

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

- Faviliukis-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 landlords. When credit loosens, renters buy from their landlord, prices pinned down by PV of 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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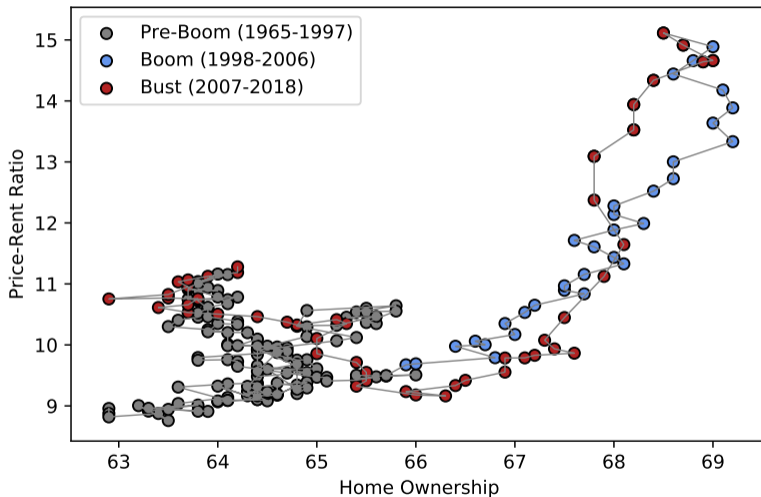
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- Model intermediate cases with imperfect arbitrage.
- Calibrate model to match empirical impact of credit on price/rent, homeownership
- Finding: credit conditions important, explain between 47% and 57% of price-rent rise.

Outline

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

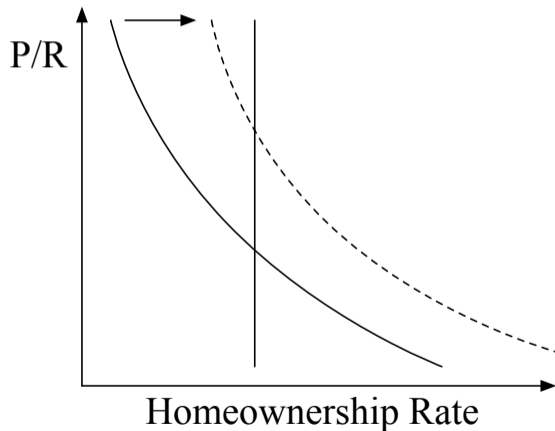
Time Series: Price-Rent Ratio vs. Home Ownership Rate



