A Comparative Analysis of Dutch House Price Indices

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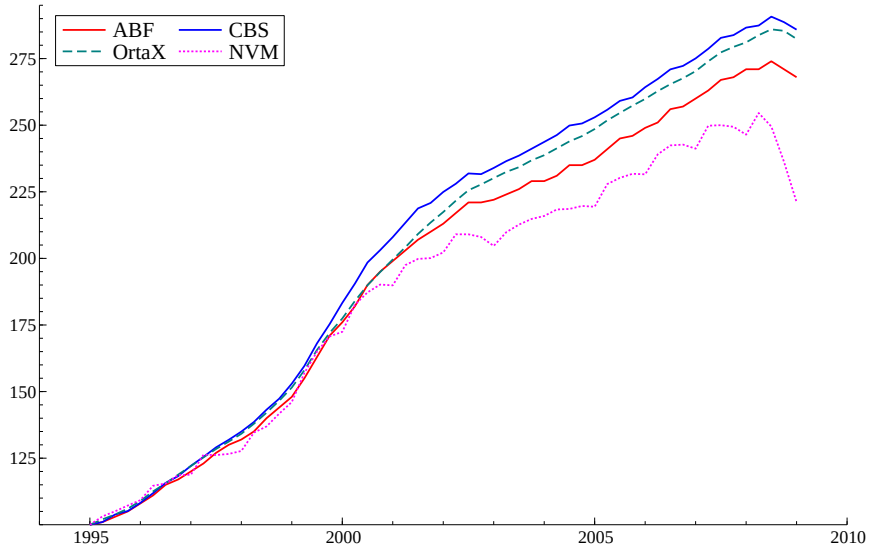
Motivation

- Analyze impact of specification level of house price index on risk-return profile of housing corporations
  - local indices
  - house type specific
- Four different suppliers of house price indices in the Netherlands
  - Dutch Brokerage Organization NVM
  - Statistics Netherlands (CBS) / Land Registry (Kadaster)
  - ABF
  - OrtaX
- Focus on comparison of returns:
  - averages
  - volatilities (standard deviations)
  - autocorrelations

Motivation

Price changes in percentages for the Netherlands

Period	NVM	CBS	ABF	OrtaX
2008Q1	0.0	1.0	1.1	0.6
2008Q2	1.9	0.2	0.0	1.0
2008Q3	-0.7	1.2	1.1	0.8
2008Q4	-2.5	-0.7	-1.0	-0.2
2009Q1	-3.1	-1.0	-0.8	-1.1
Total	-4.4	0.7	0.4	1.1



Outline

House price index data

Two main data providers for selling prices in the Netherlands:

1. NVM: Dutch Brokerage Organization; from 1985
   current market share: 70%
   - date of preliminary sale contract
   - asking price history, time on the market, transaction price
   - including all housing characteristics
2. Kadaster: (Kadaster/CBS, OrtaX, and ABF indices)
   - Availability of all prices in the Netherlands from 1993 (3.5 mln)
   - The only characteristics are
     - address details
     - house type
     - lot size
     - transaction date, price and circumstances (transaction between relatives, house is rented out, buyer is a legal entity, etc.)
   - Transaction date: date of legal transfer of property
     $\text{Date}_{\text{Transfer property}} \approx \text{Date}_{\text{Preliminary sale contract}} + 2 - 6$ Months

Price Index Construction Methods

Table: Index methodologies.

Organization	Method
NVM	Median
CBS	SPAR (Sales Price Appraisal Ratio)
ABF	“Hedonic Price Model”
OrtaX*	Repeat sales

* OrtaX also provides hedonic price indices, however in this research only the repeat sales index is considered

Simple Statistics: NVM

- Median selling price is calculated in period t and $t+1$ for each market segment
- A weighted average of the segment medians is calculated
  - weights: the relative number of sales

The relative price change equals

$$(M_{t+1}/M_t - 1) \times 100\%,$$

where

$$M_t = \frac{n_{1,t} \times M_{1,t} + \cdots + n_{B,t} \times M_{B,t}}{n_{1,t} + \cdots + n_{B,t}}.$$

