How Can One Tell When the Housing Market Is Out of Equilibrium?

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Introduction

▼ The housing market seems to be prone to booms and busts.
  ▶ Since each house is different it can be difficult to assess its fundamental value.
  ▶ Market participants tend to extrapolate expected capital gains from past performance.
  ▶ Supply is inelastic. Changes in demand can hence trigger large price changes.
  ▶ Mortgage lending standards become laxer during booms.

▼ Busts in the housing market can cause recessions, destabilize the financial system and adversely affect the wealth of the cohort that bought towards the end of the boom.
It is therefore important that departures from equilibrium are detected as soon as possible. How can such departures be detected?

- Compare user cost of housing with price-rent ratio (note: the ratio of price and rent indexes is not enough)
- Compare house prices with income
- Compare the rental yield on housing with the yield on other assets
The Equilibrium Price-Rent Ratio

▶ In equilibrium a household should be indifferent between owning and renting.
▶ The cost of owner-occupying is: \( u_t P_t \), where per dollar user cost can be calculated as follows:

\[
u_t = r_t + \omega_t + \delta_t - g_t + \gamma_t.
\]

\( r \) – the risk-free interest rate;
\( \omega \) – the land tax rate;
\( \delta \) – the depreciation rate for housing;
\( g \) – the expected nominal capital gain;
\( \gamma \) – the risk premium of owning as opposed to renting.

▶ In equilibrium: \( R_t = u_t P_t \) or \( P_t/R_t = 1/u_t \).
▶ If the median \( P_t/R_t \) is greater than \( 1/u_t \) then the price-rent ratio is too high. Some households should switch from owning to renting, thus reducing \( P_t \) and increasing \( R_t \).
Some Problems with the User-Cost Approach

- The actual price-rent ratio which is compared with $u_t$ needs to be quality adjusted.
- $u_t$ is difficult to calculate since the expected capital gain $g_t$ is not directly observable. $u_t$ is very sensitive to the chosen value of $g_t$.
- $P_t/R_t$ and $u_t$ may both differ at the low, middle and high end of the market. For example, we may have that $P_t/R_t < u_t$ at the low end while $P_t/R_t > u_t$ at the high end.
- Transaction costs can slow the adjustment back to equilibrium.
Constructing Quality-Adjusted Price-Rent Ratios Using Hedonic Methods

- This can be done by estimating hedonic models for sold houses,

\[ y_{Pt} = X_{Pt} \beta_{Pt} + u_{Pt}, \]

and for rents defined on the same set of characteristics:

\[ y_{Rt} = X_{Rt} \beta_{Rt} + u_{Rt}, \]

- \( y_{Pt} \) is a vector of log prices
- \( y_{Rt} \) is a vector of log rents
- \( X_{Pt} \) and \( X_{Rt} \) are matrices of characteristics
- \( \beta_{Pt} \) and \( \beta_{Rt} \) are vectors of shadow prices for the characteristics
Once the parameters $\beta_{Pt}$ and $\beta_{Rt}$ have been estimated, we can impute a price-rent ratio for a house $h$ sold in period $t$ as follows: $\hat{p}_{tj}(x_{Pth})/\hat{r}_{th}(x_{Pth})$.

and for a house $h$ rented in period $t$ as follows: $\hat{p}_{tj}(x_{Rth})/\hat{r}_{th}(x_{Rth})$. 
The remainder of these slides draws heavily on Hill and Syed (2013). They obtain the following results for Sydney 2001-9:

- Average raw price-rent ratio $= 29.34$
- Quality-adjusted price-rent ratio (ignoring missing characteristics and omitted variables) $= 26.96$
- Full quality-adjusted price-rent ratio $= 24.7$
- Quality adjustment reduces the price-rent ratio by 18.4 percent.
- See Table 1.
Table 1: Actual and Quality-Adjusted Median Price-Rent Ratios and Quality Bias

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Unadjusted (%)</th>
<th>Quality Adjusted 1 (%)</th>
<th>Quality Adjusted 2 (%)</th>
<th>Bias 1 (%)</th>
<th>Bias 2 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>25.63</td>
<td>23.20</td>
<td>20.48</td>
<td>10.46</td>
<td>25.15</td>
</tr>
<tr>
<td>2003</td>
<td>34.72</td>
<td>32.03</td>
<td>28.59</td>
<td>8.38</td>
<td>21.45</td>
</tr>
<tr>
<td>2004</td>
<td>35.48</td>
<td>32.33</td>
<td>29.78</td>
<td>9.74</td>
<td>19.13</td>
</tr>
<tr>
<td>2005</td>
<td>33.41</td>
<td>29.55</td>
<td>27.09</td>
<td>13.11</td>
<td>23.32</td>
</tr>
<tr>
<td>2006</td>
<td>32.06</td>
<td>27.79</td>
<td>25.44</td>
<td>15.36</td>
<td>26.01</td>
</tr>
<tr>
<td>2007</td>
<td>27.45</td>
<td>25.13</td>
<td>23.60</td>
<td>9.23</td>
<td>16.33</td>
</tr>
<tr>
<td>2008</td>
<td>23.01</td>
<td>22.22</td>
<td>21.40</td>
<td>3.55</td>
<td>7.52</td>
</tr>
<tr>
<td>Average</td>
<td>29.34</td>
<td>26.96</td>
<td>24.70</td>
<td>8.70</td>
<td>18.36</td>
</tr>
</tbody>
</table>
Figure 1: Quality-Adjusted and Unadjusted Price-Rent Ratios
House prices in Sydney peaked in 2004. After 2004 there seems to be a fall in the average quality of houses sold.

Hill and Syed (2009) document a shift towards cheaper postcodes in the latter part of their sample.

