Homeowner Balance Sheets and Monetary Policy [1]

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[1] This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.

Overview

- Motivating questions:
  - How does consumption respond to house price gains?
  - Does this arise due to wealth effects or collateral effects?
  - How does this affect how monetary shocks are transmitted to the real economy?

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- Approach:
  - National monetary shocks shift local housing demand
  - Cities differ in housing supply elasticity$\rightarrow$Differ in house price response
  - Compare consumption response across elastic/inelastic cities

Preview of Results

- 100 basis point shock to Federal Funds causes 1-2.5% decline in real house prices
  - Peaks over period of 8-12 qtrs.
  - Largest response in land-constrained, regulated areas
- Avg. Non-housing consumption rises $6 - 9¢$ for every \$1 increase in local house prices
  - Positive effect for owners only, no effect for renters
  - Primarily driven by heavy debt users (High Debt Service Ratio and Equity Extractors)
    - Evidence for collateral channel rather than wealth effect
- Implies 100 basis point shock to federal funds causes 1.5-3.75% change in real spending for owners through "homeowner balance sheets"
  - Effect varies by region & ownership status

Why Housing?

- Housing & Household Balance Sheets:
  - Approx. 50% of household balance sheet wealth (higher for younger households)
  - Collateralizable - Mortgages, Home Equity Loans/HELOCs, etc
  - Collateral determines borrowing cost and hence consumption
- Link between Housing & Consumption:
  - Wealth Effect - Increase in lifetime wealth (but also in cost of living).
  - Collateral Effect - Increase in collateral and borrowing capacity.

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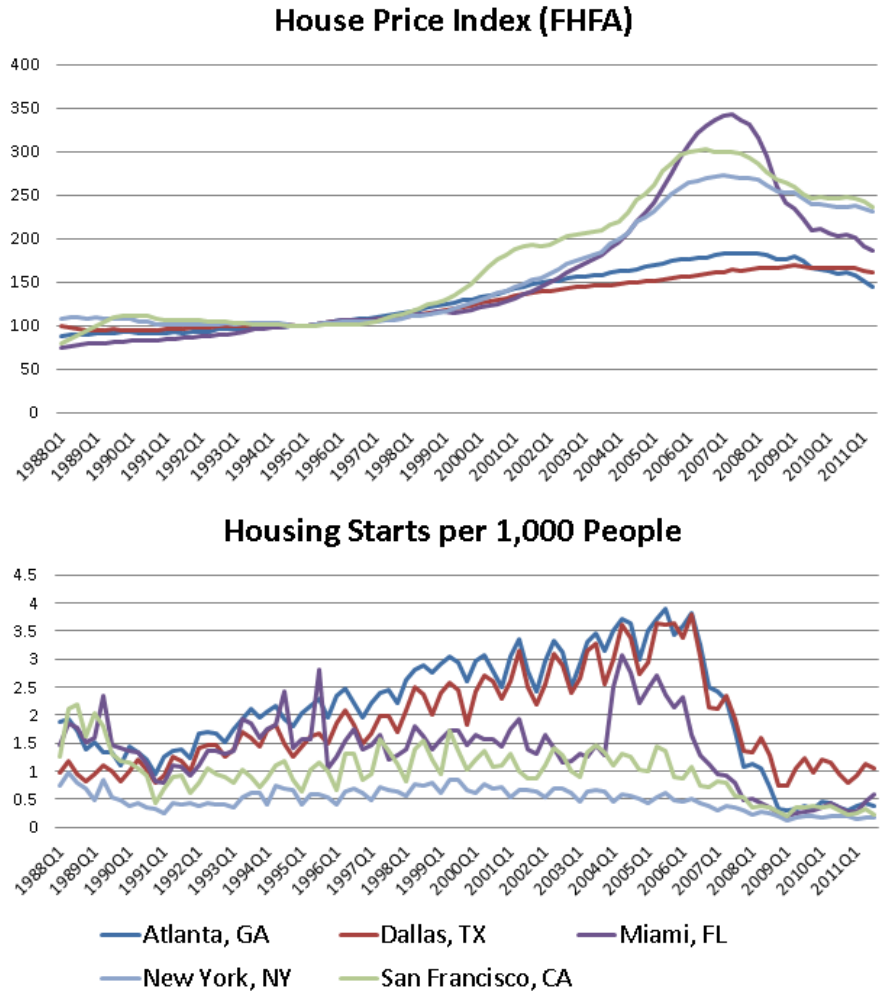
- Regional Heterogeneity:
  - House = Structure + ***Land*** $\rightarrow$not reproducible & limited supply
  - Land availability & regulation $\rightarrow$ supply elasticity
  - Heterogeneity in price & construction responses

