Mortgage Market Concentration, Foreclosures and House Prices

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Motivation

- The 2007-2009 U.S. housing crisis was characterized by a
  - sharp decline in house prices
  - steep rise in mortgage defaults
- Most defaults turned into mass foreclosures causing (pecuniary and non-pecuniary) externalities that
  - impaired the housing value of local markets
  - increased losses on lenders balance sheets

Motivation

- Much of the policy/academic discussion has focused on the role of:
  - securitization as impediment to renegotiation
  - policy intervention to foster lenders' incentives to renegotiate
- Here we take on the less discussed question of *what market forces may mitigate the negative effects of mortgage defaults on the economy*
  - Which banks are more or less inclined to renegotiate defaulting mortgages?

This paper

- Foreclosures (by "atomistic" lenders) create a pecuniary externality that causes contagious defaults:
  - i.e., liquidity (involuntary) defaults of distressed borrowers are followed by strategic (voluntary) defaults of borrowers with negative equity
- "Large" lenders internalize the pecuniary externality of their liquidation decisions on house prices:
  - i.e., larger exposure to mortgage losses foster incentives to renegotiate liquidity defaults

What we do

- Study the interaction of (liquidity and strategic) defaults, lenders' market shares and house prices in a stylized model
  - main prediction: market concentration mitigates the adverse effects of liquidity defaults on house prices because it weakens lenders' incentives to foreclose defaulting loans
- Test the model's predictions on U.S. county data exploiting variation in:
  - lenders' mortgage market concentration (lender balance sheet exposure to local housing markets)
  - house prices
  - foreclosure rates

What we find

- House prices fall in response to negative income shocks, but the price decline is muted in areas where lenders hold larger shares of the local mortgage market:
- The link between mortgage market concentration and house prices operates through foreclosure rates

Related literature I

- Role played by foreclosure laws in the collapse of housing price during the 2007-2009 financial crisis
  - Mian and Sufi and Trebbi (2012), Gerardi, Lambie-Hanson and Willen (2011)

Related literature II

- Spate of papers stressing the role of securitization (and servicers) as impediment to mortgage renegotiation
  - Piskorski, Seru and Vig (JFE, 2010); Agarwal et al. (JFE, 2011); Adelino, Gerardi and Willen (2011); Ghent (RFS, 2011)
- Two ways of looking at our work in relation to the literature on securitization:
  - Securitization arrangements can be viewed as an optimal contract for atomistic lenders with no ex post incentives to renegotiate
  - Our results hold even if we focus on just the 30 percent of the market that is not securitized

Related literature III

- Concentrated banking, bank–firm relationship, credit provision and contract terms
  - Petersen and Rajan (JF, 1995); Garmaise and Moskovitz (JF, 2006)
- Government intervention in the presence of market externalities during bankruptcy
  - Bolton and Rosenthal (JPE, 2002)

Outline

- Model (sketch)
- Emprical Analysis

Model

Assumptions I

- One period model with two dates $t = 0, 1$; two groups of agents of mass one, households (indexed by i) and banks
- At $t = 0$ households are endowed with housing $h_{0i} = 1$, outstanding mortgage debt B secured against the house, and no savings
- At $t = 1$ (after repaying outstanding debt) households make consumption and housing decisions:

$$U_{1i} = c_{1i} + \gamma_i h_{1i}$$

where, $c_{1i} \geq 0$, $h_{1i} \in \{0, 1\}$, and

$$\gamma_i \sim U\ [0, \overline{\gamma}]$$

- Housing supply is fixed, $\overline{H} < \overline{\gamma}$

Model

Assumptions II

- At $t = 1$ households receive a stochastic income w_{1i} that depends on two states of the world:
  - good state (w.p. q) – all receive w_1
  - bad state (w.p. $1 - q$) – a fraction e of households receive θw_1, $0 < \theta < 1$
- In the bad state of the world

$$\theta w_1 < B \leq w_1$$

  households cannot repay B and atomistic banks may renegotiate or seize and sell h_{0i} and p_1, to be determined
- Budget constraint at $t = 1$

$$\begin{cases} w_{1i} + p_1 h_{0i} & = c_{1i} + B + p_1 h_{1i} & \text{no default} \\ w_{1i} & = c_{1i} \qquad\quad + p_1 h_{1i} & \text{default \& liquidation} \end{cases}$$