- **2001-5**: 30.8 percent of sales were in the 4 most expensive postcode deciles.
- **2001-5**: 52.9 percent of sales were in the 4 cheapest postcode deciles.
- **2006-9**: 25.7 percent of sales were in the 4 most expensive postcode deciles.
- **2006-9**: 58.4 percent of sales were in the 4 cheapest postcode deciles.
Expected Capital Gains and the Equilibrium Price-Rent Ratio

- Extrapolating expected capital gains from past performance
- Hill and Syed (2013) find that they need to extrapolate over 30 years to generate a reasonably stable and plausible equilibrium price-rent ratio $1/u_t$.
- See Table 2.
- Alternatively, the expected capital gain in equilibrium can be imputed from the user cost formula as follows:

\[
\hat{g}_t = r_t + \omega_t + \delta_t + \gamma_t - \tilde{R}_t/\tilde{P}_t.
\]

- If $\hat{g}_t$ is implausibly high, we can conclude that the price-rent ratio is above its equilibrium level.
Table 2: A Comparison of Equilibrium and Actual Price-Rent Ratios

<table>
<thead>
<tr>
<th>Year</th>
<th>$r_t$</th>
<th>$g_t - \pi^e_t$</th>
<th>Equilibrium $P_t/R_t$</th>
<th>Actual $P_t/R_t$</th>
<th>Implied $g_t - \pi^e_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$x=10$</td>
<td>$x=20$</td>
<td>$x=30$</td>
<td>$x=10$</td>
</tr>
<tr>
<td>2001</td>
<td>0.056</td>
<td>0.029</td>
<td>0.024</td>
<td>0.024</td>
<td>19.18</td>
</tr>
<tr>
<td>2002</td>
<td>0.058</td>
<td>0.045</td>
<td>0.037</td>
<td>0.028</td>
<td>26.11</td>
</tr>
<tr>
<td>2003</td>
<td>0.054</td>
<td>0.060</td>
<td>0.047</td>
<td>0.031</td>
<td>52.88</td>
</tr>
<tr>
<td>2004</td>
<td>0.056</td>
<td>0.062</td>
<td>0.048</td>
<td>0.033</td>
<td>52.97</td>
</tr>
<tr>
<td>2005</td>
<td>0.053</td>
<td>0.059</td>
<td>0.047</td>
<td>0.033</td>
<td>47.57</td>
</tr>
<tr>
<td>2006</td>
<td>0.056</td>
<td>0.056</td>
<td>0.043</td>
<td>0.033</td>
<td>38.47</td>
</tr>
<tr>
<td>2007</td>
<td>0.060</td>
<td>0.053</td>
<td>0.045</td>
<td>0.036</td>
<td>32.41</td>
</tr>
<tr>
<td>2008</td>
<td>0.058</td>
<td>0.048</td>
<td>0.042</td>
<td>0.033</td>
<td>24.66</td>
</tr>
<tr>
<td>2009</td>
<td>0.050</td>
<td>0.034</td>
<td>0.018</td>
<td>0.030</td>
<td>26.14</td>
</tr>
<tr>
<td>Mean</td>
<td>0.056</td>
<td>0.049</td>
<td>0.038</td>
<td>0.031</td>
<td>35.60</td>
</tr>
</tbody>
</table>

Notes: $\omega_t = 0.01$, $\delta_t = 0.025$, $\gamma_t = 0.02$ and $\pi^e_t = 0.03$ for the entire period.
Was the Price-Rent Ratio Out of Equilibrium in Sydney?

- The quality-adjusted price-rent ratio was above its equilibrium level in all years except 2009. The maximum difference was observed in 2004.

- The expected real capital gain implied by equilibrium rose from 3.2 percent per year in 2001 to 4.7 percent in 2004 before falling back to 2.9 percent per year in 2009.

- By comparison, Gyourko, Mayer and Sinai (2006) compute the average real capital gain for 50 US cities over the period 1950 to 2000. The average was 1.7 percent per year, with the highest level observed being 3.5 percent for San Francisco.

- Conclusion: the price-rent ratio was too high in 2004, although no longer so by 2009.
Cross-Sectional Variation in Price-Rent Ratios

- The price-rent ratio is higher at the top end of the market than at the low end.
- See Table 3.
| Year | Price-Rent from Price Data | | Price-Rent From Rent Data | |
|------|----------------------------|----------------------------|
|      | Lower Quartile | Median | Upper Quartile | Lower Quartile | Median | Upper Quartile | |
| 2003 | 27.39          | 29.17  | 31.47          | 26.27          | 28.91  | 30.16          |
| 2005 | 26.52          | 27.07  | 27.35          | 26.14          | 27.36  | 28.19          |
| 2006 | 23.88          | 26.02  | 29.40          | 23.67          | 24.93  | 25.84          |
| 2007 | 21.57          | 25.65  | 25.54          | 21.24          | 23.01  | 25.66          |
| Average | 23.10      | 25.24  | 27.17          | 22.75          | 24.56  | 26.13          |
Some Possible Explanations

- User cost $u_t$ is lower at the top end.
  - Depreciation rate is lower at the high end.
  - Higher expected capital gains at top end.
  - Lower risk premium at top end.

- Buyers at the low end are credit constrained. As a result at the low end $P_t/R_t < 1/u_t$.

- A lack of high income renters at the top end. Hence at the top end $P_t/R_t > 1/u_t$.

- Market inefficiency

- Implication: It may be necessary to consider a few different segments of the market to get a clearer picture of what is going on.
Conclusions

- The equilibrium user-cost condition should be used with caution. There are a number of ways in which it can generate misleading conclusions.
  - Quality bias in median price-rent ratios
  - Estimating expected capital gains
  - Cross-sectional variation in actual and equilibrium price-rent ratios
- When applied with care, this user-cost approach generates useful results.