

Asset Prices and Retail Prices

Johannes Stroebel¹ Joseph Vavra²

¹NYU

²University of Chicago

October 9, 2013

- What's the relationship between local house prices, retail prices and consumer shopping behavior?
- What can this tell us about macro questions and potentially monetary policy?

What Do We Do

- Link geographically disaggregated retail price-setting and shopping behavior to geographically disaggregated house price data
- With this geographic variation identify effects of house prices that are difficult to get at through aggregate data
- We find a strong positive relationship between local house prices and local retail prices
 - We think this is interesting on its own as it suggests there may be a relationship between asset prices and inflation
 - But I'll present additional evidence that I think allows a more specific and interesting interpretation

Interpretation of Positive Relationship Between House Price and Retail Price

- By definition, when house prices rise, retail prices could rise because of increase in marginal costs or increase in markups
- We are going to provide evidence of markup channel
 - More specifically we'll argue that increases in retail prices have wealth effects that seem to lead firms to increase markups
- Why do we interpret things in this way?
 - Controlling for wages and labor market conditions doesn't change result
 - Main reason: Extremely strong interactions with owner occupancy rates
 - Show evidence that shopping behavior changes in ways that seem like wealth effects
 - Preliminary: Instrument for house price changes and still find relationship

What kind of models might we care about?

- Most monetary models use CES structure with constant desired markups
 - Is this realistic if wealth changes across time?
 - We think our evidence suggests probably not
- Welfare costs of housing shocks/insurance?
 - Housing bust is big decline in wealth
 - But if markups decline may be offsetting increase in welfare (to extent firm owners not local)

Looking for Feedback

- Is this interesting?
- Do these interpretations make sense and what would make this more convincing?
- What recent papers have picked up as effects of unemployment are dampened once you control for house prices
 - Suggests that wealth effects on consumer and retailer behavior might be more important than time or labor market effects
- Definitely wide open to looking at other things with the data
 - Other research questions, where to go from here...?
 - Do our current econometric specifications make sense or should we run different specifications?

- Description of retailer data
- Description of household data
- Description of house price data
- Preliminary Results

Retail Price-Setting Data

- Scanner data sets produced by SymphonyIRI and AC Nielsen
- Structure of data sets are similar but for today only have results for SymphonyIRI
- Longer term, will probably move towards AC Nielsen because it has some advantages, but it's harder to work with...

- Point-of-sale scanner data reported directly by stores to IRI
- Weekly data from 2001-2011
- Weekly revenues, weekly quantities for individual UPCs
- Store identifiers anonymized but include zip code
- Moderately reliable flag for store promotions and some various other info we haven't used

Data Coverage

- Data is collected for a sample of grocery store and drug stores
- 31 product categories:
 - Beer, blades, carb bev, cigarettes, coffee, cold cereal, deodorant, diapers, facial tissue, frozen dinners, frozen pizza, household cleaners, hot dogs, laundry detergent, butter, mayo, milk, mustard/ketchup, paper towels, peanut butter, photos, razors, salty snacks, shampoo, soup, spaghetti sauce, sugar substitutes, toilet tissue, tooth brushes, toothpaste, yogurt
 - Very roughly matching up with CEX categories, covers something like 15% of consumption
- 41 states including 499 counties, 2442 zip codes and 7203 stores

Big Data Set

- Approximately 2.5 billion price observations
- Approximately 130 GB
- So just basic work with the data is non-trivial and requires breaking into various category subsamples

