Online Appendix

"The Cross-Market Spillover of Economic Shocks through Multimarket Banks"
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Each section of this appendix corresponds to a section of the main text.

Section 4.2 Regression results for the restricted sample

Table A1 of this section contains a list of definitions and sources for the variables in the OLS regressions on the restricted sample in Table 2. Table A2 reports summary statistics on the variables, including the pre-winsorized values of the continuous variables. Table A3 reports correlation coefficients between the winsorized values of the continuous variables. Table A4 contains tests of the differences between the interaction coefficients (no-branch minus branch, moderately peripheral minus core, highly peripheral minus moderately peripheral, and highly peripheral minus core).

Table A1 Definitions and sources of variables in Tables 2 and 4

Variable	Definition	Source
Portfolio Originations$_{i,m,t}$	Mortgage originations by bank i in market m in year t that were either not sold or sold to affiliates by the end of the year, in thousands of dollars	HMDA
Log of Crisis Portfolio Originations$_{i,m}$	Log (Portfolio Originations$_{i,m,2008}$ + Portfolio Originations$_{i,m,2009}$)	
Log of Pre-crisis Portfolio Originations$_{i,m}$	Log (Portfolio Originations$_{i,m,2006}$ + Portfolio Originations$_{i,m,2007}$)	
Log Growth in Portfolio Originations$_{i,m}$	Log of Crisis Portfolio Originations$_{i,m}$ - Log of Pre-crisis Portfolio Originations$_{i,m}$	
Multimarket Bank$_i$	Dummy variable = 1 if at least 99 percent of bank i's 2006-2007 portfolio originations were in a single market	
Core $_{i,m}$	Dummy variable = 1 if 10 to 99 percent of bank i's 2006-2007 portfolio originations were in market m	
Moderately Peripheral $_{i,m}$	Dummy variable = 1 if 1 to 10 percent of bank i's 2006-2007 portfolio originations were in market m	
Highly Peripheral $_{i,m}$	Dummy variable = 1 if less than 1 percent of bank i's 2006-2007 portfolio originations were in market m	
ΔMortgage Delinquency Rate$_{c,m}$	Change from end of 2005 to end of 2007 in percent of borrowers in county c and market m whose mortgage loans were 90 days or more overdue at the end of year t	Trendata
ΔMortgage Delinquency Rate$_m$	Weighted average of ΔMortgage Delinquency Rate$_{c,m}$ across all counties in market m, using as weights the share of the county in the 2006-2007 portfolio originations by all banks in market m	
ΔOutside Mortgage Delinquency Rate $_{i,m}$	For all markets $s \neq m$ in which bank i originated portfolio loans in 2006-2007, the weighted average of ΔMortgage Delinquency Rate$_s$, using as weights the share of the market in the 2006-2007 portfolio originations by bank i in all markets $s \neq m$	
Assets $_{i,t}$	Assets of bank i at end of year t, in thousands of dollars	Call reports
Size $_i$	Log(Assets $_{i,2007}$)	
Equity Capital $_{i,t}$	Equity capital of bank i at end of year t, in thousands of dollars	Call reports
ΔCapital-Asset Ratio $_i$	100 × [(Equity Capital $_{i,2007}$/Assets $_{i,2007}$) - (Equity Capital $_{i,2005}$/Assets $_{i,2005}$)	
Non-mortgage Delinquencies$_{i,t}$	Loans of bank i other than home mortgages that were 90 days or more past due or non-accruing at the end of year t, in thousands of dollars	Call reports
ΔNon-mortgage Delinquency Ratio$_i$	100 × [(Non-mortgage Delinquencies$_{i,2007}$/Assets $_{i,2007}$) - (Non-mortgage Delinquencies$_{i,2007}$/Assets $_{i,2007}$)	

Table A2: Summary statistics for variables used in Table 2 regressions

Discrete variables	Observations	Mean	Min.	Max.
Branch Bank	11,737	0.574	0	1
No-branch Bank	11,737	0.426	0	1
Multimarket Bank	11,737	0.915	0	1
Core Market	11,737	0.281	0	1
Moderately Peripheral Market	11,737	0.203	0	1
Highly Peripheral Market	11,737	0.431	0	1

Continuous variables	Observations	Mean	Median	Std. Dev.	Min.	Max.
Before winsorization						
100 × Log Growth of Portfolio Originations	11,737	-76.53	-62.94	124.64	-718.63	421.20
100 × Log of Pre-crisis Portfolio Originations	11,737	850.38	833.93	178.86	340.12	1625.98
Size	11,737	15.91	15.89	3.11	10.26	21.37
ΔCapital-Asset Ratio	11,737	0.36	0.31	2.52	-70.75	22.89
Δ Non-mortgage Delinquency Ratio	11,737	0.35	0.17	0.65	-9.96	12.17
Δ Outside Delinquency Rate (all multimarket)	10,740	0.74	0.79	0.54	-1.71	4.70
Δ Outside Delinquency Rate (core market)	3,293	0.52	0.40	0.70	-1.71	4.70
Δ Outside Delinquency Rate (mod. periph. market)	2,384	0.67	0.70	0.55	-0.99	4.09
Δ Outside Delinquency Rate (highly periph. market)	5,063	0.91	1.00	0.32	-0.35	2.64
After winsorization						
100 × Log Growth of Portfolio Originations	11,737	-76.32	-63.62	123.11	-718.63	421.20
100 × Log of Pre-crisis Portfolio Originations	11,737	850.08	833.93	175.61	505.62	1351.53
Size	11,737	15.92	15.89	3.11	10.82	21.37
ΔCapital-Asset Ratio	11,737	0.42	0.31	1.72	-3.64	8.60
ΔNon-mortgage Delinquency Ratio	11,737	0.34	0.17	0.49	-0.29	2.85
ΔOutside Delinquency Rate (all multimarket)	10,740	0.73	0.79	0.51	-0.48	2.39
ΔOutside Delinquency Rate (core market)	3,293	0.50	0.40	0.62	-0.48	2.39
ΔOutside Delinquency Rate (mod. periph. market)	2,384	0.66	0.70	0.53	-0.48	2.39
ΔOutside Delinquency Rate (highly periph. market)	5,063	0.91	1.00	0.32	-0.35	2.39

Table A3: Correlation coefficients for winsorized values of continuous variables used in Table 2 regressions

Variable	No. of obs.	Log Growth of Originations	Log of Pre-crisis Orig.	Size	ΔCapital-Asset Ratio	ΔNon-mtg. Del. Ratio
Log Growth of Originations		1.00				
Log of Pre-crisis Originations	11,737	-0.35	1.00			
Size	11,737	-0.41	0.46	1.00		
ΔCapital-Asset Ratio	11,737	-0.08	0.03	0.02	1.00	
ΔNon-mtg. Delinquency Ratio	11,737	-0.03	-0.07	-0.09	0.10	1.00
ΔOutside Delinquency Rate						
All multimarket	10,740	-0.28	0.29	0.45	-0.04	-0.01
Core market	3,293	-0.10	0.19	0.13	0.01	0.10
Mod. periph. market	2,384	-0.24	0.38	0.31	-0.04	0.08
Highly periph. market	5,063	-0.27	0.40	0.52	-0.14	-0.18

Table A4: Tests of differences in estimated interaction coefficients in Table 2

	(A) All	(B) Branch	(C) No-branch	Difference: (C) – (B)
OLS estimates from Table 2:				
(1) Multimarket Bank × ΔOutside Delinquency Rate		-21.35***	-41.91**	-20.56
		[4.95]	[20.09]	[18.18]
(2) Core Market × ΔOutside Delinquency Rate	-12.93***	-12.79***	-16.81	-4.02
	[4.14]	[4.03]	[11.06]	[11.21]
(3) Mod. Periph. Market × ΔOutside Delinquency Rate	-41.83***	-25.95***	-30.30*	-4.35
	[12.84]	[9.30]	[16.44]	[16.90]
(4) Highly Periph. Market × ΔOutside Delinquency Rate	-79.48***	-42.91**	-64.44*	-21.53
	[30.13]	[19.04]	[33.52]	[32.49]
Difference:				
(3) – (2)	-28.89**	-13.16	-13.48	
	[12.51]	[9.18]	[18.01]	
(4) – (2)	-66.55**	-30.12	-47.63	
	[29.74]	[18.68]	[34.67]	
(4) – (3)	-37.66*	-16.97	-34.14	
	[22.24]	[17.75]	[24.64]	

Note: Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Section 4.2 Regression results for the full sample

Table A5 reports summary statistics on the variables in the Tobit regressions on the full sample in Table 4, including the pre-winsorized values of the continuous variables. Table A6 presents correlation coefficients between the winsorized values of the continuous variables. Table A7 reports tests of the differences between the interaction coefficients (no-branch minus branch, moderately peripheral minus core, highly peripheral minus moderately peripheral, and highly peripheral minus core).

Table A5: Summary statistics for variables used in Table 4 regressions

Discrete variables	Observations	Mean	Min.	Max.
Branch Bank	14,455	0.478	0	1
No-branch Bank	14,455	0.522	0	1
Multimarket Bank	14,455	0.930	0	1
Core Market	14,455	0.238	0	1
Moderately Peripheral Market	14,455	0.194	0	1
Highly Peripheral Market	14,455	0.498	0	1

Continuous variables	Observations	Median	Mean	Std. Dev.	Min.	Max.
Before winsorization						
100 × Log of Crisis Portfolio Originations	11,737	769.53	773.86	178.75	138.63	1547.54
100 × Log of Pre-crisis Portfolio Originations	14,455	807.09	826.17	178.34	340.12	1625.98
Size	14,455	16.48	16.05	2.97	10.26	21.37
ΔCapital-Asset Ratio	14,455	0.31	0.41	2.52	-70.75	22.89
ΔNon-mortgage Delinquency Ratio	14,455	0.21	0.40	0.68	-9.96	12.17
ΔOutside Delinquency Rate (all multimarket)	13,440	0.84	0.79	0.55	-1.71	4.70
ΔOutside Delinquency Rate (core market)	3,439	0.40	0.52	0.70	-1.71	4.70
ΔOutside Delinquency Rate (mod. periph. market)	2,807	0.70	0.69	0.57	-0.99	4.11
ΔOutside Delinquency Rate (highly periph. market)	7,194	1.00	0.95	0.36	-0.63	3.97
After winsorization						
100 × Log of Crisis Portfolio Originations	11,737	769.53	773.75	175.27	398.90	1233,62
100 × Log of Pre-crisis Portfolio Originations	14,455	807.09	825.72	174.86	488.28	1325.08
Size	14,455	16.48	16.06	2.97	10.85	21.37
ΔCapital-Asset Ratio	14,455	0.31	0.45	1.75	-3.64	7.45
ΔNon-mortgage Delinquency Ratio	14,455	0.21	0.39	0.55	-0.24	3.05
ΔOutside Delinquency Rate (all multimarket)	13,440	0.84	0.78	0.51	-0.45	2.32
ΔOutside Delinquency Rate (core market)	3,439	0.40	0.50	0.62	-0.45	2.32
ΔOutside Delinquency Rate (mod. periph. market)	2,807	0.70	0.68	0.54	-0.45	2.32
ΔOutside Delinquency Rate (highly periph. market)	7,194	1.00	0.95	0.36	-0.45	2.32

