House Prices, Foreclosures, and Bailouts

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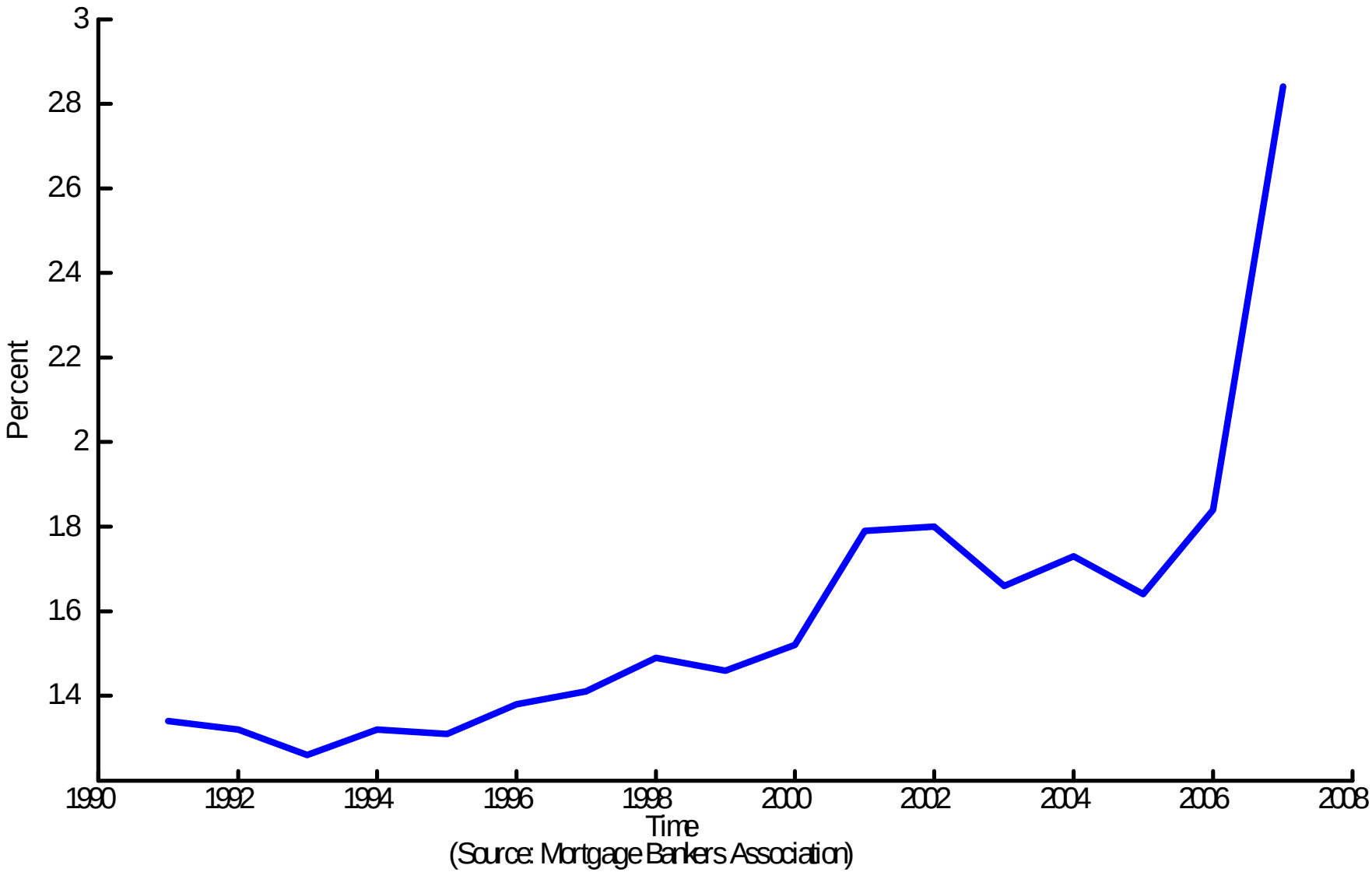
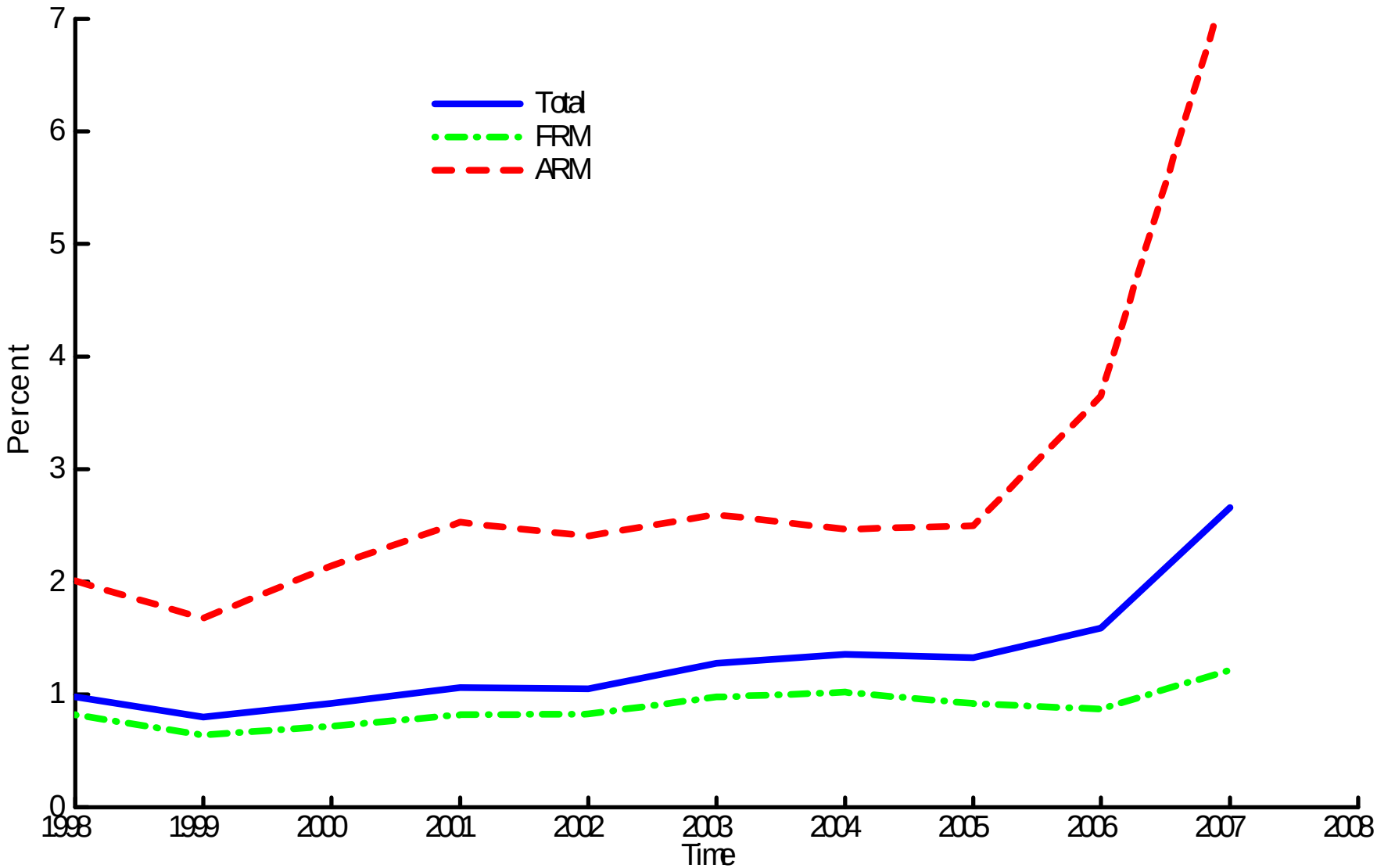
Evolution of Foreclosures U.S.: 1990-2008



