Monetary Policy, Credit Expansions, and Refinancing Waves

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Same Fed Policy, Different Outcomes

Both crises: Fed cuts rates to zero

2008: Weak Transmission

House prices had collapsed:

- 24% of counties: negative 5-year HP
- Sand states: only +3.8% appreciation

Result:

- Sand states: **3.6%** refi rate
- Rest of country: **6.7%** refi rate

2020: Strong Transmission

House prices had appreciated:

- Mean 5-year HP: +29%
- Only 1% with negative appreciation

Result:

- Largest refi boom in history
- **1.9**× higher than 2008

Same Fed policy, very different transmission — Why?

The Refinancing Channel of Monetary Policy

Standard transmission mechanism:

- Monetary easing $\Rightarrow$ lower mortgage rates
- Borrowers refinance, reducing monthly payments
- Increased disposable income stimulates consumption

Equity constraints on refinancing:

- Lenders impose maximum LTV ratios (typically 80–100%)
- House price declines erode equity, raising current LTV
- High-LTV borrowers **cannot access** lower rates

Implication:

- Refinancing capacity depends on *accumulated home equity*
- Equity reflects the *history* of local house price appreciation

$\Rightarrow$ **Path dependence**: today's refinancing capacity depends on the history of local house prices

An Important Asymmetry

Rate cuts: Induce refinancing waves

- Borrowers replace high-rate mortgages with low-rate ones
- Cash-flow relief $\Rightarrow$ consumption

Rate hikes: No effect on existing mortgages

- Fixed-rate borrowers are "locked in" to favorable terms
- No reason to refinance into a higher rate
- Hikes only affect *new* borrowers, not existing ones

$\Rightarrow$ **The refinancing channel is inherently asymmetric**

$\Rightarrow$ Rate cuts have direct balance sheet effects; rate hikes do not

This Paper

1. **Facts:** Five refinancing "waves" (1990–2024)
   - Document massive regional heterogeneity $\Rightarrow$ heterogeneous monetary policy transmission
   - Past HP appreciation determines refinancing capacity (equity channel)

2. **Causal Evidence:** Refinancing $\rightarrow$ Consumption
   - Two transmission channels: refinancing sensitivity + house price sensitivity
   - Path dependence: past equity determines current refinancing capacity

3. **Model:** Equity constraints $\varphi(\ell)$ weaken transmission after busts
   - Same rate cut: **15% weaker** transmission after bust vs. boom
   - 29% of borrowers constrained during crisis (vs. 10% in boom)

Related Literature

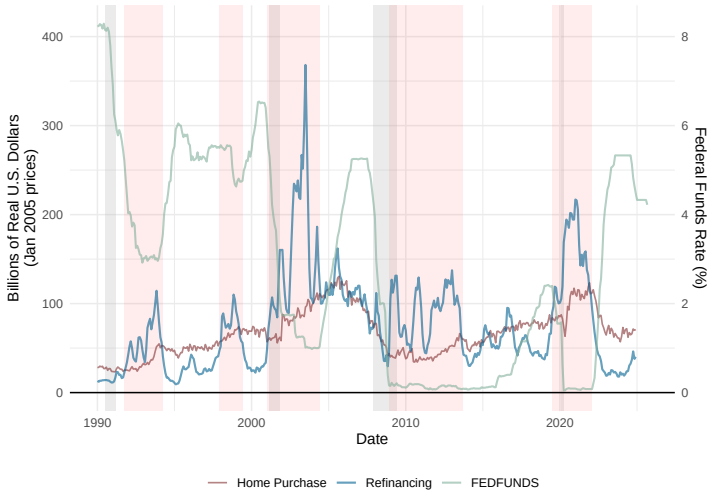
Housing wealth and consumption:

- Mian and Sufi (2011, 2014); Guren et al. (2020)
- Beraja et al. (2018); Graham and Makridis (2023); Saiz (2010)

Refinancing and monetary policy transmission:

- Iacoviello (2005); Berger et al. (2021)
- Di Maggio et al. (2017); Garriga and Hedlund (2020)
- Garriga et al. (2017); Greenwald (2018); Wong (2019)