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

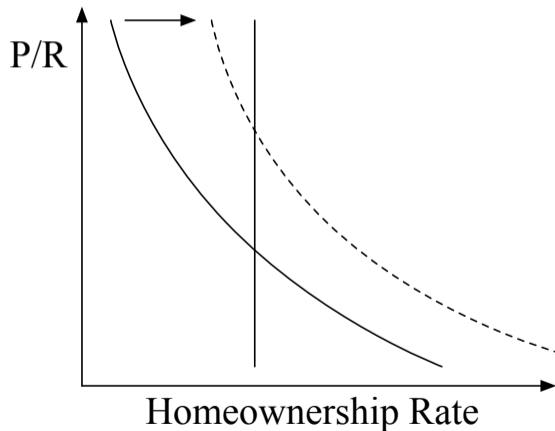
Intuition: Modified Supply and Demand

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



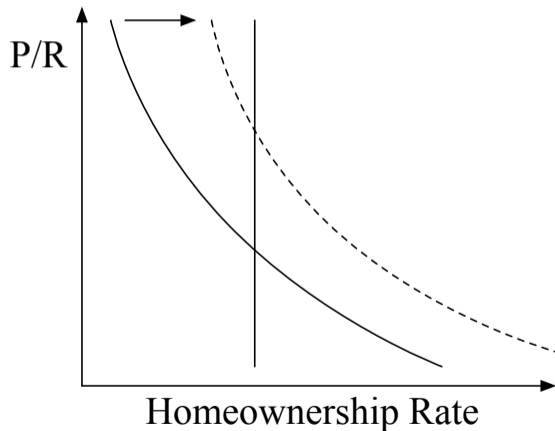
Intuition: Modified Supply and Demand

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



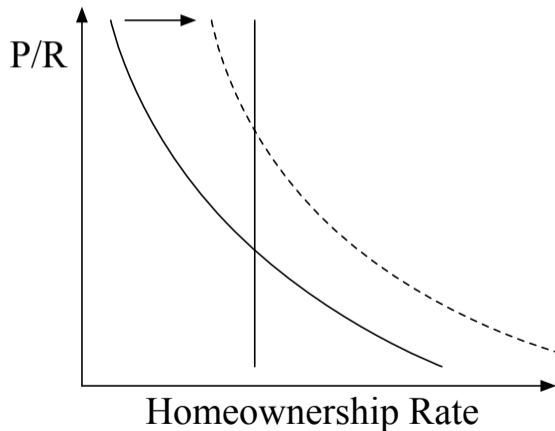
Intuition: Modified Supply and Demand

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



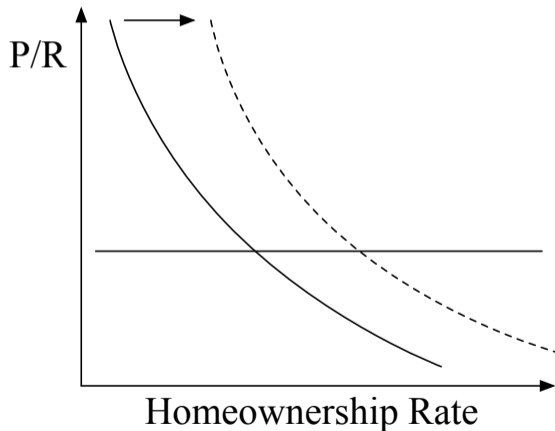
Intuition: Modified Supply and Demand

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



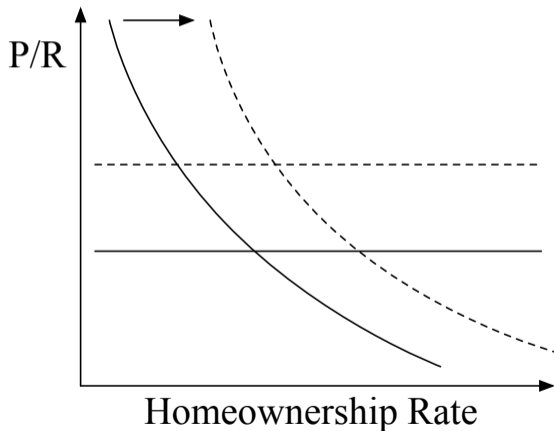
Intuition: Modified Supply and Demand

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



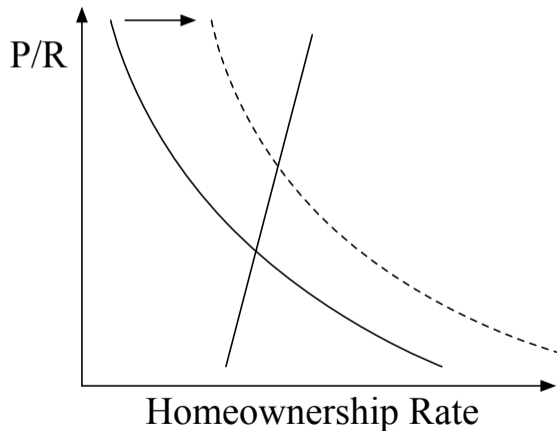
Intuition: Modified Supply and Demand

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



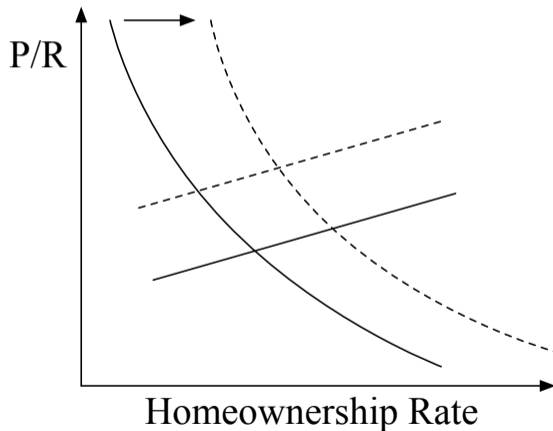
Intuition: Modified Supply and Demand

- ▶ 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:

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

► 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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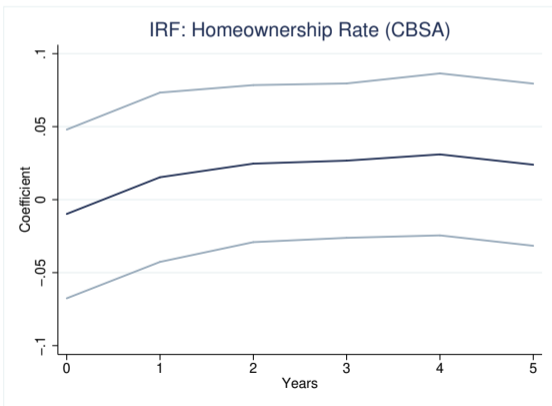
Regression Results: Price-Rent Ratio

