Intermediation in the Mortgage Market

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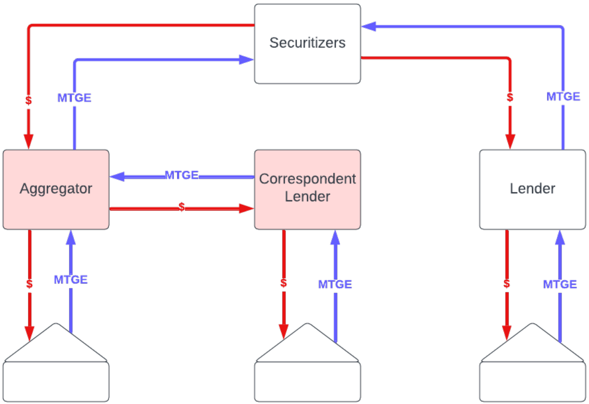
The Mortgage Market Research Conference

May 16, 2024

Motivation

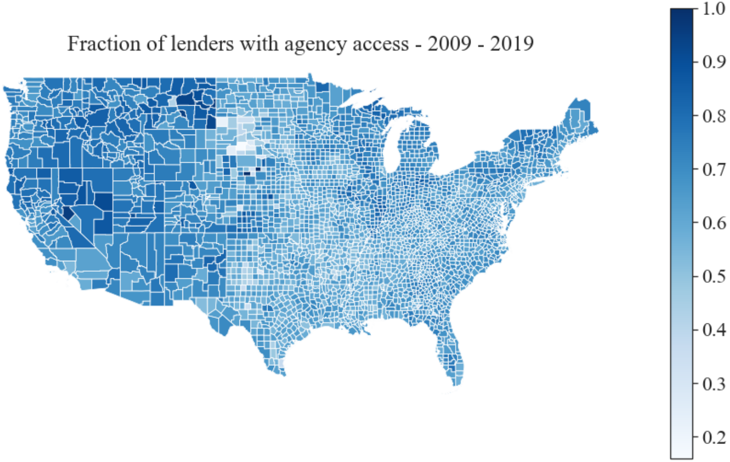
- Access to credit is a critical component of economic stability and growth
- Low-income borrowers often struggle to access credit
  - Demand side: financial literacy, lack of credit history (Lusardi and Scheresberg, 2013; Conklin 2017)
  - Supply side: bank branch presence, human capital allocation (Celerier and Matray, 2019; Huang et al, 2024; Cespedes et al, 2024)
- This paper: new supply-side frictions for credit access of low income borrowers in the mortgage market - matching frictions in mortgage aggregation

Industry structure of U.S. mortgage market

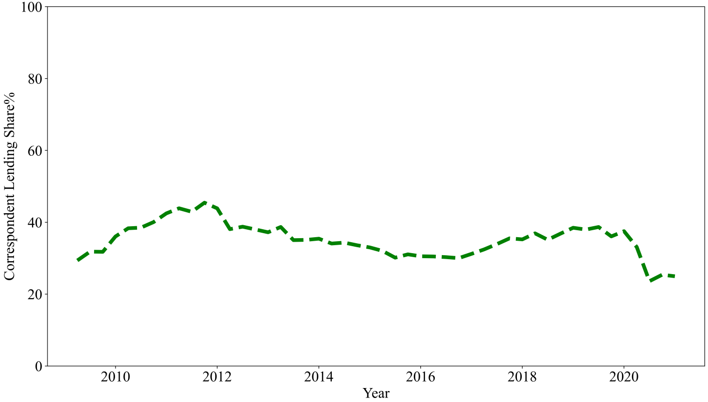


- Examples of aggregators: Wells Fargo, Bank of America
- Examples of correspondent lenders: Hendricks County Bank, Odyssey Funding LLC

