

# The Missing Home Buyers: Regional Heterogeneity and Credit Contractions

Pierre Mabilie

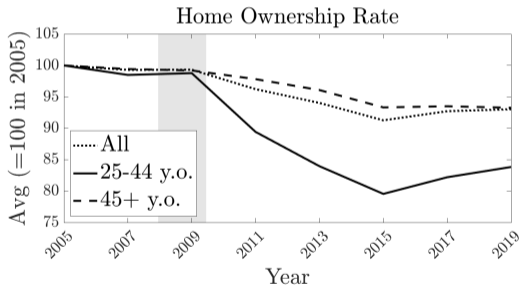
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# Motivation

- ▶ **Unprecedented decrease in young home ownership** since the Great Recession
  - ▶ Persistent drop below pre-boom level Age decomposition Long run
  - ▶ Major concern for policymakers and mortgage sector in North America and Europe



Source: AHS

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- ▶ First-time buyers are 50% of purchase mortgages and targeted by many policies (e.g. FTHC)
- ▶ We know a lot about foreclosures but less about “missing home buyers”
  - ▶ Time effect (post-recession) vs. cohort (Millennials)
  - ▶ Implications for housing markets (persistence) and stimulus policies

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# This Paper

1. **New facts** on young home buyers in panel of US metro areas
  - ▶ **Regional heterogeneity:** delaying concentrated in high-house price regions
  - ▶ Mortgage standards change uniformly nationwide
  - ▶ **Channel:** regionally-binding credit constraints
2. Structural model of regional housing and rental markets
  - ▶ Key features: GE + mobility + cohort differences
  - ▶ **New:** link macro-finance model to regional panel data
  - ▶ Indirect inference and counterfactual experiments on “missing buyers”

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# Results

- ▶ **Short run:** dynamics explained by **heterogeneous impacts** of **aggregate** credit contraction
  - ▶ Uniform LTV and PTI tightening explains cross-section of young home ownership busts
- ▶ **Long run:** differences between cohorts persistently decrease Millennial home ownership
  - ▶ Heterog effects: depress high-price owner-occupied housing, boost low-price and rental
- ▶ **Policy:** differences between regions dampen effectiveness of subsidies to first-time buyers
  - ▶ **Place-based** subsidies improve it



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# Literature

- ▶ **Exit from home ownership via foreclosures:** Mian-Rao-Sufi-Trebbi 2009-19, Piskorski-Seru 2018, Guren-McQuade 2020, Kaplan-Mitman-Violante 2020
  - ▶ **Here:** Less entry into home ownership via delaying
- ▶ **Regional heterogeneity and agg shocks:** Lamont-Stein 1999, Lustig-Van Nieuwerburgh 2010, Landvoigt-Piazzesi-Schneider 2015, Hurst-Keys-Seru-Vavra 2016, Jones-Midrigan-Philippon 2018, Beraja-Hurst-Vavra 2019
  - ▶ **Here:** Endogenous house price distribution and mobility
- ▶ **Young home buyers:** Mankiw-Weil 1989, Ortalo-Magné-Rady 2006, Kaplan 2012, Glover-Heathcote-Krueger-Ríos-Rull 2017, Bleemer-Brown-Lee-Strair-van der Klaauw 2017, Goodman-Mayer 2018, Wong 2019, Berger-Turner-Zwick 2019, Isen-Goodman-Yannelis 2019, Amromin-Eberly-Mondragon 2019
  - ▶ **Here:** Regional heterogeneity
- ▶ **Real estate:** Saiz 2010, Van Nieuwerburgh-Weill 2010, Gyourko-Mayer-Sinai 2013, Davidoff 2013, Guerrieri-Hartley-Hurst 2013, Nathanson-Zwick 2018, Favilukis-Mabille-Van Nieuwerburgh 2019
- ▶ **Heterogeneous agents models with housing:** Berger-Vavra 2005, Favilukis-Ludvigson-Van Nieuwerburgh 2017, Rognlie-Shleifer-Simsek 2018, Greenwald 2018, Kaplan-Mitman-Violante 2020

# Outline

- 1 Facts on Young Buyers
- 2 An Equilibrium Model of Regional Housing Markets
- 3 Short Run and Long Run
- 4 Housing Stimulus Policies (First-Time Homebuyer Credit)

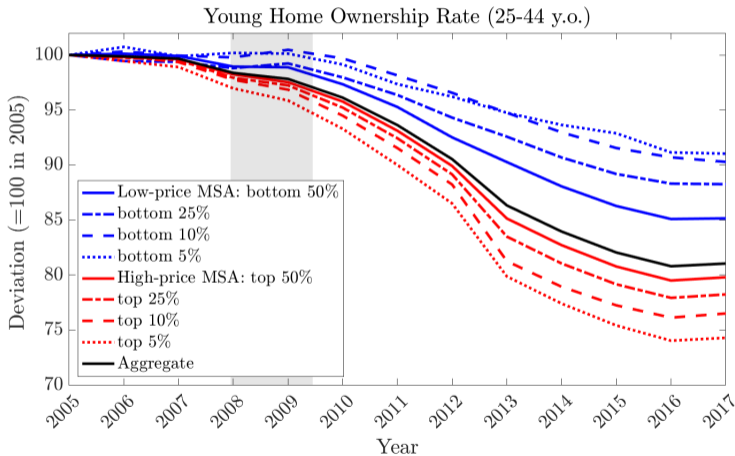
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# Data: Panel of U.S. Metro Areas in 2005-2017

- ▶ Challenge: Young home buyers' mortgage standards
  - ▶ Borrower- vs. loan-level data
  - ▶ Here: **first-time home buyers**
- ▶ **Sources**, merged at MSA level:
  - ▶ **Mortgage originations:** Consumer Credit Panel/Equifax (New York Fed)
  - ▶ **Mortgage standards:** Single Family Loan-Level Datasets (Fannie Mae, Freddie Mac)
  - ▶ House prices and rents: ZHVI, ZRI (Zillow)
  - ▶ Demographics and housing: American Community Survey, American Housing Survey
- ▶ **Low house-price** (e.g. Detroit) vs. **high-house price** (e.g. SF)

