Mortgage Debt, Consumption, and Illiquid Housing Markets in the Great Recession

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The views expressed are those of the authors and not necessarily of the Federal Reserve Bank of St. Louis or the Federal Reserve System.
INTRODUCTION

- Fallout from the housing bust and Great Recession:
  - Real house prices down 25%; existing sales down 40%.
  - Time on the market more than doubled to almost *one year*.
- Housing-induced buildup of debt + collapse in house prices/liquidity ⇒ inability to sell/refinance, highly indebted borrowers forced to deleverage.
- In traditional macroeconomic models, shocks to household balance sheets have only modest effects on consumption.

![Graphs showing nominal and real house prices, existing sales, and average time on the market (TOM) from 2006 to 2016.](image_url)
RESEARCH QUESTIONS

- The contribution of the housing market to the deterioration and recovery in broader economic activity and the availability of credit remains an open question.

Objective: Understand the relationship between housing, debt, and consumption dynamics during the Great Recession and slow recovery.

1. What are the macroeconomic implications of house price declines and spikes in selling delays?

2. How do consumption dynamics respond to changes in the liquidity of the housing market and credit market?

3. Can policy interventions make the housing and credit market more liquid?
**Methodology**

- These issues are analyzed using an incomplete markets macroeconomic model featuring:
  1. Housing tenure decisions (own vs. rent)
  2. Search frictions in the housing market (housing liquidity)
  3. Endogenous credit constraints via long-term mortgages with default (credit liquidity)

- Liquidity affects the equilibrium value $V$ of a house:
  $$V = \text{User Cost (UC)} + \text{Credit Liquidity (CL)} + \text{Housing Liquidity (HL)}$$

- In response to shocks, HL and CL drop, and new buyers are willing to pay less for the house.

- Selling delays increase the risk that homeowners who cannot make payments end up in default: $\downarrow HL \Rightarrow \downarrow CL$.

- Balance sheet adjustments have important implications for consumption.
Related Literature

- **Quantitative macro with housing**
  - Garriga, Manuelli, and Peralta-Alva (2014); Garriga, Kydland, and Sustek (2016); Kaplan, Mitman, and Violante (2016); Huo and Rios-Rull (2016); Berger, Guerrieri, Lorenzoni, and Vavra (2016); Favidukis, Ludvigson, and Van Nieuwerburgh (2016); etc.

- **Search in the housing market**
  - Diaz and Jerez (2013), Albrecht, Gautier, and Vroman (2016); Head, Lloyd-Ellis, and Sun (2014); Guren and McQuade (2015); etc.

- **Debt overhang; consumption; monetary policy**
  - Gomes, Jermann, and Schmid (2014); Mian, Rao, and Sufi (2013); Dynan (2012); Di Maggio, Kermani, and Ramcharan (2014); Aladangady (2014); Greenwald (2016); Kaplan, Moll, and Violante (2016); etc.
**Key Takeaways**

- The baseline model replicates the Great Recession and suggests that tightening credit limits and an increase in risk (via labor markets) were the principal drivers.

- Endogenous housing illiquidity is critical:
  - Amplifies the drop in house prices (27%), residential investment (24%), and consumption (32%).
  - Rationalizes the observed positive correlation between prices, sales, and ownership.
  - Matches the empirical relationship between prices and consumption, and consumption decline more persistent.

- Policy interventions in housing finance (QE):
  - Can boost consumption and speed up the recovery by making the housing market more liquid.
  - The house price response is critical for effectiveness of QE.
THE MODEL: TECHNOLOGY AND PREFERENCES

Households

- Preferences $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t, c_{h,t})$.
  - Owners: house $h \in \{h_1, h_2, h_3\}$ generates $c_h = h$.
  - Apartment dwellers: purchase $a \in [0, \bar{a}]$ competitively and receive housing services $c_h = a$, where $\bar{a} \leq h$.
  - Homeowners always occupy their houses.

- Labor efficiency $e \cdot s$ with cdf $F(e)$ and transitions $\pi_s(s'|s)$.

Technology

- Consumption good $Y_c = z_c N_c$.

- New housing $Y_h = F_h(\bar{L}, S_h, N_h)$.
  - $H' = (1 - \delta_h) H + Y_h'$.