- ▶ 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** (0.114)			-0.004 (0.040)		
$\Delta \log(\text{Vol. Loans})$	0.229*** (0.067)			-0.004 (0.030)		
$\Delta \log(\text{Loan/Income})$	0.235** (0.078)			0.004 (0.031)		
<i>N</i>	1404	1404	1346	1729	1729	1653

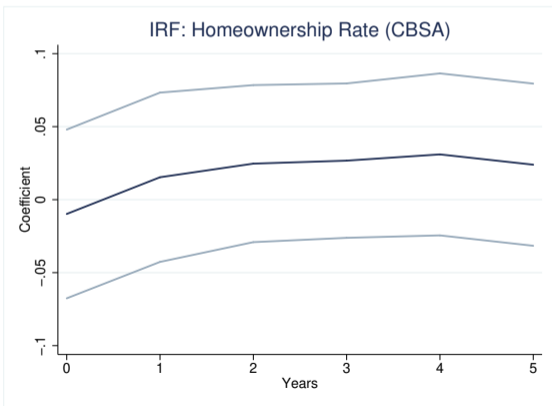
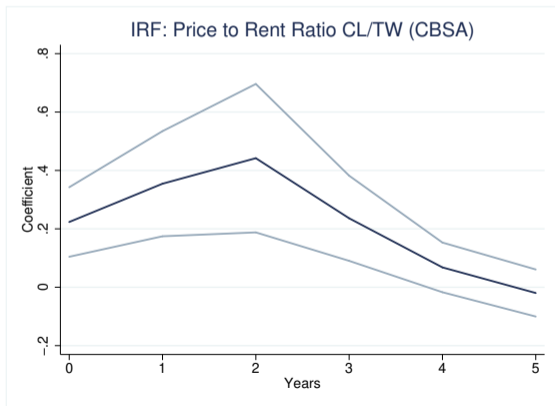
Impulse Response: Credit Shock

- ▶ 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 (slope).



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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- ▶ 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.

Model Overview

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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):

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

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

- 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):

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

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

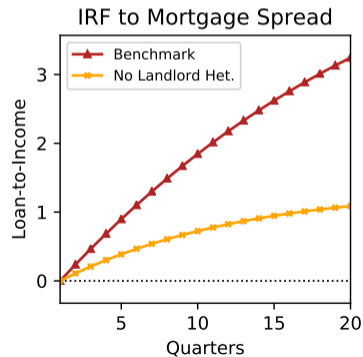
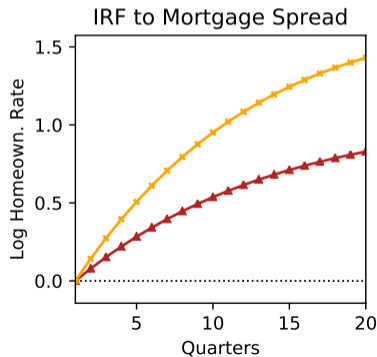
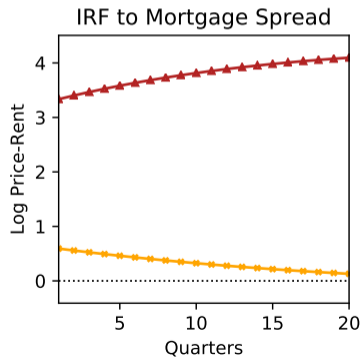
- ▶ At equilibrium, $(\bar{\omega}_t^B, \bar{\omega}_t^L)$ ensure $p_t^{\text{Demand}} = p_t^{\text{Supply}}$ and $H_t^B + H_t^L = \bar{H}_t$, where

$$H_t^B = \left(1 - \Gamma_{\omega}^B(\bar{\omega}_t^B)\right) \bar{H}_t, \quad H_t^L = \left(1 - \Gamma_{\omega}^L(\bar{\omega}_t^L)\right) \bar{H}_t$$

- ▶ Key parameter is dispersion of Γ_{ω}^L distribution (more dispersed \implies more inelastic supply).

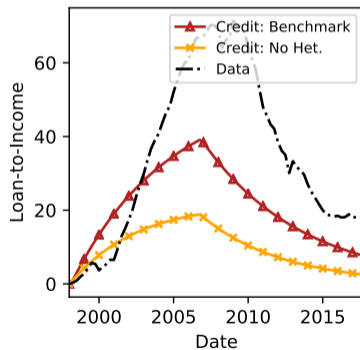
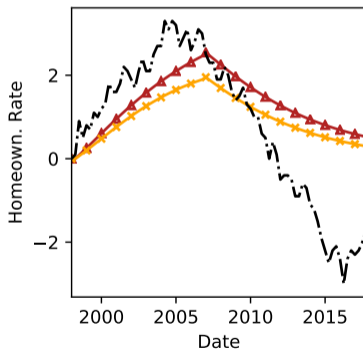
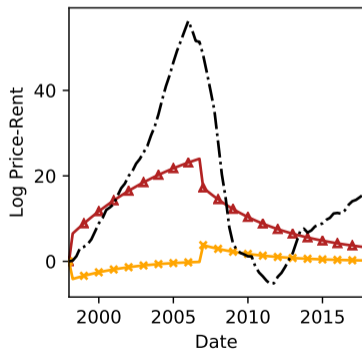
Calibration: Supply Elasticity

- ▶ Model change in CLL as shock (\downarrow 100bp) 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.



