Rental Markets and the Effects of Credit Conditions on House Prices

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What Role Did Credit Play in the Housing Boom and Bust?

- Divergent views in literature
  - Favilukis-Ludvigson-Van Nieuwerburgh; Justiniano-Primiceri-Tambalotti: Credit can explain essentially all of movement in prices.
  - Kaplan-Mitman-Violante: Credit had virtually no effect on prices.
- Why?
  - Rental market key.
  - FLVN, JPT: Fixed homeownership rate. Prices move when demand changes.
  - KMV: Perfect arbitrage by deep-pocketed investors. When credit changes, renters buy from their landlord, prices pinned down by NPV of landlord rents.
- This Paper:
  - Model intermediate cases with imperfect arbitrage.
  - Calibrate model to match empirical impact of credit on price/rent, homeownership
  - Finding: credit conditions important, explain between 47% and 57% of price-rent rise.

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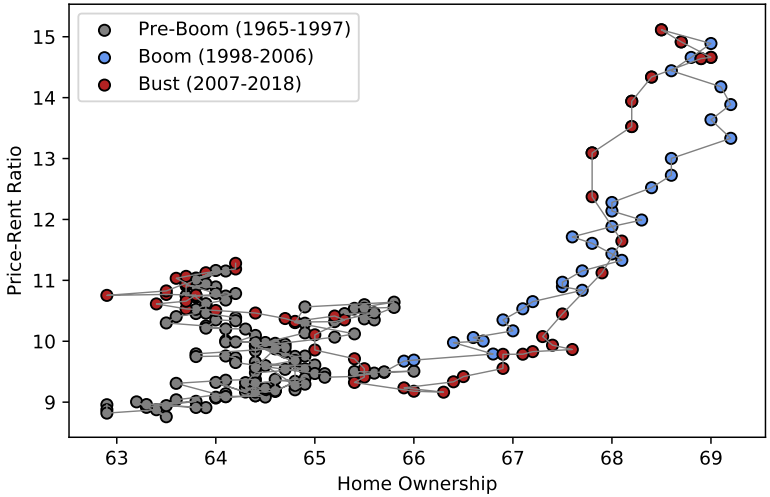
Outline

- Intuition: Modified Supply and Demand
- Empirics: Estimate Sensitivity
  - Data and Empirical Approach
  - Estimation Results
- Theory: Quantify Impact
  - Calibrated Model
  - Quantitative Results

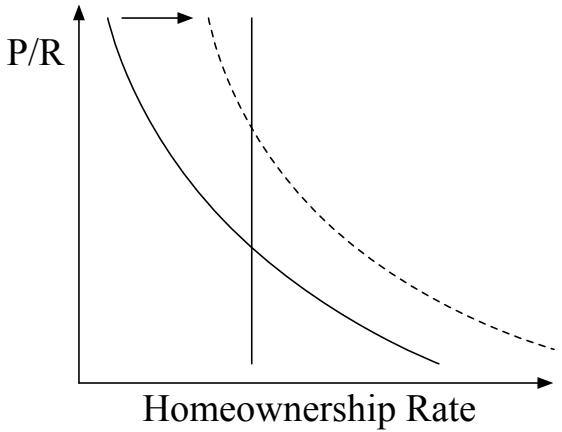
Time Series: Price-Rent Ratio vs. Home Ownership Rate



National data. Price/Rent: Flow of Funds. Homeownership: Census.

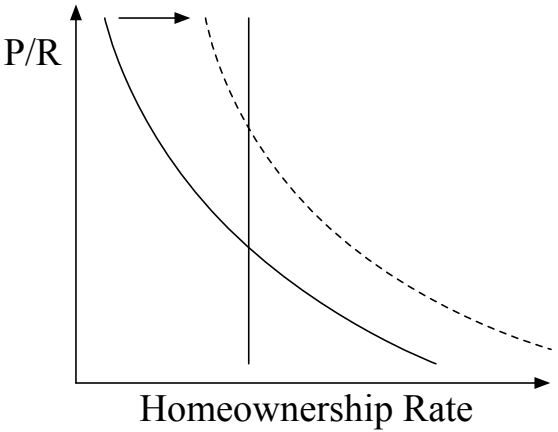
Intuition: Modified Supply and Demand

- Plot demand for owner-occupied housing against supply (willingness of landlords to sell).