Five Refinancing Waves (1990–2024)

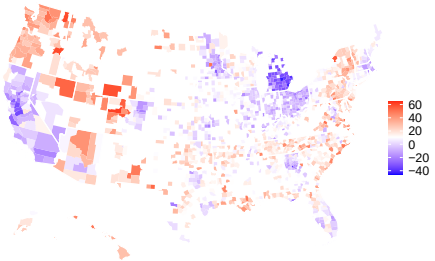


Five waves: 1992–93 · 1997–98 · 2001–03 · 2008–13 · 2020–21 Red shading = refinancing $>$ 50%

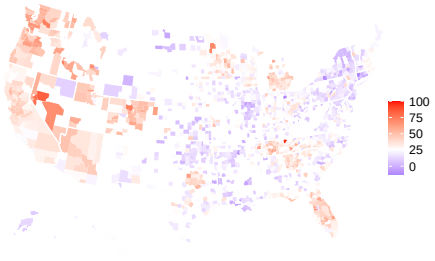
Source: cHMDA.

Equity at Wave Opening: 2008 vs. 2020

Wave 4 (Dec 2008)



Wave 5 (March 2020)



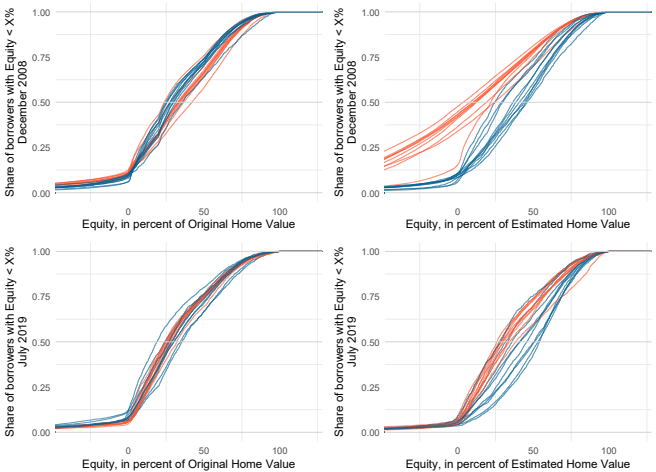
Sand states: **negative** appreciation
⇒ underwater borrowers

Broad-based **positive** appreciation
⇒ most can refinance

5-year cumulative house price appreciation at wave opening

Source: CoreLogic.

Distribution of Borrowers' Equity

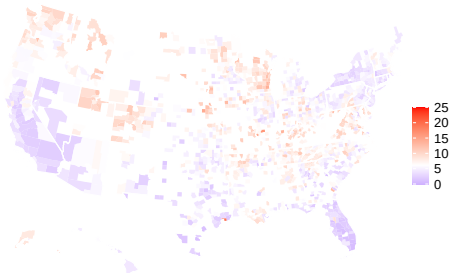


Blue: high HP growth counties Red: low HP growth counties

Source: CRISM and CoreLogic.

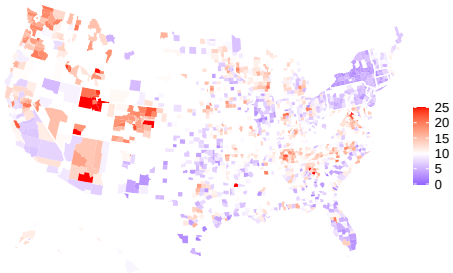
Consequence: Refinancing Rates Differed Dramatically

Wave 4 (2008)



Financial Crisis

Wave 5 (2020)



Covid Crisis

Refinancing rates **2× higher** in Wave 5 vs. Wave 4
Same Fed policy → very different transmission

Source: cHMDA.

Identification: Two Channels, Two Instruments

Does refinancing *cause* local consumption?