# Facts #1: Young Home Buyers

- ▶ Young home ownership rates diverge across regions after recession



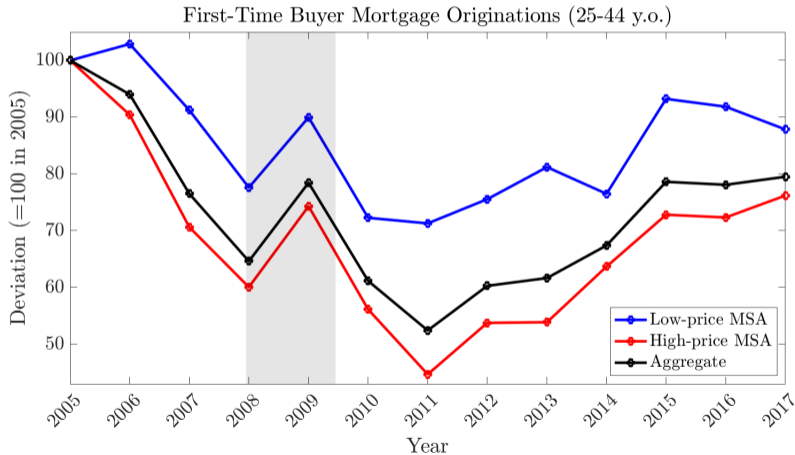
Level

Trend

Preferences

# Facts #1: Young Home Buyers

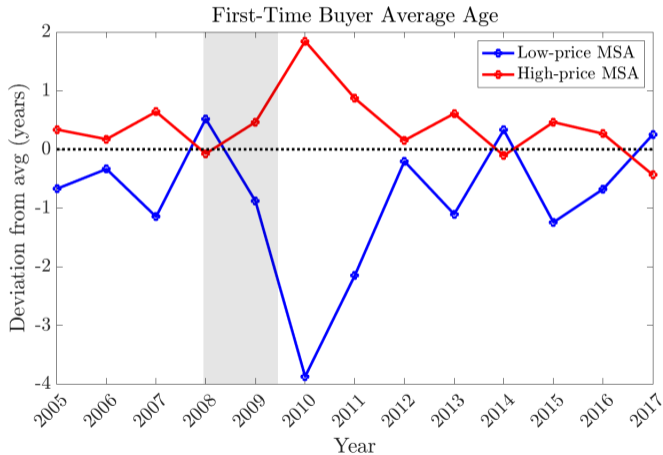
- Originations decrease more in high-price regions after recession





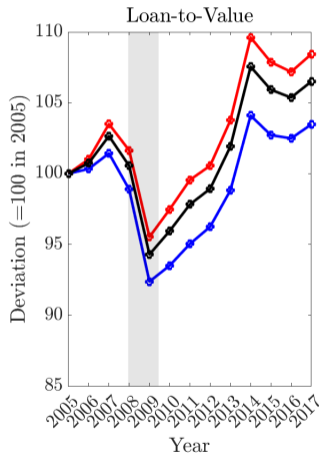
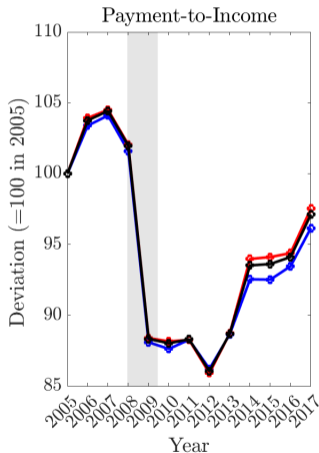
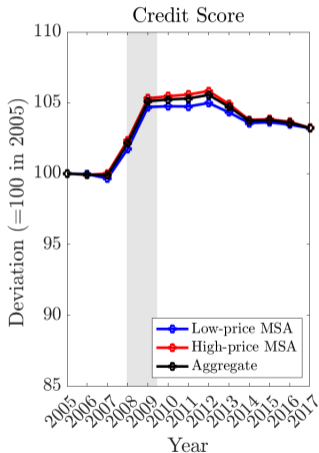
# Facts #1: Young Home Buyers [Map](#)

- ▶ **Ages of first-time buyers diverge across regions after recession**



# Fact #2: First-Time Mortgage Standards

## ► Loan characteristics covary strongly across regions



All mortgages

Securitization

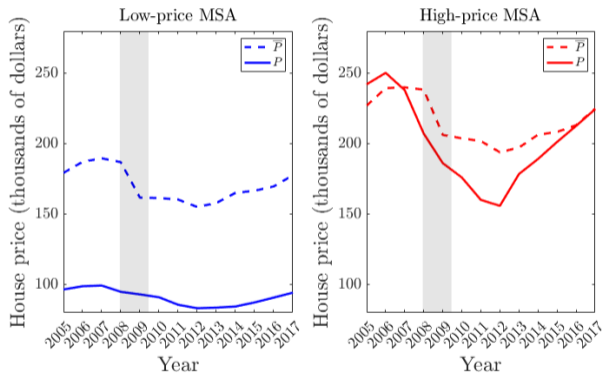
Applications and foreclosures

## Intuition: Regionally-Binding Credit Constraints

- ▶ Mortgage rate  $r^b$ , maturity  $n$ , max LTV and PTI  $\theta_{LTV}, \theta_{PTI}$ , income  $Y$
- ▶ Mortgage payment formula  $\Rightarrow$  PTI max loan size =  $\frac{1-(1+r^b)^{-n}}{r^b} \theta_{PTI} Y$
- ▶ LTV max loan size =  $\theta_{LTV} \times \text{price}$
- ▶ **Max affordable price**  $\bar{P} = \min \left[ \frac{1-(1+r^b)^{-n}}{r^b} \theta_{PTI} Y + \text{down}, \frac{\text{down}}{1-\theta_{LTV}} \right]$

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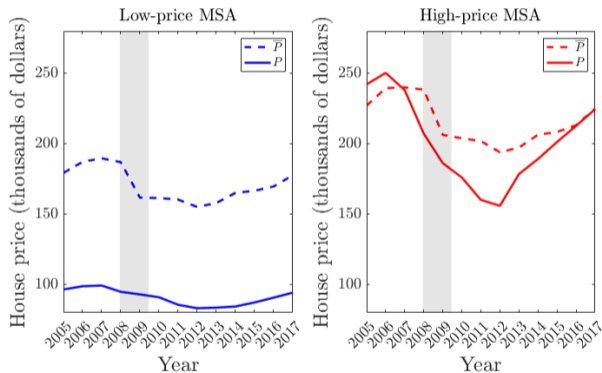
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- ▶ Simple calculations ignore heterogeneity, option to rent, to migrate, local vs. agg shocks