Table A6: Correlation coefficients for winsorized values of continuous variables used in Table 4 regressions

	No. of obs.	Log of Pre-crisis Orig.	Size	ΔCapital-Asset Ratio	ΔNon-mtg. Del. Ratio
Log of Pre-crisis Originations	14,455	1.00			
Size	14,455	0.39	1.00		
ΔCapital-Asset Ratio	14,455	0.03	0.01	1.00	
ΔNon-mtg. Delinquency Ratio	14,455	-0.10	-0.07	0.12	1.00
ΔOutside Delinquency Rate					
All multimarket	13,440	0.22	0.42	0.01	0.08
Core market	3,439	0.19	0.13	0.00	0.10
Mod. periph. market	2,807	0.37	0.28	-0.05	0.08
Highly periph. market	7,194	0.27	0.30	0.00	0.11

Table A7: Tests for differences in estimated interaction coefficients in Table 4

	(A) Branch	(B) No-branch	Difference: (B) – (A)
Tobit estimates from Table 4			
(1) Multimarket Bank × ΔOutside Delinquency Rate	-29.92***	-123.10***	-93.18***
	[7.33]	[34.32]	[30.33]
(2) Core Market × ΔOutside Delinquency Rate	-13.46**	-12.64	0.81
	[5.27]	[15.18]	[15.34]
(3) Mod. Periph. Market × ΔOutside Delinquency Rate	-39.08***	-93.58***	-54.50**
	[13.24]	[25.99]	[26.47]
(4) Highly Periph. Market × ΔOutside Delinquency Rate	-66.36***	-167.15***	-100.79**
	[22.48]	[52.25]	[47.17]
Difference:			
(3) – (2)	-25.63**	-80.94***	
	[12.62]	[27.90]	
(4) – (2)	-52.90**	-154.50***	
	[21.85]	[53.06]	
(4) – (3)	-27.27	-73.56	
	[19.69]	[45.93]	

Note: Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Section 5.1 Alternative definitions of degree of periphery

This section reports the results of the three regressions discussed in Section 5.1 of the main text, supporting our characterization of markets as core, moderately peripheral, or highly peripheral to the bank. All three regressions use OLS on the restricted sample and combine branch and no-branch observations so as to focus on the implications of alternative measures of the degree of periphery of the market to the bank. In the first regression, reported in Table A8, degree of periphery is still measured by the share of the bank's originations in outside markets, but 11 discrete categories are used instead of only three. As in the regression with only three categories, the dummy variable for the category is interacted with the change in the outside delinquency rate. In the second regression, reported in Table A9, only three categories of degree are periphery are used but the dividing line between core and moderately peripheral is 70 percent instead of the 90 percent cutoff used in the main text. In the third regression, reported in Table A10, a continuous, quadratic measure of the outside share is used instead of discrete categories. Specifically, the regression includes the multimarket bank dummy interacted with five separate variables 1) the outside share; 2) the square of the outside share; 3) the change in the outside delinquency rate; 4) the outside share times the change in the outside delinquency rate; and 5) the square of the outside share times the change in the outside delinquency rate.

To show that the first and third regressions produce consistent results, we plot the implied spillover coefficients as a function of the outside share in Figure A1. For the regression with 11 discrete categories, the solid line plots the estimated interaction coefficients from Table A7. For the regression with the continuous measure of degree of periphery, the dashed line plots the function, $a + bx + cx^2$ for $0 < x < 100$, where a, b, and c are the estimated coefficients on interaction terms 3), 4), and 5), respectively.

Table A8: Baseline regression with 11 degree-of-periphery categories instead of three

Variable	
100 × Log of Pre-crisis Originations	-0.29***
	[.05]
Size	8.73*
	[5.08]
ΔCapital-Asset Ratio	-4.55
	[4.05]
ΔNon-mortgage Delinquency Ratio	-19.85***
	[7.17]
Outside Share_1 to 10	11.06
	[5.53]**
Outside Share_1 to 10 × ΔOutside Delinquency Rate	**-11.12**
	[7.08]
Outside Share_10 to 20	14.58***
	[5.64]
Outside Share_10 to 20 × ΔOutside Delinquency Rate	**-6.28**
	[7.37]
Outside Share_20 to 30	12.96*
	[7.54]
Outside Share_20 to 30 × ΔOutside Delinquency Rate	**-10.49**
	[8.56]
Outside Share_30 to 40	-5.43
	[8.60]
Outside Share_30 to 40 × ΔOutside Delinquency Rate	**0.17**
	[8.71]
Outside Share_40 to 50	2.83
	[8.26]
Outside Share_40 to 50 × ΔOutside Delinquency Rate	**-0.59**
	[8.94]
Outside Share_50 to 60	-6.86
	[10.27]
Outside Share_50 to 60 × ΔOutside Delinquency Rate	**-2.43**
	[13.06]
Outside Share_60 to 70	-10.64
	[9.40]
Outside Share_60 to 70 × ΔOutside Delinquency Rate	**-14.61**
	[11.28]
Outside Share_70 to 80	-22.03**
	[9.46]
Outside Share_70 to 80 × ΔOutside Delinquency Rate	**-24.29*** **
	[8.75]
Outside Share_80 to 90	-31.93***
	[10.28]
Outside Share_80 to 90 × ΔOutside Delinquency Rate	**-16.85** **
	[7.73]
Outside Share_90 to 99	-40.51***
	[13.34]
Outside Share_90 to 99 × ΔOutside Delinquency Rate	**-43.31*** **
	12.85
Outside Share_GT 99	-65.33***
	[22.49]
Outside Share_GT 99 × ΔOutside Delinquency Rate	**-82.64*** **
	[29.86]
Number of observations	11,737
Adjusted R-squared	0.30

See note at end of Table A10.

Table A9: Baseline regression with three degree-of-periphery categories but alternative dividing line between core and moderately peripheral

Variable	
100 × Log of Pre-crisis Originations	-0.28***
	[0.04]
Size	6.92
	[.4.57]
ΔCapital-Asset Ratio	-4.56
	[4.12]
ΔNon-mortgage Delinquency Ratio	-19.75***
	[7.18]
Outside Share_1 to 70	6.03
	[4.22]
Outside Share_1 to 70 × ΔOutside Delinquency Rate	**-7.81***
	[4.20]
Outside Share_70 to 99	-32.79***
	[10.39]
Outside Share_70 to 99 × ΔOutside Delinquency Rate	**-34.16*** **
	[9.12]
Outside Share_GT 99	-57.58***
	[20.77]
Outside Share_GT 99 × ΔOutside Delinquency Rate	**-78.85*** **
	[29.49]
Number of observations	11,737
Adjusted R-squared	0.30

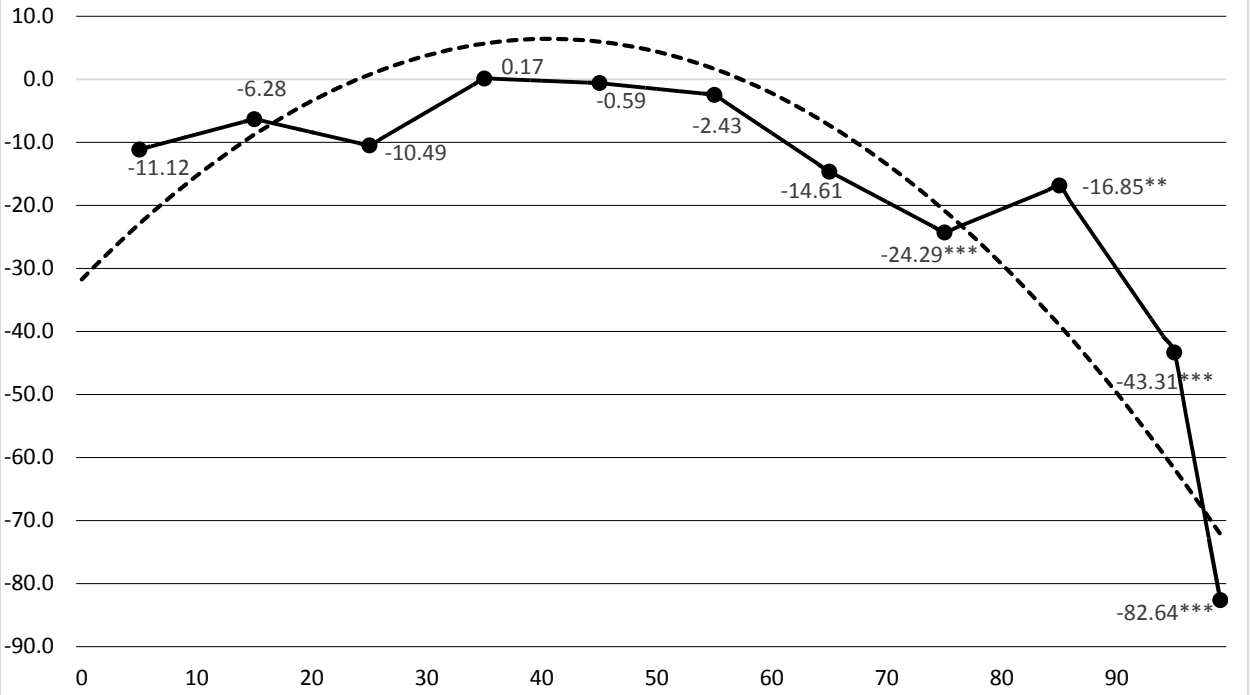
See note at end of Table A10.

Table A10: Baseline regression with continuous quadratic degree-of-periphery measure

Variable	
100 × Log of Pre-crisis Originations	-0.256***
	[0.041]
Size	3.918
	[.4.514]
ΔCapital-Asset Ratio	-4.789
	[4.192]
ΔNon-mortgage Delinquency Ratio	-16.667**
	[6.998]
Multimarket Bank	9.557
	[6.377]
Multimarket Bank × Outside Share	0.268
	[0.388]
Multimarket Bank × (Outside Share)^2	-.007*
	[.004]
Multimarket Bank × ΔOutside Delinquency Rate	**-33.635*** **
	[11.321]
Multimarket Bank × Outside Share × ΔOutside Delinquency Rate	**1.924****
	[0.775]
Multimarket Bank × (Outside Share)^2 × ΔOutside Delinquency Rate	**-.023*** **
	[.009]
Number of observations	11,737
Adjusted R-squared	0.29

Notes for Tables A8-A10: Dependent variable is 100 × (log of crisis originations – log of pre-crisis originations). Outside share is the percent of bank's total pre-crisis portfolio originations in outside markets. The regressions use Subsample 1 in Table 1 and include dummy variables for the 379 markets. No distinction is made between branch and no-branch observations. All continuous variables except the outside share and the log growth of originations are winsorized at the 1% level prior to estimation. The log growth of originations is constructed from the winsorized values of the logs of crisis and pre-crisis originations. Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Figure A1: Estimated interaction coefficients with alternative measures of degree of periphery



Share of bank's portfolio originations in outside markets (%)

Note: *, **, and *** indicate significance at 10%, 5% and 1%, respectively, using robust standard errors clustered at the bank level. Solid line is from regression for Equation (2) using 11 degree-periphery-categories defined in terms of the outside share. Dashed line is from a regression for Equation (2) using a continuous degree-of- periphery measure quadratic in the outside share.

