

Description of appendices

- Appendix A: Bank-level analysis of QE and mortgage and small business lending
- Appendix B: Additional robustness analysis
- Appendix C: Supplementary figures
- Appendix D: Supplementary tables
- Appendix E: Variable construction

Appendix A Bank-level analysis

This section provides a more detailed discussion of the bank-level results discussed in Section 3.1.2 of the main paper. Table 2 in the main text of the paper reported result for estimating Eq. (2) when using Call Report data on the overall amount of lending, the amount of mortgage lending, and the amount of C&I lending. In this section, our analysis goes further. Using data collected under the HMDA and aggregated to the bank-level, we provide further evidence on the effect on lending for residential housing. Importantly, the (confidential) version of HMDA data that we use, allows us to estimate regressions at the quarterly level (rather than the annual level which is the frequency in public HMDA data) to get a more precise sense of the timing of effects.

As described in the main text, we construct our bank-level exposure measure as a bank's MBS scaled by total assets. Fig. C.1 shows the distribution of the exposure measure averaged over the four quarters prior to QE1. More than a quarter of all commercial banks held no MBS at all, and the average MBS-to-asset ratio was around 12% in the upper quartile of the cross-sectional distribution across banks.

[FIGURE C.1 ABOUT HERE]

It's then of natural interest to ask what observable differences are their across banks with different degree of MBS exposure. Table D.1 gives a sense of those differences, splitting the sample of all commercial banks in the United States by the median of the average MBS share in the 4 quarters prior to QE1. While banks with higher MBS shares tend to be larger and tend to operate with higher leverage than banks with relatively lower MBS shares, banks sorted by MBS shares are otherwise very similar in other observable characteristics.

[TABLES D.1 and D.2 ABOUT HERE]

As in Section 3.1.2 of the main paper, we can then assess the effect of the Fed's actions at the bank level by employing a difference-in-differences (DiD) design with a continuous treatment variable. The unit of observation is the commercial bank and the recall main specification Eq. (2) is given by:

$$y_{bt} = \alpha + \beta \times \left(\frac{\text{MBS}}{\text{Total Assets}} \right)_b^{(j)} \times \text{QE}_t^{(j)} + \gamma_b + \tau_t + \sum_{k=1}^K \theta_k^{(0)} X_{bt}^{(k)} + \sum_{k=1}^K \theta_k^{(1)} X_{bt}^{(k)} \text{QE}_t^{(j)} + \epsilon_{ct}$$

As before, $y_{b,t}$ is the natural logarithm of the amount of lending of bank b at time t . We use different

categories of lending and distinguish between newly originated and refinanced mortgages as well as between small business loans of different sizes. We use data on residential mortgages from HMDA and data on small business lending from the CRA. As before, we estimate the regression for each episode of quantitative easing, $j = 1, 2, 3$, with a time window of four quarters before and after the introduction of the respective program. All results are robust to changing the time window as well as to pooling events in a single regression. $QE_t^{(j)}$ is an indicator variable equal to 1 after the introduction of the j -th round of quantitative easing. Given that the data on the commercial bank level is quarterly, we choose 2009Q1 as the event date for QE1, and 2010Q4 and 2012Q4 as the event dates for QE2 and QE3, respectively. We measure bank b 's MBS-to-assets ratio, $\left(\frac{\text{MBS}}{\text{Total Assets}}\right)_b^{(j)}$, as the average ratio over the 4 quarters prior to the j -th round of QE.

Additionally, our regression includes bank-fixed effects, γ_b , and time-fixed effects, τ_t , to control for fixed differences between banks and for differences over time that affect all banks. We include K bank-specific time-varying controls $X_b^{(k)}$ to control for remaining differences between banks. Controls included in the regression are listed in Table D.2. Note that as before, we also allow for changes in the relation between controls and outcome variables in response to QE by interacting control variables with QE event dummies.

Table D.5 shows the estimates from Eq. (2) using the amount of refinanced mortgages as well as newly issued mortgages as dependent variables. Columns (1) and (2) confirm the results for total real estate lending from the Call Report data in Table 2 in the main text. The additional specifications distinguish between new origination of mortgages and refinancing of existing mortgages. Even though aggregate lending related to housing increased during QE1 and QE3, the underlying type of lending is different. In particular, results in columns (3) and (4) reveal that the effect during QE1 is driven by increased refinancing activity of affected banks, consistent with the findings by Di Maggio et al. (2018), who show that QE1 spurred refinancing activity in the mortgage market. Columns (5) and (6) show that the effect of QE3 is driven by origination of mortgages for new home purchases and by refinancing of existing mortgages.