1. Rate Channel
Spread ↓ → Refi ↑ → Consumption ↑

$$z_{i,t}^{R} = \hat{\alpha}_i \times \text{FRMS}_{i,t}$$

$\hat{\alpha}_i$: refi sensitivity (pre-2006)
$\text{FRMS}_{i,t} = \text{FRM}_{i,t-12}^{\text{exist}} - \text{FRM}_{t}^{\text{market}}$

2. Equity Channel
HP ↑ → LTV relaxed → Refi ↑ → C ↑

$$z_{i,t}^{HP} = \hat{\gamma}_i \times \Delta P_{r(-i),t}$$

$\hat{\gamma}_i$: HP sensitivity (pre-2006)
$\Delta P_{r(-i),t}$: regional HP (leave-one-out)

Why this identifies causation:

- **Rate:** Current FRM set by Fed; locked-in rate is predetermined
- **Equity:** Regional HP uses leave-one-out — excludes county i
- **Sensitivities:** $\hat{\alpha}_i$, $\hat{\gamma}_i$ estimated from pre-2006 data

$\Rightarrow$ County i's current conditions cannot affect either instrument

Key intuition: "When the same national shock hits, who responds more?"

Shift-share design following Guren et al. (2020), building on Bartik (1991)

Details

Specification

Reduced-form local projections:

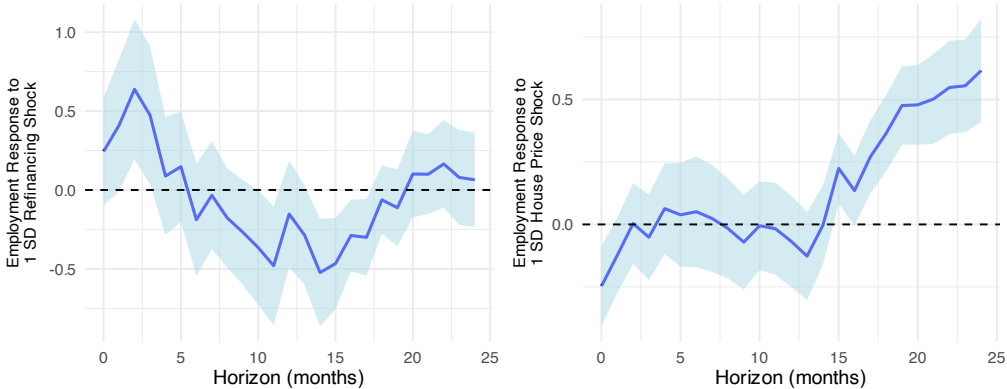
$$\Delta y_{i,t+h} \;=\; \psi_i \;+\; \xi_{d,t} \;+\; \beta_h^R \, z_{i,t}^R \;+\; \beta_h^{HP} \, z_{i,t}^{HP} \;+\; \Gamma X_{i,t} \;+\; \epsilon_{i,t+h}$$

Variable	Definition	Channel
$\Delta y_{i,t}$	12-month log change in retail employment	Consumption proxy
$z_{i,t}^R$	$\hat{\alpha}_i \times \text{Spread}_{r(-i),t}$	**Rate channel**
$z_{i,t}^{HP}$	$\hat{\gamma}_i \times \Delta P_{r(-i),t}$	**Equity channel**
$X_{i,t}$	Regional employment, bond spread, lagged wages	Controls
$\psi_i, \xi_{d,t}$	County FE, division×time FE	

Sample: 1994–2023, 999 counties, 346,889 county-months

β_h^R: Effect of rate-driven refinancing β_h^{HP}: Effect of equity-driven refinancing

Dynamic Response to Refinancing Shocks



Rate channel: Immediate boost (peaks $h = 2$), then reverts — front-loaded refinancing response.
Equity channel: Delayed effect (peaks $h = 24$) — constrained borrowers refinance as equity builds.

Magnitude: 1 pp spread decline (typical easing cycle $\approx$ 4 rate cuts) $\Rightarrow$ **+0.6 pp** retail employment growth.
Source: QCEW, CRISM, and CoreLogic.