Section 5.2 Addressing the endogeneity problem

This section reports the results of the two sets of regressions used to address the potential endogeneity from more aggressive banks simultaneously specializing in high-risk markets and specializing in riskier borrowers within each market.

Separate regressions for low-rate and. high-rate mortgages

The first way of controlling for differences in banks' propensity to take risk is to estimate separate cross-section regressions for low-rate and high-rate portfolio mortgage originations. Tables A11-A14 reports the results of these regressions. As in most of our baseline regressions, branch and no-branch coefficients are allowed to differ for all variables except market dummies. Table A11 corresponds to columns 3-6 of Table 2 in the text. Equations (1) and (2) are estimated for each loan category using OLS on the restricted sample and allowing the coefficients to differ between branch and no-branch observations. Tests of differences in the estimated interaction coefficients are reported in Table A12. Table A13 corresponds to Table 4 in the text. In this case, Equations (1') and (2') are estimated for each category using Tobit on the full sample. Tests of the differences in estimated interaction coefficients are reported in Table A14.

In Table A11 for the restricted sample, the coefficients on variables other than the change in the outside delinquency rate are similar to those in Table 2. For the bank controls, the main difference is that in the regressions for Equation (2) that take into account the degree of periphery (columns 5-8), the effect of bank size on lending growth is not only positive but statistically significant in three out of the four cases.

The interaction coefficients in Table A11 confirm that banks reduce both low-rate and high-rate mortgage lending in response to outside mortgage distress. In the regressions for

Equation (1) with the multimarket dummy only (columns 1-4), the interaction coefficient is negative and statistically significant in all four cases. In the regressions for Equation (2) that take into account degree of periphery (columns 5-8), the coefficients on the interaction terms are negative in all cases and statistically significant in 9 out of 12 cases. As in the baseline regressions that use the restricted sample and control for both branch presence and degree of periphery (last two columns of Table 2), the evidence is weaker that spillover increases when the bank lacks a branch presence or when the degree of periphery is high. Specifically, Table A12 shows that while the interaction coefficient is always more negative when the market is more peripheral to the bank and is usually more negative when the bank lacks branches, the difference is statistically significant in only 3 of the 20 cases reported.

In the Tobit estimates for the full sample in Table A13, the interactions coefficients are generally negative and statistically significant in both loan categories. The only exceptions are the coefficients for core market observations in the low-rate category, which are negative but insignificant for both branch and no-branch observations. As in the case of Table 4, the differences in interaction coefficients between branch and no-branch observations and among different degrees of periphery are much larger than in the OLS regression on the restricted sample. Table A14 shows that the difference is now statistically significant in 14 of the 20 cases reported.

Table A11: Cross-section regressions for log growth in portfolio originations from pre-crisis period to crisis period, high-rate and low-rate loans (restricted sample)

Variable	Equation (1)				Equation (2)			
	Low-rate		High-rate		Low-rate		High-rate	
	Branch	No-branch	Branch	No-branch	Branch	No-branch	Branch	No-branch
100 × Log of Pre-crisis Originations	-0.28***	-0.37***	-0.54***	-0.74***	-0.31***	-0.38***	-0.58***	-0.74***
	[0.02]	[0.05]	[0.03]	[0.05]	[0.02]	[0.05]	[0.03]	[0.05]
Size	0.05	0.52	-9.51***	3.29	7.77***	2.44	4.95**	7.60**
	[1.64]	[3.25]	[1.32]	[2.98]	[2.33]	[4.74]	[1.99]	[3.27]
Capital-Asset Ratio	-0.56	-3.10	-2.74	-8.93**	-0.96	-3.33	-3.21	-8.12**
	[1.95]	[5.31]	[2.62]	[3.57]	[1.91]	[5.25]	[2.34]	[3.60]
Nun-mortgage Delinquency Ratio	-6.00	-50.68***	-7.74*	-2.31	-9.44**	-51.33***	-10.21**	-1.07
	[4.07]	[19.42]	[4.18]	[13.65]	[3.91]	[19.80]	[4.10]	[14.30]
Multimarket Bank	21.92***	63.58	17.99***	-129.38***				
	[5.68]	[40.56]	[6.25]	[34.35]				
Multimarket Bank × ΔOutside Delinquency Rate	**-15.30*** **	**-45.19** **	**-26.70*** **	**-29.15** **				
	[5.14]	[20.85]	[6.32]	[14.15]				
Core Market					11.52**	104.50**	2.42	-24.67
					[5.39]	[45.29]	[6.09]	[40.11]
Core Market × ΔOutside Delinquency Rate					**-4.80**	**-23.15***	**-15.21** **	**-2.25**
					[4.36]	[12.91]	[6.26]	[15.41]
Mod. Periph. Market					6.28	102.26**	-32.07***	-46.17
					[10.56]	[46.81]	[10.26]	[42.14]
Mod. Periph. Market × ΔOutside Delinquency Rate					**-17.05***	**-41.71** **	**-36.46*** **	**-19.58**
					[9.94]	[20.10]	[12.22]	[15.54]
Highly Periph. Market					-10.25	108.07**	-87.14***	-46.13
					[19.56]	[51.27]	[24.35]	[43.74]
Highly Periph. Market × ΔOutside Delinquency Rate					**-48.66** **	**-59.48***	**-53.13** **	**-48.78** **
					[20.49]	[34.35]	[26.22]	[19.32]
No. of observations	10,558		6,477		10,588		6,477	
Adjusted R-square	0.29		0.56		0.30		0.57	

Note: Dependent variable is 100 × (log of crisis originations – log of pre-crisis originations). All four regressions use Subsample 1 in Table 1 and include dummy variables for the 379 markets. For each loan type, the regression is further restricted to those observations with positive originations of that type of loan in at least one pre-crisis year and at least one crisis year. In each regression, the coefficients for branch and no-branch observations are allowed to differ for all variables except the market dummies. All continuous variables except log growth of originations are winsorized at the 1% level using all observations in Subsample 1for which the variable is defined. The log growth of originations is constructed from the winsorized values of the logs of crisis and pre-crisis originations. Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Table A12: Tests for differences in estimated interaction coefficients in Table A11

	(A) Branch	(B) No-branch	Difference: (B) – (A)
1. OLS estimates for low-rate loans			
(1) Multimarket Bank × ΔOutside Delinquency Rate	-15.30***	-45.19**	-29.89
	[5.14]	[20.85]	[19.52]
(2) Core Market × ΔOutside Delinquency Rate	-4.80	-23.15*	-18.35
	[4.36]	[12.91]	[13.10]
(3) Mod. Periph. Market × ΔOutside Delinquency Rate	-17.05*	-41.71**	-24.66
	[9.94]	[20.10]	[21.12]
(4) Highly Periph. Market × ΔOutside Delinquency Rate	-48.66**	-59.48*	-10.82
	[20.49]	[34.35]	[34.47]
Difference:			
(3) – (2)	-12.25	-18.56	
	[9.86]	[21.86]	
(4) – (2)	-43.86**	-36.33	
	[20.56]	[35.52]	
(4) – (3)	-31.61	-17.77	
	[19.44]	[24.59]	
2. OLS estimates for high-rate loans			
(1) Multimarket Bank × ΔOutside Delinquency Rate	-26.70***	-29.15**	-2.45
	[6.32]	[14.15]	[13.99]
(2) Core Market × ΔOutside Delinquency Rate	-15.21**	-2.25	12.97
	[6.26]	[15.41]	[15.64]
(3) Mod. Periph. Market × ΔOutside Delinquency Rate	-36.46***	-19.58	16..88
	[12.22]	[15.54]	[18.96]
(4) Highly Periph. Market × ΔOutside Delinquency Rate	53.13**	-48.78***	4.35
	[26.22]	[19.32]	[30.44]
Difference:			
(3) – (2)	-21.24	-17.33	
	[13.32]	[19.76]	
(4) – (2)	-37.92	-46.53**	
	[26.72]	[22.59]	
(4) – (3)	-16.68	-29.20*	
	[26.18]	[15.90]	

Note: Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Table A13: Cross-section Tobit regressions for log of crisis portfolio originations, high-rate and low-rate loans (full sample)

Variable	Equation (1')				Equation (2')			
	Low-rate		High-rate		Low-rate		High-rate	
	Branch	No-branch	Branch	No-branch	Branch	No-branch	Branch	No-branch
100 × Log of Pre-crisis Originations	0.85***	0.96***	0.66***	0.66***	0.81***	0.95***	0.61***	0.59***
	[0.03]	[0.05]	[0.05]	[0.12]	[0.03]	[0.06]	[0.05]	[0.12]
Size	0.45	1.65	-12.55***	-3.79	9.46***	5.37	11.81***	13.23
	[2.05]	[5.44]	[2.40]	[9.22]	[2.83]	[7.55]	[3.57]	[10.23]
Capital-Asset Ratio	-1.55	-6.91	-6.50	-7.18	-2.26	-6.66	-7.25**	-3.13
	[2.40]	[10.77]	[3.99]	[12.84]	[2.34]	[10.11]	[3.66]	[12.51]
Nun-mortgage Delinquency Ratio	-9.20*	-118.21***	-16.23**	-95.91**	-12.90***	-115.89***	-17.03***	-89.32**
	[5.16]	[31.13]	[7.53]	[45.55]	[4.86]	[30.22]	[6.59]	[41.69]
Multimarket Bank	23.10***	-108.50**	5.96	-246.32**				
	[6.81]	[53.71]	[10.32]	[121.75]				
Multimarket Bank × ΔOutside Delinquency Rate	**-18.31*** **	**-111.71*** **	**-75.57*** **	**-202.81*** **				
	[7.14]	[37.02]	[14.47]	[42.77]				
Core Market					8.44	-106.92*	-22.88**	-171.52
					[6.69]	[64.16]	[9.23]	[106.98]
Core Market × ΔOutside Delinquency Rate					**-0.17**	**-8.35**	**-43.18*** **	**-54.82***
					[5.73]	[17.38]	[11.25]	[30.42]
Mod. Periph. Market					8.03	-82.56	-70.90***	-184.65
					[11.99]	[69.92]	[18.53]	[119.86]
Mod. Periph. Market × ΔOutside Delinquency Rate					**-26.09** **	**-97.64*** **	**-116.94*** **	**-138.19*** **
					[13.05]	[27.31]	[25.04]	[38.22]
Highly Periph. Market					-2.05	-54.66	-157.61***	-220.87
					[22.92]	[84.35]	[50.49]	[153.63]
Highly Periph. Market × ΔOutside Delinquency Rate					**-70.81*** **	**-149.10** **	**-126.56** **	**-260.79*** **
					[24.43]	[60.31]	[51.78]	[60.37]
No. of observations	13,590		10,774		13,590		10,774	
Adjusted R-square	0.09		0.07		0.09		0.07	

Note: Dependent variable is 100 × log of crisis originations. All four regressions use Subsamples 1 and 2 in Table 1 and include dummy variables for the 379 markets. For each loan type, the regression is restricted to those observations with positive originations of that type of loan in at least one pre-crisis year. In each regression, the coefficients for branch and no-branch observations are allowed to differ for all variables except the market dummies. In each case, the lower bound for the Tobit is set equal to the minimum uncensored value of the dependent variable in the sample, as in Carson and Sun (2007) and Cameron and Trivedi (2009). All continuous variables are winsorized at the 1% level, using all observations in Subsamples 1 and 2 for which the variable is defined. Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Table A14: Tests for differences in estimated interaction coefficients in Table A13