Heterogeneity in House Prices

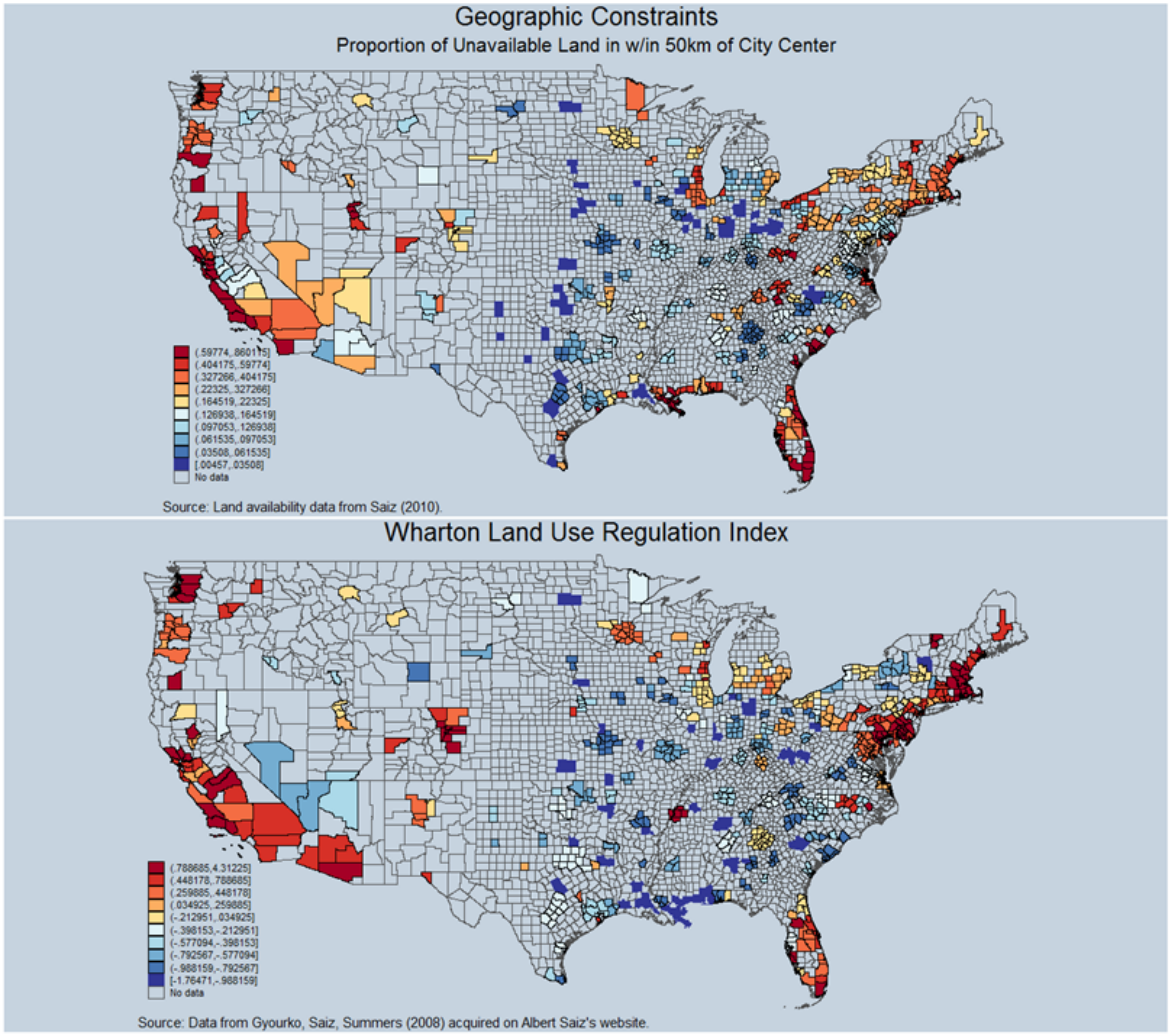


Source: FHFA House Price Index (Seasonally Adjusted, 1995q1=100); Privately-owned Single-unit Housing Starts (FRED, Federal Reserve Bank of St. Louis)

