Housing Finance, Boom-Bust Episodes, and Macroeconomic Fragility

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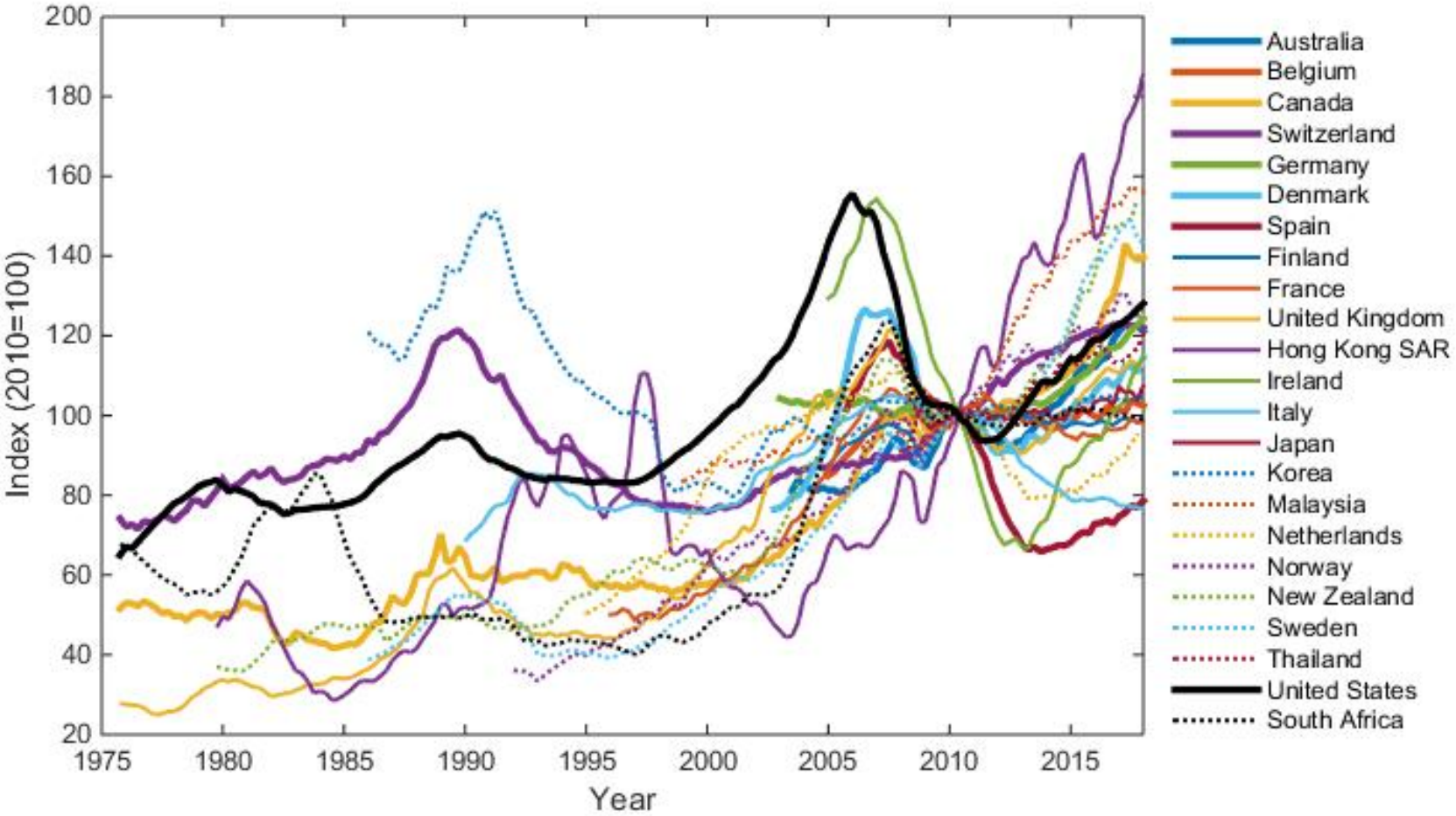
Workshop on Housing, Credit and Heterogeneity: New Challenges for Stabilization Policies

LARGE SWINGS IN REAL HOUSE PRICES



- Housing booms exhibit some common empirical regularities (Jordá, Schularick, and Taylor (2015)).

