ 0.151 \ 0.251)$ |
| (0.250) (0.271) (0.243) (0.286) (0.361) (0.254) (0.251) |
| Bank's Equity Ratio 0.00715 0.0265 0.00872 -0.0163 0.00880 0.0186 0.0210 |
| (0.0329) (0.0305) (0.0336) (0.0345) (0.0475) (0.0316) (0.0333) |
| Bank's Net Income -0.136* -0.120 -0.122* -0.0376 -0.177** -0.133* -0.130* |
| (0.0697) (0.0955) (0.0741) (0.0872) (0.0867) (0.0729) (0.0760) |
| Bank's Cost of Deposits 0.0411 0.0978 0.0972 0.0177 0.0104 0.00412 0.0336 |
| (0.171) (0.160) (0.163) (0.169) (0.206) (0.174) (0.174) |
| Bank's Cash to Assets 1.070 2.419** 1.469 -3.686** -0.405 1.834* 1.641 |
| (1.053) (1.005) (1.000) (1.848) (1.993) (1.087) (1.105) |
| Rank's Loans to Denosits0130*** _0.0154*** _0.0130*** _0.009630.0166*** _0.0136*** _0.0130*** |
| 0.0154 0.00547 (0.00446) (0.00436) (0.00567) (0.00644) (0.00577) |
| Charge in Linear Bate Bark's Counties 0.0010, 0.0127, 0.0170, 0.0016, 0.0005, 0.00055, 0.00050, 0.000151 |
| Change in Onemp. Kate, Bark's Counties -0.0249 0.0137 -0.0170 0.104 -0.0925 0.00050 -0.001013 |
| Additional Eirm Internations Vos Vos Vos Vos Vos Vos Vos Vos Vos Vo |
| Orthog MRS/Sec Holdings No No No Ves No No No |
| Gring, Missisce, findings No |
| Firm State by Quarter Fixed Effects Yes Yes Yes Yes Yes Yes Yes |
| Cumulant Estimation No No No No Yes No No |
| Observations 29980 29980 29980 27439 29980 29980 29980 |
| Adjusted R^2 0.5070.5070.5080.5330.5030.508 |

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

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Table 7Impact of monetary stimulus on firm financing

Columns 1 through 4 are panel fixed effect regressions. *Change in Debt* is the firm's quarterly change in total debt outstanding, divided by the prior quarter's assets and scaled by 100. *Change in Equity* is the percentage change in shares of outstanding common equity. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged *quarterly log-dollar amount* of gross Federal Reserve TSY purchases. *Additional Firm Interactions* include the firm variables (*Lagged Market-to-Book, Lagged Firm Size, Lagged Profitability, Lagged Tangibility*) interacted with *High MBS Holdings, High Securities Holdings*, or *Securitizer* variables, depending on the specification. Standard errors are clustered by firm and bank.

| | Change | Change in Debt Change in | | |
|---|--------------------|--------------------------|----------------|----------------|
| | (1) | (2) | (3) | (4) |
| High MBS Holdings | 14.18*** | | 11.93*** | |
| | (1.433) | | (3.208) | |
| High MBS Holdings \times MBS Purchases | -0.0321** | | 0.00647 | |
| 6 | (0.0126) | | (0.0235) | |
| Securitizer | | 11 77*** | () | 0 200*** |
| Securitizer | | (2.581) | | (2,530) |
| Constitution of MDC Description | | (2.301) | | (2.550) |
| Securitizer × MBS Purchases | | -0.0389^{**} | | (0.00826) |
| | | (0.0197) | | (0.0257) |
| High Securities Holdings | 2.193** | 2.195** | 0.142 | 0.483 |
| | (0.876) | (0.979) | (0.865) | (0.779) |
| High Securities Holdings \times TSY Purchases | 0.0320 | 0.0216 | 0.0499* | 0.0524* |
| | (0.0209) | (0.0232) | (0.0273) | (0.0291) |
| Lagged Market-to-Book | 1.059*** | 0.981*** | -0.571** | -0.281 |
| | (0.117) | (0.132) | (0.279) | (0.183) |
| Lagged Firm Size | -5.786*** | -4.940*** | -5.021*** | -4.625*** |
| | (0.425) | (0.766) | (0.859) | (0.563) |
| Lagged Profitability | -0 178** | -0 162*** | 0.0600 | 0.0738 |
| Lagged Frontability | (0.0729) | (0.0628) | (0.0600) | (0.0453) |
| Logged Tongibility | 0.0764*** | 0.0777*** | 0.0265 | 0.00156 |
| Lagged Tangionity | (0.0764^{*****}) | (0.0175) | -0.0303 | (0.00130) |
| | (0.0178) | (0.0173) | (0.0238) | (0.0173) |
| Bank's Size | -0.267 | -0.221 | 0.579 | 0.605 |
| | (0.664) | (0.670) | (0.411) | (0.415) |
| Bank's Equity Ratio | 0.0167 | -0.0134 | 0.0670 | 0.0360 |
| | (0.0602) | (0.0634) | (0.0930) | (0.0890) |
| Bank's Net Income | -0.0823 | -0.103 | 0.137 | 0.128 |
| | (0.124) | (0.127) | (0.151) | (0.156) |
| Bank's Cost of Deposits | -0.0637 | -0.0339 | 0.295 | 0.375* |
| - | (0.297) | (0.302) | (0.213) | (0.219) |
| Bank's Cash to Assets | -0.974 | -1.164 | -1.270 | -1.660 |
| | (2.216) | (2.619) | (2.244) | (2.481) |
| Bank's Loans to Deposits | -0.0147* | -0.00692 | -0.0191* | -0.0166 |
| Dank's Loans to Deposits | (0.00876) | (0.0101) | (0.0101) | (0.0100) |
| Channelin Unemer Data Daula's Countier | (0.00070) | (0.0750 | 0.0707 | 0.0(01 |
| Change in Unemp. Rate, Bank's Counties | (0.0882) | 0.0759 | -0.0/0/ | -0.0601 |
| Additional Firm Interactions | (0.241) Vac | (0.244) Vec | (0.144) Vec | (0.131) Vec |
| Firm Bank Fixed Effects | Ves | Ves | Ves | Ves |
| Firm State by Quarter Fixed Effects | Vec | Vac | Vec | Vec |
| Observations | 29980 | 29980 | 29980 | 29980 |
| Adjusted R^2 | 0 111 | 0 1 1 0 | 0 171 | 0 171 |
| najaowa n | 0.111 | 0.110 | 0.171 | 0.171 |

Table 8

Asset purchases and other bank channels

Columns 1 through 4 are panel fixed effect regressions. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. Standard errors are clustered by bank.

| | C&I Loa | n Growth | tment | |
|---|-----------------|------------|------------|------------|
| | (1) | (2) | (3) | (4) |
| High MBS Holdings | -0.427 | (-) | -1.227 | (.) |
| ingi ingo notango | (0.461) | | (1.461) | |
| High MDS Holdings & MDS Durshosse | 0.0520** | | 0.0299** | |
| High MB3 Holdings × MB3 Furchases | (0.0320^{+1}) | | (0.0182) | |
| | (0.0224) | | (0.0182) | |
| Securitizer | | 1.213 | | -1.218 |
| | | (1.385) | | (1.250) |
| Securitizer × MBS Purchases | | -0.211** | | -0.0410*** |
| | | (0.0950) | | (0.0129) |
| High Securities Holdings | 1.040* | 1.112* | 0.153 | 0.0654 |
| | (0.626) | (0.626) | (0.407) | (0.396) |
| High Securities Holdings × TSY Purchases | 0.00777 | 0.0117 | -0.0188 | -0.0150 |
| 8 | (0.0414) | (0.0414) | (0.0139) | (0.0125) |
| Bank's Size | -1 670*** | -1 596*** | 0.439* | 0.387 |
| Daik 3 5ize | (0.388) | (0.387) | (0.233) | (0.237) |
| Dark's Fauity Datia | 0.012*** | 0.011*** | 0.0176 | 0.0150 |
| Bank's Equity Ratio | (0.0752) | (0.0752) | -0.0176 | -0.0139 |
| D 11 N (I | (0.0733) | (0.0733) | (0.0403) | (0.0558) |
| Bank s Net Income | -0./02** | -0./35*** | -0.00522 | 0.00502 |
| | (0.281) | (0.282) | (0.167) | (0.167) |
| Bank's Cost of Deposits | -1.260*** | -1.272*** | 0.0604 | 0.0171 |
| | (0.406) | (0.406) | (0.223) | (0.235) |
| Bank's Cash to Assets | 0.0361 | 0.0321 | -2.072 | -1.639 |
| | (0.0400) | (0.0399) | (2.474) | (2.728) |
| Bank's Loans to Deposits | -10.25*** | -10.11*** | -0.0137*** | -0.0144*** |
| 1 | (1.562) | (1.541) | (0.00489) | (0.00461) |
| Bank's Size × MBS Purchases | -0.0319*** | -0.0334*** | -0.00190 | 0.00571 |
| Buik 5 bize × 14155 Turenases | (0.00712) | (0.00711) | (0.00615) | (0.00428) |
| Pank's Equity Patio & MPS Durahasas | 0.00506 | 0.00503 | 0.000177 | 0.00454 |
| Bank's Equity Ratio × MBS Furchases | -0.00390 | -0.00303 | (0.000177 | -0.00434 |
| | (0.00423) | (0.00418) | (0.00039) | (0.00530) |
| Bank's Net Income × MBS Purchases | 0.090/*** | 0.0944*** | 0.00686 | 0.00753 |
| | (0.0203) | (0.0204) | (0.0141) | (0.0141) |
| Bank's Cost of Deposits × MBS Purchases | 0.00669 | 0.00773 | 0.0384 | 0.0407 |
| | (0.0353) | (0.0352) | (0.0323) | (0.0294) |
| Bank's Cash to Assets × MBS Purchases | -0.000664 | 0.000571 | 0.247 | 0.281 |
| | (0.00230) | (0.00221) | (0.230) | (0.215) |
| Bank's Loans to Deposits × MBS Purchases | -0.255*** | -0.223*** | 0.000481 | 0.000897** |
| - | (0.0598) | (0.0581) | (0.000345) | (0.000363) |
| Bank's Size \times TSY Purchases | 0.00705 | 0.00725 | -0.000601 | -0.000893 |
| | (0.00848) | (0.00855) | (0.00311) | (0.00345) |
| Bank's Equity Ratio × TSY Purchases | -0.00185 | -0.00191 | 0.00644* | 0.00778** |
| Buik s Equity Rullo × 151 Turchuses | (0.00508) | (0.00509) | (0.00384) | (0.00364) |
| Bank's Net Income V TSV Durchasses | 0.0764*** | 0.0762*** | 0.0120 | 0.0142 |
| Bank's Net Income × 1511 furchases | (0.0218) | (0.0210) | (0.0129 | (0.0188) |
| Bank's Cast of Danasita at TOX Davel | 0.0210) | 0.0217) | 0.00700 | 0.0100) |
| Dank s Cost of Deposits \times 18Y Purchases | 0.0700* | 0.0701* | -0.00/00 | -0.00/20 |
| | (0.0370) | (0.0370) | (0.0170) | (0.01/3) |
| Bank's Cash to Assets \times TSY Purchases | 0.000535 | 0.000577 | 0.246* | 0.212 |
| | (0.00252) | (0.00252) | (0.147) | (0.154) |
| Bank's Loans to Deposits \times TSY Purchases | -0.286*** | -0.282*** | -0.000151 | -0.000137 |
| | (0.0890) | (0.0891) | (0.000220) | (0.000234) |
| Change in Unemp. Rate, Bank's Counties | -0.348*** | -0.349*** | -0.0196 | -0.00457 |
| | (0.0669) | (0.0669) | (0.0980) | (0.101) |
| Bank Fixed Effects | Yes | Yes | No | No |
| Quarter Fixed Effects | Yes | Yes | No | No |
| Firm Controls | No | No | Yes | Yes |
| Additional Firm Interactions | No | No | Yes | Yes |
| Firm-Bank Fixed Effects | No | No | Yes | Yes |
| Firm State by Quarter Fixed Effects | No | No | Yes | Yes |
| Observations | 77935 | 77935 | 32209 | 32209 |
| Adjusted R^2 | 0.0585 | 0.0584 | 0.509 | 0.509 |
| | | | | |