- Linear, reversible technology to produce apartment space from the consumption good $\Rightarrow$ constant rents.
**The Model: Frictional Housing Market**

- Importance of endogenizing housing illiquidity:
  - Ease of selling depends on economic conditions.
  - Challenge to generate correct default behavior and correlation of prices and sales with Walrasian housing.

- Sellers choose list price $x_s$ and sell with prob $p_s(\theta_s(x_s, h))$. Buyers choose $(x_b, h)$ and buy with prob $p_b(\theta_b(x_b, h))$.

- Real estate brokers intermediate trades. Free entry $\Rightarrow$

\[ \kappa_s h \geq \alpha_s(\theta_s(x_s, h))(p_h h - x_s) \Rightarrow p_s(\theta_s(x_s, h)) = \left( \frac{p_h h - x_s}{\kappa_s h} \right)^{\gamma_s} \]

- Equilibrium determination of $p_h$:

\[ \int h^* p_b(\theta_b(x_b^*, h^*; p_h))d\Phi_{\text{rent}} = \underbrace{Y_h(p_h)}_{\text{new housing}} + \underbrace{S_{\text{REO}}(p_h)}_{\text{REO housing}} + \underbrace{\int hp_s(\theta_s(x_s^*, h; p_h))d\Phi_{\text{own}}}_{\text{sold by owner}} \]
The Model: Financial Sector

- Long-term, fixed-rate mortgages with flexible duration that are risk-priced at origination.
- Refinancing is costly with origination cost $\zeta$.
- New borrowers who choose $m'$ with fixed rate $q_m$ receive $q^0_m(\overline{q}_m, m', b', h, s)m'$ at origination.
- Existing borrowers who choose $m' \leq m$ pay $m - \overline{q}_m m'$.
- Importance of long term mortgages:
  - No *forced* deleveraging when house prices drop.
  - Borrowers are shielded from interest rate fluctuations.
  - Houses as ATMs. Credit illiquidity $1/q^0_m$ is endogenous.
THE MODEL: LEGAL ENVIRONMENT

If borrowers default on their mortgages, lenders foreclose with probability \( \varphi \):

1. Mortgage balance set to zero and a foreclosure filing placed on credit record \((f' = 1)\).
   - No recourse in steady state.

2. House repossessed by lender and sold as REO property.
   - Foreclosure cost \( \chi \); maintenance costs, property taxes, etc. given by \( \xi_p h \).
   - Any profits go to the borrower.

3. Households with \( f = 1 \) cannot borrow; flags persist with probability \( 0 < \gamma_f < 1 \).
THE MODEL: HOUSING AND CREDIT ILLIQUIDITY

- Deteriorating housing liquidity lowers credit illiquidity, which further reduces housing liquidity: \( \downarrow p_s \Rightarrow \downarrow q^0_m \Rightarrow p_s \).

- Mortgage prices are

\[
q^0_m((q_m, m'), b', h, s; r', \theta'_s) = \frac{q_m}{1 + \zeta} \mathbb{E} \left\{ p_s + (1 - p_s) \times \left[ d'^* \varphi \min \left\{ J'_{\text{REO}}(h) \frac{m'}{m'}, 1 \right\} ight. \right.
\]

\[
+ d'^* (1 - \varphi) (-\phi + \text{cont. contract for existing balance}) + (1 - d'^*)
\]

\[
\times \left(1 + (1 + \phi) (\text{cont. contract for new balance} - q_m) \frac{m'''}{m'} \mathbf{1}_{[m''' \leq m']} \right) \right\}
\]
HOUSEHOLD DECISION PROBLEMS

▶ State \((y, m, h, s, f)\) for homeowners.
  ▶ Cash at hand \(y\), mortgage debt \(m\), housing \(h\), persistent labor efficiency \(s\), credit flag \(f\).

▶ State \((y, s, f)\) for renters
**House Selling**

- The option value of trying to sell is

\[
R_{sell}(y, m, h, s, 0) = \max\{0, \max_{x_s \geq m-y} p_s(\theta_s(x_s, h)) [(V_{rent} + R_{buy}) (y + x_s - m, s, 0) - V_{own}(y, m, h, s, 0)]\}
\]

- List price constraint: \(x_s \geq m - y\)

- Heavily indebted sellers forced to post high list prices ⇒ long selling delays; debt overhang.
**Calibration I**

- Calibrate the economy to match the cross-section of leverage in 2004, plus other key housing statistics.