INCREASING MORTGAGE DEBT

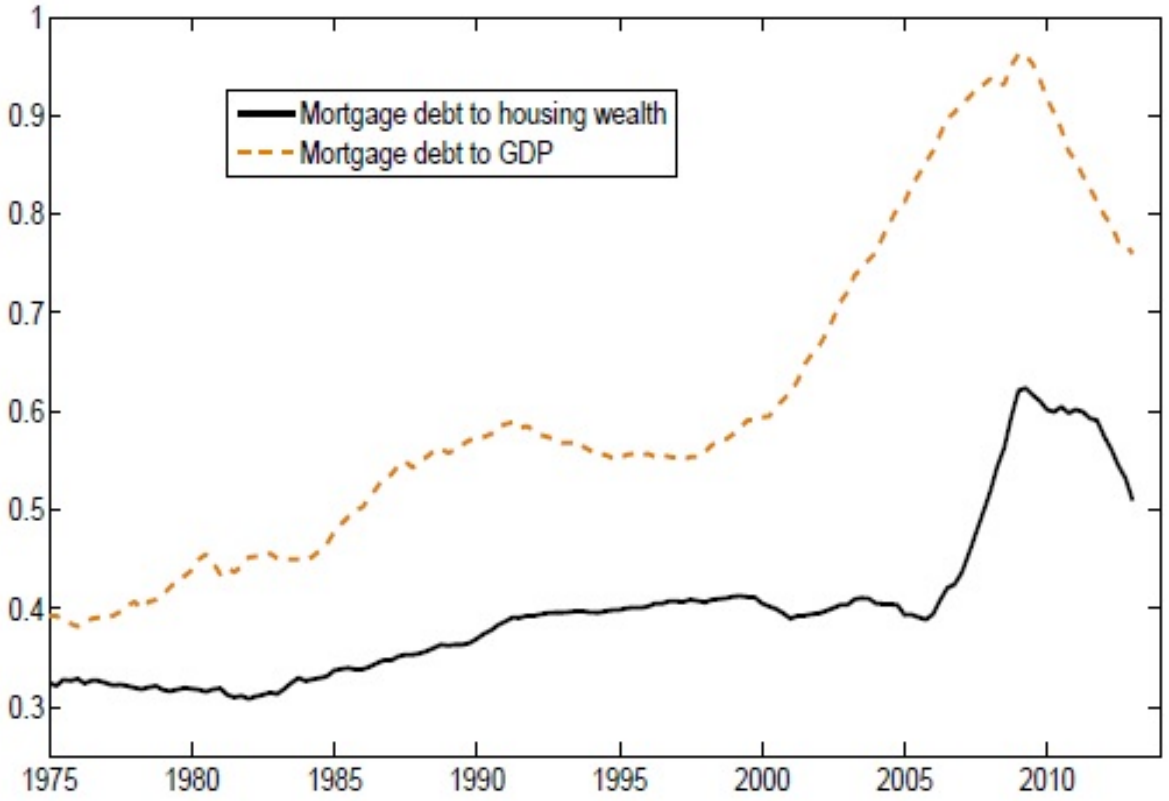


Figure: Mortgage debt. Davis and Van Nieuwerburgh (2015)

- The most recent U.S. boom coincided with ↑ debt/income but stable debt/house value.

MACRO EFFECTS

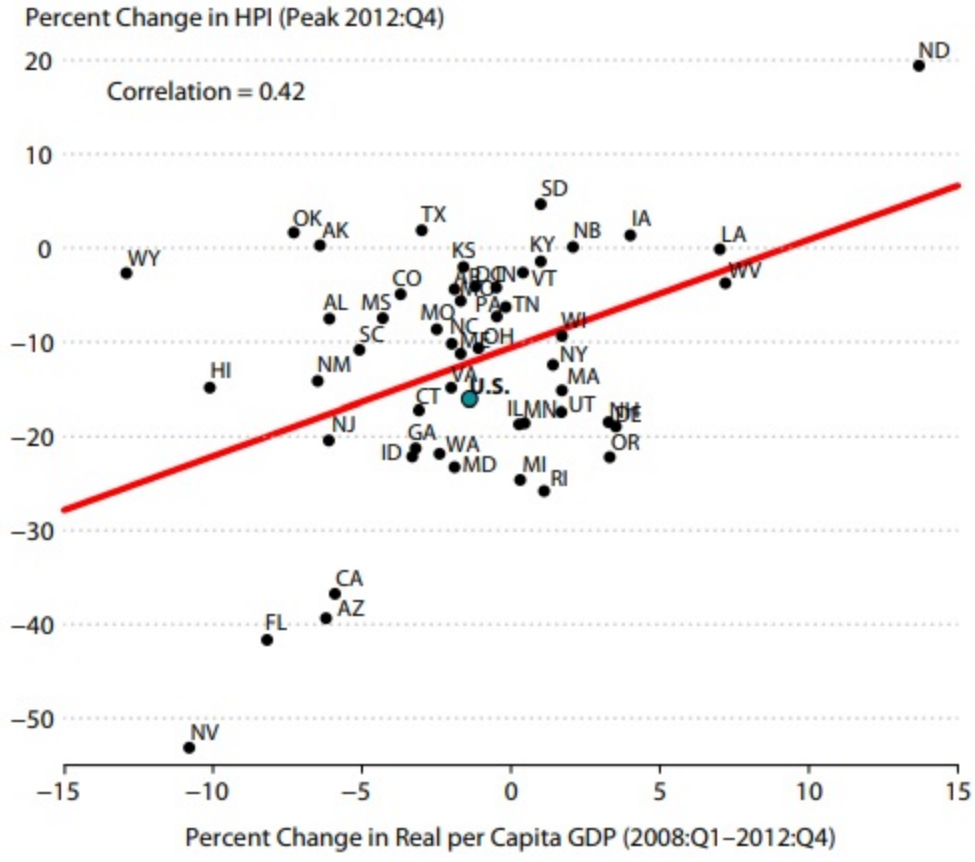


Figure: Prices vs. GDP. St. Louis Fed Economic Synopses, 2013, No. 11

- Evidence of large macro spillovers.

Longer Term Agenda

1. **What drives housing (especially prices)?**
   - Fundamentals (productivity/income growth, demand shocks, demographic change)
   - Expectations
   - Credit
   - Liquidity
2. **How does housing impact the macroeconomy?**
   - Balance sheet effects and consumption.
   - Fragility of the financial sector.
   - Investment spillovers.
   - Transmission of policy.

TODAY'S TALK

Question: *How do different features of the housing finance landscape impact boom-bust episodes and macroeconomic fragility?*

1. **Borrowing costs:** quantify the role of low mortgage rates in the housing boom using a quantitative macro model.
   - Extensive and intensive margins for housing/borrowing: easy credit affects marginal buyers and existing owners.
2. **Mortgage structure:** consequences of contract features and institutions that vary across time, person, and place.
   - First-order implications for housing dynamics; strong consumption spillovers.
3. **Regulations:** analyze how macroprudential policies impact boom-bust episodes in housing and consumption.
   - Fragility trade-off: safer debt distribution vs. less insurance.

WHICH CONTRACT FEATURES AND REGULATIONS?

- **Interest Rate Exposure:** fixed vs. adjustable rate loans. Distinguish between periods of rising and falling rates.
- **Housing as an ATM:** low-cost equity extraction vs. no cash-out refinancing.
- **Rollover Risk:** long-term contracts vs. short-term debt.
- **Macroprudential Policies:** loan-to-value constraints vs. payment-to-income constraints.

MODEL SUMMARY: I

Households

- Preferences $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t, c_{h,t})$ over consumption c and housing services c_h.
- Segmented owner and rental markets: own $h \in \mathcal{H}$ with $c_h = h$ or rent apartment space $c_h = a \in [0, \bar{a}]$, where $\bar{a} \leq \underline{h}$.
- Stochastic labor $e \cdot s$ with cdf $F(e)$ and transitions $\pi_s(s'|s)$.