	(A) Branch	(B) No-branch	Difference: (B) – (A)
1. Tobit estimates for low-rate loans:			
(1) Multimarket Bank × ΔOutside Delinquency Rate	-18.31***	-111.71**	-93.40***
	[7.14]	[37.02]	[33.69]
(2) Core Market × ΔOutside Delinquency Rate	-0.17	-8.35	-8.18
	[5.73]	[17.38]	[17.63]
(3) Mod. Periph. Market × ΔOutside Delinquency Rate	-26.09**	-97.64***	-71.55**
	[13.05]	[27.31]	[28.13]
(4) Highly Periph. Market × ΔOutside Del. Rate	-70.81***	-149.10**	-78.30
	[24.43]	[60.31]	[55.46]
Difference:			
(3) – (2)	-25.92**	-89.28***	
	[12.76]	[30.09]	
(4) – (2)	-70.64***	-140.75**	
	[24.49]	[61.03]	
(4) – (3)	-44.72**	-51.46	
	[22.60]	[53.28]	
2. Tobit estimates for high-rate loans			
(1) Multimarket Bank × ΔOutside Delinquency Rate	-75.57***	-202.81***	-127.24***
	[14.47]	[42.77]	[38.09]
(2) Core Market × ΔOutside Delinquency Rate	-43.18***	-54.82*	-11.65
	[11.25]	[30.42]	[29.92]
(3) Mod. Periph. Market × ΔOutside Delinquency Rate	-116.94***	-138.19***	-21.25
	[25.04]	[38.22]	[42.29]
(4) Highly Periph. Market × ΔOutside Delinquency Rate	-126.56**	-260.79***	-134.23**
	[51.78]	[60.37]	[60.50]
Difference:			
(3) – (2)	-73.76***	-83.36**	
	[24.59]	[40.11]	
(4) – (2)	-83.38*	-205.97***	
	[49.58]	[62.70]	
(4) – (3)	-9.62	-122.60**	
	[50.05]	[58.13]	

Note: Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Panel regressions with bank fixed effects

The second way of controlling for differences in banks' propensity to take risk is to estimate panel regressions with bank fixed effects for the years 2005-2009. The use of lagged values of the dependent variable (originations in our case) in combination with fixed-effects creates a potential bias in the estimated coefficients. To deal with this problem, we follow the approach of Anderson and Hsiao (1982), who suggest differencing the equation to be estimated and using the second lag of the dependent variable as an instrument for the lagged first difference of the dependent variable. We also follow the suggestion of Arellano and Bond (1991) to include additional lags of the dependent variable as instruments. Specifically, for each of the five years of the panel, we use both the second and third lags of the dependent variable as instruments.

To implement the approach, we start with the following differenced versions of Equations (1') and (2'):

$$(A1)\quad \Delta\, Log(Originations)_{i,m,t} = a_{mt} + b\cdot\Delta Log(Originations)_{i,m,t-1} + \sum_k c_k\cdot\Delta Bank\ Controls_{k,i,t} + d\cdot\Delta Multimarket\ Bank_{i,t} + e\cdot\Delta(Multimarket\ Bank \times \Delta Outside\ Mortgage\ Delinquency\ Rate)_{i,m,t} + \Delta\varepsilon_{i,m,t}$$

$$(A2)\quad \Delta Log(\ Originations)_{i,m,t} = a_{mt} + b\cdot\Delta Log(Originations)_{i,m,t-1} + \sum_k c_k\cdot\Delta Bank\ Controls_{k,i,t} + \cdot\sum_k d_k\cdot\Delta Degree\ of\ Periphery_{k,i,m,t} + \sum_k e_k\cdot\Delta(Degree\ of\ Periphery \times \Delta Outside\ Mortgage\ Delinquency\ Rate)_{i,m,t} + \Delta\varepsilon_{i,m,t}$$

where t is the year, Δ is the change from the previous year, and a_{mt} is a fixed effect for the market and year. We estimate these equations with 2SLS using $Log(Originations_{i,m,t-2})$ and

Log(Originations$_{i,m,t-3}$) as instruments for Δ*Log(Originations)*$_{i,m,t-1}$.[1] The interaction coefficients *d, d*$_k$*, e, and e*$_k$ have the same meaning as before, allowing us to determine if spillover is evident when we extend the time period and use differenced data to control for persistent differences in banks' propensity to take more risk.

The general approach for constructing the variables in the panel regressions can be described as follows. For each of the five years in the panel (2005,…., 2009), we first construct a merger-adjusted data set with mortgage originations, deposits, and call report data for the four years ending in that year. To be included in the panel data set for a particular year, a bank/market observation must have positive portfolio originations in that year and each of the three previous years, because the lagged log growth of originations is one of the explanatory variables and the second and third lags of the log level of originations are needed as instruments. For each year, the regression variables are calculated using the merger-adjusted data set for that year. Thus, the earliest year in the panel regression is 2005, but data going back to 2002 are required for estimation.

The construction of specific variables is most easily explained by example. For the year 2009, current log growth of originations is calculated from originations in 2008 and 2009, and lagged log growth is calculated from originations in 2007 and 2008. The instruments for lagged log growth are the log levels of originations in 2006 and 2007. The differenced value of each multimarket and degree-of- periphery dummy variable equals the 2009 value of the dummy minus the 2008 value. In constructing each dummy, we use the distribution of the bank's originations across markets in the two previous years. For example, the 2009 value of

[1] Because we use 2SLS rather than the GMM procedure proposed by Arellano and Bond (1991), the coefficient estimates are consistent but not asymptotically efficient. As in our other regressions, we cluster the standard errors by bank, helping ensure that the standard errors are robust to the serial correlation created by the differencing of the equation.

multimarket dummy equals one if the bank made at least 1 percent of its 2007-2008 originations outside a single market. The differenced value of each interaction term equals the 2009 value of the interaction term minus the 2008 value of the interaction term. In constructing the interaction terms, we use the change in the outside delinquency rate over the previous year. For example, the 2009 value of the multimarket interaction term equals the multimarket dummy for 2009 times the change in the outside delinquency rate from the end of 2007 to the end of 2008. The latter variable is calculated as a weighted average of the change in the delinquency rate in each outside market in which the bank originated loans in 2007 and 2008, where the weight equals the share of the market in the bank's total 2007-2008 originations in outside markets.

Table A15 below reports the results of the panel regressions for Equations (A1) and (A2). In the first two regressions, no distinction is made between branch and no-branch observations. In the next two regressions, the coefficients on all variables except the market-year dummies are allowed to differ between branch and no-branch observations. In these regressions, the sample is restricted to observations in which branch status remained unchanged from the previous year. Also, for the interaction of branch status with lagged log growth in originations, we use as instruments the interaction of branch status with the second and third lags of the log of originations. It should be noted that the dependent variable in the panel regressions is log growth between consecutive years, while the dependent variable in the cross-section regressions is log growth between consecutive two-year periods (2006-2007 to 2008-2009). As a result, the coefficients in Table A15 should be approximately doubled for comparison with those in the earlier regressions.

The results for the panel regressions are generally consistent with those for the cross-section regressions. The coefficients on the measures of outside mortgage distress show strong

evidence of spillover, especially for no-branch banks and especially in more peripheral markets. When observations are not distinguished by branch status or degree of periphery (first column), the interaction coefficient is negative and significant at the 1 percent level (-23.08). When observations are distinguished by degree of periphery but not by branch status (second column), the interaction coefficient is small and insignificant for core markets but is negative and significant for both moderately peripheral markets (-17.55, significant at the 5 percent level) and highly peripheral markets (-52.04, significant at the 1 percent level). When we account for branch presence but not degree of periphery (third and fourth columns), spillover is evident for both branch and no-branch banks. In particular, the interaction coefficient is -12.25 for branch banks (significant at the 5 percent level) and -42.39 for no-branch banks (significant at the 1 percent level). Finally, when we account for both branch presence and degree of periphery (last two columns), spillover is evident for branch banks in highly peripheral markets and for no-branch banks in all three types of markets. For branch banks, the interaction coefficient is small and insignificant in core and moderately peripheral markets but is highly negative (-52.80) and significant at the 1 percent level in highly peripheral markets. For no-branch banks, the interaction coefficient is negative and significant in all three types of markets but is most negative in highly peripheral markets (-51.23, significant at the 1 percent level) and least negative in core markets (-19.99, significant at the 5 percent level).

Table A16 shows that in most cases, not only is the interaction coefficient more negative for no-branch banks than branch banks, but the difference is also statistically significant. The exception is highly peripheral markets, where the coefficients for branch and no-branch banks are virtually the same. With respect to degree of periphery, the interaction coefficient is always

more negative in the more peripheral market, and the difference is statistically significant in 7 out of 9 cases.

Table A15: Panel regressions for log growth in portfolio originations from previous year, 2005-2009

Variable	Equation (A1)	Equation (A2)	Equation (A1)		Equation (A2)	
			Branch	No-branch	Branch	No-branch
100 × Lagged Log Growth in Originations	0.29***	0.24***	0.22***	0.39***	0.16***	0.34***
	[0.04]	[0.04]	[0.04]	[0.08]	[0.03]	[0.07]
ΔSize	15.45	19.26	3.42	10.07	8.45	13.21
	[19.72]	[18.28]	[30.61]	[21.96]	[18.69]	[21.09]
Δ(Capital-Asset Ratio)	4.59**	4.16**	4.35***	5.12*	3.65***	4.82*
	[1.77]	[1.66]	[0.94]	[3.02]	[0.77]	[2.89]
Δ(Nun-mortgage Delinquency Ratio)	19.91**	18.64**	5.97**	26.75*	4.63*	26.73*
	[8.35]	[8.79]	[2.57]	[13.71]	[2.54]	[13.93]
ΔMultimarket Bank	5.91*		4.06	-93.75**		
	[3.31]		[3.09]	[46.98]		
Δ(Multimarket Bank × ΔOutside Delinquency Rate)	**-23.08*** **		**-12.25** **	**-42.39*** **		
	[6.42]		[5.09]	[12.20]		
ΔCore Market		-0.03			0.52	-89.51*
		[3.08]			[2.96]	[48.70]
Δ(Core Market × ΔOutside Delinquency Rate)		**2.19**			**2.74**	**-19.99** **
		[4.62]			[4.62]	[8.37]
ΔMod. Periph. Market		56.21***			46.52***	-23.26
		[5.20]			[5.41]	[48.95]
Δ (Mod. Periph. Market × ΔOutside Delinquency Rate)		**-17.55** **			**-6.81**	**-37.31*** **
		[7.21]			[6.12]	[12.30]
ΔHighly Periph. Market		114.95***			104.25***	38.00
		[7.39]			[8.65]	[49.30]
Δ (Highly Periph. Market × ΔOutside Delinquency Rate)		**-52.04*** **			**-52.80*** **	**-51.23** **
		[10.68]			[9.78]	[13.77]
No. of observations	57,659	57,659	57,260		57,260	