- simple to compute
- no correction for differences between traded properties
- all transaction prices are used

Sale Price Appraisal Ratio (SPAR): CBS / Kadaster

SPAR is given by

$$\text{Index}_{\text{SPAR},t} = \frac{\sum_{j=1}^{n_t} T_{jt} / \sum_{j=1}^{n_t} A_{j0}}{\sum_{j=1}^{n_0} T_{j0} / \sum_{j=1}^{n_0} A_{j0}}$$

- T is the transaction price (not in logs)
- A is the appraised value (WOZ-value); to correct for the differences between properties
- for each property an appraised value must be available
- (almost) all transaction prices are used
- WOZ-value is not always market value because of fictions
- Easy to construct
- Constant quality index

Hybrid method: ABF (WOX index model)

Four steps

1. Hedonic price model per COROP region
2. Comparability model per COROP region:
   comparability coefficient between 0 and 1
3. A typical house is selected per zipcode:
   the value is determined by a weighted average of corrected sales prices
   - corrected sales price: from step (1)
   - weights: from step (2)
4. Price index for a segment is calculated by aggregating the monthly values

Hybrid method: ABF (WOX index model)

WOX index model

- a constant quality index
- a total housing stock index
  not only transacted houses, or owner-occupied houses
- vulnerable to specification errors
  - functional form
  - omitted variables
- ad hoc method:
  - combining hedonics and comparables
  - how to compute confidence bounds for price changes?
  - re-estimating the model every month can result in unexpectedly varying coefficients/indices over time

Local linear Trend Repeat Sales Model (OrtaX)

Case and Shiller (1987,1989) repeat sales model

$$y_{it} - y_{is} = \beta_t - \beta_s + \varepsilon_{it} - \varepsilon_{is} + \omega_{i,s+1} + \cdots + \omega_{i,t},$$

- $y_{it} - y_{is}$: difference in log transaction price
- β_t is price level at time t
- Assumptions:
  - characteristics do not change over time
  - Influence of characteristics is constant over time
- Smoothing:
  - Goetzmann (1992) : periodic return is normally distributed: $\Delta\beta_t \sim N(\kappa, \sigma^2)$
  - Local linear trend repeat sales (Francke, 2009): varying slope: $\Delta\beta_t \sim N(\kappa_t, \sigma^2)$, and κ_t follows a random walk, $\kappa_{t+1} = \kappa_t + \eta_t$.

Local linear Trend Repeat sales model

- It is a constant quality index
- All single transactions are omitted (approx. 40% remains).
- Sample selection bias Properties with high number of transactions may not be representative.
  - Solution: Heckman's (1979) procedure, Gatzlaff and Haurin (1997)
- Revision Due to the repeat sales structure updating of index produces "backward adjustments" in the historical return series as new "second sales" link back to earlier "first sales".
  - Local linear trend model reduces considerably revision effect.
- Flips Properties sold within short time periods (say 6 months) can have extreme price increases.
  - Flips can either be removed from sample or explicitly modeled.
- Volatile In small samples the estimated price trend can be very volatile, due to noise in the transaction prices.
  - Local linear trend model reduces effect of transaction noise.

Comparison of transaction based index methods

Table: Comparison of index methodologies.

	NVM	CBS	ABF	OrtaX
Transaction date	Sales contract	Legal transfer	Legal transfer	Legal transfer
Data	Subsample	All	All	Subsample
Sample selection bias	Less	Less	Less	More
Constant quality	No	Yes	Yes	Yes
Appraised values required	No	Yes	No	No
Detailed property information required	No	No	Yes	No
Vulnerable to specification error	No	No	Yes	No
Ass. of no change in characteristics		No	No	Yes
Ass. of no change in impact of char.		No	No	Yes
Revisions	No	No	No	No

Comparison of Price Indices

Table: Details on start, frequency, region and house type classification of different indices.

	Start	Frequency	Region	House Type
NVM	1985Q1*	Q/Y	NVM/NL	T, R, C, S, D, A
CBS	1995M1	M/Q/Y	PROV/NL	T, SF, R, C, S, D, A
ABF**	1995Q1	Q/Y	COROP/PROV/NL	T, SF, A
OrtaX	1993M1	M/Q/Y	NVM/COROP/PROV/NL	T, R+C, S, D, A

* Also available from 1972 on a yearly basis.
** Publicly available.