[TABLE D.5 ABOUT HERE]

Using additional data collected under the Community Reinvestment Act (CRA) on small business lending, we estimate the main specification using four related types of small business lending as

dependent variables: loans to small business with face value of \$ 0 to 100k, \$ 100k to 250k, and \$ 250k to 1m, as well as loans to businesses with an annual revenue of less than \$ 1 million. Table D.6 shows results. Consistent with the results in Table 2, small business lending does not respond in any category after QE1 and estimated coefficients fluctuate widely (columns (1), (3), (5), and (7) of Table D.6). For QE3, however, we find consistent effects across all categories (columns (2), (4), (6), and (8)): Coefficients are only significant in two of the categories but are positive and of similar magnitude across all of three of them. In particular, note that the coefficient for loans with a face value between 250k to 1m, the category with the highest aggregate volume, is significant.

[TABLE D.6 ABOUT HERE]

A bank that holds 12% of its assets in MBS instead of having no MBS holdings, increased the issuance of small business loans with a face value between 250k and 1m by about 4% after QE3. The magnitude is comparable to the magnitude of the effect on total C&I lending in Table 2.

Appendix B Robustness

This section provides additional evidence to corroborate our main findings. In particular, we provide evidence to show that our main results are robust to different specifications and exposure measures.

Table D.9 shows that the employment effect of QE3 is robust to a number of sample restrictions and to different definitions of the exposure measure. Columns (1) and (2) report results for our main regression (equation (5)) when we restrict the sample to counties that are relatively small as our banking market definition is arguably more likely to hold for smaller counties. The visual evidence in Figure 2 suggests that the concentration of banks with high MBS is particularly high in the Northeast corridor of the United States. Columns (3) and (4) show that results are unchanged when this region is excluded from the estimation. In columns (5) and (6), we calculate the exposure measure by using the MBS holdings of banks in the four quarters prior to QE1 instead of those holdings prior to QE3. Results are robust to this change, which is unsurprising as MBS holdings are highly autocorrelated within bank over time. Finally, columns (7) and (8) report results for calculating the exposure measure as MBS over total securities instead of MBS over total assets.

[TABLE D.9 ABOUT HERE]

A related concern is that quantitative easing led not only to a decline of MBS yields but also to a decline of long-term treasury yields (see, e.g., Krishnamurthy and Vissing-Jorgensen, 2011). As such, a bank's exposure to quantitative easing might be better captured by the sum of MBS and long-term treasury holdings. While we cannot measure long-term treasury holdings in the call reports separately, we re-estimated our main specifications using the sum of MBS and *all* treasury holdings as exposure measure. Given that only a small share of banks' assets is invested in treasuries (the average share during our sample period is less than 1%), the alternative exposure measure is very similar to our original one and, as a result, estimations with the alternative measure had little effect on conclusions.

Our main results are also robust to defining markets at the MSA level instead of the county level. Firms may borrow and employees may work across county-lines, and therefore a county might not comprise a local credit or labor market. Table D.10 shows that employment results are robust to conducting the analysis at the MSA level.

[TABLE D.10 ABOUT HERE]