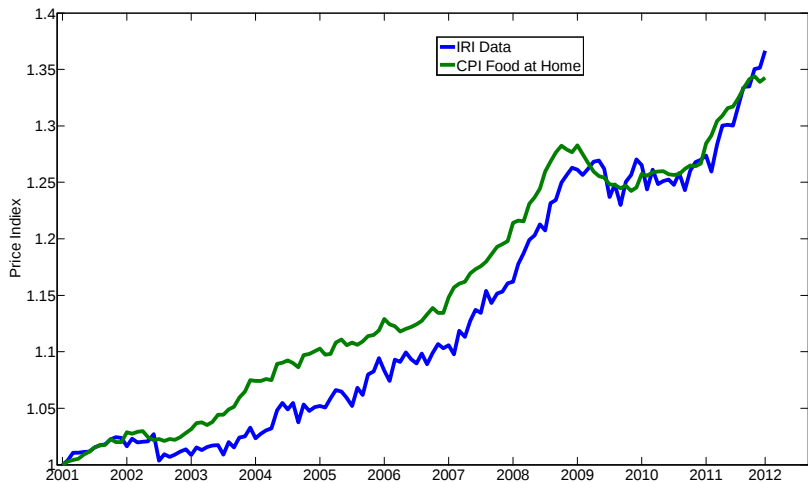
Data Example

IRI_KEY	WEEK	SY	GE	VEND	ITEM	UNITS	DOLLARS	F	D	PR
681530	1373	0	1	28400	4874	2	1.98	NONE	0	0
681530	1373	0	1	28400	4853	7	6.93	NONE	0	0
681530	1373	0	1	28400	4361	20	40.00	A	0	1
681530	1373	0	1	28400	4852	1	0.99	NONE	0	0
681530	1373	0	1	28400	4363	5	10.00	A	0	1
681530	1373	0	1	28400	4854	3	2.97	NONE	0	0
681530	1373	0	1	28400	4855	1	0.99	NONE	0	0
681530	1373	0	1	28400	4365	8	16.00	A	0	1

Constructing a Local Price Index

- Let $\Delta p_{i,j,t}$ be the log price change of an item i at a particular store in zip code j across months (or quarters)
- Let $\omega_{i,t}$ be the share of item i in zip code j 's annual expenditure
- Compute $\Delta P_{j,t} = \sum \omega_{i,t} \Delta p_{i,j,t}$ and then convert region specific inflation rate to region specific price level

Comparison to CPI:



- Nielsen has two data sets, retail scanner data and homescan data
- The retail scanner data set is exactly the same kind of data as the IRI but has some major advantages and a few disadvantages
- We haven't used the Nielsen retail scanner data so I'll just briefly describe
- Main advantage: better coverage. Much bigger set of stores covering big box stores, etc.
 - Closer to all retail consumption excluding services
- Disadvantages:
 - Shorter (2006-2010)
 - Huge size: Approximately 5 TB

- Household panel from 2004-2010
- Households record expenditures on shopping trips
- Matched to covered stores
- Hand enter prices for others

- 362,180 households
- 49 states including 2,915 counties and 20,009 zip codes
- 373,166,752 upc-transaction records on 3,183,669 unique upcs
- Transactions recorded daily

Coverage Continued

- 1,415 retailers covering:
 - Grocery,Bodega,Swapmeet Flea Market,Fish Market,Cheese Stores,Pizzeria,Home Furnishings,Apparel Stores,Craft Stores,Wireless Service Stores,Garden Stores,Online Shopping,TV/Home Shopping,Drug Store,Coffee Store/Gourmet Coffee Sh,Athletic Footwear,Sporting Goods,Shoe Store,Pro Shop,Butcher,Restaurant,Fruit Stand,Bakery,Dollar Store,Convenience Store,Gas Mini Mart,Close Out Store,Catalog Showroom,Music/CD Store,Office Supplies Store,Video Store,Free Sample/Gift,Health Food Store,Party Supply Store,Candy Store,Discount Store,Hardware/Home Improvement,Automotive Store,Quick Serve Restaurants,Kennel/Vet,Dairy Store,Tobacco Store,Manufacturer Outlet,Military Store,Electronics Store,Optical Store,Computer Store,Toy Store,Service Station,Beverage Store,Coop/Farm/Feed,Hypermarket,Beauty Supply Store,Barber/Salon,Vending Machine,Home Delivery,Home Inventory,Department Store,Warehouse Club,Mail Order,Pet Store,News/Book Store,Delicatessen,Liquor Store,Camera Shop,Stationery Store, All Other Stores