Foreclosures by Loan Type U.S.



What are we here today for?

Objective of the paper is to contruct a model capable of saying somethings about:

- The determinants of foreclosure (i.e. how many, who's, etc...)
- Understand the levels of foreclosure across loan products
- Maybe to say something about the observed spike in foreclosures and its composition across loans.
- The cost and effects associated to bailouts in the mortgage industry

Relevant features of housing

- Ownership: We want to have the right amount of owners
  - Approximately 2/3 of US households own the home they occupy.
  - Renters are skewed towards young and poor households.
- House size:
  - The average size rental-occupied 1/2 owner-occupied.
  - The average size of a house changes over the life-cyle.
- Home purchase:
  - Most home are purchased with long-term mortgage only 5 percent are purchased cash.
  - 1/3 of the homes are owned free and clear
- Foreclosures: Large for loans with high LTV and adjustable payments.

Some relevant housing literature

- **Housing (short-term loans):** Ortalo-Magne and Rady, Davis and Heathcote (2006), Díaz and Luengo (2005), Nakajima (2004), Ríos-Rull and Sánchez-Marcos (2008), Kiyotaki, Michaelides, and Nikolov (2007), Carroll and Li (2008).
- **Default with unsecured lending:** Athreya (2002), Li and Sarte (2006), Livshits, MacGee, and Tertilt (2007), Chatterjee, Corbae, Nakajima, and Ríos-Rull (2005), Chatterjee, Corbae, and Ríos-Rull (2006), Athreya, Tam, and Young (2008), Sánchez (2008), Drozd and Nosal (2008), Nakajima (2008), Mateos-Planas and Ríos-Rull (2008).
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$\Rightarrow$ This paper extends the framework developed in Chambers, Garriga, and Schlagenhauf (2005) with **housing and long-term mortgages** to include a **default option.**

A Primer on Real Estate Law on Foreclosure

- **Anti-Deficiency Law**
  - The mortgage holder **is not** responsible for the deficit between the proceeds from the selling of the property and the outstanding loan balance on the purchase money mortgage.
  - Anti-Deficiency Law does not provide protection for secondary mortgages, home equity lines, or mortgages on non primary residents

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- **Deficiency Law**
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Housing Model with Default

- Economy with global capital markets
- Life Cycle Households
  - Idiosyncratic income risk, and uncertain life expectancy
  - Borrowing constraints, no annuity markets
  - Decisions: Consumption, savings, housing, foreclosures
- Production of Goods
- Construction Sector: Manufactures new homes and housing investment
- Mortgage Brokers: Provide housing finance
- Government: Social security and bailouts

Characteristics of Houses or dwellings

- Lumpy with minimum size $\underline{h} > 0$.
- Consumption/Investment good that generate service flows $d = g(h')$
- Rental market for housing services $R(h' - d)$.
- Homes maintenance depends on utilization, $\varphi(h', d)$
- Selling a house is subject to an i.i.d. capital gains shock $p\xi h$where $E(\xi) = 1$.
- Non-convex adjustment costs $\kappa(h' \neq h, h) > 0$

Housing Finance: Long-term contracts with default option

- Finite set of mortgage loans available, $z \in Z$.
- Lender is commited to the loan a finite number of periods, N.
- Mortgage loans differ by downpayment $\chi(z)$, repayment structure $m(n)$,interest rate, $r(z)$
- Initial loan amount

$$D(N) = (1 - \chi(z))ph'$$

- Default option is exercised at time of sale

$$max(\Pi_\xi, 0)$$

where $\Pi_\xi = (1 - \phi_s)p\xi h - D(n, z)$

Investment Bank

- Mortgage brokers use capital market to finance mortgage lending.
- We assume a competitive lending sector that maximizes expected profits per mortgage contract, z.
- The mortgage rate charged is given by $r^* + \varrho(z)$, where $\varrho(z)$is a loan specific premium.
- Profit condition for mortgage contract z

$$M_{r^*+\varrho(z)}(z) - rRP' + FL = 0$$

where
$M_{r^*+\varrho(z)}(z)$ =Mortgage interest payments
RP' =Beginning of next period Outstanding Principal
FL =Proceedings from selling foreclosed properties

Structure of household's decisions: Renters (h=0)

$$v(x) = \max\{v^r, v^o\}$$

where $x = (a, h, n, z, \epsilon, j)$

Rent: $v^r(x) = \max_{(c,d,a')} u(c,d) + \beta_{j+1} E_\epsilon v(x')$

$$s.t. \qquad c + a' + Rd = y(x)$$

Own: $v^o(x) = \max_{(c,d,a',h',z')} u(c,d) + \beta_{j+1} E_\epsilon v(x'),$

$$s.t. \qquad c + a' + [\phi_b + \chi(z')]ph' + m(z') = y(x)$$

Structure of household's decisions: Owners (h>0)