Note: Dependent variable is 100 × log growth of originations from the previous year. For each year, the sample is restricted to bank/market observations for which portfolio originations were positive in that year and in each of the three previous years. In the last two regressions, the sample is further restricted to observations in which branch status was unchanged from the previous year. All regressions include dummy variables for the 1,895 market/year combinations and are estimated using 2SLS, with the second and third lags of the log of originations as instruments for the lagged log growth in originations. The first two regressions make no distinction between branch and no-branch observations, while the last two regressions allow the coefficients for branch and no-branch observations to differ for all variables except the market-year dummies. All continuous variables except log growth of originations are winsorized at the 1% level, using all observations in the panel for which the variable is defined. The log growth of originations from the

previous year is constructed from the winsorized values of the logs of current and lagged originations. Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively

Table A16: Tests of differences in estimated interaction coefficients in Table A15

	(A) All	(B) Branch	(C) No-branch	Difference: (C) – (B)
OLS estimates from Table 2:				
(1) Δ(Multimarket Bank × ΔOutside Delinquency Rate)		-12.25**	-42.39***	-30.14***
		[5.09]	[12.20]	[10.81]
(2) Δ(Core Market × ΔOutside Delinquency Rate)	2.19	2.74	-19.99**	-22.73***
	[4.62]	[4.62]	[8.37]	[6.94]
(3) Δ (Mod. Periph. Market × ΔOutside Delinquency Rate)	-17.55**	-6.81	-37.31***	-30.50***
	[7.21]	[6.12]	[12.30]	[11.58]
(4) Δ (Highly Periph. Market × ΔOutside Delinquency Rate)	-52.04***	-52.80***	-51.23**	1.57
	[10.68]	[9.78]	[13.77]	[12.60]
Difference:				
(3) – (2)	-19.74***	-9.55*	-17.32	
	[5.73]	[4.92]	[11.62]	
(4) – (2)	-54.23***	-55.54***	-31.24**	
	[11.02]	[10.62]	[14.41]	
(4) – (3)	-34.50***	-45.99***	-13.92	
	[8.96]	[9.83]	[10.97]	

Note: Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Section 5.3 Potential offsets to spillover

Offset through increases in securitized lending

The first type of offset to spillover considered is increases in local securitized lending (or smaller decreases in such lending) by banks that reduce their portfolio lending in response to increases in their outside delinquency rates. To test whether such offset occurred, we estimated Tobit regressions for Equations (1') and (2') with portfolio originations replaced by securitized originations. Tobit is appropriate for these regressions because the rate of censoring is high. Securitized originations were positive in the pre-crisis period in 10,136 of the 14,445 observations in Subsamples 1 and 2. These originations fall to zero in the crisis period in 10 percent of the branch observations and 35 percent of the no-branch observations.

The results of these regressions, with observations distinguished by branch status, are reported in Table A17 below. In Equation (1'), the interaction coefficients for both branch and no-branch observations are negative (-27.33 and -132.41, respectively), and the coefficient for no-branch observations is significant at the 5 percent level. In Equation (2'), five of the six interaction coefficient are negative and three are also statistically significant—the ones for branch observations in moderately peripheral markets (-39.42, significant at the 10 percent level), no-branch observations in moderately peripheral markets (-95.79, significant at the 5 percent level), and no-branch observations in highly peripheral markets (-169.69, significant at the 10 percent level). Thus, during the crisis, securitized lending showed a tendency to *reinforce* the declines in banks' portfolio lending due to outside mortgage distress, rather than offsetting those declines.

In footnote 34 in the text, we suggest that the reason banks experiencing outside mortgage distress reduced their securitized lending along with their portfolio lending may have

been that the two types of lending were complementary within markets—e.g., banks that quit making portfolio loans in a market no longer found it worthwhile to make securitized loans due to the fixed costs of screening and processing loans from the market. To test this idea, we re-ran the regressions including the 10,694 observations in which a multimarket bank had positive securitized originations but *zero* portfolio originations in the pre-crisis period. Table A18 shows that for these observations, the effect of an increase in the outside delinquency rate was close to zero: -5.98 in Equation (1') and -7.68 in Equation (2'), which are both statistically insignificant. This result suggests that outside mortgage distress affects a bank's securitized lending only by affecting the desirability of portfolio lending in the same market.

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Table A17: Cross-section Tobit regressions for log of securitized originations in crisis period

Variable	Equation (1')		Equation (2')	
	Branch	No-branch	Branch	No-branch
100 × Log of Pre-crisis Originations	0.97***	1.01***	0.97***	1.02***
	[0.06]	[0.10]	[0.08]	[0.11]
Size	-8.82	-16.10	-2.15	-15.78
	[9.23]	[10.99]	[12.26]	[14.83]
ΔCapital-Asset Ratio	6.03	-23.35	4.22	-23.95
	[10.73]	[16.24]	[9.03]	[16.22]
ΔNon-mortgage Delinquency Ratio	-0.08	-107.25	-5.12	-105.38
	[16.22]	[71.74]	[11.60]	[69.29]
Multimarket Bank	32.19	157.03		
	[25.33]	[119.85]		
Multimarket Bank × ΔOutside Delinquency Rate	**-27.33**	**-132.41****		
	[19.70]	[64.71]		
Core Market			5.57	159.79
			[15.12]	[125.49]
Core Market × ΔOutside Delinquency Rate			**8.75**	**-10.75**
			[9.27]	[28.65]
Mod. Periph. Market			22.00	191.45
			[42.14]	[138.30]
Mod. Periph. Market × ΔOutside Delinquency Rate			**-39.42***	**-95.79****
			[21.63]	[46.09]
Highly Periph. Market			89.03	258.33
			[123.54]	[166.96]
Highly Periph. Market × ΔOutside Delinquency Rate			**-147.75**	**-169.69***
			[99.10]	[91.01]
Number of observations	10,136		10,136	
Pseudo R-squared	0.07		0.08	

Note: Dependent variable is 100 × log of crisis securitized originations. Both regressions use the 10,136 observations in Subsamples 1 and 2 in which securitized originations were positive in at least one of the pre-crisis years, includes dummy variable for the 379 markets, and allow the coefficients for branch and no-branch observations to differ for all variables except the market dummies. In each case, the lower bound for the Tobit is set equal to the minimum uncensored value of the dependent variable in the sample, as in Carson and Sun (2007) and Cameron and Trivedi (2009). All continuous variables are winsorized at the 1% level, using all observations in Subsamples 1 and 2 for which the variable is defined. Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Table A18: Cross-section Tobit regressions for log of securitized originations in crisis period, including observations with zero pre-crisis portfolio originations

	Equation (1')		Equation (2')	
	Branch	No- branch	Branch	No-branch
100 × Log of Pre-crisis Originations	0.98***	0.98***	0.96***	0.99***
	[0.06]	[0.09]	[0.07]	[0.09]
Size	-1.08	-2.89	7.97	1.32
	[8.08]	[7.00]	[8.88]	[7.62]
ΔCapital-Asset Ratio	6.75	-21.45***	4.82	-21.94***
	[12.36]	[8.29]	[10.42]	[8.29]
ΔNon-mortgage Delinquency Ratio	11.34	-43.93*	1.52	-41.49*
	[17.52]	[24.12]	[12.82]	[23.25]
Multimarket Bank	19.74	64.00		
	[24.53]	[64.38]		
Multimarket Bank × ΔOutside Delinquency Rate	**-54.08***	**-167.26****		
	[27.95]	[79.60]		
Core Market			-5.06	54.64
			[13.33]	[41.37]
Core Market × ΔOutside Delinquency Rate			**1.34**	**-21.12**
			[9.52]	[31.39]
Mod. Periph. Market			-4.52	60.11
			[32.43]	[43.55]
Mod. Periph. Market × ΔOutside Delinquency Rate			**-66.24****	**-136.25*****
			[30.85]	[52.20]
Highly Periph. Market			62.83	91.59
			[113.14]	[95.88]
Highly Periph. Market × ΔOutside Delinquency Rate			**-188.42**	**-201.74***
			[122.76]	[110.16]
No Pre-crisis Portfolio Originations	-117.25***		-100.42***	
	[35.05]		[31.86]	
No Pre-crisis Port. Orig. × ΔOutside Delinquency Rate	**-5.98**		**-7.68**	
	[22.15]		[22.02]	
Number of observations	20,830		20,830	
Pseudo R-squared	0.10		0.10	

Note: Dependent variable is 100 × log of crisis securitized originations. Both regressions use the 10,136 observations in Subsamples 1 and 2 in which securitized originations were positive in at least one pre-crisis year plus 10,694 observations in which securitized originations were positive in at least one pre-crisis year, portfolio originations were zero in both pre-crisis years, and the bank qualified as a multimarket bank under the original definition. Each regression includes dummy variables for the 379 markets and allows the coefficients for branch and no-branch observations to differ for all variables except the market dummies and the two terms involving the dummy variable for no pre-crisis portfolio originations. In each regression, the lower bound for the Tobit is set equal to the minimum uncensored value of the dependent variable in the sample, as in Carson and Sun (2007) and Cameron and Trivedi (2009). All continuous variables are winsorized at the 1% level, using all observations in the regression sample for which the variable is defined. Robust standard errors, clustered at the bank level, are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively.

Offset through increased portfolio lending by competitors

We use three sets of regressions to test for offset from competitors to the spillover of outside mortgage distress. Below we explain each set of regressions and summarize the results.

Bank regressions. The first set of regressions test whether outside mortgage distress at other banks in the same market has a positive effect on a bank's portfolio lending in the crisis period. These regression are identical to our baseline regressions except that 1) they include as explanatory variables the weighted sums of the changes in outside delinquency rates at other branch banks and at other no-branch banks in the same market, and 2) the market dummies are replaced by a set of variables intended to capture local mortgage demand and borrower creditworthiness. We first explain our method of weighting the changes in outside delinquency rates at other banks and then discuss our reasons for not using market fixed effects in the regressions.

