Housing Market Heterogeneity in a Monetary Union

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Introduction

- Costs and benefits of monetary unions is a big question
- Difference national characteristics and asymmetric shocks can cause tensions
- Important sources of heterogeneity in EMU housing markets (e.g. Spanish housing market different from rest, should UK join EMU?)
- Should Europe move towards homogenization?
Question

Given that...

⇒ Housing markets differ across EMU countries: mortgage contracts, LTV’s, proportion of borrowers, price movements

Questions to answer:

⇒ Do shocks to the economy propagate differently across countries in a monetary union?
⇒ Should countries in a MU move towards housing market homogenization?
⇒ Does heterogeneity affect costs and benefits of MUs?
Given that...

⇒ Housing markets differ across EMU countries: mortgage contracts, LTV’s, proportion of borrowers, price movements

Questions to answer:

⇒ Do shocks to the economy propagate differently across countries in a monetary union?
⇒ Should countries in a MU move towards housing market homogenization?
⇒ Does heterogeneity affect costs and benefits of MUs?
Motivation

**Predominant Type of Mortgage Interest Rate**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom (72%)</td>
<td>United States (85%)</td>
</tr>
<tr>
<td>Spain (75%)</td>
<td>Germany (mostly)</td>
</tr>
<tr>
<td>Greece (80%)</td>
<td>France (86%)</td>
</tr>
<tr>
<td>Australia (mostly)</td>
<td>Austria (75%)</td>
</tr>
<tr>
<td></td>
<td>Netherlands (74%)</td>
</tr>
</tbody>
</table>

Motivation

LTVs in Europe (2007)

Source: European Mortgage Federation
Motivation

Source: European Mortgage Federation
Motivation

House Price % Change in Europe

Source: European Mortgage Federation
Model Overview

- Two-country, DSGE with housing
- Heterogeneous households: Savers, variable-rate borrowers, fixed-rate borrowers
- Consumption goods are tradable. Housing is non-tradable. Savers have access to foreign assets
- Two monetary regimes: Flexible exchange rates and independent monetary policy vs. monetary union
- Across countries, I allow for differences in LTV, in the proportion of borrowers and in the structure of mortgage contracts (fixed vs. variable rates). Common and asymmetric shocks.
Consumers Country A

- Consume Goods from both Countries, Housing in Country A, work
- Savers are more patient than Borrowers
- Borrowers are credit constrained
- Savers have access to foreign assets
- Country B is symmetric
Savers Country A

\[
\max_{E_0} \sum_{t=0}^{\infty} \beta^t \left( \ln C_t^u + j_t \ln H_t^u - \frac{(L_t^u)^\eta}{\eta} \right)
\]

s.t.

\[
C_{At}^u + \frac{P_{Bt}}{P_{At}} C_{Bt}^u + q_t H_t^u + \frac{R_{At-1} b_{t-1}^u}{\pi_{At}} + \frac{e_t R_{Bt-1} D_{t-1}}{P_{At}} \leq
\]

\[
q_t H_{t-1}^u + w_t^u L_t^u + b_t^u + \frac{e_t D_t}{P_{At}} + F_t + S_t
\]
Borrowers Country A

- \( \tilde{\beta} < \beta \)
- Need to collateralize their debt
- \( \alpha_A \) of them borrow at a variable rate, the rest at a fixed rate
- Maximize utility function subject to BC + an extra constraint:

\[
E_t \frac{R_{At}^c}{\pi_{At+1}} b_{At}^{ci} \leq k_A E_t q_{t+1} H_{t}^{ci}
\]

where \( R_{At}^c = R_{At} \) if the borrower is variable rate and \( R_{At}^c = \bar{R}_{At} \) if fixed rate

[FOCs]
Collateral constraint holds with equality \( \Rightarrow \) economy is endogenously divided into borrowers and savers.