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
<th>Source/Reason</th>
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</thead>
<tbody>
<tr>
<td><strong>Independent Parameters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>$\rho$</td>
<td>0.952</td>
<td>Storesletten et al (2004)</td>
</tr>
<tr>
<td>SD of Persistent Shock</td>
<td>$\sigma_e$</td>
<td>0.17</td>
<td>Storesletten et al (2004)</td>
</tr>
<tr>
<td>SD of Transitory Shock</td>
<td>$\sigma_t$</td>
<td>0.49</td>
<td>Storesletten et al (2004)</td>
</tr>
<tr>
<td>IES</td>
<td>$\nu$</td>
<td>0.13</td>
<td>Flavin and Nakagawa (2008)</td>
</tr>
<tr>
<td>Risk Aversion</td>
<td>$\sigma$</td>
<td>2</td>
<td>Standard</td>
</tr>
<tr>
<td>Structure Share</td>
<td>$\alpha_S$</td>
<td>30%</td>
<td>Favilukis et al. (2016)</td>
</tr>
<tr>
<td>Land Share</td>
<td>$\alpha_L$</td>
<td>33%</td>
<td>Lincoln Inst Land Policy</td>
</tr>
<tr>
<td>Holding Costs</td>
<td>$\eta$</td>
<td>0.7%</td>
<td>Moody’s</td>
</tr>
<tr>
<td>Depreciation (Annual)</td>
<td>$\delta_h$</td>
<td>1.4%</td>
<td>BEA</td>
</tr>
<tr>
<td>Rent-Price Ratio (Annual)</td>
<td>$r_h$</td>
<td>3.5%</td>
<td>Sommer et al. (2013)</td>
</tr>
<tr>
<td>Risk-Free Rate (Annual)</td>
<td>$r$</td>
<td>$-1.0%$</td>
<td>Federal Reserve Board</td>
</tr>
<tr>
<td>Servicing Cost (Annual)</td>
<td>$\phi$</td>
<td>3.2%</td>
<td>3.2% Real Mortgage Rate</td>
</tr>
<tr>
<td>Mortgage Origination Cost</td>
<td>$\zeta$</td>
<td>0.4%</td>
<td>FHFA</td>
</tr>
<tr>
<td>Maximum LTV</td>
<td>$\vartheta$</td>
<td>125%</td>
<td>Fannie Mae</td>
</tr>
<tr>
<td>Prob. of Repossession</td>
<td>$\varphi$</td>
<td>0.5</td>
<td>2008 OCC Mortgage Metrics</td>
</tr>
<tr>
<td>Credit Flag Persistence</td>
<td>$\lambda_f$</td>
<td>0.9500</td>
<td>Fannie Mae</td>
</tr>
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</table>
## Calibration II