Technology

- Goods production $Y_c = z_c N_c = C + S_h + \frac{1}{A} C_a + \Omega$.
- Linear, reversible technology for producing apartment space $\Rightarrow$ rents $p_a = 1/A$ are purely supply-determined.
- New owner-occupied housing $Y_h = F_h(\overline{L}, S_h, N_h)$.

MODEL SUMMARY: II

Banking Sector: issues bonds for saving; mortgages.

- Long-term: distinction between stock vs. flow of credit; down payments vs. collateral constraints.
- Interest rate exposure: FRM vs. ARM.
- Default and prepayment risks priced in at origination.
- Other dimensions: loan duration, equity extraction, etc.
- Banks actively manage foreclosure inventories.

Housing Market Frictions: endogenous transaction costs and trading delays.

- Directed search by price and house type.
- Agents face a trade-off between the terms of trade and probability/speed of a successful transaction.

CALIBRATION

- Calibrate the economy to the late 1990s.
- Important to match households' balance sheets (especially the LTV distribution), homeownership, and foreclosures.

Description	Target	Model	Source/Reason
Homeownership Rate	67.0%	67.2%	Census
Housing Wealth (Owners)	2.49	2.49	1998 SCF
Median Owner Liq. Assets/Earn	0.16	0.15	1998 SCF
Median Borrower LTV	62.90%	65.51%	1998 SCF
Borrowers with $LTV \geq 70\%$	40.00%	43.43%	1998 SCF
Borrowers with $LTV \geq 80\%$	25.0%	24.2%	1998 SCF
Borrowers with $LTV \geq 90\%$	14.50%	11.27%	1998 SCF
Borrowers with $LTV \geq 95\%$	9.20%	7.97%	1998 SCF
Foreclosure Starts (Annual)	1.60%	1.87%	Nat'l Delinq Survey

▸ Full Calibration Details

THE BOOM, BUST, AND RECOVERY IN HOUSING

- Unexpected surprises in the aggregate regime both for real and financial/credit variables.
- The result is a boom, bust, and recovery.

		Credit		*Real*	
Regime	Dates	Rates (R/R_m)	Down Payment	Prod	Inc Risk
Baseline	Pre-2001	2.9%/7.5%	None	Initial	Normal
Boom	2001–2006	0.9%/5.5%	None	+5%	Normal
Bust	2006–2011	Mixed*	10%	−5%*	↑ Left Tail
Recovery	Post-2011	0.9%/5.5%	None	+5%	Normal

*The risk-free rate increases to 4.9% briefly during Fed tightening, but mortgage pass-thru depends on FRM vs. ARM. Later, QE lowers mortgage rates to 4%.

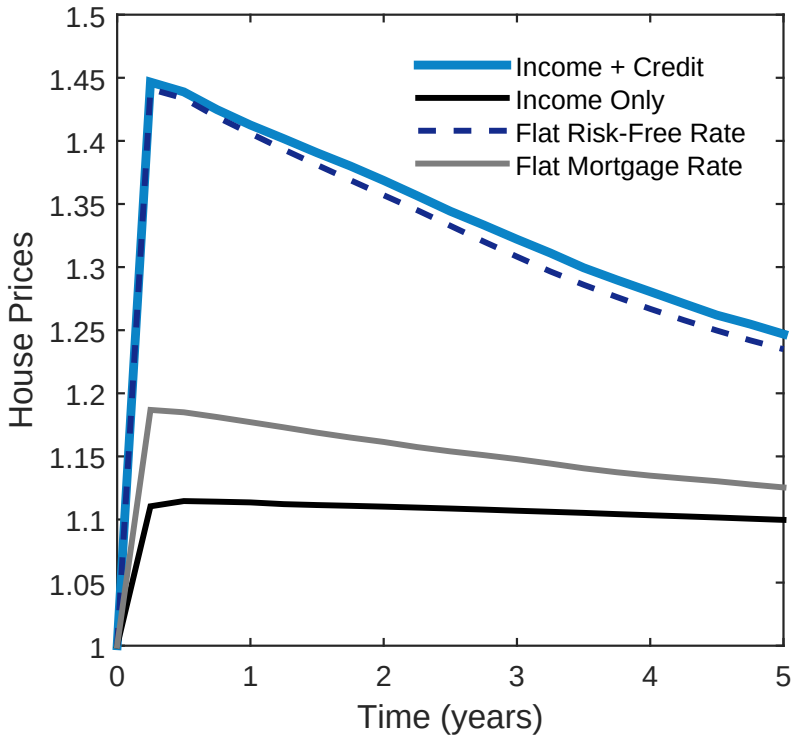
**The TFP decline only lasts 12 quarters.

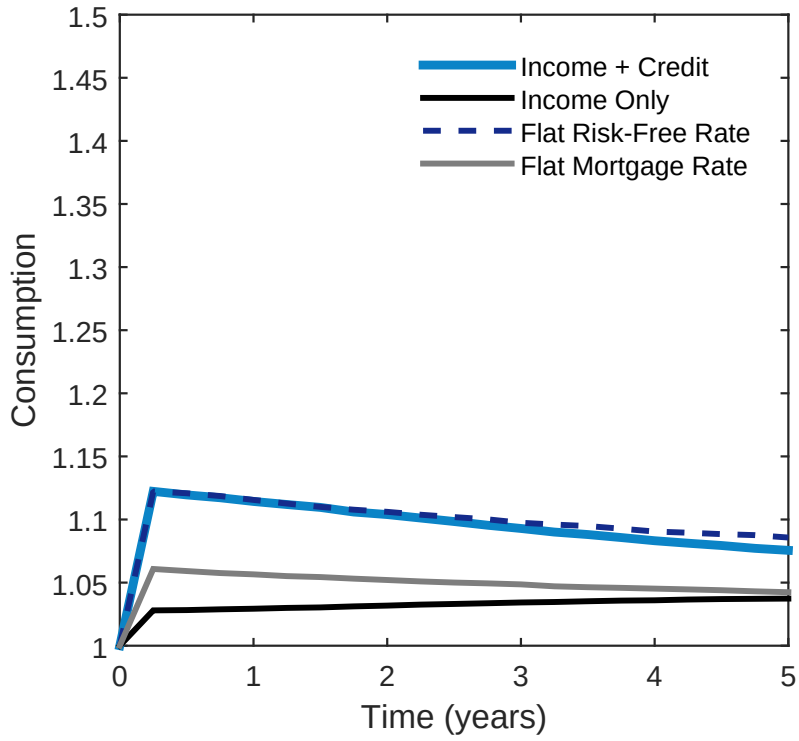
The Boom, Bust, and Recovery

	Boom			*Bust*		
	ΔPrices	ΔC	Own	ΔPrices	ΔC	Own
Model	+44.6%	+12.2%	68.1%	−24.5%	−18.5%	64.3%
Data	+41.9%	+5.1%	69.2%	−25.9%	−15.0%	64.2%

