House Price Booms, Current Account Deficits, and Low Interest Rates

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House Prices

- Boom-bust cycle trigger for Great Recession: What drives house prices?
U.S. House Prices and Current Account

Correlation = −0.81

U.S. current account balance % of GDP

U.S. real house price index (FHFA/CPI, 2001=100)

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“...[C]ountries in which current accounts worsened...had greater house price appreciation over this period [2001Q4-2006Q3]. ... This simple relationship requires more interpretation before any strong conclusions about causality can be drawn...”

Speech by Chairman Ben S. Bernanke
Annual Meeting of the American Economic Association
Atlanta, GA – January 3, 2010
Causality?

1. **Consensus**: From current account to house prices (foreign factors)

   - Global saving glut hypothesis (Bernanke, 2005)
   - Theory: Shortage of safe assets in emerging markets (Caballero et al., 2008b) or better risk-sharing opportunities in U.S. (Mendoza et al. 2009)
   - Evidence: 4% increase in lagged current account associated with 10% appreciation of real estate prices (Aizenman and Jinjarak, 2009)

2. This paper: From house prices to current account (domestic factors)

   - Theory: Financial deregulation (Boz and Mendoza, 2011; Favilukis et al. 2011) or preference shocks (Gete, 2010; Justiniano et al. 2013)
   - Evidence: House price shocks explain \( \approx 30\% \) of U.S. trade balance over a 20-quarter horizon (Fratzscher et al., 2010)
   - Problem: Domestic shocks \( \Rightarrow \) Real interest rate tends to increase

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Real Interest Rates

U.S. Short–Term Real Interest Rate

U.S. Long–Term Real Interest Rates

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Results

- If financial deregulation and/or preference shocks can explain house price boom and \( \text{corr}(hp, ca) \approx -1 \), what explains low real interest rates?
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  *By now, everyone accepts some version of...a global savings glut is at the root of the problem [of low interest rates].*

  Kenneth Rogoff
  “The Long Mystery of Low Interest Rates”
  The Korea Times, 04/19/2013
Results

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  - Low nominal interest rates in early 2000s
  - Foreign exchange rate pegs in emerging markets
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  - For house prices (Taylor, 2008)?
  - For current account (Dooley et al., 2008)?
Results

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  - Low nominal interest rates in early 2000s
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- Do these factors play a role
  - For house prices (Taylor, 2008)? No
  - For current account (Dooley et al., 2008)? No

- **Dichotomy**
  - Credit/Preference shocks ⇒ House prices and $ corr(hp, ca) $
  - Monetary policy ⇒ Low real interest rates
Two-Country Model with Borrowing Constraints

- Countries: Home and Foreign
- Goods:
  - Tradable consumption goods produced in each country
  - Housing in fixed supply (land)
- Assets:
  - Risk-free bond denominated in Home currency traded internationally
  - Risk-free bond denominated in Foreign currency traded domestically
- Frictions:
  - Financial: Collateral constraint
  - Nominal: Sticky prices and wages
- Monetary authority follows standard interest rate rule
Household Problem

- **Utility**

\[ U_t \equiv \mathbb{E}_t \left\{ \sum_{s=0}^{\infty} \beta^s \left[ \frac{X_t^{1-\sigma}}{1-\sigma} - \frac{1}{1+\nu} \int_0^1 L_{t+s}(i)^{1+\nu} di \right] \right\} \]

- **Consumption indexes**

\[ X_t \equiv \left[ \omega C_t^{\frac{e-1}{e}} + (1-\omega) e^{\eta_t} H_t^{\frac{e-1}{e}} \right]^{\frac{e}{e-1}} \quad \text{and} \quad C_t \equiv \left[ \alpha^{\frac{1}{\gamma}} C_{ht}^{\frac{1}{\gamma}-1} + (1-\alpha)^{\frac{1}{\gamma}} C_{ft}^{\frac{1}{\gamma}-1} \right]^{\frac{\gamma}{\gamma-1}} \]

- **Budget constraint**

\[ P_{ht} C_{ht} + P_{ft} C_{ft} + Q_t H_t - B_t \leq \int_0^1 W_t(i) L_t(i) di + Q_t H_{t-1} + T_t - (1+i_{t-1})B_{t-1} \]