Results: Two Channels, Different Timing

When the Fed cuts rates, refinancing unfolds in two stages:

	Rate Channel	**Equity Channel**
Peak effect	**+0.6 pp** at $h = 2$	**+0.6 pp** at $h = 24$
Timing	Immediate	Delayed (2 years)
Shock size	1 pp spread $\downarrow$	5% regional HP $\uparrow$
Mechanism	Unconstrained borrowers refi	Constrained wait for equity

- **Rate channel:** Spread $\downarrow \Rightarrow$ immediate refi $\Rightarrow$ consumption boost
- **Equity channel:** HP $\uparrow \Rightarrow$ LTV falls $\Rightarrow$ delayed refi $\Rightarrow$ consumption
- Not a wealth effect — an *access* effect

Takeaway: Rate gives *incentive*, equity gives *ability*

Why a Model?

Empirics establish:

- Equity at market value determines refinancing capacity
- Two transmission channels: refinancing sensitivity + HP sensitivity

Model lets us quantify:

- How much weaker is transmission after a bust vs. boom?
- What fraction of borrowers are constrained?
- What is the aggregate cost?

Building on Berger, Milbradt, Tourre & Vavra (2021)

- Their model: path dependence from locked-in coupons
- Our addition: path dependence from locked-in coupons *and* equity constraints

Model in a Nutshell

Setup: Continuous-time mortgage pricing model (extends BMTV 2021)

State variables for each borrower:

- r_t: Current interest rate
- m^*: Locked-in mortgage coupon rate (from last origination/refi)
- $\ell_t = M_t/H_t$: Loan-to-value ratio (mortgage balance / house value)

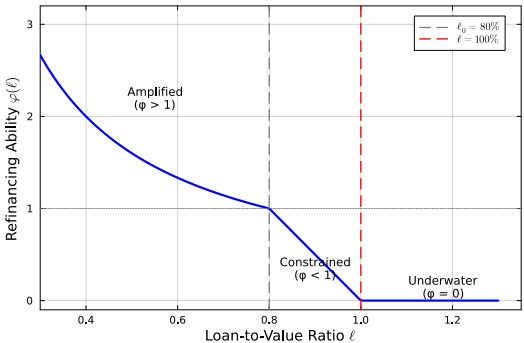
Refinancing decision:

- Borrower refinances when: (i) rate gap is large enough ($m^* > m(r_t)$), AND (ii) has sufficient equity ($\ell_t < 100\%$)
- Refinancing $\Rightarrow$ lower payments $\Rightarrow$ cash-flow relief $\Rightarrow$ consumption

Our innovation: Refinancing ability depends on equity via $\varphi(\ell)$

- BMTV: refinancing opportunities arrive randomly at rate λ (Calvo friction)
  - Not everyone refinances instantly when rates drop—captures search costs, inattention
- We modify: actual arrival rate $= \lambda \times \varphi(\ell)$
- $\varphi(\ell)$ scales the hazard based on equity: high equity $\Rightarrow$ more opportunities; underwater $\Rightarrow$ blocked

The Refinancing Ability Function: $\varphi(\ell)$



$\varphi(\ell)$ **scales** the refinancing arrival rate: actual rate $= \lambda \times \varphi(\ell)$

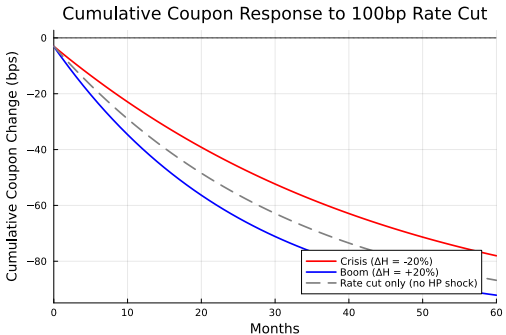
LTV (ℓ)	$\varphi(\ell)$	**Interpretation**
40%	2.00	Doubled opportunities
60%	1.33	Enhanced access
80%	1.00	Baseline
90%	0.50	Constrained
95%	0.25	Severely constrained
$\geq$100%	0.00	Blocked (underwater)

Economic logic:

- Low LTV = low risk $\Rightarrow$ lenders compete
- High LTV = high risk $\Rightarrow$ tighter standards
- Underwater = no collateral $\Rightarrow$ excluded

Model Results: Same Rate Cut, Different Effects

Experiment: 100 bp rate cut



Cumulative coupon response

	2Y	5Y
After bust (−20% HP)	−45 bp	−78 bp
After boom (+20% HP)	−63 bp	−92 bp
Gap	**18 bp**	**14 bp**

For a $300K, 30-year mortgage:

After boom: $1,970/year payment reduction
After bust: $1,640/year payment reduction
Gap: **$330/year** less relief

Fraction constrained:

After bust **29%**
Steady state 17%
After boom 10%

Source: Model simulations.

