The Missing Home Buyers: Regional Heterogeneity and Credit Contractions

Pierre Mabille

INSEAD

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Motivation

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

![Graph showing home ownership rate over years](source: AHS)
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  - 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

**Question**: Causes and consequences of lower entry into home ownership from young buyers?
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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”
This Paper

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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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Here: Less entry into home ownership via delaying


Here: Endogenous house price distribution and mobility


Here: Regional heterogeneity


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)
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)

- 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
Facts #1: Young Home Buyers

- Originations decrease more in high-price regions after recession
Ages of first-time buyers diverge across regions after recession
Fact #2: First-Time Mortgage Standards

- Loan characteristics covary strongly across regions

![Graphs showing Credit Score, Payment-to-Income, and Loan-to-Value deviations from 2005 for low-price MSA, high-price MSA, and aggregate.](image)
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 $\bar{P} = \min \left[ \frac{1-(1+r^b)^{-n}}{r^b} \theta_{PTI} Y + \text{down}, \frac{\text{down}}{1-\theta_{LTV}} \right]$
Intuition: Regionally-Binding Credit Constraints

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- Simple calculations ignore heterogeneity, option to rent, to migrate, local vs. agg shocks
Max affordable price $\bar{P} = \min \left[ \frac{1-(1+r^b)^{-n}}{\theta_{PTI}} Y + \text{down}, \frac{\text{down}}{1-\theta_{LTV}} \right]$
Facts on Young Buyers

An Equilibrium Model of Regional Housing Markets

Short Run and Long Run

Housing Stimulus Policies (First-Time Homebuyer Credit)
Model Ingredients

- 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
<th>Value</th>
<th>Source/Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma$</td>
<td>Risk aversion</td>
<td>2.000</td>
<td>Standard</td>
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<tr>
<td>$\epsilon$</td>
<td>CES parameter housing/consumption</td>
<td>0.200</td>
<td>Elasticity of substitution=1.25</td>
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<tr>
<td>$\rho_e$</td>
<td>Autocorrelation income</td>
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<td>Floden-Linde 2001</td>
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<tr>
<td>$\sigma_e$</td>
<td>Std. dev. income</td>
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<td>$\gamma^b$</td>
<td>Mortgage rate</td>
<td>0.050</td>
<td>Pre-boom 30-year FRM</td>
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<tr>
<td>$\bar{\theta}$</td>
<td>Mortgage duration</td>
<td>0.969</td>
<td>Gorea-Midrigan 2018</td>
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<tr>
<td>$f_0$</td>
<td>Proportional transaction cost selling</td>
<td>0.060</td>
<td>Kaplan et al 2020</td>
</tr>
<tr>
<td>$F_r$</td>
<td>Fixed mortgage origination fee</td>
<td>0.006</td>
<td>Kaplan et al 2020</td>
</tr>
<tr>
<td>$f_r$</td>
<td>Proportional mortgage origination fee</td>
<td>0.008</td>
<td>Kaplan et al 2020</td>
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<tr>
<td>$\delta$</td>
<td>Housing depreciation/maintenance</td>
<td>0.015</td>
<td>Kaplan et al 2020</td>
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<tr>
<td>$\theta$</td>
<td>Student debt</td>
<td>$40,000 at 21-32 y.o.</td>
<td>CCP</td>
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<tr>
<td>$\mu_{\epsilon_0}$</td>
<td>Earnings 15 yrs after graduating in recession</td>
<td>-12.5%</td>
<td>Kahn 2010</td>
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### External: regional

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>$\rho_L, \rho_H$</td>
<td>Housing supply elasticity</td>
<td>2.700, 1.800</td>
<td>Saiz 2010</td>
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## Calibration: Internal Parameters

<table>
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<td>$\beta$</td>
<td>Discount factor</td>
<td>0.952</td>
<td>Wealth/income=4.40</td>
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<tr>
<td>$\alpha$</td>
<td>Preference for housing services</td>
<td>0.400</td>
<td>Rent/income=0.23</td>
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<td>$\iota$</td>
<td>Mortgage spread</td>
<td>0.006</td>
<td>Mortgage debt/income=1</td>
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<tr>
<td>$\theta_{LTV}$</td>
<td>Max. LTV ratio</td>
<td>0.900</td>
<td>Upper LTV distribution</td>
</tr>
<tr>
<td>$\theta_{PTI}$</td>
<td>Max. PTI ratio</td>
<td>0.580</td>
<td>Upper PTI distribution</td>
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<tr>
<td>$m$</td>
<td>Utility cost of moving</td>
<td>2.750</td>
<td>Avg moving rate L-H=1.7%</td>
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### Internal: aggregate

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<tbody>
<tr>
<td>$I_L, I_H$</td>
<td>Inv. cost residential investment</td>
<td>0.048,0.014</td>
<td>$P_L = $100K, P_H = $240K</td>
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<tr>
<td>$\Xi^r_L, \Xi^r_H$</td>
<td>Amenity benefits</td>
<td>0,0.508</td>
<td>$R_L = $1,111, R_H = $1,206</td>
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<tr>
<td>$\Xi^o_L, \Xi^o_H$</td>
<td>Homeownership benefits</td>
<td>0.822,0.904</td>
<td>$ho^L_{hh} = 69%, ho^H_{hh} = 67%$</td>
</tr>
</tbody>
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### Limited spatial sorting

