

---

# Forced Asset Sales and the Concentration of Outstanding Debt: Evidence from the Mortgage Market

**Giovanni Favara**

*Federal Reserve Board*

**Mariassunta Giannetti**

*Stockholm School of Economics,  
CEPR & ECGI*

**The views in this presentation do not reflect those of the  
Federal Reserve System or its Board of Governors**

---

# Background

---

- ❑ In **illiquid** markets, forced sales of real and financial assets fetch prices below their fundamental values
  - ❑ Shleifer and Vishny, 1992, Pulvino, 1998, Coval and Stafford, 2007, Benmelech and Bergman, 2008
- ❑ With **collateralized debt**, price discounts due to forced sales may generate price-default spirals
  - ❑ Kiyotaki and Moore, 1997; Gromb and Vayanos, 2002; Brunnermeier and Pedersen, 2009
- ❑ **Why lenders do not avoid price-default spirals by renegotiating instead of liquidating assets?**
  - ❑ **Theoretical and empirical literature on this question is scant**

# This paper

---

## □ Simple model

- Lenders that hold a large share of the outstanding collateralized debt internalize the feedback effects of liquidation decisions on collateral values and may be more inclined to renegotiate defaulting debt

## □ Evidence

- Using data on **foreclosures and house prices** during the 2007-2010 U.S. housing crisis, we find evidence that such incentives are at work and are economically important
  - Loan Level Evidence
  - Zip Code Level Evidence

# Why the housing market?

---

- ❑ Mortgages entitle lenders to seize a house and sell it through a foreclosure process if a borrower defaults
- ❑ Housing market is illiquid: foreclosures are likely to generate price discounts that may spillover to non-distressed neighboring houses
  - ❑ Campbell, Giglio and Pathak, 2011; Harding, Rosenblatt, and Yao, 2009; Anenberg and Kung, 2013; Hartley, 2014.
- ❑ The recent crisis has shown that feedback loops between foreclosures and house prices contributed to the severity of the crisis
  - ❑ Mian, Sufi and Trebbi, 2015, Elul, Souleles, Chomsisengphet, Glennon, and Hunt, 2010, Guren and McQuade, 2013

# A simple framework

---

- ❑ Households' liquidity shocks generate mortgage defaults
- ❑ Foreclosures trigger a decline in house prices, as house sales create an imbalance of housing demand and supply
- ❑ The decline in house prices affect negatively **all** lenders' payoffs
  - ❑ Lower liquidation value
  - ❑ Shock amplification through further defaults
  - ❑ Negative feedback effect on the value of properties previously previously repossessed by the lenders
- ❑ When mortgages are held by competitive lenders, each lender places little weight on the effects of its foreclosure decisions on local house prices, and thus defaults are followed by further defaults
- ❑ Lenders holding a large fraction of the outstanding mortgages in a local market internalize the externality of their liquidation decisions.

# Empirical Implications

In local markets with  $N$  large lenders and a fraction  $e$  of distressed households:

1. Individual foreclosure decisions are negatively related to the share of outstanding mortgages that a lender holds on its balance sheet.
2. The probability of foreclosure is negatively related to the fraction of local distressed households and positively related to the depth of the local housing market.
3. Individual foreclosure decisions are strategic substitutes. Therefore, each lender probability of foreclosures increases in the share of the loans retained by the other large lenders.
4. Foreclosure are negatively related to the overall concentration of outstanding mortgages on lenders' balance sheets.
5. House prices increase in the overall concentration of outstanding loans on lenders' balance sheets.

# Empirical analysis

---

## ❑ Loan level analysis:

- ❑ Link mortgage origination with mortgage performance
- ❑ Test if the *same* lender has different incentives to liquidate defaulting mortgages in a given neighborhood (census tract) depending on the share of outstanding loans retained

## ❑ Zip codes level analysis:

- ❑ Zip codes are the finest geographical units for which we have data on the concentration of outstanding mortgages and house prices
- ❑ Foreclosures create externalities within narrow geographical areas (Campbell, Giglio and Pathak, 2011; Anenberg and Kung, 2014, Mian, Sufi, Trebbi, 2015)