- **Borrowing constraint**

\[ (1+i_t)B_t \leq \Theta_t \mathbb{E}_t(Q_{t+1} H_t) \]
Wage and Price Setting

- Sticky wages:

\[
\max_{W_t(i)} \mathbb{E}_t \left\{ \sum_{s=0}^{\infty} (\beta \zeta^s)^s \lambda_{t+s} \left[ W_t(i) L_{t+s}(i) - \frac{L_{t+s}(i)^{1+\nu}}{1+\nu} \right] \right\}
\]

subject to

\[
L_{t+s}(i) = \left[ \frac{W_t(i)}{W_{t+s}} \right]^{-\phi_w} L_{t+s}
\]

- Sticky prices:

\[
\max_{P_t(h)} \mathbb{E}_t \left\{ \sum_{s=0}^{\infty} (\beta \zeta^s)^s \lambda_{t+s} \left[ P_t(h) Y_{t+s}(h) - W_{t+s} L_{t+s} \right] \right\}
\]

subject to

\[
Y_{t+s}(h) = \left[ \frac{P_t(h)}{P_{ht+s}} \right]^{-\phi_p} Y_{ht+s} \quad \text{and} \quad Y_t(h) = AL_t
\]
Monetary Policy and Equilibrium

- Interest rate rule (Taylor, 1993; plus smoothing)

\[
(1 + i_t) = (1 + i_{t-1})^{\rho_i} \left[ (1 + i) \left( \frac{\Pi_{Xt}}{\tilde{\Pi}_{Xt}} \right)^{\psi_{\pi}} \left( \frac{Y_{ht}}{\tilde{Y}_{ht}} \right)^{\psi_y} \right]^{1-\rho_i} e^{\varepsilon_{it}}
\]

where \( \Pi_{Xt} \equiv P_{Xt} / P_{Xt-1}, \) \( P_{Xt} \equiv P_t^{\omega_X} OER_t^{1-\omega_X} \) and \( OER_t \equiv MRS_t^{C,H} \)
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- Law of one price holds for tradable goods but PPP doesn’t because of home bias

\[P_{ht} = \mathcal{E}_t P_{ht}^* \quad \text{and} \quad S_t \equiv \frac{\mathcal{E}_t P_t^*}{P_t} \neq 1\]

- Equilibrium in the goods market

\[Y_{ht} = C_{ht} + C_{ht}^* = \left( \frac{P_{ht}}{P_t} \right)^{-\gamma} \left[ \alpha C_t + (1 - \alpha) S_t^\gamma C_t^* \right] \]

- Equilibrium in asset markets

\[H_t = H \quad \text{and} \quad B_t + B_t^* = 0\]
Monetary Policy and Equilibrium

- Interest rate rule (Taylor, 1993; plus smoothing)

\[
(1 + i_t) = (1 + i_{t-1})^\rho_i \left[ (1 + i) \left( \frac{\Pi X_t}{\Pi X_{t-1}} \right)^\psi_{\pi} \left( \frac{Y_{ht}}{Y_{ht}} \right)^\psi_y \right]^{1-\rho_i} e^{\epsilon_{it}}
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where \(\Pi X_t \equiv P_{Xt}/P_{Xt-1}, P_{Xt} \equiv P_t^{\omega X} \text{OER}_t^{1-\omega X}\) and \(\text{OER}_t \equiv \text{MRS}_t^{C,H}\)

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- Price of land explains 2/3 of U.S. house prices (Davis and Heathcote, 2007)
Asymmetric Steady State

- Two-country model admits
  - One symmetric steady state with $B = 0$
  - A continuum of asymmetric steady states indexed by $B \neq 0$

\begin{align*}
\theta_t & = \tilde{\theta}_t + \Xi \Theta \left[ \xi_t + \theta_t - (\eta_t + c_t) + E_t q_t + 1 + E_t \pi_t + 1 \right]
\end{align*}