Model

Equilibrium housing demand and prices

- Individual housing demand

$$\gamma_i \geq p_1$$

- Aggregate demand depends on the realization of the shock, and since $\gamma_i \sim U\,[0, \overline{\gamma}]$

$$\begin{cases} \overline{\gamma} - p_1 & \text{no shock, no default} \\ (1-e)\,(\overline{\gamma} - p_1) & \text{shock, default \& liquidation} \end{cases}$$

- Given $\overline{H}$, the equilibrium price is

$$p_1^L = \overline{\gamma} - \frac{\overline{H}}{1-e} < p_1 = \overline{\gamma} - \overline{H}$$

Model

Atomistic banks and strategic default

- In the equilibrium with liquidation,

$$p_1^L < B \leq p_1$$

  and thus even intact households prefer to default (voluntary)
- This equilibrium exists *iff*:

$$\theta w_1 < p_1^L = \overline{\gamma} - \frac{\overline{H}}{1-e} < w_1$$

  - distressed borrowers cannot participate in the housing market (first $<$)
  - intact households default strategically because they can re-purchase a house from a bank at a lower price (second $<$)
- **Result 1**: *With liquidation, distressed households stay out of the housing market, the equilibrium housing price falls, and intact households default strategically*

Model

Renegotiation decisions by atomistic banks

- If all atomistic banks were to renegotiate (with a mark down on loan repayment)
  - housing demand would be the same as without shocks

$$p_1^R = p = \overline{\gamma} - \overline{H}$$

- However, since

$$\theta w_1 < \overline{\gamma} - \frac{\overline{H}}{1-e} = p_1^L$$

  - the gain from liquidation is always larger than the highest payment a bank can obtain from a distressed household
- **Result 2**: *Atomistic lenders never renegotiate a defaulting loan*

Model

Banking concentration, and house prices

- Suppose one bank holds a large fraction, ξ, of the mortgage market. If this bank renegotiates its loans (while the others liquidate) a fraction ξ of distressed households remains in possession of their houses
- Aggregate housing demand would be:

$$(1-\xi)(1-e)(\overline{\gamma}-p_1)+\xi(\overline{\gamma}-p_1)$$

and the equilibrium price

$$p_1^{L'}=\overline{\gamma}-\frac{\overline{H}}{(1-\xi)(1-e)+\xi}>p_1^L \quad \text{and} \quad \partial p_1^{L'}/\partial\xi>0$$

- **Result 3**: *Negative income shocks have a muted effect on house prices when the mortgage provision is concentrated*
  - because the large lender internalizes the effect of its liquidation decision on aggregate demand and prices

Model

Renegotiation decision for the concentrated bank

- At the equilibrium price $p_1^{L'}$, a concentrated lender is willing to renegotiate defaulting loans if

$$\underbrace{(1-e)p_1^{L'} + e\theta w_1}_{\text{Total return from renegotiation}} > \underbrace{p_1^L}_{\text{Total return from liquidation}}$$

or

$$\frac{\xi}{(1-\xi)(1-e)+\xi}\frac{\overline{H}}{1-e} > \overline{\gamma} - \frac{\overline{H}}{(1-\xi)(1-e)+\xi} - \theta w_1$$

- **Result 4**
  - As $\xi \to 0$ it is never optimal to renegotiate because

$$\theta w_1 < \overline{\gamma} - \frac{\overline{H}}{1-e} = p_1^L$$

  - As $\xi \to 1$ it is optimal to renegotiate if

$$\overline{H} > p_1^L - \theta w_1$$

    whenever, p_1^L is low (e.g., e is large) or θw_1 is high

Model

Aggregate losses

- For a large ξ *aggregate* losses of the banking system fall as:
  - large bank obtains

$$\underbrace{(1-e)p_1^{L'} + e\theta w_1}_{\text{Total return from renegotiation}} > \underbrace{p_1^L}_{\text{Total return from liquidation}}$$

  - small banks liquidate at

$$p_1^{L'} > p_1^L$$

- N.B: When the large bank renegotiates its loans, smaller banks have even more incentives to liquidate as $p_1^{L'} > p_1^L$
  - a large bank alone cannot prevent strategic defaults, but it can mitigate the effects of negative income shocks on house prices