Table 9Bank-level C&I loan growth, matched sample

Columns 1 through 6 are panel fixed effect regressions. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | | C&I | Loan Growth, | Matched San | nple | |
|--|---------------|---------------|---------------|--------------|--------------|---------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | -0.294 | | -0.247 | -0.412 | | |
| | (0.592) | | (0.596) | (1.005) | | |
| High MBS Holdings × MBS Purchases | -0.0990*** | | -0.0967*** | -0.0971** | | |
| | (0.0306) | | (0.0306) | (0.0419) | | |
| Soouritizor | (0102.00) | | (010200) | (0.0.127) | 0 707** | 2 720** |
| Securitizer | | | | | (1.208) | (1.204) |
| | | | | | (1.598) | (1.394) |
| Securitizer \times MBS Purchases | | | | | -0.401*** | -0.398*** |
| | | | | | (0.101) | (0.101) |
| High Securities Holdings | | 0.340 | 0.211 | 1.644* | | 0.324 |
| | | (0.834) | (0.840) | (0.860) | | (0.833) |
| High Securities Holdings × TSY Purchases | | 0.0429 | 0.0367 | -0.0113 | | 0.0427 |
| | | (0.0443) | (0.0443) | (0.0575) | | (0.0443) |
| Donte's Size | 1 012** | 1 170** | 1 209** | 1.077* | 1.027* | 1 159** |
| Dalik S Size | -1.213^{++} | $-1.1/9^{++}$ | -1.298^{++} | -1.277^{*} | -1.057^{+} | -1.136^{++} |
| | (0.343) | (0.371) | (0.377) | (0.762) | (0.352) | (0.371) |
| Bank's Equity Ratio | 0.762*** | 0.759*** | 0.760*** | 0.774*** | 0.765*** | 0.762*** |
| | (0.0963) | (0.0970) | (0.0969) | (0.126) | (0.0965) | (0.0971) |
| Bank's Net Income | 0.701*** | 0.695*** | 0.705*** | 0.306 | 0.685*** | 0.691*** |
| | (0.206) | (0.206) | (0.206) | (0.273) | (0.206) | (0.206) |
| Bank's Cost of Deposits | -0.311 | -0.320 | -0 335 | -0.0268 | -0 308 | -0 336 |
| Built 5 Cost of Deposits | (0.472) | (0.320) | (0.472) | (0.582) | (0.473) | (0.474) |
| Daula's Cash ta Assata | 0.0125 | 0.0218 | 0.0176 | (0.002) | 0.0159 | 0.0211 |
| Bank's Cash to Assets | (0.0135) | (0.0218) | (0.01/0) | (0.0234) | (0.0158) | (0.0211) |
| | (0.0343) | (0.0355) | (0.0357) | (0.0435) | (0.0341) | (0.0355) |
| Bank's Loans to Deposits | -0.148*** | -0.142*** | -0.146*** | -0.177*** | -0.144*** | -0.142*** |
| | (0.0202) | (0.0202) | (0.0206) | (0.0251) | (0.0199) | (0.0202) |
| Change in Unemp. Rate, Bank's Counties | -0.394*** | -0.394*** | -0.395*** | -0.501*** | -0.394*** | -0.395*** |
| | (0.120) | (0.120) | (0.120) | (0.151) | (0.120) | (0.120) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 93209 | 93209 | 93209 | 66524 | 93209 | 93209 |
| Adjusted R^2 | 0.107 | 0.107 | 0.107 | 0.129 | 0.107 | 0.107 |

Table 10Firm investment, matched sample

Columns 1 through 6 are panel fixed effect regressions. *Investment* is the firm's quarterly capital expenditures divided by lagged gross PPE, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Additional Firm Interactions* include the firm variables (*Cash Flow, Lagged Tobin's q, Lagged Z-Score, Lagged Firm Size*) interacted with *High MBS Holdings*, *High Securities Holdings*, or *Securitizer* variables, depending on the specification. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by firm and bank.

| | | | Inves | tment | | |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | 0.107 | | 0.104 | -0.240 | | |
| | (1.059) | | (1.173) | (0.261) | | |
| High MBS Holdings × MBS Purchases | -0.0476*** | | -0.0506*** | -0.0312** | | |
| 6 6 | (0.00770) | | (0.0102) | (0.0120) | | |
| Securitizer | . , | | | | 0.0469 | 0 249 |
| Securitzer | | | | | (0.958) | (1, 100) |
| Construction MDC Development | | | | | 0.0441*** | (1.100) |
| Securitizer × MBS Purchases | | | | | -0.0441*** | -0.0432^{***} |
| | | | | | (0.0112) | (0.0127) |
| High Securities Holdings | | -0.0257 | -0.0111 | -0.272* | | -0.151 |
| | | (0.404) | (0.427) | (0.154) | | (0.387) |
| High Securities Holdings \times TSY Purchases | | -0.00425 | -0.00811 | -0.0160 | | -0.0104 |
| | | (0.0165) | (0.0150) | (0.0133) | | (0.0153) |
| Cash Flow | 1.574*** | 0.833** | 1.392*** | 0.571 | 1.350*** | 1.153*** |
| | (0.284) | (0.341) | (0.293) | (0.403) | (0.325) | (0.362) |
| Lagged Tobin's q | 0.144*** | 0.135*** | 0.136*** | 0.204*** | 0.164*** | 0.166*** |
| | (0.0291) | (0.0284) | (0.0333) | (0.0200) | (0.0282) | (0.0239) |
| Lagged Z-Score | 0 492*** | 0 303*** | 0 498*** | 0 201*** | 0 332*** | 0 433*** |
| | (0.0885) | (0.110) | (0.0858) | (0.0418) | (0.0973) | (0.105) |
| Loggod Firm Size | 0.0266 | 0.274 | 0.0548 | 0.120 | 0.0700 | 0.0784 |
| Lagged Film Size | -0.0300 | -0.274 | -0.0348 | (0.120) | -0.0709 | -0.0784 |
| | (0.200) | (0.240) | (0.270) | (0.100) | (0.230) | (0.208) |
| Bank's Size | 0.0393 | -0.0171 | 0.0403 | 0.82/*** | 0.0438 | 0.0296 |
| | (0.228) | (0.252) | (0.226) | (0.297) | (0.241) | (0.240) |
| Bank's Equity Ratio | 0.0249 | 0.0408 | 0.0262 | -0.0163 | 0.0390 | 0.0403 |
| | (0.0308) | (0.0330) | (0.0325) | (0.0359) | (0.0331) | (0.0346) |
| Bank's Net Income | -0.153** | -0.145 | -0.144* | -0.0376 | -0.157** | -0.151* |
| | (0.0737) | (0.0979) | (0.0802) | (0.0905) | (0.0751) | (0.0858) |
| Bank's Cost of Deposits | 0.247 | 0.251 | 0.262 | 0.0177 | 0.221 | 0.201 |
| L | (0.167) | (0.159) | (0.159) | (0.175) | (0.167) | (0.164) |
| Bank's Cash to Assets | 1.571 | 2.830** | 1.536 | -3.686* | 2.073 | 1.793 |
| | (1.536) | (1.226) | (1.471) | (1.918) | (1.624) | (1.590) |
| Bank's Loans to Deposits | -0 00474 | -0.00645 | -0.00483 | -0.00963 | -0.00590 | -0.00569 |
| Dunk 5 Douis to Deposits | (0.00333) | (0.00387) | (0.00401) | (0.00742) | (0.00425) | (0.00495) |
| Change in Linema Bate Book's Counties | 0.0722 | 0.0250 | 0.0667 | 0.104 | 0.0525 | 0.0410 |
| Change in Onemp. Rate, Bank's Counties | -0.0722 | (0.0250) | -0.0007 | (0.0065) | -0.0333 | -0.0419 |
| Additional Firm Interactions | (0.0790) Vas | (0.0657) Voc | (0.0832) Vas | (0.0903) Vas | (0.0848) Vas | (0.0902) Vas |
| Orthog MBS/Sec Holdings | No | No | No | Ves | No | No |
| Firm-Bank Fixed Effects | Ves | Ves | Ves | Vec | Ves | Ves |
| Firm State by Quarter Fixed Effects | Ves | Ves | Ves | Yes | Ves | Ves |
| Observations | 42.669 | 42669 | 42.669 | 27439 | 42.669 | 42669 |
| Adjusted R^2 | 0.590 | 0.589 | 0.590 | 0.520 | 0.590 | 0.590 |
| | 0.570 | 0.007 | 0.570 | 0.520 | 0.570 | 0.570 |

Table 11C&I loan growth and bank constraints

Columns 1 through 4 are panel fixed effect regressions. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. The *More Constrained* sample are those banks that are below the median by *Bank's Demand Deposits* and the *Less Constrained* sample are those banks that are above the median. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is a value of 0 if in the bottom tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile non-zero securitization income and 0 otherwise. Standard errors are clustered by bank.

| | | C&I Loa | in Growth | |
|---|--------------------|--------------------|--------------------|--------------------|
| | | Demand | Deposits | |
| | (More Constrained) | (Less Constrained) | (More Constrained) | (Less Constrained) |
| | (1) | (2) | (3) | (4) |
| High MBS Holdings | -1.872** | 0.541 | | |
| | (0.749) | (0.645) | | |
| High MBS Holdings × MBS Purchases | -0.0867*** | -0.00509 | | |
| | (0.0291) | (0.0298) | | |
| Securitizer | | | 2.300 | 1.869 |
| | | | (1.542) | (1.823) |
| Securitizer \times MBS Purchases | | | -0.373*** | -0.204 |
| | | | (0.107) | (0.180) |
| High Securities Holdings | 1.939* | -0.823 | 2.218** | -0.875 |
| | (1.008) | (0.760) | (1.006) | (0.755) |
| High Securities Holdings \times TSY Purchases | 0.0656 | 0.112*** | 0.0653 | 0.112*** |
| 6 | (0.0454) | (0.0423) | (0.0454) | (0.0423) |
| Bank's Size | -1.445*** | -1.388** | -1.284** | -1.440** |
| | (0.549) | (0.580) | (0.548) | (0.571) |
| Bank's Equity Ratio | 1.009*** | 0.739*** | 1.032*** | 0.735*** |
| | (0.0922) | (0.0895) | (0.0939) | (0.0897) |
| Bank's Net Income | 0.515*** | 0.512** | 0.495*** | 0.518** |
| | (0.183) | (0.213) | (0.184) | (0.213) |
| Bank's Cost of Deposits | -1.227*** | -0.448 | -1.267*** | -0.445 |
| - | (0.415) | (0.525) | (0.416) | (0.526) |
| Bank's Cash to Assets | 0.0604* | 0.0127 | 0.0734** | 0.0116 |
| | (0.0366) | (0.0267) | (0.0364) | (0.0266) |
| Bank's Loans to Deposits | -0.124*** | -0.154*** | -0.114*** | -0.156*** |
| | (0.0196) | (0.0195) | (0.0193) | (0.0189) |
| Change in Unemp. Rate, Bank's Counties | -0.380*** | -0.324*** | -0.382*** | -0.324*** |
| | (0.0892) | (0.0967) | (0.0891) | (0.0967) |
| Bank Fixed Effects | Yes | Yes | Yes | Yes |
| Quarter Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 38668 | 38807 | 38668 | 38807 |
| Adjusted R^2 | 0.101 | 0.0414 | 0.101 | 0.0414 |