# Loan-level analysis

---

## ❑ Merged HMDA-LPS data

- ❑ Merge loans originated between 2004 and 2006 (from HMDA) with loan performance from 2007 to 2010 (from LPS)
- ❑ Test if the *same* bank has different incentives to liquidate defaulting mortgages depending on the share of outstanding loans retained in a given neighborhood

## ❑ Data issues

- ❑ LPS collects only mortgages serviced by third-party servicers



# Loan-Level regressions

---

$$\Pr(\text{For} \mid \text{Delinquency})_{i,l,z,07-10} = \alpha \text{Ret}_{l,z,04-06} + \beta X_{i,z,04-06} + \delta_l + \epsilon_{i,l,z,07-10},$$

- $\text{Ret}_{l,z,04-06} \equiv \frac{MR_{l,z}}{\text{TotalOriginations}_z}$ ,      fraction of loans lender  $l$  retains in zip code  $z$  between 04-06
- $X_{i,z,04-06}$  :      loan level controls: FICO, LTV, IO
- Equation saturated of neighborhood FE

# Probability of Foreclosure

	(1)	(2)	(3)	(4)	(5)
Sample	Portfolio	Securitized	Whole		
Share Retained	-0.294*** (0.059)		-0.256*** (0.055)	-0.216*** (0.061)	-0.257*** (0.075)
Placebo Share Retained		0.021 (0.068)			
Securitized			0.030*** (0.003)	0.031*** (0.003)	0.030*** (0.003)
LTV	0.001 (0.022)	0.073*** (0.009)	0.082*** (0.008)	0.079*** (0.009)	0.079*** (0.009)
FICO	-0.004 (0.003)	-0.010*** (0.001)	-0.022*** (0.001)	-0.024*** (0.001)	-0.025*** (0.001)
Jumbo	-0.027*** (0.005)	-0.029*** (0.003)	-0.015*** (0.002)	-0.002 (0.002)	0.001 (0.003)
IO	0.053*** (0.005)	0.063*** (0.002)	0.056*** (0.002)	0.056*** (0.002)	0.056*** (0.002)
High Cost	0.060*** (0.006)	0.066*** (0.002)	0.067*** (0.002)	0.063*** (0.002)	0.060*** (0.002)
Minority	0.001 (0.004)	0.015*** (0.002)	0.004*** (0.002)	-0.000 (0.002)	0.000 (0.002)
Lender FE	Yes	Yes	Yes	Yes	Yes
Neighborhood FE	No	No	County	Zip Code	Census Tract
Obs	71008	388538	460039	458087	454057
R2	.0844	.0416	.0714	.101	.165

# Foreclosure Probability: Exogenous variation in the Proportion of Retained Loans

Sample	First Stage		Second Stage	
	Whole	Portfolio	Whole	Portfolio
Share Retained			-3.647*** (0.744)	-3.334** (1.578)
Mergers	0.030*** (0.005)	0.011*** (0.003)		
LTV	0.000 (0.001)	-0.010*** (0.002)	0.085*** (0.009)	0.011 (0.028)
FICO	-0.000*** (0.000)	-0.000 (0.000)	-0.023*** (0.001)	-0.019*** (0.003)
Jumbo	0.000*** (0.000)	0.002*** (0.001)	-0.014*** (0.002)	0.004 (0.006)
IO	0.000* (0.000)	0.000 (0.000)	0.056*** (0.002)	0.055*** (0.005)
High Cost	-0.001*** (0.000)	-0.003*** (0.000)	0.064*** (0.002)	0.050*** (0.008)
Minority	0.000*** (0.000)	0.001*** (0.000)	0.006*** (0.002)	-0.000 (0.004)
Securitized	-0.022*** (0.000)		-0.052*** (0.018)	
Lender FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Cragg-Donald Wald F Statistics			32.51	14.32
Obs	460039	70910	460039	70910
R2	.461	.349	.0624	.0803

Economic Magnitude: A one-standard deviation change in Share Retained predicts a decrease in the probability of foreclosure of almost 6 percentage points. This is approximately 10 percent of the probability of foreclosure for a 90 plus days delinquent loan of 75 percent. In the OLS, a one-standard-deviation increase in Share Retained implies only a 1 percent drop in the average probability of foreclosure.

