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 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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  - 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

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.

![Diagram showing the relationship between P/R and Homeownership Rate with a shift to the right indicating an increase in demand for owner-occupied housing due to credit expansion.]
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 \textit{separate} shock to supply.
  - E.g., change in lender beliefs, \textit{lender credit conditions}.

![Diagram showing the relationship between P/R and Homeownership Rate.]
Intuition: Modified Supply and Demand

- Alternative view: credit expansion + \textit{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.

<table>
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<th>Δ log(Vol. Loans)</th>
<th>Δ log(Loan/Income)</th>
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<td>Δ log(Price/Rent)</td>
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<td>0.229***</td>
<td>0.235**</td>
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<td></td>
<td>(0.114)</td>
<td>(0.067)</td>
<td>(0.078)</td>
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<td>Δ log(Homeownership Rate)</td>
<td>-0.004</td>
<td>-0.004</td>
<td>0.004</td>
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<tr>
<td></td>
<td>(0.040)</td>
<td>(0.030)</td>
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<tr>
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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.
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 \(S\).

▶ Key modeling contribution: borrower and landlord heterogeneity.
  - Model as het. ownership benefits/costs \((h = \text{housing services}, H = \text{owned housing})\):
    \[
    V_{i,t}^B = \log(c_{i,t}^B) + \xi_B \log(h_{i,t}^B) + \omega_{i,t}^B H_{i,t}^B,
    \quad \omega_i^B \sim \Gamma^B
    \]
    \[
    V_{i,t}^L = c_{i,t}^L + \omega_{i,t}^L H_{i,t}^L,
    \quad \omega_i^L \sim \Gamma^L
    \]
  - \(\omega_i^B\) stands in for life cycle, preferences, ability to come up with down payment, etc.
  - \(\omega_i^L\) stands in for suitability of renting (urban multifamily vs. rural detached).
Model Solution

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

\[
p_t^{\text{Demand}} = \left(1 - C_t\right)^{-1} E_t \left\{ \Lambda_{t+1}^B \left[ \bar{\omega}_t^B + \text{rent}_t + (1 - \delta - (1 - \rho_{t+1})C_{t+1})p_{t+1} \right] \right\}
\]

\[
p_t^{\text{Supply}} = E_t \left\{ \Lambda_{t+1}^L \left[ \bar{\omega}_t^L + \text{rent}_t + \left(1 - \delta\right)p_{t+1} \right] \right\}
\]

- 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

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

- Key parameter is dispersion of \(\Gamma^L\omega\) distribution (more dispersed \(\Rightarrow\) more inelastic supply).
Calibration: Supply Elasticity

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

![Graphs showing IRF to Mortgage Spread for Log Price-Rent, Log Homeown. Rate, and Loan-to-Income over Quarters 0 to 20.](graph.png)
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.