Consumer Ruthlessness and Strategic Default During the 2007-2009 Housing Bust

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Federal Reserve Board [1]

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[1] The views expressed here are those of the authors and not necessarily those of the Board of Governors of the Federal Reserve System or its staff.

How “Ruthless” Are Consumers?

2006-2009: House prices fell sharply and mortgage defaults skyrocketed

- How important is strategic default (having the resources to make payments but choosing not to)?
- How deeply underwater must a borrower be before he decides to strategically default?

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Preview of Findings:

- 19% of the defaults observed in our sample are strategic
- The median borrower walks away when he is 62% underwater

Two Views About Underwater Borrowers and Default

(1) Can't Pay ("Double Trigger Hypothesis")
(2) Won't Pay ("Ruthless Default Hypothesis")

Previous research shows both factors are important.

- Quigley and Van Order (1995), Quigley et al. (2000), Bajari et al. (2008), Elul et al. (2010)

BUT don't know which is more important

- Previous research limited by availability of data

No Holy Grail

Ideally, want to observe default, equity, and life events/liquidity shocks over time for a large sample of borrowers

- But these data do not exist

What do other studies do?

- Proxies for liquidity – county unemployment rate, state divorce rate, credit card utilization rates
- Hand-waving

What do we do?

- Impose some structure
- Borrow an old trick from 25 years ago

Impose Some Structure

In general, there are many types of strategic behavior, many ways to observe borrower "ruthlessness"

Suppose we assume that borrowers default $\iff TC_i < -E_{it}$, where TC_i includes:

- Damages to one's credit score, legal liabilities, stigma and moral costs
- Expectations of capital gains

What can we learn about TC_i?

- Large? Small? Heterogeneity?
- How does it differ for different types of borrowers?

Data Description

Sample

- CoreLogic data on non-prime securitized loans
- First lien, owner-occupied, single-family purchase mortgages
- Originated in 2006 in AZ, CA, FL, NV with initial CLTV=100%
- Monthly observation for each loan until September 2009

Measuring Equity

- House value imputed using purchase price and CoreLogic ZIP code HPI
- Mortgage balance observed in CoreLogic data

Definition of Default

- Default defined as $90+$ days delinquent for 2 consecutive months
- Decision to default occurs 3 months before that

Figure 1: House Prices

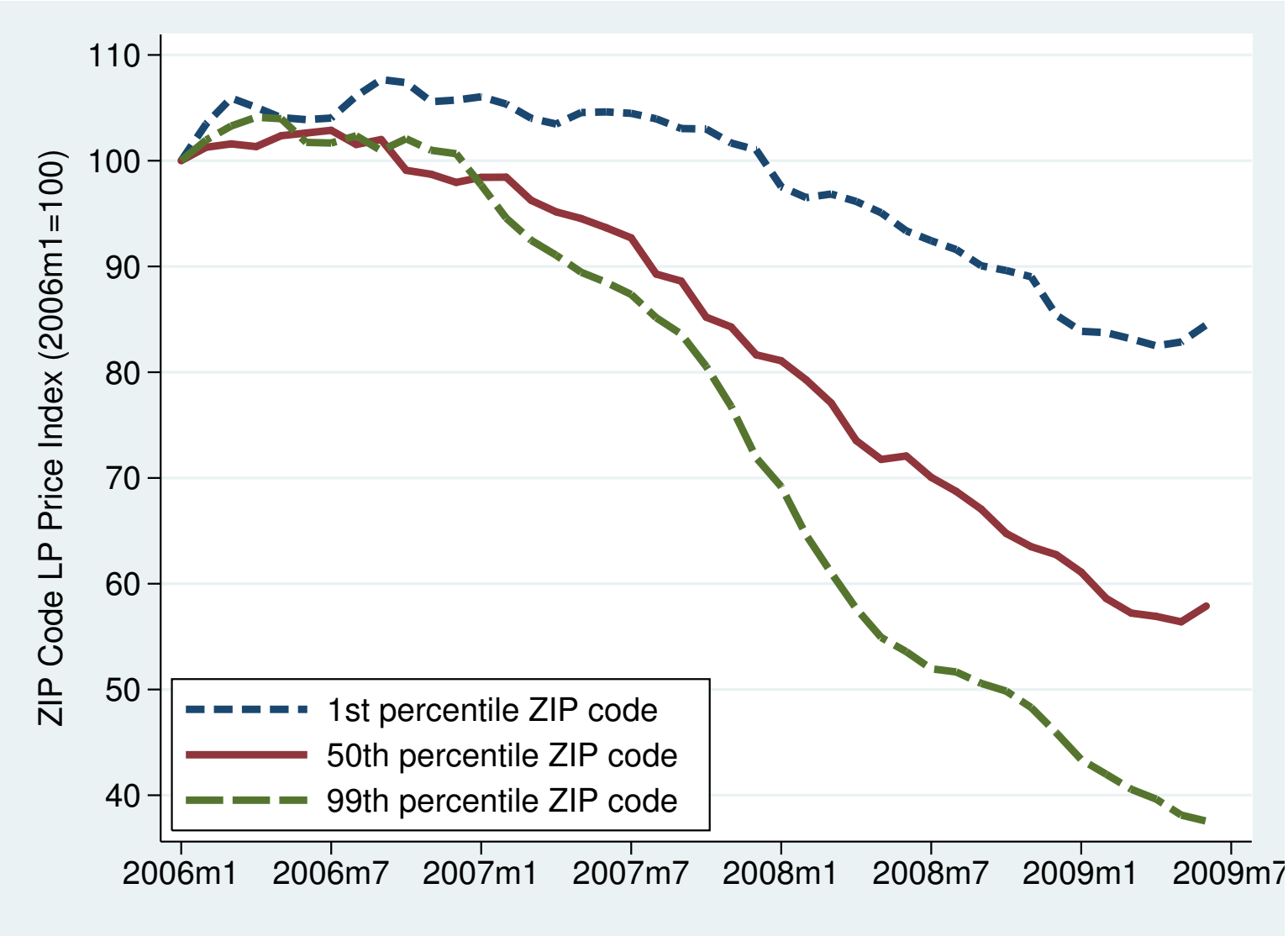
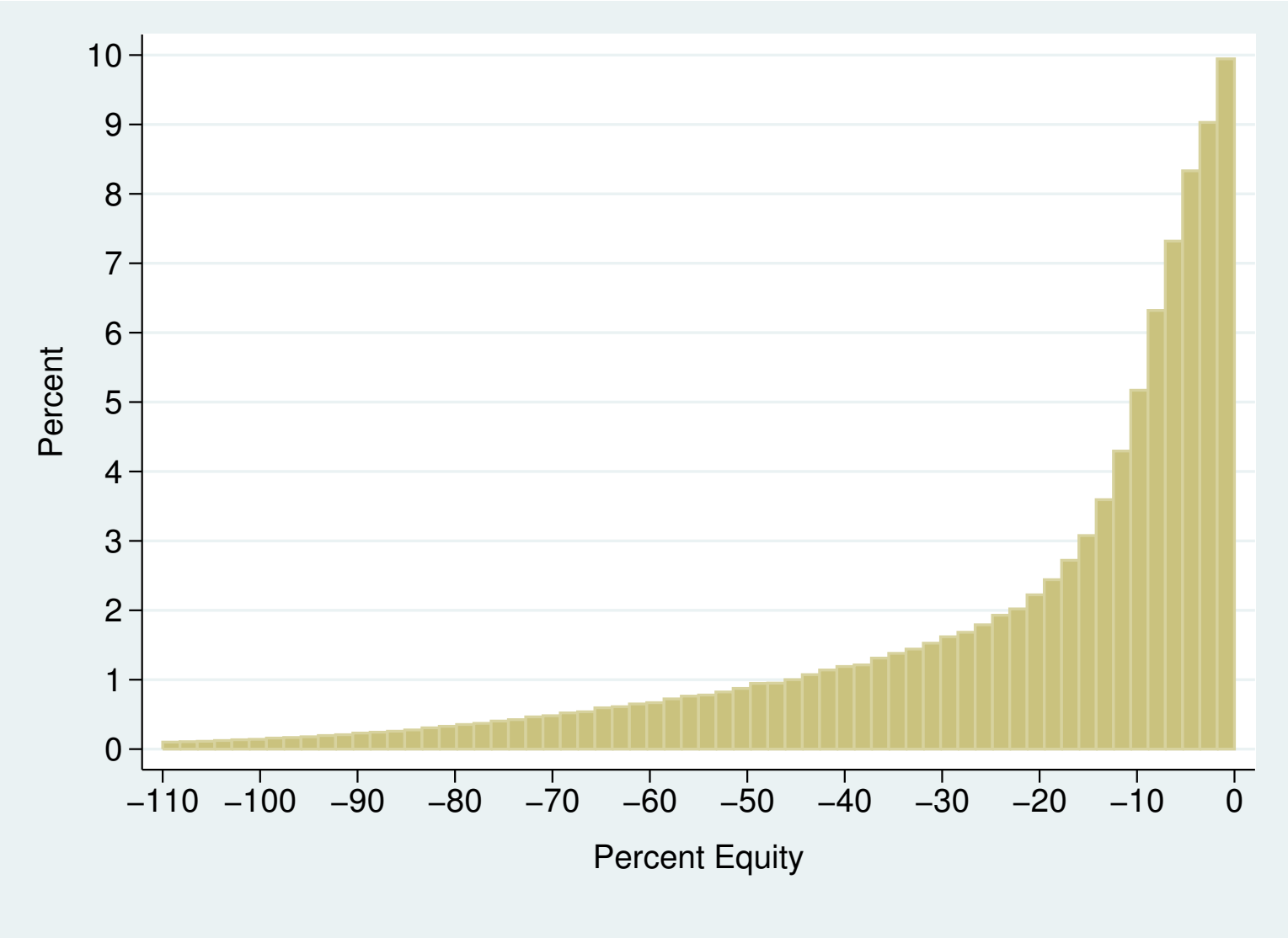