$\tilde{\theta}_t$ is formula for real house prices absent borrowing constraint

$\Rightarrow$ Focus on asymmetric steady state ($\beta < \beta^* \Rightarrow B > 0 \Rightarrow \Xi > 0$)

Aside: Open economy model with incomplete markets but binding borrowing constraint pins down steady state net foreign debt position
Asymmetric Steady State

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- Solve the model with linear methods
  - Symmetric steady state not interesting for looking at effects of $\theta_t$ ($\Xi = 0$)

$$q_t = \tilde{q}_t + \Xi\Theta[\xi_t + \theta_t - (\eta_t + c_t) + \mathbb{E}_t q_{t+1} + \mathbb{E}_t \pi_{t+1}]$$

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### Standard (International) Macro Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>$\beta^*$</td>
<td>0.99</td>
<td>Foreign discount factor</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>2</td>
<td>Risk aversion</td>
</tr>
<tr>
<td>$\nu$</td>
<td>2</td>
<td>Frisch elasticity</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.7</td>
<td>Home bias</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>2</td>
<td>Elasticity of substitution H vs F</td>
</tr>
<tr>
<td>$\epsilon$</td>
<td>1</td>
<td>Elasticity of substitution C vs H</td>
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<tr>
<td>$\phi_p = \phi_w$</td>
<td>7.67</td>
<td>Elasticity of substitution among varieties</td>
</tr>
<tr>
<td>$\zeta_p = \zeta_w$</td>
<td>0.75</td>
<td>Price and wage stickiness</td>
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<tr>
<td>$\psi_{\pi}$</td>
<td>1.5</td>
<td>Taylor rule coefficient on inflation</td>
</tr>
<tr>
<td>$\psi_y$</td>
<td>0.5</td>
<td>Taylor rule coefficient on output</td>
</tr>
<tr>
<td>$\rho_i$</td>
<td>0.7</td>
<td>Interest rate smoothing</td>
</tr>
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<td>$\omega_X$</td>
<td>0.7</td>
<td>Weight on goods consumption price index</td>
</tr>
</tbody>
</table>
House Price Booms

- Two potential drivers (domestic factors):
  1. Financial deregulation
  2. Preference shocks

  1. Financial deregulation:
     - Debate on actual importance for house price boom/bust (Favilukis et al., 2011; vs. Justiniano et al., 2013)
     - Take as given ongoing debate on causes
       - Political response to inequality (Rajan, 2010)
       - Political economy of financial system (Mian et al., 2013)
       - Technological improvements in banking (Favara and Imbs, 2011)

  2. Preference shocks:
     - Possibly a stand-in for house price bubbles (Case and Shiller, 2003)
     - Crucial role in estimated DSGE models (Iacoviello and Neri, 2010)
     - Can generate negative correlation with current account (Gete, 2010)
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1. $\Theta$ literally represents Loan-to-Value ratio:
   - $\Theta_t$ from 85% to 95% between 2001 and 2006 (Justiniano et al., 2013)

Source: Duca, Muellbauer and Murphy (2011, updated 2013)
Financial Deregulation: Two Experiments

1. \( \Theta \) literally represents Loan-to-Value ratio:
   - \( \Theta_t \) from 85% to 95% between 2001 and 2006 (Justiniano et al. 2013)

2. \( B \) represents all forms of collateralized borrowing:
   - \( \Theta_t \) from 75% to 99% between 2001 and 2006 (Favilukis et al. 2011)
Financial Deregulation: Two Experiments

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   - $\Theta_t$ from 85% to 95% between 2001 and 2006 (Justiniano et al. 2013)

2. $B$ represents all forms of collateralized borrowing:
   - $\Theta_t$ from 75% to 99% between 2001 and 2006 (Favilukis et al. 2011)
   - HELs allow for additional credit (Mian and Sufi, 2011)
   - Also capture reduction of transaction costs (Favilukis et al. 2011)
   - Entry of households previously unable to buy (Geanakoplos, 2010a,b)
   - At peak of boom marginal household borrows with zero downpayment (Haughwout et al., 2011)
Financial Deregulation: Two Experiments

1. $\Theta$ literally represents Loan-to-Value ratio:
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   - $\Theta_t$ from 75% to 99% between 2001 and 2006 (Favilukis et al. 2011)