$$v(x) = \max\{v^s, v^c, v^r\}$$

Stay: $v^m(x) = \max_{(c,d,a')} u(c,d) + \beta_{j+1} E_\epsilon v(x')$

$$s.t. \qquad c + a' + m(z) = y(x)$$

Change: $v^c(x) = \max_{(c,d,a',h',z')} E_{\xi,\epsilon}[u(c,d,\varphi I_f) + \beta_{j+1} v(x')],$

$$s.t. \qquad c + a' + [\phi_b + \chi(z')]ph' + m(z') = y(x) + \max(\Pi_\xi, 0)$$

i) Repay ($I_f = 0$)**:** $\Pi_\xi = (1-\phi_s)p\xi h - D(x) \geq 0$

ii) Foreclosure ($I_f = 1$)**:** $\Pi_\xi = (1-\phi_s)p\xi h - D(x) < 0$

Construction Sector

- Manufactures new homes and housing investment using a linear reversible technology, $I_H = C_H/\theta$,
- Optimization problem competitive firm

$$\max_{H,C_H} pI_H - C_H$$
$$s.t. \quad I_H = C_H/\theta$$

- Equilibrium house price satisfies

$$p = \theta$$

- The aggregate law of motion for housing investment is

$$I_H = (1+\rho)H' - H + \varkappa(H, \delta_o, \delta_r).$$

Mapping the Model and the Data (I)

Functional Forms

- **Preferences:**

$$U(c,d) = \gamma \frac{c^{1-\sigma_1}}{1-\sigma_1} + (1-\gamma)\frac{d^{1-\sigma_2}}{1-\sigma_2}$$

- **Technology:**

$$F(K,L) = K^{\alpha} L^{1-\alpha}$$

Mapping the Model and the Data (II)

Statistic	**Target**	**Model**
Ratio of capital to GDP (K/Y)	2.54	2.54
Ratio of housing to capital stock (H/K)	0.48	0.43
Housing investment to housing stock (x_H/H)	0.04	0.04
Ratio housing services to consumption (Rd/c)	0.24	0.23
Ratio capital investment to GDP $(\delta K/Y)$	0.14	0.14
Capital Income Share	0.29	0.29
Homeownership rate	66.3	66.5
Default rate (Non FRM)	0.02	0.02

Model Fit: Why is this a good model?

Housing Distributions: Model and Data

Homeownership Rate

by Age Cohorts	Total	20-34	35-49	50-64	65-74	75-89
Data 1998	66.3	39.3	75.8	80.1	79.1	77.4
Baseline	66.5	46.2	79.6	81.9	84.1	76.9

Sqft. Owners[1]

by Age Cohorts	Total	20-34	35-49	50-64	65-74	75-89
Data 1998	2,137	1,854	2,220	2,301	2,088	2,045
Baseline	2,228	1,957	2,185	2,392	2,463	2,377

Data source: American Housing Survey (AHS) and Current Population Survey (CPS)