Figure 2: Distribution of Equity in Default Decisions



Summary Statistics

Table 1: Summary Statistics

	Mean	Median	SD
Loan Characteristics (N=133,281)			
Defaulted During Observation Period	**0.78**	1	0.42
Home Value at Origination ($ 000's)	393	360	183
Home Value at Termination ($ 000's)	308	268	172
Mortgage Balance at Termination ($ 000's)	393	359	184
Percent Equity at Termination (%)	-34.4	-23.7	35.0
Equity at Termination ($ 000's)	-79.7	-59.6	78.1
Scheduled Payments at Termination ($, monthly)	2011	1828	927
Loan Age at Termination (months)	18.4	18.0	9.8
Interest Rate at Origination (%)	7.4	7.5	1.2
Interest Rate at Termination (%)	7.6	7.5	1.1
FICO Score at Origination	676	671	50.7
Low or No Documentation Indicator	0.70	1	0.46
Property in Arizona	0.09	0	0.28
Property in California	0.63	1	0.48
Property in Florida	0.24	0	0.43
Property in Nevada	0.05	0	0.21
Change in Unemployment Rate at Termination (%)	1.80	1.30	1.70
Change in Credit Card Delinquency Rate at Termination (%)	0.35	0.30	0.44

Basic Idea

In the data, observe

- Borrowers who do not default ($D = 0$) $\rightarrow$ Infer total cost of default is high $\rightarrow TC > -E$
- Borrowers who default ($D = 1$)
  - Liquidity shock ($s = 1$)
  - No liquidity shock ($s = 0$) $\rightarrow$ Infer total cost of default is low $\rightarrow$ $-E_{-1} < TC < -E$

$\rightarrow$ What are $Pr(s = 0|D = 1)$ and $Pr(s = 1|D = 1)$?

A Two-Step Estimation Strategy

Step 1: Borrow an old idea

Estimate a discrete time default hazard model

$$\Pr(T_i = t | T_i \geq t, A_{it}, \mathbf{X_{it}}, E_{it}) = \Lambda(A_{it} \cdot countygroup_j + \mathbf{X_{it}}\boldsymbol{\beta} + E_{it})$$

- A_{it} are the loan age dummies (measured in months).
- $countygroup_j$ are the three county group dummies based on unemployment changes from June 2006 to June 2009.
- $\mathbf{X_{it}}$ include time dummies (measured in quarters), interest rate changes, county unemployment rate changes, and county credit card delinquency rate changes.
- E_{it} are the equity dummies.

$\rightarrow$ Impute the likelihood of a liquidity-driven default at each equity level:

$$\Pr(s_{it} = 1 | E_{it}, D_{it} = 1)$$

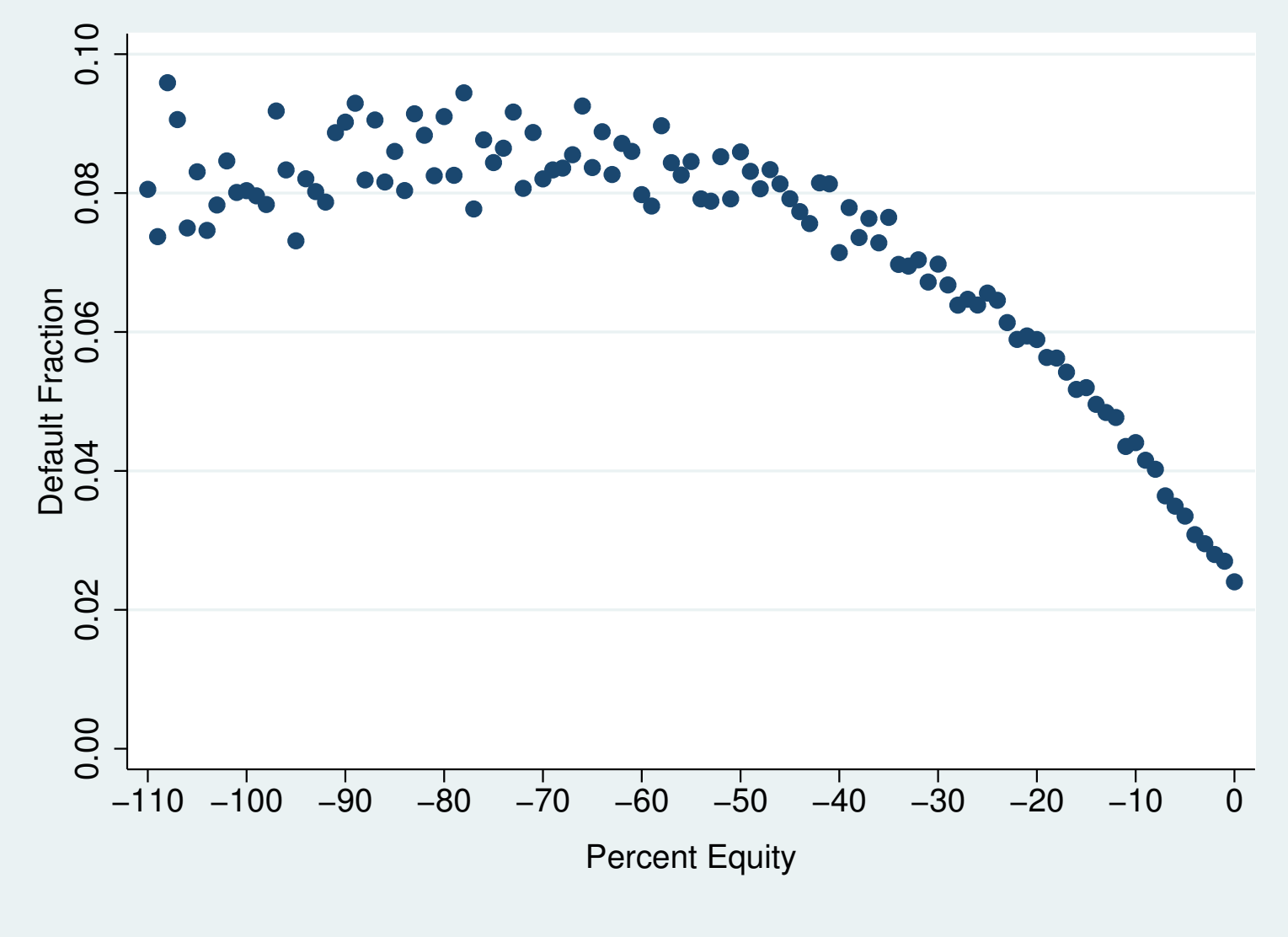
Step 1 Estimation Results

Table 2: Logit Estimation of the Probability of Default

	Coefficient	**SE**	**Odds Ratio**
	(1)	(2)	(3)
Housing Equity Fixed Effects			
Equity between -1% and -4%	0.04	(0.03)	1.05
Equity between -5% and -9%	0.08	(0.05)	1.08
Equity between -10% and -19%	0.16	(0.06)	1.17
Equity between -20% and -29%	0.31	(0.07)	1.36
Equity between -30% and -39%	0.45	(0.08)	1.58
Equity between -40% and -49%	0.56	(0.09)	1.75
Equity between -50% and -59%	0.65	(0.09)	1.91
Equity between -60% and -79%	0.76	(0.10)	2.15
Equity between -80% and -99%	0.90	(0.10)	2.45
Equity -100% or below	1.01	(0.11)	2.76
Change in Interest Rate	0.41	(0.01)	1.50
Change in Interest Rate Lag 1	0.38	(0.03)	1.46
Change in Interest Rate Lag 2	0.23	(0.01)	1.26
Change in Unemployment Rate	0.16	(0.08)	1.18
(Change in Unemployment Rate)^2	-0.02	(0.01)	0.98
Change in Credit Card Delinquency Rate	0.53	(0.08)	1.70
(Change in Credit Card Delinquency Rate)^2	-0.19	(0.06)	0.83

Step 1 Estimation Results

Figure 3: Relationship between Equity and Default



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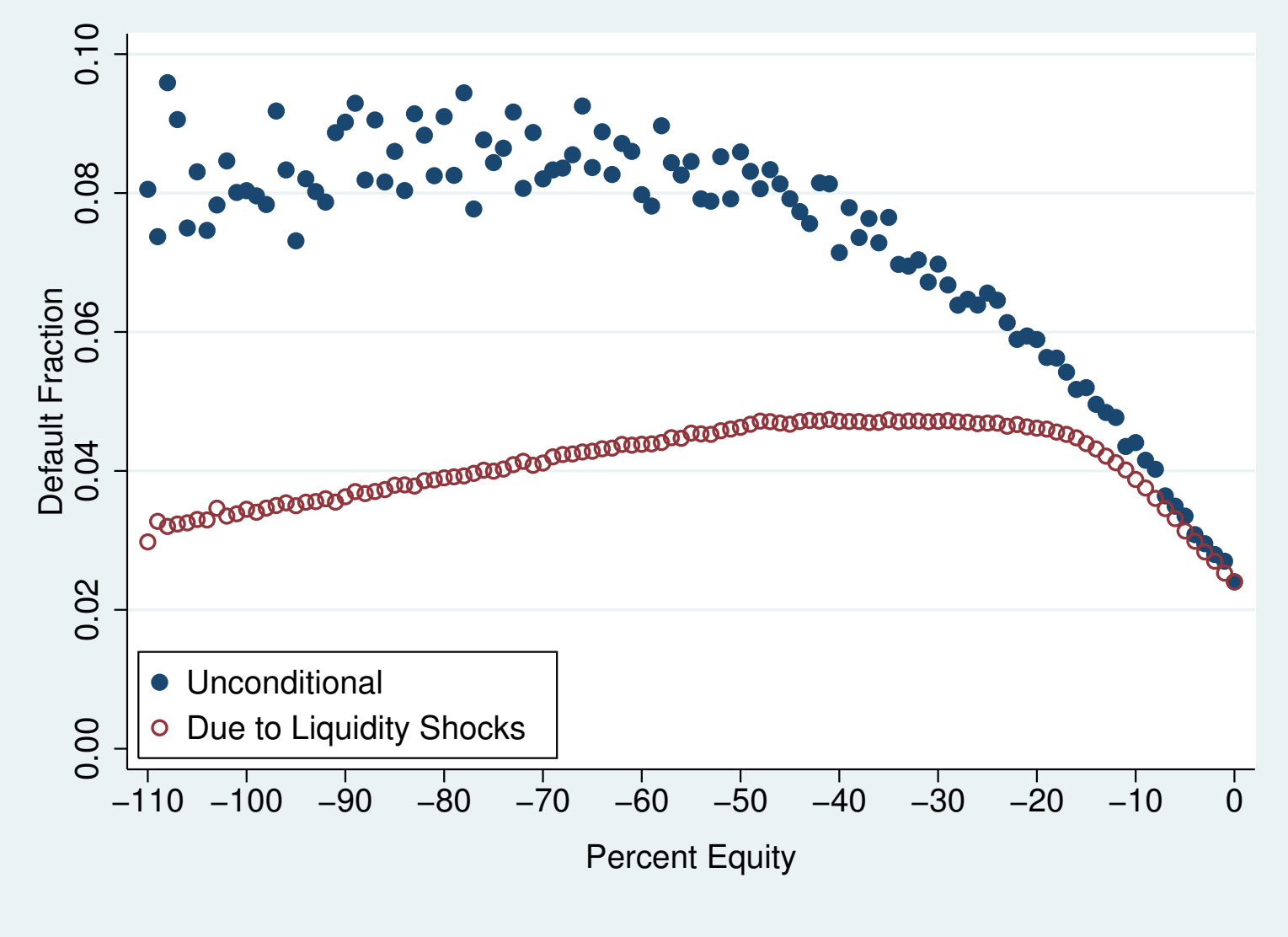