Imbalanced direct access to agency securitization

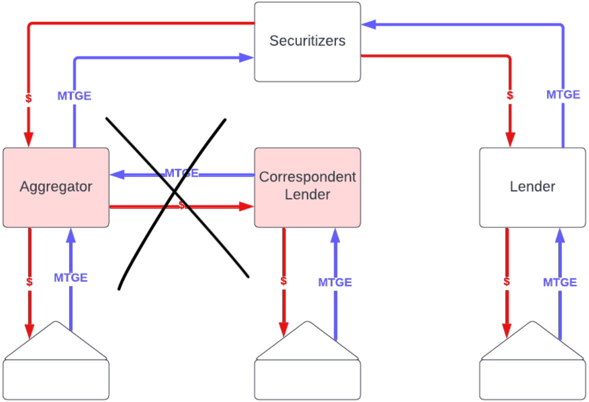


Share of mortgages from correspondent lending channel



Data source: Fannie Mae and Freddie Mac single family loan performance data

Research question



- How do disruptions to the aggregation network affect lending?

Overview

- Mortgage aggregation eases securitization frictions for correspondent lenders
  - Decrease in mortgage aggregation reduces mortgage origination by correspondent lenders
- Matching frictions in aggregation network drive the reduction in credit supply
  - Correspondent lenders with ex-ante lower number of aggregators, higher concentration in selling and lower number of nearby aggregators experience a larger decline in credit supply
- Low-income borrowers experience larger credit supply decrease and higher rejection rates
  - Higher correspondent lending share in low-income areas
  - Higher marginal costs of lending to low-income borrowers

Data and Methodology

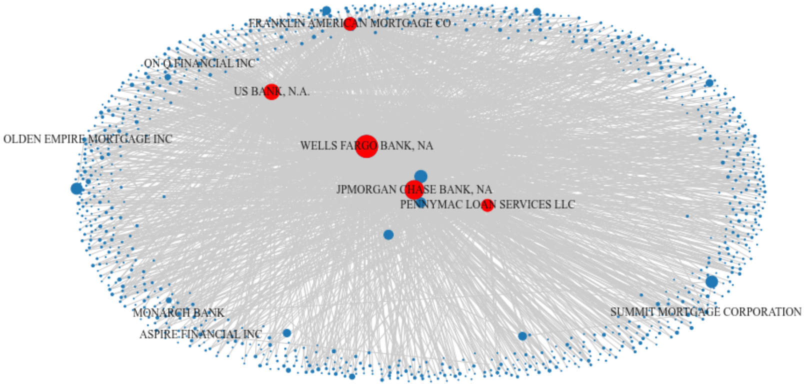
Data sources

- Home Mortgage Disclosure Act (HMDA)
  - Annual mortgage application-level data with loan & borrower characteristics & lender identity
  - Origination, purchase, and rejections
- Fannie Mae and Freddie Mac dataset
  - Loan level dataset with loan characteristics and loan performance
  - Covers fixed rate mortgages sold to Fannie Mae and Freddie Mac
- Bank call reports and shadow bank mortgage call reports (MCR)
  - Balance sheet and income statements for banks and shadow banks
- American Community Survey
  - County level racial and ethnic composition, education, income, homeownership etc

Sample construction

- Construct a new dataset for aggregation network ▸ HMDA details
  - Public HMDA does not have loan id that links originated loans and aggregated loans
  - Matching based on censustract, loan amount and other loan characteristics
- Aggregators summary statistics ▸ Summary statistics
  - On average 525 aggregators per year, and a median aggregator buys from 7 sellers
  - Aggregation amount is concentrated in large aggregators
  - Aggregators on average originate $2 billion and aggregate $764 million mortgages per year
- Correspondent lender summary statistics
  - On average 5368 sellers per year, and a median correspondent lender sells to 5 aggregators
  - Correspondent lenders originate less, have lower liquidity and higher capital
  - Correspondent lenders on average originate $737 million and sell $178 million mortgages to aggregators per year

Main aggregators



- How do disruptions to the aggregation network affect lending?