Geography & Regulation Measures

- Land Availability Measure (Saiz, 2010) - % "buildable land" in 50km radius of MSA's city-center Maps
  - "Buildable land" excludes water bodies & steep grades
  - Measure of *long-run* supply of land in a city
  - Fixed radius accounts for differences in MSA size & sprawl
- *Wharton Land Use Regulation Index* (Gyourko, et al, 2008)
  - Survey-based Index of strictness of zoning laws in MSA's
  - Measures time and financial cost of acquiring permits & beginning construction
- Total of 269 MSA's (over 816 counties) represented
  - Roughly 80% of population & 20% of land area

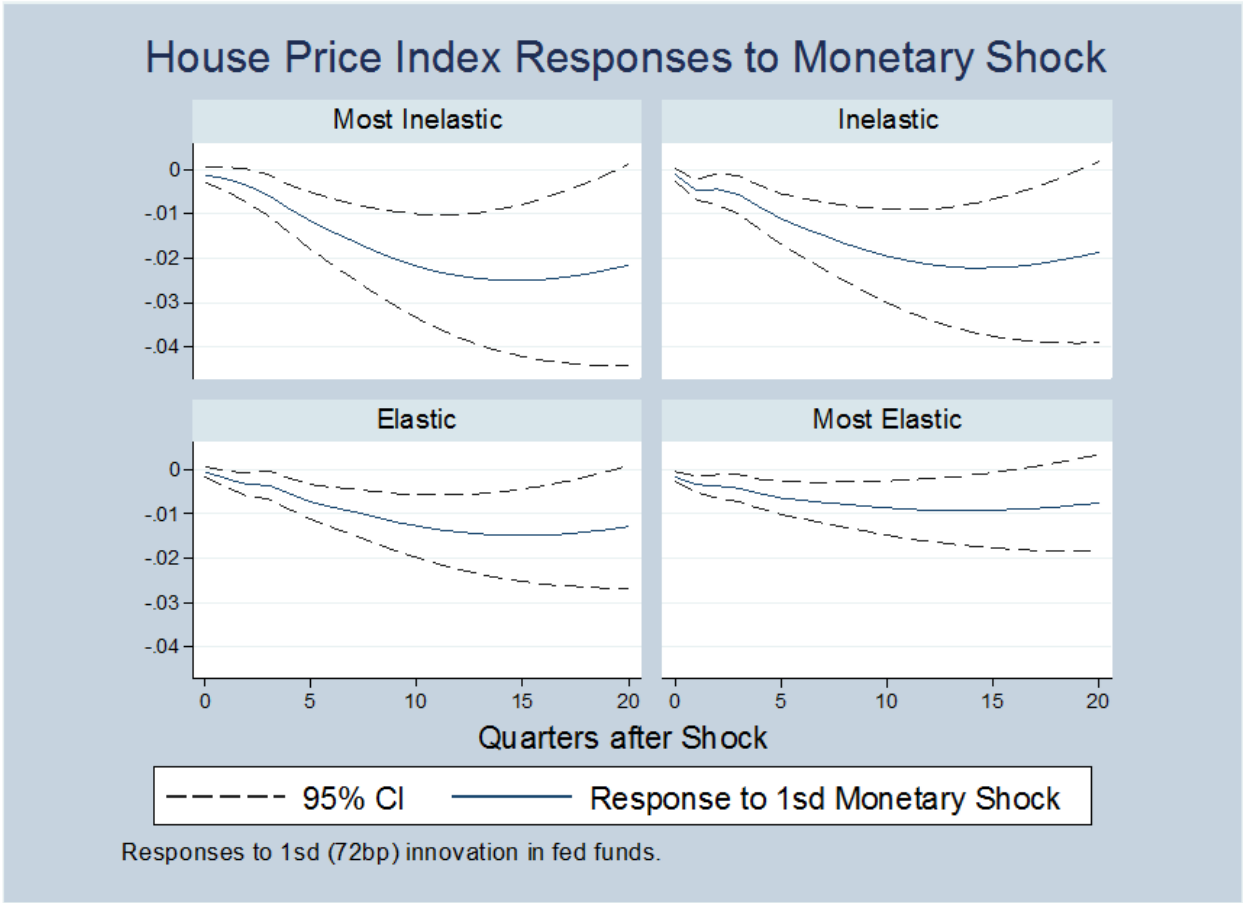
Geography & Regulation Measures



Heterogeneous Effects on House Prices (1)