A Two-Step Empirical Strategy

Step 2: Estimate the distribution of TC

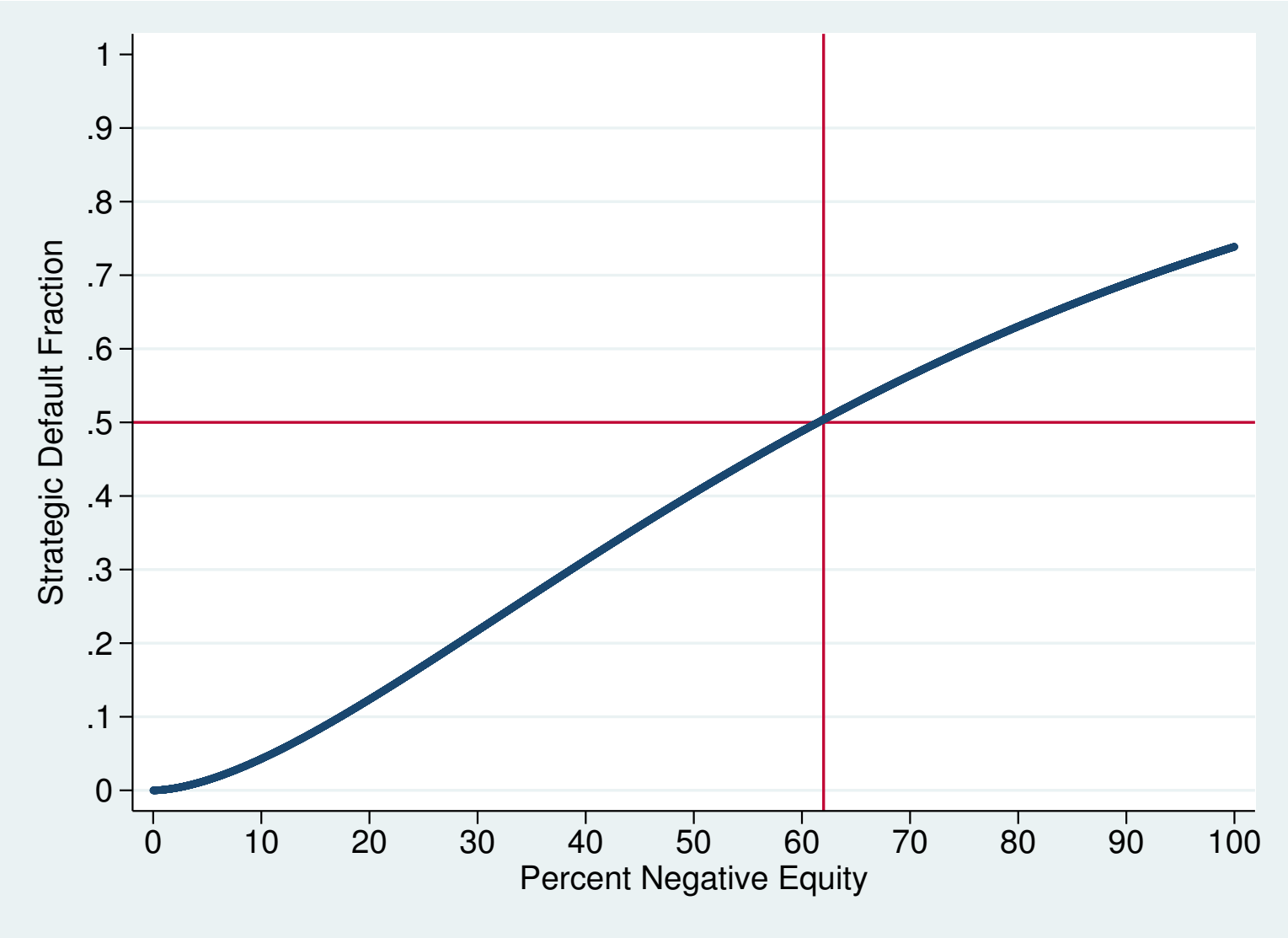
$$L = \prod_{i=1}^{N} \left[F(-E_i|\boldsymbol{\theta}) - F(-E_{-1,i}|\boldsymbol{\theta})\right]^{D_i \cdot \Pr(s_i=0|E_i,D_i=1)} \left[1 - F(-E_i|\boldsymbol{\theta})\right]^{1-D_i}$$

where

- $TC \sim gamma(\mu, \kappa)$.
- $F(\cdot)$ is cumulative $gamma$ density function.
- $\boldsymbol{\theta} = (\mu, \kappa)$
- $\Pr(s_i = 0|E_i, D_i = 1)$ is imputed from the first-step estimates.

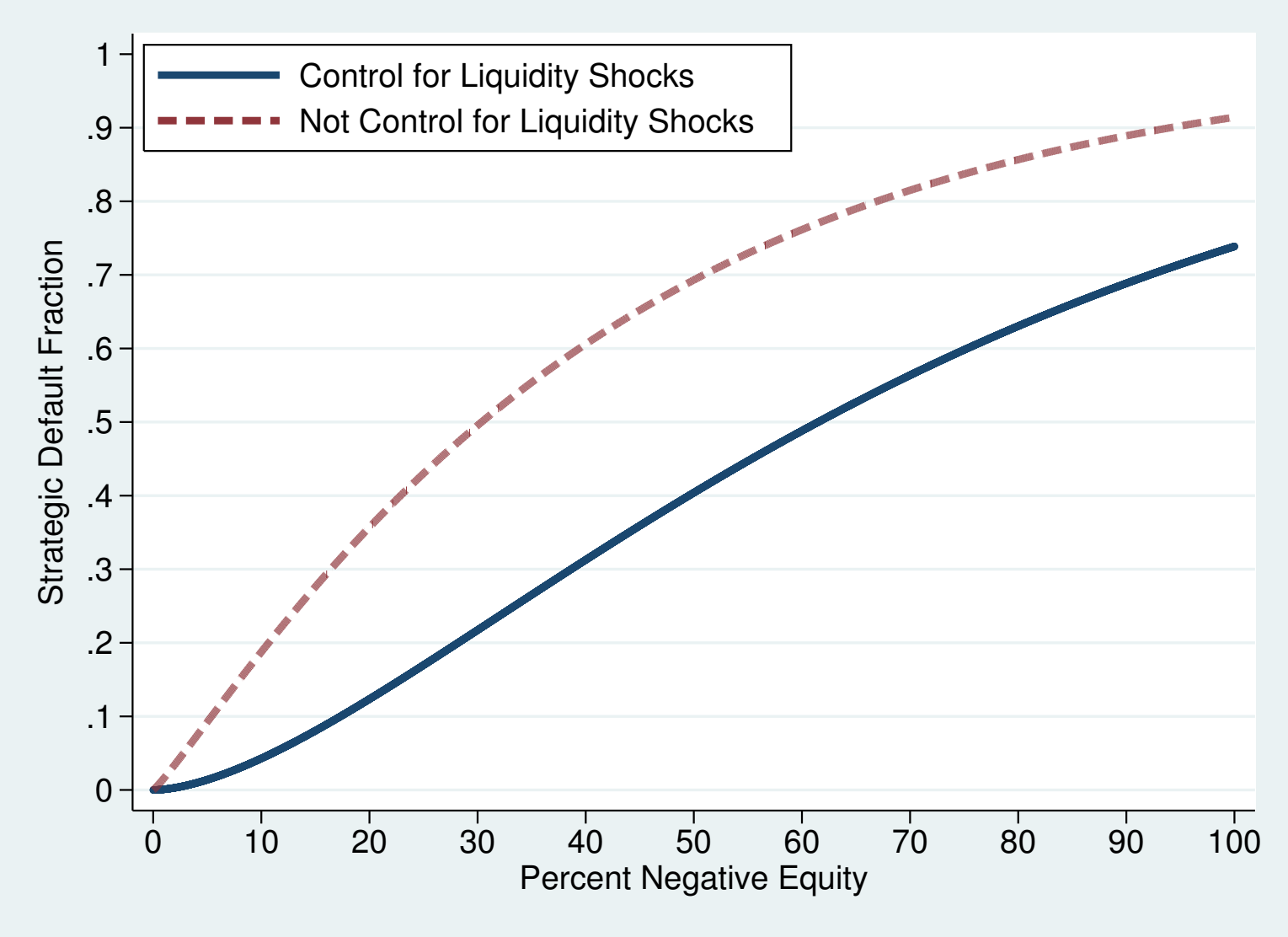
Step 2 Estimation Results

$$\hat{\mu} = 1.73, \hat{\kappa} = 43.6$$



Step 2 Estimation Results

Figure 4: Cumulative Distribution of Default Cost (TC)