# Foreclosure Probability: Model Cross-Sectional Implications

Share Retained	0.499 (0.357)	-0.247*** (0.062)
Share Retained x Prop Affected	-0.918** (0.429)	
Share Retained x Desirable Neighborhood		0.200 (0.132)
Securitized	0.031*** (0.003)	0.031*** (0.003)
LTV	0.080*** (0.009)	0.080*** (0.009)
FICO	-0.024*** (0.001)	-0.024*** (0.001)
Jumbo	-0.002 (0.002)	-0.002 (0.002)
IO	0.056*** (0.002)	0.056*** (0.002)
High Cost	0.063*** (0.002)	0.063*** (0.002)
Minority	-0.000 (0.002)	-0.000 (0.002)
Lender FE	Yes	Yes
Neighborhood FE	Zip Code	Zip Code
Obs	458087	458087
R2	.101	.101

# Probability of Loan Modification

Estimation Method:		OLS		2SLS
Share Retained	0.170** (0.069)	0.257*** (0.064)	0.308*** (0.077)	1.384** (0.584)
Securitized	-0.014*** (0.003)	-0.012*** (0.003)	-0.012*** (0.004)	0.020 (0.016)
LTV	0.055*** (0.008)	0.052*** (0.008)	0.045*** (0.008)	0.053*** (0.008)
FICO	-0.046*** (0.001)	-0.045*** (0.001)	-0.044*** (0.001)	-0.046*** (0.001)
Jumbo	-0.022*** (0.002)	-0.024*** (0.002)	-0.029*** (0.002)	-0.023*** (0.002)
IO	-0.022*** (0.001)	-0.021*** (0.001)	-0.021*** (0.002)	-0.022*** (0.001)
High Cost	-0.032*** (0.002)	-0.030*** (0.002)	-0.028*** (0.002)	-0.032*** (0.002)
Minority	0.023*** (0.001)	0.022*** (0.001)	0.022*** (0.002)	0.023*** (0.001)
Lender FE	Yes	Yes	Yes	Yes
Neighborhood FE	County	Zip Code	Census Tract	County
Cragg-Donald Wald F Statistics				30.69
Obs	417310	415346	410782	417310
R2	.0479	.0801	.149	.047

# More on Modifications and Defaults

	(1) Probability that a 30 days delinquent loan becomes 90 days delinquent	(2) Probability that a loan is 90 days delinquent	(3) Zip code delinquency rate	(4) Foreclosure and lender's county specific differences in organizational structure
Share Retained	-0.106* (0.062)	-0.001 (0.026)		-0.239*** (0.064)
Top 4			-0.084*** (0.007)	

Controls Omitted

# Zip-Code Level Data

---

- ❑ Mortgage data – *HMDA*
- ❑ Foreclosure data – *RealtyTrack*
  - ❑ Population of foreclosures in a zip code
- ❑ House price data – *CoreLogic*
- ❑ Controls – *Equifax/Census*
  - ❑ subprime borrowers, FICO, LTV, mortgage per capita, delinquency rates, population and income

## Index of local concentration of mortgages on lenders' balance sheets:

---

- Proportion of HMDA **mortgages retained by** the 4 biggest holders in a zip code ( $z$ ) between 2004 and 2006, relative to all mortgages originated in the zip code