- Does monetary policy affect house prices? Does the response vary by local geography/regulation?
- Estimate a Monetary VAR:
  - Including GDP, Inflation, Federal Funds Rate, Mortgage Rate
  - PLUS 4 house price indices for quartiles of elasticity measure
  - Identify Monetary Shocks using recursive ordering:
    - Current GDP & Inflation are ordered prior to Fed Funds
    - Home values are ordered after

Heterogeneous Effects on House Prices (2)



Consumer Expenditure Survey Micro-Data

- Public-Use Micro-data (Interview Survey)
  - Rotating Panel : 5,000-7,500 Households/Quarter interviewed for 4 qtrs
  - Quarterly Survey of 500+ categories comprising most of expenditures
    - Consumption measure aggregates nondurables
  - First & last wave include income/balance sheet questions

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- Sample:
  - 1986q1-2008q4
  - ages 20-80, not in subsidized/school housing
  - dropped inconsistent changes in age/sex, large changes in family size
  - trimmed top/bottom 1% of expenditures growth

CE Summary Stats

Variable	Mean	Median	Std. Dev
Total Qtrly Expenditures	$9,563	$7,213	$8,835
Family After-Tax Income	$43,551	$31,000	$46,820
Home Value (owners)	$194,829	$136,000	$210,521
Age of Head	46.66	45	16.13
Family Size	2.61	2	1.52
% Owning Homes	64.62%		
% w/ Mtg. Reported	24.42%		
% Renting	33.25%		

Data and Sample, cont'd

- Housing Supply Elasticity Data
  - Cross-section of 269 MSA's
    - Land Available = % of land 50km from city-center with no geographic barriers
    - Wharton Zoning Regulation Index
  - Land and Regulations account for most variation in supply elasticity (Saiz, 2010)
- House Price Index (Federal Housing Finance Agency)
  - Quarterly, Repeat-Sales Index of MSA house prices
  - Based on Fannie/Freddie Conforming Loans (no cash purchases, subprimes, jumbos)
    - Robustness checks include Zillow Home Value Index (1996-2008)
- Macro Data: GDP, CPI, Fed Funds, and Mortgage Rates

Roadmap to Estimation Strategy

1. Identify national monetary shocks in a VAR
   - Monetary shocks $\rightarrow$ household consumption/house prices
   - Household/Local variables $\nrightarrow$national aggregates
2. Utilize difference in house price responses to construct instrument
   - Only "inelastic supply" MSA's will have price change
   - Use shock η_t and measure of elasticity z_i to construct instrument
3. Estimate β_1 using instrumental variables

Identifying Monetary Shocks

- Monetary shock η_t identified from Fed Funds equation in a recursive VAR
  - Ordered GDP, Inflation, Fed Funds, 30yr Mortgage Rate, House Price Index
  - Baseline Assumption: Policy rule reacts to only GDP and Inflation within quarter

$$ff_t = a_1 gdp_t + a_2 \pi_t + a_3(L) Y_{t-1} + D_t + \eta_t$$

  - Note: Policy rule excludes local/individual variables

Identifying Effect of House Price on Consumption

- Estimate responses of consumption c_{it} to house prices q_{it} and monetary shock η_t:

$$\begin{aligned} \Delta c_{i,t+1} &= \beta_1 \Delta q_{i,t+1} + \beta_2(L)\eta_t + \beta_3 \Delta x_{i,t+1} + u_{i,t+1} \\ \Delta q_{i,t+1} &= \gamma(L)\eta_t + \gamma_4 \Delta x_{i,t+1} + v_{i,t+1} \end{aligned}$$

- Econometric issue:
  - House Price growth endogenous to unobserved shocks to wealth/productivity
  - OLS estimate of β_1 is biased
- Interact shock with Land Availability & Regulation to use as instrument:
  - Only geographically/regulation-constrained MSA's will have $\Delta q_{it} \neq 0$ after a demand shock
  - Compare response between elastic & inelastic MSA's

