House Prices, Residential Mortgage Credit and Monetary Policy

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Objectives

• Should the Bank respond to house price growth?

• Use model with a financial accelerator in household sector to answer this question

• Answer this question in the presence of deviations from fundamentals
Outline

• Baseline Model

• Model assessment

• Deviation from fundamental experiment

• Policy rule comparison
Related Literature

- Household Financial Accelerator:
  - Aoki et al. (2002)
  - Iacoviello (2004)
Model Overview

• 2 types of households: patient and impatient
• Financial intermediary
• House producers
• Intermediate good producers
• Final good producers
• Monetary authority
Patient Consumers

\[
\max_{C_i^p, H_i^{p+1}, L_i^p, B_{t+1}} E_t \sum_{j=0}^{\infty} \beta^t_p \left[ \log C_{t+j}^p + \gamma \log H_{t+j}^p + \xi \log (1 - L_{t+j}^p) \right]
\]

subject to:

\[
P_{t+j} C_{t+j}^p + Q_{t+j} \left( H_{t+j+1}^p - (1 - \delta) H_{t+j}^p \right) + Q_{t+j} \Phi \left( \frac{H_{t+j+1}^p}{H_{t+j}^p} \right) H_{t+j}^p + D_{t+j+1} + T_{t+j}^p
\]

\[
= W_{t+j} L_{t+j}^p + R_{t+j} D_{t+j} + V_{t+j}^p
\]

where:

\[
\Phi \left( \frac{H_{t+j+1}^p}{H_{t+j}^p} \right) = \frac{\phi}{2} \left( \frac{H_{t+j+1}^p}{H_{t+j}^p} - 1 \right)^2
\]
Impatient Consumers

\[
\max_{C^i_t, H^i_t, L^i_t, B_{t+1}} E_t \sum_{j=0}^{\infty} \beta^i_t \left[ \log C^i_{t+j} + \gamma \log H^i_{t+j} + \xi \log (1 - L^i_{t+j}) \right]
\]

subject to:

\[
P_{t+j} C^i_{t+j} + Q_{t+j} \left( H^i_{t+j+1} - (1 - \delta) H^i_{t+j} \right) + Q_{t+j} \Phi \left( \frac{H^i_{t+j+1}}{H^i_{t+j}} \right) H^i_{t+j} + Z_{t+j-1} B_{t+j} = W_{t+j} L^i_{t+j} + B_{t+j+1}
\]

In equilibrium:

\[
Z_{t+j} = \psi \left( \frac{B_{t+j+1}}{Q_{t+j} H^i_{t+j} + 1} \right) R_{t+j}
\]
House Producers

Evolution process for housing stock:

\[ H_{t+1} - (1 - \delta)H_t = F(I_t, I_{t-1}) \]

where

\[ F(I_t, I_{t-1}) = \left[ 1 - \frac{\eta}{2} \left( \frac{I_t}{I_{t-1}} - 1 \right)^2 \right] I_t \]

House producers’ profit maximization problem:

\[
\max_{I_t} E_t \sum_{j=0}^{\infty} \beta^j p^j \lambda_{t+j}^p \left[ Q_{t+j} F(I_{t+j}, I_{t+j-1}) - P_{t+j} I_{t+j} \right]
\]
Final Good Producer

• Technology:

\[ Y_t = \left[ \int_0^1 Y_t(z)^{\frac{\varepsilon-1}{\varepsilon}} \, dz \right]^{\frac{\varepsilon}{\varepsilon-1}} \]

• Profit maximization implies:

\[ Y_t(z) = \left( \frac{P_t(z)}{P_t} \right)^{-\varepsilon} Y_t \]
Intermediate Good Producers

• Intermediate good \( z \in (0,1) \) is produced by a monopolist with technology:

\[
Y_t(z) = A_t L(z)^{1-\alpha}
\]

• They hire labour in a perfectly competitive market
Policy Reaction Function

\[ \hat{R}_t = \rho_R \hat{R}_{t-1} + (1 - \rho_R) \left[ \mu_\pi \hat{\pi}_t + \mu_y \hat{y}_t \right] + \varepsilon_{R,t} \]
## Key Parameter Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Calibrated Value</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_p$</td>
<td>0.995</td>
<td>SS annual real interest rate of 2 per cent</td>
</tr>
<tr>
<td>$\beta_i$</td>
<td>0.989</td>
<td>SS EFP of 245 bps</td>
</tr>
<tr>
<td>?</td>
<td>0.09</td>
<td>C/H ratio of 0.35</td>
</tr>
<tr>
<td>$d$</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>?</td>
<td>2.48</td>
<td></td>
</tr>
<tr>
<td>?</td>
<td>0.042</td>
<td></td>
</tr>
</tbody>
</table>
Rise of 100 bps in Interest Rate
Random Deviation From Fundamental

• The fundamental price of housing is still determined by the linearized adjustment cost equation:

\[
\hat{q}_t = \eta (\hat{I}_t - \hat{I}_{t-1}) - \beta_p \eta (E_{t+1} \hat{I}_{t+1} - \hat{I}_t)
\]

• The observed market price of housing:

\[
\hat{s}_t = \hat{q}_t + \hat{v}_t
\]
Random Deviation From Fundamental

• Deviation process:

\[ \hat{v}_t = \rho_v \hat{v}_{t-1} + \hat{u}_t \]

\[ \hat{u}_t = \rho_u \hat{u}_{t-1} + \varepsilon^u_t \]

• Auto-correlated innovation allows deviation to increase for several periods after initial shock
Deviation From Fundamental

Observed House Prices

Output

Inflation

-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5

-0.5
0
0.5
1
1.5

0 2 4 6 8 10 12

0 2 4 6 8 10 12
Policy Possibility Frontiers

\[
\hat{R}_t = \rho_R \hat{R}_{t-1} + (1 - \rho_R) \left[ \mu_{\pi} \hat{\pi}_t + \mu_y \hat{y}_t + \mu_s \hat{s}_t \right] + \varepsilon_{R,t}
\]

\[
\hat{R}_t = \rho_R \hat{R}_{t-1} + (1 - \rho_R) \left[ \mu_{\pi} \hat{\pi}_t + \mu_y \hat{y}_t + \mu_b \hat{b}_t \right] + \varepsilon_{R,t}
\]
Policy Frontier for Credit Level Response - All Shocks

Standard Deviation of Output (%) vs. Standard Deviation of Inflation (%)
Conclusion - Findings

• Responding mildly to house price growth may reduce inflation and output variabilities
Conclusion – Future Work

• Consider other ways of modeling deviation from fundamental

• Address non-linear effects of a prolonged deviation from fundamentals

• Introduce other frictions to improve dynamics of inflation and output
Conclusion – Future Work

• In the presence of non-fundamental house price movements, what is the optimal horizon for returning inflation back to target?
Interest Rate Rise of 100 bps (2)

Aggregate Consumption

Hours Worked
Interest Rate Rise of 100 bps (3)
Interest Rate Rise of 100 bps (4)
Positive Technology Shock (1)
Positive Technology Shock (3)
Positive Government Spending Shock (1)
Positive Government Spending Shock (2)

Aggregate Consumption

Hours Worked
Positive Government Spending Shock (3)
Deviation from Fundamental (2)

Aggregate Consumption

Hours Worked
Deviation from Fundamental (3)