Model's predictions

- *Negative income shocks have a smaller effect on house prices if the provision of mortgage credit is concentrated*
- *Negative income shocks are associated with lower foreclosure rates in markets with concentrated mortgage lending*

Data and Empirical Analysis

Data: mortgage market concentration

- HMDA mortgage data — aggregated at the county level from 2001 to 2009
  - mortgages originated (by commercial banks, thrifts, credit union and mortgage companies) for the purchase of single-family owner occupied houses
- County-level Herfindahl-Hirschman index of local mortgage market concentration:

$$HHI_{c,t}^{num} = \sum_{b_i \in B_{c,t}} \left(\frac{\sum_m mort_{m,b_i}^{ret}}{\sum_{b_i} \sum_m mort_{m,b_i}^{ret} + \sum_{b_i} \sum_n mort_{n,b_i}^{\text{sec}}} \right)^2$$

  - $B_{c,t}$ set of distinct lenders (b_i) originating loans in county c in period $t = \{2001-2003, 2004-2006, 2007-2009\}$
  - $mort_{m,b_i}^{ret}$ mortgage m originated by bank b_i and non-securitized
  - $mort_{n,b_i}^{\text{sec}}$ mortgage n originated by bank b_i and securitized within a year to GSEs or private institutions
- Compute also $HHI_{c,t}^{vol}$ (volume of loans originated) and $HHI_{c,t}^{non-\text{sec}}$ (securitized mortgages excluded from the computation of market shares)

Data: foreclosures, house prices, economic/financial data

- House price data — Moody's & CoreLogic
  - median and quality-adjusted house price index of existing single family properties
- Foreclosure data — RealtyTrack
  - foreclosures rates computed as the number of foreclosures (NOS, NTS, REO) for single-family properties per homeowner
- Other data:
  - income per capita, population, unemployment rates (BEA);
  - delinquency rates on consumer debt balances (Equifax), delinquency rates on securitized mortgage loans (LPS)
  - single family housing stock (Census), single family housing units sold (NAR)

The empirical framework

Mortgage concentration and house prices: 2004-2009

- Reduced form regression, $t = 2004 - 2006,\ 2007 - 2009$

$$\begin{aligned}\Delta \ln p_{c,t} &= \alpha_1 HHI_{c,t-1} + \alpha_2 1_{\Delta \ln y_{i,t}<0} + \alpha_3 HHI_{c,t-1} \times 1_{\Delta \ln y_{i,t}<0} \\ &\quad + \beta X_{c,t} + \gamma_t + \delta_{MSA} + \varepsilon_{c,t},\end{aligned}$$

  - $\Delta \ln p_{c,t}$ – log change of house price in each subperiod
  - $HHI_{c,t-1}$ – lagged index of banking concentration
  - $1_{\Delta \ln y_{i,t}<0}$ – indicator variable equal to one if a county experiences a negative income shock from one period to the next
  - $X_{c,t}$ – time-varying county-specific controls
  - δ_{MSA} and γ_t – MSA and time fixed effects

- **Prediction:** $\alpha_2 < 0$ **and** $\alpha_3 > 0$

TABLE 2

Mortgage concentration, income shocks, and house prices: Pooled regression 2004-2009

	Dependent Variables: House price growth							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Negative income growth	-0.053***	-0.053***	-0.045***	-0.044***	-0.049***	-0.047***	-0.016	-0.014
	(0.013)	(0.013)	(0.011)	(0.011)	(0.010)	(0.010)	(0.015)	(0.016)
HHI-Number	-0.563**		-0.678**		-0.708**		-0.767	
	(0.267)		(0.277)		(0.274)		(1.124)	
HHI-Number*Negative	1.365***		1.438***		1.519***		1.821**	
income growth	(0.363)		(0.384)		(0.330)		(0.788)	
HHI-Volume		-0.653*		-0.746**		-0.751**		-0.179
		(0.337)		(0.330)		(0.310)		(1.226)
HHI-Volume*Negative		1.394***		1.314***		1.354***		1.406*
income growth		(0.437)		(0.465)		(0.372)		(0.777)
Observations	1847	1847	1835	1835	1835	1835	1835	1835
N. of counties	1044	1044	1044	1044	1044	1044	1044	1044
Controls	no	no	yes	yes	yes	yes	yes	yes
Fixed effects	MSA	MSA	MSA	MSA	--	--	County	County
Standard errors clusters	MSA	MSA	MSA	MSA	MSA	MSA	County	County
R2	0.667	0.667	0.738	0.737	0.556	0.554	0.854	0.853