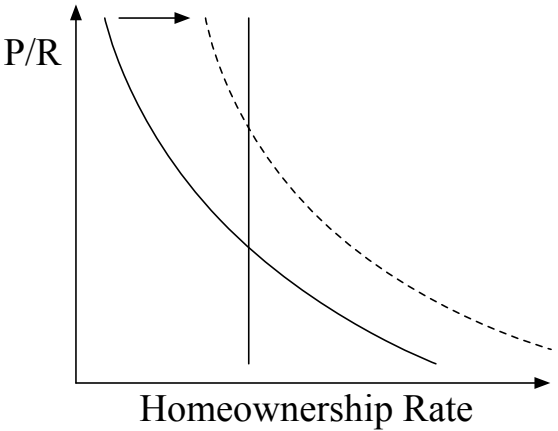
Intuition: Modified Supply and Demand

- Price-rent ratio and homeownership rate robust to changes in housing stock.



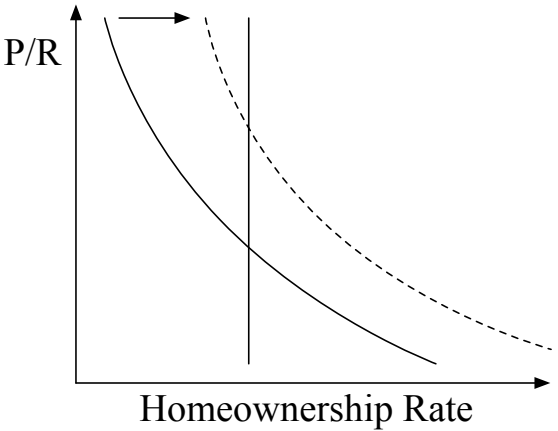
Intuition: Modified Supply and Demand

- Credit expansion: demand for owner-occupied housing shifts right.



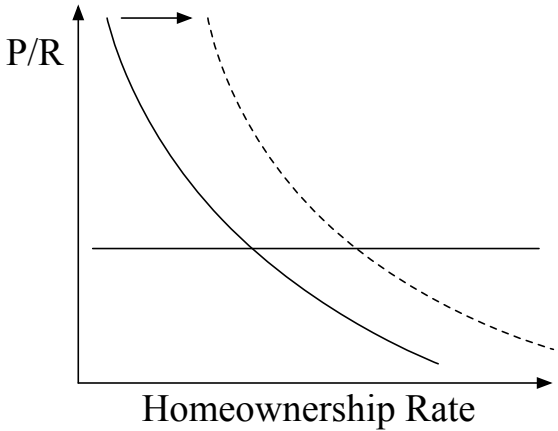
Intuition: Modified Supply and Demand

- Fixed supply (e.g., FLVN) $\implies$ all adjustment through price-rent ratio.



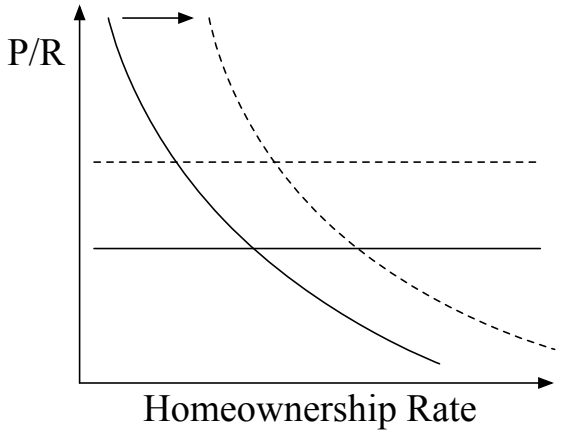
Intuition: Modified Supply and Demand

- Perfect rental market (e.g., KMV) $\Longrightarrow$ all adjustment through homeownership rate.



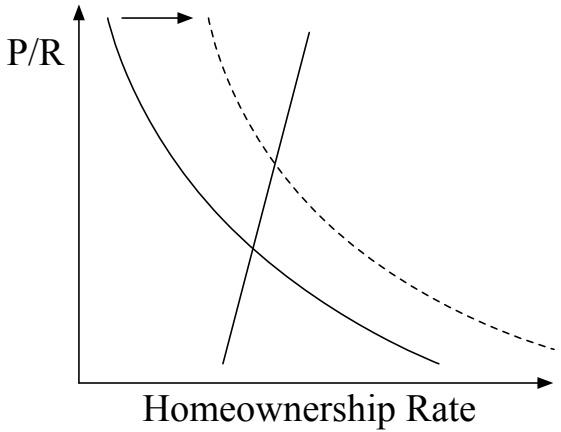
Intuition: Modified Supply and Demand

- In this world, increase in price-rent requires **separate** shock to supply.
  - E.g., change in lender beliefs, **lender credit conditions**.