Combining EE for foreign and domestic bonds:

\[
R_{At} = \frac{R_{Bt}E_t e_{t+1}}{e_t}
\]

Law of one price holds:

\[
P_{At} = e_t P_{At}^*
\]
Financial Intermediary in Country A

- Accepts deposits, and extends both fixed and variable-rate loans to consumers
- Optimality condition for setting the fixed interest rate implies that at each point in time, the intermediary is indifferent between lending at a variable or at a fixed rate
- Financial markets clear $\Rightarrow$ domestic savings = domestic borrowings
Firms in Country A

- Firms produce consumption goods
- Sticky prices $\Rightarrow$ Phillips Curve
- Housing supply is fixed
Monetary Policy

- Two different monetary policy regimes for comparison:

  **Independent monetary policies and flexible exchange rates:**

  \[
  r_{At} = \rho_A r_{At-1} + (1 - \rho_A) (1 + \phi_{\pi A}) \pi_{At} + \varepsilon_{R,t} \\
  r_{Bt} = \rho_B r_{Bt-1} + (1 - \rho_A) (1 + \phi_{\pi A}) \pi_{Bt} + \varepsilon^*,t
  \]

  **Monetary Union:**

  \[
  r_t = \rho r_{t-1} + (1 - \rho) [(1 + \phi_{\pi}) (n \pi_{At} + (1 - n) \pi_{Bt})] + \varepsilon_{R,t}
  \]
## Dynamics

### Parameter Values in Baseline Model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>.99</td>
<td>Discount Factor for Savers</td>
</tr>
<tr>
<td>$\bar{\beta}$</td>
<td>.98</td>
<td>Discount Factor for Borrowers</td>
</tr>
<tr>
<td>$j$</td>
<td>.1</td>
<td>Weight of Housing in Utility Function</td>
</tr>
<tr>
<td>$\eta - 1$</td>
<td>1</td>
<td>Inverse of labor elasticity</td>
</tr>
<tr>
<td>$k$</td>
<td>.8</td>
<td>Loan-to-value ratio</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>.7</td>
<td>Labor share for Savers</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>1</td>
<td>Proportion of variable-rate borrowers</td>
</tr>
<tr>
<td>$X$</td>
<td>1.2</td>
<td>Steady-state markup</td>
</tr>
<tr>
<td>$n$</td>
<td>.9</td>
<td>Size of Country A</td>
</tr>
<tr>
<td>$\theta$</td>
<td>.75</td>
<td>Probability of not changing prices</td>
</tr>
<tr>
<td>$\rho$</td>
<td>.8</td>
<td>Interest-Rate-Smoothing Parameter in Taylor Rule</td>
</tr>
<tr>
<td>$\phi_\pi$</td>
<td>.5</td>
<td>Inflation Parameter in Taylor Rule</td>
</tr>
</tbody>
</table>
Dynamics: Common Shock in a Heterogeneous MU

- Consumption decreases by more in the country with high LTV \( \Rightarrow \) Shocks amplified. Financial accelerator ▶ Figure 1
- Consumption decreases by more in the country with high borrowers share \( \Rightarrow \) Collateral constraints more pervasive ▶ Figure 2
- Fixed vs. variable rates. Small aggregate differences ▶ Figure 3
Dynamics: Asymmetric Shocks

- Technology shock in Country B.
  - Interest rates react little in a MU.
  - If Country B conducts monetary policy independently, the interest rate in Country B decreases significantly, housing prices in Country B increase and therefore consumption increases by more.
  - In the MU, Country A has also lower interest rates and housing prices increase. Wealth effects make consumption and GDP increase.

Figure 4
Dynamics: Asymmetric Shocks

- House price shock in Country A
  - Consumption increases in A because of wealth effects
  - The shock is slightly transmitted to Country B where consumption also increases because the countries are trading
  - Interest rates, especially in the union, decrease and this makes house prices in Country B increase as well. [Figure 5]
Welfare

- Should countries in a MU move towards institutional homogenization?
- Should a country join a MU with different institutional features?
Define individual welfare:

\[
V_{u,t} \equiv E_t \sum_{m=0}^{\infty} \beta^m \left( \ln C_{t+m}^u + j_t \ln H_{t+m}^u - \frac{(L_{t+m}^u)^{\eta}}{\eta} \right)
\]

\[
V_{ci,t} \equiv E_t \sum_{m=0}^{\infty} \tilde{\beta}^m \left( \ln C_{t+m}^{ci} + j_t \ln H_{t+m}^{ci} - \frac{(L_{t+m}^{ci})^{\eta}}{\eta} \right)
\]

Social welfare:

\[
V_t = (1 - \beta) V_{u,t} + (1 - \tilde{\beta}) \left[ \alpha V_{cv,t} + (1 - \alpha) V_{cf,t} \right]
\]