Estimation Results

Table 3: Main Estimation Results

	Control for Liquidity Shocks (1)	**Not Control for Liquidity Shocks** (2)
Estimated Percent of Defaults due to Strategic Behavior (%)		
Equity below 0	**19**	100
Equity between 0 and -10%	5	100
Equity below -50%	51	100
Estimated Gamma Distribution		
Shape Parameter (μ)	1.73	1.12
	(0.02)	(0.01)
Scale Parameter (κ)	43.6	37.5
	(1.0)	(0.57)
N	100,224	100,243
Estimated Distribution of Default Cost as Percent of Home Value (%)		
p25	34	13
p50	**62**	30
p75	102	57

Further Discussions

Potential objections to our method:

- You don't observe individual-level liquidity shocks

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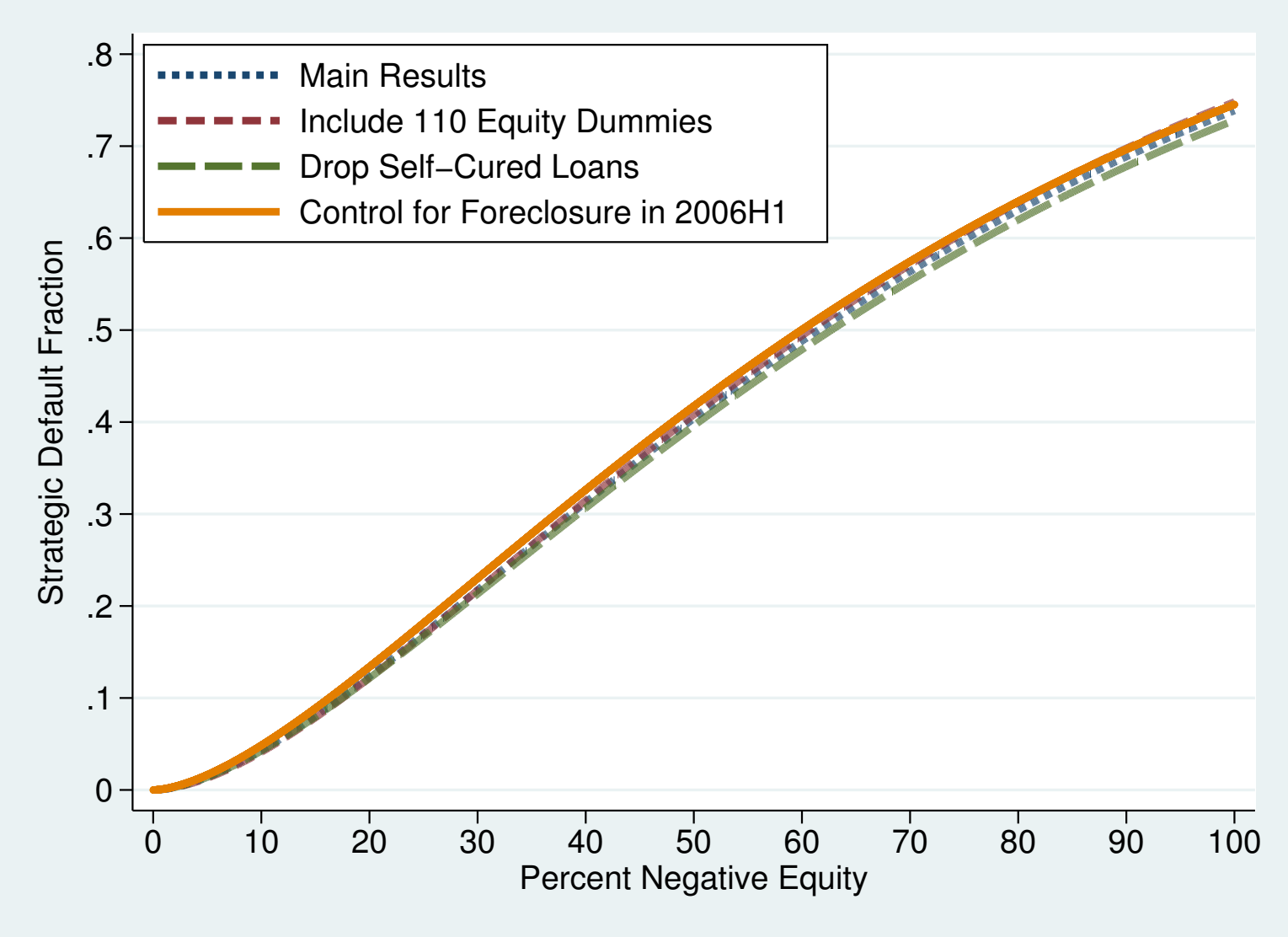
Control Variables	Fraction Strategic
Loan age	0.31
Loan age, time, interest rate	0.23
Loan age, time, interest rate, county measures	0.19