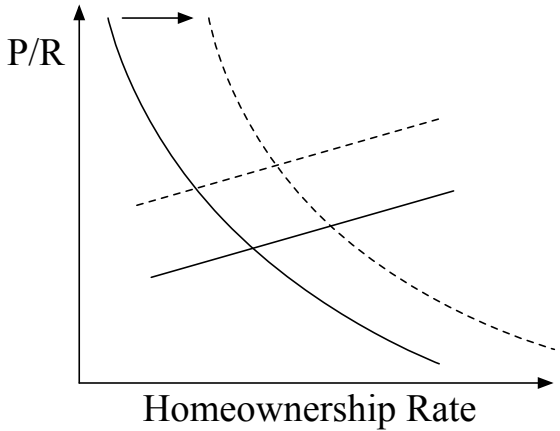
Intuition: Modified Supply and Demand

- Alternative view: credit expansion + **upward sloping supply** (imperfect rental market).



Intuition: Modified Supply and Demand

- Any intermediate combination of upward sloping supply and supply shift also possible.
  - Need a way to **identify slope** of supply curve.



Data

- CBSA- and State-Level Panels 1990-2017
- Prices: CoreLogic Repeat Sale HPI (CBSA), FHFA (State)
- Rents: CBRE Economic Advisors Totoro-Wheaton Index (CBSA)
  - High-quality repeat sale rent index for multi-family (single family index behaves similarly).
  - Measures rent commanded by newly rented unit
- Homeownership Rate: Census Housing and Vacancy Survey
  - CBSA definitions change over time. Drop periods where definitions change.
  - State level HOR and price panel to have fixed HOR definitions.
- Credit: HMDA
  - Following Favara-Imbs, use no. of loans, dollar volume of originations, loan/income ratio (IRS).

Empirical Approach

- Specification:

$$\Delta \log(\text{outcome}_{i,t}) = \xi_i + \psi_t + \beta \Delta \log(\text{credit}_{i,t}) + \gamma \Delta \log(\text{outcome}_{i,t-1}) + \varepsilon_{i,t}$$

- Problems:
  - Credit is endogenous.
  - Measurement error in credit: loan volume picks up refinancing.
- Instrument: Loutskina and Strahan (2015)
  - Idea: change in conforming loan limit has bigger bite in cities with more homes priced near CLL.
  - Instrument: interact fraction of originations within 5% of CLL at $t-1$ with % change in CLL.
  - Include triple interaction with Saiz elasticity as well for power.
  - Slightly weak instrument (F between 6 and 9), but 2SLS and LIML similar.
- Future work: augment with additional instruments.

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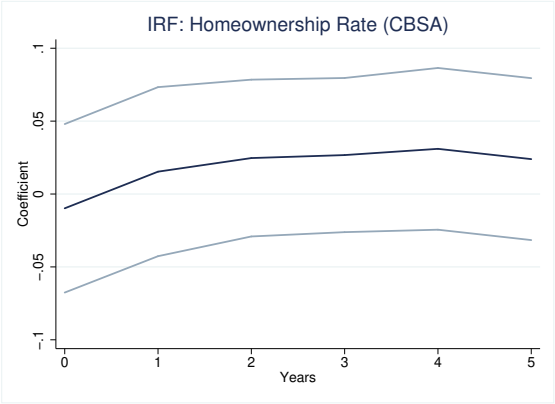
Regression Results: Price-Rent Ratio

- CBSA-level IV regressions.
- Substantial increase in price-rent ratio.
- Homeownership response not significantly different from zero.

