House Prices, Local Demand, and Retail Prices

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Introduction

- How do markups and prices respond to demand shocks?
  - Important for business cycle modeling.
  - Large empirical literature uses aggregate time-series data:
    - Hard to identify demand shock and measure marginal cost.
    - Little consensus on markup cyclicity.

• Our approach:
  1. Link disaggregated data on house prices, retail prices, and shopping behavior to:
  2. Identify causal response of local retail prices to house-price-induced local demand shocks.
  3. Show that price response driven by $\Delta$ markups, not $\Delta$ marginal cost.
  4. Why? Show homeowners become less price sensitive when house prices rise, and firms respond by raising markups.
  5. Countercyclical shopping effort $\Rightarrow$ important component of markups is pro-cyclical
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  1. Identify causal response of local retail prices to house-price-induced local demand shocks.
  2. Show that price response driven by $\Delta$ markups, not $\Delta$ marginal cost.
  3. Why? Show homeowners become less price sensitive when house prices rise, and firms respond by raising markups.
  4. Countercyclical shopping effort $\Rightarrow$ important component of markups is pro-cyclical
Why Study House-Price Driven Demand Shocks

- Directly informative for understanding Great Recession
- But patterns we identify more general, since share many characteristics with business cycle patterns
  - Unanticipated and large
  - Medium-Run persistence, business cycle frequencies
  - Shopping responses similar to aggregate business cycle
- Contrasts with existing literature that has studied store strikes, weather events, seasonal holidays
Constructing a Local Price Indices

- **Data description:**
  - Point-of-sale scanner data reported directly by stores to IRI.
  - Weekly data from 2001-2011 for 7,200 retail stores in 2,400 zip codes.
  - UPC-level price information for products in 31 categories (e.g., frozen dinners, carbonated beverages, toothpaste).

- **Price Index Construction:**
  - Annually chained retail price indices for MSAs and zip codes.
  - Approximate BLS-CPI construction.
IRI Data Compared to CPI

- Nationally-aggregated IRI index tracks CPI Food-at-Home.
  - Not exact since different regional and product coverage.
Section 1

Effects of House Prices on Retail Prices
Empirical Results - Correlation

- Merge local retail price indices with local house price indices.
- Strong positive relationship between local retail prices and house prices.

(a) Time Period: 2001-2006

(b) Time Period: 2007-2011
Empirical Results - Causality

- Simultaneity concern: Common unobserved shock might raise both house prices and retail prices.
- Causal evidence using two complementary identification strategies:
  - Instrumental variables
  - Exploiting differences in house price effects for homeowners and renters
- Hard to rationalize alternative stories for both.
Identification Strategy 1 - Instrumental Variables

- Instrument for house price changes using well-studied measures of local housing supply elasticity:
  - Local geography-based supply elasticity (Saiz)
  - Wharton Regulation Index (Gyourko et al.)
- **Logic:** Same national housing demand shock translates into larger price increases where supply increases less elastically.
  - Strong predictors of house price changes in both boom and bust.
  - Exclusion restriction: Housing supply elasticity only affects retail price changes through house price channel.
    - Inherently untestable
    - Uncorrelated with many economic fundamentals such as income growth.
    - Correlated with some observables that we can and do control for.
    - In paper, we directly address other channels (e.g., entry)
Identification Strategy 1 - Instrumental Variables (MSA)

Second Stage: \( \Delta \log R_{P_i} = \alpha + \beta \Delta \log H_{P_i} + \epsilon_i \)

First Stage: \( \Delta \log H_{P_i} = \xi + \psi \text{SupplyElasticity}_i + \epsilon_i \)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Second Stage – Dependent Variable: ( \Delta \log R_{P_i} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-2006 Saiz IV</td>
<td>0.129*** (0.042)</td>
</tr>
<tr>
<td>2007-2011 Saiz IV</td>
<td>0.124*** (0.042)</td>
</tr>
<tr>
<td>2001-2006 Wharton IV</td>
<td>0.224*** (0.048)</td>
</tr>
<tr>
<td>2007-2011 Wharton IV</td>
<td>0.147*** (0.048)</td>
</tr>
<tr>
<td>Num Obs</td>
<td>112 112 112 112</td>
</tr>
</tbody>
</table>
Identification Strategy 2: Renters vs. Owners

- Renters and homeowners: Different net asset positions in housing
  - House price increase asset value + implicit rent for home owners (Sinai and Souleles, 2005), no asset value increase for renters, who still face higher rents.