Appendix C Supplementary figures

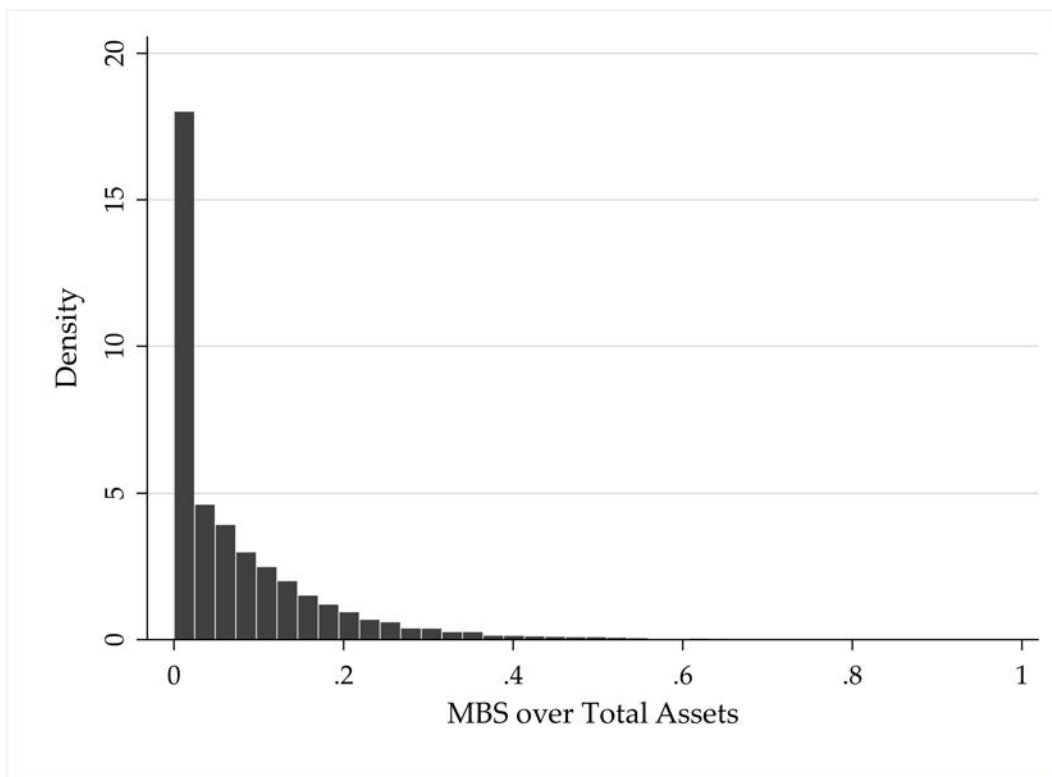
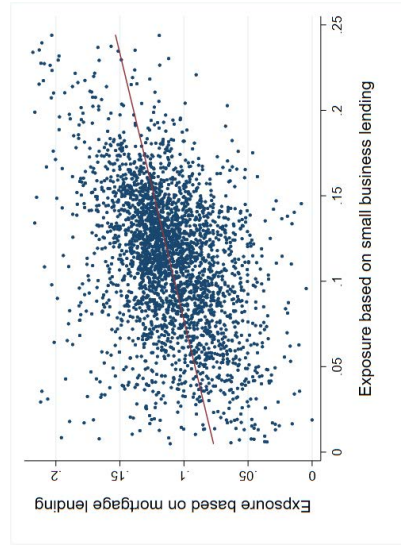
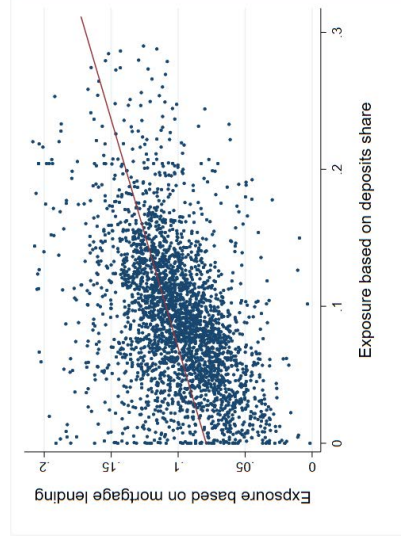


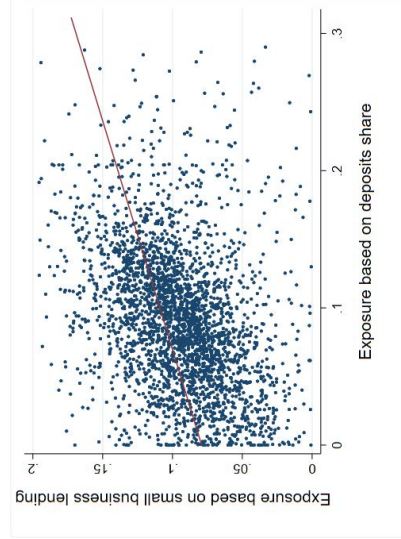
Figure C.1: *Distribution of banks' average MBS shares prior to QE1*



(a) Mortgage and small business lending, $\rho = 0.49$



(b) Mortgage lending and deposits, $\rho = 0.56$



(c) Small business lending and deposits, $\rho = 0.54$

Figure C.2: Scatterplot of different exposure measures prior to QE3. A country's MBS exposure is measured as banks' MBS-to-asset ratios, weighted by banks' average small business lending volume in a county, weighted by banks' average deposit volume in a county (panel B) and weighted by banks' average mortgage origination volume (panel C) prior to each QE event.