Data Example

upc	71988113241
product_module_code	7885
product_group_code	4505
department_code	7
brand_code_uc	595630
quantity	1
total_price_paid	34.98
coupon_value	0
deal_flag_uc	0
household_code	8112087
retailer_code	9002
panel_year	2006
purchase_date	6/30/2006
projection_factor	292
household_income	26
type_of_residence	1
male_head_age	8
male_head_occupation	2
race	2
panelist_zip_code	77040
fips_county_code	201
organic	0
channel_type	Department Store

- Deed level transactions data
 - 31,586,696 transactions in 10,302 zip codes, 1,085 counties and 34 states
- Corelogic house price indices
 - Zip-code, county, and state house price indices available monthly, constructed from deeds level data
- Long-term we may work with the deeds data since it's more transparent but I'll just show results for corelogic for now

- BLS county level unemployment data and average weekly wages
- Zip Code level Owner Occupancy Rates:
 - American Community Survey Data.
 - 5-year Averages ending in 2011

Putting Everything Together

- Price level data from IRI (or Nielsen RMS)
- Expenditure and purchases data from Nielsen HMS
- House price data from Corelogic (or Deeds data)
- Local labor market from BLS
- Owner occupancy data from ACS

Section 1

Effects of House Prices on Retail Prices

Empirical Specification

- How do relative increases in house prices affect relative retail prices, expenditures, shopping behavior?
- $\log P_{i,t} = \beta_1 \log HP_{i,t} + \beta_2 \log U_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t}$
- Results I'll show use Driscoll-Kraay standard errors to correct for spatial and temporally correlated errors
- Have redone things with various versions of clustered standard errors and they produce similar results

Baseline Results (Zip Code quarter)

Effect on Log Price Level	(1)	(2)	(3)	(4)
Log House Price (2-std dev effect)	.0188 (.0024)	.0117 (.0032)	.0178 (0.0023)	.0089 (.0037)
Unemp Rate (2-std dev effect)			-.0093 (.0016)	-.0086 (.0042)
Zip Code Fixed Effect	NO	YES	NO	YES
Time Fixed Effect	YES	YES	YES	YES
Number of Observations	48649	48649	48640	48640

- Long difference specification:

$$\Delta \log P_{2011q4-2001q1,i} \\ = \alpha + \beta_1 \log HP_{2011q4-2001q1,i} + \beta_2 \log U_{2011q4-2001q1,i} + \varepsilon_i$$

$\Delta \log P$	(1)	(2)
$\Delta \text{Log House Price (2-std dev effect)}$	.031 (.012)	.029 (.012)
$\Delta \text{Unemp Rate (2-std dev effect)}$		-.014 (.012)
Zip Code Fixed Effect	NO	NO
Time Fixed Effect	NO	NO
Number of Observations	673	673

Robustness

Effect on Log Price Level	(Mth-ZIP)	(Qt-CT)	(Mth-CT)	(Qt-ST)	(Mth-ST)
Log HP (2-std effect)	.011 (.004)	.021 (.005)	.026 (.004)	.015 (.005)	.027 (.004)
Unemp Rate (2-std effect)	-.008 (.0036)	.002 (.003)	-.001 (.004)	.004 (.008)	.0002 (.006)
Zip Code Fixed Effect	YES	YES	YES	YES	YES
Time Fixed Effect	YES	YES	YES	YES	YES
Number of Observations	149644	13454	40953	1762	5370

