Housing Finance, Boom-Bust Episodes, and Macroeconomic Fragility

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ABFER Household Finance
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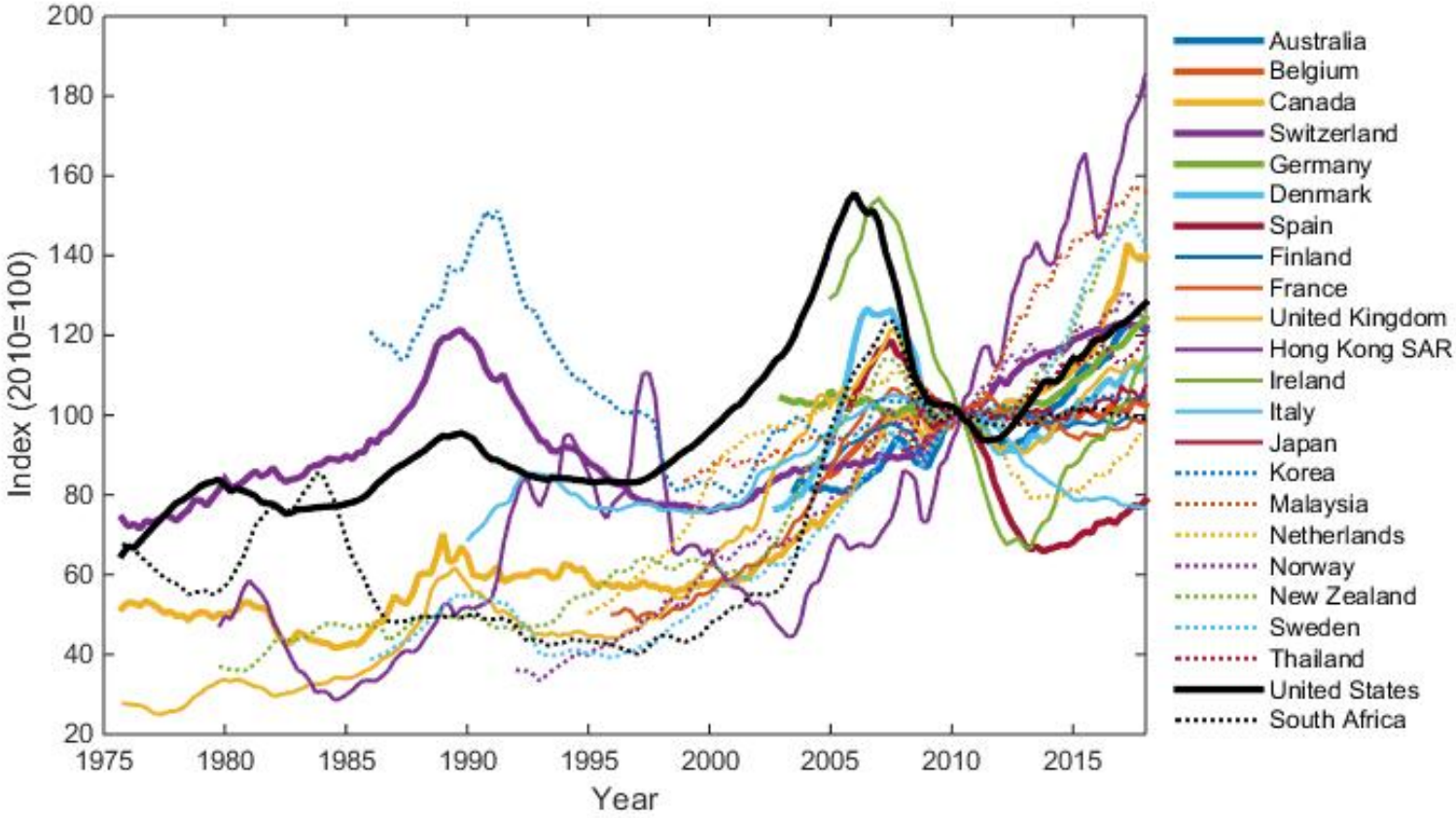
BOOM-BUST EPISODES: A GLOBAL PHENOMENON



- Some empirical regularities (Jordá, Schularick, and Taylor (2019)): coincide with credit expansion (low borrowing costs and low return to safe assets).

BROADER AGENDA (FINANCE/ECON ⇔ HOUSING)

1. **What drives real estate markets (especially prices)?**
   - Fundamentals (population, preferences, income, etc.)
   - Expectations
   - Credit
   - Liquidity

$$P_t = \underbrace{R_t}_{\text{fundamentals}} + \underbrace{\mathbb{E}}_{\text{expectations}} \left\{ \Gamma_{t,t+1} \underbrace{\left[1 - \tau(\Omega)\right]}_{\text{liquidity}} P_{t+1} \right\} + \underbrace{\mu_t \theta P_t}_{\text{credit}}$$

2. **How does housing impact financial and macro behavior?**
   - Household portfolio choice and risk management; consumer default; financial fragility; etc.
3. **What are the implications for policy?**
   - Macroprudential policies; transmission of monetary and fiscal policy; inequality and safety net policies.

TODAY'S TALK

Question: *How does the housing finance landscape (e.g. regulations, mortgage design) shape boom-bust episodes and financial 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:** evaluate how macroprudential policies impact housing and credit dynamics as well as fragility.
   - 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.
- **Equity extraction:** low-cost equity extraction ("housing as an ATM") 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 that come from renting or owning.
- 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 $\bar{a} \leq \underline{h}$.
- Uninsurable income risk with persistent and transitory components: $e \cdot s$ with cdf $F(e)$ and transitions $\pi_s(s'|s)$.

Production

- Wage $w = z_c$ pinned down by the goods-producing sector. Output goes to final consumption, structures for Y_h, and rentals (elastic $Y_a \Rightarrow$ supply-determined rents).
- New owner-occupied housing $Y_h = F_h(\bar{L}, S_h, N_h)$.

MODEL SUMMARY: II

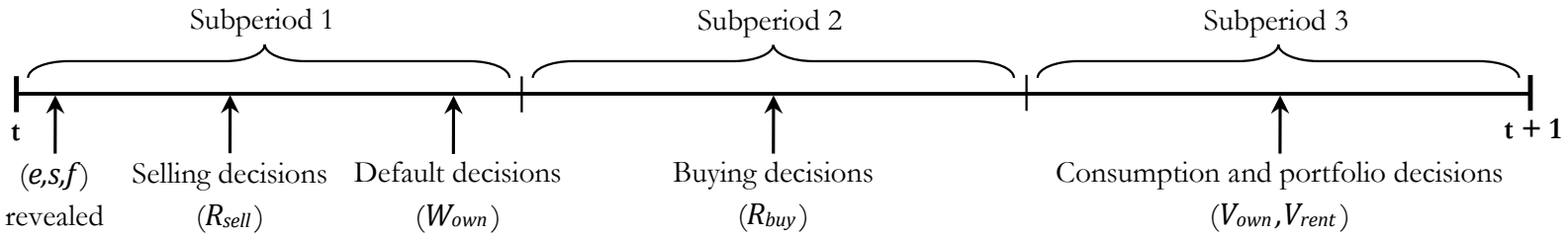
Banking Sector: issues bonds for saving; mortgages.

- Long-term: distinction between stock vs. flow of credit; down payments vs. collateral constraints.
- Defaultable: equilibrium foreclosure risk priced into loans at origination.
- Borrower interest rate risk: FRM vs. ARM. Lenders face prepayment risk.
- Can toggle ease of equity extraction and loan duration.
- Banks actively manage foreclosure inventories.

Housing Market Frictions: endogenous 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.

HOUSEHOLD TIMELINE



- State $(y, (\bar{r}_m, m), h, s, f)$ for owners; state (y, s, f) for renters.
  - Cash at hand $y = wes + b$, mortgage rate $\bar{r}_m$ and balance m, housing h, persistent labor efficiency s, credit flag f.
- Subperiod 1: owners decide whether to sell; non-sellers decide whether to default.
- Subperiod 2: non-owners decide whether to buy.
- Subperiod 3: consumption and portfolio choice decisions.

HOUSEHOLD PORTFOLIO CHOICE

New originations ($m' > m$ or to lower rate $r_m < \bar{r}_m$):

$$V^R_{own}(y,(\bar{r}_m,m),h,s,0) = \max_{m',b',c\geq 0} u(c,h) + \beta \mathbb{E}\left[(W_{own}+R_{sell})(y',(r_m,m'),h,s',0)\right]$$

subject to

$$c + \gamma p(h) + qb' + m \leq y + \underbrace{q_m((r_m,m'),b',h,s)}_{=1+r_m+\text{default premium}} m'$$

$$q_m((r_m,m'),b',h,s)m' \leq \vartheta_{LTV} p(h)$$

$$r_m m' \leq \vartheta_{PTI}\bar{e}s$$

Owners making a regular payment ($m' \leq m$, $\bar{r}_m$ unchanged):

$$V^C_{own}(y,(\bar{r}_m,m),h,s,0) = \max_{l,b',c\geq 0} u(c,h) + \beta \mathbb{E}\left[(W_{own}+R_{sell})(y',(\bar{r}_m,m'),h,s',0)\right]$$

subject to

$$c + \gamma p(h) + qb' + l \leq y$$

$$l \geq \frac{\bar{r}_m}{1+\bar{r}_m} m$$

$$m' = (m-l)(1+\bar{r}_m)$$

HOUSE BUYING AND SELLING

- Search by price (sellers p_t^{list}, buyers p_t^{bid}) and house type h.
- Sellers face a trade-off between price and their probability $\eta_t^{sell}(\cdot)$ of a successful transaction. Analogous for buyers.
- Probabilities $\eta^{sell}(p_t^{list}, h; \Phi_t)$ and $\eta^{buy}(p_t^{bid}, h; \Phi_t)$ depend on choices and aggregate conditions, including heterogeneity.
- The option value of trying to sell is

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

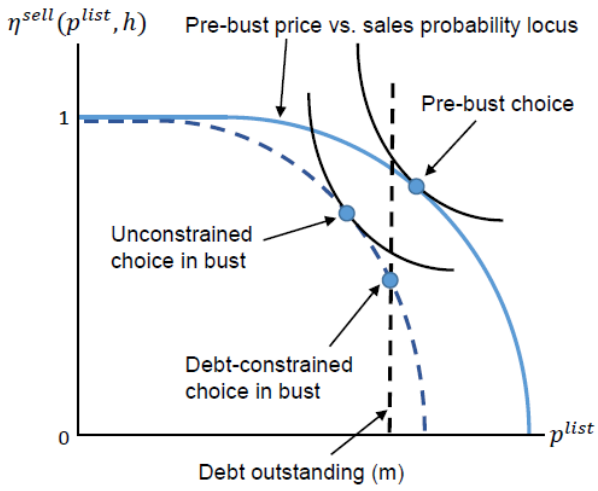
such that

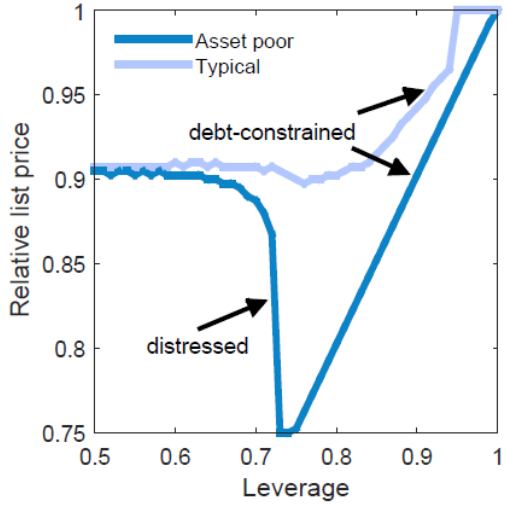
$$p_s + y \geq m$$

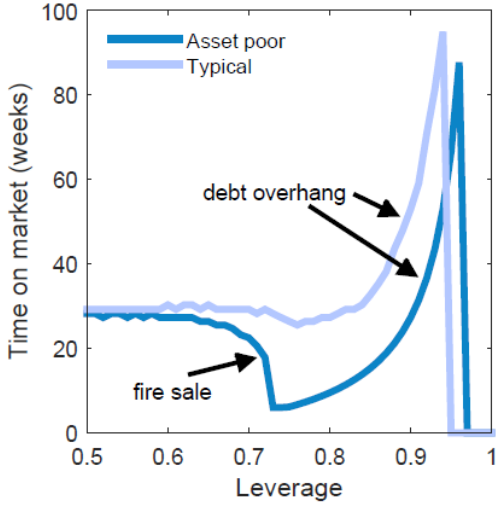
- Heavily indebted sellers forced to post high list prices.

HOUSE BUYING AND SELLING

- At low leverage, list prices insensitive to mortgage debt.
- Distressed sellers with some equity cushion who cannot borrow on good terms set firesale price.
- Debt overhang for very high leverage ⇒ long delays.