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# Model Ingredients Bellman eqn

- ▶ OLG heterog households w/ life-cycle and incomplete markets → Young constrained buyers
- ▶ Regional heterogeneity → Cross-section of housing markets
  - Construction costs
  - Price-elasticity of housing supply
  - Amenities
- ▶ Local and aggregate shocks
  - Income
  - Mortgage standards on long-term debt (LTV, PTI, fees)
- ▶ **Key features**
  - Dynamics of local house prices and rents endogenous
  - Mobility
  - Cohort differences: initial income and wealth
- ▶ *Full transition dynamics*

# Calibration: External Parameters

Parameter	Explanation	Value	Source/Target
<b>External: aggregate</b>			
$\gamma$	Risk aversion	2.000	Standard
$\epsilon$	CES parameter housing/consumption	0.200	Elasticity of substitution=1.25
$\rho_e$	Autocorrelation income	0.914	Floden-Linde 2001
$\sigma_\epsilon$	Std. dev. income	0.097	Floden-Linde 2001
$r^b$	Mortgage rate	0.050	Pre-boom 30-year FRM
$\tilde{\theta}$	Mortgage duration	0.969	Gorea-Midrigan 2018
$f_o$	Proportional transaction cost selling	0.060	Kaplan et al 2020
$F_r$	Fixed mortgage origination fee	0.006	Kaplan et al 2020
$f_r$	Proportional mortgage origination fee	0.008	Kaplan et al 2020
$\delta$	Housing depreciation/maintenance	0.015	Kaplan et al 2020
–	Student debt	\$40,000 at 21-32 y.o.	CCP
$\mu_{e_0}$	Earnings 15 yrs after graduating in recession	-12.5%	Kahn 2010
<b>External: regional</b>			
$\rho_L, \rho_H$	Housing supply elasticity	2.700,1.800	Saiz 2010



# Calibration: Internal Parameters

Parameter	Explanation	Value	Source/Target
<b>Internal: aggregate</b>			
$\beta$	Discount factor	0.952	Wealth/income=4.40
$\alpha$	Preference for housing services	0.400	Rent/income=0.23
$\iota$	Mortgage spread	0.006	Mortgage debt/income=1
$\theta_{LTV}$	Max. LTV ratio	0.900	Upper LTV distribution
$\theta_{PTI}$	Max. PTI ratio	0.580	Upper PTI distribution
$m$	Utility cost of moving	2.750	Avg moving rate L-H=1.7%
<b>Internal: regional</b>			
$\bar{I}_L, \bar{I}_H$	Inv. cost residential investment	0.048,0.014	$P_L = \$100K, P_H = \$240K$
$\Xi_L^i, \Xi_H^r$	Amenity benefits	0,0.508	$R_L = \$1,111, R_H = \$1,206$
$\Xi_L^o, \Xi_H^o$	Homeownership benefits	0.822,0.904	$ho_L^{hh} = 69\%, ho_H^{hh} = 67\%$

Variable	Data L	Model L	Data H	Model H
Price per unit	100,000	100,000	240,000	240,000
Rent per unit	1,111	1,010	1,206	1,415
Homeownership rate	0.69	0.69	0.67	0.67
Income	29,300	29,309	38,261	38,253
Price/income	3.41	3.41	6.27	6.27
Price/rent	7.50	8.25	16.58	14.13
Population share	0.42	0.39	0.58	0.61

▶ Limited spatial sorting

- ▶ Why? Option to rent + mobility cost between MSAs
- ▶ Why important? Regionally-binding constraints amplify credit shocks

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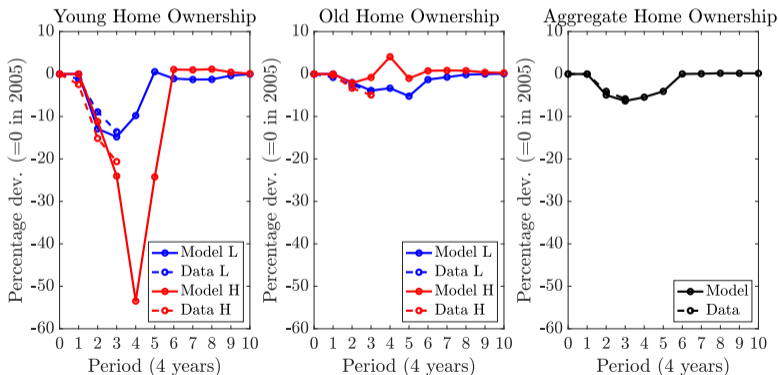
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## Short Run (Transition Dynamics): Response to Credit Contraction

- ▶ **Main experiment:** feed in uniform transitory shocks to match household leverage decrease
  - ▶  $\theta_{LTV,t}$  decreases from 90% to 72%,  $\theta_{PTI,t}$  from 58% to 29%
- ▶ Aggregate tightening of mortgage standards → home ownership ↓ in level and cross-section

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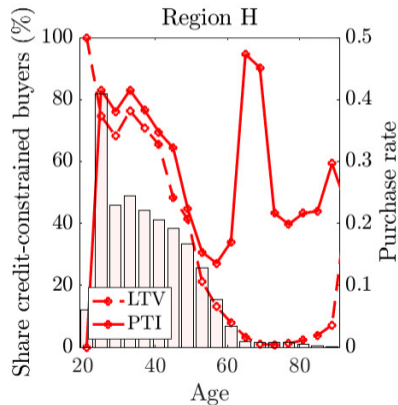
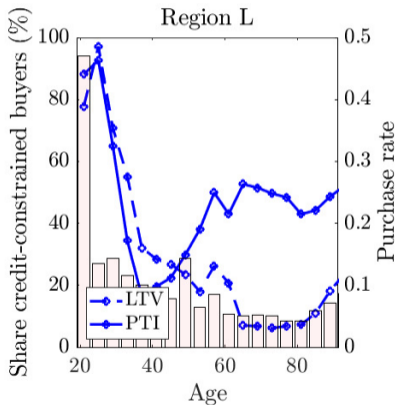