The Automatic Stabilization Failure

The refinancing channel *should* provide automatic stabilization:

- Recession ⇒ Fed cuts rates ⇒ refinancing ⇒ cushions the blow

But equity constraints make it *pro-cyclical*:

- Boom: HP appreciation ⇒ equity ⇒ channel amplifies
- Bust: HP decline ⇒ underwater ⇒ channel blocked

Constraints bind precisely when stimulus is most needed

Aggregate cost: If 20% of borrowers are constrained during crisis, foregone stimulus ≈ **$4.4 billion/year**

Policy Implication: Restoring Monetary Transmission

The Home Affordable Refinance Program (HARP, 2009–2018)

- Permitted refinancing of GSE-backed mortgages regardless of LTV
- Initial cap of 125% LTV, subsequently removed (HARP 2.0)
- Resulted in 3.4 million refinances through program expiration

Reinterpretation through our framework:

- Standard view: HARP as borrower relief or loss mitigation
- Our interpretation: **intervention to restore monetary transmission**

Mechanism:

- By relaxing LTV constraints, HARP effectively set $\varphi(\ell) > 0$ for high-LTV borrowers
- This restored refinancing access precisely for households excluded by equity constraints
- Enabled Fed rate cuts to transmit to constrained households

Broader Policy Implications

For monetary policy:

- Transmission strength depends on housing market state
- Regional HP distribution matters for aggregate stimulus
- May need complementary policies during busts

For macroprudential policy:

- Underwriting standards affect future monetary policy potency
- Tighter LTV limits today $\Rightarrow$ more constrained borrowers tomorrow
- **Macroprudential and monetary policy are intertwined**

Distributional consequences:

- Benefits flow to mortgage holders in high-HP areas
- Renters and underwater borrowers excluded
- Creates feedback loop: high-HP regions accumulate advantages

Conclusion

Main findings:

1. **Path dependence in monetary transmission**
   - Locked-in coupons: past rates determine incentive to refinance
   - Equity constraints: past prices determine ability to refinance

2. **Transmission is state-dependent**
   - 15% weaker pass-through to mortgage coupons after busts than booms

Policy implication: Programs like HARP can restore transmission by relaxing equity constraints precisely when monetary stimulus is most needed

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Who Benefits? Heterogeneity by Income

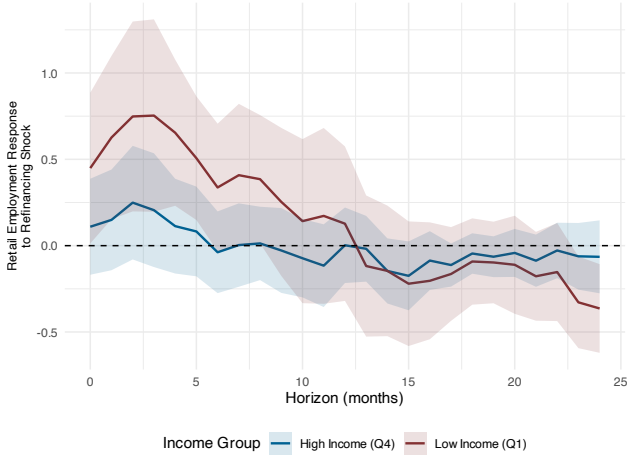
	Coefficient	Std. Error	First-Stage F
Full Sample	0.05	0.15	41,850
By County Income (Quartiles)			
Low Income (Q1)	**0.36****	0.18	5,737
High Income (Q4)	0.10	0.12	15,310
Formal Test of Difference			
Q4 − Q1	−0.26**	0.10	—

** $p < 0.05$; *** $p < 0.01$

Consumption response is **significantly stronger** in low-income counties

Refinancing → consumption operates through **high-MPC households**

Dynamic Response by Income



Blue: Low-income counties (Q1). Red: High-income counties (Q4). Shaded: 95% CI.