- The model captures the behavior of housing and consumption during the boom and bust.
- Ownership shifts toward larger houses.

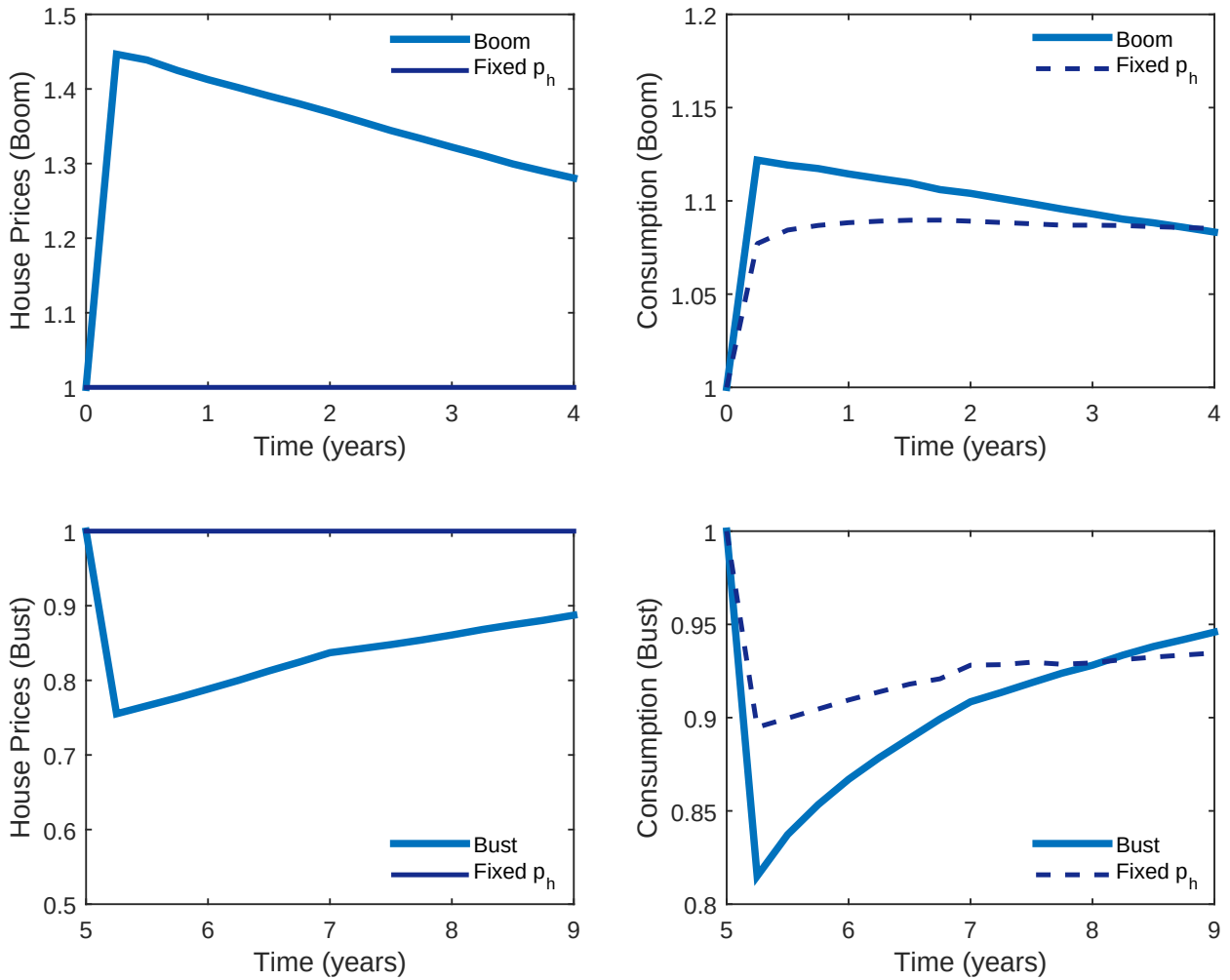
BORROWING COSTS AND THE BOOM





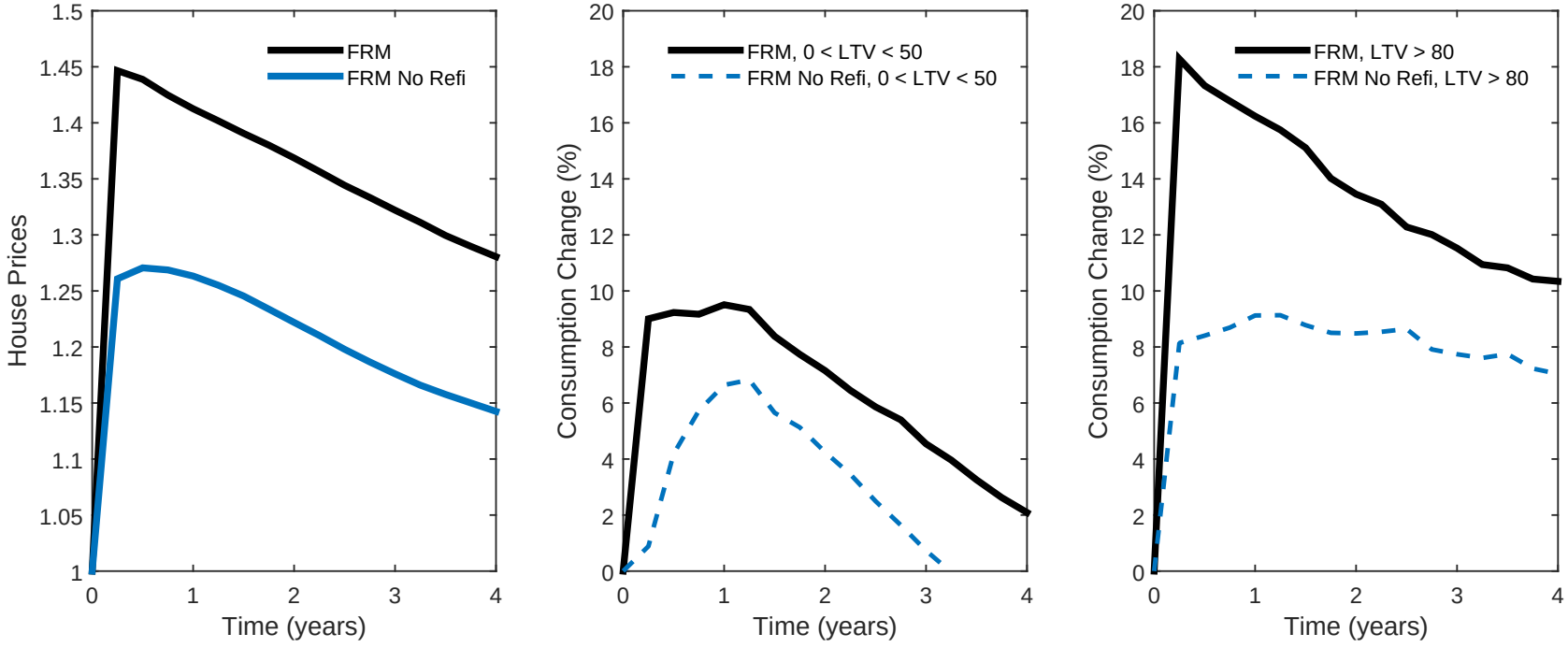
- Cheaper credit is more important than higher income.