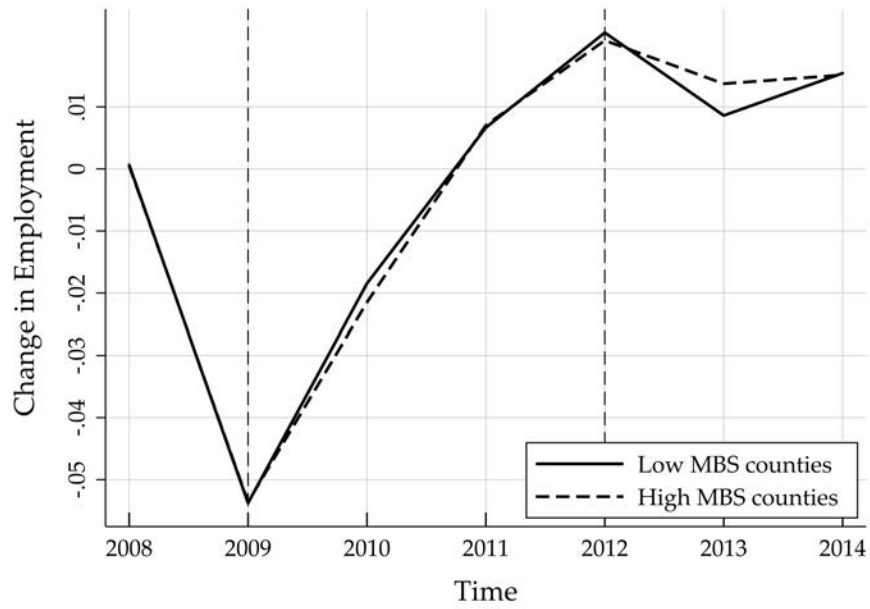


Figure C.3: Employment growth between 2008 and 2014 in the annual CBP data. Annual employment growth rate, ΔEmp_{ct} , averaged separately over counties in the upper and in the lower terciles of the cross-county MBS exposure distribution prior to QE3.

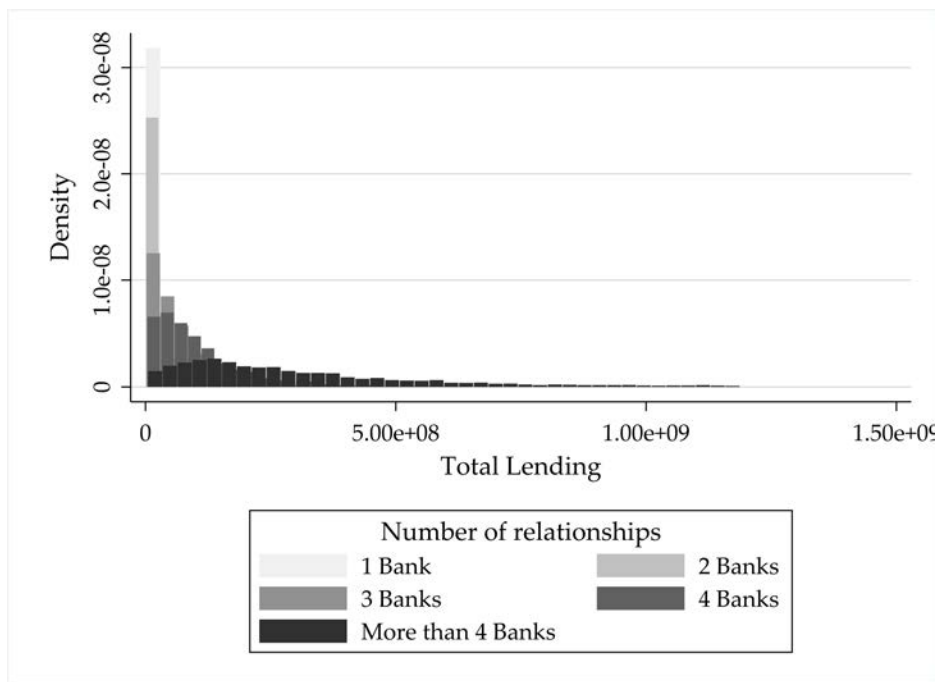


Figure C.4: *Distribution of firms' average total lending in 2012 in the Y-14 data by the number of bank-firm relationships. A firm and a bank have a relationship if the bank lends to the firm in at least three quarters between 2011Q3 and 2016Q2.*