MORTGAGE PRICING

- Key features: endogenous default premia, prepayment, equity extraction through costly refinancing.
- For ARMs, $\bar{r} = r_t$ adjusts every period.

$$(1+\zeta)q_t((\bar{r}, m_{t+1}), b_{t+1}, h, z_t) = \frac{1}{1+r_{t+1}}\mathbb{E}\left\{ \overbrace{\eta^{sell}_{t+1}}^{\text{sell, repay}} + \overbrace{(1-\eta^{sell}_{t+1})}^{\text{no house sale}} \left[\overbrace{d^*_{t+1}}^{\text{default}} \overbrace{\varphi \min\left\{1, \frac{J^{REO}_{t+1}(h)}{m_{t+1}}\right\}}^{\text{foreclosure recovery ratio}} \right.\right.$$

$$\left.\left. + \underbrace{d^*_{t+1}(1-\varphi)(1+\zeta)q^{delinq}_{t+1}}_{\text{continuation value of delinquency}} + (1-d^*_{t+1}) \left\{ \underbrace{\mathbf{1}_{[\text{Refi},t+1]}}_{\text{repay in full}} + \mathbf{1}_{[\text{No Refi},t+1]} \underbrace{\left(\frac{l^*_{t+1} + (1+\zeta)q^{cont}_{t+1} m^*_{t+2}}{m_{t+1}} \right)}_{\text{payment + continuation value}} \right\} \right] \right\}$$

such that

$$\eta^{sell}_{t+1} \equiv \eta_s(\theta_s(p^{list*}_{t+1}, h; p_{t+1})) \textbf{ (probability of house sale)}$$

$$q^{delinq}_{t+1} \equiv q_{t+1}((\bar{r}, m_{t+1}), b^{delinq*}_{t+2}, h, z_{t+1}) \textbf{ (mark-to-market price for delinquent } m_{t+1}\textbf{)}$$

$$q^{cont}_{t+1} \equiv q_{t+1}((\bar{r}, m^*_{t+2}), b^*_{t+2}, h, z_{t+1}) \textbf{ (mark-to-market price for updated } m^*_{t+2}\textbf{)}$$

$$m^*_{t+2} = (m_{t+1} - l^*_{t+1})(1+\bar{r}) \textbf{ (endogenous amortization)}$$

PARAMETRIZATION I

- Parametrize the economy to match aggregate and cross-sectional moments from the late 1990s.

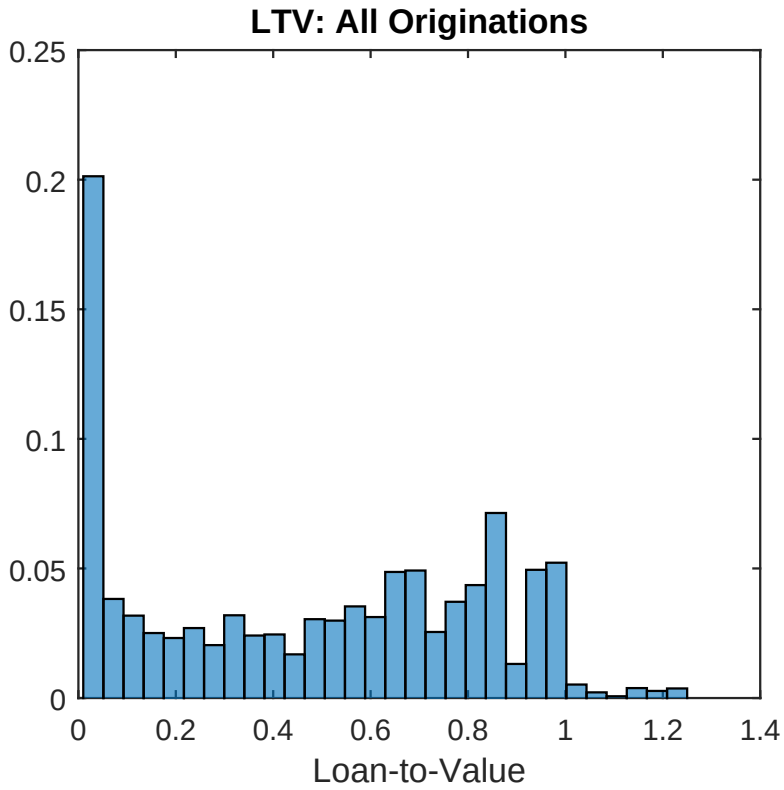
Description	Parameter	Value	Source/Reason
	Independent Parameters		
Autocorrelation	ρ	0.952	Storesletten et al (2004)
SD of Persistent Shock	σ_ϵ	0.17	Storesletten et al (2004)
SD of Transitory Shock	σ_e	0.49	Storesletten et al (2004)
IES	ν	0.13	Flavin and Nakagawa (2008)
Risk Aversion	σ	2	Standard
Structure 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

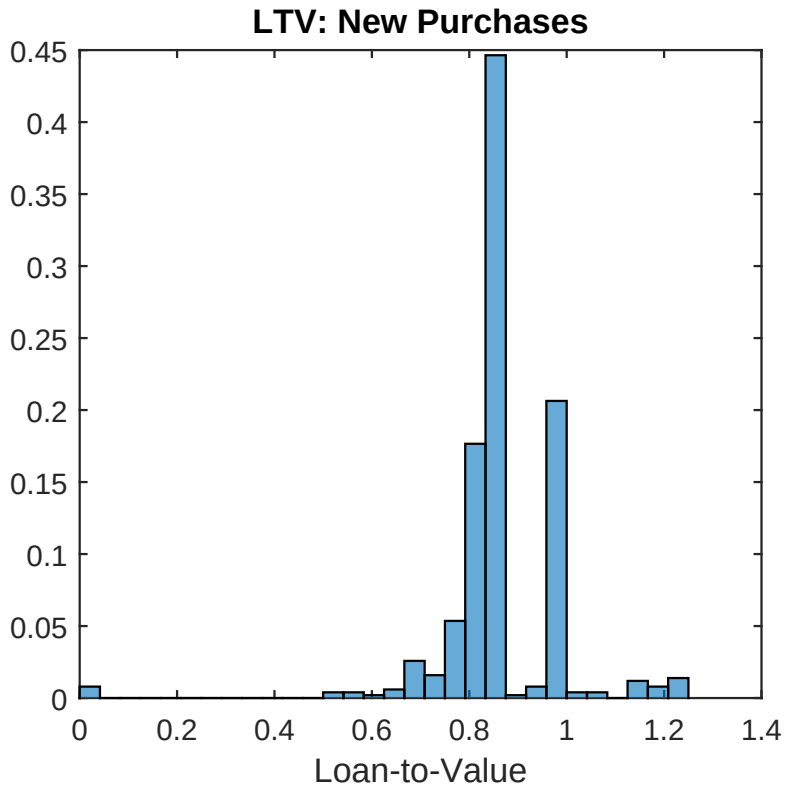
PARAMETRIZATION II

- Important to match households' balance sheets (especially the LTV distribution), homeownership, and foreclosures.

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
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
Median Owner Liq. Assets/Earn			0.16	0.15	1998 SCF

LOAN-TO-VALUE DISTRIBUTION: PURCHASE VS. REFI



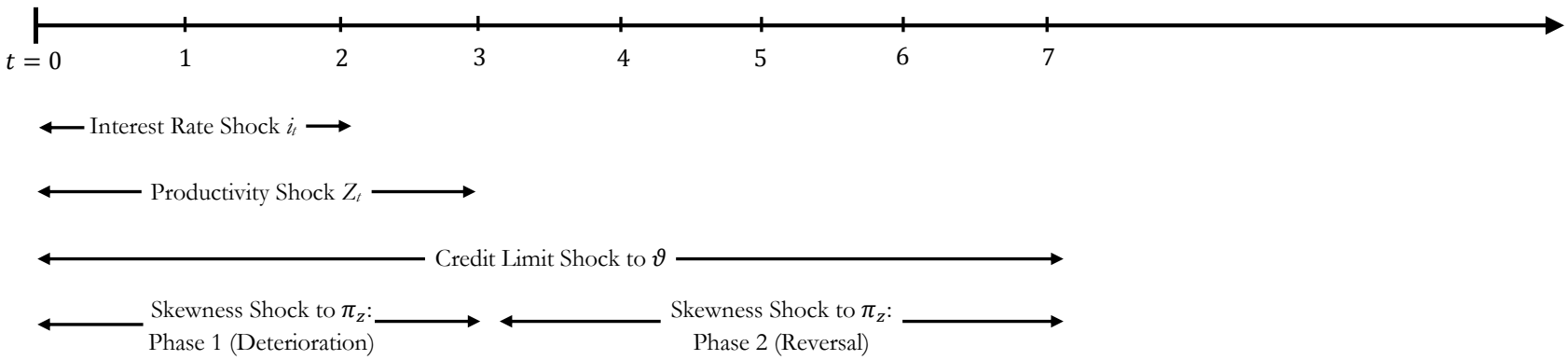


- Downpayments cluster at 95–100% and 80–85% LTVs.
- High LTV loans are expensive because of default risk.
- Refinance originations have a more uniform distribution.

THE BOOM, BUST, AND RECOVERY IN HOUSING

- The boom is caused by higher TFP and lower interest rates. Households perceive the boom to be permanent but are surprised by a sequence of temporary negative shocks.

		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 STABILITY OF LTVS IN THE BOOM

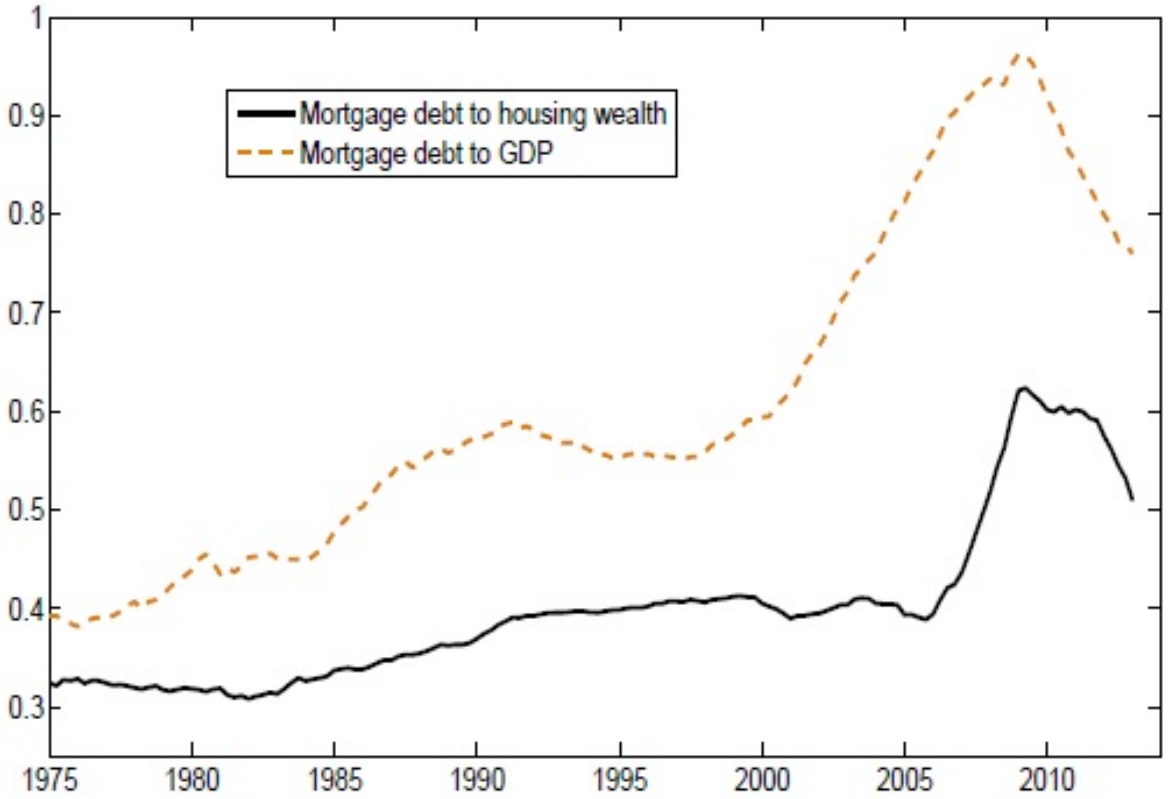
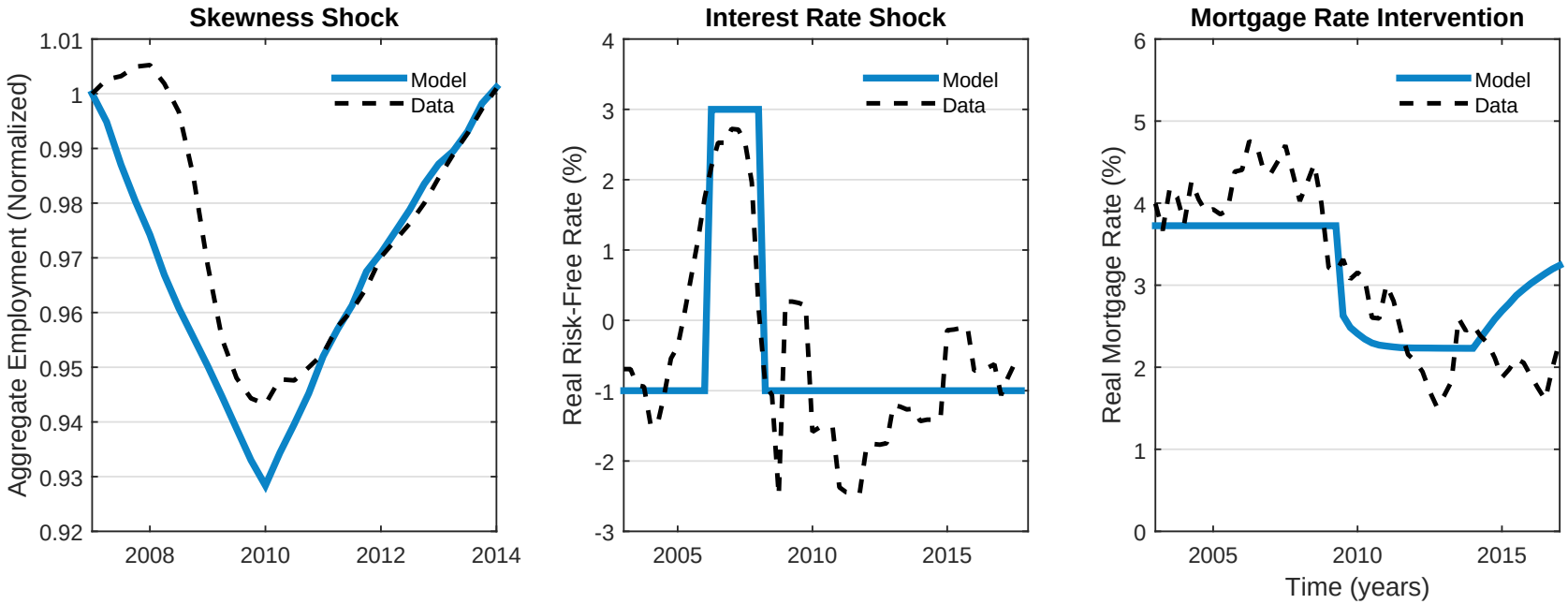