Foreclosures (I): Aggregate Rate

Foreclosures by Loan Type

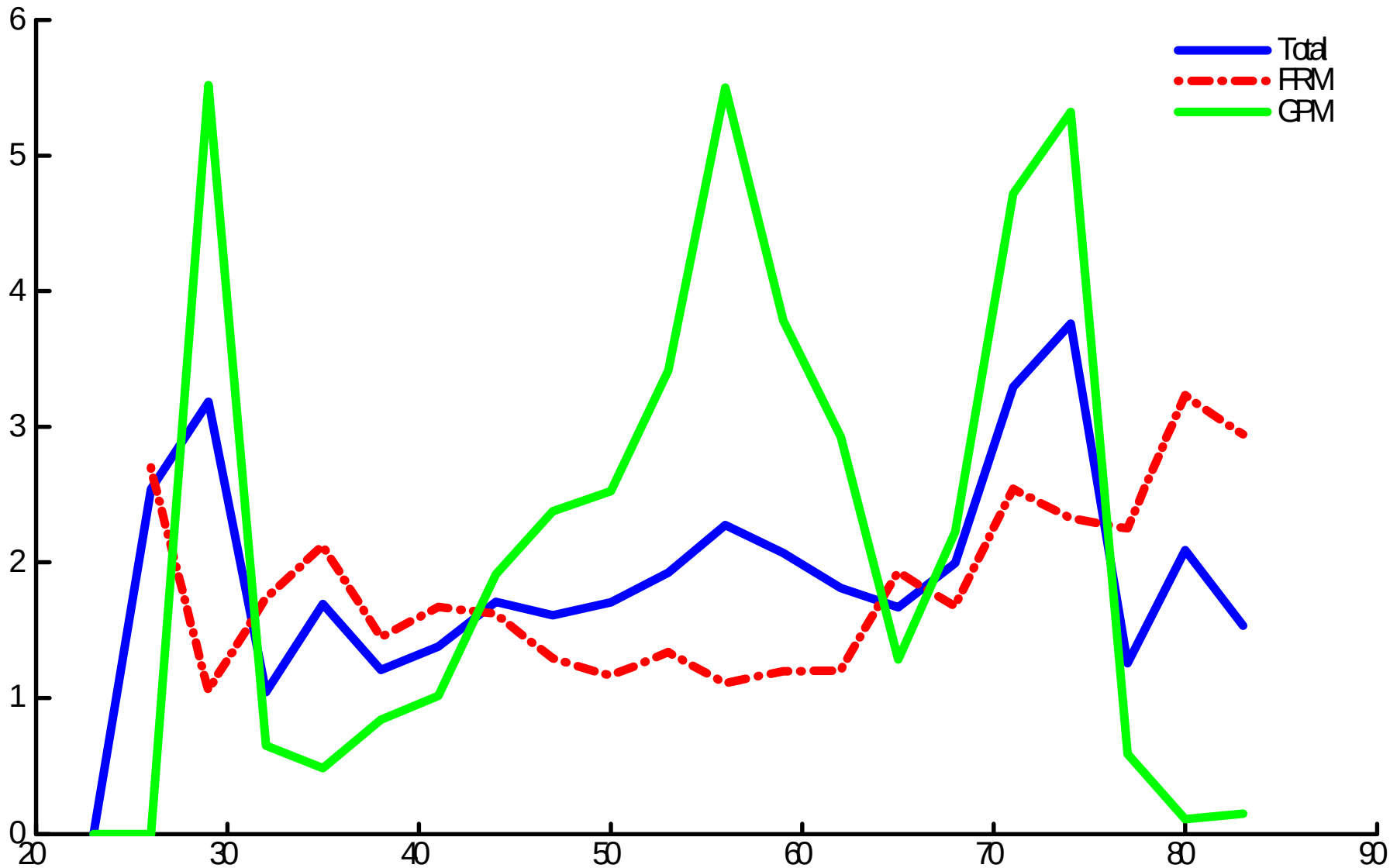
	Data (1998)	**Model**
Aggregate	1.5	1.8
by loan type		
FRM	0.8	1.7
GPM	2.0	2.0

Foreclosures (II): Distributions by Age

Foreclosure Rates by Age (No data!!!)