Table 12Investment regression for firm constraints

Columns 1 through 4 are panel fixed effect regressions. *Investment* is the firm's quarterly capital expenditures divided by lagged gross PPE, scaled by 100. Dividing firms by size, *More Constrained* firms are in the smallest tercile and *Less Constrained* firms are in the largest tercile. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Additional Firm Interactions* include the firm variables (*Cash Flow, Lagged Tobin's q, Lagged Z-Score, Lagged Firm Size*) interacted with *High MBS Holdings, High Securities Holdings*, or *Securitizer* variables, depending on the specification. Standard errors are clustered by firm and bank.

| | Investment | | | | |
|--|--------------------|--------------------|--------------------|--------------------|--|
| | Firm Size | | | | |
| | (More Constrained) | (Less Constrained) | (More Constrained) | (Less Constrained) | |
| High MDC Haldings | (1) | (2) | (3) | (4) | |
| High MBS Holdings | -3.091 | | | | |
| High MBS Holdings × MBS Purchases | 0.0876** | 0.0115* | | | |
| Tigh WBS Holdings × WBS Furchases | (0.0445) | (0.00671) | | | |
| Sacuritizar | (0.0113) | (0.00071) | 1 733 | | |
| Sceuntizer | | | (3.674) | | |
| Securitizer \times MBS Purchases | | | -0.0824*** | -0.0136 | |
| Securitzer × WIDO Furchases | | | (0.0301) | (0.0109) | |
| High Securities Holdings | 1 054 | 1 673*** | 0.601 | 1 659*** | |
| Then becanties fromings | (1.440) | (0.588) | (1.460) | (0.567) | |
| High Securities Holdings × TSY Purchases | -0.0289 | -0.0124 | -0.0350 | -0.0160* | |
| | (0.0243) | (0.00803) | (0.0257) | (0.00837) | |
| Cash Flow | 0.158 | 2 255*** | -0 579 | 2 349*** | |
| | (0.508) | (0.309) | (0.753) | (0.352) | |
| Lagged Tobin's a | 0.124*** | 0.389*** | 0.152*** | 0.376*** | |
| | (0.0382) | (0.0324) | (0.0375) | (0.0356) | |
| Lagged Z-Score | 0.297*** | 0.278*** | 0.271*** | 0.284* | |
| | (0.0952) | (0.0986) | (0.0718) | (0.147) | |
| Lagged Firm Size | -0.305 | 1.249*** | -0.710 | 1.132*** | |
| | (0.611) | (0.391) | (1.014) | (0.434) | |
| Bank's Size | 0.0984 | -0.0512 | 0.119 | -0.0459 | |
| | (0.309) | (0.263) | (0.271) | (0.256) | |
| Bank's Equity Ratio | 0.0287 | -0.119*** | 0.0600 | -0.106*** | |
| | (0.0642) | (0.0209) | (0.0632) | (0.0224) | |
| Bank's Net Income | -0.0686 | -0.193** | -0.0788 | -0.196** | |
| | (0.123) | (0.0956) | (0.110) | (0.0910) | |
| Bank's Cost of Deposits | 0.0546 | -0.332 | -0.0439 | -0.391 | |
| | (0.268) | (0.278) | (0.287) | (0.308) | |
| Bank's Cash to Assets | 0.318 | -3.545* | -0.373 | -3.111 | |
| | (2.568) | (1.863) | (2.439) | (2.042) | |
| Bank's Loans to Deposits | -0.00818 | -0.00863** | -0.00973 | -0.0113*** | |
| | (0.00617) | (0.00387) | (0.00906) | (0.00370) | |
| Change in Unemp. Rate, Bank's Counties | -0.0417 | 0.135* | -0.0434 | 0.131 | |
| | (0.149) | (0.0778) | (0.156) | (0.0807) | |
| Additional Firm Interactions | Yes | Yes | Yes | Yes | |
| Firm-Bank Fixed Effects | Yes | Yes | Yes | Yes | |
| CHILLS State by Quarter Fixed Effects | 10S 9527 | res 9412 | res 9527 | res 9412 | |
| Adjusted R^2 | 0.506 | 0.614 | 0.507 | 0.613 | |
| | 0.000 | 0.011 | 0.007 | 0.010 | |

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

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Table 13Change in C&I loan profitability

Columns 1 through 6 are panel fixed effect regressions. *Change in C&I Loan Profitability* is the difference in the profitability of C&I loans for the current and prior quarter, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | Change in C&I Loan Profitability | | | | | |
|--|----------------------------------|-----------|-----------|-----------|-----------|-----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | -0.238 | | -0.296 | -0.601 | | |
| | (0.668) | | (0.668) | (0.807) | | |
| High MBS Holdings × MBS Purchases | 0.101*** | | 0.0978*** | 0.0873** | | |
| | (0.0351) | | (0.0353) | (0.0390) | | |
| Commition of | (010000) | | (000000) | (0.000,0) | 0.540 | 0.472 |
| Securitizer | | | | | -0.349 | -0.472 |
| | | | | | (1.913) | (1.910) |
| Securitizer × MBS Purchases | | | | | 0.377*** | 0.374*** |
| | | | | | (0.135) | (0.135) |
| High Securities Holdings | | 0.759 | 0.851 | 0.703 | | 0.772 |
| 6 6 | | (1.015) | (1.020) | (1.235) | | (1.015) |
| High Securities Holdings × TSV Purchases | | -0 191*** | -0 189*** | -0 219*** | | -0 192*** |
| | | (0.0641) | (0.0640) | (0.0683) | | (0.0641) |
| | 1.000 | (0.00+1) | (0.0040) | (0.0005) | 1.07(1) | (0.00+1) |
| Bank's Size | 1.366** | 1.436** | 1.484** | 1.183* | 1.276** | 1.419** |
| | (0.573) | (0.583) | (0.589) | (0.674) | (0.564) | (0.583) |
| Bank's Equity Ratio | -0.324*** | -0.321*** | -0.327*** | -0.445*** | -0.321*** | -0.323*** |
| | (0.0979) | (0.0983) | (0.0984) | (0.107) | (0.0979) | (0.0984) |
| Bank's Net Income | -1.140*** | -1.136*** | -1.139*** | -1.102*** | -1.133*** | -1.134*** |
| | (0.233) | (0.234) | (0.234) | (0.276) | (0.234) | (0.234) |
| Pank's Cost of Danosits | o o 21*** | 0 125*** | 0 107*** | 1 762** | 2 220*** | 2 120*** |
| Bank's Cost of Deposits | -2.234 | -2.133 | -2.127 | (0.508) | -2.230*** | -2.120 |
| | (0.323) | (0.324) | (0.323) | (0.398) | (0.323) | (0.324) |
| Bank's Cash to Assets | -0.0264 | -0.0440 | -0.0344 | -0.0522 | -0.0348 | -0.0433 |
| | (0.0304) | (0.0307) | (0.0309) | (0.0356) | (0.0302) | (0.0307) |
| Bank's Loans to Deposits | 0.264*** | 0.260*** | 0.263*** | 0.252*** | 0.261*** | 0.260*** |
| _ | (0.0201) | (0.0198) | (0.0204) | (0.0217) | (0.0195) | (0.0198) |
| Change in Unemp Rate Bank's Counties | 0 527*** | 0 532*** | 0 531*** | 0 541*** | 0 527*** | 0 532*** |
| change in chemp. Rate, Bank's Countes | (0.139) | (0.139) | (0.139) | (0.160) | (0.139) | (0.139) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Ouarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 76584 | 76584 | 76584 | 63250 | 76584 | 76584 |
| Adjusted R^2 | 0.00807 | 0.00815 | 0.00822 | 0.00767 | 0.00801 | 0.00817 |

Table 14C&I loan growth and interest rates

Columns 1 through 6 are panel fixed effect regressions. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | C&I Loan Growth | | | | | |
|---|-------------------|-----------|-----------|------------|-----------|-----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | -1.194** | | -1.229** | -0.208 | | |
| | (0.599) | | (0.602) | (0.927) | | |
| High MBS Holdings × MBS Purchases | -0.0555*** | | -0.0516** | -0.0907*** | | |
| | (0.0208) | | (0.0208) | (0.0328) | | |
| Securitizer | | | | | 4.428* | 4.216 |
| | | | | | (2.579) | (2.587) |
| Securitizer \times MBS Purchases | | | | | -0.390*** | -0.385*** |
| | | | | | (0.0898) | (0.0894) |
| High Securities Holdings | | -0.0741 | -0 374 | 1 673*** | | -0.0868 |
| | | (0.705) | (0.713) | (0.615) | | (0.705) |
| High Securities Holdings × TSV Purchases | | 0 113*** | 0 111*** | 0.0481 | | 0 113*** |
| Then securities fioldings × 151 Turchases | | (0.0307) | (0.0307) | (0.0364) | | (0.0307) |
| High MDS Holdings & Data Stimulus | 0.100* | (0.0507) | 0.227** | 0.0708 | | (0.0507) |
| High MBS Holdings × Rate Stimulus | (0.190°) | | (0.101) | (0.181) | | |
| | (0.0997) | | (0.101) | (0.101) | 0.507 | 0.5.47 |
| Securitizer × Rate Stimulus | | | | | -0.58/ | -0.54/ |
| | | | | | (0.377) | (0.377) |
| High Securities Holdings \times Rate Stimulus | | 0.0976 | 0.156 | 0.0286 | | 0.0963 |
| | | (0.123) | (0.125) | (0.153) | | (0.123) |
| Bank's Size | -1.771*** | -1.874*** | -1.925*** | -2.177*** | -1.671*** | -1.851*** |
| | (0.368) | (0.377) | (0.380) | (0.503) | (0.363) | (0.377) |
| Bank's Equity Ratio | 0.908*** | 0.908*** | 0.903*** | 0.869*** | 0.918*** | 0.912*** |
| | (0.0627) | (0.0626) | (0.0624) | (0.0863) | (0.0630) | (0.0627) |
| Bank's Net Income | 0.569*** | 0.577*** | 0.579*** | 0.347* | 0.562*** | 0.574*** |
| | (0.140) | (0.140) | (0.140) | (0.192) | (0.141) | (0.140) |
| Bank's Cost of Deposits | -0.650** | -0.721** | -0.730** | -0.469 | -0.663** | -0.735** |
| ĩ | (0.312) | (0.313) | (0.312) | (0.404) | (0.312) | (0.312) |
| Bank's Cash to Assets | 0.0373* | 0.0530*** | 0.0490** | 0.0704** | 0.0404** | 0.0518** |
| | (0.0197) | (0.0202) | (0.0204) | (0.0288) | (0.0195) | (0.0202) |
| Bank's Loans to Deposits | -0 142*** | -0 135*** | -0 138*** | -0 174*** | -0 139*** | -0 136*** |
| | (0.0129) | (0.0127) | (0.0130) | (0.0164) | (0.0126) | (0.0127) |
| Change in Unemp Rate Bank's Counties | -0 329*** | -0 335*** | -0 333*** | -0 417*** | -0 332*** | -0 335*** |
| Change in Olemp. Rate, Dank's Countes | (0.0669) | (0.0669) | (0.0669) | (0.0899) | (0.0669) | (0.0669) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 77935 | 77935 | 77935 | 45618 | 77935 | 77935 |
| Banks | 4914 | 4914 | 4914 | 3951 | 4914 | 4914 |
| Adjusted R^2 | 0.0567 | 0.0568 | 0.0570 | 0.0708 | 0.0566 | 0.0569 |