- Lower mortgage rates drive the boom, not a re-evaluation of discounted implicit rents from a lower risk-free rate.

CONSUMPTION SPILLOVERS



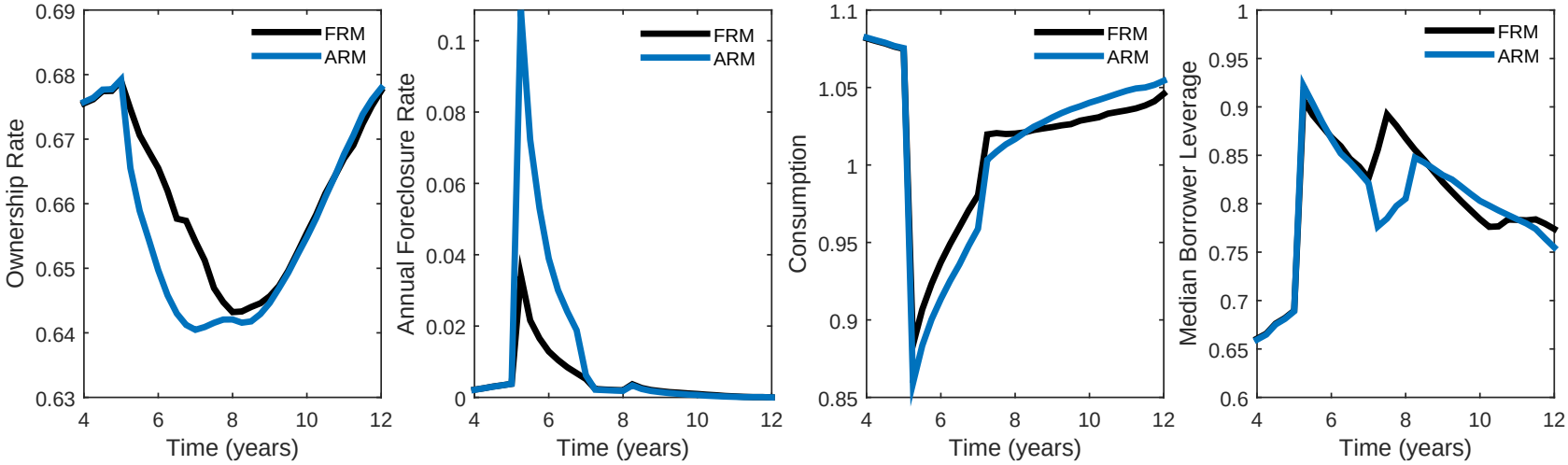
- Asymmetric balance sheet effects: equity evaporation far more damaging to consumption.

