Capital Inflows and the US Housing Boom

Filipa Sá and Tomasz Wieladek

King’s College London and Bank of England

Housing, Stability and the Macroeconomy
Federal Reserve Bank of Dallas
November 2013
Introduction

- Rapid increase in house prices in the US from the mid-1990s to 2007
- Simultaneous increase in the US current account deficit
- This paper looks at the effect of external shocks which generate capital inflows to the US on the housing market
  - ‘Savings-glut’ shock
  - Monetary policy expansion abroad
- Domestic shocks
  - Monetary policy expansion in the US
  - Financial-deregulation shock
  - Housing-preference shock
Introduction - Evidence

Chart 1. Current account balance and house prices

Sources: OECD Economic Outlook, Federal Housing Finance Agency (FHFA).
Introduction - Our contribution

- Use a 2-country DSGE model to derive predictions for how US and ROW variables respond to different types of shocks:
  
  **External shocks**
  - ‘Savings-glut’ shock
    - Preference shock that makes foreign households more patient
    - Risk-premium shock
  - Foreign monetary expansion

  **Domestic shocks**
  - Domestic monetary expansion
  - Increase in LTV - financial deregulation
  - Housing-preference shock

- Estimate a VAR with sign restrictions to investigate the effect of these shocks on real residential investment and real house prices
Introduction - Results

- ‘Savings-glut’ shocks have a positive and significant effect on real residential investment and real house prices
- These shocks explain a larger fraction of the variation in the housing variables than the other types of shocks that we identify
Theoretical framework

• Adapt the model in Ferrero (2012) to introduce external shocks
  • 2 countries: US and ROW
  • Households consume tradable goods and housing services. Tradable goods can be produced in the US or in ROW. No capital.
  • Households face an endogenous collateral constraint which limits the amount of private credit that they can obtain as a fraction of the expected value of housing
  • Nominal wage and price rigidities: households and intermediate-goods firms set wages and prices on a staggered basis
  • There is a single bond that is traded internationally and is denominated in US dollars. ROW investors can also hold a ROW bond. UIP holds.
Theoretical framework - External Shocks

- Increase in savings in ROW
  Preference of foreign households:

  \[
  U_t^* \equiv E_t \left\{ \sum_{s=0}^{\infty} \beta^s Z_{\beta t+s} \left[ \frac{X_{t+s}^{1-\sigma}}{1-\sigma} - \frac{1}{1+\nu} \int_0^1 L_{t+s}^*(i)^{1+\nu} \, di \right] \right\}
  \]

  \[
  \ln Z_{\beta t}^* = \rho_{\beta t} \ln Z_{\beta t-1}^* + u_{\beta t}^*, \quad u_{\beta t} \sim i.i.d. N(0, \sigma_{\beta t}^2)
  \]

- Risk-premium shock
  UIP condition:

  \[
  i_t = i_t^* + \epsilon_t - E_t \epsilon_{t+1} + z_{\kappa t}
  \]

  \[
  z_{\kappa t} = \rho_{\kappa} z_{\kappa t-1} + u_{\kappa t}, \quad u_{\kappa t} \sim i.i.d. N(0, \sigma_{\kappa}^2)
  \]

  The risk-premium shock is an increase in the perceived safety of US assets, i.e. a reduction in \( z_{\kappa t} \).
Theoretical framework - External Shocks (cont.)

- Expansionary monetary-policy shock in ROW
  Interest-rate rule:

  \[ i_t^* = \rho i_{t-1}^* + (1 - \rho) (\varphi_\pi \pi_t^* + \varphi_y y_{Ft}) + \varphi_\varepsilon (\varepsilon_t - \varepsilon_{t-1}) + z_{i^*t} \]

  \[ z_{i^*t} = \rho z_{i^*t-1} + u_{it}, \quad u_{it} \sim i.i.d. N(0, \sigma_i^2) \]
Theoretical framework - Domestic Shocks

- Expansionary monetary-policy shock in the US
  Interest-rate rule:

  \[ i_t = \rho i_{t-1} + (1 - \rho)(\varphi_\pi \pi_t + \varphi_y y_{H_t}) + z_{it} \]

  \[ z_{it} = \rho_i z_{it-1} + u_{it}, \quad u_{it} \sim i.i.d. N(0, \sigma_i^2) \]