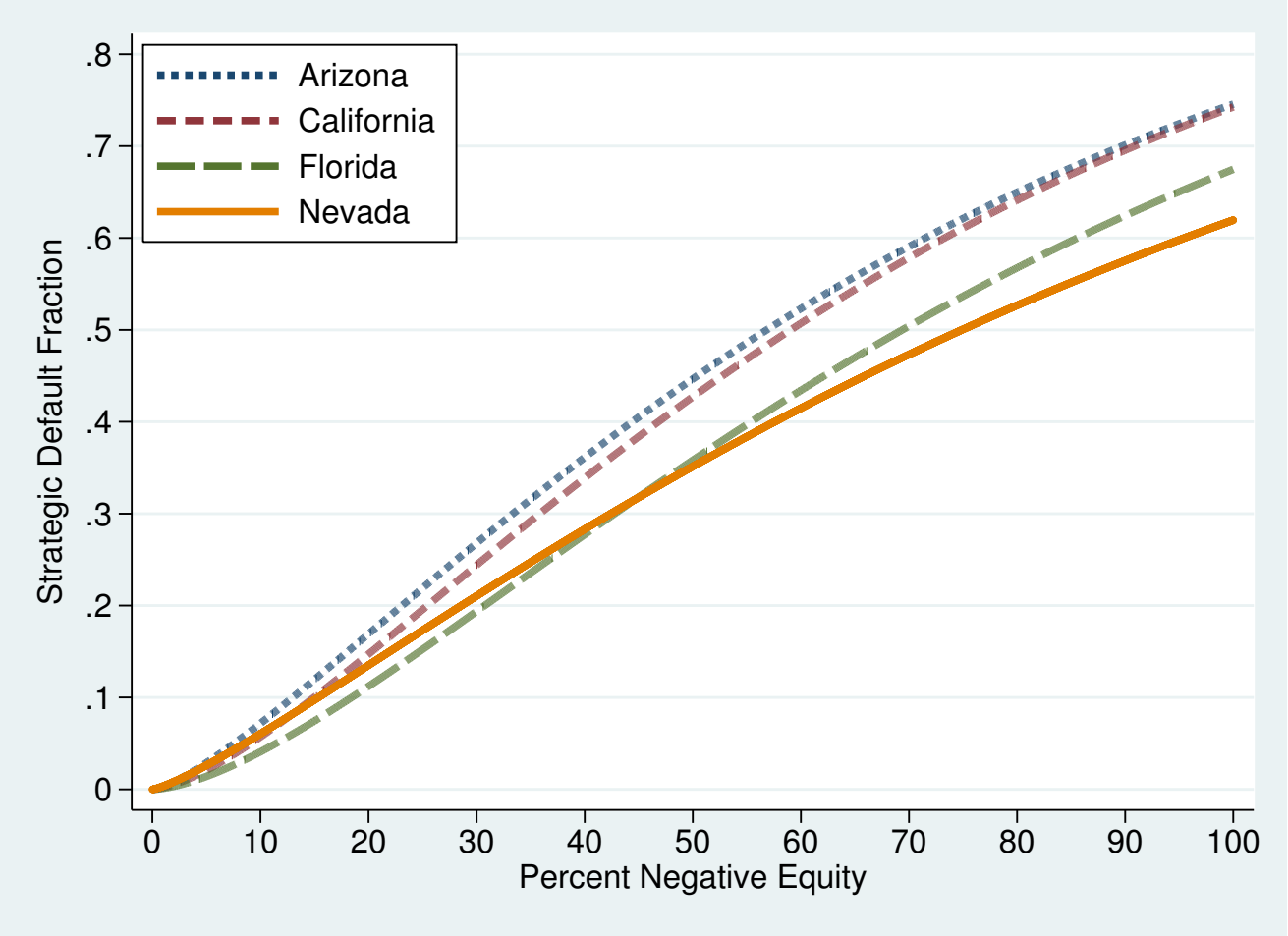
Robustness Checks

Figure 5: Robustness Checks



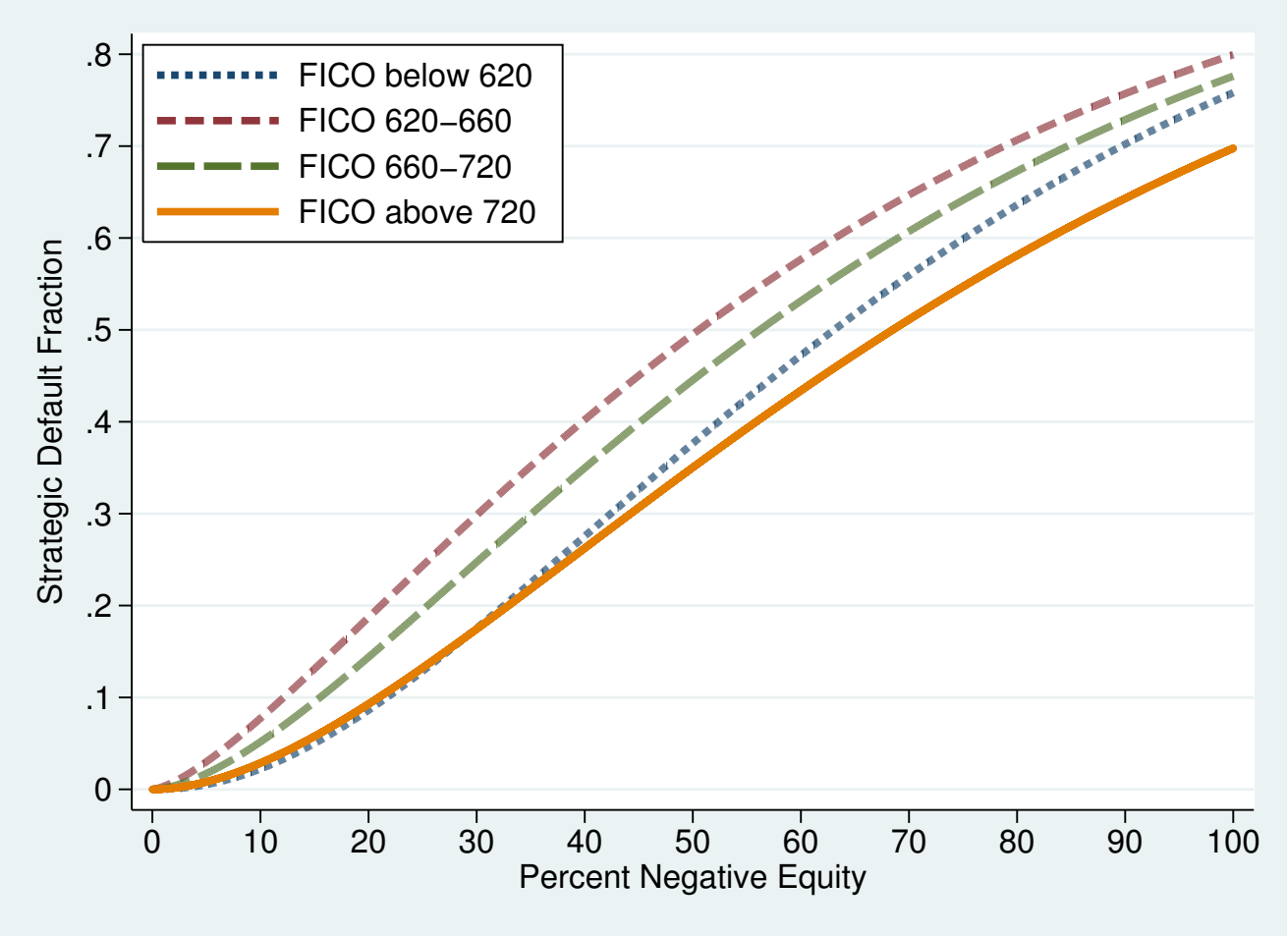
Heterogeneity

Figure 6: Lenders in FL and NV can sue for deficiency judgment



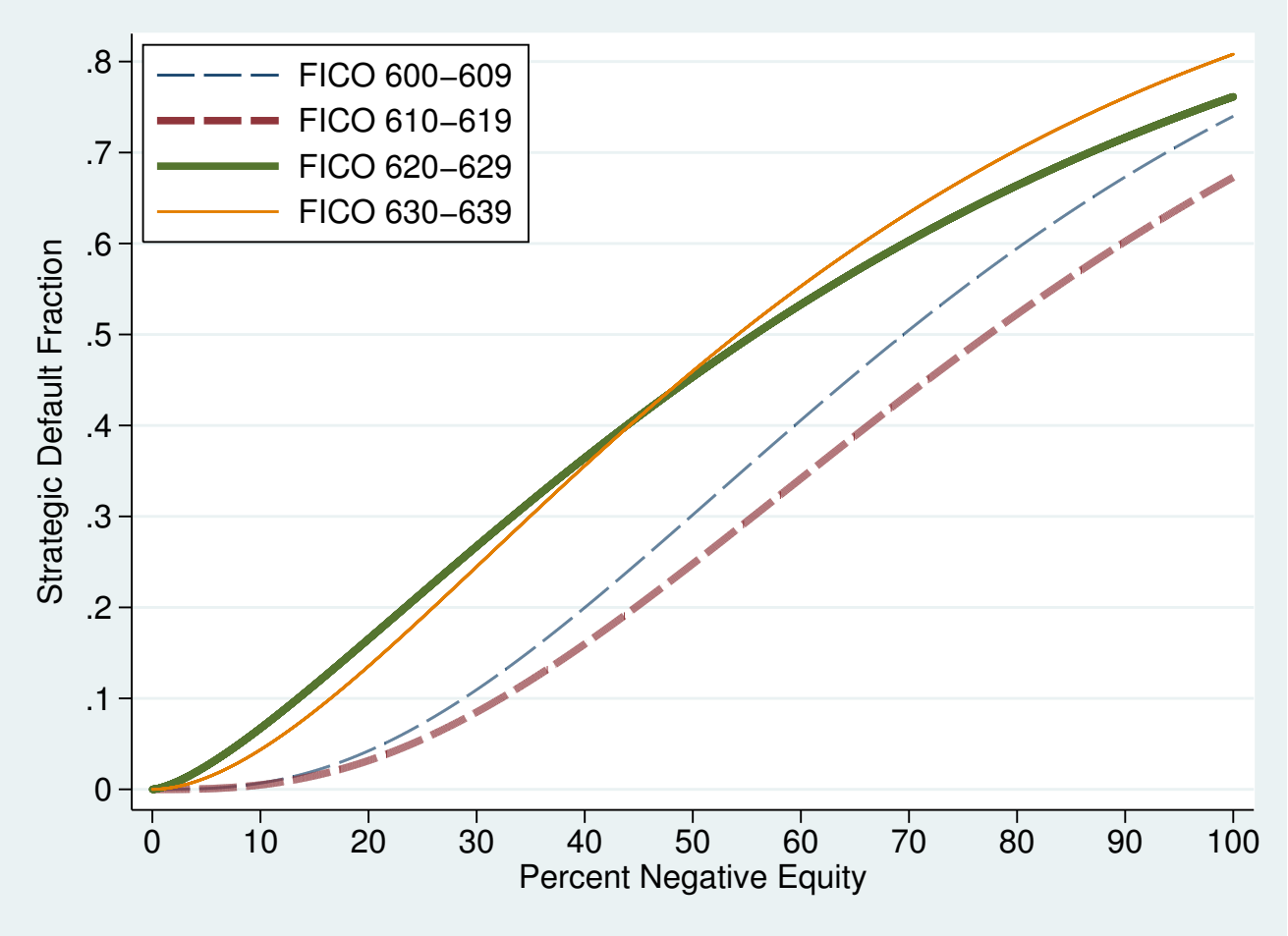
Heterogeneity

Figure 7: Borrowers with higher FICO scores have higher default costs



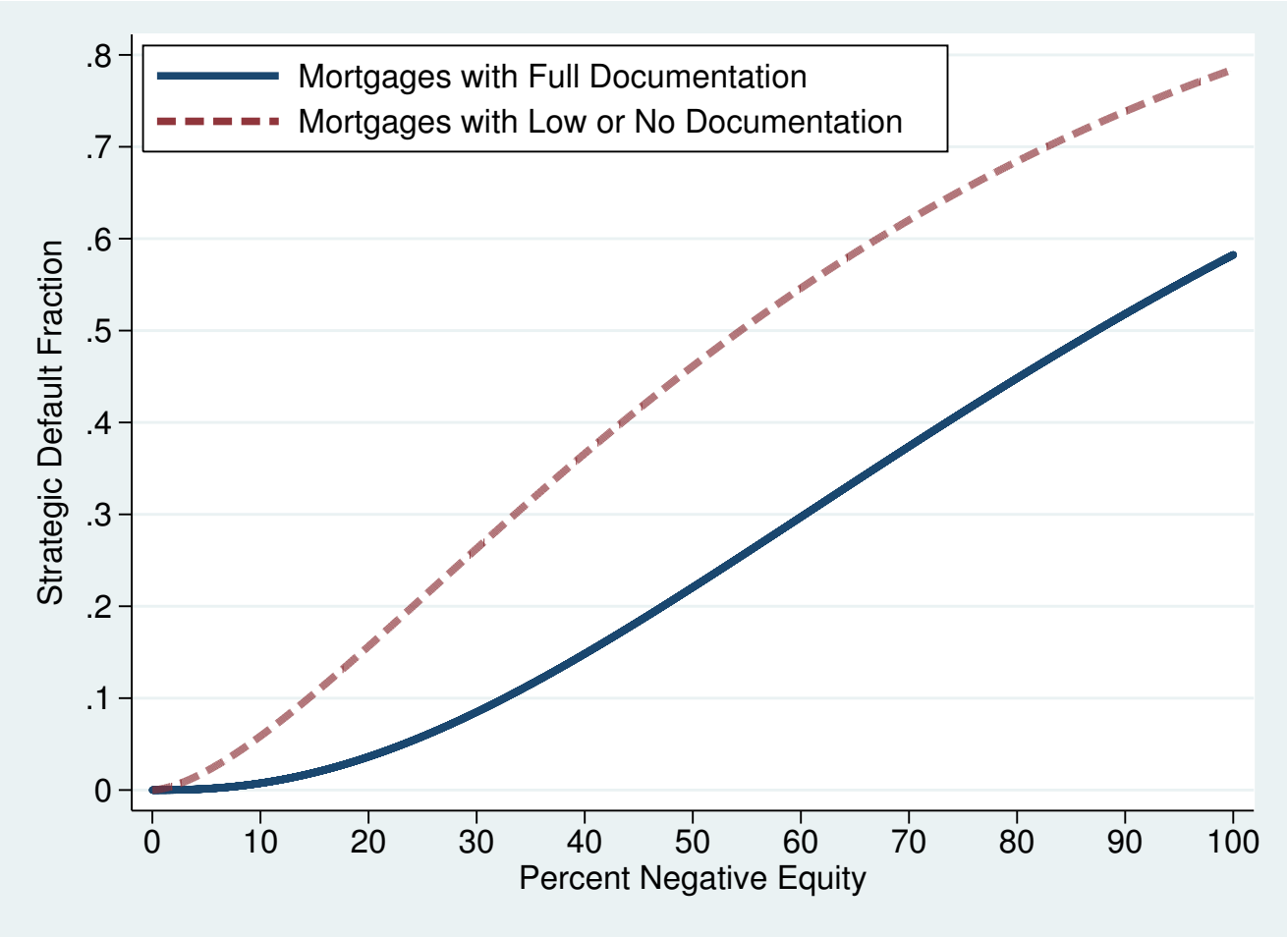
Heterogeneity

Figure 8: Lenders screen borrowers with FICO< 620 more



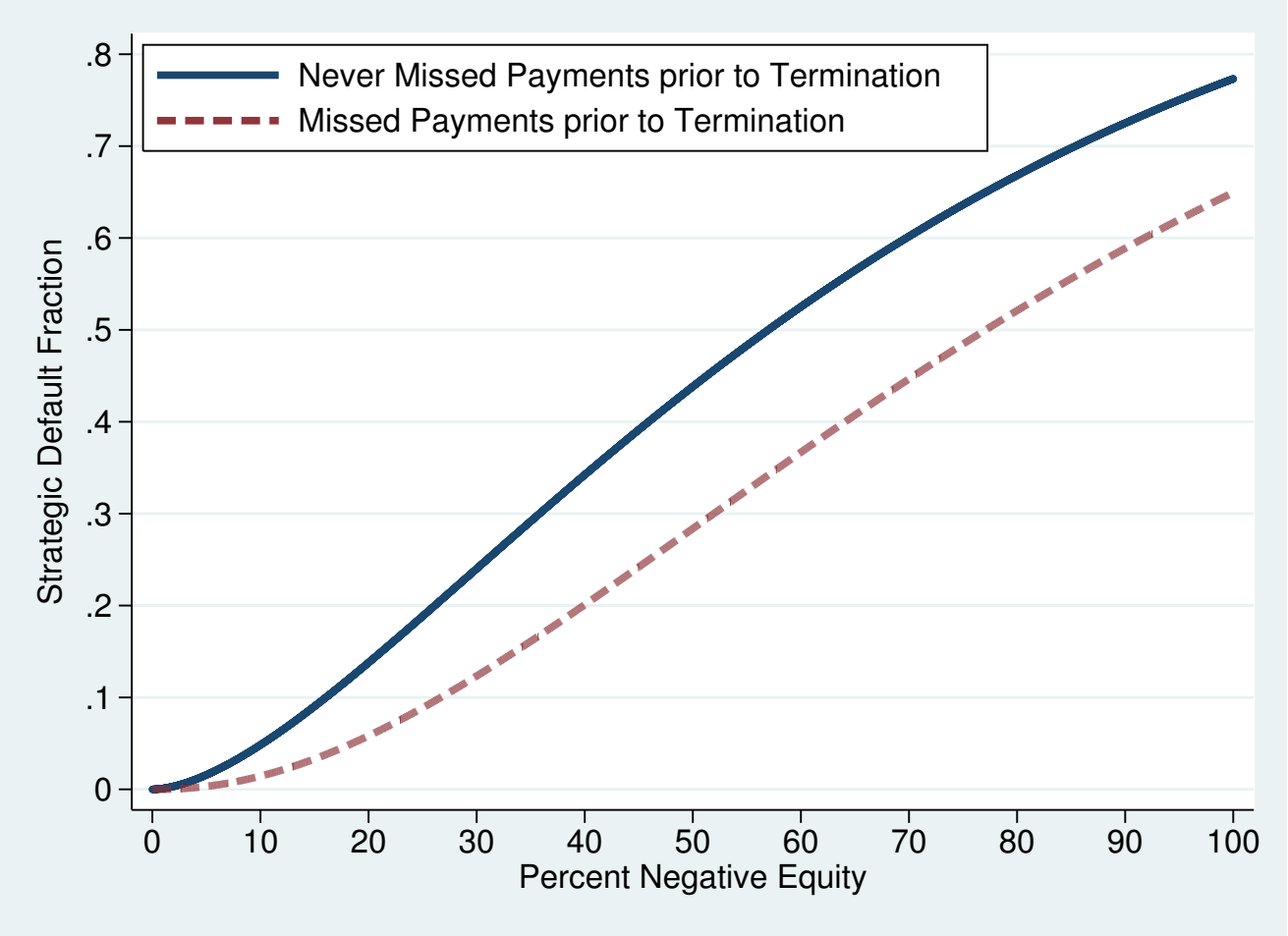
Heterogeneity

Figure 9: Borrowers providing little documentation have lower default costs



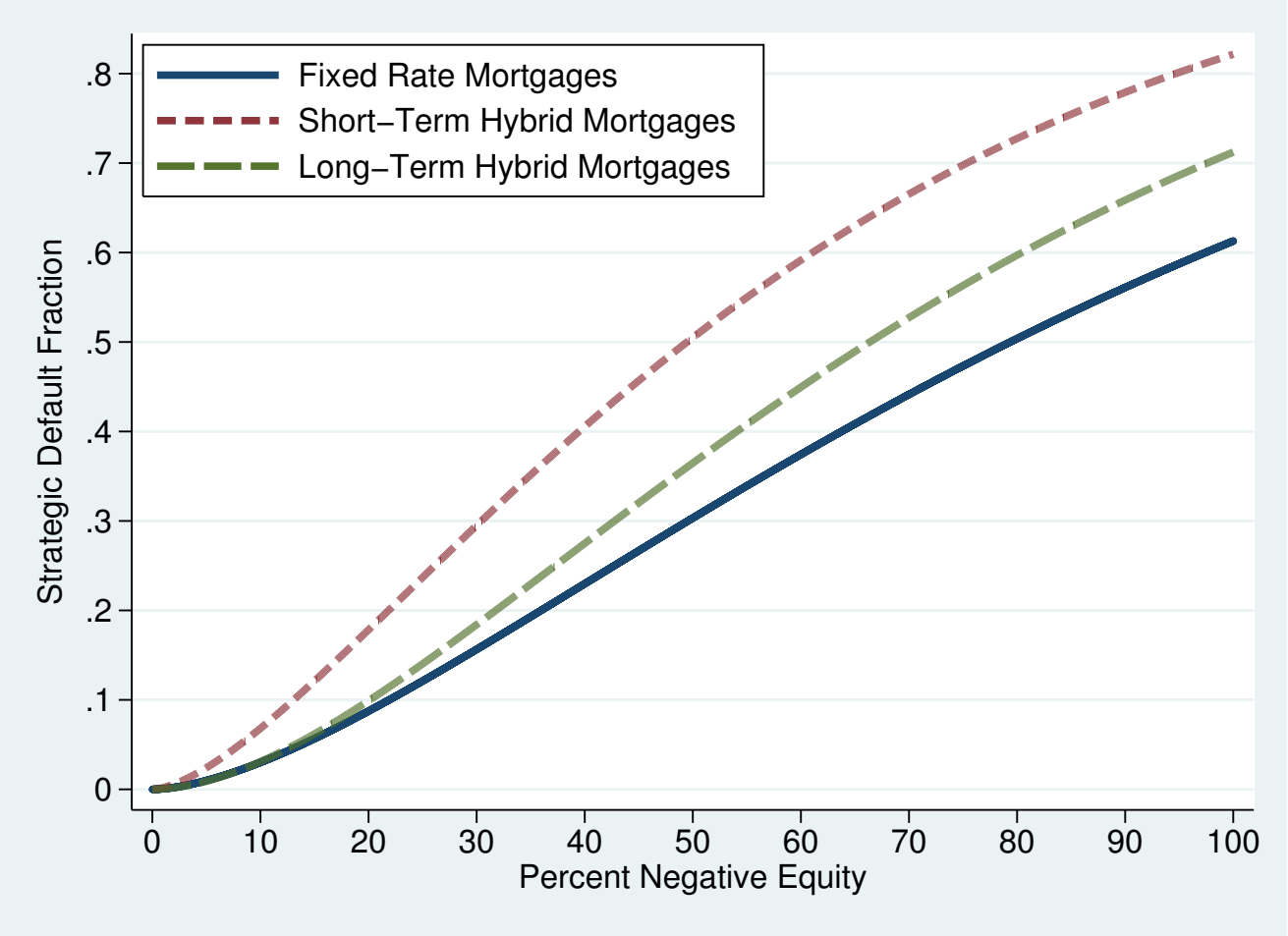
Heterogeneity

Figure 10: Borrowers who try are less likely to walk away



Heterogeneity

Figure 11: Borrowers who bet on house prices are more “ruthless”



Discussion of External Validity

Our estimates may be an upper bound for average borrower's strategic default behavior

- Bought homes in 2006 and have less attachment
- Put no money down
- Likely have little wealth that lenders can pursue
- Have low credit scores $\rightarrow$ might not find default as stigmatizing

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<u>BUT</u> may have underestimate

- Equity is measured with noise
- More difficult for non-prime borrowers to buy again in future
- Non-prime borrowers may be less sophisticated and overestimate costs of default

Conclusion

We estimate the level of negative equity that triggers default, accounting for:

- Censoring
- Confounding liquidity shocks

Overall, 19% of defaults in our sample are strategic

- When equity declines below -50%, about one half of defaults are strategic

Median borrower walks away when he is 62% underwater

- Likely an upper bound of strategic behavior
- Reflects high perceived default costs (e.g. stigma), moral aversion to default
  - OR borrowers are not fully informed/rational