Appendix D Supplementary tables

Table D.1: *Banks with high and low MBS shares*

	Low MBS Share		High MBS Share		Difference	
	Mean	Std	Mean	Std	Diff	t-stat
log(assets)	11.622	1.262	12.171	1.396	0.549	17.660
Equity/TotalAssets	0.133	0.119	0.115	0.075	-0.018	-8.263
Deposit Ratio	0.799	0.152	0.798	0.101	-0.001	-0.365
Trading Book Ratio	0.001	0.013	0.001	0.006	-0.000	-0.245
Profitability	0.006	0.183	0.003	0.015	-0.003	-1.598
Overhead Ratio	0.820	1.225	0.807	1.129	-0.012	-0.612
Net interest margin	0.020	0.685	0.023	0.011	0.003	0.451
Non-performing Loans Ratio	0.010	0.018	0.010	0.017	-0.001	-1.480
Delinquency Ratio	1.950	1.104	1.916	1.066	-0.034	-1.476
Real Estate Ratio	0.676	0.180	0.693	0.163	0.016	4.080
C&I Loan Ratio	0.154	0.114	0.155	0.099	0.002	0.698
Tier 1 Ratio	0.233	1.116	0.173	0.350	-0.061	-3.360

This table reports bank characteristics prior to QE1 averaged separately for banks above and below the median of the cross-bank MBS-to-assets distribution. MBS-to-assets are averaged over the four quarters prior to QE1 for each bank.

Table D.2: *Descriptive statistics for bank-level control variables*

	Mean	Std	10th Perc	25th Perc	Median	75th Perc	90th Perc	N
Agency MBS/TotalAssets	0.08	0.10	0.00	0.00	0.05	0.12	0.21	166563
Agency MBS/TotalSecurities	0.36	0.33	0.00	0.02	0.31	0.60	0.84	166563
Treasuries/TotalAssets	0.01	0.03	0.00	0.00	0.00	0.00	0.01	166563
Treasuries/TotalSecurities	0.03	0.13	0.00	0.00	0.00	0.00	0.04	166563
log(Assets)	12.07	1.31	10.62	11.23	11.93	12.71	13.61	166563
Equity/TotalAssets	0.11	0.04	0.08	0.09	0.10	0.12	0.15	166563
Deposit Ratio	0.84	0.07	0.75	0.81	0.85	0.88	0.90	166563
Trading Book Ratio	0.00	0.01	0.00	0.00	0.00	0.00	0.00	166563
Profitability	0.00	0.01	-0.00	0.00	0.00	0.01	0.01	166563
Overhead Ratio	0.77	2.59	0.53	0.61	0.71	0.82	0.97	166560
Net interest margin	0.02	0.01	0.01	0.01	0.02	0.03	0.04	166563
Non-performing Loans Ratio	0.01	0.02	0.00	0.00	0.01	0.02	0.03	166563
Delinquency Ratio	2.11	1.73	0.31	0.85	1.71	2.93	4.42	166563
Real Estate Ratio	0.69	0.19	0.43	0.59	0.73	0.83	0.89	166563
C&I Loan Ratio	0.15	0.10	0.05	0.08	0.12	0.19	0.26	166563
Tier 1 Ratio	0.16	0.24	0.10	0.12	0.14	0.18	0.24	166563

This table reports means, standard deviations and various percentiles of variables used as controls in bank-level regressions. The dataset runs from 2007Q1 to 2015Q2, and includes up to around 7000 banks.

Table D.3: *Banks with high and low MBS shares: Banks in Y14 data*

	Low MBS Share		High MBS Share		Difference	
	Mean	Std	Mean	Std	Diff	t-stat
log(assets)	19.428	1.418	19.042	0.948	-0.339	-0.696
Equity/TotalAssets	0.106	0.029	0.116	0.015	0.009	1.125
Tier 1 Ratio	0.129	0.024	0.123	0.021	-0.005	-0.694
RoA	0.009	0.012	0.005	0.009	-0.003	-1.165
Real Estate Ratio	0.175	0.182	0.279	0.145	0.096	1.452
Loans to Assets	0.469	0.262	0.560	0.214	0.083	0.862
C&I Loan Ratio	0.317	0.321	0.231	0.091	-0.086	-0.929
Non-performing Loans Ratio	0.010	0.010	0.012	0.009	0.001	0.505

This table reports bank characteristics prior to QE3 averaged separately for banks above and below the median of the cross-bank MBS-to-assets distribution, for banks in the Y14 data only. MBS-to-assets are averaged over the four quarters prior to QE3 for each bank.