Identifying Effect of House Price on Consumption (3)

$$\begin{aligned}\Delta c_{it} &= \beta_1 \Delta q_{it} + \beta_2(L)\eta_t + \beta_3 \Delta X_{it} + u_{it} \\ \Delta q_{it} &= \gamma_1 z_i + (\gamma_2(L) z_i + \gamma_3(L))\,\eta_t + \gamma_4 \Delta X_{it} + v_{it}\end{aligned}$$

- Excluded instruments: $z_i = [geog_i,\ reg_i]$ & interaction $\eta_t z_i$
- Controls:
  - Life-cycle: age polynomial & change in family size
  - Local & household income growth controls potential correlations between z_i and local productivity

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- Controls:
  - Life-cycle: age polynomial & change in family size
  - Local & household income growth controls potential correlations between z_i and local productivity
- Identifying Assumptions:
  - $E[z_i u_{it}] = 0$ & $E[z_i \eta_t u_{it}] = 0$
  - Trend consumption and response to η_t do not vary systematically with z_i

Results

Consumption Growth Regressions

	(1) Owners Only	(2) Renters Only	(3) All Households
House Price Growth	1.503***	-0.00227	0.178
	(0.400)	(0.447)	(0.295)
CU Inc. Growth	0.0235***	0.0174***	0.0239***
	(0.00552)	(0.00609)	(0.00456)
Age	-0.104**	0.0360	0.0163
	(0.0442)	(0.0727)	(0.0425)
Age^2	0.00139***	0.000202	0.000231
	(0.000394)	(0.000699)	(0.000400)
Chg. Family Size	9.932***	6.655***	7.296***
	(0.896)	(0.929)	(0.709)
Observations	24,270	10,345	34,615

All regressions also include qtr. dummies & direct effects of monetary shocks.
Standard errors in parentheses are clustered at MSA-level.
*** p<0.01, ** p<0.05, * p<0.1

Selected Robustness Checks

Consumption Response (Selected Robustness Checks)

	(1) Pre-Bubble (1986-2000)	(2) Zillow House Prices	(3) Asset Returns	(4) Excluding Regulations
House Price Growth	1.201**	0.962***	1.533***	0.950*
	(0.487)	(0.160)	(0.401)	(0.505)
Household Inc. Growth	0.0146***	0.0463***	0.0245***	0.0333***
	(0.00506)	(0.00608)	(0.00555)	(0.00738)
10-yr Treasury Return			0.653***	
			(0.123)	
1-yr SP500 Return			-0.00984	
			(0.0173)	
Observations	16,083	12,864	24,270	38,694

All regressions include age, family changes, qtr. dummies & direct effects of monetary shocks.
Standard errors in parentheses are clustered at MSA-level
*** p<0.01, ** p<0.05, * p<0.1

Why? Collateral vs Wealth

- Owner is both landlord and tenant
  - Rising home value raises asset wealth (landlord)...
  - ...and also cost of living (tenant)
  - Infinitely-lived agent is hedged against fluctuations (Sinai & Souleles, 2005)
- Wealth effects for buyers/sellers only
  - Rising price helps seller & hurts buyer
  - Transfer of wealth = small aggregate effects
- Collateral effects
  - Two types of agents: natural borrowers vs natural savers
  - Borrowers cannot commit to repay
  - Rising home value circumvents the agency cost

Credit Constraints: Collateral vs Wealth

- Two measures to identify "constrained" households:
  1. High Debt-Service Ratio: $DSR = \frac{\text{Debt Service Payments}}{\text{Income}}$
     - Top 25% DSR likely constrained (Li & Johnson, 2007)
  2. Home Equity Extraction: Mortgage, Home Equity Loans, & HELOC's
     - Reported increase in home debt balance during survey period
- Split sample between constrained & unconstrained
  - Do constrained have higher response?