# Credit Constraints Decomposition

Credit standards

House prices

- ▶ LTV more binding for youngest buyers
- ▶ PTI more binding for middle-aged buyers, esp. in high-price MSAs



# Long Run (Steady State): Impact of Cohort Differences

- ▶ **Counterfactual:** Millennials have no **student debt** and no **worse initial labor market**
- ▶ Baseline: persistently lower home ownership b/c slower wealth accumulation: -6 pp
  - ▶ Larger effect of graduating in recession (prices -6%) than of student debt (-2%)
- ▶ Heterogeneous impact on housing markets
  - ▶ **Regions:** depress high-price owner-occupied, boost low-price → Relocation Population
  - ▶ **Sectors:** boost rentals → Delaying Rents



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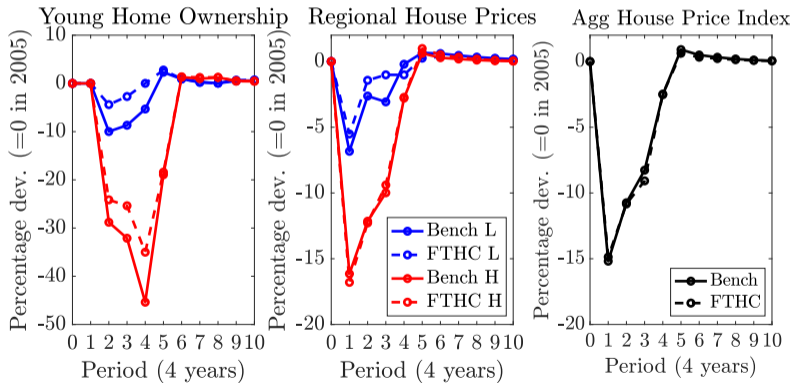
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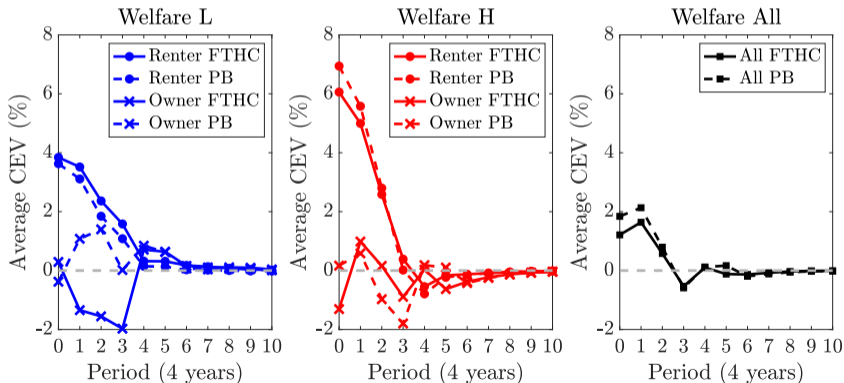
# Regional Heterogeneity Dampens Effectiveness of FTHC

- ▶ \$8k subsidy uniform across regions (2008-10) Background
  - ▶ “One size fits all” subsidy boosts housing demand relatively less in high-price MSAs
  - ▶ Small welfare gains because preference for high-price MSAs



# Improving the Effectiveness of FTHC

- ▶ **Place-based subsidy:** proportional to local house prices, budget-neutral
- ▶ Larger, persistent welfare gains
- ▶ Design of housing stabilization should account for price differences and regional preferences

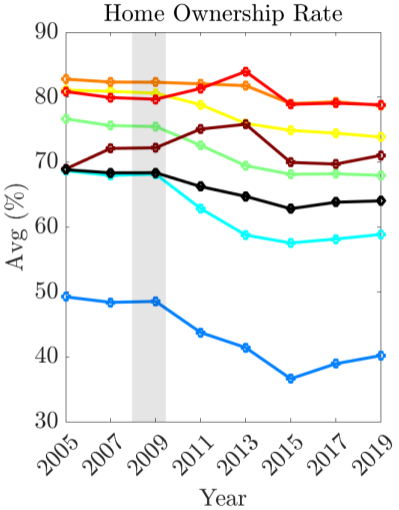
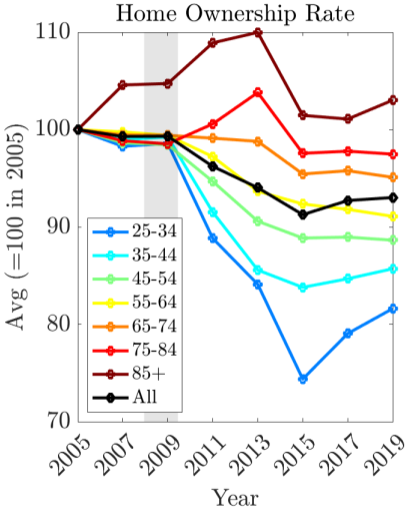


# Conclusion

- ▶ “Regional macro-finance”
  - ▶ MSA panel on first-time buyers
  - ▶ Equilibrium model of regional housing and rental markets
- ▶ Regionally-binding credit constraints affect first-time buyers → short run, long run, policy
- ▶ More results in the paper!

# Age Decomposition of Home Ownership

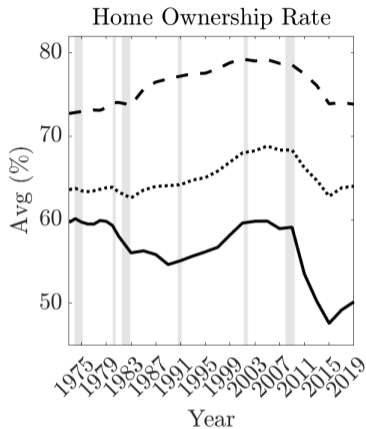
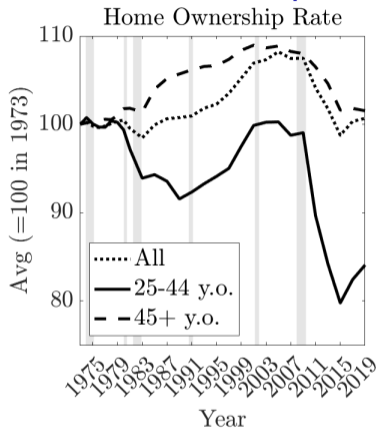
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Source: AHS