Table D.4: *Descriptive statistics for bank-level control variables: Banks in Y14 data*

	Mean	Std	10th Perc	25th Perc	Median	75th Perc	90th Perc	N
MBS/TotalAssets	0.095	0.058	0.009	0.031	0.103	0.154	0.162	502
MBS/TotalSecurities	0.553	0.293	0.195	0.236	0.578	0.806	0.907	502
log(assets)	19.237	1.223	17.826	18.208	18.961	20.434	21.365	502
Equity/TotalAssets	0.111	0.024	0.080	0.096	0.111	0.123	0.135	502
Tier 1 Ratio	0.126	0.023	0.101	0.111	0.122	0.137	0.158	502
RoA	0.007	0.012	-0.001	0.003	0.006	0.011	0.017	502
Real Estate Ratio	0.227	0.173	0.002	0.029	0.225	0.369	0.468	502
Loans to Assets	0.514	0.243	0.075	0.340	0.630	0.699	0.746	502
C&I Loan Ratio	0.282	0.279	0.053	0.148	0.221	0.303	0.603	502
Non-performing Loans Ratio	0.011	0.010	0.001	0.004	0.009	0.016	0.024	502

This table reports means, standard deviations and various percentiles of variables used as controls in bank-level regressions. The dataset runs from 2011Q3 to 2016Q3 and includes 25 banks.

Table D.5: *QE and bank-level mortgage lending*

Dependent variable	log(Total)		log(Refinance)		log(Origination)	
	(1)	(2)	(3)	(4)	(5)	(6)
$QE_t^{(1)} \times \left(\frac{MBS}{TotAssets}\right)_b^{(1)}$	0.452*** (0.161)		0.712*** (0.206)		0.212 (0.148)	
$QE_t^{(3)} \times \left(\frac{MBS}{TotAssets}\right)_b^{(3)}$		0.229** (0.113)		0.220* (0.129)		0.214* (0.127)
R_a^2	0.057	0.032	0.119	0.064	0.065	0.108
No. Banks	4178	3581	4039	3495	4102	3493
N	24958	25449	22811	23206	23381	23780
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	Yes	Yes	Yes	Yes	Yes	Yes

This table reports estimates of the effect of banks' MBS-to-asset ratios on mortgage lending using Home Mortgage Disclosure Act (HMDA) data. The outcome variable is the log of a bank's quarterly total mortgage lending in columns (1) and (2), the log of mortgage refinancing volume in columns (3) and (4), and the log of mortgage origination volume in columns (5) to (6). MBS-to-assets is averaged over the four quarters prior to each QE event. All specifications include bank and time fixed effects and bank-level controls, see Eq. (2) for details. Standard errors in parentheses are two-way clustered at the bank and quarter levels. Stars indicate significance at the 10%, 5% and 1% levels, respectively.

Table D.6: QE and bank-level small business lending

Dependent variable	log(C&I lending)							
	[0, 100k]		[100k, 250k]		[250k, 1m]		Rev<1mil	
Loan size	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$QE_t^{(1)} \times \left(\frac{MBS}{TotAssets}\right)_b^{(1)}$	-0.126 (0.124)		0.012 (0.120)		0.107 (0.122)		0.248* (0.150)	
$QE_t^{(3)} \times \left(\frac{MBS}{TotAssets}\right)_b^{(3)}$		0.137 (0.114)		0.183** (0.089)		0.395*** (0.125)		0.299** (0.134)
R_a^2	0.316	0.072	0.322	0.136	0.319	0.150	0.350	0.119
No. Banks	743	652	742	653	744	654	743	650
N	1826	1674	1821	1674	1818	1681	1826	1665
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports estimates of the effect of banks' MBS-to-asset ratios on mortgage lending using Community Reinvestment Act (CRA) data. The outcome variable is the log of a bank's total C&I loans with loan volume less than \$100k in columns (1) and (2), the log of total C&I loans with loan volume between \$100k and \$250k in columns (3) and (4), the log of total C&I loans with loan volume between \$250k and \$1m in columns (5) and (6), and the log of total C&I loans to businesses with revenue less than \$1m in columns (7) and (8). MBS-to-assets is averaged over the four quarters prior to each QE event. All specifications include bank and time fixed effects and bank-level controls, see Eq. (2) for details. Standard errors in parentheses are two-way clustered at the bank and quarter levels. Stars indicate significance at the 10%, 5% and 1% levels, respectively.