Credit Constraints: Results

Consumption Growth Regressions (Constrained vs Unconstrained)

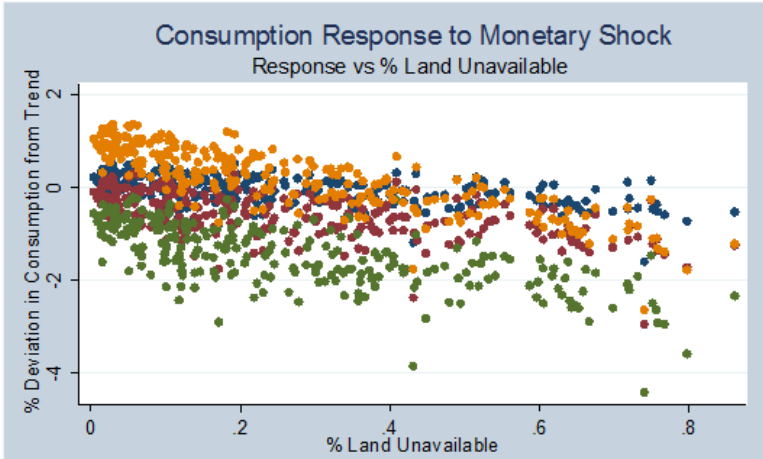
	(1) Constrained (high DSR)	(2) Unconstrained (low DSR)	(3) Increased Home Debt	(4) No Increase Home Debt
House Price Growth	2.857***	-0.0655	3.569***	1.389***
	(1.028)	(0.495)	(1.203)	(0.374)
Household Inc. Growth	0.0516***	0.0188**	0.00943**	0.0544***
	(0.0103)	(0.00845)	(0.00468)	(0.0111)
Age	-0.900***	0.124**	-0.253*	0.0365
	(0.139)	(0.0542)	(0.137)	(0.0632)
Age^2	0.00966***	-0.000607	0.00257*	0.000167
	(0.00146)	(0.000488)	(0.00143)	(0.000603)
Chg. Family Size	0.803	7.516***	10.63***	7.988***
	(1.893)	(1.120)	(1.570)	(1.108)
Observations	3,496	14,700	3,586	15,273

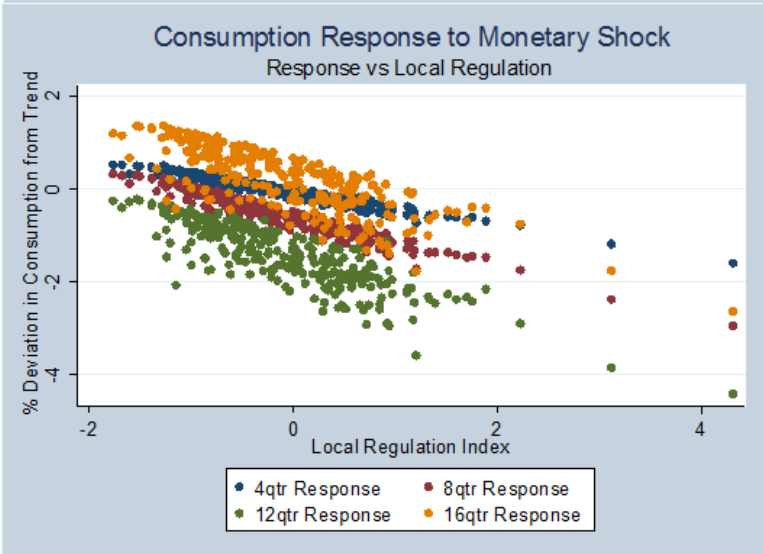
All regressions include qtr. dummies & direct effects of monetary shocks.
Standard errors in parentheses are clustered at MSA-level
*** p<0.01, ** p<0.05, * p<0.1

Role of Housing in Monetary Transmission

- Evidence for a "balance sheet" channel (Iacoviello, 2005; Bernanke, Gertler, & Gilchrist, 1999)
  - 100bp increase in Fed Funds causes 1-2.5% fall in real house price
  - Elasticity of consumption to house prices is approx 1.5
  - Implies a 1.5-3.75% peak consumption response
- Heterogeneity of responses:
  - "Inelastic" supply regions affected more
  - Owners and Credit Constrained most affected
- Construct responses by MSA using reduced form