# Long Run: Home Ownership

◀ back

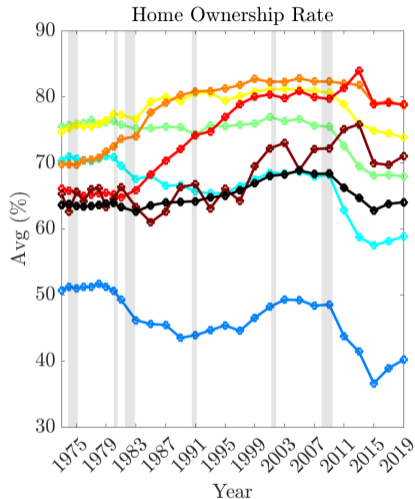
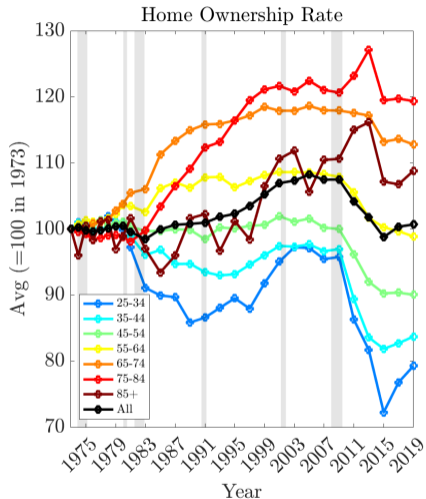


Source: AHS

- ▶ Mean-reversion in aggregate home ownership after the housing boom of the 1990-2000s
- ▶ But young home ownership persistently below pre-boom level



# Long Run: Age Decomposition of Home Ownership



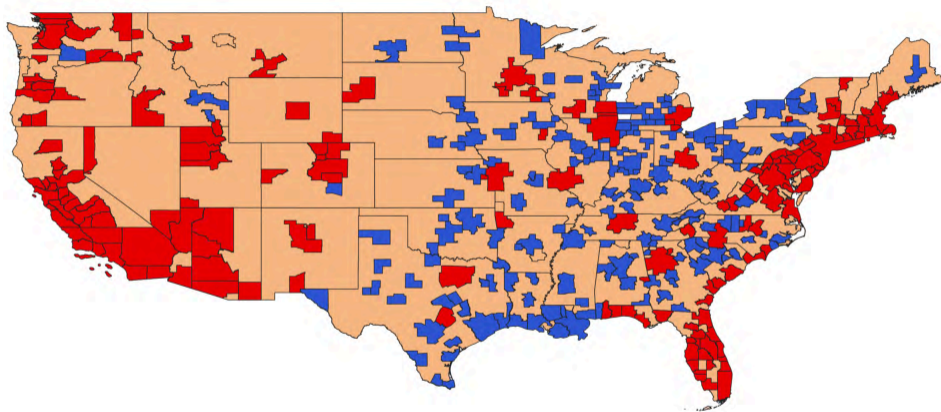
Source: AHS

# Demographic Determinants of Home Ownership

Home ownership rate	2005-15 change (pp)
<b>All</b>	-6.1
<b>Age</b>	
25-34	-14.7
<b>Income</b>	
Q3	-7.4
<b>Race</b>	
Black	-6.3
<b>Education</b>	
Less than high school	-8.5
<b>Household composition</b>	
Female single householder, with kids	-9.7

Sources: AHS, Goodman-Mayer (2018)

# Regional Distribution of House Price Levels [◀ back](#)



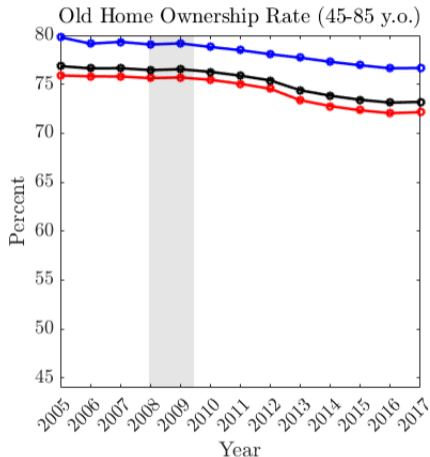
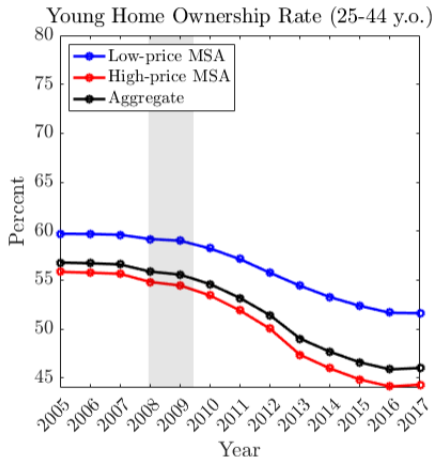
(blue=bottom 50% of median house price distribution, red=top 50%)

Source: Zillow

- ▶ Scarring effect à la Malmendier-Nagel 2011?
- ▶ *Indirect measures*
  - ▶ ACS: h.o. of households likely to buy and be unconstrained (prime white hhs 25-34 y.o., married with children, annual income > \$100k): -2.8 pp vs. -5.4 pp all hhs in 1990-2015
- ▶ *Surveys*
  - ▶ Survey of Consumer Expectations' Housing Survey (New York Fed)
    - ▶ "Would you like to own instead of rent your primary residence?": 71.3% yes (19.4% no)
    - ▶ "Vs. other financial investments, buying in your zip code today is": 64.9% good (9.1% bad)
  - ▶ Housing Confidence Survey (Pulsenomics)
    - ▶ "Is housing a good long-term investment?"
  - ▶ National Housing Survey (Fannie Mae, e.g. Adelino-Schoar-Severino 2018)
- ▶ **Model:** interpret as residual  $\approx 0$