Table D.7: Descriptive statistics for firm-level variables

	Mean	Std	10th Perc	25th Perc	Median	75th Perc	90th Perc	N
Sample	Compustat							
Total Assets (in million)	15005.26	108343.67	192.69	611.90	2019.86	6728.73	21728.00	1831
Total Bank Credit	3823.87	7029.06	162.74	500.00	1819.39	4747.69	9231.01	1831
Capital Expenditures	414.85	1449.08	1.13	10.18	51.92	234.46	904.52	1831
No of Employees	16927.64	67383.27	238.00	999.00	3400.00	11800.00	35283.00	1831
Sample	Not in Compustat							
Total Assets (in million)	1381.05	27442.46	1.57	4.94	16.05	71.55	421.42	40319
Total Bank Credit	211.18	765.16	12.07	18.59	40.20	129.14	402.39	40319
Capital Expenditures	30.29	1013.57	-0.17	0.00	0.01	1.17	11.94	40319

This table reports means, standard deviations and various percentiles of firm characteristics for firms in the Y14 data collection. Panel A includes firms that can be matched to Compustat, and also includes employment which is not available in the Y14 data. Panel B includes firms that cannot be matched to Compustat. Data are as reported in 2012Q4.

Table D.8: Firm-level regression: Investment and employment effects for firms in Y14 and for firms matched to Compustat

Panel A: Continuous treatment						
Dependent variable	$\Delta C\&I$ lending					
Sample	Entire sample		Not in SNC		SNC sample	
	(1)	(2)	(3)	(4)	(5)	(6)
$QE^{(3)} \times \left(\frac{MBS}{TotAssets}\right)_b^{(3)}$	0.344*** (0.023)	0.402*** (0.054)	0.301** (0.120)	0.501*** (0.145)	0.206*** (0.041)	0.226*** (0.046)
R ²	0.206	0.524	0.217	0.560	0.189	0.529
No Banks	25	25	25	25	25	25
No Firms	127305	9768	117713	4101	9592	5667
No Bank-Firm-Relationships	152803	33642	124696	9726	28107	23916
No obs	641048	145669	511503	37675	129545	107994
Panel B: Binary treatment						
Dependent variable	$\Delta C\&I$ lending					
Sample	Entire sample		Not in SNC		SNC sample	
	(1)	(2)	(3)	(4)	(5)	(6)
$QE^{(3)} \times Treat_b^{(3)}$	0.022*** (0.001)	0.026*** (0.004)	0.021*** (0.007)	0.030*** (0.011)	0.024*** (0.004)	0.022*** (0.004)
R ²	0.208	0.533	0.217	0.560	0.189	0.529
No Banks	25	25	25	25	25	25
No Firms	127305	9768	117713	4101	9592	5667
No Bank-Firm-Relationships	152803	33642	124696	9726	28107	23916
No obs	641048	145669	511503	37675	129545	107994

Bank-firm level analysis with firm-time fixed effect. Observations are restricted to 7 quarters, 3 quarters before and 3 quarters after QE3. Standard errors in parentheses are clustered at the firm-time level and stars indicate significance at the 10%, 5%, and 1% level, respectively. We use the computationally efficient estimator of linear models with multiple levels of fixed effects proposed by Correia (2017).

Table D.9: Robustness: Main employment effect

Dependent variable	ΔEmp							
	Population		Exclude Northeast		QE1 exposure		MBS Exposure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{QE}_t^{(3)} \times \text{Exposure}_c^{(3)}$	0.044** (0.022)		0.045** (0.022)					
$\text{QE}_t^{(3)} \times \text{Treat}_c^{(3)}$		0.004** (0.002)		0.004** (0.002)				
$\text{QE}_t^{(3)} \times \text{Exposure}_c^{(1)}$					0.037* (0.022)			
$\text{QE}_t^{(3)} \times \text{Treat}_c^{(1)}$						0.004* (0.002)		
$\text{QE}_t^{(3)} \times \text{Exposure}_c^{(3)MBS}$							0.012** (0.005)	
$\text{QE}_t^{(3)} \times \text{Treat}_c^{(3)MBS}$								0.004* (0.002)
R_a^2	0.457	0.452	0.436	0.433	0.433	0.428	0.435	0.420
No. Counties	1750	1161	2590	1734	2888	1922	2784	1862
N	12069	8079	17628	11756	19718	13076	18978	12675
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports estimates of the effect of MBS exposure on employment in a number of robustness checks. The outcome variable is county-level quarterly growth of employment. MBS exposure is measured as banks' MBS-to-asset ratios, weighted by banks' average deposit volume in a county prior to QE3. All specifications include county and time fixed effects and county-level controls, see Equation (4) and Equation (5) for details. In columns (1) and (2), the sample is restricted to counties with population of more than 15000 and no more than 250000. In columns (3) and (4), the sample excludes the following states: Connecticut, Delaware, Massachusetts, Maine, New York, New Jersey, New Hampshire, Pennsylvania, Rhode Island, Vermont. In columns (5) and (6), exposure is based on the MBS holdings of banks in the 4 quarters prior to QE1. In columns (7) and (8), exposure is based on MBS over total securities instead of MBS over total assets. Standard errors in parentheses are clustered by county and quarter. Stars indicate significance at the 10%, 5% and 1% levels, respectively.