Table 15 C&I loan growth over the QE period

Columns 1 through 3 are panel fixed effect regressions. C&I Loan Growth is the growth rate in C&I loans between the current and prior quarter, scaled by 100. High MBS Holdings takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. High Securities Holdings takes a value of 1 if the lending bank is in the top tercile by all non-MBS securities to total assets, and a value of 0 if in the bottom tercile. MBS Purchases is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. TSY Purchases is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. Securitizer takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. Orthog. MBS/Sec. Holdings refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| C&I Loan Growth | | | | | | | |
|---|---------------|-----------|-----------|--|--|--|--|
| | (1) | (2) | (3) | | | | |
| High MBS Holdings | -0.446 | -0.0610 | | | | | |
| | (0.464) | (0.776) | | | | | |
| High MBS Holdings \times MBS Purchases, through OE1 | -0.101*** | -0.149*** | | | | | |
| 8 | (0.0237) | (0.0412) | | | | | |
| High MBS Holdings × MBS Purchases post OF1 | 0.0104 | 0.0274 | | | | | |
| Then MDS Holdings × MDS I dichases, post QEI | (0.0243) | (0.0274) | | | | | |
| | (0.02+3) | (0.0404) | 2 | | | | |
| Securitizer | | | 2.055 | | | | |
| | | | (1.360) | | | | |
| Securitizer \times MBS Purchases, through QE1 | | | -0.317*** | | | | |
| | | | (0.108) | | | | |
| Securitizer \times MBS Purchases, post QE1 | | | -0.346*** | | | | |
| • - | | | (0.0849) | | | | |
| High Securities Holdings | 0.265 | 1.754*** | 0.384 | | | | |
| | (0.585) | (0.606) | (0.584) | | | | |
| High Securities Holdings × TSV Durchases, through OF1 | 0.000612 | 0.0246 | 0.00538 | | | | |
| Then securities fiolidings × 151 Furchases, unough QE1 | (0.0386) | (0.0240) | (0.00338) | | | | |
| | (0.0380) | (0.0471) | (0.0385) | | | | |
| High Securities Holdings \times TSY Purchases, post QE1 | 0.172*** | 0.116*** | 0.167*** | | | | |
| | (0.0315) | (0.0427) | (0.0313) | | | | |
| Bank's Size | -1.902*** | -2.171*** | -1.836*** | | | | |
| | (0.378) | (0.495) | (0.375) | | | | |
| Bank's Equity Ratio | 0.907*** | 0.871*** | 0.915*** | | | | |
| | (0.0621) | (0.0862) | (0.0624) | | | | |
| Bank's Net Income | 0 562*** | 0 330* | 0 559*** | | | | |
| | (0.139) | (0.192) | (0.140) | | | | |
| Pank's Cost of Denosits | 0.770** | 0.468 | 0.772** | | | | |
| Bank's Cost of Deposits | -0.770^{11} | -0.408 | (0.311) | | | | |
| | (0.311) | (0.403) | (0.311) | | | | |
| Bank's Cash to Assets | 0.0482** | 0.0657** | 0.0515** | | | | |
| | (0.0203) | (0.0285) | (0.0201) | | | | |
| Bank's Loans to Deposits | -0.140*** | -0.175*** | -0.137*** | | | | |
| | (0.0130) | (0.0164) | (0.0127) | | | | |
| Change in Unemp. Rate, Bank's Counties | -0.334*** | -0.418*** | -0.337*** | | | | |
| | (0.0669) | (0.0900) | (0.0669) | | | | |
| Orthog. MBS/Sec. Holdings | No | Yes | No | | | | |
| Bank Fixed Effects | Yes | Yes | Yes | | | | |
| Quarter Fixed Effects | Yes | Yes | Yes | | | | |
| Observations | 77935 | 45618 | 77935 | | | | |
| Adjusted R^2 | 0.0574 | 0.0711 | 0.0573 | | | | |

Table 16 Mortgage market share

Columns 1 through 3 are panel fixed effect regressions. *Mortgage Origination Market Share* is the state-level market share (in basis points) for a given bank in a particular state and year. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *MBS Purchases* is the quarterly log-dollar amount of gross Federal Reserve MBS purchases from the fourth quarter of the prior year. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS Holdings* refers to whether the MBS terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | Mortgage Orig Market Share | | | |
|--|----------------------------|---------------------|----------------------|--|
| | (1) | (3) | | |
| High MBS Holdings | -3.667 (2.598) | -4.770* (2.538) | | |
| High MBS Holdings \times MBS Purchases | 0.577*** (0.203) | 0.352** (0.153) | | |
| Securitizer | | | -37.89 (30.22) | |
| Securitizer \times MBS Purchases | | | 4.620** (1.938) | |
| Bank's Size | 10.05*** (3.257) | 5.990*** (1.953) | 8.799*** (3.032) | |
| Bank's Equity Ratio | 0.682 (0.468) | 0.219 (0.469) | 0.508 (0.440) | |
| Bank's Net Income | 0.575 (1.256) | 1.487 (1.054) | 1.006 (1.145) | |
| Bank's Cost of Deposits | -6.696** (2.964) | -4.749 (3.403) | -5.486* (2.811) | |
| Bank's Cash to Assets | -0.434** (0.184) | -0.385** (0.162) | -0.380*** (0.147) | |
| Bank's Loans to Deposits | -0.102 (0.133) | -0.164 (0.131) | -0.0702 (0.124) | |
| Change in Unemp. Rate, Bank's Counties | -0.0507 (0.431) | -0.219 (0.383) | 0.185 (0.394) | |
| Orthog. MBS Holdings | No | Yes | No | |
| Bank Fixed Effects | Yes | Yes | Yes | |
| State by Year Fixed Effects | Yes | Yes | Yes | |
| Observations | 45332 | 38561 | 45332 | |
| Adjusted R^2 | 0.510 | 0.242 | 0.512 | |

Table 17 Mortgage rates

Columns 1 through 6 are panel fixed effect regressions. Average 30-Year Rate is the average 30-year fixed mortgage rate (in basis points) for the bank in a specific state. Average 15-Year Rate is the average 15-year fixed mortgage rate (in basis points) for the bank in a specific state. High MBS Holdings takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. MBS Purchases is the quarterly log-dollar amount of gross Federal Reserve MBS purchases from the fourth quarter of the prior year. Securitizer takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. Orthog. MBS Holdings refers to whether the MBS terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | Avg. 30-Year Rate | | Av | Avg. 15-Year Rate | | |
|--|-------------------|---------|-----------|-------------------|-----------|-----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | 29.77* | -36.60 | | 5.151 | -38.19 | |
| | (17.42) | (27.06) | | (23.74) | (25.05) | |
| High MBS Holdings × MBS Purchases | -1.505** | -0.370 | | -1.991*** | -1.623*** | |
| | (0.616) | (0.458) | | (0.689) | (0.527) | |
| Securitizer | | | 94.59*** | | | 76.30*** |
| | | | (8.504) | | | (12.08) |
| Securitizer \times MBS Purchases | | | -1.324*** | | | -2.504*** |
| | | | (0.459) | | | (0.712) |
| Bank's Size | 12.30 | 15.28 | 18.54** | 6.543 | 21.35** | 15.18* |
| | (8.886) | (11.39) | (9.293) | (7.566) | (9.101) | (7.874) |
| Bank's Equity Ratio | -0.204 | 0.437 | 0.00214 | -1.726 | -1.407 | -1.354 |
| | (1.714) | (2.363) | (1.689) | (1.818) | (2.846) | (1.737) |
| Bank's Net Income | 0.883 | -4.179 | 0.559 | 2.156 | -2.638 | 0.857 |
| | (2.931) | (3.476) | (2.914) | (2.736) | (3.306) | (2.786) |
| Bank's Cost of Deposits | 6.560 | 4.762 | 6.115 | 6.214 | 4.842 | 3.618 |
| - | (5.596) | (8.087) | (5.362) | (4.613) | (5.808) | (4.175) |
| Bank's Cash to Assets | 0.793 | 0.860 | 0.883* | 1.431** | 1.049 | 1.578** |
| | (0.518) | (0.693) | (0.516) | (0.633) | (0.727) | (0.629) |
| Bank's Loans to Deposits | 24.67 | -4.340 | 17.24 | 54.83*** | -11.96 | 45.56** |
| | (16.92) | (16.18) | (17.82) | (20.48) | (21.10) | (21.30) |
| Change in Unemp. Rate, Bank's Counties | -2.230** | -0.595 | -2.096** | 0.0406 | 0.715 | -0.0500 |
| | (0.985) | (1.027) | (0.970) | (1.122) | (1.526) | (1.123) |
| Orthog. MBS/Sec. Holdings | No | Yes | No | No | Yes | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| State by Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4366 | 2433 | 4366 | 6080 | 3754 | 6080 |
| Adjusted R^2 | 0.921 | 0.934 | 0.922 | 0.914 | 0.927 | 0.915 |

Appendix: For review and online publication only

Appendix A. Loan data and firm-bank lending relationships

We use DealScan data to establish lending relationships between firms and banks. We consider the presence of any loan between the bank and borrowing firm to be evidence of a relationship. In the case of syndicated loans with multiple lenders, following Bharath, Dahiya, Saunders, and Srinivasan (2011) and Chakraborty, Goldstein, and MacKinlay (2018), we consider the relationship bank to be the one which serves as lead agent on the loan.³⁴ The duration of the relationship is defined as follows: it begins in the first quarter that we observe a loan being originated between the firm and bank, and it ends when the last loan observed between the firm and bank matures, according to the original loan terms. Firms and banks are considered in an active relationship both in quarters that new loans are originated and quarters in which no new loan originations occur with that bank.