TABLE 3

Robustness: Other market concentration indexes, securitization and delinquency rate

	Dependent Variables: House price growth							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Negative Income Growth	-0.042***	-0.043***	-0.045***	-0.043***	-0.063***	-0.060***	-0.038***	-0.037***
	(0.010)	(0.010)	(0.011)	(0.011)	(0.017)	(0.017)	(0.010)	(0.010)
HHI-Number (current)	-0.221							
	(0.173)							
HHI-Number (current) * Negative Income Growth	0.773***							
	(0.226)							
HHI-Volume (current)		-0.306						
		(0.224)						
HHI-Volume (current)* Negative Income Growth		0.939***						
		(0.300)						
HHI-Number			-0.653**				-1.377***	
			(0.295)				(0.464)	
HHI-Number*Negative Income Growth			1.448***				1.277**	
			(0.387)				(0.536)	
HHI-Volume				-0.757**				-1.224**
				(0.353)				(0.509)
HHI-Volume *Negative Income Growth				1.311***				1.028*
				(0.466)				(0.523)
HHI -Number-No Securitized					0.018			
					(0.134)			
HHI -Number-No Securitized *Negative Income Growth					0.428***			
					(0.164)			
HHI -Volume-No Securitized						0.075		
						(0.118)		
HHI -Volume-No Securitized *Negative Income Growth						0.351**		
						(0.150)		
Securitized Loans			0.012	-0.005	0.055	0.045	-0.043	-0.035
			(0.066)	(0.064)	(0.064)	(0.061)	(0.077)	(0.073)
Securitized Loans- 60days delinquency rate							-0.136**	-0.132**
							(0.062)	(0.062)
Consumer Credit 60 days-delinquency rate							-0.149***	-0.151***
							(0.028)	(0.028)

Further robustness

- **Did counties with concentrated mortgage lending experience smaller price appreciations before the crisis?**
  - The controls for delinquency rates and house turnover should pick it up
  - Results robust to controlling for previous price appreciations
  - Results also robust to using propensity scores matching counties on 'Housing units sold', 'Income per capita', and 'Unemployment rate'
- **Were counties with concentrated mortgage lending more indebted**?
  - Results are robust if we control for mortgage per capita
- **Did banks in countries with concentrated mortgage lenders differ along any other dimension?**
  - Instrumental variable methodology exploting variation in concentration due to "exogenous" mergers
  - Results are robust to the inclusion of controls for bank profitability and size
- **Is the county the right geographical using for price spillovers**?
  - Results are robust at the *census tract level*

Robustness

Judicial vs. Power of sale states

- Lending concentration should have a smaller effect in areas where foreclosures are less likely (or renegotiations more likely)
- Compare judicial vs. power of sale states:
  - the court involvement in auctioning a distressed property slows down the foreclosure process relative to power of sale states where lenders have the automatic right to carry out a foreclosure action in the event of default (Pence, 2006; Mian, Sufi, Trebbi, 2012)
  - foreclosures are less likely in judicial states because they are more costly

Robustness — empirical framework

Judicial vs. Power of sale states

- Reduced form regression:

$$\begin{aligned}\Delta \ln p_{c,t} &= \alpha_1 HHI_{c,t-1} + \alpha_2 1_{\Delta \ln y_{i,t}<0} \\ &\quad + \alpha_3 HHI_{c,t-1} \times 1_{\Delta \ln y_{i,t}<0} \\ &\quad + \alpha_4 HHI_{c,t-1} \times 1_{\Delta \ln y_{i,t}<0} \times 1_{Jud=1} \\ &\quad + \beta_5 X_{c,t} + \varepsilon_{c,t},\end{aligned}$$