Identification - Background

- Plausibly exogeneous shock to aggregation: U.S. implementation of Basel III standards on mortgage servicing rights (MSRs) in 2012Q2 differed from international standards and largely unanticipated (Irani et al, RFS 2021)
  - Cap on MSRs' contribution to Tier 1 capital lowered from 50% to 10%
  - Risk weight on MSRs increased from 100% to 250%

- Relevance between MSRs and mortgage aggregation: aggregators gain servicing through correspondent lending Relevance

- Punitive MSR treatment $\rightarrow \downarrow$ aggregation $\rightarrow \downarrow$ correspondent lender origination

Measures

- Aggregator level measure: $\frac{MSR_{b_{2008}}}{Tier1Capital_{b_{2008}}}$ (Buchak et al, 2018)
- Construct correspondent lender level treatment variable

$$\text{MSR\%}_s \equiv \sum_{b\in s}\left(\frac{MSR_{b_{2008}}}{Tier1Capital_{b_{2008}}} \times \frac{Aggregation_{bs_{2008}}}{\sum_{b\in s} Aggregation_{b_{2008}}}\right) \times 100$$

- Correspondent lender level analysis

$$y_{s,t} = \beta \times \text{MSR\%}_s \times \text{Post}_t + FE_s + FE_t + \epsilon_{s,t}$$

Aggregation Network & Credit Supply

Basel III capital requirement decreases aggregation amount

$$y_{s,t} = \beta \times \text{MSR\%}_s \times \text{Post}_t + FE_s + FE_t + \epsilon_{s,t}$$

Dependent Variable:	Log Aggregation Amt		
Model:	(1)	(2)	(3)
$MSR\%_s \times$ Post	-1.19***	-1.12***	-0.914***
	(0.302)	(0.302)	(0.223)
$MSR\%_s$	8.34***	8.27***	
	(0.441)	(0.440)	
Post	0.645***		
	(0.061)		
Fixed-effects			
Year		Yes	Yes
Correspondent lender			Yes
Fit statistics			
Observations	10,178	10,178	10,178
R^2	0.165	0.170	0.899

- Correspondent lenders with higher MSR exposure experience lower aggregation volume
- $\uparrow$ MSR exposure ($\text{MSR\%}_s$) by 1 SD $\rightarrow \downarrow$ 10.26% decrease in aggregation volume

Aggregation eases securitization frictions of correspondent lenders

$$y_{s,t} = \beta \times \text{MSR\%}_s \times \text{Post}_t + FE_s + FE_t + \epsilon_{s,t}$$

Dependent Variables:	Log Ori Amount		
Sample:	All	Agency	No Agency
Model:	(1)	(2)	(3)
$MSR\%_s$ × Post	-0.174	-0.196	-0.417**
	(0.140)	(0.179)	(0.192)
Fixed-effects			
Year	Yes	Yes	Yes
Correspondent lender	Yes	Yes	Yes
Fit statistics			
Observations	10,178	6,386	3,792
R^2	0.937	0.935	0.910

- Correspondent lenders with higher MSR exposure originate less mortgages
- $\uparrow$ MSR exposure ($\text{MSR\%}_s$) by 1 SD $\rightarrow \downarrow$ 4.42% decrease in origination volume

Identification concerns

- Loan demand drives correspondent lender level results
  - Correspondent lender-aggregator pair-level analysis
  - Lender-county level results with rejection rates as a dependent variable
- Non-random match between correspondent lenders and aggregators
  - Parallel trends in both purchase amount and origination amount
  - Explore relationship formation due to correspondent lender/aggregator merger and acquisition
- Correlation between exposure to treated aggregators and direct treatment effect from Basel III capital requirement
  - Insiginificant correlation between Basel III capital shortfall and treatment variable

Seller-year FE | Purchase | Origination | Relationship formation | Lender-county Rej | Correlation

Why does aggregation matter for origination?

- Matching frictions between aggreagtors and correspondent lenders
  - Sticky relationship between aggregators and correspondent lenders ▸ Sticky
  - Headquarter distance as a determinant for relationship formation ▸ Distance
  - Origination volume reduces more when correspondent lenders have (i) ex-ante small number of aggregators (ii) high concentration in selling mortgages and (iii) small number of nearby aggregators
- Alternative funding sources
  - Limited increase in deposit funding for mortgage origination ▸ Deposits
  - More business relationships with government agencies, especially for small correspondent lenders ▸ Agencies