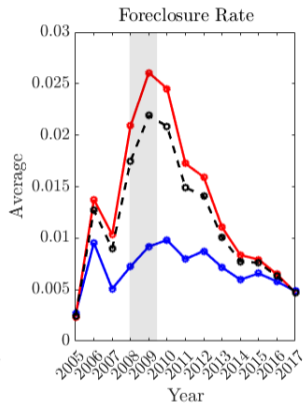
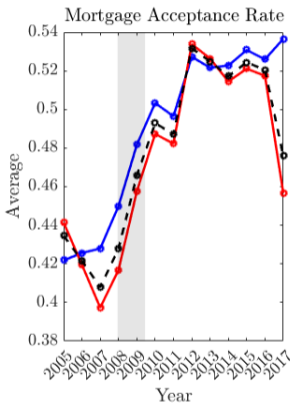
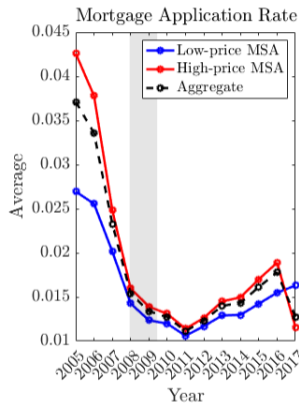
# Young vs. Old Home Ownership Across Regions

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Source: ACS, Zillow

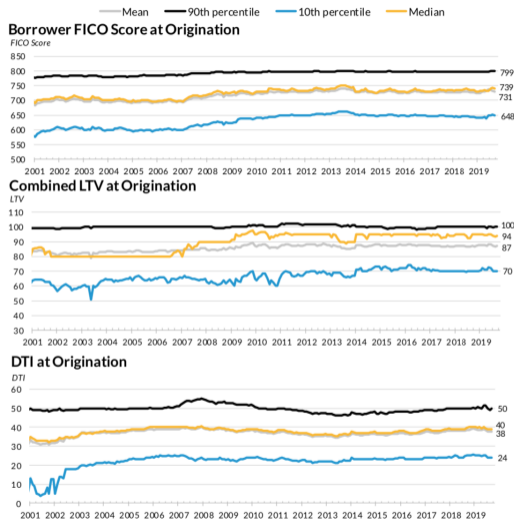
# Loan Application, Rejection, Foreclosure Rates Across Regions



Source: HMDA, RealtyTrac, Zillow

# Mortgage Underwriting Standards (All Loans)

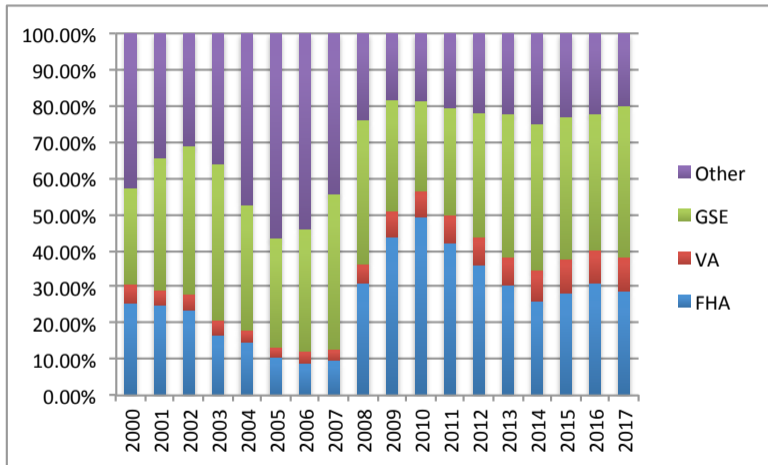
◀ back



Sources: Black Knight, eMBS, HMDA, SIFMA, CoreLogic, Urban Institute

# Securitization of First-Time Mortgages

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Source: FRBNY CCP/Equifax



- ▶ Renter from **H**:

$$V_t^{rH} = \max \left[ V_t^{rH,rH}, V_t^{rH,rL}, V_t^{rH,oH}, V_t^{rH,oL} \right]$$

- ▶ Renter from **H** buying a house in **L**:

$$V_t^{rH,oL}(a, b_t, y_t) = \max_{c_t, h_t, b_{t+1}} \frac{u(c_t, h_t)^{1-\gamma}}{1-\gamma} + \Xi_H - m + \beta \left[ p^a \mathbb{E}_t V_{t+1}^{oL}(a+1, b_{t+1}, y_{t+1}) + (1-p^a) U_{t+1} \right]$$

$$U_{t+1} = U \left( b_{t+1} + P_{L,t+1} \bar{h} \right)$$

$$\text{s.t. } c_t + R_{H,t} h_t + P_{L,t} \bar{h} (1 + f_r) + F_r + b_{t+1} = y_t - T(y_t) + (1+r)b_t$$

$$b_{t+1} \geq -\theta_{LTV,t} P_{L,t} \bar{h}$$

$$b_{t+1} \geq -\frac{\theta_{PTI,t} y_t}{(1+r^b - \tilde{\theta})}$$

# Solving for Dynamics of Regional House Price Distribution

- ▶ Challenge: solve for  $\{P_{L,t}, P_{H,t}, R_{L,t}, R_{H,t}\}$  in response to local and aggregate shocks
- ▶ **Numerical solution for class of regional models**
  - ▶ **Calibrate** steady state regional house price distribution
    - ▶ Invert market-clearing conditions:  $\bar{h}$ , homogeneity of  $I(p)$
  - ▶ Compute nonlinear transition dynamics in response to **unanticipated shocks**
    - ▶ Smooth discrete choice problem: idiosyncratic taste shocks  $\sim$  type I Extreme Value
- ▶ **New:** combine macro-finance model and regional panel data

# Model Fit: Aggregate Moments

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Variable	Data	Model
Wealth/income	4.40	4.15
Avg. rent/ income	0.23	0.22
Leverage	0.37	0.32
P90 LTV	0.92	0.83
P90 PTI	0.58	0.56
Migration Rate	0.016	0.014

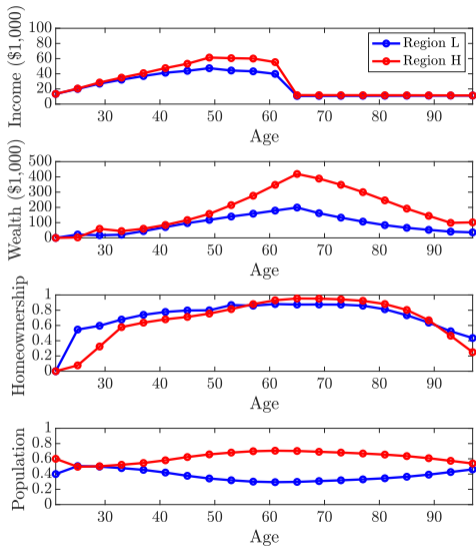
► Targeted moments

	LTV		PTI	
	Data	Model	Data	Model
P10	0.19	0.26	–	0.08
P25	0.40	0.44	–	0.13
P50	0.64	0.62	0.36	0.28
P75	0.79	0.79	0.48	0.37
P90 (targeted)	0.92	0.83	0.58	0.56