- Various channels can lead housing wealth to generate real wealth effects for homeowners, none of which apply to renters.
  - Relaxed borrowing constraints
  - Can move to realize capital gain
  - Target bequests or behavioral stories

- Rising house prices increase relative wealth for homeowners, so should see strong interaction between house prices, retail prices and owner occupancy rates
Identification Strategy 2: Renters vs. Owners

- Looking at owner occupancy interaction requires moving to zip code level analysis to have power.
  - Zip code level owner occupancy rates from 9%-98%, SD of 16%
  - Much smaller variation across MSAs
- Only show zip code results for additional identification evidence, not primary elasticity estimate
- Zip code results probably biased down relative to MSA benchmark:
  - Zip code data noiser, not all shopping in zip codes, no zip code IV
# Identification Strategy 2: Renters vs. Owners

$$\Delta \log RP_i = \alpha + \beta_1 \Delta \log HP_i + \beta_2 \Delta \log HP_i \times \text{Occ}_i + \beta_3 \text{Occ}_i + \epsilon_i$$

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>log $HP$</td>
<td>0.046*** (0.009)</td>
<td>-0.049 (.032)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.026*** (0.009)</td>
</tr>
<tr>
<td>log $HP \times OwnOcc$</td>
<td>0.144*** (0.048)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.090** (0.046)</td>
</tr>
<tr>
<td>OwnOcc</td>
<td>-0.063** (0.027)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.026 (0.019)</td>
</tr>
<tr>
<td>Labor Market Controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>708</td>
<td>708</td>
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<tr>
<td></td>
<td></td>
<td>846</td>
</tr>
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<td></td>
<td></td>
<td>846</td>
</tr>
</tbody>
</table>
Identification Strategy 2: Renters vs. Owners

- Is zip code homeownership rate just picking up other demographics?
  - Could correlate with age, which might affect responsiveness to housing wealth shocks.
  - Could correlate with population density, which affects share bought in zip code (and therefore measured response).
- Include interaction of house price change with (i) age and (ii) population density; does not affect estimated homeownership interaction.
Section 2

Why do retail prices rise?
Empirical Results - Markups or Marginal Costs?

- Price increase: Higher markup or higher marginal cost?
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- Price increase: Higher markup or higher marginal cost?
  - Items in our data not produced locally.
    - COGS 75% of total cost, nearly all of marginal cost.
      → Local component in marginal cost small.
    - Robust to excluding goods with high local value (e.g., milk).
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    - COGS 75% of total cost, nearly all of marginal cost.
      - Local component in marginal cost small.
    - Robust to excluding goods with high local value (e.g., milk).
  - Controlling for wages and labor market conditions doesn’t change result.
  - Results not driven by changes in firms’ rent overhead.
    - Elasticity of retail rent wrt. house prices over period only 10%.
    - Control for $\Delta$ retail rent.
    - Results persist after excluding high-rent cities (e.g., New York).
    - Rent pass-through could not explain HO interaction.
Directly measuring costs and markups

- IRI data only has prices, but obtain data from "large-retailer" used in Jaimovich, Eichenbaum and Rebelo (2012)
  - Internal measure of marginal cost ("shadow replacement cost") inclusive of wholesale cost, shipping, and various vendor rebates
  - Relevant measure for their price-setting
  - Construct price, marginal cost and markup index just like in IRI

- Disadvantages relative to IRI:
  - Single chain with only 240 stores (IRI has 7,200), so learning about specific retailer rather than broad local prices
  - 2004q1-2007q2
  - 192 zip codes but only 39 MSAs and most of these only have 1 store, data concentrated in CA, TX, NJ
  - MSA analysis infeasible, focus on zip-HO interaction
Observable markup results

\[ \Delta \log \text{Outcome}_i = \alpha + \beta_1 \Delta \log \text{HP}_i + \beta_2 \Delta \log \text{HP}_i \times \text{Occ}_i + \beta_3 \text{Occ}_i + \varepsilon_i \]

<table>
<thead>
<tr>
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<th>2004q1-2007q2</th>
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<tbody>
<tr>
<td></td>
<td>( \Delta RP )</td>
<td>( \Delta \text{Markup} )</td>
<td>( \Delta \text{Cost} )</td>
</tr>
<tr>
<td>( \Delta \log \text{HP} )</td>
<td>-0.093</td>
<td>-0.132*</td>
<td>0.041</td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td>(.077)</td>
<td>(0.080)</td>
</tr>
<tr>
<td>( \Delta \log \text{HP} \times \text{OwnOcc} )</td>
<td>0.146**</td>
<td>0.172***</td>
<td>-0.026</td>
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<tr>
<td></td>
<td>(0.072)</td>
<td>(0.065)</td>
<td>(0.067)</td>
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<tr>
<td>( \text{OwnOcc} )</td>
<td>-0.038</td>
<td>-0.041</td>
<td>0.003</td>
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<tr>
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<td>(0.019)</td>
<td>(0.018)</td>
<td>(0.020)</td>
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<tr>
<td>Demographic/Density Controls</td>
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<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>192</td>
<td>192</td>
<td>192</td>
</tr>
</tbody>
</table>

→ If not marginal cost pass-through, has to be higher markups.
Section 3

Household-Level Evidence
Empirical Results - Shopping and Demand Elasticity

- Why raise markups?
  - Higher house prices make homeowners less price sensitive.
  - Many optimal price-setting models then imply larger markups.