Interpreting the Magnitude of these effects

- Elasticity of retail prices with respect to house prices is $.015 \sim .04$
- Is this big?
- Moving from the 10th percentile of house prices to the 90th percentile associated with 2-6% increase in price level
- For comparison the 90-10 difference in log nominal wages is .65, so price level effects induced by house price movements $\sim 1/10$ of the dispersion of wages
- If we assume constant marginal cost, CES within a region and 15% average markup, then moving from 10th percentile to 90th percentile of house prices reduces elasticity of substitution from 9.3 to 6.5

Section 1

More Interpretable Evidence of Wealth Effects

More Direct Evidence of Wealth Effects

- Unclear what moves house prices, and assuming constant marginal cost is a strong assumption, so want to look for more direct evidence of wealth effects
 - Although worth noting that basically none of these goods are produced locally

Controlling for Observable Costs

- We can rerun results with local wage data:

Effect on Log Price Level	(1)	(2)
Log House Price (2-std dev effect)	.0074 (.0037)	.018 (.0026)
Log Wage (2-std dev effect)	-.0042 (.0022)	-.000025 (.0007)
Unemp Rate (2-std dev effect)	-.0057 (.0024)	-.0045 (.0009)
Zip Code Fixed Effect	YES	NO
Time Fixed Effect	YES	YES
Number of Observations	48649	48649

Exploiting Occupancy Data

- We now want to look at interaction between owner occupancy rates and retail-house price relationship
- We view this as our key specification for two reasons:
 - 1) House price increases only increase wealth if you own
 - If you rent, if house prices go into rent prices then negative wealth effect
 - 2) It helps us sort out cost from markup channels
 - What if house prices perfectly correlated with costs?
 - Positive relationship between house prices and retail prices may have nothing to do with markups
 - But no reason to think changes in cost should interact with owner occupancy rates
 - If firm costs rise, shouldn't matter whether people own or rent in region

Occupancy Results (Zip Code quarter)

Effect on Log Price Level	HO<35%	35%-60%	60%-80%	>80%
Log House Price (2-std dev effect)	-.030 (.0069)	.0034 (.0040)	.0079 (0.004)	.0222 (.0037)
Zip Code Fixed Effect	YES	YES	YES	YES
Time Fixed Effect	YES	YES	YES	YES
Unemployment Controls	YES	YES	YES	YES
Number of Observations	1992	13950	24089	8609

Interaction specification

$$\bullet \log P_{i,t} = \beta \log HP_{i,t} + \alpha \log HP_{i,t} \times OCC_i + \gamma_i + \delta_t$$

Effect on Log Price Level	(1)	(2)	(3)	(4)
Log House Price (2-std dev effect)	-.018 (.006)	-.0129 (.008)	.0129 (.0025)	.0142 (.0025)
Log HP X OCC (2-std effect)	.113 (.028)	.110 (.031)	.009 (.0013)	.010 (.001)
Zip Code Fixed Effect	YES	YES	NO	NO
Time Fixed Effect	YES	YES	YES	YES
Unemployment Controls	YES	NO	YES	NO
Number of Observations	48640	48649	48640	48649

Interaction Effects are Large:

- Moving from 10th percentile of house prices to 90th percentile of house prices if owner occupancy rate is 50% lowers retail prices by .0027
- The same change in house prices increases retail prices by 6% if owner occupancy rate is 95%
 - (Owner occupancy rates in the data range from 5% to 99% across zip codes)
- Can redo things at higher aggregations and find similar results, although variation in occupancy rates falls

What Drives House Price Movements?