- Persistence: $\rho_\theta = 0.99$
  - “Regime-switching effect” (Boz and Mendoza, 2012)

- Find $\beta$ s.t. financial deregulation fully generates boom
  - If $\Theta_t$ from 85 to 95% $\Rightarrow \beta = 0.89$
  - If $\Theta_t$ from 75 to 99% $\Rightarrow \beta = 0.96$

- Generate full boom-bust cycle but focus on boom only
Financial Deregulation

House Prices

% deviations from steady state

Current Account

% GDP

-0.8
-0.6
-0.4
-0.2
0

Current Account

quarters

\( \theta = 0.85 \rightarrow 0.95 \)

\( \theta = 0.75 \rightarrow 0.99 \)
Preference Shocks: Equivalence Result

- In spite of evidence of higher LTVs, not obvious lower collateral constraints cause house price booms (Glaeser et al., 2008)
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- **Alternative:** House price (preference) shocks

\[ q_t = (1 - \beta - \Xi \Theta) \eta_t + \Xi \Theta \theta_t + \ldots, \]

- Direct impact of preference shocks $\propto$ Direct impact of financial deregulation
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  \[ q_t = (1 - \beta - \Xi \Theta) \eta_t + \Xi \Theta \theta_t + ..., \]

  - Direct impact of preference shocks \( \propto \) Direct impact of financial deregulation

- Main difference: Preference shocks do not directly impact debt
  - Deterioration of current account less pronounced
Preference Shocks: Equivalence Result

House Prices

% deviations from steady state

0 5 10 15 20
2 4 6 8 10 12 14 16 18 20

House Prices

Current Account

% of GDP

Borrowing constraint shocks
Preference shocks

2 4 6 8 10 12 14 16 18 20

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House Prices, Current Account, Interest Rates

November 14, 2013
Financial Deregulation and Preference Shocks

- Full house price boom
- Between 1/4 and almost 1/2 of current account deterioration (% of GDP)
  - Corollary: $\text{corr}(hp, ca) \approx -1$
Financial Deregulation and Preference Shocks

- Full house price boom
- Between 1/4 and almost 1/2 of current account deterioration (% of GDP)
  - Corollary: $\text{corr}(hp, ca) \approx -1$
- Also consistent with:
  - Increase in net foreign debt (Lane and Milesi-Ferretti, 2007)
  - Increase in consumption: Non-durable consumption $\approx 2\%$ above trend
Financial Deregulation and Preference Shocks

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- Between 1/4 and almost 1/2 of current account deterioration (% of GDP)
  ▶ Corollary: $\text{corr}(hp, ca) \approx -1$

- Problem: Counterfactual evolution of real interest rate

```
<table>
<thead>
<tr>
<th>Year</th>
<th>Real Interest Rate: Data</th>
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<tbody>
<tr>
<td>2000</td>
<td>4.5</td>
</tr>
<tr>
<td>2001</td>
<td>3.2</td>
</tr>
<tr>
<td>2002</td>
<td>2.1</td>
</tr>
<tr>
<td>2003</td>
<td>1.5</td>
</tr>
<tr>
<td>2004</td>
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<td>2005</td>
<td>1.5</td>
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<table>
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<th>Quarter</th>
<th>Real Interest Rate: Model</th>
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<tr>
<td>1</td>
<td>Θ = 0.85−&gt;0.95</td>
</tr>
<tr>
<td>2</td>
<td>Θ = 0.75−&gt;0.99</td>
</tr>
<tr>
<td></td>
<td>Preference shocks</td>
</tr>
</tbody>
</table>
```

Popular explanation: Global saving glut (Bernanke, 2005)

This paper: A role for monetary policy?