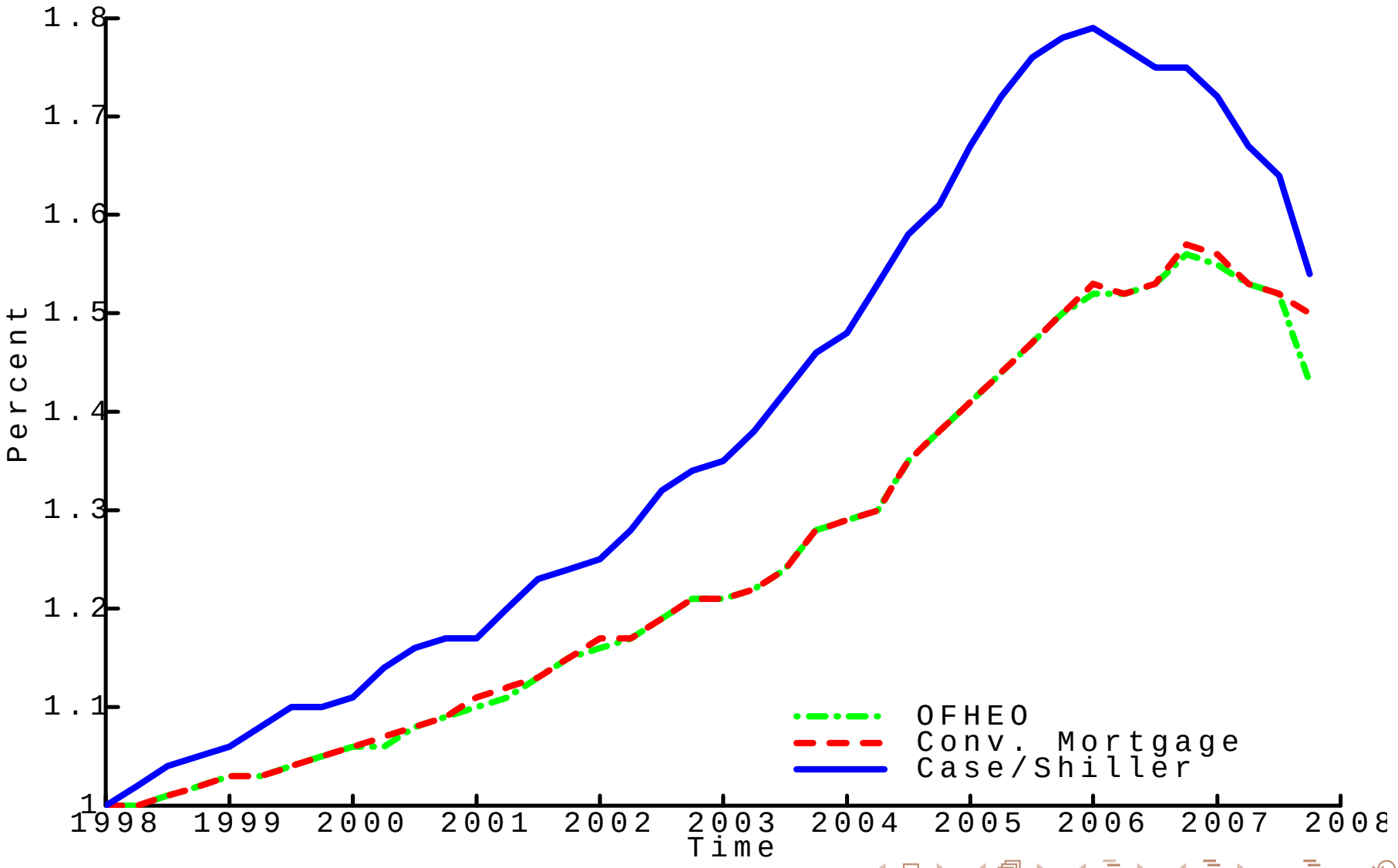
by Age Cohorts	**20-34**	**35-49**	**50-64**	**65-74**	**75-89**
Level	1.6	1.5	1.9	2.5	2.1
Share	16.7	15.6	19.8	26.0	21.9

Foreclosures (III): Distributions by Loan Type and Age



Rationalizing the Spike in Foreclosures

- Our mechanism is a sharp (unanticipated) decline in house prices



Generation of a decline in house prices

- We consider a one time unanticipated $\triangle\theta$ that decline in the current house price, but σ_ξ same.
- Existing Homeowners face an equity loss, $p_0 > p_1$.
- The adjustment of the rental market ($\triangledown R$) is **very important** to prevent an increase in participation.
- Lenders have short-term losses ($\triangle$ increase in default rates and $\triangledown$ collateral value)
- Government bails out firms to ensure zero profits.

Model prediction decline home prices

Foreclosures by Loan Type (at t=1)

	Default Rate	Ownership	Rental Price (%△)
Baseline	1.8	66.5	
▽15%	2.7	66.3	-8.6%

Default rates by mortgage type

Foreclosures by Loan Type (at t=1)

	Data		**Model**	
	1998	**2007**	**Baseline**	$\nabla 15\%$
Aggregate	1.5	2.8	1.8	2.7
by loan type				
FRM	0.8	1.22	1.7	2.2
GPM	2.0	7.4	2.0	4.0

Driving Force of Foreclosure: Equity Multiplier

- A decline in house prices have a larger negative "multiplier effect" in homeowners' equity.
- The value of a property V_0 can be decomposed in