DealScan provides loan origination information, which gives us information on the borrower, the lender (or lenders in the case of a loan syndicate), and the terms of the loan facility, including the size, interest rate, maturity, and type of loan being originated. The median relationship last five years and involves two loans. For those observations without sufficient maturity data to determine the relationship duration, we assume the median sample relationship duration of five years.

For our bank balance sheet variables, we use Call Report data from each quarter, aggregated to the bank holding company (BHC) level, using the RSSD9348 variable. We also aggregate the HMDA mortgage data to the BHC-level in a similar manner. To address mergers between banks over our sample period, we update the current holding company for lenders over time. Similar to Chakraborty, Goldstein, and MacKinlay (2018), we use Summary of Deposits data and historical press releases about different mergers between banks to do this. We assume that the relationship between a borrower and lender continues under the new bank holding company for the duration of the loan, and any subsequent loans under that same DealScan lender.

³⁴To determine the lead agent, we use the following ranking hierarchy from Chakraborty, Goldstein, and MacKinlay (2018): 1) lender is denoted as "Admin Agent", 2) lender is denoted as "Lead bank", 3) lender is denoted as "Lead arranger", 4) lender is denoted as "Mandated lead arranger", 5) lender is denoted as "Mandated arranger", 6) lender is denoted as either "Arranger" or "Agent" and has a "yes" for the lead arranger credit, 7) lender is denoted as either "Arranger" or "Agent" and has a "no" for the lead arranger credit, 8) lender has a "yes" for the lead arranger credit but has a role other than those previously listed ("Participant" and "Secondary investor" are also excluded), 9) lender has a "no" for the lead arranger credit but has a role other than those previously listed ("Participant" and "Secondary investor" are also excluded), and 10) lender is denoted as a "Participant" or "Secondary investor". For a given loan package, the lender with the highest title (following the ten-part hierarchy) is considered the lead agent.

Appendix B. Back of the envelope calculations

This section provides a simple calculation of the impact of the Fed's MBS purchases on bank lending in terms of mortgage origination and commercial loans. To further trace out the bank lending channel, we also calculate the effect on firm investment. We also calculate the bank's relative substitution between mortgage and commercial lending, and the sensitivity of firm investment to the reduction in commercial lending. Finally, to provide some aggregate numbers, we use the Fed's balance sheet expansion of \$1.75 trillion in MBS over the three QEs.

B.1. Mortgage origination

Table 1 reports that the mean MBS purchases per quarter in our sample period is 95.3 billion. Data from the FHFA shows that the average single-family conventional mortgage originations from 2001–2005 are approximately \$2,854 billion per year.³⁵ We use this period to establish a baseline amount of origination activity that is not affected by the QE treatment and also avoids the strongest boom years and the financial crisis itself. We use single-family conforming loans as these can be packaged readily into agency MBS which the Federal Reserve was purchasing as part of QE.

Column 3 of Table 2 reports a coefficient of 1.865. Since the dependent variable, annual mortgage origination growth rate, is scaled by 100, this means for 1% additional MBS purchases, there is a 0.01865 percentage point (pp) increase in mortgage origination growth for the high-MBS securitizer banks. Using HMDA data, we estimate that high-MBS securitizers originated approximately 26% of mortgages. Hence, we calculate 0.13839 billion $(26\% \times 2,854B \times 0.01865 \times 0.01)$ of additional originations for a 1% increase in MBS purchases at the mean, using our pre-QE baseline origination averages. In dollar terms, a 1% increase in annual MBS purchases at the mean is 3.812 billion $(1\% \times 95.3B/quarter \times 4)$.

The last two numbers allow us to calculate a dollar for dollar number: for each \$1 of additional MBS purchases, securitizing banks originate 3.63 cents (0.13839/3.812) of additional mortgages. For the Fed's balance sheet expansion of \$1.75 trillion in MBS, we obtain an estimate of \$63.53 billion of additional originations by high-MBS securitizer banks that benefited from QE.

³⁵See https://www.fhfa.gov/DataTools/Downloads/Pages/Current-Market-Data.aspx for the file titled "Single-Family Mortgage Originations."

B.2. Commercial loans

The average quarterly commercial lending for the banks from Call Report data is \$912.89 billion. Similar to the mortgage origination calculations above, we use the period of 2001–2005 to calculate this number which avoids the strongest boom years and the financial crisis itself when banks were treated with QE.

Column 5 of Table 5 reports a coefficient of -0.364. The dependent variable is scaled by 100 and is quarterly. This means that 1% additional MBS purchases leads to a 0.00364 pp reduction in commercial loan growth. As our baseline aggregate quarterly commercial lending is \$912.89 billion, and approximately 35% of the market share is controlled by the high-MBS securitizers, a 0.00364 pp decrease in commercial loans translates to a decrease of \$0.01163 billion ($35\% \times 912.89B \times -0.00364 \times 0.01$). As the mean MBS purchases per quarter in our sample period is 95.3 billion, 1% additional quarterly MBS purchases at the mean is \$953 million.

Dollar for dollar, for every \$1 of additional MBS purchases, we note a reduction of 1.22 cents (-0.01163/0.953) in terms of commercial loans extended. We can compare the commercial lending reduction with the mortgage lending increase as well: for each dollar of additional mortgage lending, securitizing banks substitute away from commercial lending by 34 cents (1.22/3.63). For the Fed's total balance sheet expansion of \$1.75 trillion, this translates to a reduction in commercial lending of \$21.36 billion.

B.3. Firm investment

The average quarterly investment by Compustat firms with banking relationships is \$91.82 billion. Similar to the mortgage and commercial loans calculations above, we use the period of 2001–2005 to calculate this number.

Column 6 of Table 6 reports a coefficient of -0.0355. Since the dependent variable is scaled by 100 and is quarterly, this means that 1% additional MBS purchases at the mean (953 million per quarter) leads to a 0.000355 pp reduction in firm investment as a fraction of property, plant, and equipment (PP&E). Given the mean investment rate of 2.82% of lagged gross PP&E per quarter, this translates to 0.01259 pp (0.000355/0.0282) in terms of investment. Given the market share of securitizers is 35% for commercial lending, 0.01259 pp in reduced firm investment translates to a \$0.00405 billion ($35\% \times 91.82B \times 0.01259 \times 0.01$) reduction in firm investment for a 1% increase in MBS purchases.

Dollar for dollar, for every \$1 of additional MBS purchases, we calculate a reduction of 0.425 cents

(-0.00405/0.953) in terms of reduced firm investment. Thus, for each dollar of commercial lending cut by high-MBS securitizer banks because of MBS purchases, firms that borrow from these banks reduce firm investment by 35 cents (0.425/1.22). Scaled differently, for every dollar of additional mortgage lending stimulated through MBS purchases, firms reduce investment by 12 cents (0.425/3.63).

Appendix C. Additional robustness tests

C.1. Alternative security exposure variable

Table 5 shows that commercial lending increased when Treasuries were purchased by the Federal Reserve. To calculate the impact of Treasury purchases, we calculate the exposure of banks to non-MBS securities that include Treasury securities, other U.S. government agency or sponsored-agency securities, securities issued by states and other U.S. political subdivisions, other asset-backed securities (ABS), other debt securities, and investments in mutual funds and other equity securities. The average bank in our sample holds 14.4% of assets in these non-MBS securities. 8.2% of assets on average are held in just Treasury and other U.S. federal government securities.

To address the argument that Treasury purchases have a larger or more direct effect on government securities compared to other asset classes, we now restrict securities holdings to just Treasuries and other U.S. federal government securities. Table C.2 reports the results for this alternative measure and finds that the results remain similar to Table 5.

C.2. Comparison with alternative research designs

Rodnyansky and Darmouni (2017) (RD) utilize an alternative research design to investigate the same sample period. In comparing the effect of monetary policy on commercial lending, there are two points of overlap in our papers: C&I lending at the bank level and loan growth at the firm level. This section seeks to understand how the differences in research designs contribute to the differences in our results.

C.2.1. Bank-level C&I lending

Columns 5 and 6 of Table 6 of RD report C&I lending results in response to QE. The authors do not find any result in column 5. In column 6, the authors only find a positive and significant coefficient in case of

interacting the MBS exposure measure with the indicator for QE3. Because it is their strongest result, this section focuses on the specification from column 6.

Two differences regarding the specification choice are:

- 1. Economically, having a continuous measure of monetary policy (quarter by quarter asset purchases) is important compared to three time dummies for the three QE stages because a continuous measure allows us to separate the effects of asset purchases from other contemporary economic events. A continuous measure with quarter fixed effects ensures that identification is obtained from within-quarter differences in responses by banks to asset purchases. Since QE1 and QE3 had both MBS and Treasury purchases, it is important to distinguish the impact of both. A specification that uses QE indicators commingles both types of purchases. By only using MBS-related treatments for QE1 and QE3, RD assumes that MBS purchases are the only channel of note.³⁶
- 2. Another important difference in specifications is the choice of outcome variable. Rodnyansky and Darmouni (2017) use the total balance sheet amount of loans. In contrast, we focus on the growth in loans in response to the treatment of asset purchases from the prior quarter. As the Federal Reserve's MBS purchases primarily influence banks' new mortgage origination activity, the principal effect of these new originations is on the crowding out of new C&I lending. We believe this crowding-out effect is better measured by C&I loan growth. In this choice, our approach is similar to Kashyap and Stein (2000) and Khwaja and Mian (2008). Additionally, in any treatment on the treated analysis, the initial state before the treatment needs to be controlled for so that only the change since the treatment is attributed to the treatment.³⁷

Column 1 of Table C.3 attempts to replicate column 6 of Table 6 in Rodnyansky and Darmouni (2017). We construct the variables as in their specification and perform the propensity score matching procedure as described in RD. We are able to obtain a positive statistical effect of QE3 on banks with more MBS holdings, which is similar to their result. In column 2, based on the second difference mentioned above, we use the C&I loan growth as the dependent variable, while keeping everything else the same as in their

³⁶The reason the authors suggest that they can ignore Treasury purchases is because banks do not hold as much Treasury securities as MBS. However, they ignore non-Treasury U.S. government agency securities. Our summary statistics (Table I, Panel A) show that banks hold approximately 8.2% of assets in U.S. government securities, which is similar to the MBS holdings of approximately 7-8% of assets in both our dataset and that of RD. Further, the total non-MBS securities holdings are approximately 14% of assets, which should also benefit from Treasury purchases through lower interest rates. Thus, we do not believe that the treatment dummies of QE1 and QE3 can be attributed to MBS purchases only.

³⁷For example, a change in health due to taking a pill, rather than the conflated health level of the patient after taking the pill.

specification. The positive coefficient for QE3 is not obtained. Column 3 resets the specification back to column 1 and switches from QE period indicators to continuous measures of purchases during QE based on the first difference mentioned above. Again, the positive result in QE3 disappears as MBS purchases are separated from conflating Treasury purchases in QE1 and QE3. Thus, a combination of the two differences is necessary for their C&I results; not each individually.

Column 5 is the closest to our specification while still using the RD controls and propensity score matching. Specifically, we switch to our tercile measures for MBS holdings and non-MBS securities holdings, use continuous measures of asset purchases, and introduce quarter fixed effects. The statistical significance and economic magnitude of our coefficients remain similar to the results in Table 5 of our paper. Even though we have concerns that the level of C&I lending is not the most appropriate dependent variable, we run a specification that uses levels and moves closer to their specification (Column 4). Similar to column 5, we get a negative result.