Matching frictions and credit supply

Dependent Variable:	Log Ori Amount			
Model:	(1)	(2)	(3)	(4)
$MSR\%_s$ × Post × HighReliance	-0.472***			
	(0.140)			
$MSR\%_s$ × Post × LowNumPurchasers		-1.19***		
		(0.202)		
$MSR\%_s$ × Post × HighHHI			-0.979***	
			(0.139)	
$MSR\%_s$ × Post × OutsideOption				0.052***
				(0.002)
Correspondent lender	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
County-year	Yes	Yes	Yes	Yes
Correspondent lender-County	Yes	Yes	Yes	Yes
Observations	538,013	538,013	538,013	538,013
R^2	0.815	0.815	0.815	0.815

- Negative effect on purchase volume is weaker for downstream lenders with multiple aggregators, low concentration in selling and more nearby aggregators

Aggregate Effects

Identification - County level

- Utilize regional heterogeneity in exposure to bank aggregators before Basel III
- Treatment variable: ex ante aggregation-weighted MSRs as % of banks' capital in county c

$$\text{MSR\%}_c \equiv \sum_{b \in c} \left(\frac{MSR_{b_{2011}}}{Tier1Capital_{b_{2011}}} \times \frac{Aggregation_{b_{2011}}}{\sum_{b \in c} Aggregation_{b_{2011}}} \right) \times 100$$

- Using aggregation market share as weights
- Parallel trends at the county level

T Purchase | T Origination | Purchase | Origination

Credit access for low income borrowers

Dependent Variables:	Log Amount	Rejection Rate
Model:	(1)	(2)
$MSR\%_c \times$ Post	-1.9***	0.21***
	(0.54)	(0.08)
Fixed-effects		
Year	Yes	Yes
county	Yes	Yes
Fit statistics		
Observations	17,253	16,121
R^2	0.766	0.346

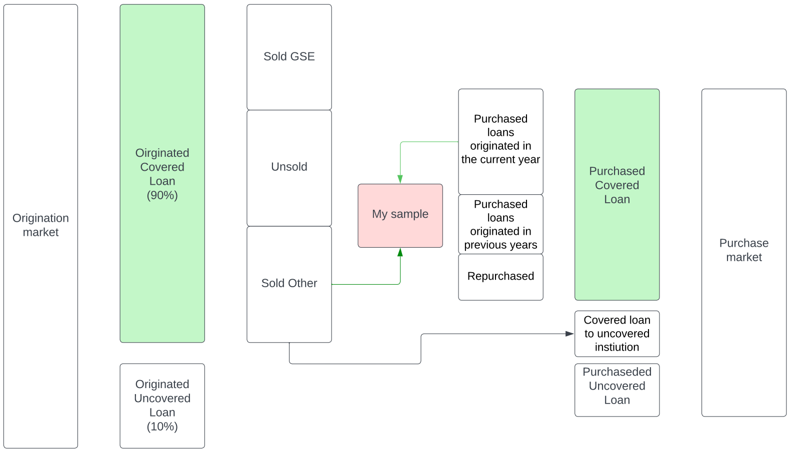
- Correspondent lenders serve **low income** areas ▸ Binned Scatter
- Correspondent lenders decrease loan origination to low income borrowers and rejection rate for loan application increases

Conclusion

- Documented new empirical facts on the aggregation network in the U.S. mortgage market in the post-crisis period
- Mortgage aggregation eases securitization frictions for correspondent lenders
  - Decrease in mortgage aggregation reduces mortgage origination by correspondent lenders
- Highlighted the impact of matching frictions in aggregation market on credit access of low income borrowers