Low-income: **strong positive response**, fades by month 12 — High-income: **flat at zero**

Source: QCEW, CRISM, and CoreLogic.

Shift-Share Design: Intuition

General structure: Adapted from Guren et al. (2020), building on Bartik (1991) and Palmer (2015)

$$z_{i,t} = \underbrace{\text{Share}_i}_{\text{local sensitivity}} \times \underbrace{\text{Shift}_t}_{\text{aggregate shock}}$$

Share (cross-sectional)

- Same shock hits counties differently
- Some counties more "exposed" than others
- Exposure is slow-moving $\Rightarrow$ not driven by current conditions

Shift (time-series)

- Aggregate shock (national)
- Leave-one-out: excludes county i
- Not driven by any single county's demand

Key intuition: "When the same national shock hits, who responds more?"

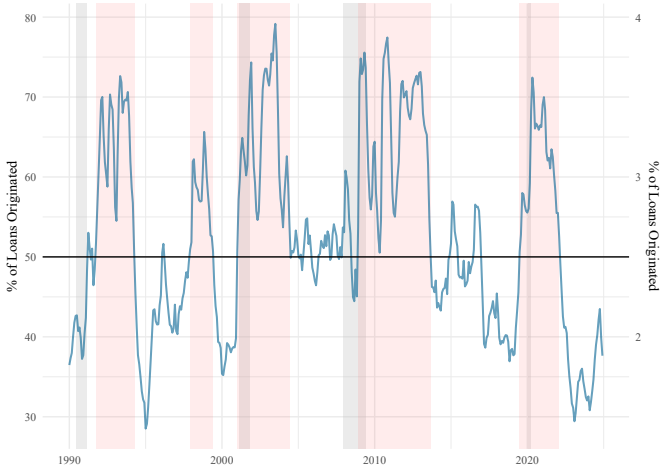
Identifying assumption (Guren et al., 2020): No unobserved factor that is *both*:

(i) correlated with national shocks in the *time series*, AND

(ii) differentially affects the same counties that are sensitive to national shocks in the *cross section*

Back

Refinancing Share of Mortgage Originations



The market alternates between **refinancing-dominated** and **purchase-dominated** periods

During waves: refinancing is **50–80%** of originations

Source: cHMDA.

Data Sources

Mortgages:

- HMDA: Universe of originations (1990–2024)
- McDash: 226M loans, 9.5B monthly records (1992–2024)
- CRISM: Matched mortgage-credit bureau data

House prices: CoreLogic county-level repeat-sales index

Consumption proxy: QCEW retail employment

Sample: 999 counties, 346,889 county-months

First Stage

	Rate Instrument $z^R_{i,t}$	**HP Instrument** $z^{HP}_{i,t}$
Coefficient	0.26	0.25
	(0.03)	(0.06)
F-statistic	**41,850**	**4,470**
Within R^2	7.8%	4.1%
N	346,889	346,889

Both instruments strongly predict refinancing (F-stat $\gg$ 10)

Note: Sensitivities estimated from pre-2006 data following GMNS (2020)

Income Heterogeneity: Full Results

	Coef.	SE	t-stat	First-Stage F
Full Sample	0.05	0.15	0.34	41,850
By County Income (Quartiles)				
Low Income (Q1)	**0.36****	0.18	2.01	5,737
High Income (Q4)	0.10	0.12	0.80	15,310
Formal Test of Difference				
Q4 − Q1	−0.26**	0.10	−2.55	—

** $p < 0.05$; *** $p < 0.01$

The difference between Q1 and Q4 is **statistically significant** ($p = 0.011$)

Why Stronger Effects in Low-Income Counties?