- For interaction specification, I'm not sure if we care
- Anything not working through the occupancy rate channel should be picked up by direct effect
- Haven't thought of any reason that occupancy rates should interact with house price movements besides things that look like wealth effects
- But probably can come up with some reason, so:
- Can also try to look for exogenous movements in house prices so don't have to worry about omitted variables affecting both house prices and retail prices

Instrumenting for House Price Changes

- Use standard instruments for house prices
 - Saiz instruments, housing bubbles not related to fundamentals, other changes in housing laws/regulations not related to macro conditions
- For now Saiz housing elasticity measure
 - House prices ran up more in boom and fell more in bust in areas with less elastic housing supply
 - Should induce exogenous movements in house prices
 - Elasticity doesn't change with time, so concentrate on long-difference specification

- Same basic results in terms of point estimates
- Significance all over the place across specifications
- Work in progress... not completely clear what this instrument captures or if it's what we want
- Also I think other papers have argued against this particular instrument
- Also, the benchmark specification really needs interactions with owner occupancy rates to fully make sense, but Saiz instrument only available at high aggregation units and owner occupancy variation only observed at narrow aggregation... what to do?

Section 1

Wealth Effects and Shopping Behavior (Homescan)

How Do House Prices Affect Expenditures?

Effect	Expenditures HH	Expenditures HH
Log HP (2-std effect)	.0100 (.00035)	.0117 (.0028)
Zip Code Fixed Effect	YES	YES
Time Fixed Effect	YES	YES
Unemployment controls	YES	NO
HH Fixed effects	YES	YES
Number of Observations	907931	907931

Interactions with Owner Occupancy Rates

Effect	Expenditures HH	Expenditures HH
Log HP (2-std effect)	-.0190 (.0112)	-.0174 (.0113)
Log HP X Occ (2-std effect)	.119 (.0452)	.119 (.0448)
Zip Code Fixed Effect	YES	YES
Time Fixed Effect	YES	YES
Unemployment controls	YES	NO
HH Fixed effects	YES	YES
Number of Observations	907931	908052

Effects on Shopping Behavior

Effect	Deal	Coupon	Generic
Mean Dep Variable	.287	.0785	.178
Log HP (2-std effect)	-.0021 (.0025)	-.0016 (.0026)	-.0038 (.0013)
Zip Code Fixed Effect	YES	YES	YES
Time Fixed Effect	YES	YES	YES
Household fixed effect	YES	YES	YES
U controls	YES	YES	YES
Number of Observations	907931	907931	907931

Interactions with Owner Occupancy Rates

Effect	Deal	Coupon	Generic
Mean Dep Variable	.287	.0785	.178
Log HP (2-std effect)	.0065 (.0037)	.0012 (.00092)	.00085 (.0017)
Log HP X Occ (2-std effect)	-.0354 (.0092)	-.0116 (.0043)	-.0189 (.0044)
Zip Code Fixed Effect	YES	YES	YES
Time Fixed Effect	YES	YES	YES
Household fixed effect	YES	YES	YES
U controls	YES	YES	YES
Number of Observations	907931	907931	907931

Empirical Conclusions

- House price increases associated with higher retail prices, larger expenditures and changes in shopping behavior
- Independent of local labor market effects
- Much stronger effects when interacted with owner occupancy rates
 - Wealth effects of house price changes only present for owners
- Semi-supported by instrument approach but need to think through more

Section 4

Some other random observations

Allowing for store and product switching

- All the price results I showed are for fixed baskets within a year. Yuriy has argued that most action is on store-switching margin.
- We've redone things allowing for store switching, don't find big effects
- Should redo it allowing for product switching within a store

Asymmetric Responses

- We find most of our identification comes off of the run up rather than the decline in house prices

Reassessing Costs of House Price Declines?

- In benchmark specification, a two standard deviation decline in house prices leads to 1% decline in *nominal* expenditures
 - Mian, Rao and Sufi (forthcoming) find large declines in nominal expenditures for highly leveraged regions with large price declines
 - But they don't have local price deflators
 - Our results suggest a price effect that works in the opposite direction
 - Probably not strong enough to undo their results but hard to say since different data
- Don't particularly feel like pushing this since not particularly constructive

Where to go from here?

- Models?
 - Is this interesting enough on its own?
 - What kind of models would this speak most to?
- Can we use this kind of evidence to answer any existing questions or inform other debates?
- Different questions using data?