Appendix

Sample



Return

Summary statistics of aggregators and correspondent lenders

	N	Mean	Std	25%	50%	75%
Panel A: Aggregators						
Matched Purchase Amt	10727	764,824.71	5,602,004.18	661.50	4,648.00	35,885.50
Origination Amt	10727	2,331,264.72	11,972,468.98	19,174.00	123,321.00	715,892.50
LogAssets	6615	14.21	2.05	12.81	13.83	15.40
LiquidityRatio	6615	21.24%	12.72%	12.42%	19.22%	28.11%
CapitalRatio	6612	11.36%	6.76%	8.31%	9.94%	12.31%
ROA	6601	0.20%	0.98%	0.11%	0.22%	0.33%
Panel B: Correspondent lenders						
Matched Sell Amt	31704	178,603.78	646,697.29	1,860.00	19,032.00	128,158.50
Origination Amt	31704	737,314.84	4,926,938.76	31,838.00	102,136.50	354,437.25
LogAssets	7945	13.06	1.60	12.15	12.95	13.84
LiquidityRatio	7945	19.06%	12.27%	10.34%	16.92%	25.47%
CapitalRatio	7945	13.58%	8.58%	9.74%	11.13%	13.71%
ROA	7944	0.34%	1.50%	0.13%	0.25%	0.37%

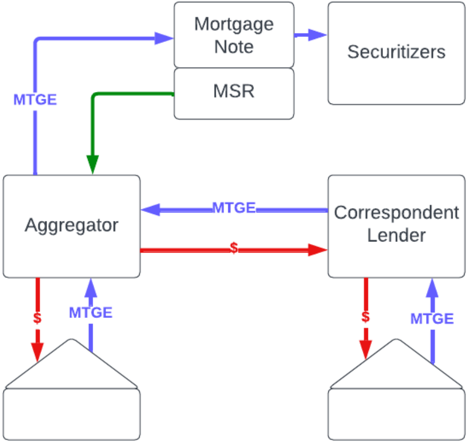
Return

Relevance between MSRs and mortgage aggregation

- Mortgage servicing right is an asset created when loan is securitized Institutional details
- Correspondent lenders have minimum exposure to MSRs Density plot
- Aggregators purchase mortgages to obtain MSRs
  - Reuters: “Banks typically use correspondent lending to generate more mortgages to, in turn, sell to investors and service them.”
  - Ocwen Fianncial Corp 2024 10-K: “We originate and purchase residential mortgage loans that we promptly sell or securitize on a servicing retained basis, thereby generating mortgage servicing rights.”
- Correlation between MSRs and aggregation market share Correlation

Return

Relevance - MSR and mortgage aggregation



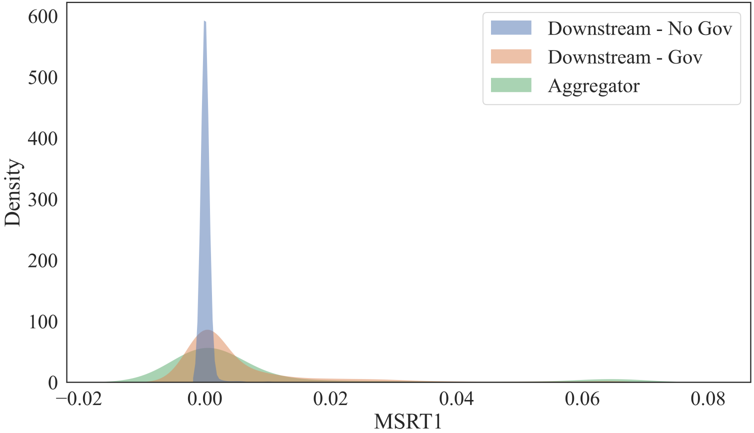
Return

Correlation between MSR exposure and aggregation market share

Dependent Variable:	MktShare
Model:	(1)
MSR_b	0.059^{***}
	(0.003)
Constant	0.002^{***}
	(0.0003)
Fit statistics	
Observations	9,639
R^2	0.029

Return

Distribution of MSR exposure by lender type



Return

Aggregator-lender level - aggregation amount

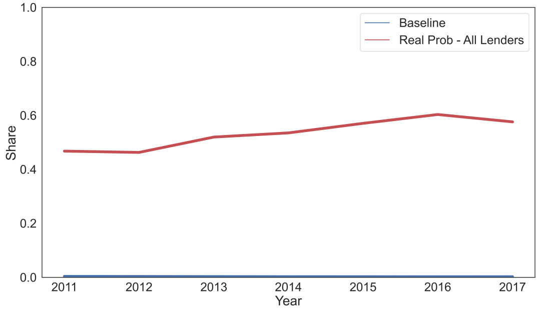
$$y_{s,b,c,t} = \beta \times \text{MSR\%}_b \times \text{Post}_t + FE_{c,t} + FE_{s,t} + FE_{s,b} + \epsilon_{s,b,c,t}$$