- Financial-deregulation shock

  \[ (1 + i_t) B_t \leq \theta Z_{\theta t} E_t (Q_{t+1} H_t) \]

  \[ \ln Z_{\theta t} = \rho_\theta \ln Z_{\theta t-1} + u_{\theta t}, \quad u_{\theta t} \sim i.i.d. N(0, \sigma_\theta^2) \]

- Housing-preference shock
  Consumption index:

  \[ X_t \equiv \left[ \eta C_t^{\frac{\varepsilon-1}{\varepsilon}} + (1 - \eta) e^{\omega_t} H_t^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}} \]

  \[ \omega_t = \rho_\omega \omega_{t-1} + u_{\omega_t}, \quad u_{\omega_t} \sim i.i.d. N(0, \sigma_\omega^2) \]
Theoretical framework

- We derive theoretical impulse responses that are robust across a range of parameter values:

Table 1. Parameter ranges

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>Preference share for home goods</td>
<td>0.6 – 0.8</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>Elasticity of substitution between home and foreign tradables</td>
<td>1.5 – 2.5</td>
</tr>
<tr>
<td>$\epsilon$</td>
<td>Elasticity of substitution between consumption and housing</td>
<td>0.15 – 1.5</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Coefficient of relative risk aversion</td>
<td>1.5 – 2.5</td>
</tr>
<tr>
<td>$\nu$</td>
<td>Inverse of Frisch elasticity of labour supply</td>
<td>1.5 – 2.5</td>
</tr>
<tr>
<td>$\phi_p$</td>
<td>Elasticity of substitution between intermediate goods</td>
<td>3 – 11</td>
</tr>
<tr>
<td>$\phi_w$</td>
<td>Elasticity of substitution between labor inputs</td>
<td>3 – 11</td>
</tr>
<tr>
<td>$\zeta_p$</td>
<td>Probability that the price does not adjust</td>
<td>0.6 – 0.9</td>
</tr>
<tr>
<td>$\zeta_w$</td>
<td>Probability that the wage does not adjust</td>
<td>0.6 – 0.9</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Smoothing coefficient in Taylor rule</td>
<td>0.5 – 0.9</td>
</tr>
<tr>
<td>$\varphi_\pi$</td>
<td>Response to CPI in Taylor rule</td>
<td>1 – 3</td>
</tr>
<tr>
<td>$\varphi_y$</td>
<td>Response to output in Taylor rule</td>
<td>0.3 – 0.7</td>
</tr>
<tr>
<td>$\varphi_\varepsilon$</td>
<td>Response to nominal exchange rate depreciation in foreign Taylor rule</td>
<td>0 – 3</td>
</tr>
<tr>
<td>$\rho_\eta$</td>
<td>Persistence of preference for housing shock</td>
<td>0.95 – 0.99</td>
</tr>
<tr>
<td>$\rho_\theta$</td>
<td>Persistence of financial deregulation shock</td>
<td>0.95 – 0.99</td>
</tr>
<tr>
<td>$\rho_\kappa$</td>
<td>Persistence of risk-premium shock</td>
<td>0.95 – 0.99</td>
</tr>
<tr>
<td>$\rho_i$</td>
<td>Persistence of monetary-policy shock</td>
<td>0.4 – 0.7</td>
</tr>
<tr>
<td>$\rho_{\beta^*}$</td>
<td>Persistence of foreign preference shock</td>
<td>0.95 – 0.99</td>
</tr>
</tbody>
</table>

with $\beta = 0.98$, $\beta^* = 0.99$, $\theta = 85\%$
Increase in savings in ROW
Risk-premium shock
ROW monetary-policy expansion
Financial deregulation in the US
Positive shock to housing preferences in the US
### Implied sign restrictions