MORTGAGE STRUCTURE: EQUITY EXTRACTION



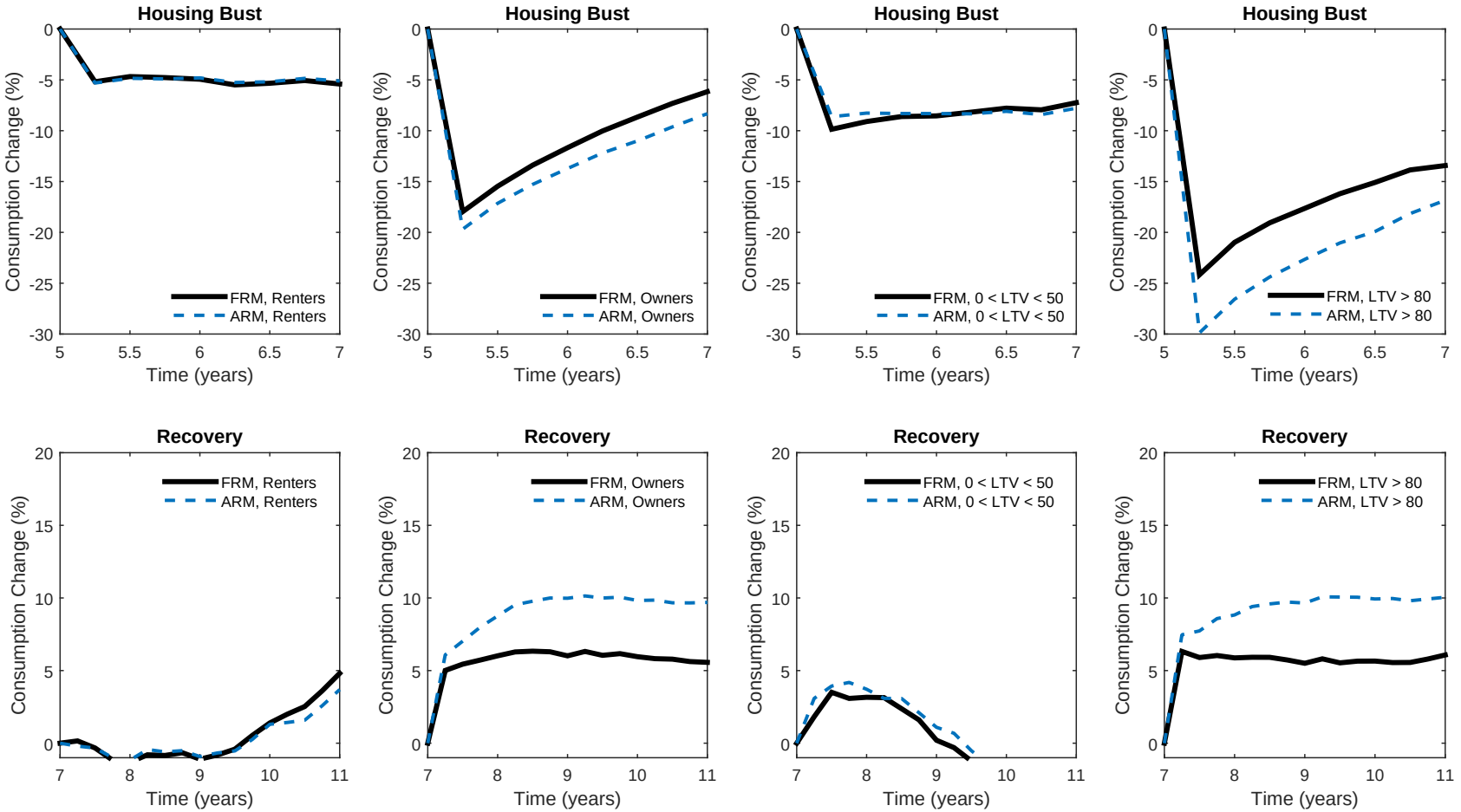
- Without the ability to refinance, the house price boom is 40% smaller and exhibits less overshooting.
- When houses can't be used as ATMs, the spillover to consumption is smaller and more gradual.
- Impact on consumption most stark for high LTV owners.

MORTGAGE STRUCTURE: INTEREST RATE EXPOSURE



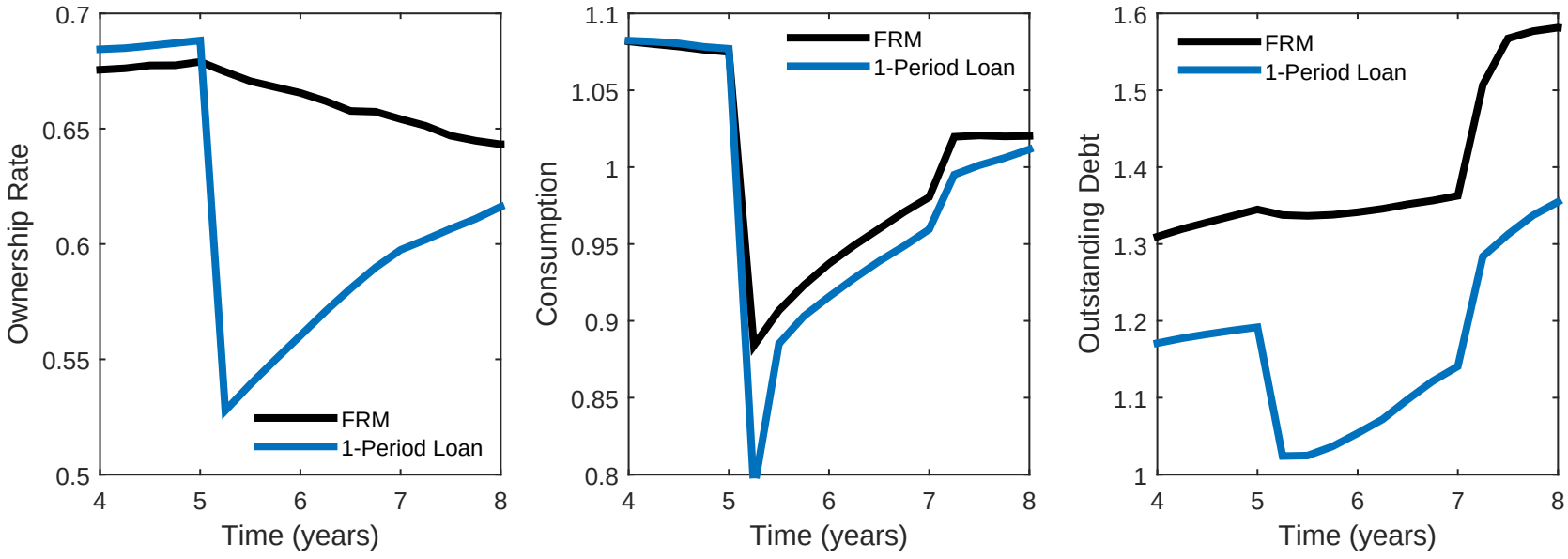
- FRM vs. ARM: no difference during the boom.
- Homeowners face higher debt servicing costs under ARMs when rates rise $\Rightarrow$ steeper homeownership decline, bigger foreclosure spike, more severe consumption drop.
- ARM holders automatically benefit from post-QE lower rates. FRM holders must refinance to benefit.