Figure: Mortgage debt. Davis and Van Nieuwerburgh (2015)

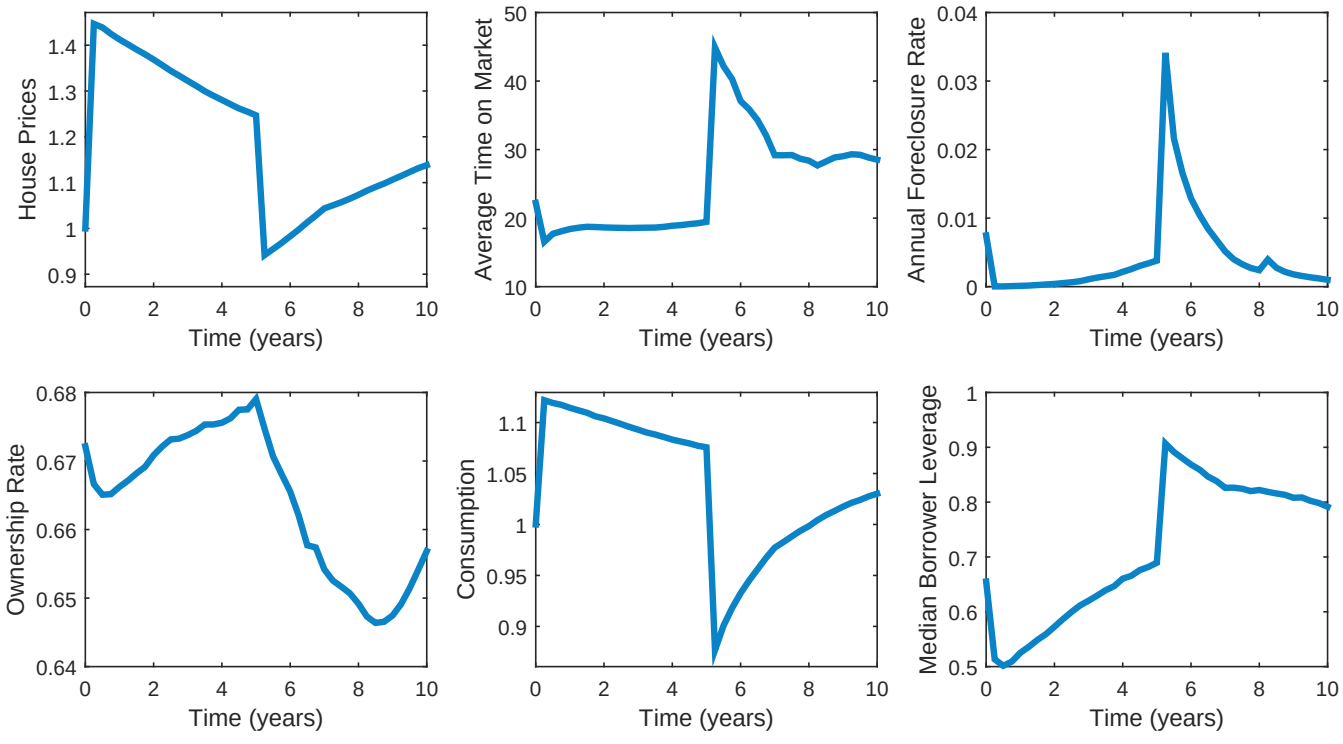
- Boom: ↑ debt-to-income (DTI), stable loan-to-value (LTV).
- Bust: ↑ LTV as house prices fell. Long-term debt important.

RECESSIONARY SHOCKS TO GENERATE THE BUST



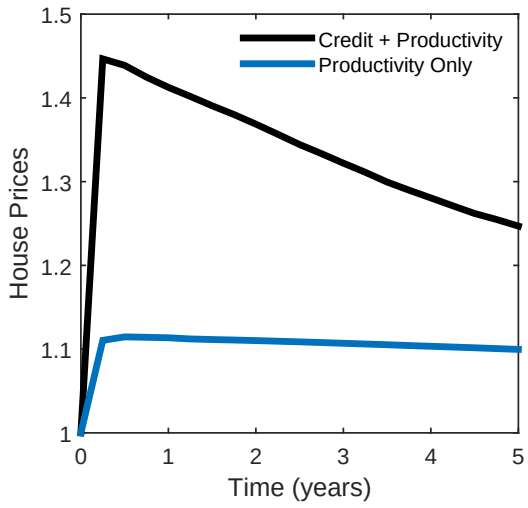
- The skewness shocks increase downside earnings risk.
- They are calibrated to generate aggregate labor supply (employment) that is consistent with the data.
- Interest rates during the bust and recovery follow a smoothed version of the path from the data.

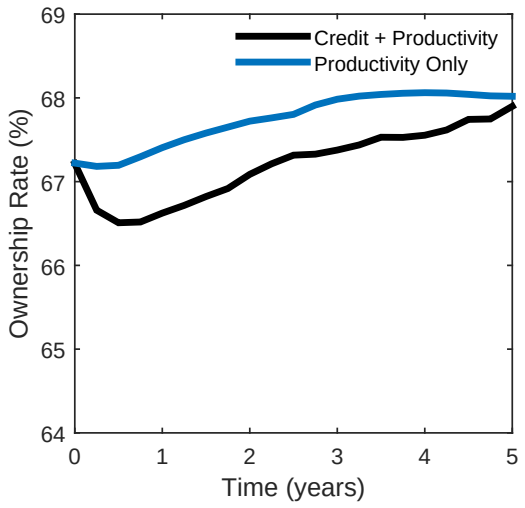
THE BOOM, BUST, AND RECOVERY

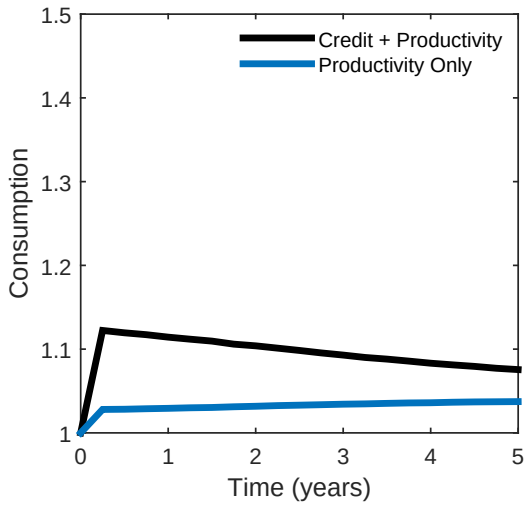


	Boom			*Bust*		
	ΔPrices	ΔC	Own	ΔPrices	ΔC	Own
Model	+44.6%	+12.2%	68.1%	−24.5%	−18.5%	64.3%
Data	+41.9%	+5.1%	69.2%	−25.9%	−15.0%	64.2%

PRODUCTIVITY BOOMS VS. CREDIT BOOMS







- "Typical" productivity-driven business cycles cannot generate large house price increases.
- The reduction in borrowing costs is key to the price boom.
- However, cheaper credit need not stimulate ownership. Price increases neutralize the direct effect.

CREDIT AND THE "NEW NARRATIVE"

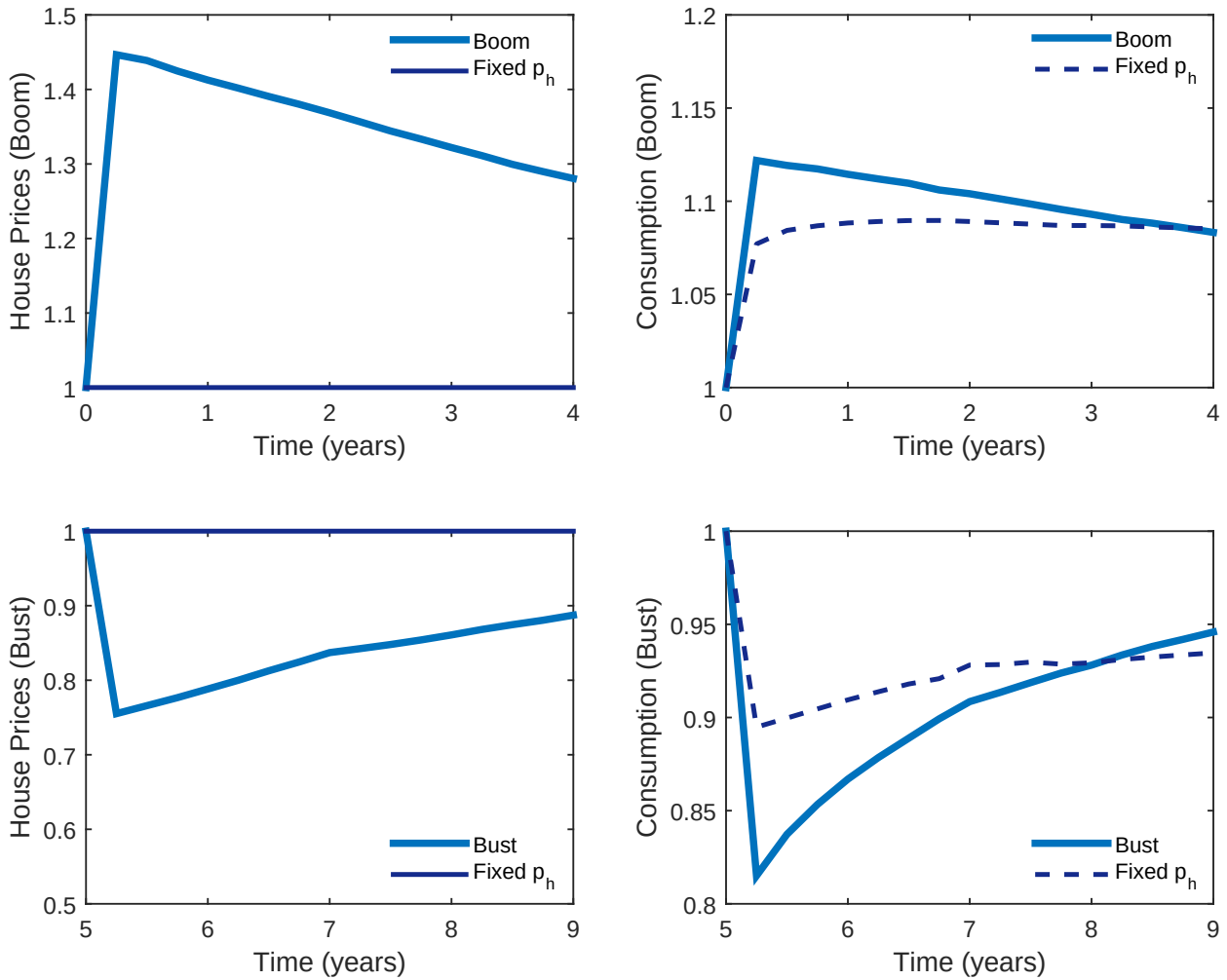
	Low Income	Middle Income	High Income
Average Borrower LTV			
Pre-Boom	59.3%	61.3%	70.3%
Productivity Only	56.4%	58.9%	57.1%
Productivity + Credit	60.9%	65.8%	69.3%
Δ*Credit*	+4.5%	+6.9%	+12.2%
*High-LTV Share**			
Pre-Boom	13.9%	14.6%	36.3%
Productivity + Credit	16.7%	22.7%	31.1%
Consumption Change			
Productivity Only	4.8%	4.2%	1.3%
Productivity + Credit	6.0%	11.7%	13.3%
Δ*Credit*	+1.2%	+7.5%	+12.0%

*The percentage of borrowers with mortgage debt exceeding 80% LTV.

- Broad-based credit expansion, not just subprime.
- Little extensive margin change in ownership, but a shift toward larger houses.