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
<th>Target</th>
<th>Model</th>
<th>Source/Reason</th>
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</thead>
<tbody>
<tr>
<td><strong>Jointly Determined Parameters</strong></td>
<td></td>
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</tr>
<tr>
<td>Homeownership Rate</td>
<td>$\bar{a}$</td>
<td>3.2840</td>
<td>69.0%</td>
<td>68.9%</td>
<td>Census</td>
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<tr>
<td>Starter House Value</td>
<td>$h_1$</td>
<td>2.7100</td>
<td>2.75</td>
<td>2.75</td>
<td>Corbae and Quintin (2015)</td>
</tr>
<tr>
<td>Housing Wealth (Owners)</td>
<td>$\omega$</td>
<td>0.8159</td>
<td>3.99</td>
<td>3.99</td>
<td>2004 SCF</td>
</tr>
<tr>
<td>Borrowers with $LTV \geq 90%$</td>
<td>$\beta$</td>
<td>0.9749</td>
<td>11.40%</td>
<td>11.28%</td>
<td>2004 SCF</td>
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<tr>
<td>Months of Supply*</td>
<td>$\xi$</td>
<td>0.0013</td>
<td>4.90</td>
<td>4.89</td>
<td>Nat’l Assoc of Realtors</td>
</tr>
<tr>
<td>Avg. Buyer Search (Weeks)</td>
<td>$\gamma_b$</td>
<td>0.0940</td>
<td>10.00</td>
<td>10.04</td>
<td>Nat’l Assoc of Realtors</td>
</tr>
<tr>
<td>Maximum Bid Premium</td>
<td>$\kappa_b$</td>
<td>0.0209</td>
<td>2.5%</td>
<td>2.5%</td>
<td>Gruber and Martin (2003)</td>
</tr>
<tr>
<td>Maximum List Discount</td>
<td>$\kappa_s$</td>
<td>0.1256</td>
<td>15%</td>
<td>15%</td>
<td>RealtyTrac</td>
</tr>
<tr>
<td>Foreclosure Discount</td>
<td>$\chi$</td>
<td>0.1370</td>
<td>20%</td>
<td>20%</td>
<td>Pennington-Cross (2006)</td>
</tr>
<tr>
<td>Foreclosure Starts (Annual)</td>
<td>$\gamma_s$</td>
<td>0.6550</td>
<td>1.20%</td>
<td>1.29%</td>
<td>Nat’l Delinquency Survey</td>
</tr>
<tr>
<td><strong>Model Fit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrowers with $LTV \geq 80%$</td>
<td></td>
<td></td>
<td>21.90%</td>
<td>27.2%</td>
<td>2004 SCF</td>
</tr>
<tr>
<td>Borrowers with $LTV \geq 95%$</td>
<td></td>
<td></td>
<td>7.10%</td>
<td>7.25%</td>
<td>2004 SCF</td>
</tr>
<tr>
<td>Median Owner Liq. Assets</td>
<td></td>
<td>0.19</td>
<td>0.22</td>
<td>2004 SCF</td>
<td></td>
</tr>
</tbody>
</table>
Replicating the Great Recession

- Financial Conditions
  - The maximum LTV $\vartheta$ drops from 125% to 90% and the origination cost $\zeta$ increases from 0.4% to 2%.
  - The real risk-free rate $r$ increases from $-1\%$ to 3% for 8 quarters.

- Labor Market Conditions
  - Higher uncertainty: deteriorating transitions $\pi_s(s'|s)$ gradually reduce labor supply by 6.2%.
  - TFP $A_c$ decreases by 5% for 12 quarters.
THE SIMULATED GREAT RECESSION

<table>
<thead>
<tr>
<th></th>
<th>ΔHouse Prices</th>
<th>ΔConsumption</th>
<th>Max Foreclosures</th>
<th>Max TOM</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>−23.8%</td>
<td>−17.9%</td>
<td>4.3%</td>
<td>51.0 weeks</td>
<td>68.9%/64.3%</td>
</tr>
<tr>
<td>Data</td>
<td>−25.9%</td>
<td>−16.0%</td>
<td>5.2%</td>
<td>50.8 weeks</td>
<td>69.0%/64.0%</td>
</tr>
</tbody>
</table>
The LTV tightening contributes 5 – 6 percentage points to the house price and consumption declines.

Removing the LTV tightening reduces foreclosures by half and alleviates selling delays.
## Decomposition: Financial Conditions

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Excluded</th>
<th>Alone</th>
<th>Bounds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tighter Credit Access</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House Price Trough</td>
<td>−23.8%</td>
<td>−19.2%</td>
<td>−5.6%</td>
<td>[4.6%,5.6%]</td>
</tr>
<tr>
<td>Consumption Trough</td>
<td>−17.9%</td>
<td>−13.2%</td>
<td>−4.0%</td>
<td>[4.0%,4.7%]</td>
</tr>
<tr>
<td>Peak Foreclosure Rate</td>
<td>4.3%</td>
<td>2.4%</td>
<td>0.7%</td>
<td>[0.1pp,1.9pp]</td>
</tr>
<tr>
<td>Peak TOM (Weeks)</td>
<td>51.0</td>
<td>40.1</td>
<td>25.1</td>
<td>[1.9,10.9]</td>
</tr>
<tr>
<td><strong>Interest Rate Increase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House Price Trough</td>
<td>−23.8%</td>
<td>−20.2%</td>
<td>−3.8%</td>
<td>[3.6%,3.8%]</td>
</tr>
<tr>
<td>Consumption Trough</td>
<td>−17.9%</td>
<td>−14.6%</td>
<td>−5.0%</td>
<td>[3.3%,5.0%]</td>
</tr>
<tr>
<td>Peak Foreclosure Rate</td>
<td>4.3%</td>
<td>4.0%</td>
<td>1.2%</td>
<td>[0.3pp,0.6pp]</td>
</tr>
<tr>
<td>Peak TOM (Weeks)</td>
<td>51.0</td>
<td>44.2</td>
<td>27.2</td>
<td>[4.0,6.8]</td>
</tr>
</tbody>
</table>

To quantify each shock, two differences are calculated: (1) excluded vs. baseline, and (2) alone vs. steady state (zero by construction, except for foreclosures).
Highly nonlinear foreclosure response to house prices.