► Untargeted LTV and PTI

# Model: Regional Life-Cycle Profiles

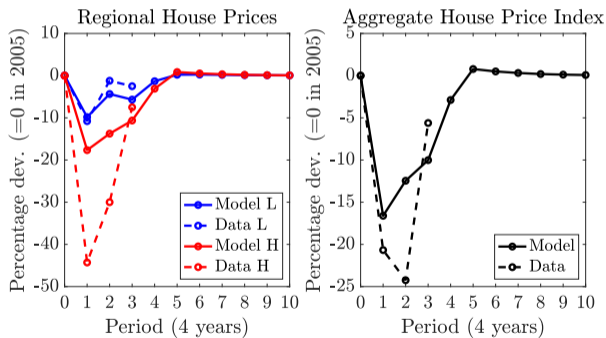
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# Short Run (Transition Dynamics): Response to Credit Contraction

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- ▶ **House prices** ↓ in level and cross-section
  - ▶ Even without different local shocks or housing supply elasticities



More Shocks

Housing supply elasticity

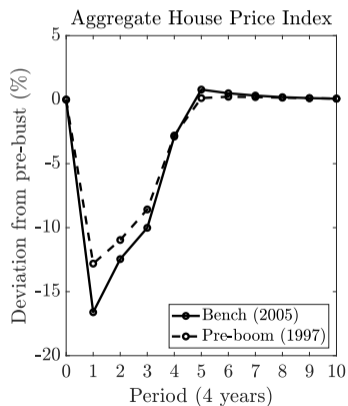
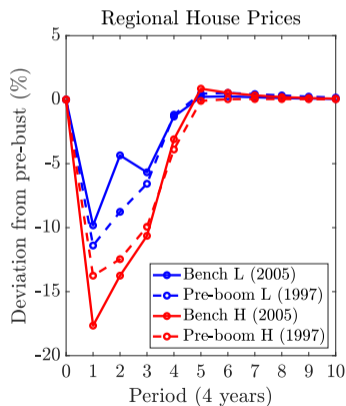
IRF decomposition

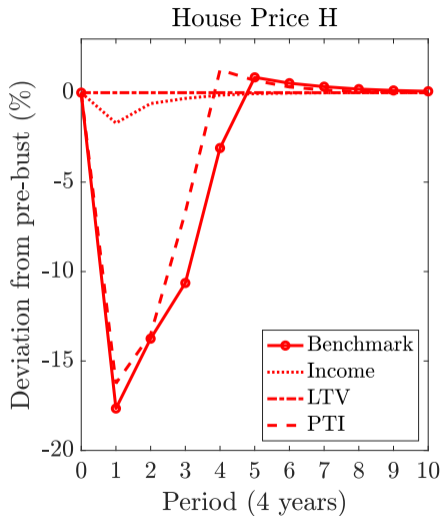
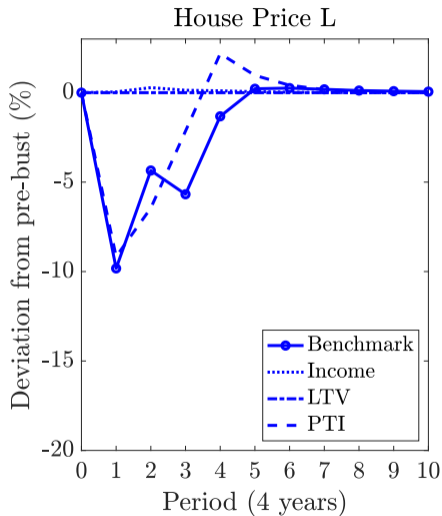
Time-varying

- ▶ Usually attributed to housing supply restrictions  $\rho_j, \bar{I}_j$   
e.g. Saiz instrument in Mian-Sufi
- ▶ **Here:** any driver of preexisting differences in house price levels  $P_H > P_L$ 
  - ▶ Young buyers' **credit constraints** more binding in **H**
  - ▶  $\bar{I}_H = \bar{I}_L$  and  $\rho_H = \rho_L$  decreases differences in house price decline from 8 pp to 3.5 pp
  - ▶  $\Xi_H = \Xi_L$  decreases difference in house price declines from 8 pp to 3 pp
- ▶ **Time-varying:** more heterogeneous house price distribution → more heterogeneous busts
  - ▶ Amplification in 2005 vs. 1997
  - ▶ Explains “sand states” puzzle during Great Recession

# Time-Varying Impact of Credit Constraints [◀ back](#)

- ▶ Heterogeneous house price **levels**  $\Rightarrow$  heterogeneous **busts**
- ▶ **Counterfactual:** response to same shocks with more equal 1997 house price distribution
  - ▶ 2005 price distribution **amplifies** regional differences and aggregate price decline

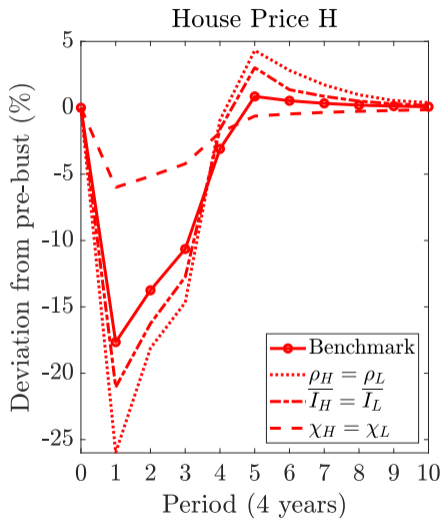
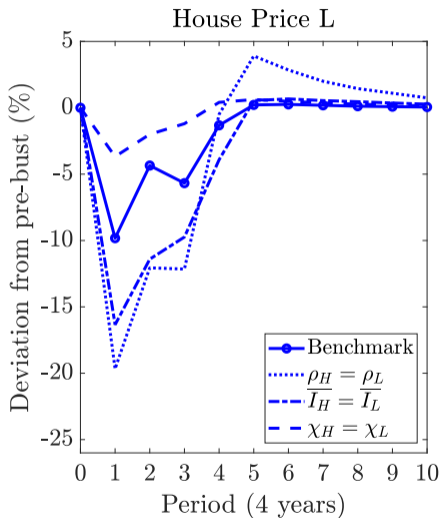






