Limitations and impact of hedonic adjustment for the Swiss rent index
Contents

1. Introduction
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Introduction

Rents for housing:

- a major part of the CPI basket
- a higher increase as the overall CPI
- a special market
- a major issue: quality adjustment
Annual change in rents, CPI and mortgage rate
Quality adjustment methods for rents

Statified ex post according to number of rooms and dwelling age.

-1993-2005 : further QA in accordance with renovations
The rent matrix

<table>
<thead>
<tr>
<th>Age/nb rooms</th>
<th>1 room</th>
<th>2 rooms</th>
<th>3 rooms</th>
<th>4 rooms</th>
<th>5 rooms</th>
<th>6 rooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td></td>
<td></td>
<td>950.-</td>
<td></td>
<td></td>
<td>2'800.-</td>
</tr>
<tr>
<td>6-10 years</td>
<td></td>
<td>850.-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-20 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 20 years</td>
<td></td>
<td></td>
<td>850.-</td>
<td>1'450.-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 3 rooms
  - 1970
  - 850.-

- 6 rooms
  - 2011
  - 2'800.-

- 2 rooms
  - 2005
  - 950.-

- 4 rooms
  - 1990
  - 1'450.-
The rent matrix with adjustment according to renovations

<table>
<thead>
<tr>
<th>Age/nb rooms</th>
<th>1 room</th>
<th>2 rooms</th>
<th>3 rooms</th>
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<th>5 rooms</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-20 years</td>
<td></td>
<td></td>
<td>1'200.-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 20 years</td>
<td>850.-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3 rooms, 1995, 1'200.-

Partially renovated, calculated age
Quality adjustment methods for rents

Stratified ex post according to number of rooms and dwelling age.

-2006-2010: -------
-2011-now: hedonic model
Hedonic adjustment

Hedonic adjustment (2011-now) : main features

- hedonic repricing / hedonic QA
- rent structure survey 2003
- multiplicative model
- issue of location
Hedonic model

Hedonic repricing : principles

\[ I_t^{adj} = I_t^{unadj} \cdot \frac{1}{I_t^{quality}} \]

With Jevons-index:

\[ I_t^{unadj} = \frac{\prod_{i=1}^{nt}(P_{i,t})^{\frac{1}{nt}}}{\prod_{i=1}^{n_0}(P_{i,0})^{\frac{1}{n_0}}} \]

Adjustment factor

\[ I_t^{quality} = \frac{\prod_{i=1}^{nt}(\hat{P}_{i,t})^{\frac{1}{nt}}}{\prod_{i=1}^{n_0}(\hat{P}_{i,0})^{\frac{1}{n_0}}} \]
Hedonic model

Why hedonic repricing?

• Hedonic regression not constrained to current/base period: 2003

• Database for regression <> Database for index calculation: MSE (90‘000 dwellings) + external suppliers (location)

• Close to standard QA approaches
Hedonic model

Multiplicative model (1)

1) Estimated model:

\[ \ln(\hat{P}_i) = \hat{\alpha} + \hat{\beta}_1 X_{1,i} + \hat{\beta}_2 \ln(X_{2,i}) \]

=> Multiplicative relation:

\[ \hat{P}_i = e^{\hat{\alpha}} \cdot e^{\hat{\beta}_1 X_{1,i}} \cdot X_{2,i}^{\hat{\beta}_2} = \text{cst} \cdot (1 + \text{fact1}_i \%) \cdot (1 + \text{fact2}_i \%) \]
Hedonic model

Multiplicative model (2)

2) Adjustment factor:

\[
I_{t,\text{quality}} = \frac{\Pi_{i=1}^{nt}(1 + \text{factor}1_{i,t} \%)^{\frac{1}{nt}}}{\Pi_{i=1}^{n0}(1 + \text{factor}1_{i,0} \%)^{\frac{1}{n0}}} \cdot \frac{\Pi_{i=1}^{nt}(1 + \text{factor}2_{i,t} \%)^{\frac{1}{nt}}}{\Pi_{i=1}^{n0}(1 + \text{factor}2_{i,0} \%)^{\frac{1}{n0}}}
\]
# Hedonic model

## Variables

<table>
<thead>
<tr>
<th>Type</th>
<th>Variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural (12 / 8D)</td>
<td>Age, room, storey, garage, penthouse, duplex</td>
<td></td>
</tr>
<tr>
<td>Micro-location (13 / 10D)</td>
<td>Distance from the lake, lake view, mountain view, gradient, exposure, noise</td>
<td></td>
</tr>
<tr>
<td>Macro-location (33 / 30D)</td>
<td>Potential accessibility, fiscal capacity, tax rate, canton, major city</td>
<td></td>
</tr>
</tbody>
</table>

\[
\ln(\hat{y}_i) = \alpha + \sum_{j=1}^{12} \beta_j X_{ij}^{\text{structure}} + \sum_{k=1}^{47} \rho_k X_{ik}^{\text{location}}
\]

\[
\hat{y}_i = \alpha + \sum_{j=1}^{12} \beta_j X_{ij}^{\text{structure}} + \text{Hectare value}_i
\]
## Impact

### Impact on the index

<table>
<thead>
<tr>
<th></th>
<th>Index AC</th>
<th>Total index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadj. change</td>
<td>+ 0.81%</td>
<td>+ 0.18%</td>
</tr>
<tr>
<td>Adj. change</td>
<td>+ 1.03%</td>
<td>+ 0.21%</td>
</tr>
<tr>
<td>Deviation</td>
<td>+ 0.21%</td>
<td>+ 0.03%</td>
</tr>
</tbody>
</table>
Impact

- Data points: 2011q1 to 2014q4
- Y-axis: Values from 0.97 to 1.015
- X-axis: Quarters from 2011q1 to 2014q4
- Chart title: Adjustment factor
- Sub-title: Adjustment factor (mean since 2011q1)
Swiss Confederation

Breakdown

Breakdown
Breakdown
Breakdown

![Bar chart showing breakdown of storey and storey (mean) from 2011q1 to 2014q1. The chart displays the price indices over time with a distinct visual representation for storey and a dotted line for the mean.](image-url)
Breakdown

![Bar chart showing breakdown of consumer price indices from 2011q1 to 2014q1. The chart indicates fluctuations in location and location (mean) indices over the specified periods.](image)
Conclusions

Impact depends on the entire construction of the index

Limited impact on the short term

No impact in the long run