<table>
<thead>
<tr>
<th>Variables/shock</th>
<th>Savings glut</th>
<th>ROW monetary expansion</th>
<th>US monetary expansion</th>
<th>US financial deregulation/housing preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>US consump</td>
<td>$\geq 0$</td>
<td>$\geq 0$</td>
<td>$\geq 0$</td>
<td>$\geq 0$</td>
</tr>
<tr>
<td>ROW consump</td>
<td>$\leq 0$</td>
<td>$\geq 0$</td>
<td>$\geq 0$</td>
<td>$\leq 0$</td>
</tr>
<tr>
<td>US short rate</td>
<td></td>
<td></td>
<td>$\leq 0$</td>
<td></td>
</tr>
<tr>
<td>ROW short rate</td>
<td></td>
<td>$\leq 0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US long rate</td>
<td>$\leq 0$</td>
<td></td>
<td>$\leq 0$</td>
<td>$\geq 0$</td>
</tr>
<tr>
<td>ROW long rate</td>
<td></td>
<td>$\leq 0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US CPI</td>
<td></td>
<td></td>
<td>$\geq 0$</td>
<td></td>
</tr>
<tr>
<td>ROW CPI</td>
<td></td>
<td>$\geq 0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current account</td>
<td>$\leq 0$</td>
<td>$\leq 0$</td>
<td>$\leq 0$</td>
<td>$\leq 0$</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>$\geq 0$</td>
<td>$\geq 0$</td>
<td>$\leq 0$</td>
<td>$\geq 0$</td>
</tr>
</tbody>
</table>
Empirical model and data

- VAR

\[ Y_t = c + \sum_{k=1}^{L} A_k Y_{t-k} + u_t \quad t = 1, \ldots, T \quad u_t \sim N(0, \Sigma) \]

\[ L = 2 \text{ lags} \]

- 12 variables:
  - real consumption in US and ROW
  - short-term (typically 3 month) nominal interest rates in US and ROW
  - long-term (typically 10 year) nominal interest rates in US and ROW
  - CPI in US and ROW
  - ratio of US current account balance to GDP
  - dollar real trade-weighted exchange rate
  - real residential investment
  - real house prices
Empirical model and data

- ROW variables constructed using trade weights. Data from Pesaran, Schuermann and Smith (2009)
- All variables in log levels except interest rates
- Baseline period: 1979Q1 to 2006Q4
- Use Litterman prior to deal with large dimension of the VAR
  - Variables centred around a random walk with a drift
  - Prior of white noise for interest rates and exchange rate
- Identification using sign restrictions: imposed on impact for the CA and on impact plus two quarters for all other variables
‘Savings-glut’ shock
ROW monetary-policy expansion

- Consumption US
- Consumption ROW
- Nominal short rate US
- Nominal short rate ROW
- Nominal long rate US
- Nominal long rate ROW
- CPI US
- CPI ROW
- Current Account
- Real exchange rate
- US real residential investment
- US real house prices
US monetary-policy expansion
Financial-deregulation/housing-preference shock in the US
## Variance decompositions

<table>
<thead>
<tr>
<th></th>
<th>Real residential investment</th>
<th>Real house prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Year</td>
<td>3 Years</td>
</tr>
<tr>
<td>Savings glut</td>
<td>6.7%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Monetary expansion ROW</td>
<td>3.9%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Monetary expansion US</td>
<td>2.1%</td>
<td>2%</td>
</tr>
<tr>
<td>LTV/housing preference US</td>
<td>4.3%</td>
<td>3.4%</td>
</tr>
</tbody>
</table>
Conclusion

- ‘Savings-glut’ shocks have a statistically significant and positive effect on real house prices and residential investment.
- ‘Savings-glut’ shocks contributed more to the housing boom than the other types of shocks that we identify.
- Domestic financial deregulation and housing preference shocks also explain a large fraction of the variation in real house prices at longer horizons, but are less important in explaining real residential investment.
- Domestic and foreign monetary shocks have a statistically-insignificant effect on these housing variables and explain a much smaller fraction of their variance.
Median-target (MT) empirical impulse responses

‘Savings-glut’ shock
ROW monetary-policy expansion
US monetary-policy expansion

US real residential investment

US real house prices

Quarters

Percent
Financial-deregulation/housing-preference shock in the US