	$\Delta \log(\text{Price/Rent})$			$\Delta \log(\text{Homeownership Rate})$		
$\Delta \log(\#\text{ Loans})$	0.297**			-0.004		
	(0.114)			(0.040)		
$\Delta \log(\text{Vol. Loans})$		0.229***			-0.004	
		(0.067)			(0.030)	
$\Delta \log(\text{Loan/Income})$			0.235**			0.004
			(0.078)			(0.031)
N	1404	1404	1346	1729	1729	1653

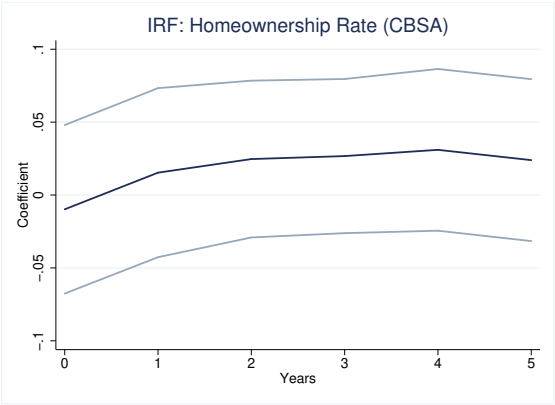
Impulse Response: Credit Shock

- CBSA level: price-rent ratio peaks at over 0.4 relative to 0.03 for HOR.
- State level (not shown): house prices peak at 0.6 relative to 0.1 for HOR.



Impulse Response: Credit Shock

- Conservative estimate: elasticity of PRR is 5x elasticity of HOR (likely higher).
- Use **5x ratio** as calibration target to pin down supply elasticity (lender heterogeneity).



Model Overview

- Endowment economy, endogenous investment in housing stock.
- Realistic mortgages: long term, fixed-rate, prepayable.
  - Loan-to-value (LTV) and payment-to-income (PTI) limits at origination only.
- Three types: borrowers (B), landlords (L), savers (S).
  - Borrowers: consume owned and rented housing, borrow in mortgages ($\beta_B < \beta_S$).
  - Landlords: risk-neutral, own housing to rent to borrowers (full model: can also borrow).
  - Savers: finance borrower mortgages (full model: landlord mortgages too).
- Key modeling contribution: **borrower and landlord heterogeneity**.

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- Three types: borrowers (B), landlords (L), savers (S).
- Key modeling contribution: **borrower and landlord heterogeneity**.
  - Without any heterogeneity, 0% or 100% home ownership.
  - How heterogeneity falls on borrowers vs. landlords determines slope of demand vs. supply.

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- Three types: borrowers (B), landlords (L), savers (S).
- Key modeling contribution: **borrower and landlord heterogeneity**.
  - Model as het. ownership benefits/costs (h = housing services, H = owned housing):

$$V_{i,t}^B = \log(c_{i,t}^B) + \xi_B \log(h_{i,t}^B) + \omega_{i,t}^B H_{i,t}^B, \qquad \omega_i^B \sim \Gamma_\omega^B$$

$$V_{i,t}^L = c_{i,t}^L + \omega_{i,t}^L H_{i,t}^L, \qquad \omega_i^L \sim \Gamma_\omega^L$$

  - ω_i^B stands in for life cycle, preferences, ability to come up with down payment, etc.
  - ω_i^L stands in for suitability of renting (urban multifamily vs. rural detached).

Model Solution

- Key optimality conditions (ignore landlord credit for today):

$$p_t^{\text{Demand}} = \underbrace{\Big(1 - \mathcal{C}_t\Big)^{-1}}_{\text{credit conditions}} E_t\Bigg\{\Lambda_{t+1}^B\Bigg[\underbrace{\bar{\omega}_t^B + \text{rent}_t}_{\text{housing services}} + \underbrace{\Big(1 - \delta - (1-\rho_{t+1})\mathcal{C}_{t+1}\Big)p_{t+1}}_{\text{continuation value}}\Bigg]\Bigg\}$$

$$p_t^{\text{Supply}} = E_t\Bigg\{\Lambda_{t+1}^L\Bigg[\underbrace{\bar{\omega}_t^L + \text{rent}_t}_{\text{housing services}} + \underbrace{\Big(1-\delta\Big)p_{t+1}}_{\text{continuation value}}\Bigg]\Bigg\}$$