Labor risk is necessary for declining homeownership.

TFP has modest effects as in Kehoe et al (2014).
# Decomposition: Labor Market Conditions

<table>
<thead>
<tr>
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<th>Baseline</th>
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<th>Alone</th>
<th>Bounds</th>
</tr>
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<tbody>
<tr>
<td><strong>Labor Risk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House Price Trough</td>
<td>-23.8%</td>
<td>-14.8%</td>
<td>-11.6%</td>
<td>[9.0%,11.6%]</td>
</tr>
<tr>
<td>Consumption Trough</td>
<td>-17.9%</td>
<td>-12.2%</td>
<td>-4.6%</td>
<td>[4.6%,5.7%]</td>
</tr>
<tr>
<td>Peak Foreclosure Rate</td>
<td>4.3%</td>
<td>1.2%</td>
<td>1.5%</td>
<td>[0.9pp,3.1pp]</td>
</tr>
<tr>
<td>Peak TOM (Weeks)</td>
<td>51.0</td>
<td>38.8</td>
<td>32.8</td>
<td>[9.6,12.2]</td>
</tr>
<tr>
<td><strong>TFP Drop</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House Price Trough</td>
<td>-23.8%</td>
<td>-21.7%</td>
<td>-2.0%</td>
<td>[2.0%,2.1%]</td>
</tr>
<tr>
<td>Consumption Trough</td>
<td>-17.9%</td>
<td>-14.9%</td>
<td>-1.5%</td>
<td>[1.5%,3.0%]</td>
</tr>
<tr>
<td>Peak Foreclosure Rate</td>
<td>4.3%</td>
<td>3.0%</td>
<td>1.7%</td>
<td>[1.1pp,1.3pp]</td>
</tr>
<tr>
<td>Peak TOM (Weeks)</td>
<td>51.0</td>
<td>47.3</td>
<td>25.7</td>
<td>[2.5,3.7]</td>
</tr>
</tbody>
</table>

To quantify each shock, two differences are calculated: (1) excluded vs. baseline, and (2) alone vs. steady state (zero by construction, except for foreclosures).
The Role of Endogenous Housing Illiquidity
The Role of Endogenous Housing Illiquidity

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Exogenous Illiquidity</th>
<th>Amplification</th>
</tr>
</thead>
<tbody>
<tr>
<td>House Price Trough</td>
<td>-23.8%</td>
<td>-18.8%</td>
<td>26.6%</td>
</tr>
<tr>
<td>Res. Investment Trough</td>
<td>-52.9%</td>
<td>-42.7%</td>
<td>23.9%</td>
</tr>
<tr>
<td>Consumption Trough</td>
<td>-17.9%</td>
<td>-13.6%</td>
<td>31.6%</td>
</tr>
<tr>
<td>Peak Foreclosure Rate</td>
<td>4.3%</td>
<td>1.3%</td>
<td>428.6%</td>
</tr>
</tbody>
</table>

Conceptually, the value of housing $V$ satisfies

$$V = \text{User Cost (UC)} + \text{Credit Liquidity (CL)} + \text{Housing Liquidity (HL)}$$

Its variance is then

$$\sigma^2_V = \sigma^2_{UC} + \sigma^2_{CL} + \sigma^2_{HL} + 2\sigma_{UC,CL} + 2\sigma_{UC,HL} + 2\sigma_{CL,HL}$$

Model with exogenous illiquidity:

$$\sigma^2_V = \sigma^2_{UC} + \sigma^2_{CL} + 2\sigma_{UC,CL}$$
Consumption and Housing

- Consumption is sensitive to house prices (elasticity = 0.3), consistent with Mian and Sufi evidence.