The weighting scheme we use takes into account that when a bank with outside mortgage distress has a high market share, not only will the potential amount of lending to be made up by other banks will be large, but whatever make-up does occur will represent a large proportional change in the other banks' lending. To justify the weighting scheme more formally, we make two simplifying assumptions: 1) when a bank reduces lending due to outside mortgage distress, a fixed fraction β_1 of the decline in lending is made up by other banks if the bank experiencing the distress is a branch bank and a fixed fraction β_2 if it is a no-branch bank; and 2) when a decline in lending is made up by other banks, each of the other banks shares in the increase in lending in proportion to the bank's initial lending. Let $L_{i,m}$ be lending by bank i in market m; let L_m be lending by all banks in market m; let $\Delta d_{i,m}$ be the increase in bank i's outside delinquency rate; let α_1 be the proportional change in $L_{i,m}$ due to a one-unit increase in $\Delta d_{i,m}$ if bank i is a branch

bank, and let α_2 be the proportional change in $L_{i,m}$ due to a one-unit increase in $\Delta d_{i,m}$ if the bank is a no-branch bank.[2] Under these assumptions, the proportional change in bank i's lending due to a one-unit increase in the change in its *own* outside delinquency rate can be expressed as

$$\text{(A3)} \qquad \Delta L_{i,m}/L_{i,m} = \begin{cases} \alpha_1 \Delta d_{i,m} & \text{if bank i is a branch bank} \\ \alpha_2 \Delta d_{i,m} & \text{if bank i is a no-branch bank} \end{cases}$$

The proportional change in bank i's lending due to a one-unit increase in the change in the outside delinquency rate at *another* bank j is

$$\text{(A4)} \qquad \Delta L_{i,m}/L_{i,m} = \begin{cases} -\beta_1 \Delta L_{j,m}/(L_m - L_{j,m}) = -\alpha_1\beta_1 (L_{j,m}/(L_m - L_{j,m}))\Delta d_{j,m} & \text{if bank j is a branch bank} \\ -\beta_2 \Delta L_{j,m}/(L_m - L_{j,m}) = -\alpha_2\beta_2 (L_{j,m}/(L_m - L_{j,m}))\Delta d_{j,m} & \text{if bank j is a no-branch bank} \end{cases}$$

The proportional change in bank i's lending due to increases or decreases in the change in the outside delinquency rate at *all other* banks is obtained by summing the expression on the right over those banks:

$$\text{(A5)} \qquad \Delta L_{i,m}/L_{i,m} = -\alpha_1\beta_1 COMP1_{i,m} - \alpha_2\beta_2 COMP2_{i,m}$$

where

$$\text{(A6)} \qquad \begin{aligned} COMP1_{i,m} &= \sum_j s_{j,m}/(1-s_{j,m})\, \Delta d_{j,m} \text{ for all banks } j \neq i \textit{ with} \text{ branches} \\ COMP2_{i,m} &= \sum_j s_{j,m}/(1-s_{j,m}) \Delta d_{j,m} \text{ for all banks } j \neq i \textit{ without} \text{ branches} \end{aligned}$$

[2] A complication we ignore is that the proportional change in originations will actually be -1.0 if the bank's desired originations fall below the minimum feasible level, causing the bank to exit the market.

and $s_{j,m} = L_{j,m}/L_m$, the share of bank j in total lending in market m. COMP1 is our measure of the changes in outside delinquency rates at branch competitors, and COMP2 our measure of the changes at no-branch competitors.

The estimated coefficients on the two measures of outside mortgage distress allow us to estimate both the offset from competitors and the net effect on total lending. Let e_1 be the estimated coefficient on Δd if the bank is a branch bank; let e_2 the estimated coefficient on Δd if the bank is a no-branch bank; let f_1 be the estimated coefficient on COMP1, and let f_2 be the estimated coefficient on COMP2. From Equation (A3), the coefficients e_1 and e_2 serve as estimates of α_1 and α_2, respectively—i.e., of the effect of a change in a bank's outside delinquency rate on its own lending.[3] Also, from Equation (A5), the coefficients f_1 sand f_2 provide estimates of $-\alpha_1\beta_1$ and $-\alpha_2\beta_2$—i.e., of the effect of a change in a bank's outside delinquency rate on the lending of other banks.[4] It follows that the coefficient sums, $e_1 + f_1$ and $e_2 + f_2$, provide estimates of $\alpha_1(1-\beta_1)$ and $\alpha_2(1-\beta_2)$, respectively--the net effect of a change in a bank's outside delinquency rate on total lending.

The reason for not using market fixed effects in the regression is that the change in the bank's outside delinquency rate tends to have a strong negative correlation within markets with the weighted sum of changes in outside delinquency rates at competitors with the same branch status. If all banks in a market with the same branch status also had the same market share, the negative correlation would be perfect, and estimating the regression with market fixed effects would not even be possible. (This is easily verified from Equation (A6).) In our sample, market

[3] More precisely, given our regression specification, the coefficients e_1 and e_2 represent the effect of a change in Δd on the log of originations, which is an approximation for the proportional change in originations.

[4] It is also possible that increases in outside delinquency rates at competing banks *reduce* the bank's lending by causing a deterioration in local economic condition. If so, the coefficients on COMP1 and COMP2 could be negative. See Dagher and Kazimov (2015), who make the same point about decreases in local mortgage lending by banks that relied heavily on wholesale funding.

shares do differ significantly within markets among banks with the same branch status, but the negative correlation between the change in a bank's own outside delinquency rate and the weighted sum of changes at competitors of the same branch status is still strong. When each market is weighted by the number of observations, the average intra-market correlation between the change in the bank's outside delinquency rate and the weighted sum of changes in outside delinquency rates at competitors with the same branch status is -0.45 for branch banks and -0.29 for no-branch banks. This negative correlation and the fact that identification within markets is coming solely from variation in shares makes it difficult to estimate precisely the separate effects of a change in a bank's own outside delinquency rate and a change in the outside delinquency rates of its competitors. Another reason for using measures of market conditions instead of market fixed effects in the bank regressions is to make the results more comparable to those of the market regression, in which market fixed effects obviously cannot be used.

We use six measures of market conditions in the regressions: the size of the local mortgage market, as measured by the log of pre-crisis portfolio originations; the average change in the mortgage delinquency rate from the end of 2005 to the end of 2007; the change in house prices from mid-2005 to mid-2007; the average change in the debt-to-income ratio of households from 2005 to 2007; the average percent change in median household income from 2005 to 2007; and the average change in the unemployment rate from 2005 to 2007. Definitions and sources for these variables are given in Table A19 and sample stats for the variables in the bottom panel of Table A20. For all variables except house prices, the measures are weighted averages of the values for the counties making up the market, using as weights the share of each county in total pre-crisis portfolio originations in the market.

The regressions are estimated with Tobit on the full sample of 14,455 bank/market observations. The results for the regression corresponding to Equation (1'), in which observations are distinguished by branch status but not degree of periphery, are in Tables A21 and A22. The results for the regression corresponding to Equation (2'), in which observations are distinguished by both branch status and degree of periphery, are in Tables A23 and A24. For the second regression, the definitions of the measures of outside mortgage distress at competitors are a straightforward extension of the definitions for the first regression. For example, the weighted sum of changes in outside delinquency rates at no-branch competitors in highly peripheral markets uses as weights the market share of each of those competitors divided by one minus the market share.

Market regressions. The market regressions exploit differences across markets in the proportion of banks with outside market distress to estimate the net effect of such distress on local lending. The dependent variable in the regressions is the log change in market portfolio originations from the pre-crisis period to the crisis period, using the full sample. For each right-hand variable in Equation (1), we compute the weighted sum of the variable among all branch banks and among all no-branch banks, using as weights the share of the bank in total pre-crisis originations, $s_{i,m}$. This is the same as computing the average values of the variable for branch banks and no-branch banks and multiplying by the market shares of the two types of banks. To interpret the coefficients on the two measures of changes in outside delinquency rates, we take weighted averages of (A3) and (A5) across all banks in market m:

$$(A7) \qquad \Delta L_m/L_m = \sum_i s_{i,m}\, \Delta L_{i,m}/L_{i,m} \;=\; \alpha_1(1-\beta_1)\Delta D1_m + \alpha_2(1-\beta_2)\Delta D2_m$$

where

$$\text{(A8)} \qquad \begin{aligned} \Delta D1_m &= \sum_i s_{i,m}\,\Delta d_{i,m} \text{ for all banks i in market m } \textit{with} \text{ branches} \\ \Delta D2_m &= \sum_i s_{i,m}\,\Delta d_{i,m} \text{ for all banks i in market m } \textit{without} \text{ branches} \end{aligned}$$

$\Delta D1$ and $\Delta D2$ are our two measures of the average change in outside delinquency rates. From (A7), the coefficients on these variables provide estimates of $\alpha_1(1-\beta_1)$ and $\alpha_2(1-\beta_2)$, respectively—i.e. of the net effect of a change in a bank's outside delinquency rate on total lending. The regression results corresponding to Equation (1) are reported in Tables A21 and A22, and the results corresponding to Equation (2) in Tables A23 and A24. As in the bank regressions, the variable definitions for the second regression are straightforward extensions of the definitions for the first regression. For each market, for example, the measure of the change in outside delinquency rates at no-branch banks in highly peripheral markets is the weighted sum of changes in outside delinquency rates at such banks, using as weights the bank's market share.

Competitor regressions. The third set of regressions represent the flip side of the first set. Instead of testing whether outside mortgage distress at a bank's competitors has a favorable effect on its own lending, we test whether outside mortgage distress at the bank has a favorable effect on its competitors' lending. As before, the regression is estimated on the 14,455 bank/market observations in the full sample. Now, however, the dependent variable is the log growth of portfolio originations at competitors and estimation is by OLS. For each bank control and the change in competitors' outside delinquency rates, we calculate the weighted sum of the variable for branch competitors and the weighted sum for no-branch competitors, using as weights the share of the competitor in the pre-crisis originations of all competitors, branch and no-branch. As the measure of outside mortgage distress at the bank, we use the change in the

outside delinquency rate at the bank multiplied by the ratio of the bank's market share to one minus the market share, the same adjustment as in the bank regressions. For the same reasons as before, we also use measures of market conditions instead of market fixed effects. The estimated coefficients on the change in the bank's outside delinquency rate provide estimates of $-\alpha_1\beta_1$ and $-\alpha_2\beta_2$, respectively—the effect of a change in the outside delinquency rate of a branch or no-branch bank on the lending of other banks. The estimated coefficients on the average changes in outside delinquency rates at competitors represent a blend of the direct spillover effect at these banks and the impact on each of them of increases in outside delinquency rates at the other competitors. As before, regression results corresponding to Equation (1') are reported in Tables A21 and A22, and regression results corresponding to Equation (2') in Tables A23 and A24.

Summary of regression results for Equations (1') and (1). The bank, market, and competitor regressions yield similar results. The coefficients on the measures of market conditions have the expected signs and in most cases are statistically significant. Of more interest are the coefficients on the various measures of outside mortgage distress. In all three regressions, the results imply that an increase in the outside delinquency rate of a no-branch bank leads to a large *net* decrease in lending—i.e., that increases in lending at competing banks are too small to offset the decline in lending at the bank itself. In contrast, when the outside shock is experienced by a branch bank, the possibility cannot be ruled out that there is no net change in lending—i.e. that increased lending by competitors fully offsets the decline in lending at the bank.

In the bank regression (first two columns of Table A21), the offset coefficients are positive but modest in size. The coefficient on changes in outside delinquency rates at

competitors is 13.90 for branch competitors and 25.05 for no-branch competitors, both of which are statistically insignificant. In the case of branch banks, the offset coefficient is smaller in absolute value than the direct spillover coefficient, which is -23.19. However, because the coefficients do not differ very much in absolute value, we cannot rule out the possibility that the offset fully makes up for the direct spillover effect. As Table A22 shows, the sum of the two coefficients—our measure of the net change in lending--is only -9.29 for branch banks, which is statistically insignificant. In contrast, the offset coefficient for no-branch competitors is much smaller in absolute value than the direct spillover coefficient for no-branch banks (-117.21), implying that the net effect on lending is highly negative. Specifically, Table A22 shows that the sum of the offset coefficient and the direct spillover coefficient for no-branch banks is -92.17, which is significant at the 5 percent level. Table A22 shows further that the difference between branch banks and no-branch banks in the net effect on lending is both large (-82.88) and statistically significant.