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data L</th>
<th>Model L</th>
<th>Data H</th>
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<tbody>
<tr>
<td>Price per unit</td>
<td>100,000</td>
<td>100,000</td>
<td>240,000</td>
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<tr>
<td>Rent per unit</td>
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<td>1,010</td>
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<td>1,415</td>
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<tr>
<td>Homeownership rate</td>
<td>0.69</td>
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<td>0.67</td>
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<tr>
<td>Income</td>
<td>29,300</td>
<td>29,309</td>
<td>38,261</td>
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<tr>
<td>Price/income</td>
<td>3.41</td>
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<td>Price/rent</td>
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<td>8.25</td>
<td>16.58</td>
<td>14.13</td>
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<tr>
<td>Population share</td>
<td>0.42</td>
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## Model Fit

### Aggregate Life-Cycle

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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 $\rightarrow$ home ownership ↓ in level and cross-section
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![Graphs showing change in young and old home ownership and aggregate home ownership over time]

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Credit Constraints Decomposition

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

![Graph showing share of credit-constrained buyers and purchase rate by age in Region L and Region H.](chart.png)
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
  - Sectors: boost rentals → Delaying Rents
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  - **Sectors:** boost rentals → **Delaying** (Rents)
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)
Regional Heterogeneity Dampens Effectiveness of FTHC

$8k$ subsidy uniform across regions (2008-10)

- “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

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

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# Demographic Determinants of Home Ownership

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

Sources: AHS, Goodman-Mayer (2018)
Regional Distribution of House Price Levels

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

Source: Zillow
Millennial Attitude Towards Home Ownership

- 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 ≈ 0
Young vs. Old Home Ownership Across Regions

Source: ACS, Zillow

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Loan Application, Rejection, Foreclosure Rates Across Regions

Source: HMDA, RealtyTrac, Zillow
Mortgage Underwriting Standards (All Loans)

Sources: Black Knight, eMBS, HMDA, SIFMA, CoreLogic, Urban Institute
Securitization of First-Time Mortgages

Source: FRBNY CCP/Equifax

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Household Problem: Not Buying in High-Price MSA

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

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

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

  \[
  b_{t+1} \geq -\frac{-\theta LTV, t P_{L, t} h}{\theta_{PTV, t} y_t} \]

  \[
  b_{t+1} \geq -\frac{\theta_{PTV, t} y_t}{(1 + r b - \theta)}
  \]
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 ~ type I Extreme Value
- **New:** combine macro-finance model and regional panel data
## Model Fit: Aggregate Moments

### Targeted moments

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<thead>
<tr>
<th>Variable</th>
<th>Data</th>
<th>Model</th>
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<tbody>
<tr>
<td>Wealth/income</td>
<td>4.40</td>
<td>4.15</td>
</tr>
<tr>
<td>Avg. rent/income</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.37</td>
<td>0.32</td>
</tr>
<tr>
<td>P90 LTV</td>
<td>0.92</td>
<td>0.83</td>
</tr>
<tr>
<td>P90 PTI</td>
<td>0.58</td>
<td>0.56</td>
</tr>
<tr>
<td>Migration Rate</td>
<td>0.016</td>
<td>0.014</td>
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### Untargeted LTV and PTI

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<tr>
<td>P50</td>
<td>0.64</td>
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<tr>
<td>P75</td>
<td>0.79</td>
<td>0.79</td>
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<tr>
<td>P90 (targeted)</td>
<td>0.92</td>
<td>0.83</td>
</tr>
</tbody>
</table>
Model: Regional Life-Cycle Profiles

- Income ($1,000)
  - Region L
  - Region H

- Wealth ($1,000)

- Homeownership

- Population
Short Run (Transition Dynamics): Response to Credit Contraction

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

![Graph showing regional and aggregate house price changes](Image)

- More Shocks
- Housing supply elasticity
- IRF decomposition
- Time-varying
Usually attributed to housing supply restrictions $\rho_j, I_j$

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 $H$
- $I_H = I_L$ 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 $\rightarrow$ more heterogeneous busts

- Amplification in 2005 vs. 1997
- Explains “sand states” puzzle during Great Recession
Time-Varying Impact of Credit Constraints

- Heterogeneous house price levels ⇒ heterogeneous busts

- **Counterfactual**: response to same shocks with more equal 1997 house price distribution
  - 2005 price distribution amplifies regional differences and aggregate price decline

![Graph showing regional house prices and aggregate house price index over time with deviation from pre-bust]
Impacts of Shocks

House Price L

Deviation from pre-bust (%)

Period (4 years)

Benchmark, Income, LTV, PTI

House Price H

Deviation from pre-bust (%)

Period (4 years)

Benchmark, Income, LTV, PTI
Extended Model: Leverage Response

![Graph showing the deviation from pre-bust (%) over a period of 10 periods (4 years) with data points for both Model and Data, indicating a drop followed by a rise and eventual stabilization.](image-url)
Extended Model: Consumption Response

![Graph showing consumption response over time]
Regional Population Changes

Source: ACS, Zillow
Rent Dynamics

Source: ACS, Zillow

Pierre Mabille (INSEAD)
Stimulus Policy: First-Time Home Buyer Credit

- **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% ≈ estimates (Berger-Turner-Zwick 2019)