  where $1_{Jud=1}$ is indicator function for judicial foreclosure states

- **Prediction:** $\alpha_2 < 0$, $\alpha_3 > 0$ **and** $\alpha_4 < 0$

TABLE IV

Judicial vs. Power of sale states — Cross-county regression: 2007-2009

	Dependent Variable: House price growth			
	Full Sample	Bordering	Full Sample	Bordering
	(1)	(2)	(3)	(4)
Negative income growth	-0.019	-0.037*	-0.004	-0.039**
	(0.016)	(0.019)	(0.016)	(0.015)
HHI-Number	-0.415	-0.156	-0.627*	0.043
	(0.356)	(0.330)	(0.379)	(0.306)
HHI-Number*Negative income growth	1.318***	0.984*	1.321***	0.993**
	(0.374)	(0.492)	(0.392)	(0.402)
HHI-Number*Negative income growth*Judicial foreclosure	-1.503**	-1.668		
	(0.686)	(1.188)		
HHI-Number*Negative income growth*Days dummy			-1.437**	-1.960*
			(0.711)	(1.045)
Judicial foreclosure	0.029	0.001		
	(0.021)	(0.021)		
Days dummy			0.038*	0.013
			(0.020)	(0.026)
Observations	1044	232	1044	232
Controls	yes	yes	yes	yes
Standard errors clusters	MSA	MSA	MSA	MSA
R2	.492	.449	.485	.485

Mechanism

Mortgage concentration, income shocks and foreclosure rates

- Mortgage concentration mitigates the effects of negative shocks on house prices because it weakens lenders' incentives to foreclose defaulting loans
- Are foreclosure rates lower in concentrated markets?

TABLE 5

Cross-county regression: 2007-2009

	Dependent variable: foreclosure rates			
	Full sample	Bordering	Full sample	Bordering
	(1)	(2)	(3)	(4)
Negative income growth	0.019***	0.026***	0.020***	0.026**
	(0.006)	(0.008)	(0.006)	(0.010)
HHI-Number	0.517**	0.906	0.454**	0.589
	(0.202)	(0.609)	(0.205)	(0.726)
HHI-Number*Negative	-0.896***	-1.298**	-0.911***	-1.057
income growth	(0.200)	(0.626)	(0.292)	(0.932)
Securitized Loans 60days			0.013	-0.045
delinquency			(0.031)	(0.051)
Observations	774	157	756	154
Controls	yes	yes	yes	yes
Standard errors clusters	MSA	MSA	MSA	MSA
R2	0.371	0.114	0.378	0.122

TABLE 6

Judicial vs. non-judicial states – Cross-county regression 2007-2009

	Dependent variable: foreclosure rates			
	Full sample	Bordering	Full sample	Bordering
	(1)	(2)	(3)	(4)
Negative income growth	0.028***	0.044***	0.037***	0.041***
	(0.010)	(0.014)	(0.009)	(0.013)
HHI-Number	0.465**	2.168***	0.609***	1.844***
	(0.221)	(0.472)	(0.207)	(0.522)
HHI-Number*Negative income growth	-1.616***	-3.064***	-1.802***	-2.765***
	(0.490)	(0.679)	(0.441)	(0.702)
HHI-Number*Negative income growth*Judicial foreclosure	1.241*	4.379**		
	(0.722)	(1.963)		
HHI-Number*Negative income growth*Days dummy			2.276***	3.993**
			(0.807)	(1.877)
Securitized Loans 60days delinquency	0.028	-0.022	0.021	-0.021
	(0.031)	(0.049)	(0.030)	(0.049)
Observations	756	154	756	154
Controls	yes	yes	yes	yes
Standard errors clusters	MSA	MSA	MSA	MSA
R2	0.399	0.151	0.4	0.148

Conclusion

- In mortgage markets with a dispersed lending structure lenders foreclose defaulting loans more often because they do not internalize the effects of foreclosures decisions on house prices
- We provide evidence supporting this mechanism for US counties (and census tracts) during the recent housing market collapse
- We find that after a negative income shock
  - house prices drop less in markets with more mortgage lending concentration
  - mortgage markets with high concentration experience fewer foreclosures

Conclusion

- Policy implications:
  - consolidation of mortgage lenders with similar geographical exposure strengthen their incentives to renegotiate defaulting loans, limiting lenders' losses and stabilizing house prices
  - rational for restructuring strategy involving a bad bank
  - the model may also explain why large banks have an icentive to offer refinancing in certain neighbors during financial crisis
- The mechanism highlighted here has bearings beyond the housing market
  - it has implications for the price volatility of any collateralized market with dispersed lending structure