Heterogeneous Housing Markets: Structural Implications for Pricing and Risk

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Introduction

• Motivation:
  – The lack of data availability at the market segment level and the problematic definition of a market segment for empirical assessments relating house prices to rent
  • Preliminary motivation is the paper; An Elasticity Approach to Housing Markets

Main question:
- What is the «cost» of this «lack of data» measured in terms of assessments regarding house prices and house price risk
The model

• We build a linear housing market model with two segments linked by equity induced up-trading or parents’ housing equity withdrawal assisting their children in becoming home-owners

• We consider shocks that either highlight or supress the link between segments
  – While the first mirrors a heterogeneous housing market structure the latter does the same for a homogeneous housing market structure
The model

• Equilibriums
  \[ D_i = S_i \]

• The demand for stater homes
  \[ D_s = k_s + m_s M_s + e_s E_{0s} + y_s Y_s - p_s P_s \]

• The demand for family homes
  \[ D_m = k_m + m_m M_m + e_m E_{0m} + e_m P_s + y_m Y_m - p_m P_m \]

• The house price index
  \[ P = \sum_i \alpha_i P_i \]
Definitions

• DEFINITION 1: A symmetric housing market structure:
  \[ \alpha_s = \alpha_m = \overline{\alpha} \quad \text{and} \quad p_s = p_m = 1. \]

• DEFINITION 2: A net-demand increase equal across market segments:
  \[ \Delta ND_s = \Delta ND_m = \Delta \overline{ND} \]

• DEFINITION 3: A risk increase equal across market segments:
  \[ \Delta \sigma_s = \Delta \sigma_m = \Delta \overline{\sigma} \]

• DEFINITION 4: An aggregate neutral shift in net-demand:
  \[ \Delta ND_i > 0, \Delta ND_j < 0 \quad \text{og} \quad |\Delta ND_i| = |\Delta ND_j| = \Omega. \]

• DEFINITION 5: An aggregate neutral shift in risk
  \[ \Delta \sigma_i > 0, \Delta \sigma_j < 0 \quad \text{og} \quad |\Delta \sigma_i| = |\Delta \sigma_j| = \Psi. \]
Homogeneous housing market (The benchmark)

- We start out by assuming no link between segments

Table 1: Price- and risk structures in a housing market benchmark.

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter homes</strong></td>
<td>$P_s^B = \frac{1}{p_s} [ND_s]$</td>
<td>$\sigma_s^B = \frac{1}{p_s} \sigma_{ND_s}$</td>
</tr>
<tr>
<td><strong>Family homes</strong></td>
<td>$P_m^B = \frac{1}{p_m} [ND_m]$</td>
<td>$\sigma_m^B = \frac{1}{p_m} \sigma_{ND_m}$</td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td>$P_l^B = \alpha_m [ND_m] + \alpha_s [ND_s]$</td>
<td>$\sigma_l^B = \alpha_m \sigma_{ND_m} + \alpha_s \sigma_{ND_s} + \sqrt{2\alpha_m \alpha_s \sigma_{ND_s} \sigma_{ND_m} \rho_{ND_s,ND_m}}$</td>
</tr>
</tbody>
</table>
Heterogeneous market structure

Equity induced up-trading

Table 2: Price- and risk structures in a housing market with equity induced up-trading

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter homes</strong></td>
<td>$P^K_s = P^B_s$</td>
<td>$\sigma^K_s = \sigma^B_s$</td>
</tr>
<tr>
<td><strong>Family homes</strong></td>
<td>$P^K_m = P^B_m + \frac{e^{ms}}{p_m} ND_s$</td>
<td>$\sigma^K_m = \sigma^B_m + \frac{e^{ms}}{p_m} \sigma_{ND_s} + \sqrt{2\alpha_{K} \sigma_{ND_s} \sigma_{ND_m} \rho_{ND_s,ND_m}}$</td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td>$P^K_I = P^B_I + \alpha^I_m e^{ms} ND_s$</td>
<td>$\sigma^K_p = \sigma^B_p + \frac{e^{ms}}{p_m} \sigma_{ND_s} + \sqrt{\omega \sigma_{ND_s} \sigma_{ND_m} \rho_{ND_s,ND_m}}$</td>
</tr>
</tbody>
</table>

As long as $e^{ms} > 0$ are family home prices $P^K_m > P^B_m$ and the house price index $P^K_I > P^B_I$ higher than in the homogeneous housing market structure while starter home prices are unaffected.

We see how both family home price risk and aggregate housing market risk is higher than in our benchmark as long as $\sigma_{ND_s} > 0$ even if $\rho_{ND_s,ND_m} = 0$.

Equity induced up-trading increases risk even if there is no correlation between net-demand across segments.
Heterogeneous market structure

Housing equity withdrawal

Table 3: Price and risk structures in a housing market with intergenerational transfer of wealth

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Starter homes</td>
<td>$P_s^R = P_s^B + a_m p_s^{-1} ND_m$</td>
<td>$\sigma_s^R = \sigma_s^B + a_m \sigma_{ND_m} + \sqrt{\alpha_R^s \sigma_{ND}^s \sigma_{ND_m} \rho_{NDs,NDm}}$</td>
</tr>
<tr>
<td>Family homes</td>
<td>$P_m^R = P_m^B$</td>
<td>$\sigma_m^R = \sigma_m^B$</td>
</tr>
<tr>
<td>Index</td>
<td>$P_i^R = P_i^B + a_m \alpha_i ND_m$</td>
<td>$\sigma_i^R = \sigma_i^B + a_m \alpha_i \sigma_{ND_m} + \sqrt{\alpha_R^i \sigma_{ND_i} \sigma_{ND_m} \rho_{NDs,NDm}}$</td>
</tr>
</tbody>
</table>

As long as $a_m > 0$ are starter home prices $P_s^R > P_s^B$ and the house price index $P_i^R > P_i^B$ higher than in the homogeneous housing market structure while family home prices are unaffected.

We see how both starter home price risk and aggregate housing market risk is higher than in our benchmark as long as $\sigma_{ND_m} > 0$ even if $\rho_{NDs,NDm} = 0$.

Equity withdrawal used for stimulating first time entry increases risk even if there is no correlation between net-demand across segments.
The effects of shocks

- **Definition 2** results in prices overreacting when markets are *heterogeneous* while there are no overreactions when markets are *homogeneous*.

- **Definitions 3** results in a stronger aggregate risk increase when markets are *heterogeneous* than when they are *homogeneous*. 
The effects of shocks

- Definitions 4 and 5:
  - Homogeneous Housing Market Structure
    *No effect* on the house price index or aggregate housing market risk
  - Heterogeneous Housing Market Structure
    *Both* the house price index and the aggregate housing market risk is affected

- The reason is found in segments’ indirect effects when housing markets are assumed to be heterogeneous – effects which are lacking when markets are assumed homogeneous
Conclusions

• The interplay between segments impacts both the *structure of pricing* and the *structure of risk* in housing markets

• Models that ignore the interplay between segments *underestimate* how housing markets respond to shocks and the inherent house price risk

• When taking the interplay between segments into account we see how *aggregate neutral shocks* to either demand or risk impacts the *aggregate house price index* or the *aggregate housing market risk-features that are complete suppressed when assuming homogeneous housing market structures*