In the market regression (middle two columns of Table A21), the coefficient on the average change in the outside delinquency rate is small and insignificant for branch banks (6.23) but highly negative and significant at the 1 percent level for no-branch banks (-114.36). Thus, as in the bank regression, we can be confident that lending at competing banks does not increase enough to fully offset the direct spillover effect on lending when outside mortgage distress is experienced by no-branch banks, but not when the outside distress is experienced by branch banks. The last column in Table A22 shows that the difference in the net effect of outside mortgage distress at the two types of banks is both large (-120.59) and statistically significant.

The results of the competitor regression (last two columns of Table A21) are generally consistent with those of the bank and market regressions. The coefficient on the change in the

bank's outside delinquency rate, our measure of offset in this regression, is modest in size for both branch banks and no-branch banks (9.06 and 17.23, respectively). The only difference from the bank regression is that the offset coefficient for branch banks, while small, is statistically significant. As noted earlier, the coefficient on the average change in competitors' outside delinquency rates reflects both the direct spillover of outside mortgage distress at each competitor and the offset to that spillover from other competitors. This coefficient is small and insignificant for branch competitors (8.80) but highly negative and significant for no-branch competitors (-111.18). As in the bank and market regressions, these results allow us to rule out full offset when outside mortgage distress occurs at no-branch banks but not when it occurs at branch banks.

Summary of regression results for Equations (2') and (2). When we take into account degree of periphery as well as branch status, the three regressions suggest that the net effect on lending of outside mortgage distress is highly negative when the distress is experienced by no-branch banks in highly peripheral markets—i.e. in such cases, offset from competitors is far outweighed by direct spillover. The regressions differ, however, on whether the net effect on lending is also negative when the outside distress is experienced by branch banks in moderately and highly peripheral markets. The bank regression implies that the net effect is negative in such cases, while the market and competitor regressions imply that the net effect is close to zero or even positive.

In the bank regression (first two columns of Table A23), the offset coefficients are relatively small and statistically insignificant for all combinations of branch status and degree of periphery except no-branch competitors in core markets.[5] In highly peripheral markets, Table

[5] The offset coefficient for such competitors is large, negative, and statistically significant at the 10 percent level. This is puzzling in that that the direct spillover coefficient for no-branch banks in core markets is small and

A24 shows that the sum of the offset and direct spillover coefficients—our measure of the net effect on lending--is negative and statistically significant at both branch banks and no-branch banks, but especially at no-branch banks (-42.05 at branch banks, which is significant at the 10 percent level, and -145.58 at no-branch banks, which is significant at the 1 percent level). The last column shows that the difference between branch banks and no-branch banks in the net effect on lending in highly peripheral markets is both large (-103.53) and statistically significant. In moderately peripheral markets, the sum of the spillover and offset coefficients is negative for both no-branch banks and branch banks (-39.13 and -62.63, respectively) but is statistically significant only for branch banks. Thus, in contrast to highly peripheral markets, full offset to outside mortgage distress in moderately peripheral markets can be ruled out only for branch banks and not for no-branch banks.

In the market regression (middle two columns of Table A23), the coefficient on the average change in the outside delinquency rate is highly negative and significant at no-branch banks in highly peripheral markets (-151.52), consistent with the bank regression. However, the coefficient on the average change in outside delinquency rates at branch banks in highly peripheral markets is positive and significant (59.25), implying that outside mortgage distress at these banks leads to a net *increase* in lending. Another difference from the bank regression is that at branch banks in moderately peripheral markets, the coefficient on the average change in the outside delinquency rate is relatively small and statistically insignificant, implying no net effect of outside mortgage distress on lending at these banks.

The competitor regression (last two columns of Table A23) is consistent with the bank regression in that the offset coefficients are generally small and statistically insignificant. There

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insignificant, ruling out the possibility that a decline in lending at such banks adversely affects lending at other banks by worsening local economic conditions. It should be noted, however, that no-branch banks in core markets account for only 6 percent of the no-branch observations in our sample.

are two exceptions. The first is the coefficient on the change in the outside delinquency rate at branch banks in highly peripheral markets, which is small (9.41) but significant at the 5 percent level. The second exception is the coefficient on the change in the outside delinquency rate at no-branch banks in core markets, which is both highly negative and significant, just as in the bank regression. The competitor regression is also consistent with the bank regression in implying that the net effect on lending of outside mortgage distress at no-branch banks in highly peripheral markets is highly negative. In particular, the coefficient on the average change in the outside delinquency rate at no-branch competitors in highly peripheral markets is -119.93, which is statistically significant at the 5 percent level. Like the market regression, however, the competitor regression differs from the bank regression in suggesting that the net effect on lending of outside mortgage distress at branch banks in highly peripheral markets is positive. Specifically, the coefficient on the average change in the outside delinquency rate at branch competitors in highly peripheral markets is 68.91, which is significant at the 1 percent level.

Table A19 Definitions and sources for measures of market conditions

Variable	Definition	Source
Log of Pre-crisis Portfolio Originations$_m$	Log of total portfolio originations by all banks in market m in 2006 and 2007	HMDA
ΔMortgage Delinquency Rate$_m$	Same as in Table A1	Derived from Trendata
%ΔHouse Prices$_m$	Percent change in all-transactions House Price Index for market m from 2005:Q2 to 2007:Q2	FHFA
ΔDebt-to-Income Ratio$_{c,m}$	Change from 2005 to 2007 in the debt-to-income ratio of households in county c in market m	Fed. Reserve. Bank of N.Y. and IRS*
ΔDebt-to-Income Ratio$_m$	Weighted average of ΔDebt-to-Income Ratio$_{c,m}$ across all counties in market m, using as weights the share of the county in the 2006-2007 portfolio originations by all banks in market m	
%ΔMedian Household Income$_{c,m}$	Percent change in median household income in county c in market m from 2005 to 2007	U.S. Census Bureau
%ΔMedian Household Income$_m$	Weighted average of %ΔMedian Household Income$_{c,m}$ across all counties in market m, using as weights the share of the county in the 2006-2007 portfolio originations by all banks in market m	
ΔUnemployment Rate$_{c,m}$	Percentage-point change in unemployment rate in county c in market m from 2005 to 2007	U.S. Bureau of Labor Stats.
ΔUnemployment Rate$_m$	Weighted average of ΔUnemployment Rate$_{c,m}$ across all counties in market m, using as weights the share of the county in the 2006-2007 portfolio originations by all banks in market m	

*Downloaded from website of Prof. Amir Sufi (http://faculty.chicagobooth.edu/amir.sufi/data.html)

Table A20 Summary statistics for variables used in market regressions in Tables A20 and A22

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Dependent variable:						
100 × Log Growth of Portfolio Originations	379	-101.11	-96.83	40.5	-252.63	-14.35
Bank characteristics:						
Market Share of Branch Banks	379	0.74	0.76	0.13	0.27	0.97
Market Share of Multimarket Banks	379	0.97	1.00	0.05	0.61	1.00
Market Share of Core Banks	379	0.19	0.15	0.17	0.00	0.83
Market Share of Moderately Peripheral Banks	379	0.17	0.11	0.21	0.00	0.99
Market Share of Highly Peripheral Banks	379	0.61	0.64	0.24	0.00	1.00
100 × Av. Log of Pre-crisis Originations	379	1031.92	1007.59	144.34	741.71	1505.84
Av. Size	379	18.43	18.66	1.33	14.42	20.82
Av. ΔCapital-Asset Ratio	379	0.49	0.45	0.44	-0.49	3.49
Av. ΔNon-mtg. Delinquency Rate	379	0.27	0.26	0.11	0.02	1.10
Av. ΔOutside Del. Rate (multimarket banks)	379	0.88	0.90	0.22	0.05	1.25
Av. ΔOutside Del. Rate (core market)	363	0.49	0.34	0.70	-0.73	3.42
Av. ΔOutside Del. Rate (mod. periph. market)	352	0.57	0.59	0.45	-0.60	2.25
Av. ΔOutside Del. Rate (highly periph. market)	379	1.06	1.09	0.09	0.57	1.22
Market measures:						
100 × Log of Pre-crisis Portfolio Originations	379	1277.36	1255.70	148.02	982.47	1731.88
ΔMortgage Delinquency Rate	379	0.46	0.24	0.94	-1.71	4.78
%ΔHouse Prices	379	11.16	9.74	9.06	-7.92	42.64
ΔDebt-to-Income Ratio	379	0.15	0.09	0.18	-0.09	0.88
%ΔMedian Household Income	379	9.00	8.77	4.60	-5.13	25.60
ΔUnemployment Rate	379	-0.49	-0.48	0.75	-5.32	4.01

Note: For the bank controls, the sample statistics reported are for the weighted average of the variable among all banks in the market, using as weights the share of the bank in total pre-crisis originations. For outside mortgage distress, the sample statistics reported are for the weighted average value of ΔOutside Delinquency Rate among the indicated type of bank in the market, using as weights the share of the bank in the total pre-crisis originations of that type of bank.

Table A21: Regressions testing for offset by competitors—Equation (1)

	Tobit regression for 100 × log of crisis originations at bank		OLS regression for 100 × log growth of originations in market		OLS regression for 100 × log growth of originations at bank's competitors	
	Branch	No-branch	Branch	No-branch	Branch	No-branch
100 × Log of Pre-crisis Originations	0.84***	0.88***	-0.16***	-0.20**	-0.12***	-0.03
	[0.03]	[0.06]	[0.06]	[0.09]	[0.04]	[0.06]
Size	-4.88***	-3.76	-12.63***	12.19*	-12.89***	6.93
	[1.86]	[5.65]	[2.00]	[6.94]	[1.77]	[6.12]
ΔCapital-Asset Ratio	-1.46	-8.99***	-4.41	-8.34	-5.42**	-7.92
	[2.12]	[10.43]	[2.89]	[7.04]	[2.84]	[6.32]
ΔNon-mortgage Delinquency Ratio	-13.48***	-112.45***	-32.06**	-122.62***	-53.75***	-147.76***
	[4.36]	[33.18]	[12.66]	[38.64]	[11.49]	[36.28]
Multimarket Bank	9.02*	-74.32	-43.68**	-371.71***	-34.06**	-396.94**
	[5.03]	[61.36]	[20.34]	[132.81]	[18.59]	[119.85]
Multimarket Bank × ΔOutside Delinquency Rate	**-23.19*** **	**-117.21*** **	**6.23**	**-114.36*** **	**8.80**	**-111.18*** **
	[6.42]	[33.88]	[11.82]	[43.88]	[10.60]	[38.23]
ΔOutside Delinquency Rate at Other Bank(s)	**13.90**	**25.05**			**9.06** **	**17.23**
	[12.13]	[19.01]			[4.55]	[13.15]
100 × Log of Market Pre-crisis Originations	0.13***		0.20***		0.11***	
	[0.03]		[0.05]		[0.03]	
Change in Delinquency Rate	-0.78		-3.92*		-3.98*	
	[3.91]		[2.21]		[2.30]	
Change in House Prices	-0.33		-0.24		-0.45**	
	[0.29]		[.18]		[0.18]	
Change in Debt-to-Income Ratio	-75.07***		-70.06***		-66.71***	
	[18.68]		[12.55]		[11.67]	
Log Growth in Median Household Income	1.82***		1.32***		1.23***	
	[0.47]		[0.28]		[0.27]	
Change in Unemployment Rate	-4.52*		-4.38***		-4.04***	
	[2.54]		[1.40]		[1.13]	
Constant	-23.72		104.71***		178.45***	
	[42.82]		[38.65]		[30.30]	
Number of observations	14,455		379		14,455	
Pseudo R-squared	0.08					
Adjusted R-squared			0.73		0.74	