Effect of Transaction Noise

- Expectation: No effect
- Standard deviation: Increase
- Autocorrelation: Decrease

COROP Regions and Provinces

Yearly price changes

Table: Yearly return rate statistics for the Netherlands 1995–2008.

All houses	NVM 72-08	NVM	CBS	ABF	OrtaX
μ	6.5%	7.0%	8.4%	7.9%	8.2%
σ	9.7%	5.2%	5.1%	4.7%	4.4%
ACF(-1)	0.617	0.592	0.758	0.754	0.799
ACF(-2)	0.221	0.232	0.421	0.418	0.516

- The NVM has a lower average rate of return
- The volatility almost doubles when the sample period is extended to 1972–2008.
- Variation over house types
  - Average: from 7.7% (row houses) to 9.8% (detached houses)
  - Volatility: from 4.4% (row houses) to 6.6% (detached houses)
- No large differences between different methods, except for detached houses
  - CBS: average and volatility: 9.8% and 6.6%
  - OrtaX: average and volatility: 8.9% and 5.2%

Quarterly price changes

Comparison ABF and OrtaX price changes over COROP regions (40)

- Large variation between COROP regions:
  - Average return varies from 1.54% (1.45%) to 2.25% (2.20%)
  - Volatility varies from 1.12% (1.35%) to 1.51% (2.79%)
- There is some spatial clustering in the average return rate.
  - High average returns can be found in the Amsterdam region (21–24), Friesland (4–6) and Brabant (35–36),all $> 2.0\%$.
  - On the lower end the regions Limburg (37–39) and Flevoland (40) can be found
- On average the volatility of the ABF series is much higher than the OrtaX series, 1.96% versus 1.12%.
  - The ABF series show some negative autocorrelation for the first time-lag. A possible explanation is the impact of transaction noise in the index: negative autocorrelations tend to coincide with large volatilities. A large price increase (decrease) in one period is compensated for in the next period, resulting in negative autocorrelations.

Monthly price changes

Comparison CBS and OrtaX price changes over provinces (12)