⋆ Loose monetary policy in the U.S. (Taylor, 2008)

⋆ Foreign exchange rate pegs (Dooley et al., 2008)
Financial Deregulation and Preference Shocks

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Taylor’s Hypothesis

- Loose U.S. monetary policy caused housing bubble (Taylor, 2008)
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  - Fed kept FFR below “prescribed” interest rate between 2001 and 2005
  - If inflation expectations anchored $\Rightarrow$ Real interest rate too low
  - Interest-rate sensitive sectors (e.g. housing) took off

Quantitative evaluation of Taylor’s hypothesis:
- Domestic factors continue to generate house price boom
  $\Theta$ from 85 to 95% ($\beta = 0.95$) $\Rightarrow$ 50% of boom
  Other 50% due to preference shocks
- Departures of FFR from interest rate prescribed by $i_t = 0.7 \ast i_{t-1} + 0.3 \ast [1.5 \ast (\pi_t - 2) + 0.5 \ast (y_t - \tilde{y}_t)]$
  $\pi_t \equiv$ YOY CPI inflation
  $y_t - \tilde{y}_t \equiv$ Deviation of real GDP from CBO potential
Taylor’s Hypothesis

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    \[
    i_t = 0.7^* i_{t-1} + 0.3^* [1.5^* (\pi_t - 2) + 0.5^* (y_t - \tilde{y}_t)]
    \]
    - $\pi_t \equiv$ YOY CPI inflation
    - $y_t - \tilde{y}_t \equiv$ Deviation of real GDP from CBO potential
Evaluating Taylor’s Hypothesis

House Prices

Current Account

Real Interest Rate

Domestic and Monetary Policy shocks

Domestic shocks only

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Summary

1. Domestic shocks account for house price boom and $corr(hp, ca) \approx -1$

2. Monetary policy shocks unimportant for house prices and current account

3. Monetary policy shocks explain low real interest rate
Summary

1. Domestic shocks account for house price boom and $\text{corr}(hp, ca) \approx -1$

2. Monetary policy shocks unimportant for house prices and current account

3. Monetary policy shocks explain low real interest rate
   - Effect still small (model: $\approx -1\%$, data: $\approx -4\%$)
Summary

1. Domestic shocks account for house price boom and $corr(hp, ca) \approx -1$

2. Monetary policy shocks unimportant for house prices and current account

3. Monetary policy shocks explain low real interest rate
   - Effect still small (model: $\approx -1\%$, data: $\approx -4\%$)

Role for foreign monetary policy?
   - Assume ROW pegs to $\Rightarrow$ Evaluation of “Bretton Woods II” hypothesis
Who Finances U.S. External Deficits?

Bilateral U.S. trade balance % of GDP by area

Europe
Canada
Japan
Other (includes China and OPEC until 1998)
China (post−1998)
OPEC (post−1998)
The “Bretton Woods II” Hypothesis

- Emerging markets and oil producers pegged exchange rate to $
  - IMF exchange rate regime classification
- These countries “finance” widening U.S. current account deficit
  - Emerging Asia: High productivity growth
  - Oil Producers: High oil prices
- Flexible exchange rates $\Rightarrow$ Appreciation of domestic currency
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- Flexible exchange rates $\Rightarrow$ Appreciation of domestic currency

- Peg $\Rightarrow$ Emerging economies “import” U.S. monetary policy

- Loose U.S. monetary policy $\Rightarrow$ Loose global monetary policy 
  - Downward pressure on world real interest rates
  - Prevents U.S. real exchange rate from depreciating
  - Policy stimulus for emerging markets exports
Evaluating “Bretton Woods II” Hypothesis

House Prices

Current Account

Real Interest Rate

Andrea Ferrero (Oxford)
Conclusions

- Financial deregulation + Preference Shocks $\Rightarrow \text{corr}(hp, ca) \approx -1$

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Extensions:

1. Risk-taking channel of monetary policy? Little evidence from LTVs and FFR
Conclusions

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Extensions:

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Interest Rates and Financial Deregulation

- Financial deregulation process exogenous to monetary policy
  - Objection: Low(er) interest rates encourage excessive risk-taking
    1. Lower than predicted by benchmark rule? (Taylor, 2008)
    2. Low levels? (Rajan, 2013)

\[
LTV_t = \alpha + \rho LTV_{t-1} + \beta x_t + u_t
\]

\begin{align*}
\alpha &= 0.000 \quad 0.000 \quad 0.000 \\
\rho &= 0.696 \quad 0.000 \quad 0.000 \\
\beta &= 0.480 \quad 0.500 \quad 0.502 \\
\end{align*}

\begin{align*}
x_t &= \text{FFR}_t \\
\end{align*}

(0.004) (0.074) (0.003)