▸ Extensive vs. Intensive Margin following LTV Tightening

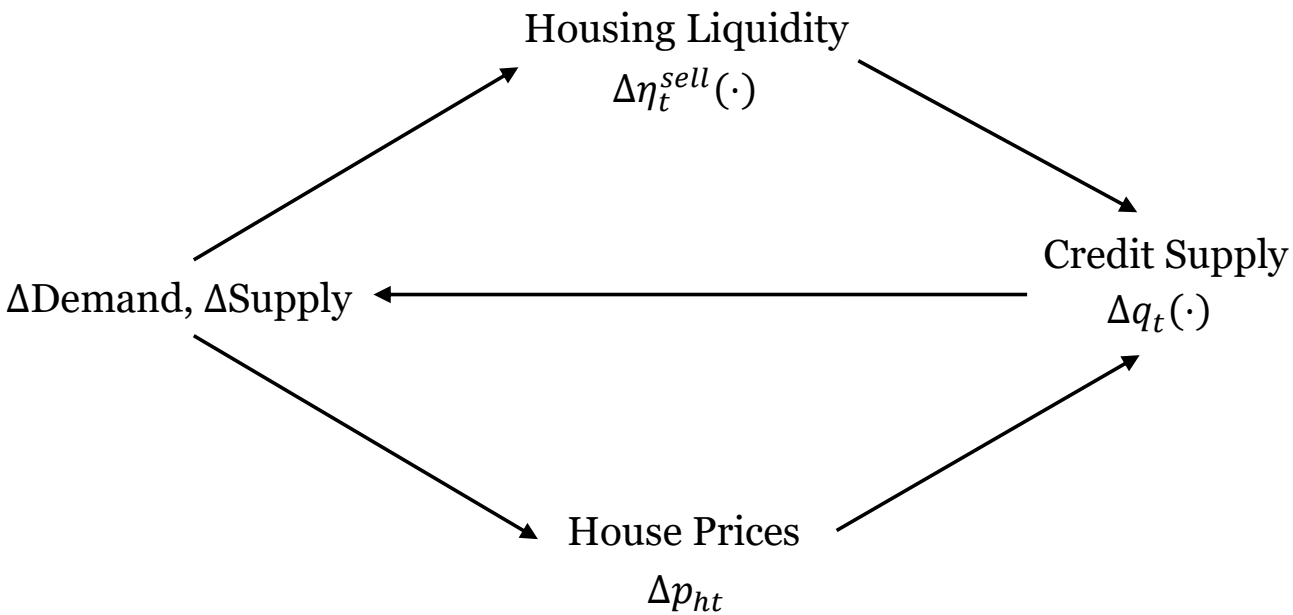
BALANCE SHEET EFFECTS IN THE BOOM AND BUST



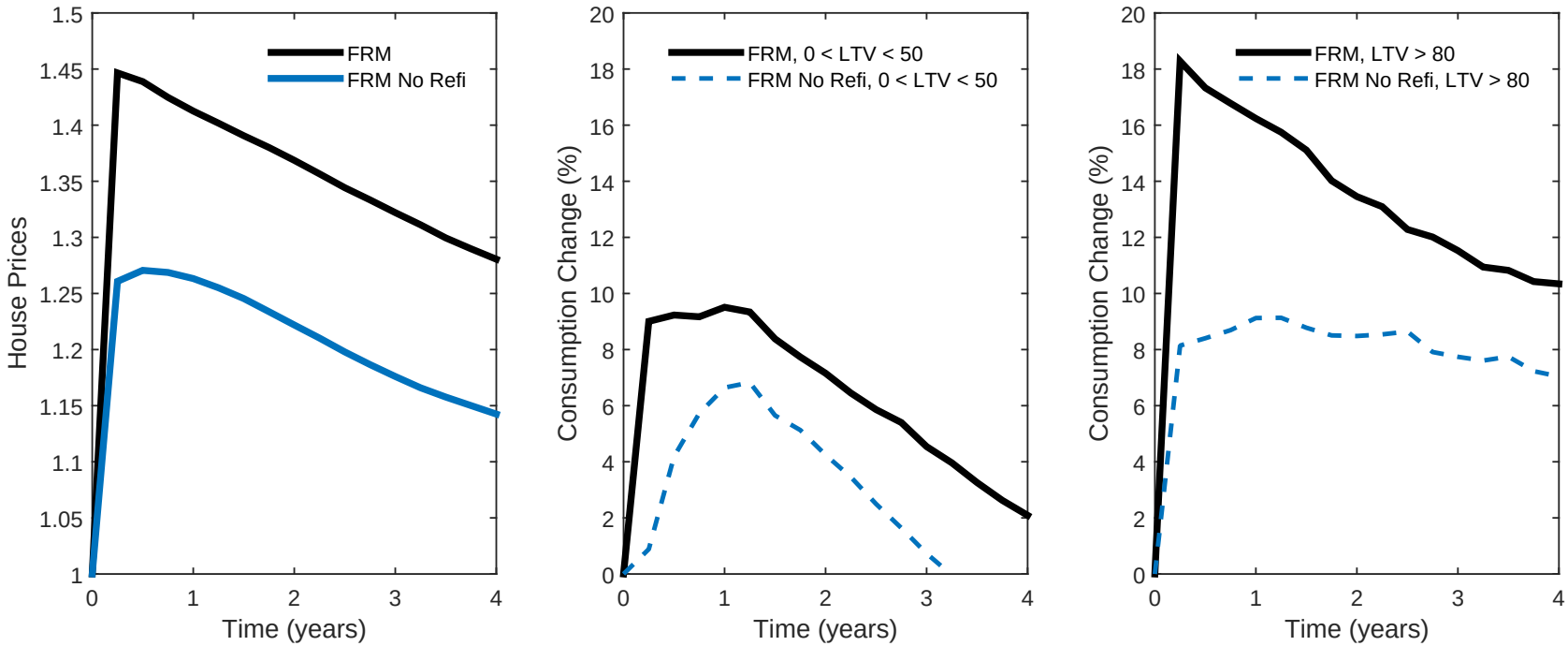
- Asymmetric balance sheet effects: equity evaporation far more damaging to consumption.

LIQUIDITY RISK AND FINANCIAL SPILLOVERS

- Mortgage default affected by house prices *and* housing liquidity: the *liquidity-adjusted double trigger*. ▸ 3-D Maps
- Each additional month of time on the market is associated with a 0.81pp rise in default (Garriga and Hedlund 2020): $\Delta \text{DefaultRate}^{i}_{06-10} = \beta_0 + \beta_1 \%\Delta \text{HNW}^{i}_{06-10} + \beta_2 \Delta \text{Illiquid}^{i}_{05-08}$.
- The result is amplified financial market spillovers.

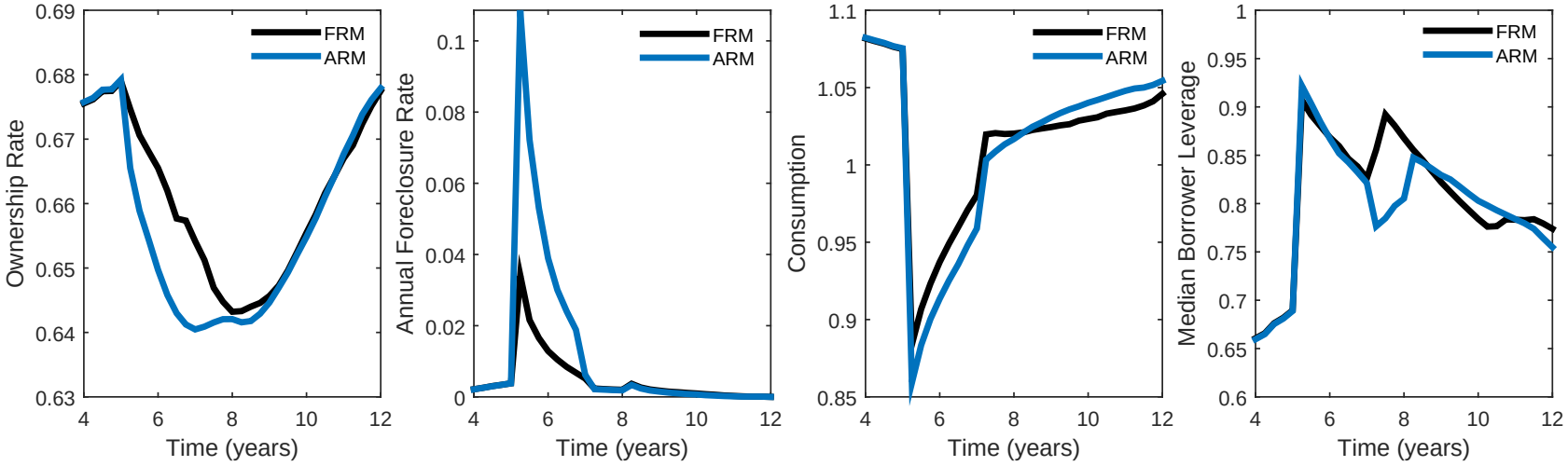


MORTGAGE STRUCTURE: EQUITY EXTRACTION



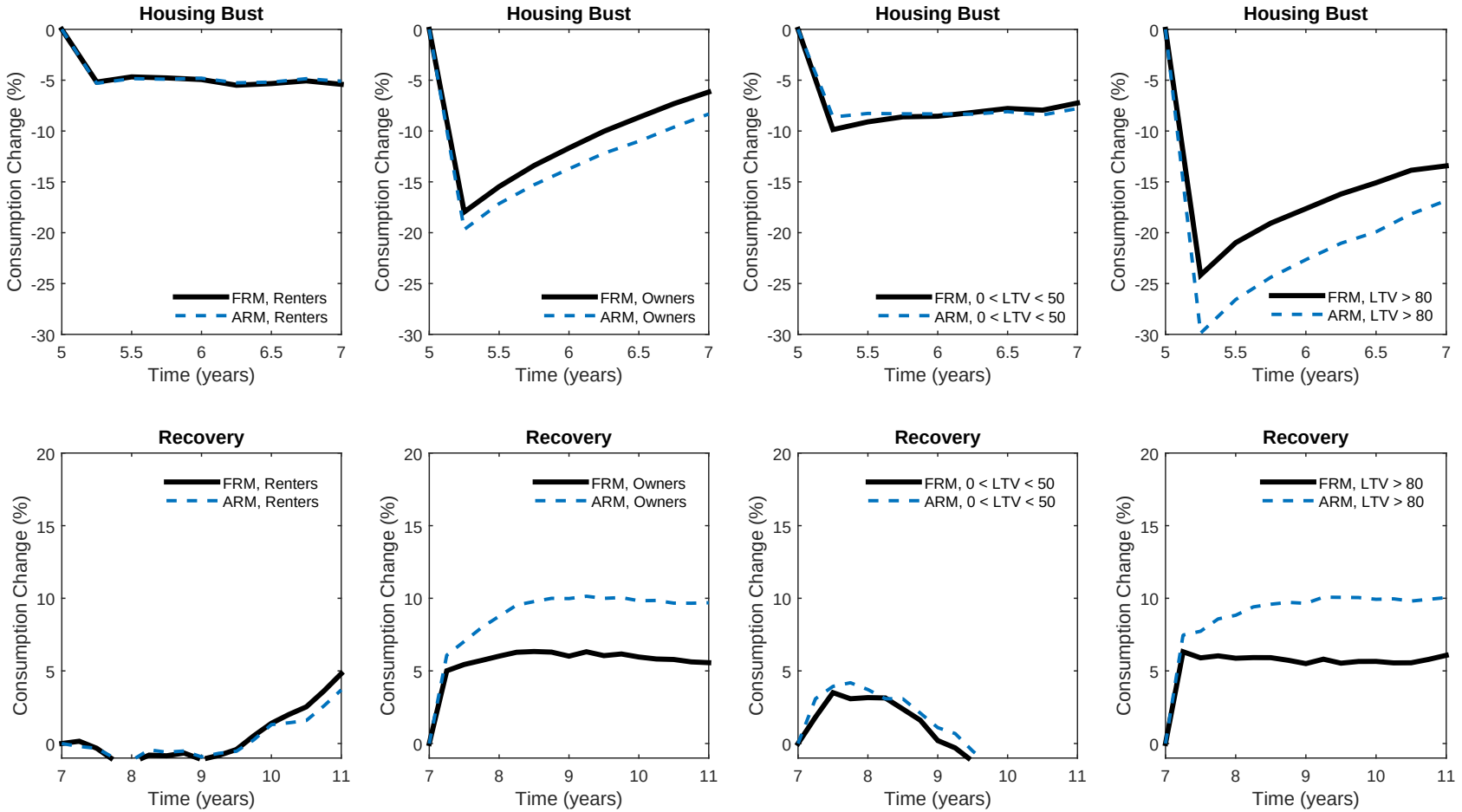
- Without the ability to refinance, the house price boom is 40% smaller and exhibits less overshooting.
- When houses can't be used as ATMs, the spillover to consumption is smaller and more gradual.
- Impact on consumption most stark for high LTV owners.