Cumulative Consumption Response





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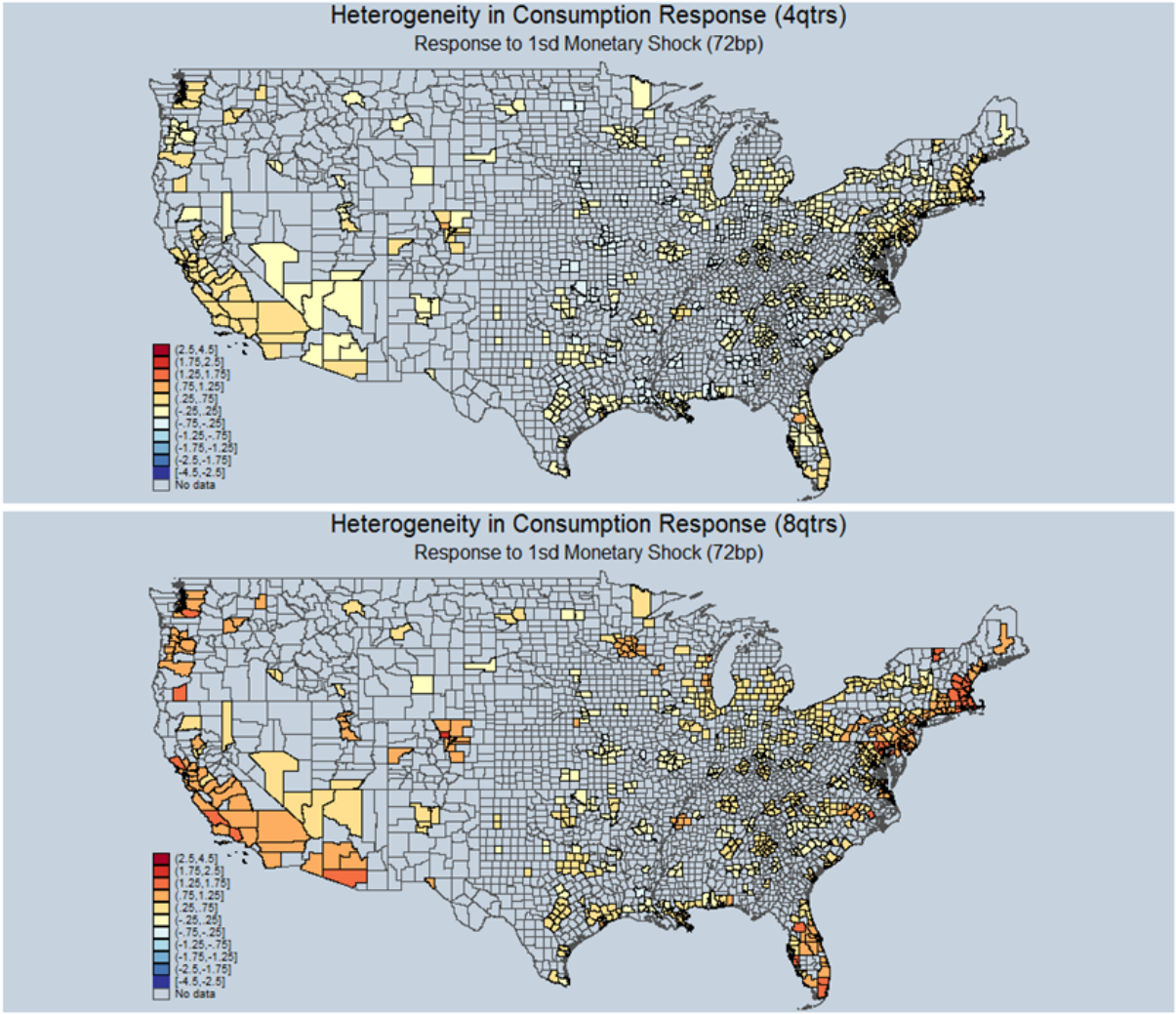