(0.004) (0.079) (0.002)
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\[
\begin{array}{ccc}
 & \alpha & \beta & R^2 \\
\hline
x_t = \varepsilon_{FFR,t} & -0.010** & -0.013*** & 0.145 \\
& (0.005) & (0.003) & \\
\hline
x_t = FFR_t & -0.001 & -0.008*** & 0.146 \\
& (0.005) & (0.002) & \\
\end{array}
\]
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<table>
<thead>
<tr>
<th></th>
<th>(\alpha)</th>
<th>(\rho)</th>
<th>(\beta)</th>
<th>(R^2)</th>
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<tr>
<td>(x_t = 0)</td>
<td>0.000</td>
<td>0.696***</td>
<td>0</td>
<td>0.480</td>
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<td>0.641***</td>
<td>-0.005*</td>
<td>0.500</td>
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Dicotomy:

- Financial deregulation + Preference Shocks $\Rightarrow corr(hp, ca) \approx -1$
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Monetary Policy and Asset Prices

- Dicotomy:
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- What would have happened if Fed had responded to house prices?

\[
i_t = \rho_i i_{t-1} + (1 - \rho_i) (\psi \pi_X + \psi y_y h_t) + \psi q \Delta q_t + \varepsilon_t
\]
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- **Dicothomy:**
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  - Pick $\psi_q$ so that house prices increase by 10% max
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    \[ i_t = \rho_i i_{t-1} + (1 - \rho_i) (\psi_{\pi} \pi X_t + \psi_{y} y_{ht}) + \psi_{q} \Delta q_t + \varepsilon_{it} \]
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Response to house prices ⇒ Recession + Deflation
Financial Deregulation: Intuition (Partial Equilibrium)

- Steady state of small open economy version with single consumption good, fixed labor supply, no nominal rigidities

\[
RB = \Theta QH \\
QH = (\omega^{-1} - 1) C / (1 - \beta - \Xi \Theta)
\]
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\[
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- **Experiment**: Permanent increase in \( \Theta \) (borrowing constraint)
  - For given consumption, foreign debt and real house prices increase
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- Experiment: Permanent increase in \( \Theta \) (borrowing constraint)
  - For given consumption, foreign debt and real house prices increase
  - Endogenous amplification on \( B \) via \( QH \)
  - Eventually, consumption decreases to repay debt
    \[
    C = Y - (R - 1)B
    \]
    But along transition consumption booms (credit availability increases)
Permanent Increase in LTV from 80% to 90%
Intuition (Partial Equilibrium)

- Steady state of small open economy version with single consumption good, fixed labor supply, no nominal rigidities

Net foreign debt \( RB = \Theta QH \)

Real value of housing stock \( QH = (\eta^{-1} - 1) C / (1 - \beta - \Xi \Theta) \)

- **Note:** Borrowing constraint binding

\[ \Xi = (1 - \beta R) / R > 0 \]

- True only if \( 1 - \beta R > 0 \) ⇒ “Low” real interest rate \( (R < 1/\beta) \)
  - True in the data
  - Problem for a two-country model conditional on shocks to \( \Theta \) only
United States: A Nation in Debt

Data source: FRBNY Quarterly Report on Household Debt and Credit

1Data source: FRBNY Quarterly Report on Household Debt and Credit
## Growth of Subprime

### Mortgage Origination by Product (in %)

<table>
<thead>
<tr>
<th>Year</th>
<th>FHA/VA</th>
<th>Conv/Conf</th>
<th>Jumbo</th>
<th>Subprime</th>
<th>Alt A</th>
<th>HEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>8</td>
<td>57</td>
<td>20</td>
<td>7</td>
<td>2</td>
<td>5</td>
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<tr>
<td>2002</td>
<td>7</td>
<td>63</td>
<td>21</td>
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<td>6</td>
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<tr>
<td>2003</td>
<td>6</td>
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<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2004</td>
<td>4</td>
<td>41</td>
<td>17</td>
<td>18</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>2005</td>
<td>3</td>
<td>35</td>
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<tr>
<td>2006</td>
<td>3</td>
<td>33</td>
<td>16</td>
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<tr>
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* Source: Abraham, Pavlov and Wachter (2008)
- FHA/VA = Federal Housing / Veteran Administration
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- HEL = Home Equity Loans
Growth of Subprime