Dependent Variable:	Log aggregation amount				
Model:	(1)	(2)	(3)	(4)	(5)
$\text{MSR}_b \times \text{Post}$	-1.11***	-0.931***	-0.788***	-1.04***	-1.13***
	(0.147)	(0.146)	(0.139)	(0.134)	(0.115)
MSR_b	6.97***	6.93***			
	(0.107)	(0.107)			
Post	0.964***				
	(0.038)				
Fixed-effects					
Year		Yes	Yes	Yes	Yes
Purchaser			Yes	Yes	Yes
Lender-Year				Yes	Yes
Lender-Aggregator					Yes
Fit statistics					
Observations	107,145	107,145	107,145	107,145	107,145
R^2	0.07	0.08	0.22	0.41	0.81

- Lender-year fixed effects (Column 4) account for correspondent side supply of mortgages for sale

Return

Sticky correspondent lender-aggregator relationship



- An aggregator that served as the prior aggregator of a correspondent lender has a 50 - 60 percentage point greater likelihood of serving as the new aggregator

▸ Regression results

Distance as a determinant for relationship formation

Dependent Variable:	Dummy - Aggregation relationship				
Model:	(1)	(2)	(3)	(4)	(5)
	Full Sample	500 km	1000 KM	Large lender	Small lender
Log(1+Distance)	-0.930***	-1.35***	-1.22***	-0.439***	-1.07***
	(0.013)	(0.034)	(0.022)	(0.021)	(0.029)
Fixed-effects					
Lender-Year	Yes	Yes	Yes	Yes	Yes
Aggregator-Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	7,723,460	976,103	2,428,438	1,219,417	1,219,357
R^2	0.294	0.312	0.317	0.172	0.311

- Larger the headquarter distance, lower the likelihood of forming relationships
- Small lenders are more sensitive to headquarter distance when forming relationships with aggregators

Return

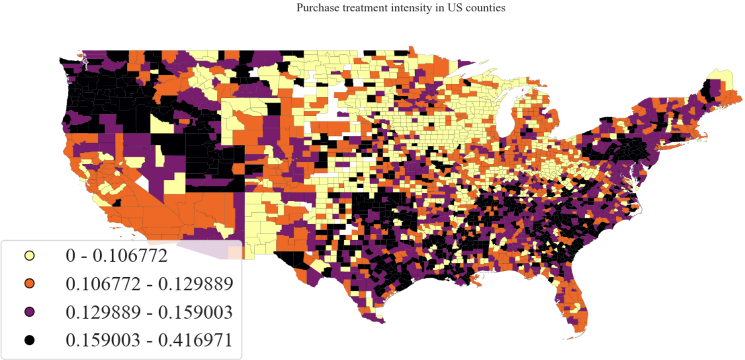
Persistence in seller-purchaser relationship

Dependent Variable:	Current					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Previous	0.530***	0.400***	0.394***	0.389***	0.389***	0.389***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Previous × Shadow seller	0.127***	0.156***	0.157***	0.160***	0.160***	0.154***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Shadow seller	0.011***	0.013***	0.013***	0.008***		
	(0.0004)	(0.0004)	(0.0004)	(0.0004)		
(Intercept)	0.006***					
	(9.79×10^{-5})					
Fixed-effects						
Purchaser		Yes				
Purchcaser-Year			Yes	Yes	Yes	Yes
Seller State-Year			Yes	Yes	Yes	Yes
Seller Quartile-Year				Yes	Yes	Yes
Seller-Year					Yes	
Seller-Purchaser-Year						Yes
Observations	14,407,066	14,407,066	14,407,066	14,404,750	14,404,750	14,404,750
R^2	0.29	0.34	0.37	0.37	0.37	0.37

- A purchaser that served as the prior purchaser of a seller has a 40 percentage point greater likelihood of serving as the new purchaser
- Shadow sellers have higher repeat-selling propensity