- Endogenous illiquidity increases persistence of this sensitivity and magnifies consumption drop.
INDIVIDUAL CONSUMPTION DYNAMICS

**Graphs and Charts:**

- **Homeowners vs. Renters:**
  - Time (years)
  - Consumption Change (%)
  - Graphs showing consumption change over time for Homeowners and Renters.

- **LTV > 80% vs. 0% < LTV < 50%:**
  - Time (years)
  - Consumption Change (%)
  - Graphs depicting consumption changes for different LTV categories during the Great Recession.

- **Non-Defaulters vs. Defaulters:**
  - Time (years)
  - Consumption Change (%)
  - Graphs illustrating consumption changes for Non-Defaulters and Defaulters.

- **Future Defaulters:**
  - Time (years)
  - Consumption Change (%)
  - Graph showing consumption changes for Future Defaulters during the Great Recession.

**Steady State:**

- Steady State representation is mentioned, indicating a state of equilibrium or stability in consumption dynamics.
Housing Finance: FRM vs. ARM

- FRMs provide insurance against interest rate fluctuations.
- The model with ARMs amplifies the house price drop, surge in foreclosures, and decline in homeownership.
Consumption Dynamics: FRM vs. ARM

Consumption for highly leveraged borrowers falls by 32% more (21% vs. 16%) with ARMs.
QE: The Role of Expectations and Loan Type

The Role of Expectations and Loan Type

House Prices

Ownership Rate

Consumption

Median Borrower Leverage

0 2 4 6

0.75
0.8
0.85
0.9

0 2 4 6

0.65
0.7
0.75
0.8
0.85
0.9

0 2 4 6

0.65
0.7
0.75
0.8
0.85
0.9
QE, Consumption, and House Prices

- The endogenous response of house prices accounts for much of the increase in consumption.

- Policy affects the consumption sensitivity to house prices.
QE AND CONSUMPTION DYNAMICS: FRMs

**Introduction**

**The Model**

**Calibration**

**Results**

**Conclusions**
QE AND CONSUMPTION DYNAMICS: ARM

**Introduction**

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**Results**

**Conclusions**
The model replicates the Great Recession and suggests that tightening credit limits and higher labor market risk were the principal drivers.

Endogenous housing illiquidity amplifies the drop in prices (27%) and consumption (32%) and is needed to explain foreclosure, sales, and ownership dynamics.

The model rationalizes the empirical relationship between house prices and consumption.

Quantitative easing effectively boosts house prices and consumption. The response of house prices is critical for the effectiveness of QE.
## The Full Boom/Bust/Recovery Episode

### Graphs

- **House Prices**
  - Time (years): 0, 2, 4, 6, 8, 10
  - Values: 0.9, 1, 1.1, 1.2, 1.3, 1.4

- **Average Time on Market**
  - Time (years): 0, 2, 4, 6, 8, 10
  - Values: 10, 20, 30, 40, 50

- **Annual Foreclosure Rate**
  - Time (years): 0, 2, 4, 6, 8, 10
  - Values: 0, 0.005, 0.01, 0.015, 0.02

- **Ownership Rate**
  - Time (years): 0, 2, 4, 6, 8, 10
  - Values: 0.64, 0.65, 0.66, 0.67, 0.68, 0.69

- **Consumption**
  - Time (years): 0, 2, 4, 6, 8, 10
  - Values: 0.9, 0.95, 1, 1.05, 1.1

- **Median Borrower Leverage**
  - Time (years): 0, 2, 4, 6, 8, 10
  - Values: 0.5, 0.6, 0.7, 0.8, 0.9

### Table

<table>
<thead>
<tr>
<th></th>
<th>ΔHouse Prices</th>
<th>ΔConsumption</th>
<th>Forecl&lt;sub&gt;max&lt;/sub&gt;</th>
<th>TOM&lt;sub&gt;max&lt;/sub&gt;</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>−23.8%</td>
<td>−17.9%</td>
<td>4.3%</td>
<td>51.0 weeks</td>
<td>68.9%/64.3%</td>
</tr>
<tr>
<td>Boom/Bust</td>
<td>−23.2%</td>
<td>−16.0%</td>
<td>1.7%</td>
<td>41.1 weeks</td>
<td>68.1%/64.7%</td>
</tr>
</tbody>
</table>

**Back to Baseline**
Consumption during the Great Recession
INDIVIDUAL CONSUMPTION DYNAMICS