Monetary Stimulus and Bank Lending

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Online Appendices

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.[1] 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

[1] To 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.

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.

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.[2] 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 ($26\% \times 2,854\text{B} \times 0.01865 \times 0.01$) of additional originations for a 1% increase

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

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 ($1\% \times 95.3$B/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.

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 ($35\% \times 912.89\text{B} \times -0.00364 \times 0.01$). 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 ($35\% \times 91.82\text{B} \times 0.01259 \times 0.01$) 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.[3]

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

[3]The 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.

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.[4]

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 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.

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

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.[5] We also find positive estimates for the effect of Treasury purchases, which is statistically significant in the case of loan renewals.

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

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 (Tables 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		
	Definition	Data Sources
Bank Variables		
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 profitability 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 *MBS Holdings*.	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 Origination 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		
	Definition	Data Sources
Monetary Policy Variables		
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 quarterly 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 amortization divided by prior quarter's gross PPE.	Compustat
Lagged Tobin's q	Sum of current liabilities, long-term debt, and market value of equity (closing 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

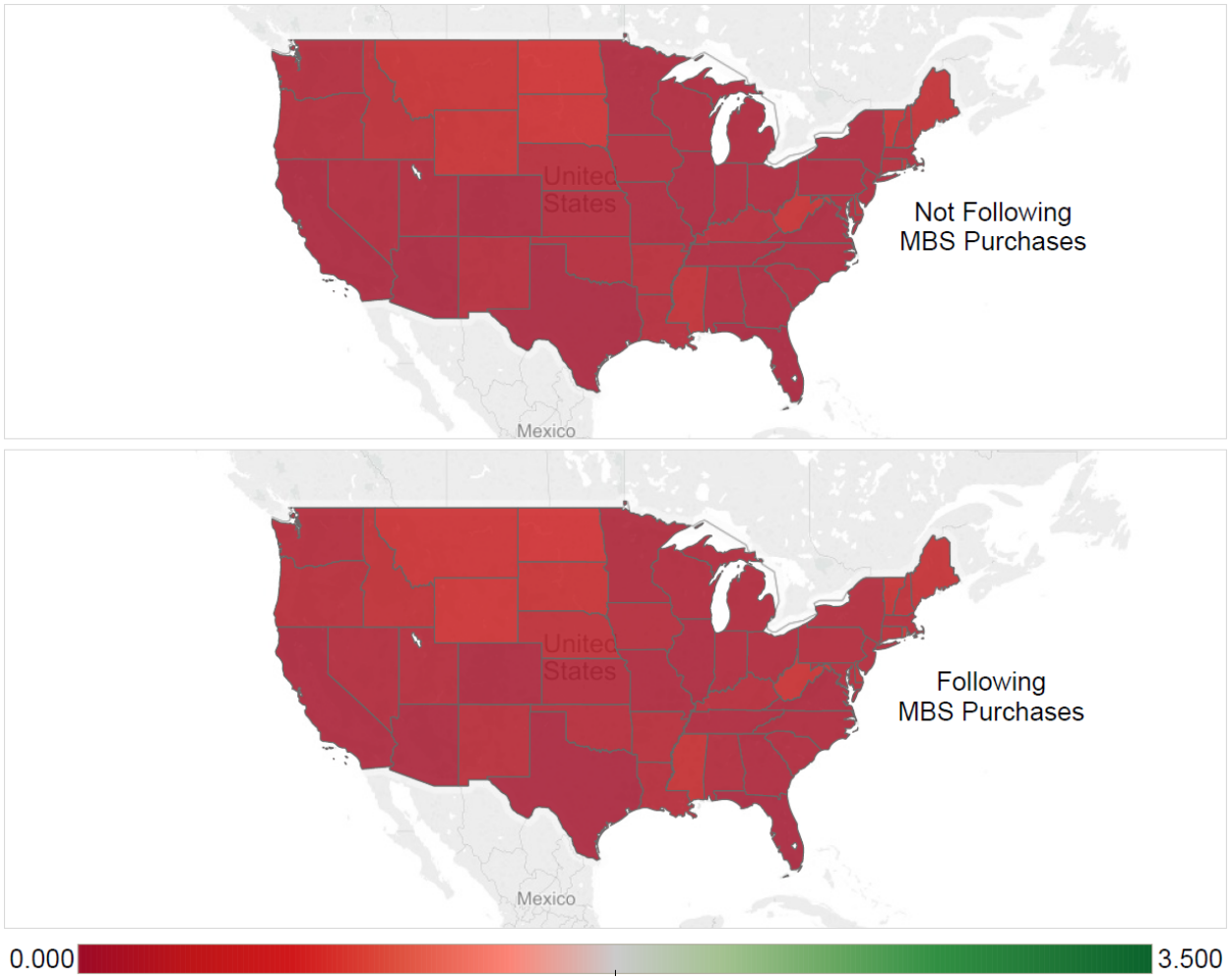