MORTGAGE STRUCTURE: INTEREST RATE EXPOSURE



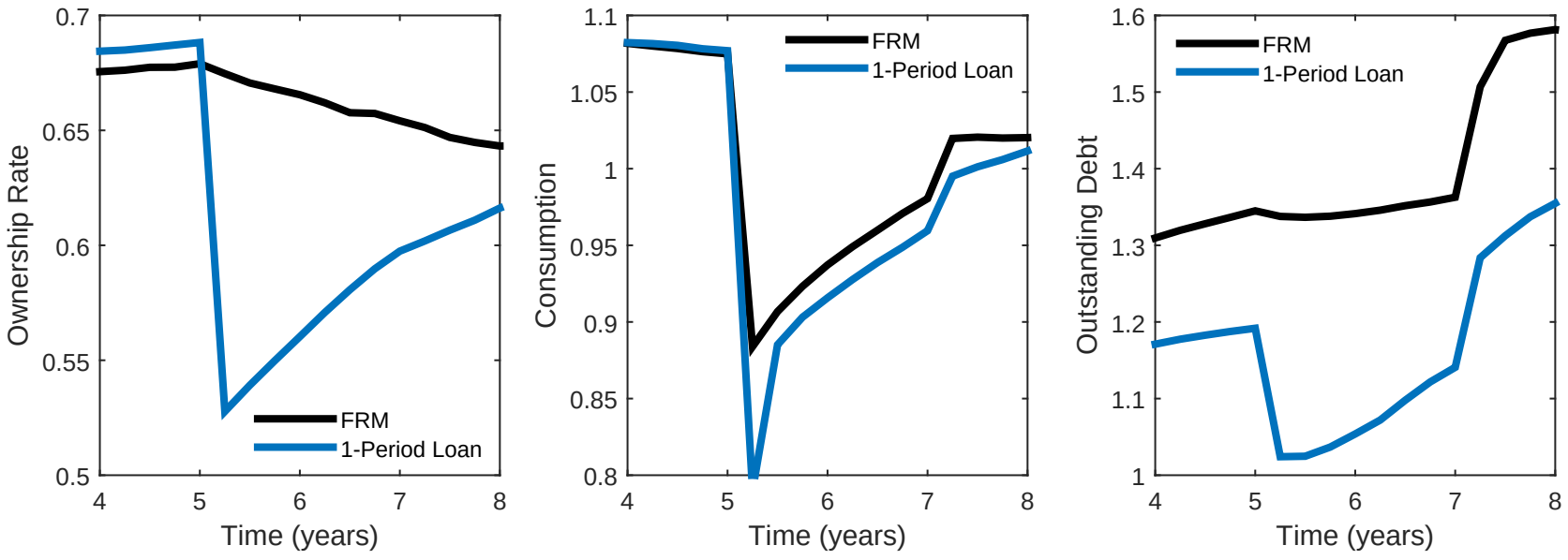
- FRM vs. ARM: no difference during the boom.
- Homeowners face higher debt servicing costs under ARMs when rates rise ⇒ steeper homeownership decline, bigger foreclosure spike, more severe consumption drop.
- ARM holders automatically benefit from post-QE lower rates. FRM holders must refinance to benefit.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

INTEREST RATE EXPOSURE IN THE CROSS SECTION



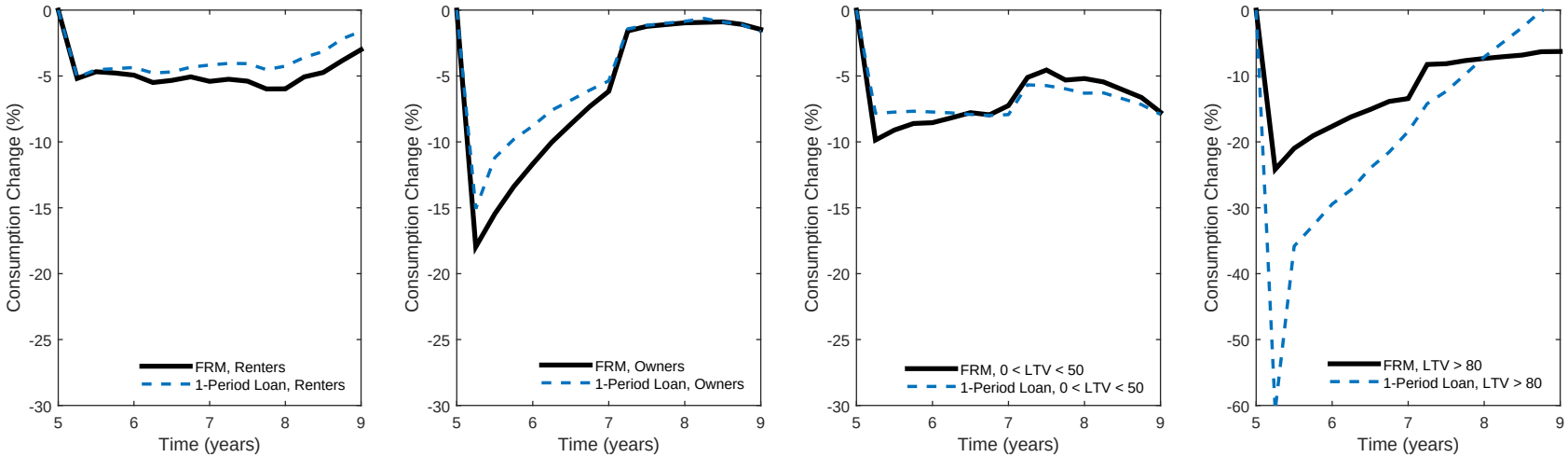
- Consumption is more sensitive to interest rates in the ARM economy, particularly among highly leveraged owners.

MORTGAGE STRUCTURE: ROLLOVER RISK



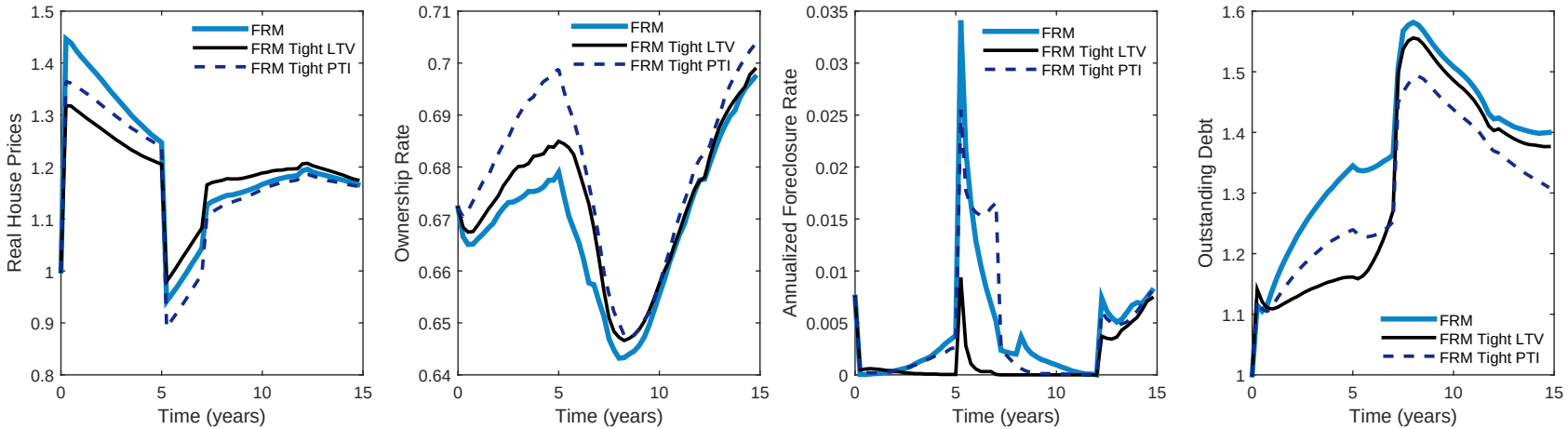
- Mortgage duration has almost no impact on housing dynamics during the boom.
- A wave of margin calls during the bust creates involuntary deleveraging and a crisis in ownership and consumption.

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

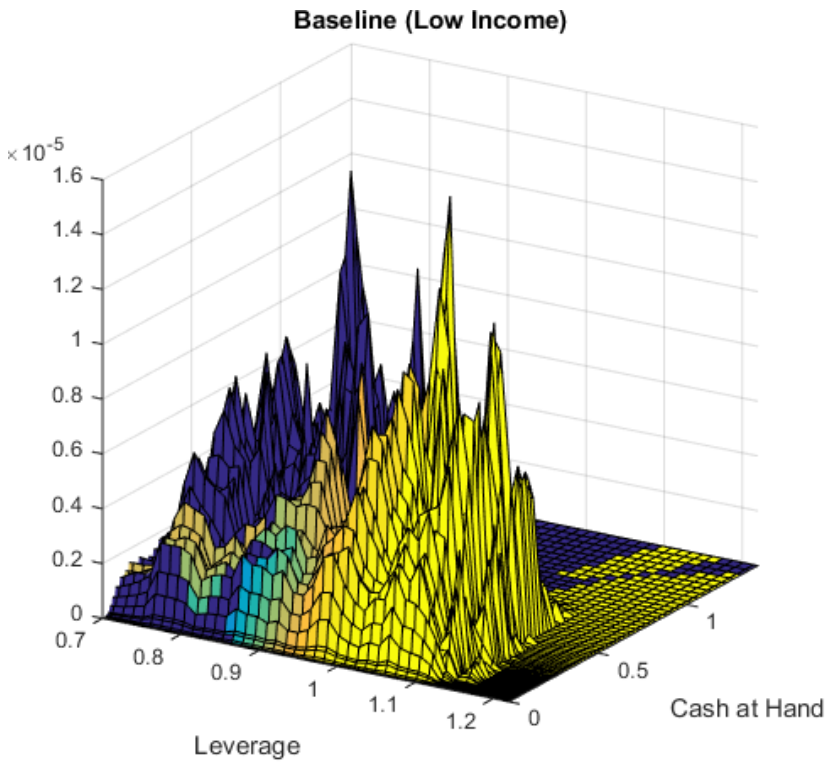


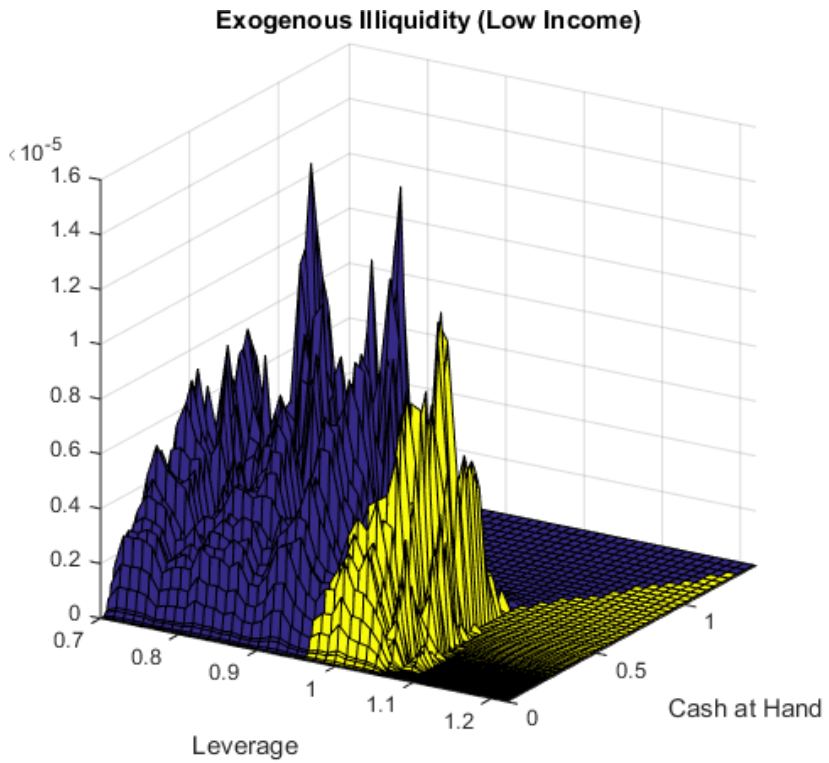
- Two factors affect fragility: the debt distribution and the ability to insure against shocks.
- LTV and PTI caps both reduce debt. ▸ LTV Caps: Portfolio Dynamics
- LTV caps reduce fragility, but PTI caps more severely limit insurance during the bust and *increase* fragility.

Conclusions

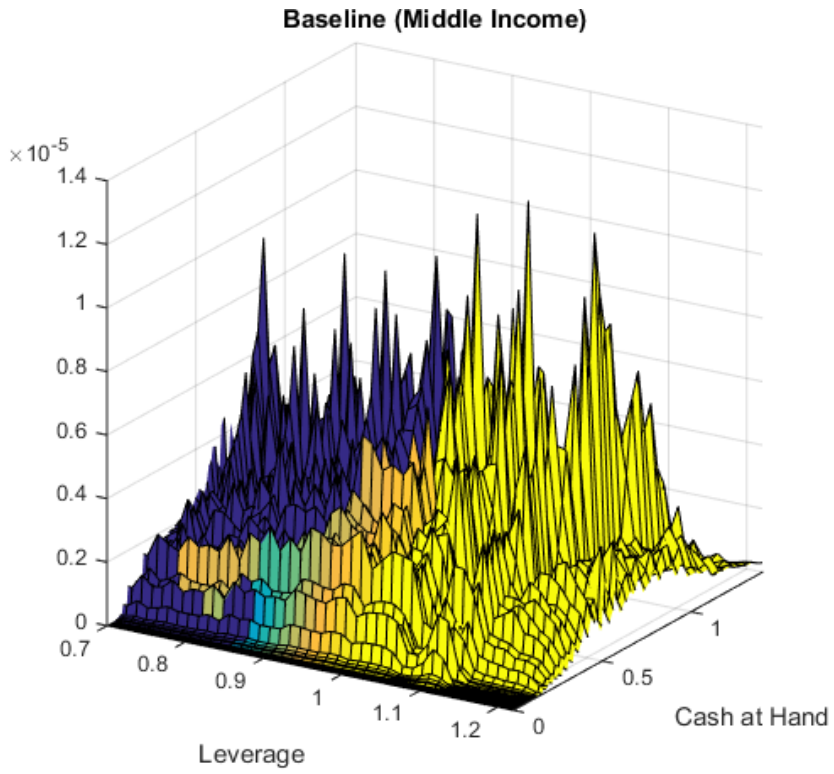
- Credit expansions/reversals are key to explaining real estate swings, which in turn create strong spillovers to financial markets and the macroeconomy.
- Mortgage structure has significant, asymmetric aggregate and distributional consequences.
- Equity extraction contributes significantly to swings 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.