INTEREST RATE EXPOSURE IN THE CROSS SECTION



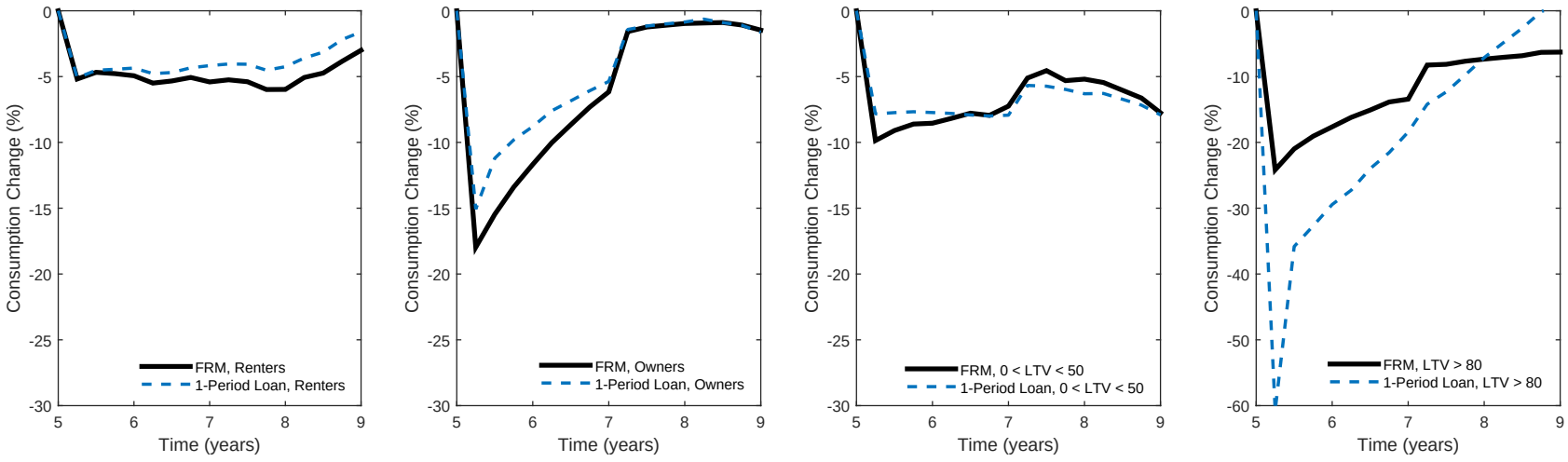
- Consumption is more sensitive to interest rates in the ARM economy, particularly among highly leveraged owners.

MORTGAGE STRUCTURE: ROLLOVER RISK



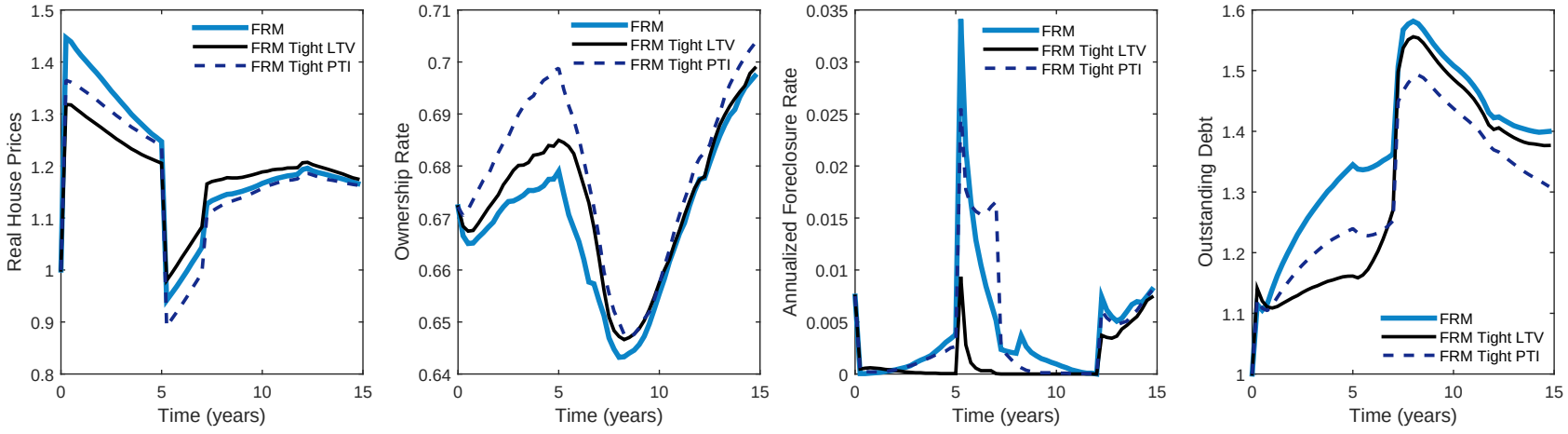
- Mortgage duration has almost no impact on housing dynamics during the boom.
- A wave of margin calls during the bust creates involuntary deleveraging and a crisis in ownership and consumption.

ROLLOVER RISK IN THE CROSS SECTION



- Homeowners with equity are largely shielded from rollover risk during the bust.
- Highly leveraged owners experience a consumption disaster with short-term debt.

MACROPRUDENTIAL POLICY: LTV VS. PTI CAPS



- Two factors affect fragility: the debt distribution and the ability to insure against shocks.
- LTV and PTI caps both reduce debt.
- LTV caps reduce fragility, but PTI caps more severely limit insurance during the bust and *increase* fragility.

Conclusions

- Credit booms/reversals have strong macroeconomic effects through the housing market.
- Mortgage structure has significant, asymmetric aggregate and distributional consequences.
- Equity extraction contributes significantly to swings in housing and consumption.
- Interest-rate exposure and roll-over risk also important.
- Macroprudential policies impact fragility by altering the debt distribution and the ability to insure against shocks.