Total welfare

\[
\hat{V}_t = n V_t + (1 - n) V_t^*
\]
Welfare Results. Common Technology Shock

<table>
<thead>
<tr>
<th>Symmetric</th>
<th>Baseline</th>
<th>( k_A = k_B = .2 )</th>
<th>( \gamma_A = \gamma_B = .2 )</th>
<th>( \alpha_A = \alpha_B = 0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.486</td>
<td>-3.087</td>
<td>-3.208</td>
<td>-1.476</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asymmetric</th>
<th>( k_A = .8/k_B = .2 )</th>
<th>( \gamma_A = .7/\gamma_B = .2 )</th>
<th>( \alpha_A = 0/\alpha_B = 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.453</td>
<td>-3.865</td>
<td>-1.615</td>
</tr>
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</table>

- Homogenization towards high LTV decreases welfare
- Heterogeneity delivers the lowest welfare result concerning \( \gamma \)
- Homogenization towards fixed rate mortgages is welfare improving
## Welfare

Technology Shock in Country B.

<table>
<thead>
<tr>
<th>Symmetric</th>
<th>MU</th>
<th>Flex ER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.229</td>
<td>-71.99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asymmetric</th>
<th>$k_A = \frac{8}{k_B} = 0.2$</th>
<th>$\gamma_A = \frac{7}{\gamma_B} = 0.2$</th>
<th>$\alpha_A = 0 / \alpha_B = 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MU</td>
<td>Flex ER</td>
<td>MU</td>
<td>Flex ER</td>
</tr>
<tr>
<td>-3.188</td>
<td>-16.35</td>
<td>-3.331</td>
<td>26.91</td>
</tr>
<tr>
<td>-3.218</td>
<td>2.146</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Asymmetry reduces benefits from monetary union when there are asymmetric shocks.
Housing market characteristics matter for the transmission of shocks and welfare

Variables respond more strongly to common shocks if the country has a high LTV, a high proportion of borrowers or mainly variable-rate mortgages.

In a monetary union, housing market homogenization per se is not necessarily beneficial \(\Rightarrow\) Low LTVs and fixed-rate contracts are welfare enhancing

Housing market heterogeneity reduces benefits from monetary union when there are asymmetric shocks
Figure: Impulse Responses to a Monetary Policy Shock in a Monetary Union.
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**Figure:** Impulse Responses to a Monetary Policy Shock in a Monetary Union.
**Figure:** Impulse Responses to a Technology Shock in Country B. Monetary Union versus Flexible Exchange Rate regime.
Figure: Impulse Responses to a House Price Shock in Country A. Monetary Union versus Flexible Exchange Rates.
\[\frac{C_{At}^u}{C_{Bt}^u} = \frac{nP_{Bt}}{(1 - n)P_{At}}\]

\[\frac{1}{C_{At}^u} = \beta E_t \left( \frac{R_{At}}{\pi_{At+1} C_{At+1}^u} \right),\]

\[\frac{1 - \psi D_t}{C_{At}^u} = \beta E_t \left( \frac{R_{Bt} e_{t+1}}{\pi_{At+1} C_{At+1}^u e_t} \right),\]

\[w_t^u = (L_t^u)^{\eta-1} \frac{C_{At}^u}{n},\]

\[\frac{j_t}{H_t^u} = \frac{n}{C_{At}^u} q_t - \beta E_t \frac{n}{C_{At+1}^u} q_{t+1}.\]
\[ \frac{C_{At}^{ci}}{C_{Bt}^{ci}} = \frac{nP_B}{(1 - n)P_A} \]

\[ \frac{n}{C_{At}^{ci}} = \tilde{\beta} E_t \left( \frac{nR_{At}^c}{\pi_{At+1} C_{At+1}^{ci}} \right) + \lambda_{At}^{ci} R_{At}^c, \]

\[ w_t^{ci} = \left( L_t^{ci} \right)^{\eta - 1} \frac{C_{At}^{ci}}{n}, \]

\[ \frac{j_t}{H_t^{ci}} = \frac{n}{C_{At}^{ci}} q_t - \tilde{\beta} E_t \frac{n}{C_{At+1}^{ci}} q_{t+1} - \lambda_{At}^{ci} k_{At} E_t q_{t+1} \pi_{At+1}. \]
\[ R_{AT}^{OPT} = \frac{\sum_{i=\tau+1}^{\infty} \beta^{i-\tau} \Lambda_{\tau,i} R_{Ai-1}}{E_{\tau} \sum_{i=\tau+1}^{\infty} \beta^{i-\tau} \Lambda_{\tau,i}}. \]

\[ R_{At} = \frac{R_{At-1} b_{t-1}^{cf} + R_{At}^{OPT} (b_{t}^{cf} - b_{t-1}^{cf})}{b_t^{cf}}. \]