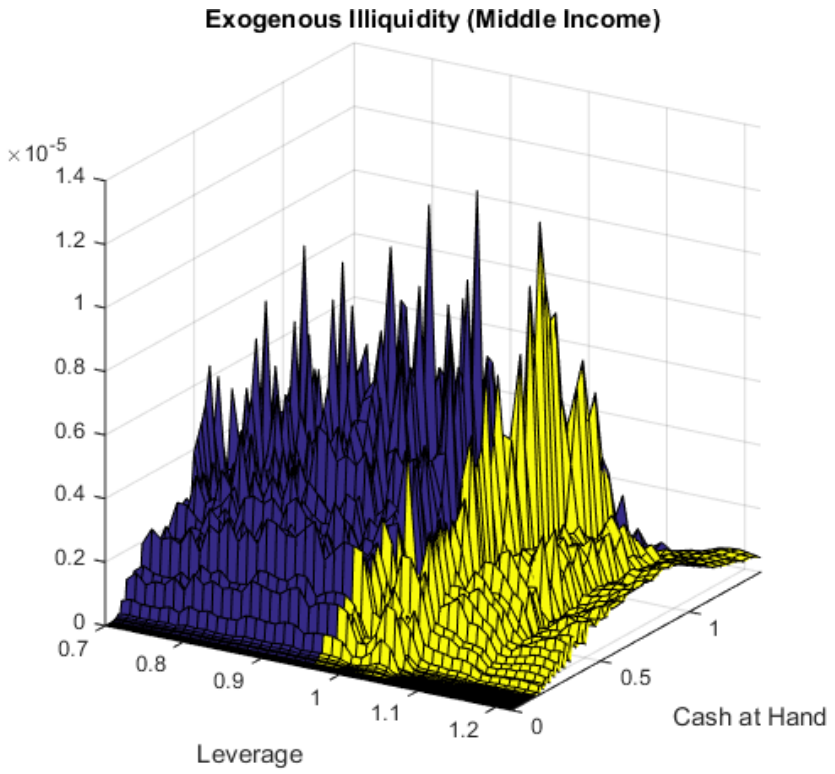
The Liquidity-Adjusted Double Trigger





The Liquidity-Adjusted Double Trigger





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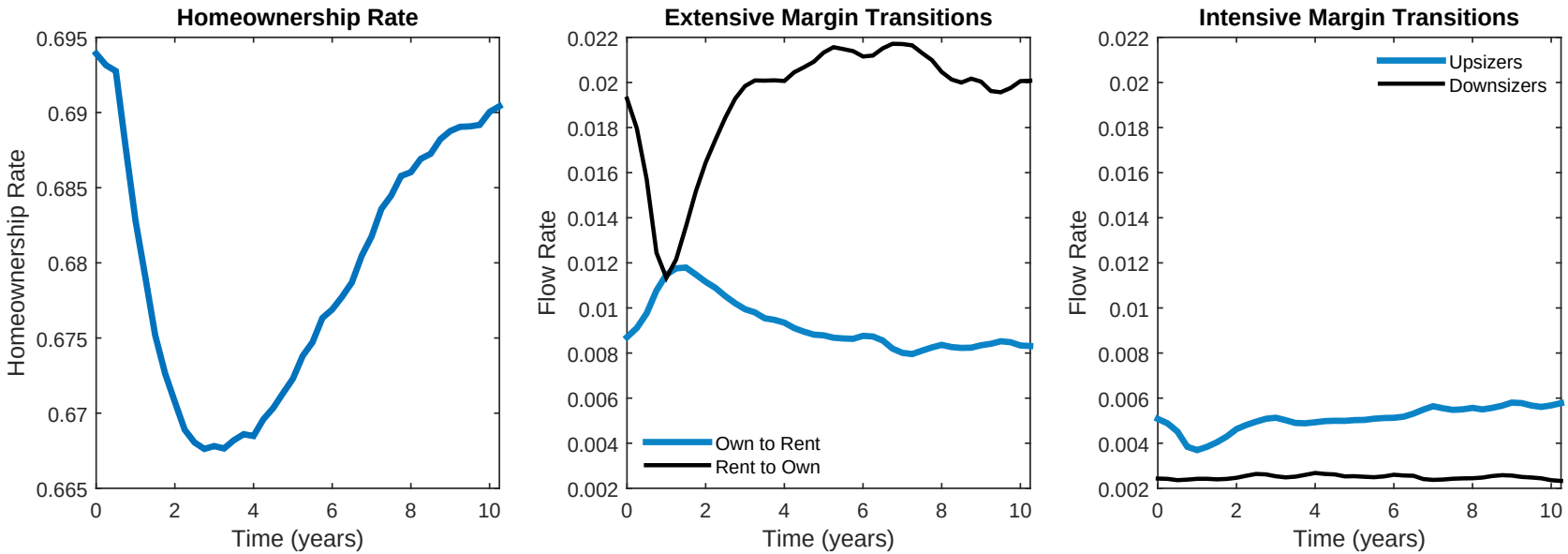
TIGHTER LTVS AND HOMEOWNERSHIP DYNAMICS



- Consider a permanent tightening in LTVs. In the short run, homeownership falls, but it recovers in the long run.
- The short-run decline is due more to lower rent-to-own flows rather than higher own-to-rent flows. The long-term nature of mortgage contracts is key.

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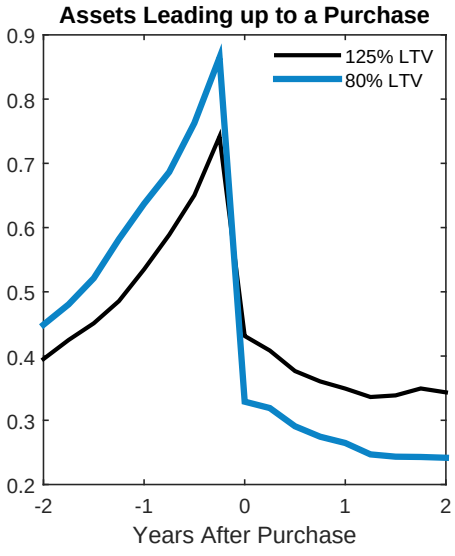
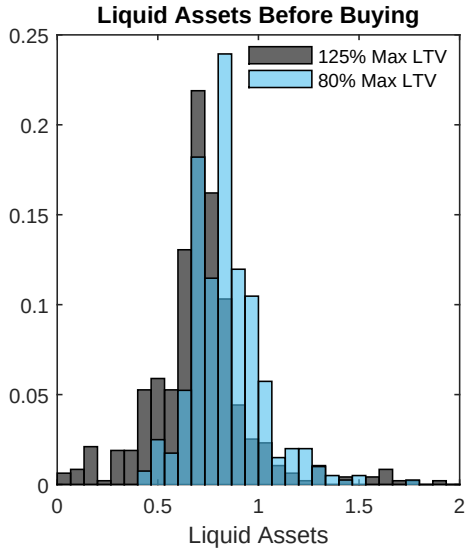
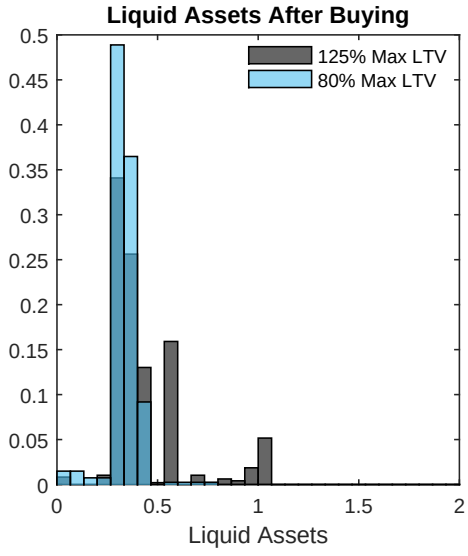
LTV Caps: Home Purchase Portfolio Dynamics







- Tighter credit conditions create a longer build-up period of assets and by a steeper decline after purchase.
- This behavior also shows up in the cross-section distribution of liquid assets.

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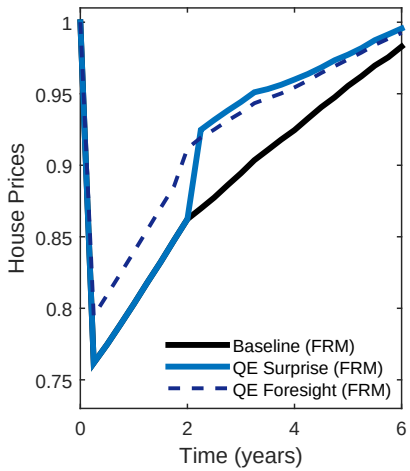
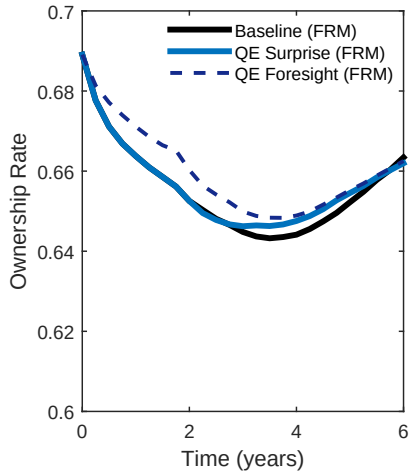
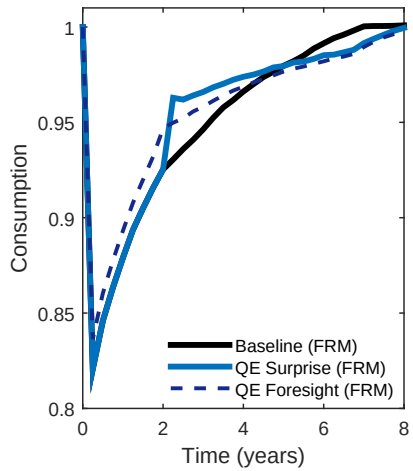
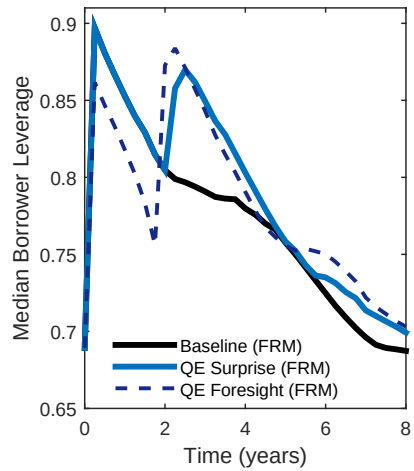
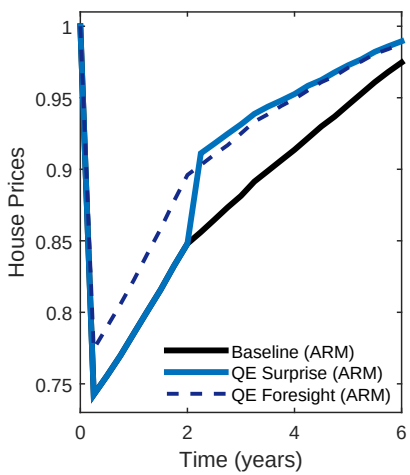
"Quantitative Easing"