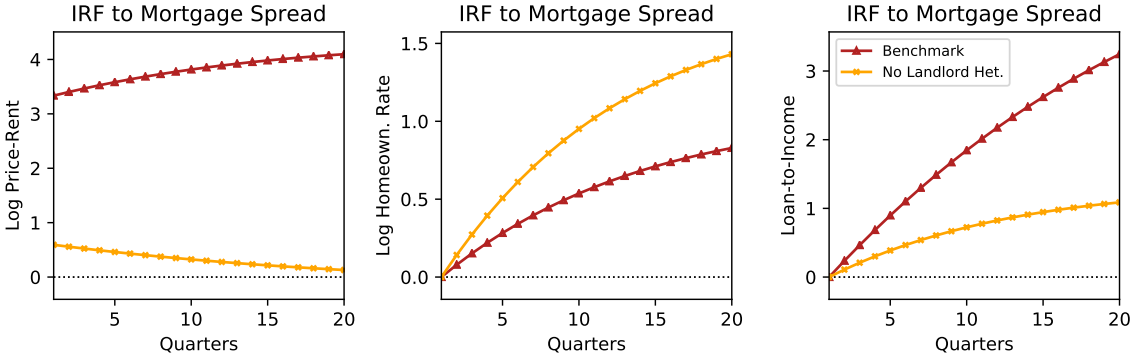
- At equilibrium, $(\bar{\omega}_t^B, \bar{\omega}_t^L)$ ensure $p_t^{\text{Demand}} = p_t^{\text{Supply}}$ and $H_t^B + H_t^L = \bar{H}_t$, where

$$H_t^B = \Big(1 - \Gamma_\omega^B(\bar{\omega}_t^B)\Big)\bar{H}_t, \qquad H_t^L = \Big(1 - \Gamma_\omega^L(\bar{\omega}_t^L)\Big)\bar{H}_t$$

- Key parameter is dispersion of Γ_ω^L distribution (more dispersed $\implies$ more inelastic supply).

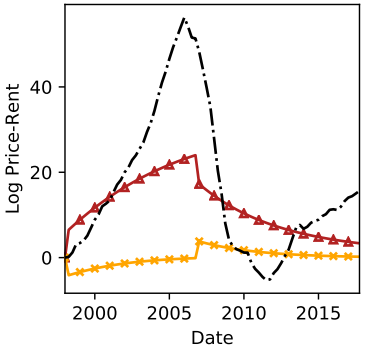
Calibration: Supply Elasticity

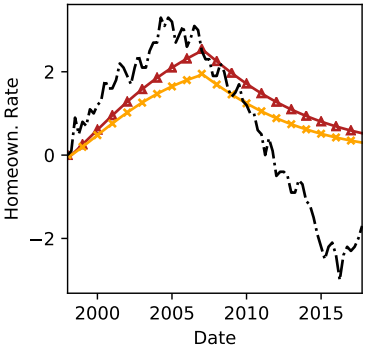
- Model change in CLL as shock to real mortgage spreads for borrowers.
- Choose dispersion of Γ_ω^L to ensure 5x larger price-rent vs. homeownership response.
  - Requires substantial deviation from frictionless rental markets with no landlord heterogeneity.

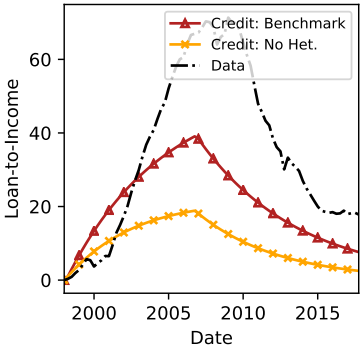


Credit Expansion Experiment

- Credit expansion: increase max LTV ratio from 85% to 99%, max PTI ratio from 36% to 65%.
- Start in 1998 Q1, surprise reversal in 2007 Q1, compute nonlinear perfect foresight paths.

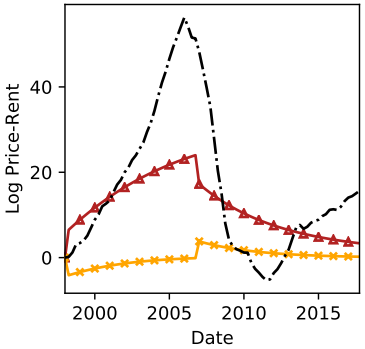


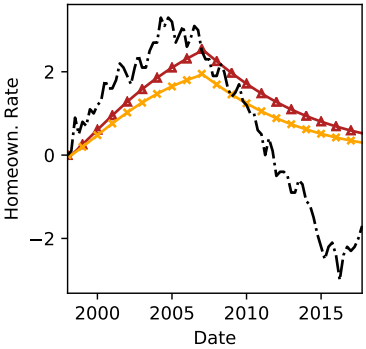


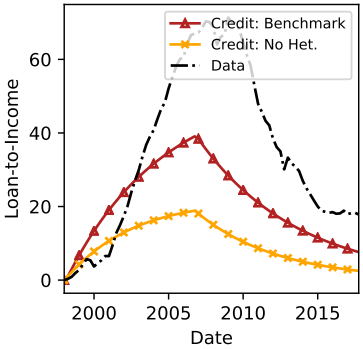


Credit Expansion Experiment

- Benchmark: credit explains 47% of peak price-rent increase, 58% of peak LTI increase.
- Perfect rental markets: credit explains 0% of price-rent, only 28% of peak LTI increase.