Table D.10: QE and MSA-level employment

Dependent variable	Δ Employment							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$QE_t^{(1)} \times Exposure_c^{(1)SBL}$	-0.003 (0.014)	0.001 (0.014)						
$QE_t^{(1)} \times Treat_c^{(1)SBL}$			-0.000 (0.001)	0.000 (0.001)				
$QE_t^{(3)} \times Exposure_c^{(3)SBL}$					0.044*** (0.013)	0.048*** (0.013)		
$QE_t^{(3)} \times Treat_c^{(3)SBL}$							0.004*** (0.001)	0.004*** (0.001)
R^2	0.723	0.724	0.704	0.704	0.541	0.541	0.560	0.560
No. Counties	950	950	633	633	928	928	617	617
N	6383	6383	4236	4236	6419	6419	4266	4266
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interacted Controls	No	Yes	No	Yes	No	Yes	No	Yes

This table reports estimates of the effect of MBS exposure on employment. The outcome variable is MSA-level quarterly growth of employment. MBS exposure is measured as banks' MBS-to-asset ratios, weighted by banks' average small business lending volume in a MSA prior to each QE event. All specifications include MSA and time fixed effects and MSA-level controls, see Equation (4) and Equation (5) for details. Column (1)-(2) and (5)-(6) report coefficients for the continuous treatment variable and column (3)-(4) and (7)-(8) report coefficients for the indicator treatment variable. Standard errors in parentheses are clustered by MSA and quarter. Stars indicate significance at the 10%, 5% and 1% levels, respectively.

Appendix E Variable construction

Bank variables are from the merger-adjusted Consolidated Reports of Condition and Income (FFIEC031 and FFIEC041). Banks are indexed by b , time is indexed by t (quarters).

- Total securities (available for sale, fair value) $_{b,t}$: RCFD1773
- Total securities (held to maturity, amortized cost) $_{b,t}$: RCFD1754
- MBS (held to maturity, amortized cost) $_{b,t}$: The sum of all item in Schedule RC-B, item 4, column A, excluding items a.(3), b.(3), and c(1b) and c(2b).
- MBS (available for sale, fair value) $_{b,t}$: The sum of all item in Schedule RC-B, item 4, column C, excluding items a.(3), b.(3), and c(1b) and c(2b).
- Bank size $_{b,t}$: the log of total assets: $\text{Log}(\text{RCFD2170})$
- Return on Assets $_{b,t}$: Income (loss) before discontinued operations over assets: $\text{RIAD4300}/\text{RCFD2170}$
- Overhead ratio $_{b,t}$: The ratio of Noninterest expense (RIAD4093) divided by revenue. Revenue is the sum of net interest income (RIAD4074) and noninterest income (RIAD4079)).
- Net-interest margin $_{b,t}$: The ratio of Annualized net interest income (RIAD4074) divided by (30-day average) interest-earning assets ($\text{RCFD3381} + \text{RCFDB558} + \text{RCFDB559} + \text{RCFDB560} + \text{RCFD3365} + \text{RCFD3360} + \text{RCFD3484} + \text{RCFD3401}$)
- (Delinquencies/Loan Loss Reserves) $_{b,t}$: The ratio of Delinquencies on all loans and leases (RC-N) divided by reserves for loan losses (RCFD3123)
- Ratio of non-performing loans $_{b,t}$: The sum of all loans that are past due 90 days or more and still accruing (Schedule RC-N, Items 1 – 9 Column B) divided by total loans (RCFD2112)
- Equity ratio $_{b,t}$: Total equity capital over assets: $\text{RCFDG105}/\text{RCFD2170}$
- Real estate loan ratio $_{b,t}$: Loans secured by real estate over total loans and leases held for investment and held for sale: $\text{RCFD1410}/\text{RCFD2122}$
- Deposit ratio $_{b,t}$: Deposits in foreign and domestic offices over assets: $(\text{RCON2200} + \text{RCFN2200})/\text{RCFD2170}$

- Loans $Loans_{b,t}$: Total loans and leases held for investment and held for sale over assets:
 $RCFD2122/RCFD2170$
- C&I Lending $Lending_{b,t}/Loans_{b,t}$: Commercial and industrial loans over total loans:
 $(RCFD1763+RCFD1764)/RCFD2122$
- Tier 1 capital ratio $ratio_{b,t}$: RCFA7206