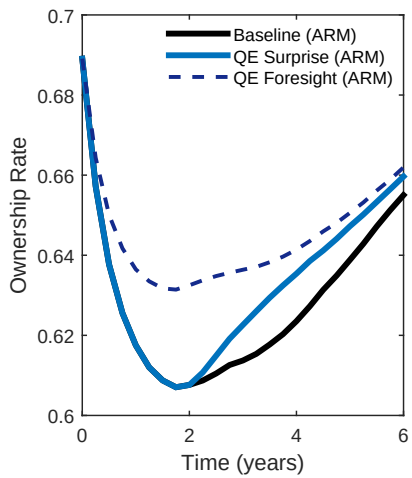


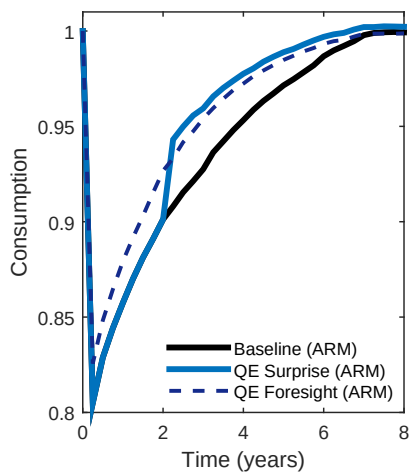


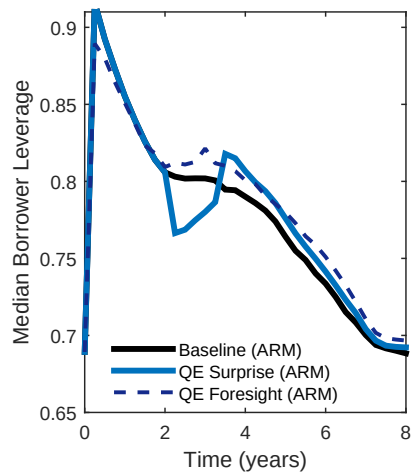












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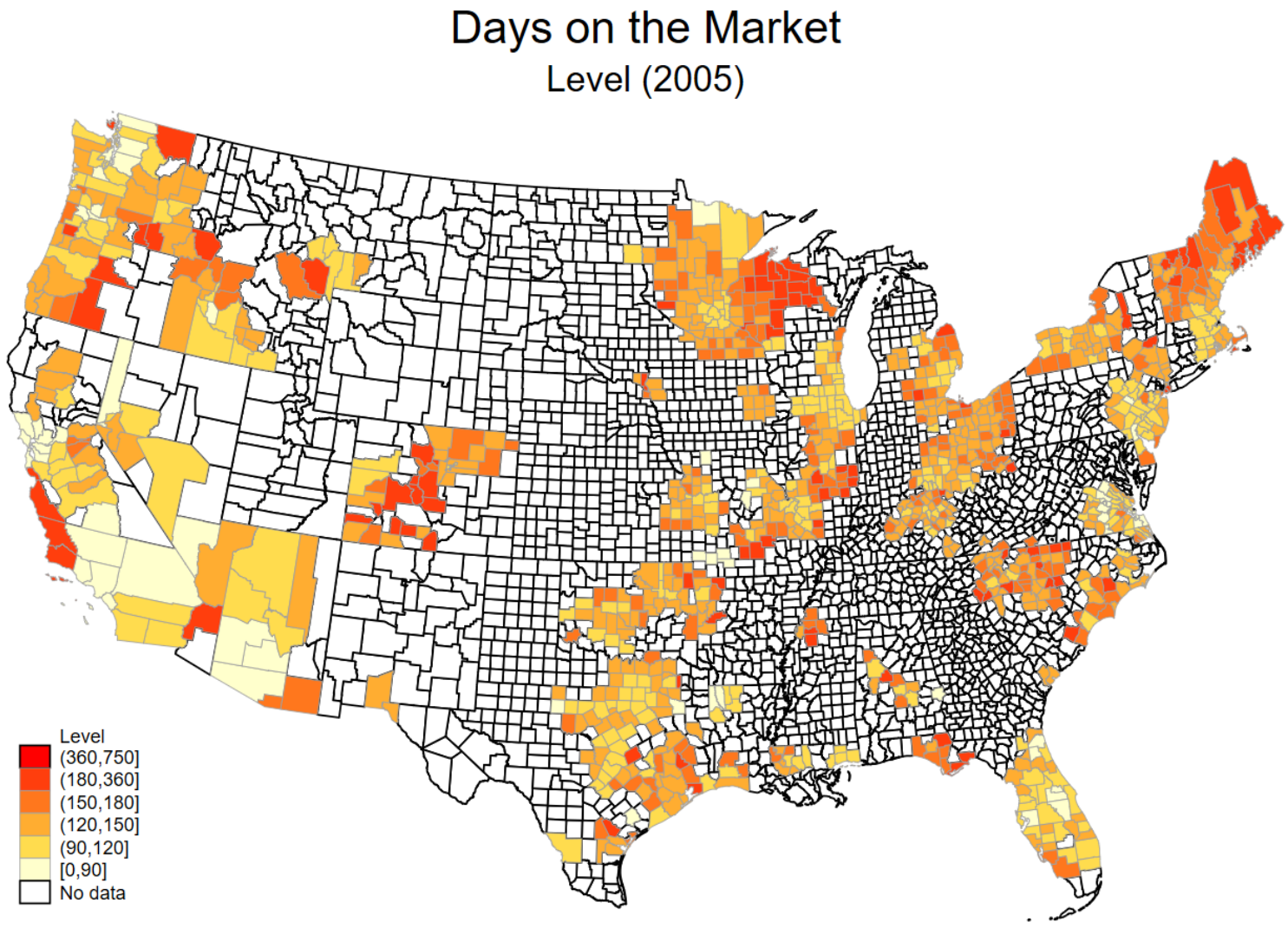
The Deterioration of Housing Liquidity: 2005



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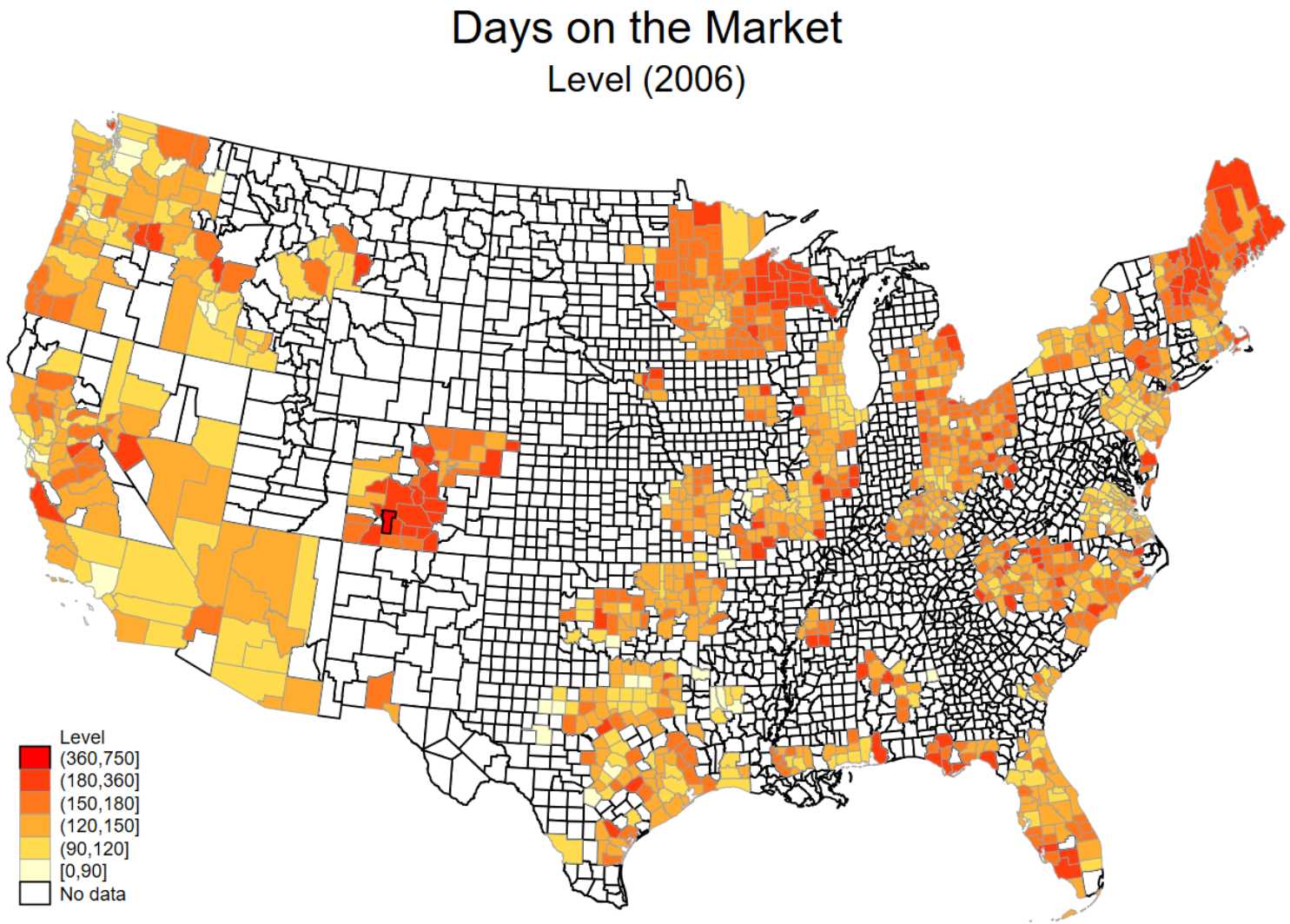

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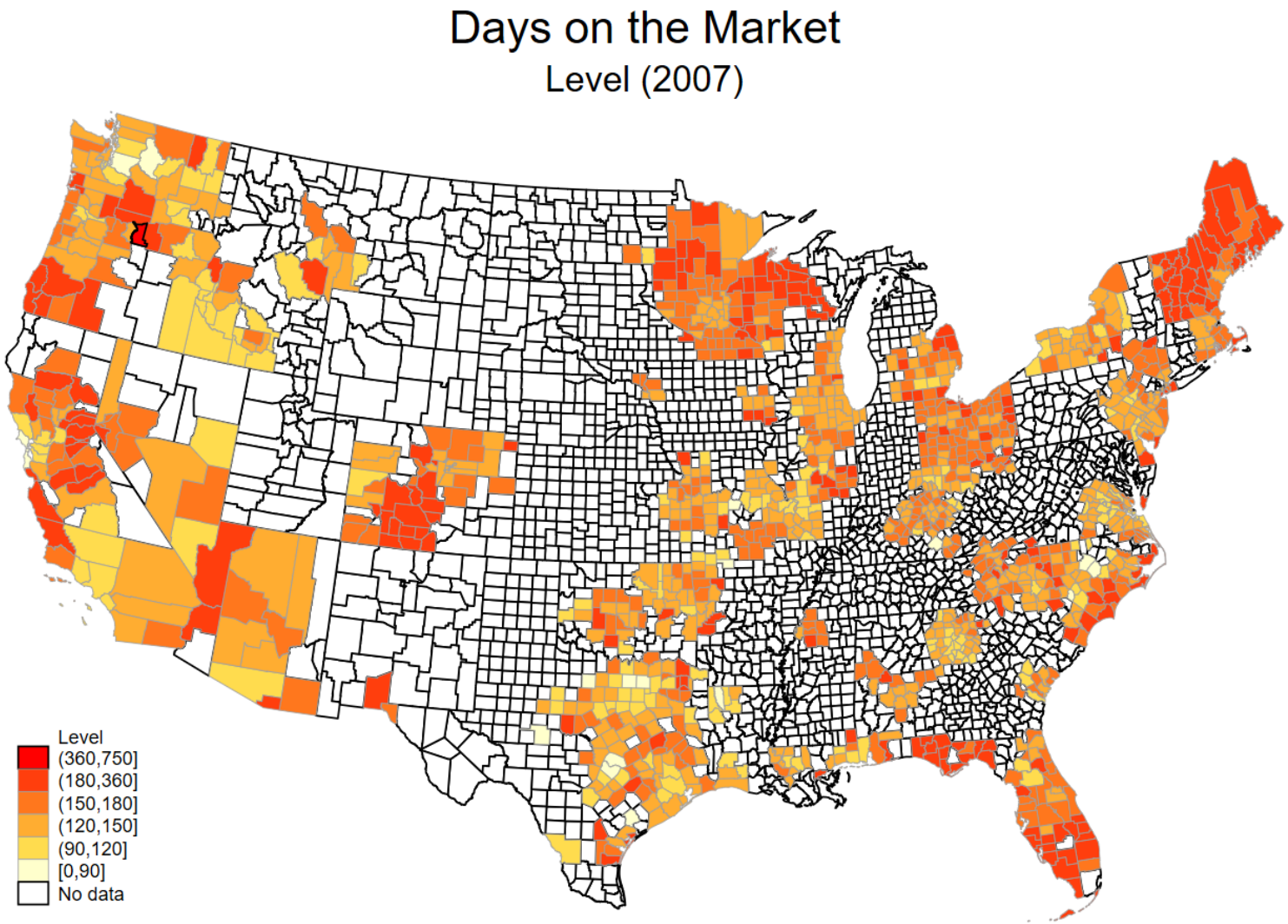