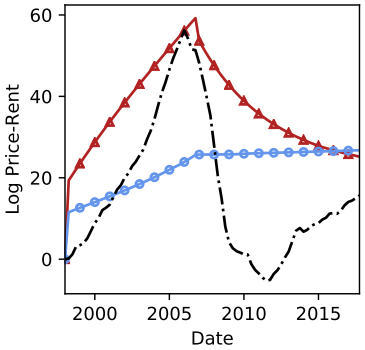


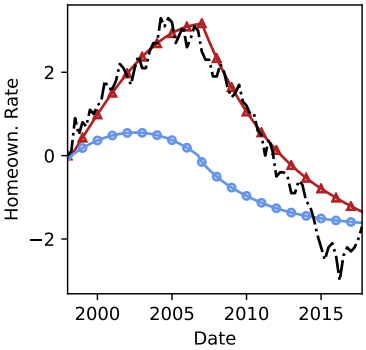


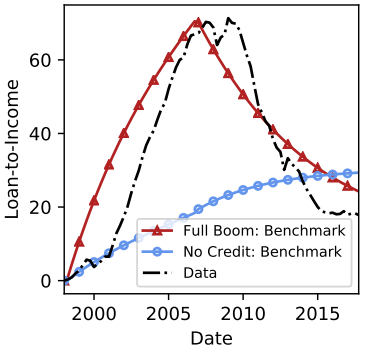
Boom Counterfactuals: Benchmark Model

- Add observed fall in interest rates, then set house price expectations (expected rental growth) to explain entire boom in price-rent ratio and credit growth.
  - Fall in landlord discount rates, mortgage rates, credit limits in bust.

- Now **removing** credit expansion kills 57% of boom in price-rent ratios, 74% of boom in LTI.

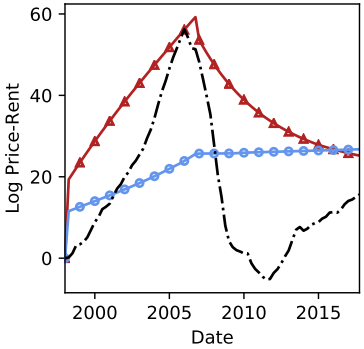


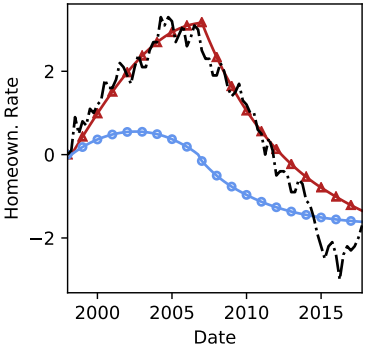


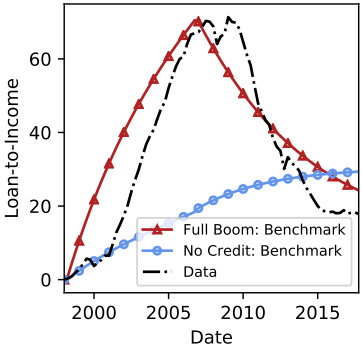


Boom Counterfactuals: Benchmark Model

- Why does order credit is added/removed matter?
  - Loose credit amplifies low rate + expectation effects on demand.
- Takeaway: credit changes played important role in the boom for both debt and house prices.







Conclusion

- What role did credit play in the housing boom and bust?
- Empirical results:
  - 5x or larger elasticity for price-rent ratio than homeownership rate along supply curve.
  - Next steps: more instruments, expanded evidence.
- Quantitative model calibrated to match empirical findings (landlord supply elasticity):
  - Allows us to consider cases between fixed homeownership rate and perfect arbitrage.
  - Main finding: credit conditions explain 47 – 57% of price-rent growth during boom.
  - Next steps: investigate role of landlord credit, improve model fit.