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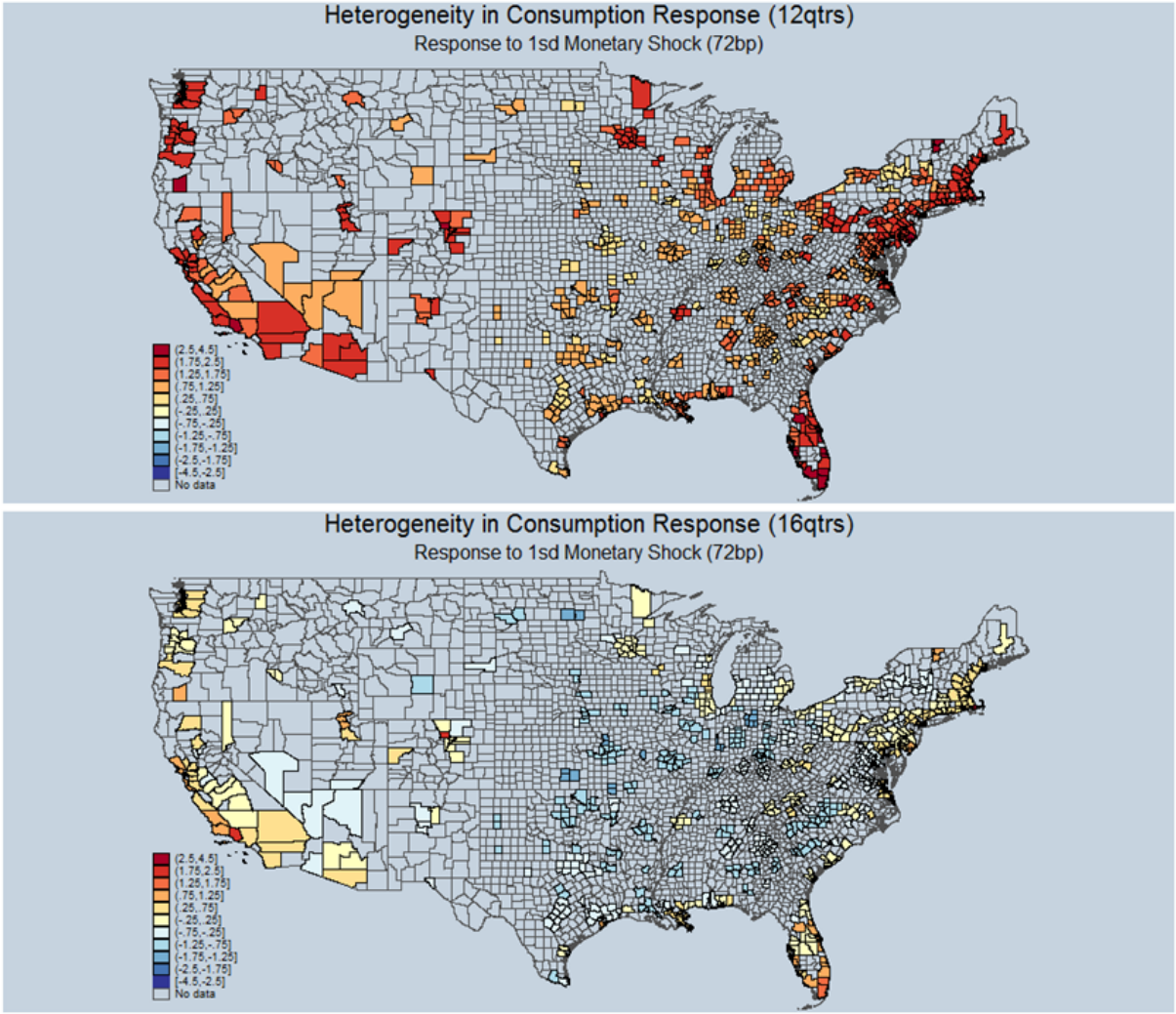

Relation to Macro/Housing Literature

- "Financial Accelerator" Models (Iacoviello, 2005; Bernanke, Gertler, & Gilchrist, 1999)
  - Iacoviello (2005), Bernanke, et al (1999) - shocks amplified through borrower balance sheets.
  - Chaney, Sraer, Thesmar (2013) - empirical evidence on firm investment side
- Housing Bubble and Consumer Credit
  - Cooper (2009) - Evidence Propensity to consume out of housing wealth
  - Mian & Sufi (2010) - Evidence of Credit responses to housing wealth
  - Campbell & Cocco (2007) Attanasio, et al (2009) - Collateral vs Wealth Effects
- Other Literatures:
  - Regional Heterogeneity in Housing (Saiz, 2010; Gyourko, et al, 2008; Paciorek, 2013)
  - Monetary Policy & Inequality (Gorodnichenko, et al, 2012)

Conclusions

- Local house prices respond to monetary shocks
  - differ based on geography & local regulations
- Average propensity to consume out of housing wealth: $6 - 9¢$ for every \$1 increase in local house prices
  - Positive effect for owners only, no effect for renters
  - Primarily due to credit constrained households $\rightarrow$Collateral Effects
- Implies 100 basis point shock to federal funds causes 1.5-3.75% change in spending for owners through "homeowner balance sheets"
  - Effect varies substantially by region & ownership status

Heterogeneity in Land

back

Dallas

San Francisco