FRICTIONAL HOUSING MARKET: I

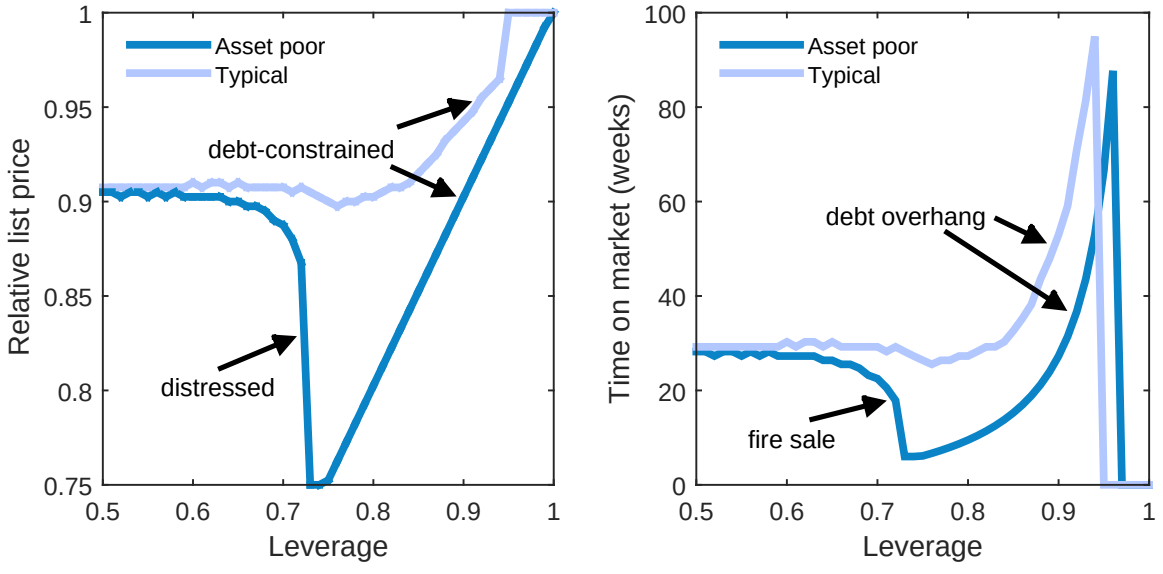
- The option value of trying to sell is

$$\max\{0, \max_{p_s} \eta_s(\theta_s(p_s, h)) \left[(V_{rent} + R_{buy}) (y + p_s - m, s, 0) - V_{own}(y, m, h, s, 0) \right] \}$$

such that

$$p_s + y \geq m$$

- Heavily indebted sellers forced to post high list prices $\Rightarrow$ long selling delays; debt overhang.



FRICTIONAL HOUSING MARKET: II

- Importance of endogenous housing liquidity explored in Garriga and Hedlund (2016).
- Sellers choose list price p_s and sell w/prob $\eta_s(\theta_s(p_s, h))$.
- Dynamic sorting problem simplified by brokers $\Rightarrow$ block recursivity: θ_s, θ_b do not depend directly on distribution Φ.

$$\eta_s(\theta_s(p_s, h; \Phi)) = \left(\frac{p(\Phi)h - p_s}{\kappa_s h}\right)^{\frac{\gamma_s}{1-\gamma_s}} \quad \eta_b(\theta_b(p_b, h; \Phi)) = \left(\frac{p_b - p(\Phi)h}{\kappa_b h}\right)^{\frac{\gamma_b}{1-\gamma_b}}$$

- Equilibrium determination of sufficient statistic $p(\Phi)$:

$$\int h^* \eta_b(\theta_b(p_b^*, h^*; p)) d\Phi_{rent} = \underbrace{Y_h(p)}_{\text{new housing}} + \underbrace{S_{REO}(p)}_{\text{REO housing}} + \underbrace{\int h \eta_s(\theta_s(p_s^*, h; p)) d\Phi_{own}}_{\text{sold by owner}}$$

▸ Back to Household Problem

CALIBRATION I

- Calibrate the economy to match the cross-section of leverage in 1998, plus other key housing statistics.

Description	Parameter	Value	Source/Reason
	Independent Parameters		
Autocorrelation	ρ	0.952	Storesletten et al (2004)
SD of Persistent Shock	σ_ϵ	0.17	Storesletten et al (2004)
SD of Transitory Shock	σ_e	0.49	Storesletten et al (2004)
IES	ν	0.13	Flavin and Nakagawa (2008)
Risk Aversion	σ	2	Standard
Structure Share	α_S	30%	Favilukis et al. (2016)
Land Share	α_L	33%	Lincoln Inst Land Policy
Holding Costs	η	0.7%	Moody's
Depreciation (Annual)	δ_h	1.4%	BEA
Rent-Price Ratio (Annual)	r_h	5%	Sommer et al. (2013)
Risk-Free Rate (Annual)	r	1.0%	Federal Reserve Board
Servicing Cost (Annual)	ϕ	3.1%	3.2% Real Mortgage Rate
Mortgage Origination Cost	ζ	0.4%	FHFA
Maximum LTV	ϑ	125%	Fannie Mae
Prob. of Repossession	φ	0.5	2008 OCC Mortgage Metrics
Credit Flag Persistence	λ_f	0.9500	Fannie Mae

CALIBRATION II

Description	Parameter	Value	Target	Model	Source/Reason
Jointly Determined Parameters					
Homeownership Rate	$\bar{a}$	2.005	67.0%	67.2%	Census
Starter House Value	h_1	2.4250	1.75	1.75	American Housing Survey
Housing Wealth (Owners)	ω	0.8177	2.49	2.49	1998 SCF
Borrowers with $LTV \geq 80\%$	β	0.9657	25.0%	24.2%	1998 SCF
Months of Supply*	ξ	0.0016	5.40	5.42	Nat'l Assoc of Realtors
Avg. Buyer Search (Weeks)	γ_b	0.0940	10.00	9.95	Nat'l Assoc of Realtors
Maximum Bid Premium	κ_b	0.0171	2.5%	2.5%	Gruber and Martin (2003)
Maximum List Discount	κ_s	0.1029	15%	15%	RealtyTrac
Foreclosure Discount	χ	0.0980	21%	21%	Pennington-Cross (2006)
Foreclosure Starts (Annual)	γ_s	0.6550	1.60%	1.87%	Nat'l Delinquency Survey
Model Fit					
Median Borrower LTV			62.90%	65.51%	1998 SCF
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