Mortgage Origination by Product (in %)

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Definition of “subprime” (Board of Governors, 2001)
- ≥ 2 30-day (≥ 1 60-day) delinquencies in last 12 (24) months
- Judgment, foreclosure, repossession, or charge-off in prior 24 months
- Bankruptcy in last 5 years
- Relatively high default probability (FICO ≤ 660)
- Debt-income ratio ≥ 50%

Pinto (2008): Subprime is larger than “subprime” (Alt-A and HELs also have subprime characteristics)
## Loan-to-Value Ratios

**LTVs for prime, Alt-A and subprime mortgages (in %)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Fixed-Rate</th>
<th>Adjustable-Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CLTV</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td><strong>Prime</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>65.4 3.0</td>
<td>66.5 4.1</td>
</tr>
<tr>
<td>2003</td>
<td>63.8 4.4</td>
<td>68.2 10.1</td>
</tr>
<tr>
<td>2004</td>
<td>67.4 7.0</td>
<td>73.5 20.7</td>
</tr>
<tr>
<td>2005</td>
<td>70.9 13.4</td>
<td>74.1 21.7</td>
</tr>
<tr>
<td>2006</td>
<td>74.5 23.1</td>
<td>75.3 26.2</td>
</tr>
<tr>
<td><strong>Alt-A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>74.7 22.0</td>
<td>74.3 20.8</td>
</tr>
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<td>78.0 33.3</td>
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</tr>
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</table>

* Source: Abraham, Pavlov and Wachter (2008)
- CLTV = Combined (i.e. first and second mortgage) loan-to-value ratio
# Loan-to-Value Ratios

## LTV ratios (in %)

<table>
<thead>
<tr>
<th>Year</th>
<th>25(^{th})</th>
<th>50(^{th})</th>
<th>75(^{th})</th>
<th>90(^{th})</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>56</td>
<td>80</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>2005</td>
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</tr>
<tr>
<td>2006</td>
<td>70</td>
<td>90</td>
<td>100</td>
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</tbody>
</table>

### All Housing Purchases\(^2\)

<table>
<thead>
<tr>
<th>Year</th>
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</tbody>
</table>

### Non-Prime Purchases\(^3\)

\(^2\)Source: Glaeser, Gottlieb and Gyourko (2010)

\(^3\)Source: Haughwout, Lee, Tracy and Van der Klaauw (2011)
Beyond LTV Ratios: Home Equity Loans (HEL)

- From 5 to 15% of **new** mortgage origination between 2001 and 2007
- Mian and Sufi (2011): Increase in HEL by **existing** homeowners responsible for substantial fraction of:
  - Increase in household **leverage** between 2002 and 2006
  - Increase in **default** rates between 2006 and 2008
- Average household extracts 25c per $1 of house price appreciation
- Borrowed funds not used to buy new real estate or repay (high interest) credit card debt
  - Must be used for real outlays
    - Consumption
    - Home improvement
Notable International Episodes

- **Iceland**: LTVs from 65% to 90% in 2003 (EMF Hyopstat, 2008)
  - 60% increase in real house prices between 2001 and 2006
  - 20% deterioration of current account over same period

- **UK (80s)**: LTVs from 75% to 85% (Ortalo-Magné and Rady, 2004)
  - House prices up 88% between 1982 and 1989
  - Current account balance from $\approx +2\%$ to $\approx -5\%$ over a decade

- **Spain**: Tight regulation on LTV ratios (Bank of Spain)
  - Recent events revealed different reality
  - Plus other ways to get around restrictions (e.g. inflated appraisals)
Lagrange Multipliers

Andrea Ferrero (Oxford)
House Prices, Current Account, Interest Rates
November 14, 2013 39 / 41
The Role of Nominal Rigidities