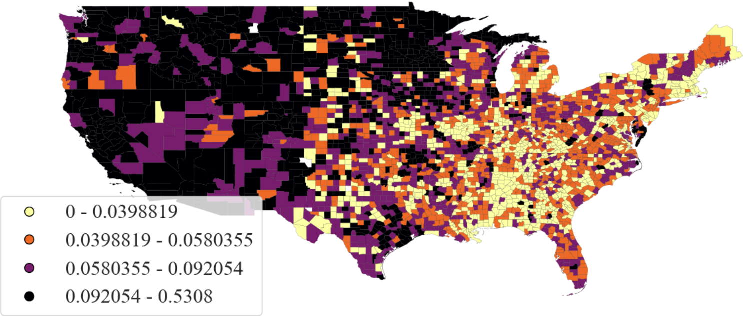
Return

Treatment intensity using purchase market share



Treatment intensity using origination market share

Origination treatment intensity in US counties

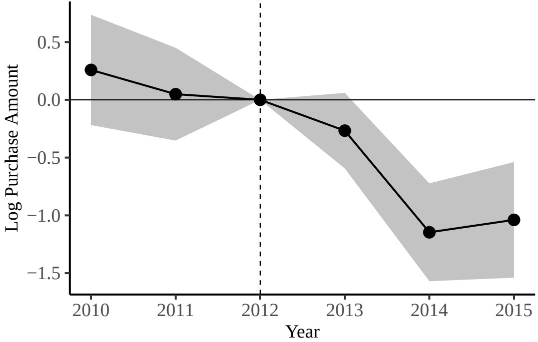


Aggregator balance sheet capacity

	Amt Share			Count Share		
Dependent Variables:	Unsold	GSE	Jumbo	Unsold	GSE	Jumbo
Model:	(1)	(2)	(3)	(4)	(5)	(6)
$\text{MSR}\%_c \times$ Post	-0.101**	0.085*	-0.016*	-0.090*	0.038	-0.009**
	(0.047)	(0.047)	(0.009)	(0.049)	(0.041)	(0.004)
Fixed-effects						
Year	Yes	Yes	Yes	Yes	Yes	Yes
County	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	16,008	16,008	15,692	16,008	16,008	15,692
R^2	0.58	0.75	0.34	0.61	0.77	0.35

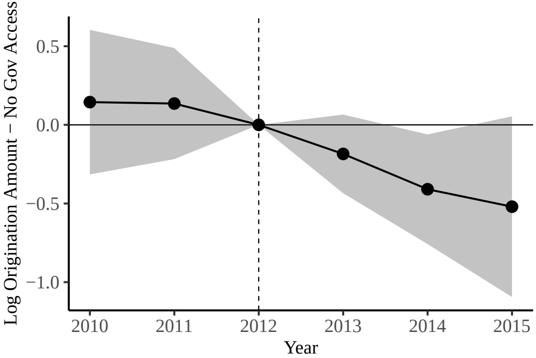
- With increase in shadow bank aggregator market share, purchasers
  - Keep less on balance sheet, sell more mortgages to GSEs, aggregate less jumbo loans

Correspondent lender level - Treatment effect on aggregation



Return

Correspondent lender level - Treatment effect on origination



Return

Relationship formation

Dependent Variable:	Log HomePurc Amt				
Model:	(1)	(2)	(3)	(4)	(5)
$MSR\%_b \times$ Post	-1.20***	-1.03***	-0.949***	-1.19***	-1.28***
	(0.172)	(0.172)	(0.161)	(0.155)	(0.129)
$MSR\%_b$	7.10***	7.07***			
	(0.125)	(0.125)			
Post	0.918***				
	(0.044)				
Fixed-effects					
Year		Yes	Yes	Yes	Yes
Aggregator			Yes	Yes	Yes
Correspondent-Year				Yes	Yes
Correspondent-Aggregator					Yes
Fit statistics					
Observations	80,598	80,598	80,598	80,598	80,598
R^2	0.07	0.08	0.23	0.41	0.81