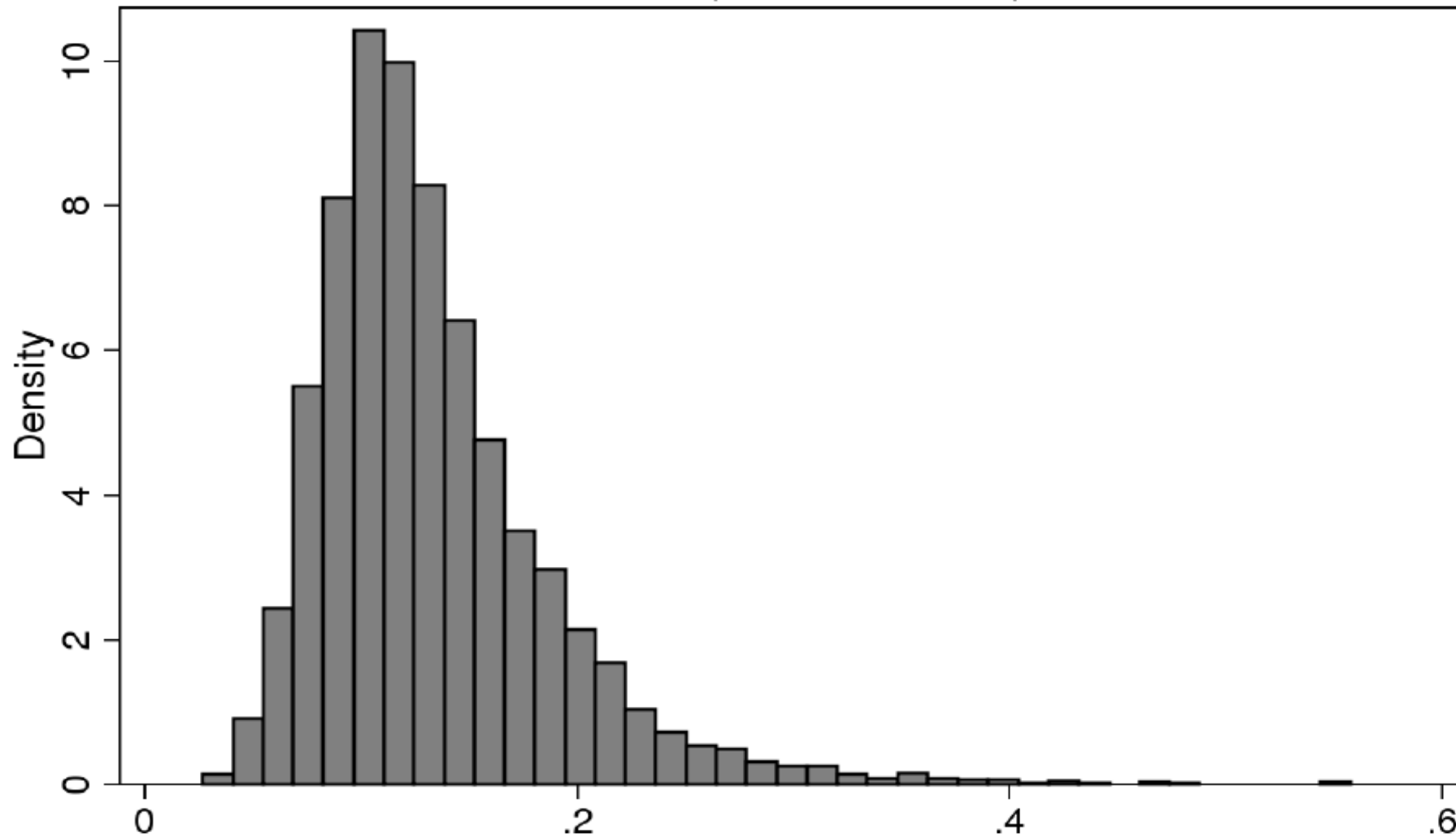
$$\text{Top } 4_{z,04-06} = \frac{MR_{1,z} + \dots + MR_{4,z}}{\text{Total Mortgage Origination}_z}$$

- Mortgage retention proxies for credit risk exposure of lenders to local markets



## *Top 4 nationwide distribution*

---



# Empirical framework

---

## ❑ Reduced form cross-sectional regressions: 2007—2010

$$y_{z,07-10} = \alpha Top4_{z,04-06} + \beta 90^{+} Delinquencies_{z,07-10} + \gamma X_{z,l,04-06} + \delta_C + \epsilon_{z,07-10};$$

- ❑  $y_{z,07-10}$  : zip codes foreclosure rates; mortgage modifications; house price changes
- ❑  $Top4_{z,04-06}$  : index of outstanding mortgage concentration
- ❑  $X_{z,l,04-06}$  : lagged zip-code controls: securitization, HPI change, loans originated, debt-per-capita, pop, income (2004-2006).