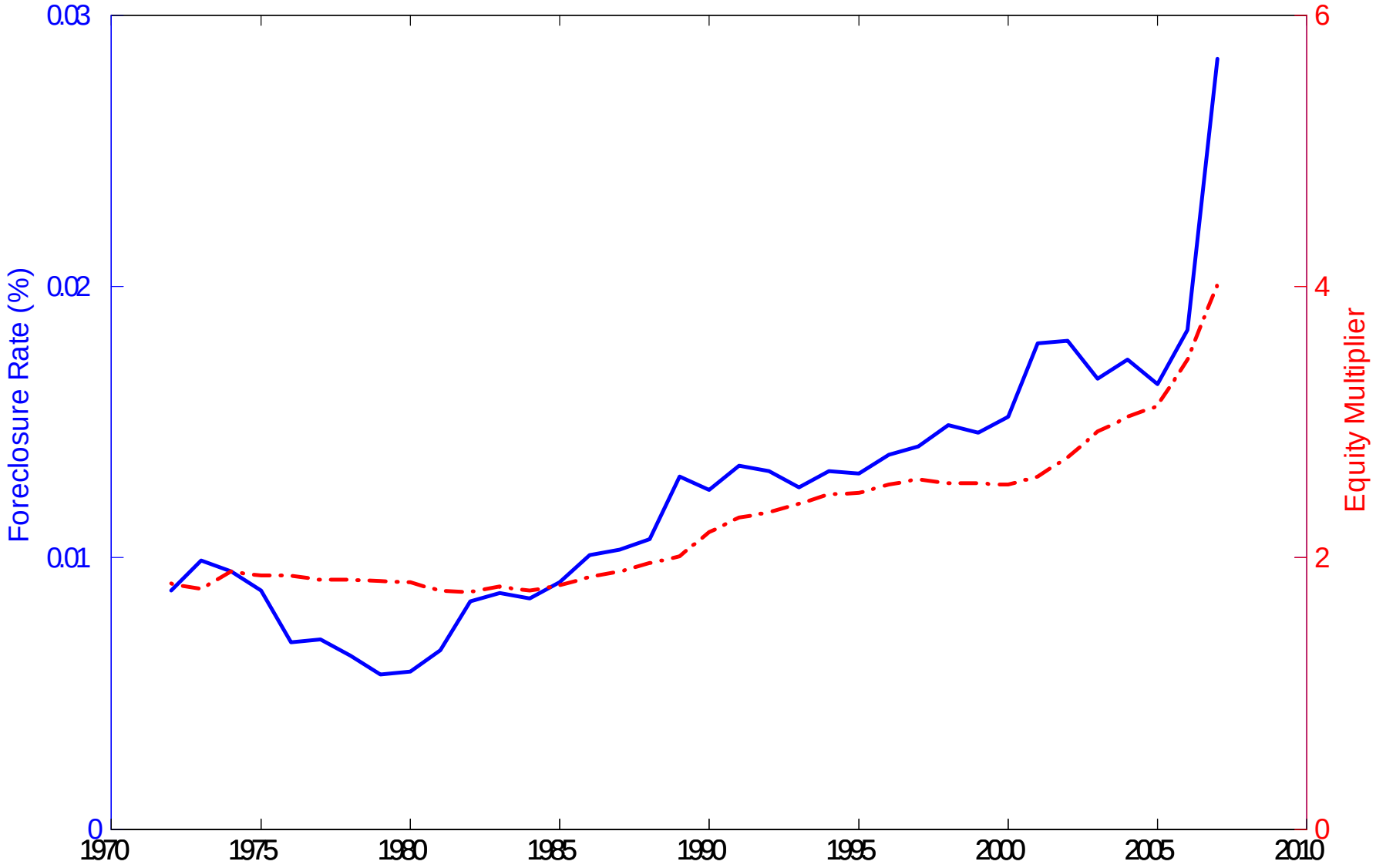
$$V_0 = D_0 + E_0$$

  where D_0 =outstanding debt, and E_0 = home equity.
- A decline in the house value amplified by leverage and equity drops at a faster rate

$$e = \frac{1}{1 - LTV} v.$$

  where $LTV = D_0 / V_0$.
- Our model suggests that leverage matters for default!!!

Evidence of the Equity Multiplier and Foreclosures



Conclusions

- We have developed a quantitative model of secured long-term lending with default.
- Main findings
  1. the model can generate sizeable default rates at the aggregate level and across mortgage types.
  2. the models predicts that a decline in house prices can partially rationalize the spike in foreclosure rates.
  3. the composition of default across loan products is harder to pin down. Mortgage rates include additional premiums.
  4. aggregate leverage makes the economy more vunerable to house price risk