In summary, our specification is robust to using the set of controls as in Rodnyansky and Darmouni (2017). Our version of their specification from their Table 6 is not robust to the elimination of either one of the two differences mentioned above.

C.2.2. Firm-level loan growth

Table 7 of Rodnyansky and Darmouni (2017) presents evidence that firm-level loan growth increases for firms which borrow from treated banks during QE1 and QE3. The specification for Table 7 is different from that in their Table 6. However, in this case as well, difference #1 mentioned above is present: the authors divide QE into three phases, while in Section 3.2 we utilize quarterly MBS and Treasury purchases along with time fixed effects. We find a negative effect of MBS purchases on C&I lending and evidence that Treasury purchases have a positive effect on C&I lending. As above, a reason for the positive result in their paper for QE1 and QE3 could be due to the purchase of Treasuries being commingled with the purchase of MBS.

Regarding difference #2, the authors use the change in lending rather than the level in Table 7. This provides additional support for our choice of using the change in lending as discussed above. In addition, Table 7 of has another difference with our approach in Section 3.2. We control for heterogeneity across banks using bank-level controls and bank fixed effects (Difference #3). While using the change in lending and firm fixed effects help address concerns about changes in *firm* credit demand affecting the results, they

do not control for other *bank* motivations not related to MBS purchases. As banks with higher MBS holdings have other characteristics such as size, leverage, or income that may affect lending decisions, accounting for these other characteristics is important.

Table C.4 in Appendix C.2 presents our version of their Table 7. In addition to the differences mentioned above, we have a larger sample of firms (14,704 loan-growth observations versus 3,267 loan-growth observations in RD). This is likely because of differences in the hand matching of banks between DealScan and Call Report bank data. We utilize and extend the hand-matched sample in Chakraborty, Goldstein, and MacKinlay (2018), while the authors also conduct their own hand match. To illustrate the importance of difference #1, we first pool the observations across all three QE periods and control separately for the total MBS or Treasury purchases in each QE period. Although not as granular as the quarterly-level asset purchase approach we use in Section 3.2, we nonetheless find a negative and significant effect of MBS purchases on loan growth or loan renewals for above-median MBS banks.³⁸ We also find positive estimates for the effect of Treasury purchases, which is statistically significant in the case of loan renewals.

The remaining specifications of Table C.4 follows RD and treats each QE period separately. The odd numbered columns 3–13 of Table C.4 correspond to the specifications of Table 7 in their paper. For the QE1 and QE3 specifications, we get negative (columns 3 and 5) or insignificant results (columns 11 and 13). This compares to their specifications which get positive results. We suspect that the particular sample that the authors use, which is not as large as our own, is selecting a group of firms that appear less negatively affected on average than our sample.

Regarding difference #3, since the authors do not include bank-level controls, any omitted bank characteristic (such as size, leverage, or income) that would presumably affect a bank's decision to renew a commercial loan are not included. As many of these factors will have correlations with MBS exposure, their specification will likely suffer from an omitted variable bias. To illustrate this issue, in the even numbered columns 4–14 of Table C.4, we include our set of bank-level controls. We find that the estimates tend to become more negative when we include our bank variables as additional controls. This is especially the case for the estimates related to QE3 (columns 11–14), where we find a negative and significant effect of the MBS treatment indicator on firm loan growth and loan renewals. Because of this omitted variable issue, we suspect that many of the results in Rodnyansky and Darmouni (2017) would be reduced in magnitude and significance with the inclusion of bank controls. As a point of comparison, our main loan-level results (Ta-

³⁸In contrast to their results elsewhere, Table 7 of RD uses a median cut-off to designate banks which are more exposed to QE.

bles 3 and 4), include both these bank-level controls and bank fixed effects to further control for bank-level heterogeneity.

C.3. Continuous balance sheet variables

Our main results on firm-level investment (Section 4.1) are based on dividing banks into terciles on the basis of the exposure of banks' balance sheets to MBS and securities holdings. While the terciles approach simplifies the interpretation of the effect between the most and least exposed banks, in this section, we employ continuous variables to measure the exposure of banks to MBS and other non-MBS securities.

Table C.8 reports how firm investment responds to asset purchases conditional on the lending banks' holdings in terms of MBS and non-MBS securities holdings. Like in Table 6, we find a negative and statistically significant impact of MBS purchases on firm investment if the MBS holdings of the lending bank are higher. Also similar to Table 6, the impact of Treasury purchases on investment is insignificant.

Table A.1 Variable Definitions

This table presents the data sources and the method of construction of the variables used in our analysis.

| Variable Definitions | | | | | |
|--|--|---------------------------------|--|--|--|
| Dank Vaniahlas | Definition | Data Sources | | | |
| MBS Holdings | Balance sheet mortgage-backed securities (RCFD8639) plus trading asset mortgage-backed securities (RCFD G379 + G380 + G381 + K197 + K198) divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| Securities Holdings | Total balance sheet securities (RCFD8641) minus balance sheet MBS holdings (RCFD8639), divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| U.S. Gov. Securities Holdings | U.S. Treasury securities (RCFD0211 + RCFD1287 + RCON3531) plus U.S. government agency obligations (RCFD1289 + RCFD1294 + RCFD1293 + RCFD1298 + RCON3532), divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| C&I Loan Growth | Quarterly growth in total commercial and industrial loans. Total C&I loans are the sum of balance sheet C&I loans (RCFD1766) and trading asset C&I loans (RCFDF614). Scaled by 100. | Call Report | | | |
| Change in C&I Loan Profitability | Quarterly change in the profitability of C&I loans. Quarterly C&I loan prof- itability is the interest and fee income on commercial and industrial loans (RIAD4012) divided by commercial and industrial loans (RCFD1766). Scaled by 100. | Call Report | | | |
| Bank's Size | Log of total assets (RCFD2170) | Call Report | | | |
| Bank's Equity Ratio | Total equity capital (RCFD3210) divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| Bank's Net Income | Net income (RIAD4340) divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| Bank's Cost of Deposits | Interest on deposits (RIAD4170) divided by total deposits (RCFD2200). Scaled by 100. | Call Report | | | |
| Bank's Cash to Assets | Cash and balances due from depository institutions (RCFD0010) divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| Bank's Loans to Deposits | Loans and leases (RCFD2122) divided by total deposits (RCFD2200). Scaled by 100. | Call Report | | | |
| Bank's Demand Deposits | Total demand deposits (RCFD2210) divided by total assets (RCFD2170). Scaled by 100. | Call Report | | | |
| Securitizer | Indicator that bank reports non-zero net securitization income (RIADB493) and is in the highest tercile of <i>MBS Holdings</i> . | Call Report | | | |
| Change in Unemployment Rate, Bank's Counties | Quarterly change in unemployment rate (as a %) in counties where bank has deposits, weighted by most recently available summary of deposits. | Summary of Deposits, FRED | | | |
| Mortgage Origination Growth | Bank's mortgage origination growth rate (nationwide). Scaled by 100. | HMDA | | | |
| State-Level Mortgage Origina- tion Market Share (bps) | Bank's share of the mortgage origination market, for a given state-level market. Measured annually in basis points. | HMDA | | | |
| Average 30-Yr. Rate (bps) | Average APR of 30-year fixed rate mortgages. Measured quarterly in basis points for each bank at the state level. | RateWatch | | | |
| Average 15-Yr. Rate (bps) | Average APR of 15-year fixed rate mortgages. Measured quarterly in basis points for each bank at the state level. | RateWatch | | | |

Table A.1—*Continued*

| Variable Definitions | | | | |
|---------------------------|---|------------------------|--|--|
| Manatan Dalim Variahlar | Definition | Data Sources | | |
| TSY Purchases (Bil. USD) | Amount of Treasury securities purchased by the Federal Reserve in a given quarter. | New York Fed | | |
| MBS Purchases (Bil. USD) | Amount of MBS purchased by the Federal Reserve in a given quarter. | New York Fed | | |
| Rate Stimulus | Difference between the rate implied by the Taylor Rule and the average quar- terly effective federal funds rate. | FRED | | |
| Loan Characteristics | | | | |
| Loan Amount | Loan facility amount divided by the borrowing firm's prior quarter's book assets. Scaled by 100. | DealScan, Compustat | | |
| All In Drawn Spread (bps) | Basis point spread over LIBOR for each dollar of loan facility drawn. | DealScan | | |
| Maturity (months) | Loan facility maturity (in months) at origination. | DealScan | | |
| Takeover Loan | Indicator that loan purpose is an acquisition line, LBO, MBO, or takeover. | DealScan | | |
| Revolving Credit Line | Indicator that loan facility is a revolving credit line. | DealScan | | |
| Term Loan | Indicator that loan facility is a term loan. | DealScan | | |
| Firm Loan Growth | Log difference in a bank's loan share to a given firm. Loan share is the sum of the total amount of lending between a firm and a bank in a year. Scaled as a quarterly percentage. | DealScan | | |
| Firm Variables | | | | |
| Investment | Quarterly capital expenditures divided by prior quarter's gross PPE. Scaled by 100. | Compustat | | |
| Change in Debt | Quarterly change in total debt divided by prior quarter's book assets. Scaled by 100. | Compustat | | |
| Change in Equity | Quarterly change in common shares outstanding, adjusted for stock splits and dividends. Scaled by 100. | Compustat | | |
| Cash Flow | Quarterly income before extraordinary items plus depreciation and amortiza- tion divided by prior quarter's gross PPE. | Compustat | | |
| Lagged Tobin's q | Sum of current liabilities, long-term debt, and market value of equity (clos- ing stock price times shares outstanding) minus current assets, all divided by gross PPE. All variables from prior quarter. | Compustat | | |
| Lagged Z-Score | Sum of 3.3 times pre-tax income, sales, 1.4 times retained earnings, 1.2 times the difference between current assets and current liabilities, all divided by book assets. All variables from prior quarter. | Compustat | | |
| Lagged Firm Size | Log of book assets from prior quarter. | Compustat | | |
| Lagged Market-to-Book | Book assets plus closing stock price times shares outstanding minus common equity, all divided by book assets. All variables from prior quarter. | Compustat | | |
| Lagged Profitability | Quarterly operating income before depreciation divided by book assets. Both variables from prior quarter. Scaled by 100. | Compustat | | |
| Lagged Tangibility | Net PPE divided by book assets. Both variables from prior quarter. Scaled by 100. | Compustat | | |



Fig. C.1. Average state-level mortgage origination market share for non-securitizer banks, in percentage points. Top panel includes years not following fourth-quarter MBS purchases (2006, 2007, 2008, 2009, 2012). Bottom panel includes years following fourth-quarter MBS purchases (2010, 2011, 2013).
Table C.2 C&I loan growth, using an alternative treasury purchase exposure measure

Columns 1 through 6 are panel fixed effect regressions. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Gov. Securities Holdings* takes a value of 1 if the lending bank is in the top tercile by all U.S. federal government securities to total assets, and a value of 0 if in the bottom tercile. *High Gov. Securities Holdings* takes a value of 0 if in the bottom tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Securitizer* takes a value of 1 if a high-MBS bank reported non-zero securitization income and 0 otherwise. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities terciles have been orthogonalized to other bank characteristics. Standard errors are clustered by bank.