Fig. C.1. Average state-level mortgage origination market share for non-securitizer banks, in percentage points. Top panel includes years not following fourth-quarter MBS purchases (2006, 2007, 2008, 2009, 2012). Bottom panel includes years following fourth-quarter MBS purchases (2010, 2011, 2013).

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. *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	-0.154		-0.137	-0.329		
	(0.481)		(0.485)	(0.353)		
High MBS Holdings × MBS Purchases	-0.0611***		-0.0580***	-0.0793***		
	(0.0209)		(0.0209)	(0.0207)		
Securitizer					2.467*	2.461*
					(1.311)	(1.313)
Securitizer × MBS Purchases					-0.370***	-0.368***
					(0.0925)	(0.0925)
High Gov. Securities Holdings		-0.548	-0.626	-0.399		-0.544
		(0.442)	(0.447)	(0.343)		(0.442)
High Gov. Securities Holdings × TSY Purchases		0.115***	0.114***	0.0482*		0.115***
		(0.0276)	(0.0276)	(0.0246)		(0.0276)
Bank's Size	-1.695***	-1.675***	-1.722***	-1.886***	-1.612***	-1.661***
	(0.374)	(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 Deposits	-1.003***	-1.042***	-1.041***	-0.544*	-1.019***	-1.055***
	(0.328)	(0.328)	(0.328)	(0.322)	(0.328)	(0.328)
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 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. *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 × QE1	-0.161***	-3.776***			
	(0.0563)	(1.419)			
Cont. Treasury Holdings × QE2	-0.125	6.140			
	(0.516)	(5.973)			
Cont. MBS Holdings × QE3	0.376***	-0.838			
	(0.101)	(1.678)			
Cont. MBS Holdings × MBS Purchases			-0.0211***		
			(0.00516)		
Cont. Treasury Holdings × TSY Purchases			-0.0307		
			(0.0253)		
High MBS Holdings				-0.0624**	0.380
				(0.0258)	(0.487)
High MBS Holdings × MBS Purchases				-0.00612***	-0.0606**
				(0.000975)	(0.0281)
High Securities Holdings				-0.136***	0.697
				(0.0307)	(0.650)
High Securities Holdings × TSY 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 × 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

Table C.4
Loan growth and loan renewals following QE periods

Columns 1 through 14 are panel fixed effect regressions. $\Delta \log(loan)$ is the log change in the dollar amount of lending to a specific firm from the pre- to post-QE period and *renewal* is an indicator that a loan was renewed. The construction of these variables and the determinations of the different QE periods is as defined in Rodnyansky and Darmouni (2017). *Above Median MBS (Treat)* takes a value of 1 if the lending bank is above the median in terms of MBS holdings, and a value of 0 if it is below the median. Standard errors are in parentheses.