Return

Lender-county level analysis

Dependent Variables:	Log Ori Amount			Rejection Rate		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
$MSR\%_s$ × Post	-0.977*	-0.854***	-0.957***	0.044	0.046*	0.047*
	(0.576)	(0.198)	(0.204)	(0.053)	(0.024)	(0.026)
Fixed-effects						
Lender	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
County-year		Yes	Yes		Yes	Yes
Lender-county			Yes			Yes
Fit statistics						
Observations	94,731	94,731	94,731	94,731	94,731	94,731
R^2	0.155	0.484	0.859	0.109	0.405	0.778

Return

Dependent Variable:			$MSR\%_s$		
Model:	(1)	(2)	(3)	(4)	(5)
Sample:	All	Subsidiaries	Correspondents	Agency Access	No Agency Access
Shortfall	0.29	0.43	0.02	0.39	-0.22
	(0.31)	(0.75)	(0.33)	(0.55)	(0.42)
Constant	0.16***	0.18***	0.16***	0.14***	0.16***
	(0.01)	(0.03)	(0.01)	(0.02)	(0.01)
Fit statistics					
Observations	504	120	384	147	237
R^2	0.002	0.003	6.14×10^{-6}	0.003	0.001

Return

Deposits for mortgage lending?

Dependent Variable:	LogDeposits		
Model:	(1)	(2)	(3)
$MSR\%_s$ × Post	-0.020	-0.041	0.007
	(0.075)	(0.104)	(0.103)
Seller FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	5,713	3,302	2,411
R^2	0.989	0.990	0.979

- No significant increase in deposits

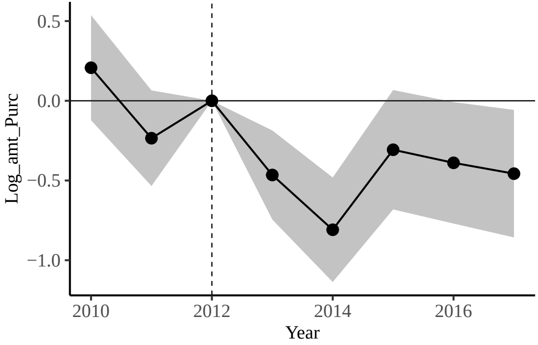
Return

New relationships with government agencies?

Dependent Variable:	Selling directly to agencies	
Model:	(1)	(2)
$MSR\%_s$ × Post	0.510***	0.562***
	(0.096)	(0.098)
$MSR\%_s$ × Post × Big		-0.860*
		(0.452)
Post × Big		0.175*
		(0.093)
Seller FE	Yes	Yes
Year FE	Yes	Yes
Observations	5,508	5,508
R^2	0.532	0.533

- Higher likelihood of establishing new relationships with government agencies

County level: Tighter regulation $\rightarrow$ lower purchase volume



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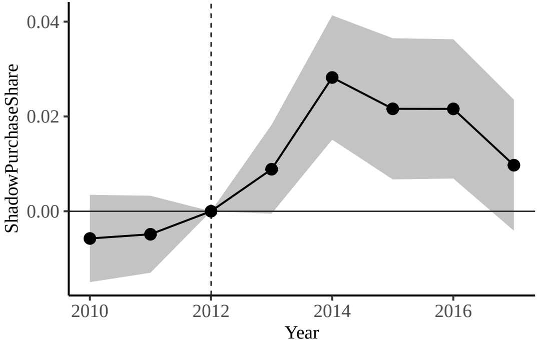
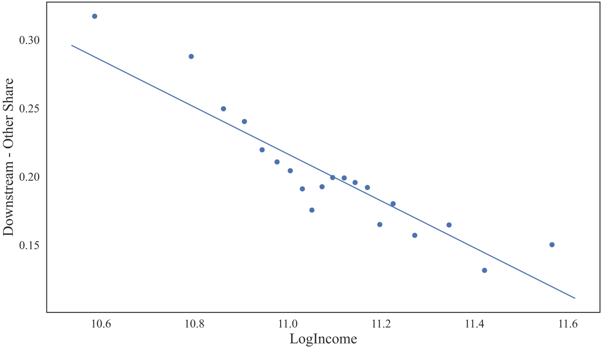
County level: Tighter regulation → Entry of shadow banks into purchase market



Correspondent lenders serve **low income** areas



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