| | | | C&I Loar | n Growth | | |
|--|------------|-----------|---------------|------------|-----------|-------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| High MBS Holdings | -0.154 | | -0.137 | -0.329 | | |
| | (0.481) | | (0.485) | (0.353) | | |
| High MBS Holdings \times MBS Purchases | -0.0611*** | | -0.0580*** | -0.0793*** | | |
| | (0.0209) | | (0.0209) | (0.0207) | | |
| | (0.020)) | | (01020)) | (010207) | 2 4 (7* | 2 4 (1* |
| Securitizer | | | | | 2.40/* | 2.401^{*} |
| | | | | | (1.511) | (1.515) |
| Securitizer \times MBS Purchases | | | | | -0.370*** | -0.368*** |
| | | | | | (0.0925) | (0.0925) |
| High Gov. Securities Holdings | | -0.548 | -0.626 | -0.399 | | -0.544 |
| c c | | (0.442) | (0.447) | (0.343) | | (0.442) |
| High Gov. Securities Holdings × TSY Purchases | | 0 115*** | 0 1 1 4 * * * | 0.0482* | | 0 115*** |
| Then dov. becanties fioldings × 101 fullenases | | (0.0276) | (0.0276) | (0.0702) | | (0.0276) |
| | 1.0054444 | (0.0270) | (0.0270) | (0.0210) | 1 (10) | (0.0270) |
| Bank's Size | -1.695*** | -1.6/5*** | -1.722*** | -1.886*** | -1.612*** | -1.661*** |
| | (0.3/4) | (0.383) | (0.385) | (0.398) | (0.370) | (0.382) |
| Bank's Equity Ratio | 0.956*** | 0.963*** | 0.962*** | 0.830*** | 0.960*** | 0.965*** |
| | (0.0678) | (0.0679) | (0.0677) | (0.0662) | (0.0680) | (0.0679) |
| Bank's Net Income | 0.551*** | 0.558*** | 0.564*** | 0.376** | 0.540*** | 0.555*** |
| | (0.147) | (0.147) | (0.147) | (0.165) | (0.148) | (0.147) |
| Bank's Cost of Denosits | 1 003*** | 1 0/2*** | 1 0/1*** | 0.544* | 1 010*** | 1 055*** |
| Bank's Cost of Deposits | (0.328) | (0.328) | (0.328) | (0.322) | (0.328) | (0.328) |
| | (0.520) | (0.320) | (0.520) | (0.522) | (0.520) | (0.520) |
| Bank's Cash to Assets | 0.0506** | 0.0582*** | 0.0517** | 0.0497** | 0.0561*** | 0.0576*** |
| | (0.0203) | (0.0204) | (0.0206) | (0.0220) | (0.0201) | (0.0204) |
| Bank's Loans to Deposits | -0.139*** | -0.136*** | -0.139*** | -0.159*** | -0.136*** | -0.137*** |
| | (0.0129) | (0.0127) | (0.0130) | (0.0129) | (0.0126) | (0.0127) |
| Change in Unemp. Rate, Bank's Counties | -0.362*** | -0.364*** | -0.364*** | -0.408*** | -0.363*** | -0.365*** |
| | (0.0669) | (0.0669) | (0.0669) | (0.0647) | (0.0669) | (0.0669) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes | No | No |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 75836 | 75836 | 75836 | 73865 | 75836 | 75836 |
| Adjusted R^2 | 0.0563 | 0.0565 | 0.0566 | 0.0525 | 0.0563 | 0.0566 |

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table C.3 C&I lending comparison

Columns 1 through 5 are panel fixed effect regressions. *Log(C&I) Loans* is the log-level of the bank's balance sheet C&I loans. *C&I Loan Growth* is the growth rate in C&I loans between the current and prior quarter, scaled by 100. *Cont. MBS Holdings* is the bank's balance sheet MBS holdings scaled by total assets. *Cont. Treasury Holdings* is the bank's balance sheet Treasury holdings scaled by total assets. *High MBS Holdings* takes a value of 1 if the lending bank is in the top tercile by MBS securities to total assets, and a value of 0 if in the bottom tercile. *High Securities Holdings* takes a value of 1 if the lending bank is in the top tercile. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Controls* include the bank's size, equity ratio, return on assets, and duration gap. *QE Indicators* stipulates that there are indicator variables for QE1 (2008q4–2010q2), QE2 (2010q4–2011q2), MEP (2011q4–2012q2), and QE3 (2012q3–2014q4). Standard errors are clustered by bank.

| | Log(C&I Loans) | C&I Loan Growth | Log(C&I Loans) | Log(C&I Loans) | C&I Loan Growth |
|---|----------------|-----------------|----------------|----------------|-----------------|
| | (1) | (2) | (3) | (4) | (5) |
| Cont. MBS Holdings \times QE1 | -0.161*** | -3.776*** | | | |
| | (0.0563) | (1.419) | | | |
| Cont. Treasury Holdings × QE2 | -0.125 | 6.140 | | | |
| | (0.516) | (5.973) | | | |
| Cont. MBS Holdings \times QE3 | 0.376*** | -0.838 | | | |
| e e | (0.101) | (1.678) | | | |
| Cont. MBS Holdings \times MBS Purchases | | | -0.0211*** | | |
| e e e e e e e e e e e e e e e e e e e | | | (0.00516) | | |
| Cont Treasury Holdings × TSY Purchases | | | -0.0307 | | |
| Cont. Heasing Holdings × 151 Fullehases | | | (0.0253) | | |
| High MBS Holdings | | | (000200) | -0.0624** | 0 380 |
| mgn wibb fioldings | | | | (0.0024) | (0.487) |
| High MBS Holdings × MBS Purchases | | | | -0.00612*** | -0.0606** |
| Then who fillenings × who fullenases | | | | (0.000012 | (0.0281) |
| High Committee Holdings | | | | 0.126*** | 0.607 |
| High Securities Holdings | | | | -0.130^{+++} | (0.650) |
| | | | | (0.0307) | (0.050) |
| High Securities Holdings \times 15Y Purchases | | | | -0.00403*** | 0.0656* |
| | | | | (0.00128) | (0.0382) |
| MBS Purchases | | | -0.000254 | 0.000416 | |
| | | | (0.000551) | (0.000946) | |
| TSY Purchases | | | -0.00145*** | -0.00170*** | |
| | | | (0.000290) | (0.000451) | |
| QE Indicators | Yes | Yes | Yes | Yes | No |
| Controls | Yes | Yes | Yes | Yes | Yes |
| Controls \times QE Ind. | Yes | Yes | Yes | Yes | Yes |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Quarter Fixed Effects | No | No | No | No | Yes |
| Banks | 3824 | 3824 | 3824 | 2913 | 2913 |
| Observations | 149148 | 149148 | 149148 | 63157 | 63157 |
| R^2 | 0.258 | 0.0301 | 0.257 | 0.267 | 0.0371 |

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

| Columns 1 through 14 a post-QE period and <i>renewal</i> i defined in Rodnyansky and D: a value of 0 if it is below the r | ure panel fixed ef s an indicator th armouni (2017). nedian. Standard | fect regressio at a loan was <i>Above Media</i> l errors are in | ns. ∆log renewed. 1 <i>MBS</i> (<i>T</i> ¹ parenthes | (<i>loan</i>) is The cor <i>veat</i>) take es. | s the log on the struction of a value of a v | change in of these of 1 if the | the dolla variables e lending | ar amou and the bank is (| at of lenc determin above the | ling to a ations of median | specific 1 the differ in terms o | firm fron rent QE _] f MBS h | a the pre- periods is oldings, a | to as nd |
|---|--|--|---|--|--|--------------------------------------|-------------------------------------|---------------------------------|-------------------------------------|----------------------------------|--|--|--|--------------------------|
| | All QEs, $\Delta \log(\text{loan})$ (1) | All QEs, renewal (2) | QE1, A log (3) | g(loan) (4) | QE1, rel (5) | newal (6) | QE2, A lo (7) | g(loan) (8) | QE2, re (9) | snewal (10) | QE3, A Ic (11) | g(loan) (12) | QE3, rel (13) | newal (14) |
| Above Median MBS (Treat) | -1.273*** (0.224) | -0.0728*** (0.0122) | -0.191* (0.0985) | -0.228** (0.108) | -0.0144*** (0.00541) | -0.0148** (0.00593) | -0.116 (0.237) | -0.129 (0.281) | -0.00710 (0.0129) | -0.00658 (0.0153) | -0.0535 (0.171) | -0.493** (0.228) | -0.00309 (0.00914) | -0.0245** (0.0122) |
| Above Median MBS \times MBS Purchases | -0.0510** (0.0245) | -0.00314** (0.00134) | | | | | | | | | | | | |
| Above Median MBS \times TSY Purchases | 0.0404 (0.0276) | 0.00264* (0.00151) | | | | | | | | | | | | |
| Bank's Size | | | | 0.0165 (0.0602) | | 0.00336 (0.00335) | | 0.0463 (0.147) | | 0.00301 (0.00806) | | -0.118 (0.124) | | -0.00507 (0.00670) |
| Bank's Equity Ratio | | | | 0.0638 (0.0490) | | 0.00347 (0.00273) | | 0.365*** (0.117) | | 0.0194^{***} (0.00638) | | 0.0310 (0.0872) | | 0.00160 (0.00475) |
| Bank's Net Income | | | | 0.533** (0.219) | | 0.0251** (0.0121) | | -0.434 (0.470) | | -0.0256 (0.0259) | | -1.543*** (0.555) | | .0.0812*** (0.0299) |
| Bank's Cost of Deposits | | | | 0.0776 (0.194) | | 0.00689 (0.0102) | | -2.257*** (0.779) | | -0.120*** (0.0417) | | -6.724*** (1.342) | | -0.363*** (0.0717) |
| Bank's Cash to Assets | | | | -3.195 (2.931) | | -0.158 (0.165) | | -7.928** (3.613) | | -0.436** (0.195) | | 0.734^{***} (0.124) | | 0.0387*** (0.00641) |
| Bank's Loans to Deposits | | | | 0.00159 (0.00483) | | 0.0000611 (0.000265) | | -0.000617 (0.0123) | | -0.000133 (0.000669) | | -0.00385 (0.00918) | | -0.000275 (0.000498) |
| Change in Unemp. Rate, Bank's Counties | | | | 0.625*** (0.218) | | 0.0314^{***} (0.0118) | | -2.575*** (0.518) | | -0.141*** (0.0272) | | -0.252 (0.488) | | -0.0140 (0.0263) |
| Constant | -18.34*** (0.289) | 0.00426 (0.0155) | -17.24*** (0.0415) | -18.89*** (1.439) | 0.0453*** (0.00228) | -0.0931 (0.0794) | -12.62*** (0.113) | -15.25*** (3.389) | 0.291*** (0.00614) | 0.151 (0.184) | -12.76*** (0.0887) | -8.256** (3.346) | 0.298^{***} (0.00475) | 0.518^{***} (0.180) |
| QE Indicators Firm Fixed Effects | Yes Yes | Yes Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes | No Yes |
| Firms | 2635 | 2637 | 1831 | 1831 | 1831 | 1831 | 1002 | 1002 | 1002 | 1002 | 1403 | 1403 | 1403 | 1403 |
| Observations | 14704 | 14721 | 5246 | 5246 | 5246 | 5246 | 2788 | 2788 | 2788 | 2788 2.0700 | 4432 | 4432 | 4432 | 4432 |
| K ⁻ Standard errors in parentheses. * p<0.10, ** p<0.0 | 0.180 5, *** p<0.01 | 7/1.0 | 616000.0 | 0.0000 | c/100:0 | CC800.0 | 0.0000881 | 0.0/8/ | 0.000112 | c6/0.0 | / 670000.0 | 1700.0 | 1/70000.0 | 7700.0 |