	All QEs, Δ log(loan)	All QEs, renewal	QE1, Δ log(loan)		QE1, renewal		QE2, Δ log(loan)		QE2, renewal		QE3, Δ log(loan)		QE3, renewal	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Above Median MBS (Treat)	-1.273***	-0.0728***	-0.191*	-0.228**	-0.0144***	-0.0148**	-0.116	-0.129	-0.00710	-0.00658	-0.0535	-0.493**	-0.00309	-0.0245**
	(0.224)	(0.0122)	(0.0985)	(0.108)	(0.00541)	(0.00593)	(0.237)	(0.281)	(0.0129)	(0.0153)	(0.171)	(0.228)	(0.00914)	(0.0122)
Above Median MBS × MBS Purchases	-0.0510**	-0.00314**												
	(0.0245)	(0.00134)												
Above Median MBS × TSY Purchases	0.0404	0.00264*												
	(0.0276)	(0.00151)												
Bank's Size				0.0165		0.00336		0.0463		0.00301		-0.118		-0.00507
				(0.0602)		(0.00335)		(0.147)		(0.00806)		(0.124)		(0.00670)
Bank's Equity Ratio				0.0638		0.00347		0.365***		0.0194***		0.0310		0.00160
				(0.0490)		(0.00273)		(0.117)		(0.00638)		(0.0872)		(0.00475)
Bank's Net Income				0.533**		0.0251**		-0.434		-0.0256		-1.543***		-0.0812***
				(0.219)		(0.0121)		(0.470)		(0.0259)		(0.555)		(0.0299)
Bank's Cost of Deposits				0.0776		0.00689		-2.257***		-0.120***		-6.724***		-0.363***
				(0.194)		(0.0102)		(0.779)		(0.0417)		(1.342)		(0.0717)
Bank's Cash to Assets				-3.195		-0.158		-7.928**		-0.436**		0.734***		0.0387***
				(2.931)		(0.165)		(3.613)		(0.195)		(0.124)		(0.00641)
Bank's Loans to Deposits				0.00159		0.0000611		-0.000617		-0.000133		-0.00385		-0.000275
				(0.00483)		(0.000265)		(0.0123)		(0.000669)		(0.00918)		(0.000498)
Change in Unemp. Rate, Bank's Counties				0.625***		0.0314***		-2.575***		-0.141***		-0.252		-0.0140
				(0.218)		(0.0118)		(0.518)		(0.0272)		(0.488)		(0.0263)
Constant	-18.34***	0.00426	-17.24***	-18.89***	0.0453***	-0.0931	-12.62***	-15.25***	0.291***	0.151	-12.76***	-8.256**	0.298***	0.518***
	(0.289)	(0.0155)	(0.0415)	(1.439)	(0.00228)	(0.0794)	(0.113)	(3.389)	(0.00614)	(0.184)	(0.0887)	(3.346)	(0.00475)	(0.180)
QE Indicators	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	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	4432	4432	4432	4432
R^2	0.180	0.172	0.000919	0.00808	0.00173	0.00855	0.0000881	0.0787	0.000112	0.0793	0.0000237	0.0627	0.0000277	0.0622

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

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

Table C.6
Comparison of banks

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

* p<0.10, ** p<0.05, *** p<0.01

Table C.7
Comparison of borrowers

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

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

* p<0.10, ** p<0.05, *** p<0.01

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.

	Investment			
	(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
		(0.0134)	(0.0122)	(0.0111)
Securities Holdings × TSY Purchases		0.000110	0.0000593	-0.000282
		(0.000584)	(0.000557)	(0.000754)
Cash Flow	0.815***	0.820***	0.815***	0.816***
	(0.262)	(0.259)	(0.261)	(0.261)
Lagged Tobin's q	0.180***	0.181***	0.180***	0.180***
	(0.0112)	(0.0114)	(0.0113)	(0.0113)
Lagged Z-Score	0.214***	0.219***	0.214***	0.216***
	(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
	(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

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