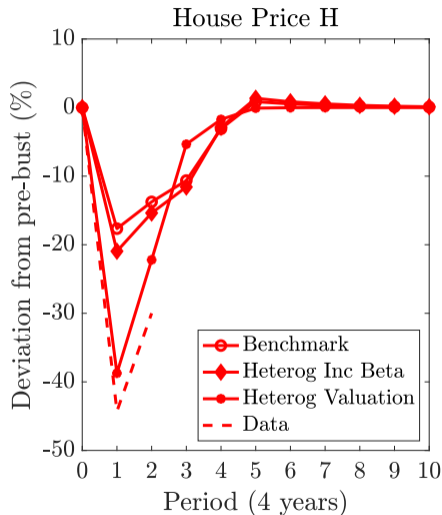
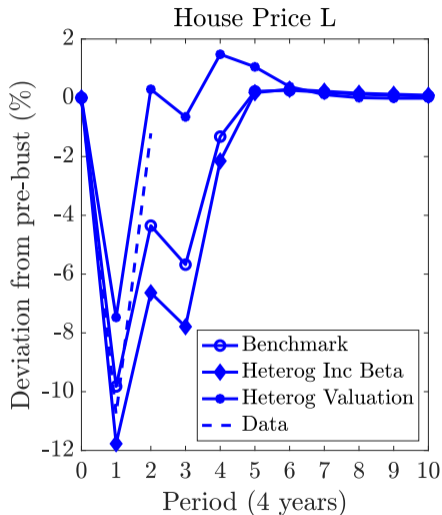
# Impacts of Regional Differences

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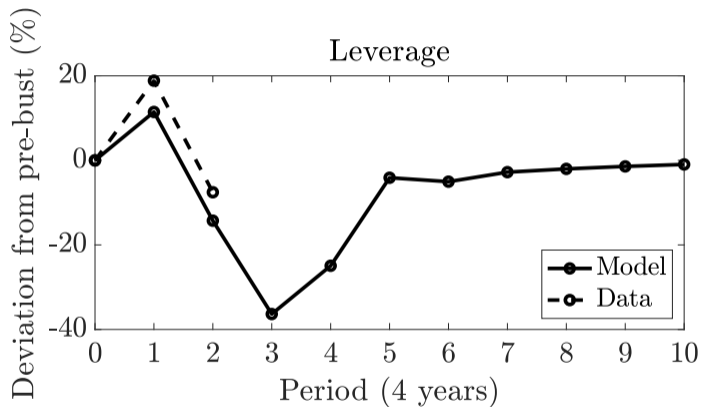


# Extended Model: Price Responses

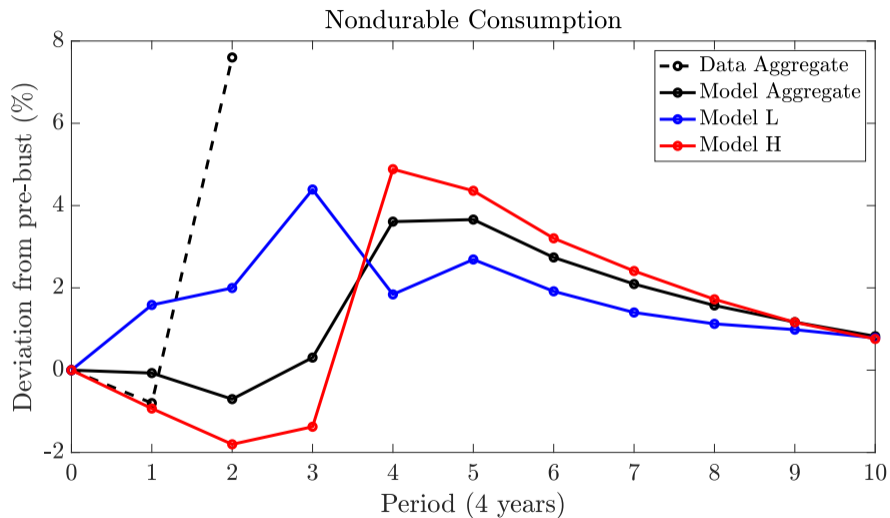
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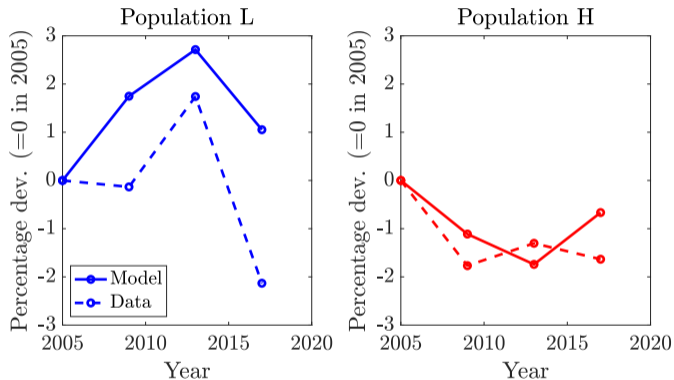
## Extended Model: Leverage Response



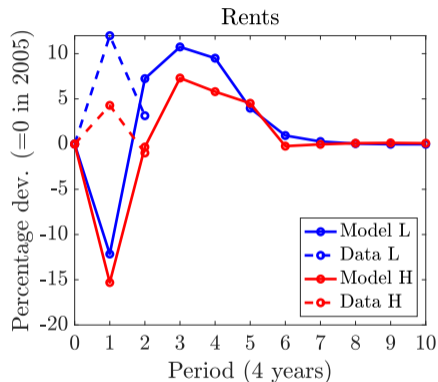
# Extended Model: Consumption Response



# Regional Population Changes [◀ back](#)



Source: ACS, Zillow



Source: ACS, Zillow

- ▶ **Background** (2009 American Recovery and Reinvestment Act)
  - ▶ Tax credit of \$8,000 for first-time buyers with annual income below \$112,000
  - ▶ Unanticipated subsidy during recession, financed by distortionary taxes
- ▶ **Validation:** cushions bust in h.o. 10%, agg price 1%  $\approx$  estimates (Berger-Turner-Zwick 2019)