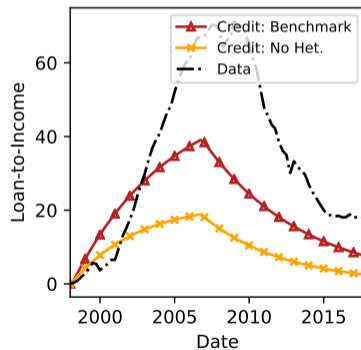
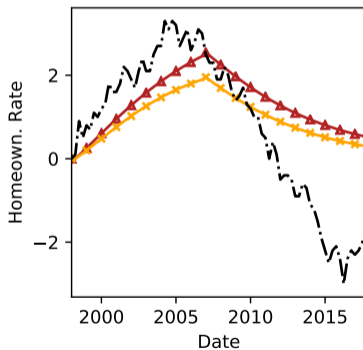
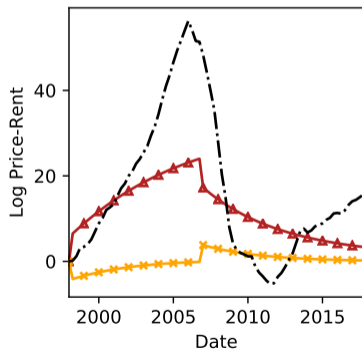
Credit Expansion Experiment

- ▶ 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.



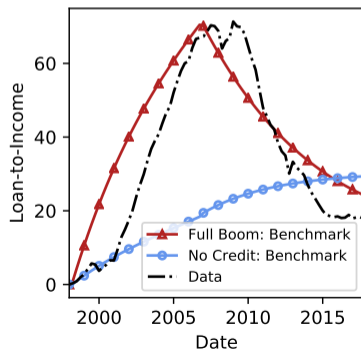
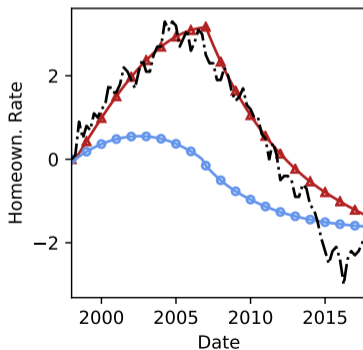
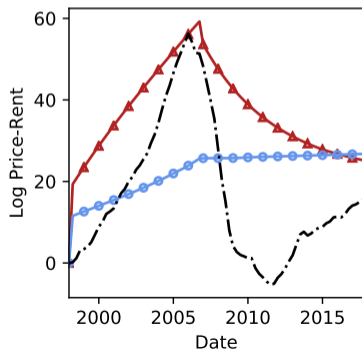
Credit Expansion Experiment

- ▶ 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.



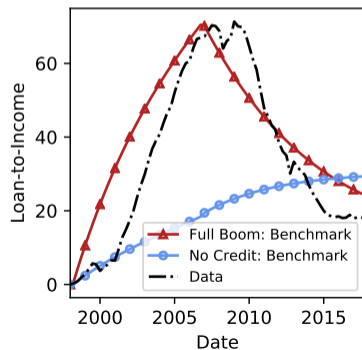
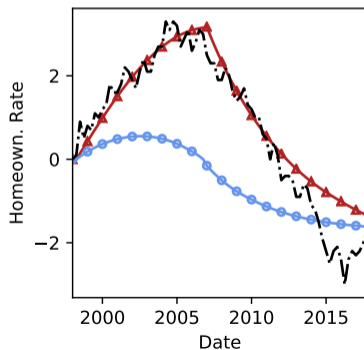
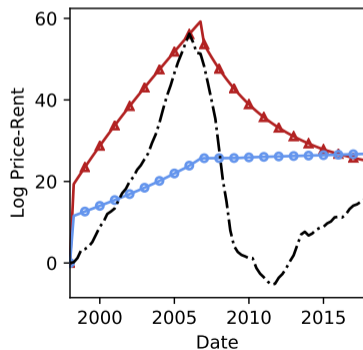
Boom Counterfactuals: Benchmark Model

- ▶ 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.