## ❑ Predictions:

- ❑ Foreclosures *negatively* correlated with  $Top4$
- ❑ House price changes *positively* correlated with  $Top4$

# Determinants of the Top 4

	(1)	(2)
Zip Code Mergers	0.116*** (0.030)	0.069*** (0.017)
90+ days delinquency ratio		-0.560*** (0.060)
Securitization, 2004-2006		-0.254*** (0.017)
Loans originated, 2004-2006		-0.047*** (0.014)
Census income, 2000		-0.009*** (0.003)
Population, 2000		-0.024*** (0.003)
House price change, 2004-2006		-0.012 (0.008)
Obs	6346	6346
R2	.622	.744

# Foreclosures rate

	(1)	(2) 2SLS	(3)	(4)
Top 4, 2004-2006	-0.061*** (0.013)	-0.426*** (0.144)	-0.093*** (0.020)	-0.060*** (0.013)
Top 4, 2004-2006×Judicial foreclosures			0.052* (0.027)	
90+ days delinquency ratio	0.772*** (0.089)	0.570*** (0.101)	0.768*** (0.088)	0.776*** (0.088)
Securitization, 2004-2006	0.012** (0.006)	-0.083** (0.035)	0.011* (0.006)	0.012** (0.006)
Loans originated, 2004-2006	0.011 (0.012)	-0.004 (0.012)	0.010 (0.012)	0.011 (0.012)
Census income, 2000	0.005* (0.003)	0.001 (0.003)	0.005* (0.003)	0.005* (0.003)
Population, 2000	-0.004** (0.002)	-0.014*** (0.005)	-0.004** (0.002)	-0.003** (0.002)
House price change, 2004-2006	-0.026*** (0.009)	-0.030*** (0.009)	-0.025*** (0.009)	-0.026*** (0.009)
Obs	6016	5893	6016	6016
R2	.676	.0718	.676	.677

in column 1, a one-standard-deviation increase in the Top4 index is associated with a 20% of a standard deviation reduction in the foreclosure rate.

# Differences across zip codes

---

## ❑ Judicial versus power of sale states:

- ❑ Effect of *Top4* on forelclosure is weaker in judicial states, because foreclosures are more costly in these jurisdictions, therefore less likely for any bank

# House Prices

---

## □ Zip code level analysis

- If foreclosures adversely affect local house prices, house prices changes should be positively correlated with the concentration of outstanding mortgages in a neighborhood

# House Prices

	(1)	(2) 2SLS	(3)	(4)
Top4, 2004-2006	0.119*** (0.043)	0.638* (0.382)	0.247*** (0.073)	0.125*** (0.043)
Top 4, 2004-2006×Judicial foreclosures			-0.214*** (0.082)	
90+ days delinquency ratio	-1.444*** (0.165)	-1.147*** (0.240)	-1.424*** (0.161)	-1.461*** (0.162)
Securitization, 2004-2006	0.014 (0.024)	0.147 (0.100)	0.016 (0.024)	0.014 (0.024)
Loans originated, 2004-2006	-0.010 (0.036)	0.016 (0.031)	-0.009 (0.036)	-0.012 (0.036)
Census income, 2000	0.014* (0.008)	0.019*** (0.007)	0.013 (0.008)	0.014* (0.008)
Population, 2000	-0.006 (0.005)	0.007 (0.010)	-0.006 (0.005)	-0.004 (0.004)
House price change, 2004-2006	0.033 (0.023)	0.039** (0.019)	0.032 (0.023)	0.034 (0.023)
Obs	6346	6220	6346	6346
R2	.889	.0831	.889	.89

In column 2, a one-standard-deviation increase in the Top4 index is associated with 6 percentage points lower house price depreciation, equivalent to one third of a standard deviation of the change in house prices.

# Conclusions

---

- ❑ Lenders with a larger share of the outstanding mortgage on their balance sheet foreclose less often as they have stronger incentives to internalize the negative spillovers of foreclosures on house prices
- ❑ We provide evidence consistent with this claim in U.S. zip codes during the recent housing market crisis
- ❑ **The mechanism highlighted in this paper has bearings beyond the housing market:**
  - ❑ It has implications for the price volatility of any illiquid market with dispersed lending structure



# Policy implications

---

## **Ex Post**

- ❑ Consolidation of mortgage lenders with similar geographical exposure
- ❑ Rationale for restructuring defaulting loans through a “bad-bank”

## **Ex ante**

- ❑ Policies aiming at increasing “risk retention” at origination may lead lenders to internalize the externality of foreclosures —besides reducing moral hazard at origination