- Evidence? Use household shopping data to measure price sensitivity.
  - 125k households in over 20k zip codes.
  - Households record expenditures and prices on shopping trips.
  - Record which goods purchased on sale, with coupon or generic.
Effect on Broad Expenditures

\[ \log E_{i,t} = \beta \log HP_{i,t} + \alpha \log HP_{i,t} \times Own_{i,t} + \gamma_i + \delta_t + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>log Exp</th>
<th>log Exp</th>
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<tbody>
<tr>
<td>log HP</td>
<td>-0.018</td>
<td>-0.021</td>
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<tr>
<td></td>
<td>(0.014)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>log HP \times Own</td>
<td>0.050***</td>
<td>0.052***</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.014)</td>
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</tbody>
</table>

Time Fixed Effect: YES
Household Fixed Effect: YES
Labor Market Controls: NO
Number of Observations: 830,142

- Suggests that \( \uparrow \) HP generates a demand shock.
Empirical Results - Shopping and Demand Elasticity

\[ \log \text{ExpShare}_{i,t} = \beta \log \text{HP}_{i,t} + \alpha \log \text{HP}_{i,t} \times \text{Own}_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t} \]

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>$\text{Frac}_{\text{deal}}$</th>
<th>$\text{Frac}_{\text{coupon}}$</th>
<th>$\text{Frac}_{\text{generic}}$</th>
</tr>
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<tbody>
<tr>
<td>$\log \text{HP}$</td>
<td>0.021***</td>
<td>0.007***</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>$\log \text{HP} \times \text{Own}$</td>
<td>-0.022***</td>
<td>-0.014***</td>
<td>-0.008**</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.002)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Time Fixed Effect</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Household Fixed Effect</td>
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<tr>
<td>Labor Market Controls</td>
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<tr>
<td>Mean Dependent Variable</td>
<td>0.298</td>
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<td>Number of Observations</td>
<td>802,200</td>
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<td>802,200</td>
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</table>
Section 4

Summary and Implications
Summary of Empirical Evidence

• Strong positive relationship between HP and RP
  - Both in OLS and various different IVs
  - Not driven by observable costs or commercial rents
  - Suggests that house price increases cause increases in retail markups

• Different relationship between HP and RP for high and low owner-occupancy zip codes
  - Naturally explained if capturing wealth effect
  - Hard to think of unobserved confounding shock that would match this evidence

• Shopping behavior changes in a way consistent with wealth effects
  - Again, strong interaction with home ownership
Implications for Inflation Magnitudes

- Our pricing elasticities imply 4.4 - 8.4% increase in retail prices from aggregate house price boom (2001-2007).
  - Food-at-home CPI increase was 13.2%, broad CPI increased 14.5%.
  - Other factors also affect aggregate inflation (trade, oil prices).
- Our elasticities explain half the cross-MSA heterogeneity in retail price changes.
  - Differential housing boom-bust was one of largest regional factors during sample period.
Implications for Business Cycle Modeling

- Demand shocks provide pro-cyclical force on firms’ **desired** markups.
  - Works against sticky-price counter-cyclical markup.
  - Total markup sum of both effects: complicates learning about NK channel from cyclicality of total markup.

- Business Cycle Modeling:
  - Simple NK models, assume constant desired markups: not supported
  - Quantitative models (e.g., Smets-Wouters) add *exogenous* shocks to desired markups: can be rationalized by our evidence
  - But our evidence implies desired markups *endogenously* respond to policy (Lucas critique).
Implications for Urban and Real Estate Economics

• Geographic Variation Literature:
  • Growing literature exploits geographical variation to study macro questions: should be cautious of "PEQ" style conclusions
    • Aggregating nominal consumption responses from local level might overstate aggregate real effect

• Regional Insurance:
  • Price movements can potentially help insure against local shocks: retail prices fall in regions that experience negative wealth shocks.
    • Amplifies conclusions in Notowidigdo (2013).

• Spatial sorting:
  • In Roback style models, workers sort across locations to equalize costs and benefits ... response of retail prices to house prices can be an important force