Note: All three regressions are for portfolio originations, use Subsamples 1 and 2 in Table 1, and include measures of market conditions instead of market dummies. In the bank regression, ΔOutside Delinquency Rate at Other Bank(s) is the weighted sum of ΔOutside Delinquency Rate at competitors with the indicated branch status, where the weight depends on the competitor's market share as described in the text. In this regression, the bank controls and

Multimarket Bank × ΔOutside Delinquency Rate are the values for a bank with the indicated branch status. In the market regression, all variables are weighted sums of the values for banks with the indicated branch status, with the weight equal to the market share of the bank. In the competitor regression, ΔOutside Delinquency Rate at Other Bank(s) is the value of ΔOutside Delinquency Rate at a bank with the indicated branch status, adjusted for the bank's market share as described in the text. In this regression, the bank controls and Multimarket Bank × ΔOutside Delinquency Rate are weighted sums of the values for competitors with the indicated branch status, with the weight equal to the market share of the competitor divided by the market share of all competitors. In the bank regression, the lower bound for the Tobit is set equal to the minimum uncensored value of the dependent variable in the sample, as in Carson and Sun (2007) and Cameron and Trivedi (2009). In the bank and competitor regressions, all continuous variables at the bank level are winsorized at the 1% level, using all observations in the sample for which the variable is defined. Robust standard errors are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively. Standard errors are clustered at the bank and market levels in the bank and competitor regressions.

Table A22: Tests for differences in estimated coefficients in Table A21

Variable	(A) Branch	(B) No-branch	Difference (B) – (A)
Bank regression			
(1) Multimarket Bank × ΔOutside Delinquency Rate	-23.19***	-117.21***	-94.03***
	[6.42]	[33.88]	[30.88]
(2) ΔOutside Delinquency Rate at Other Bank(s)	13.90	25.05	11.15
	[12.19]	[19.01]	[13.46]
Sum (net effect)			
(1) + (2)	-9.29	-92.17**	-82.88**
	[12.20]	[37.39]	[34.64]
Market regression			
Multimarket Bank × ΔOutside Delinquency Rate	6.23	-114.36***	-120.59***
	[11.82]	[43.88]	[46.42]

Table A23: Regressions testing for offset by competitors—Equation (2)

Variable	Tobit regression for 100 × log of crisis originations at bank		OLS regression for 100 × log growth of originations in market		OLS regression for 100 × log growth of originations at bank's competitors	
	Branch	No-branch	Branch	No-branch	Branch	No-branch
100 × Log of Pre-crisis Originations	0.80***	0.84***	-0.24***	-0.25***	-0.15***	-0.04
	[0.03]	[0.07]	[0.06]	[0.08]	[0.05]	[0.07]
Size	3.13	4.40	-1.58	12.38	-9.08***	4.49
	[2.58]	[7.69]	[3.43]	[8.08]	[2.36]	[7.19]
ΔCapital-Asset Ratio	-2.04	-7.97	-3.01	-13.86*	-4.24	-10.46
	[2.06]	[9.59]	[2.58]	[7.54]	[2.72]	[6.68]
ΔNon-mortgage Delinquency Ratio	-15.52***	-108.58***	-23.72**	-129.04***	-44.09***	-156.72***
	[4.16]	[30.69]	[11.40]	[40.39]	[11.40]	[36.41]
Core Market	-2.70	-114.64*	-46.19**	-181.84	-31.76*	-268.19**
	[4.87]	[62.59]	[20.03]	[146.38]	[18.40]	[135.04]
Core Market × ΔOutside Delinquency Rate	**-9.58***	**-7.01**	**-0.80**	**-165.64***	**3.27**	**-199.53***
	[5.15]	[16.81]	[13.27]	[99.33]	[12.01]	[104.28]
Moderately Peripheral Market	-5.94	-107.35	-76.03***	-373.30**	-38.05	-360.71***
	[9.58]	[69.17]	[26.90]	[151.25]	[24.02]	[137.66]
Moderately Peripheral Market × ΔOutside Delinquency Rate	**-31.52****	**-88.37*****	**-19.24**	**18.99**	**-9.84**	**-65.32**
	[13.02]	[26.46]	[19.45]	[76.60]	[17.14]	[73.06]
Highly Peripheral Market	-25.20	-90.66	-181.42***	-222.73	-126.40***	-298.09**
	[20.38]	[84.65]	[41.60]	[168.17]	[34.81]	[152.32]
Highly Peripheral Market × ΔOutside Delinquency Rate	**-57.31*****	**-162.76*****	**59.25****	**-151.52****	**68.91*****	**-119.93****
	[21.27]	[51.69]	[26.13]	[65.56]	[23.08]	[49.67]
ΔOutside Del. Rate at Other Bank(s) in Core Market	**4.35**	**-188.55***			**-16.00**	**-163.02****
	[13.26]	[96.65]			[11.13]	[80.79]
ΔOutside Del. Rate at Other Bank(s) in Mod. Periph. Market	**-7.61**	**25.74**			**8.91**	**-20.63**
	[14.58]	[28.50]			[10.53]	[22.41]
ΔOutside Del. at Other-Bank(s) in Highly Periph. Market	**15.26**	**17.18**			**9.41****	**17.62**
	[12.52]	[17.29]			[4.39]	[13.33]
100 ×Log of Market Pre-crisis Originations	0.14***		0.22***		0.12***	
	[0.03]		[0.05]		[0.04]	
Change in Delinquency Rate	-1.50		-5.24**		-4.16*	
	[3.47]		[2.15]		[2.32]	
Change in House Prices	-0.33		-0.37**		-0.50***	
	[0.28]		[0.18]		[0.18]	

Table A23: Regressions testing for offset by competitors—Equation (2) (continued)

Variable	Tobit regression for 100 × log of crisis originations at bank	OLS regression for 100 × log growth of originations in market	OLS regression for 100 × log growth of originations at bank's competitors
Change in Debt-to-Income Ratio	-72.19***	-59.78***	-63.28***
	[17.56]	[12.40]]	[11.61]
Log Growth in Median Household Income	1.63***	1.15***	1.17***
	[0.46]	[0.26]	[0.27]
Change in Unemployment Rate	-5.01*	-4.07***	-4.00***
	[2.79]	[1.39]	[1.10]
Constant	-99.44**	12.23	141.12***
	[43.69]	[40.84]	[31.46]
Number of observations	14,455		14,455
Pseudo R-squared	0.09		
Adjusted R-squared		0.74	0.75

Note: All three regressions are for portfolio originations, use Subsamples 1 and 2 in Table 1in the main text, and include measures of market conditions instead of market dummies. In the bank regression, ΔOutside Delinquency Rate at Other Bank(s) in a particular type of market is the weighted sum of ΔOutside Delinquency Rate at competitors with the indicated branch status, where the weight depends on the competitor's market share as described in the text. In this regression, the bank controls and ΔOutside Delinquency Rate in a particular type of market are the values for a bank with the indicated branch status, just as in the baseline regression. In the market regression, the bank controls and Multimarket Bank × ΔOutside Delinquency Rate in a particular type of market are weighted sums of the values for banks with the indicated branch status, with the weight equal to the market share of the bank. In the competitor regression, ΔOutside Delinquency Rate at Other Bank(s) in a particular type of market is the value for a bank with the indicated branch status, adjusted for the bank's market share as described in the text. In this regression, the bank controls and ΔOutside Delinquency Rate in a particular type of market are weighted sums of the values for competitors with the indicated branch status, with the weight equal to the market share of the competitor divided by the market share of all competitors. In the bank regression, the lower bound for the Tobit is set equal to the minimum uncensored value of the dependent variable in the sample, as in Carson and Sun (2007) and Cameron and Trivedi (2009). In the bank and competitor regressions, all continuous variables at the bank level are winsorized at the 1% level, using all observations in the sample for which the variable is defined. Robust standard errors are in brackets, with *, **, and *** indicating significance at 10%, 5% and 1%, respectively. Standard errors are clustered at the bank and market levels in the bank and competitor regressions.

Table A24: Tests for differences in estimated coefficients in Table A23

Variable	(A) Branch	(B) No-branch	Difference (B) – (A)
Bank regression			
(1) Core Market × ΔOutside Delinquency Rate	-9.58*	-7.01	2.57
	[5.15]	[16.81]	[16.97]
(2) ΔOutside Del. Rate at Other Bank(s) in Core Market	4.35	-188.55**	-192.90**
	[13.26]	[96.65]	[96.25]
(3) Moderately Peripheral Market × ΔOutside Delinquency Rate	-31.52**	-88.37***	-56.85**
	[13.02]	[26.46]	[26.51]
(4) ΔOutside Del. Rate at Other Bank(s) in Mod. Periph. Market	-7.61	25.74	33.35
	[14.58]	[28.50]	[30.01]
(5) Highly Peripheral Market × ΔOutside Delinquency Rate	-57.31***	-162.76***	-105.45**
	[21.27]	[51.69]	[47.98]
(6) ΔOutside Del. Rate at Other Bank(s) in Highly Periph. Market	15.26	17.18	1.91
	[12.52]	[17.29]	[12.06]
Sums (net effects)			
(7): (1) + (2)	-5.23	-195.56**	-190.33**
	[13.19]	[95.74]	[95.75]
(8): (3) + (4)	-39.13**	-62.63	-23.50
	[19.12]	[38.48]	[40.27]
(9): (5) + (6)	-42.05*	-145.58***	-103.53**
	[24.24]	[54.00]	[52.73]
Differences in sums (effect of degree of periphery)			
(8) – (7)	-33.90*	132.93	166.83*
	[20.64]	[93.79]	[93.38]
(9) – (7)	-36.82	49.97	86.80
	[24.84]	[107.26]	[106.76]
(9) – (8)	-2.92	-82.95	-80.03
	[20.84]	[55.84]	[58.32]

Table A24: Tests for differences in estimated interaction coefficients in Table A23 (continued)

Variable	(A) Branch	(B) No-branch	Difference (B) – (A)
Market regression			
1) Core Market × ΔOutside Delinquency Rate	-0.80	-165.64*	-164.84
	[13.27]	[99.33]	[102.72]
(2) Moderately Peripheral Market × ΔOutside Delinquency Rate	-19.24	18.99	38.23
	[19.45]	[76.60]	[79.51]
(3) Highly Peripheral Market × ΔOutside Delinquency Rate	59.25**	-151.52**	-210.77***
	[26.13]	[65.56]	[71.99]
Differences (effect of degree of periphery)			
(2) – (1)	-18.44	184.63	203.07
	[20.96]	[136.01]	[137.44]
(3) – (1)	60.05**	14.12	-45.93
	[29.43]	[120.40]	[126.76]
(3) – (2)	78.48**	-170.51*	-248.99**
	[30.52]	[94.11]	[104.36]