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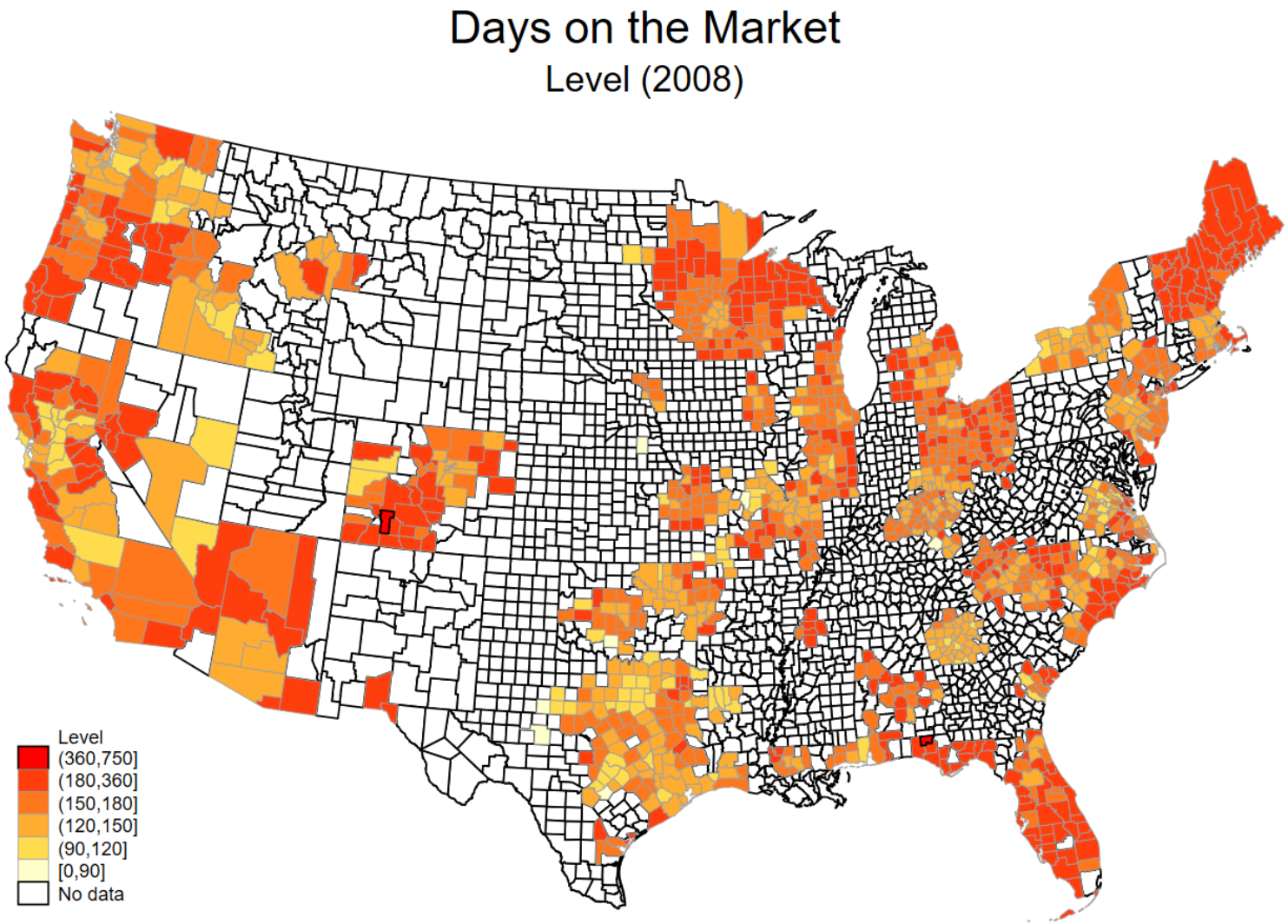

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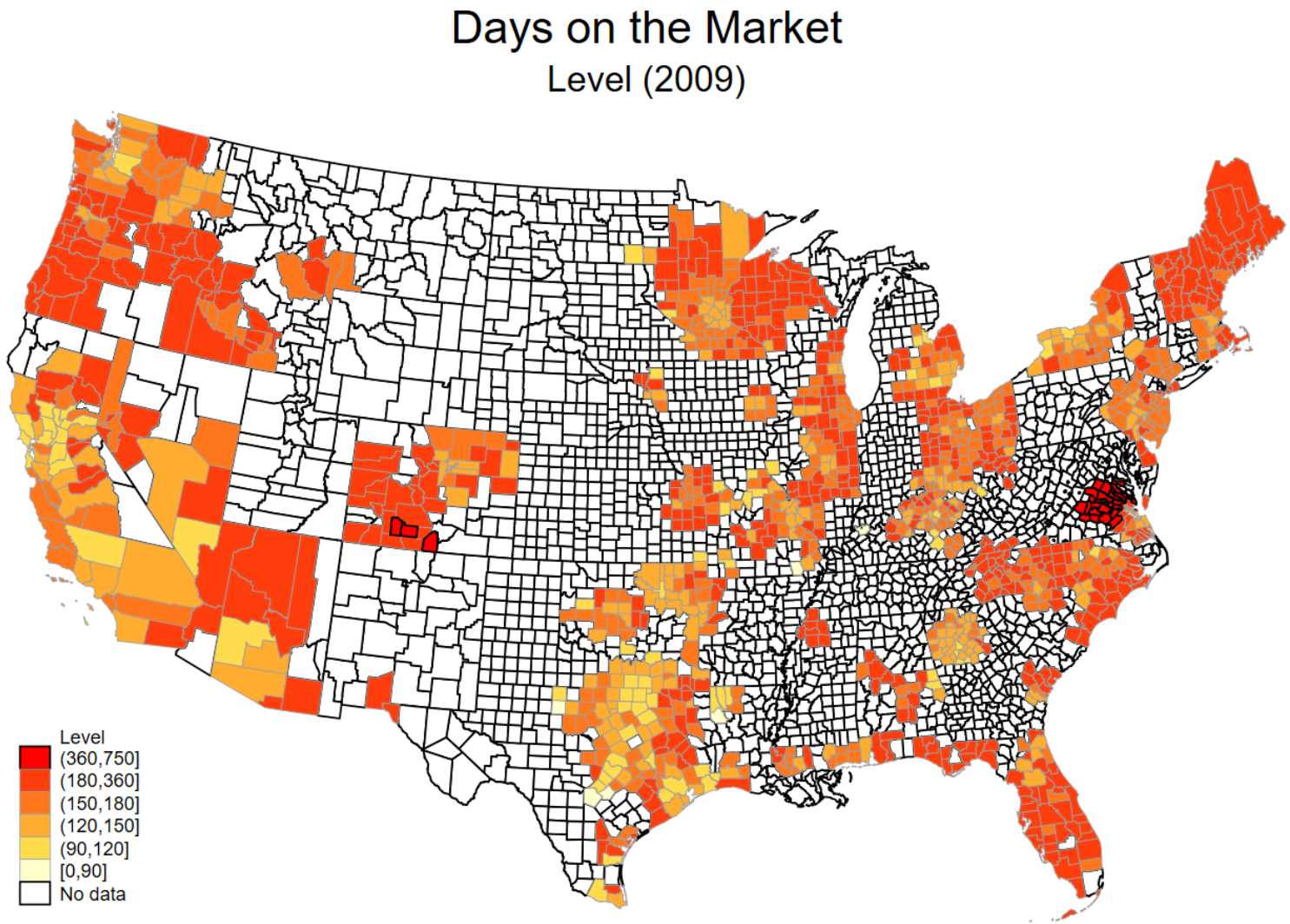
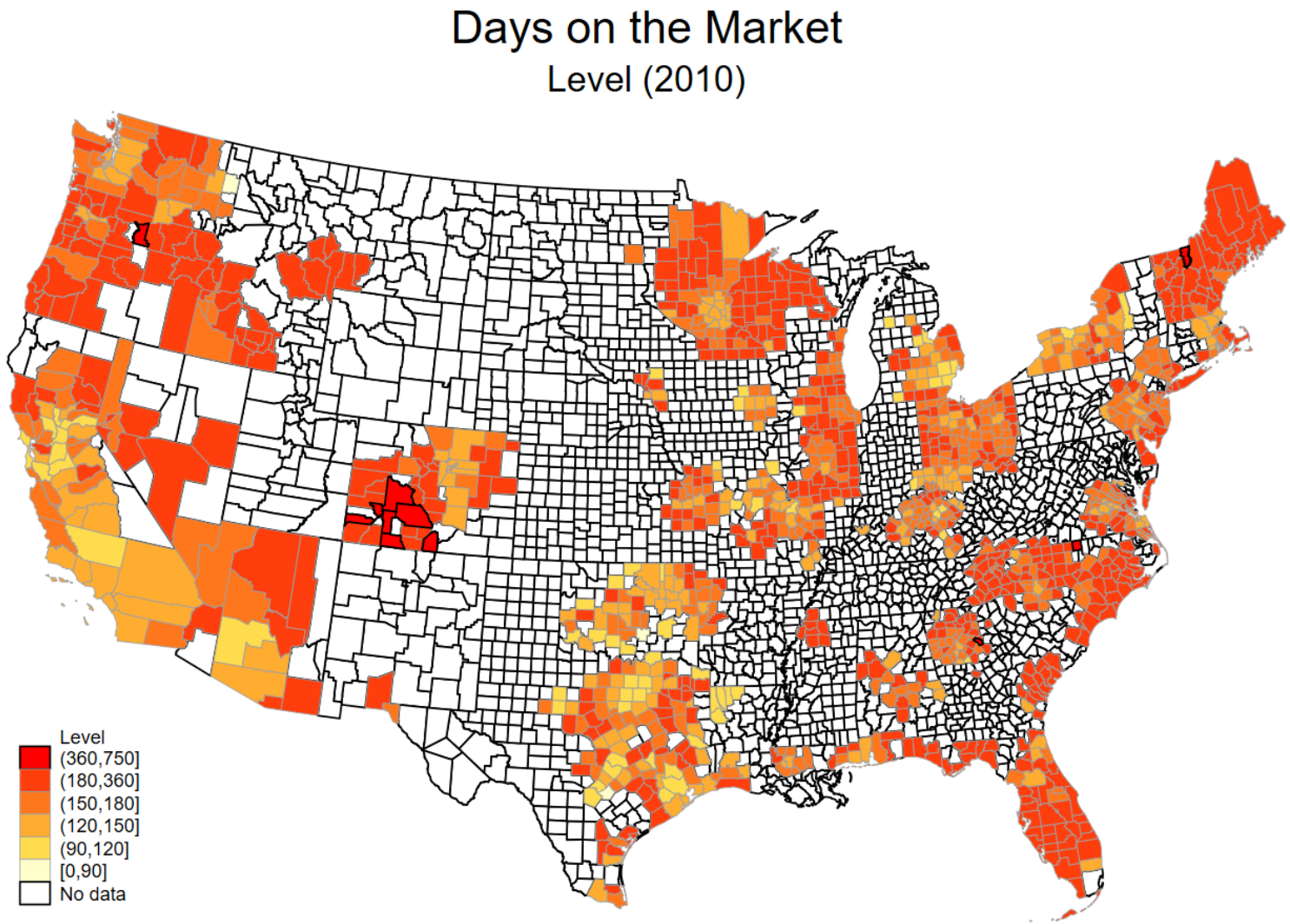
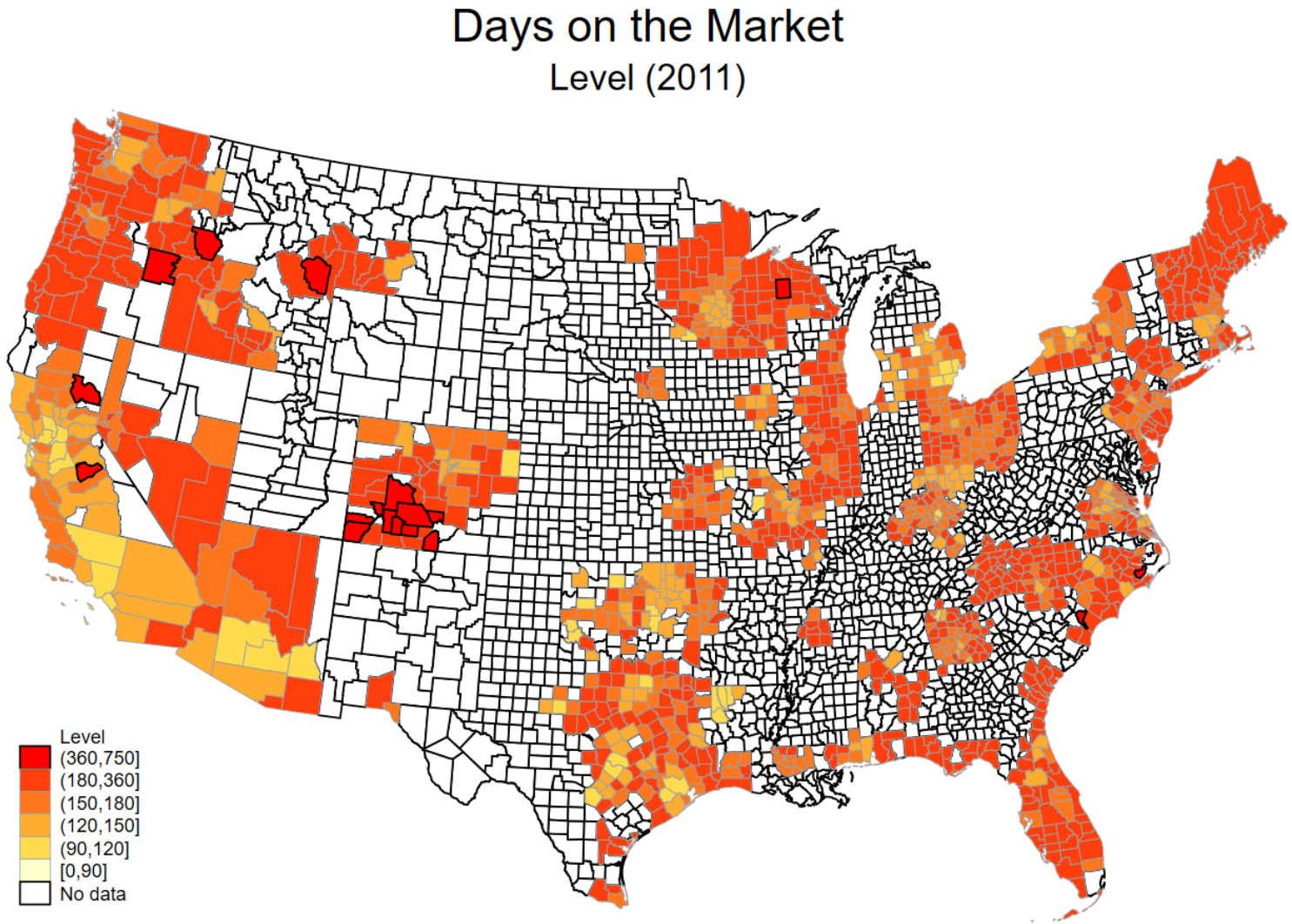


The Deterioration of Housing Liquidity: 2010



The Deterioration of Housing Liquidity: 2011



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