75

Loan growth and loan renewals following QE periods

Table C.4

Table C.5 MBS holdings transition matrix

This table presents the fraction of banks in a given MBS holdings tercile that remain or transition to a different MBS holdings tercile in the next period.

| | | Next Period Tercile | |
|------------------------|-------------------|---------------------|------------------|
| Current Period Tercile | High MBS Holdings | Medium MBS Holdings | Low MBS Holdings |
| High MBS Holdings | 0.96 | 0.038 | 0.00080 |
| Medium MBS Holdings | 0.064 | 0.91 | 0.023 |
| Low MBS Holdings | 0.0028 | 0.033 | 0.96 |

| | banks |
|--------|-------|
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This table compares the means for bank-level variables depending on MBS holdings, securitization status, or securities holdings. The standard error of the difference is in parentheses.

| | High MBS Holdings | Low MBS Holdings | Difference | Securitizer | Non-Securitizer | Difference | High Securities Holdings | Low Securities Holdings | Difference |
|---|----------------------|---------------------|-------------------------|-------------|-----------------|-------------------------|-----------------------------|----------------------------|-------------------------|
| Bank's Size | 12.6 | 11.6 | 1.03^{**} (0.010) | 17.2 | 12.2 | 5.04^{***} (0.069) | 11.6 | 12.4 | -0.82 * * (0.012) |
| Bank's Equity Ratio | 10.2 | 10.8 | -0.58*** (0.022) | 10.8 | 10.5 | 0.28^{**} (0.14) | 11.7 | 10.1 | 1.62^{***} (0.025) |
| Bank's Net Income | 0.40 | 0.50 | -0.097*** (0.0051) | 0.62 | 0.44 | 0.17^{***} (0.034) | 0.63 | 0.39 | 0.24*** (0.0060) |
| Bank's Cost of Deposits | 1.00 | 1.14 | -0.14*** (0.0060) | 1.06 | 1.06 | -0.0012 (0.039) | 0.95 | 1.09 | -0.14*** (0.0070) |
| Bank's Cash to Assets | 5.85 | 8.26 | -2.41*** (0.046) | 4.20 | 6.86 | -2.66*** (0.31) | 6.28 | 7.01 | -0.73*** (0.055) |
| Bank's Loans to Deposits | 75.0 | 81.2 | -6.26*** (0.15) | 91.1 | 77.5 | 13.7^{***} (0.98) | 54.6 | 84.2 | -29.7*** (0.14) |
| Change in Unemp. Rate, Bank's Counties | 0.071 | 0.074 | -0.0024 (0.0093) | 0.063 | 0.072 | -0.0096 (0.062) | 0.041 | 0.082 | -0.041*** (0.011) |
| MBS Holdings | 14.6 | 0.12 | 14.5^{***} (0.044) | 12.6 | 8.60 | 4.00^{**} (0.45) | 6.59 | 9.21 | -2.63*** (0.079) |
| Securities Holdings | 11.3 | 15.2 | -3.84*** (0.094) | 5.78 | 12.9 | -7.16*** (0.63) | 34.8 | 6.51 | 28.3^{***} (0.049) |
| US Gov. Securities Holdings | 5.37 | 10.3 | -4.95*** (0.070) | 2.38 | 7.44 | -5.06*** (0.48) | 21.4 | 3.34 | 18.1^{***} (0.055) |
| C&I Loan Growth (%) | 1.53 | 1.61 | -0.085 (0.10) | 2.25 | 1.56 | 0.69 (0.68) | 1.97 | 1.44 | 0.53^{***} (0.12) |
| Change in C&I Loan Profitability (%) | -1.57 | -0.27 | -1.29*** (0.20) | 0.39 | -1.04 | 1.43 (1.31) | -0.88 | -1.08 | 0.19 (0.23) |
| Mortgage Origination Growth (%) | 24.9 | 21.9 | 2.97** (1.35) | 13.6 | 23.4 | -9.84 (10.7) | 21.2 | 26.3 | -5.12*** (1.37) |
| State-Level Mortgage Orig. Market Share (bps) | 32.1 | 9.59 | 22.5*** (0.92) | 182.7 | 16.0 | 166.7*** (2.54) | 11.3 | 43.6 | -32.2*** (1.22) |
| Average 30-Yr. Rate (bps) | 554.9 | 587.6 | -32.7*** (4.77) | 570.7 | 551.9 | 18.8^{***} (2.96) | 544.9 | 567.7 | -22.8*** (5.03) |
| Average 15-Yr. Rate (bps) | 522.9 | 612.1 | -89.3*** (4.24) | 525.8 | 538.9 | -13.1*** (3.54) | 563.4 | 542.7 | 20.7*** (4.65) |
| * p<0.10, ** p<0.05, *** p<0.01 | | | | | | | | | |

| | High MRS | I ow MRS | Difference | Securitizer | Non-Securitizer | Difference | High Securities | I ow Securities | Difference |
|----------------------|------------|----------|-------------------------|-------------|--------------------|-------------------------|-----------------|-----------------|-------------------------|
| | Holdings | Holdings | | | INTERNAL INCLUSION | | Holdings | Holdings | |
| Investment | 3.09 | 2.80 | 0.29*** (0.033) | 3.03 | 2.91 | 0.12^{**} (0.033) | 2.68 | 3.05 | -0.38^{***} (0.039) |
| Cash Flow | 0.053 | 0.057 | -0.0033** (0.0014) | 0.059 | 0.051 | 0.0073*** (0.0014) | 0.049 | 0.057 | -0.0077*** (0.0016) |
| Lagged Tobin's q | 3.37 | 2.97 | 0.40^{***} (0.057) | 3.27 | 3.11 | 0.16^{**} (0.057) | 2.95 | 3.26 | -0.31*** (0.066) |
| Lagged Z-Score | 0.50 | 0.60 | -0.10^{**} (0.016) | 0.66 | 0.45 | 0.21^{***} (0.016) | 0.26 | 0.64 | -0.39^{***} (0.019) |
| Lagged Firm Size | 6.90 | 8.19 | -1.29*** (0.019) | 6.96 | 7.92 | -0.95*** (0.019) | 7.92 | 7.33 | 0.59^{***} (0.023) |
| Lagged Profitability | 3.19 | 3.60 | -0.41*** (0.028) | 3.36 | 3.38 | -0.019 (0.028) | 3.04 | 3.47 | -0.43^{***} (0.032) |
| Lagged Tangibility | 30.9 | 34.1 | -3.26*** (0.27) | 29.8 | 34.5 | -4.76*** (0.27) | 33.9 | 31.8 | 2.04^{***} (0.32) |
| * p<0.10, ** p<0.05, | *** p<0.01 | | | | | | | | |

This table compares the means for the firm-level variables of borrowers depending on the lending bank's MBS holdings, securitization status, or securities Comparison of borrowers

Table C.7

Table C.8

Firm investment, using alternative exposure measures

Columns 1 through 4 are panel fixed effect regressions. *Investment* is the firm's quarterly capital expenditures divided by lagged gross PPE, scaled by 100. *MBS Holdings* is the ratio of the bank's MBS securities to total assets from the prior quarter, scaled by 100. *Securities Holdings* is the ratio of the bank's non-MBS securities to total assets from the prior quarter, scaled by 100. *MBS Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve MBS purchases. *TSY Purchases* is the lagged quarterly log-dollar amount of gross Federal Reserve TSY purchases. *Orthog. MBS/Sec. Holdings* refers to whether the MBS and securities holdings have been orthogonalized to other bank characteristics. Standard errors are clustered by firm and bank.

| | | Inves | stment | |
|--|-------------|------------|-------------|-------------|
| | (1) | (2) | (3) | (4) |
| MBS Holdings | 0.0166 | | 0.0166 | 0.0160 |
| | (0.0120) | | (0.0122) | (0.0119) |
| MBS Holdings × MBS Purchases | -0.00210*** | | -0.00210*** | -0.00206*** |
| - | (0.000637) | | (0.000682) | (0.000741) |
| Securities Holdings | | 0.00408 | -0.000605 | 0.00292 |
| C | | (0.0134) | (0.0122) | (0.0111) |
| Securities Holdings \times TSY Purchases | | 0.000110 | 0.0000593 | -0.000282 |
| | | (0.000584) | (0.000557) | (0.000754) |
| Cash Flow | 0 815*** | 0 820*** | 0.815*** | 0.816*** |
| Cash i low | (0.262) | (0.259) | (0.261) | (0.261) |
| Lagged Tobin's a | 0.180*** | 0.181*** | 0.180*** | 0.180*** |
| Lagged Toolin's q | (0.0112) | (0.0114) | (0.0113) | (0.0113) |
| Lagged 7 Sages | 0.214*** | (0.0114) | 0.214*** | 0.216*** |
| Lagged Z-Score | (0.0342) | (0.0343) | (0.0342) | (0.0342) |
| | (0.0342) | (0.0343) | (0.0342) | (0.0342) |
| Lagged Firm Size | -0.235 | -0.242 | -0.235 | -0.236 |
| | (0.236) | (0.237) | (0.236) | (0.236) |
| Bank's Size | -0.197 | -0.216 | -0.197 | -0.217 |
| | (0.274) | (0.273) | (0.272) | (0.272) |
| Bank's Equity Ratio | -0.00444 | -0.0134 | -0.00461 | -0.000367 |
| | (0.0274) | (0.0249) | (0.0261) | (0.0309) |
| Bank's Net Income | -0.00467 | 0.00649 | -0.00461 | -0.00434 |
| | (0.0587) | (0.0702) | (0.0583) | (0.0703) |
| Bank's Cost of Deposits | -0.115 | -0.169 | -0.115 | -0.122 |
| - | (0.136) | (0.139) | (0.136) | (0.135) |
| Bank's Cash to Assets | -0.863 | -0.769 | -0.868 | -0.698 |
| | (1.037) | (0.724) | (1.044) | (0.737) |
| Bank's Loans to Deposits | -0.00581 | -0.00713* | -0.00581 | -0.00675 |
| | (0.00509) | (0.00421) | (0.00512) | (0.00507) |
| Change in Unemp Rate Bank's Counties | -0.0599 | -0.0495 | -0.0597 | -0.0604 |
| Change in Chemp. Face, Bank 5 Countes | (0.0767) | (0.0810) | (0.0790) | (0.0789) |
| Orthog. MBS/Sec. Holdings | No | No | No | Yes |
| Firm-Bank Fixed Effects | Yes | Yes | Yes | Yes |
| Firm State by Quarter Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 64490 | 64490 | 64490 | 64490 |
| Adjusted R ² | 0.489 | 0.488 | 0.489 | 0.489 |

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01