The Marginal Propensity to Consume (MPC) Channel:

Low income $\Rightarrow$ Liquidity constrained $\Rightarrow$ High MPC $\Rightarrow$ Spend refi savings

High income $\Rightarrow$ Buffer stock $\Rightarrow$ Low MPC $\Rightarrow$ Save refi savings

Evidence from IRF by income:

- Low-income counties: strong positive response, peaks at h=0, fades by h=12
- High-income counties: flat at zero throughout

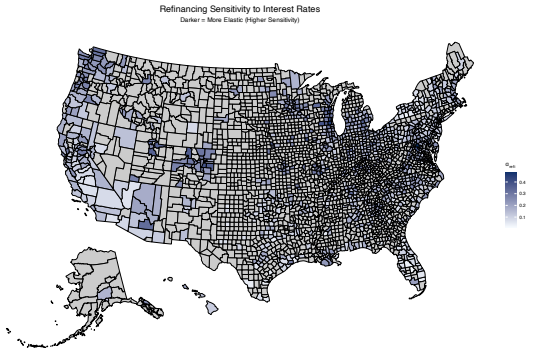
Refinancing $\rightarrow$ **consumption** operates through cash-constrained households

Model Calibration

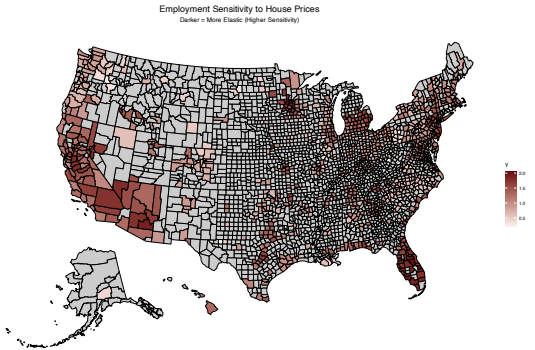
Parameter	Description	Value	Source
$\bar{r}$	Mean interest rate	3.5%	FRED 1990–2019
κ	Mean reversion	0.13	Treasury yields
σ	Rate volatility	6%	Treasury yields
σ_H	HP volatility	12%	CoreLogic
ρ	Rate-HP correlation	0.30	County panel (0.34)
χ	Refi intensity	22.8%	BMTV (2021)
ν	Moving rate	4.1%	AHS
ℓ_0	Baseline LTV	80%	Conforming standard

Rate-HP correlation validated: 0.34 in data, rises to 0.48 during 2007–11 crisis

Sensitivity Maps: Geographic Distribution



Refinancing Sensitivity (α_i)



House Price Sensitivity (γ_i)

Darker = higher sensitivity (more responsive to shocks)

The two instruments capture **different** transmission channels

Source: Authors' estimates from cHMDA and CoreLogic.

Instrument Construction: Step by Step

1. Estimate sensitivity $\hat{\alpha}_i$ from pre-sample data:

$$\text{Refi}_{i,t} = \alpha_i \times \text{Spread}_t + \text{controls} + \epsilon_{i,t}$$

- α_i = how much county i responds to 1 pp change in national spread
- Estimated pre-2006 with controls $\Rightarrow$ reflects structural characteristics

2. National spread (the shock):

$$\text{Spread}_t = \text{Old mortgage rate} - \text{Current 30-year FRM}$$

- Determined by Fed policy, not by any county's conditions
- Same shock hits all counties

3. Instrument = interaction:

$$z_{i,t} = \hat{\alpha}_i \times \text{Spread}_t$$

$\Rightarrow$ **Nothing about county i today enters the instrument** — only its historical sensitivity and national rates

Model vs. Baseline (No Equity Constraints)

	Full Model	Baseline ($\varphi = 1$)
5-Year Coupon Response to 100bp Cut		
After bust (-20% HP)	-78 bp	-87 bp
After boom ($+20\%$ HP)	-92 bp	-87 bp
Swing	**14 bp**	0 bp
Fraction Constrained		
Steady state	17%	—
After bust	29%	—

The 14 bp swing is *entirely* due to equity constraints

Setting $\varphi(\ell) = 1$ eliminates state dependence

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