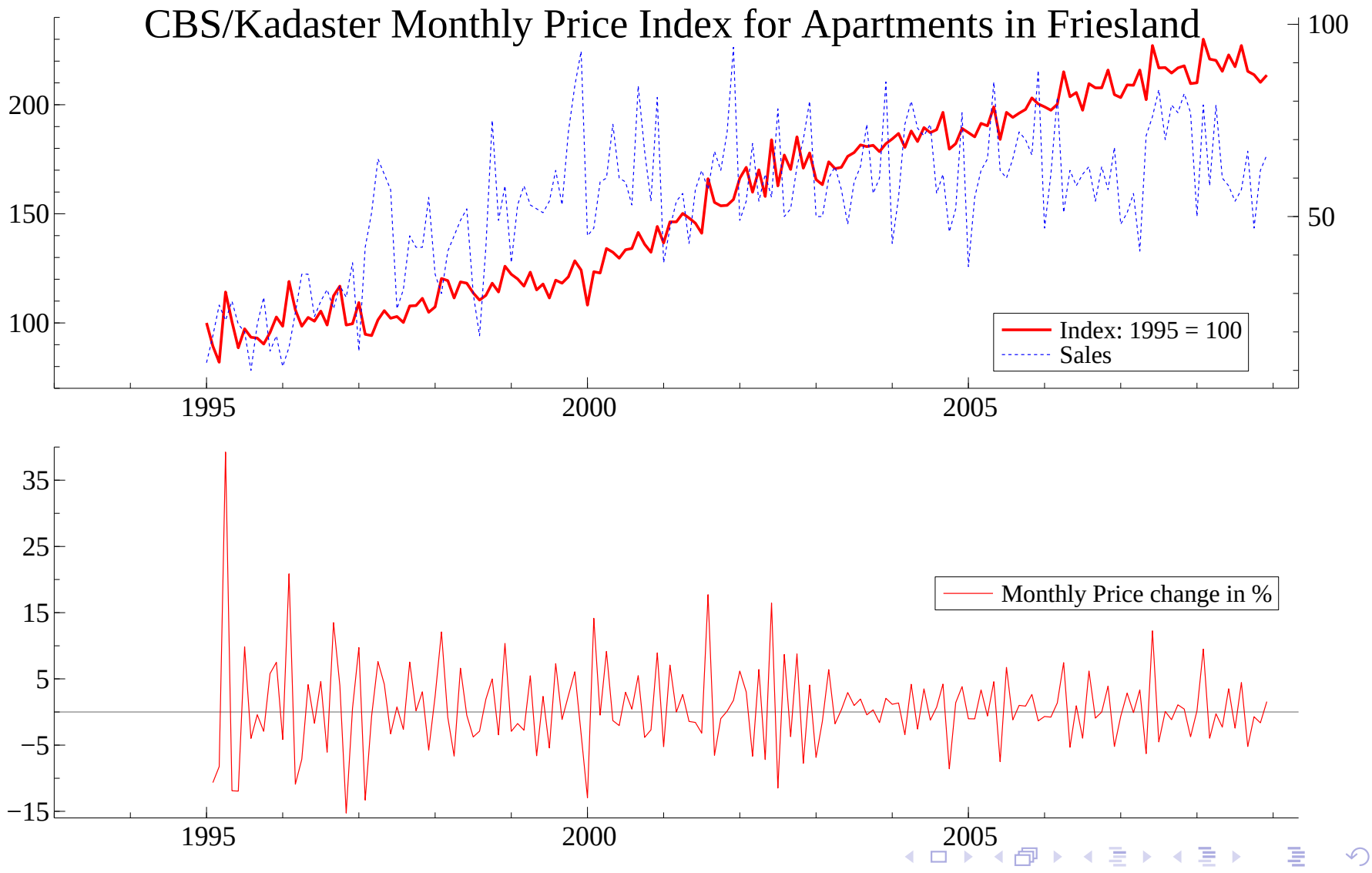
- Differences in average return rates between CBS and OrtaX are small
- Differences in average return rates over provinces are substantial
  - From 136% (Limburg) to 222% (Noord-Holland) price increase in the period 1995–2008
- Differences in volatilities between CBS and OrtaX are large
  - Average volatility CBS: 1.23%
  - Average volatility OrtaX: 0.36%
  - Volatility CBS series ranging from 0.77% to 1.79% over provinces (average rate of return is 0.63%)
  - Volatility OrtaX series ranging from 0.28% to 0.44% over provinces

Monthly price changes

Comparison CBS and OrtaX price changes over provinces (12)

- The CBS series can be characterized by having large standard deviations and negative first time-lag autocorrelation;
  - for row houses between 0.88% and 2.35%,
  - for semi-detached houses between 1.46% and 4.13%,
  - for detached houses between 2.18% and 5.41%, and
  - for apartments between 0.97% and 6.93%.
    - ★ The impact of transaction and appraisal noise is apparently higher, as the number of observations can be quite small (24 a month)
- The OrtaX series can be characterized by having relatively small standard deviations and relatively large autocorrelations.
  - The standard errors are ranging between 0.31% and 0.43% for row houses,
  - for semi-detached houses between 0.24% and 0.45%,
  - for detached houses between 0.28% and 0.54% and
  - for apartments between 0.29% and 1.28%.
  - The autocorrelations are approximately 0.95 for time-lag 1, 0.90 for time-lag 2 and 0.65 for time-lag 12.

Price Index for thin market



Conclusions

- NVM index
  - leading the other indices
  - no constant quality index: unreliable in thin markets
- Other index series
  - Differences in averages and volatilities over regions/house types
  - Differences between methods
    - ★ OrtaX series is the only series where monthly/quarterly/yearly volatilities are consistent

Volatilities (all houses)	CBS	ABF	OrtaX
Yearly	5.10%	4.70%	4.40%
Quarterly (annualized)		8.07%	4.56%
Monthly (annualized)	15.80%		4.41%

- Companion paper: “The impact of house price index specification levels on the risk profile of housing corporations” (Session 6E - Housing)