



Transaction Based Indices for Commercial Real Estate Derivatives

Marc Francke

University of Amsterdam, Ortec Finance

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Commercial Real Estate Indices

1. Appraisal-based

- Examples: NCREIF and MSCI/IPD
- Issues: smoothing- and lagging; can be subject to influence

2. Transaction-based

- Methods
 - a. hedonic model:
not applicable due to heterogeneity and low number of transactions
 - b. repeat sales model: RCA CPPITM
 - c. hedonic model with appraisal value as explanatory variable (or SPAR): ECB
- Issues
 - Noise (in granular indices) and revision (in specific for repeat sales models)

3. Stock market-based

- Example: FTSE-NAREIT 'pure' property market
- Issues
 - Information only indirect about actual property market, requires de-levering, not everywhere applicable

Geltner and Fisher (2007, JPM)

“Transaction-based indexes can be good bases for derivatives provided the indexes are carefully constructed using **sufficient quantity and quality of transactions observation data** and **state-of-the-art statistical procedures** to control for apples-versus-oranges differences in properties trading in different periods and to **minimize noise in the index returns.**”

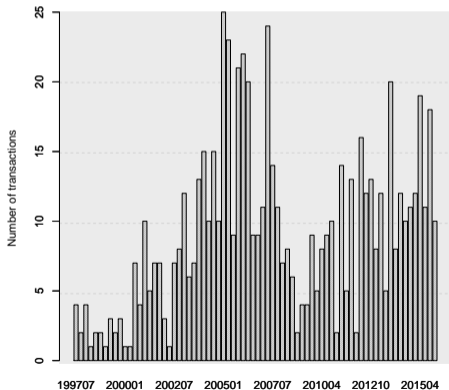
10 years later

- Good quality CRE database from Real Capital Analytics
- State-of-the-art repeat sales models, explicitly dealing with
 - reducing impact of noise in index returns
 - reducing random revision: in specific problematic for derivatives
adjustment of index values in the past due to adding new transactions
 - granular indices
- Repeat Sales Models
 - price index is derived from the price changes of individual properties (requires 2 or more transactions per property)
 - Why? CRE is very heterogeneous and number of transactions is limited
 - RS controls for apples-versus-oranges difference (same property), however
 - no correction for effect of depreciation and capital expenditures
- Index reflects capital gains only

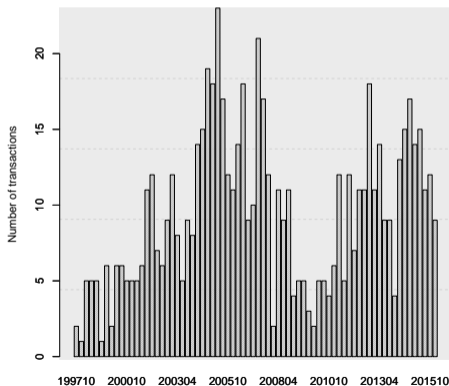
Data from Real Capital Analytics

■ Granular quarterly indices 1997 – 2016

- Office index for Inland Empire and Orange County (Los Angeles metro area)
- Apartment index for Oakland (San Francisco metro area)

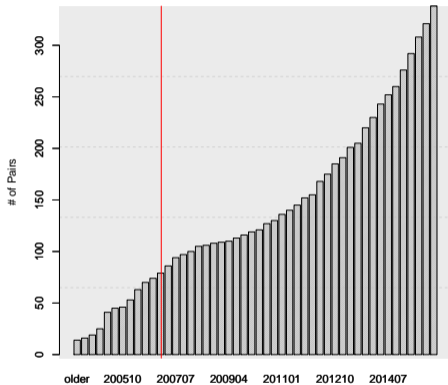


(a) Office transactions, LA

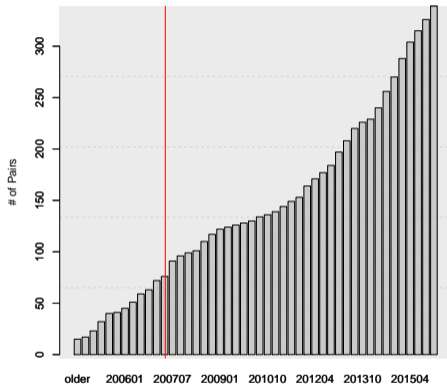


(b) Apartment transactions, SF

Number of pairs



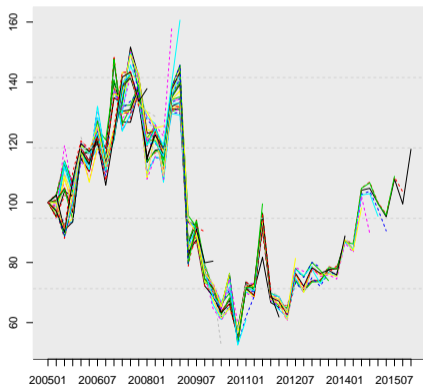
(a) Office transactions, LA



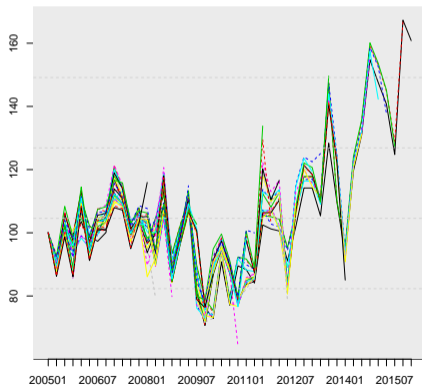
(b) Apartment transactions, SF

Standard repeat sales models

- Assume price level/change at time t to be independent from other periods
 - Perfect, when you have plenty of data, let data speak for itself
 - Not so smart, when you have limited and noisy data



(a) Office transactions, LA



(b) Apartment transactions, SF

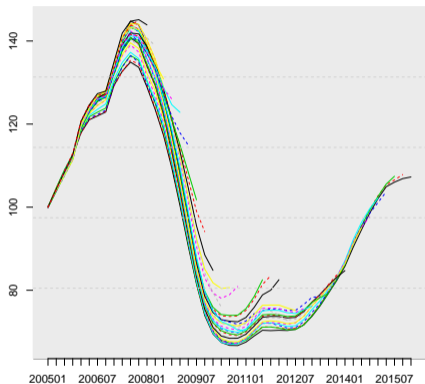
Structural Time Series Repeat Sales Model

1. current price change depends on previous price change: AR(1)-model
filters out signal from noise
2. error terms have fat tails (t -distribution, degrees of freedom to be estimated)
reduces impact of outliers
3. stochastic volatility in measurement equation and index equation
noise is higher during a crisis

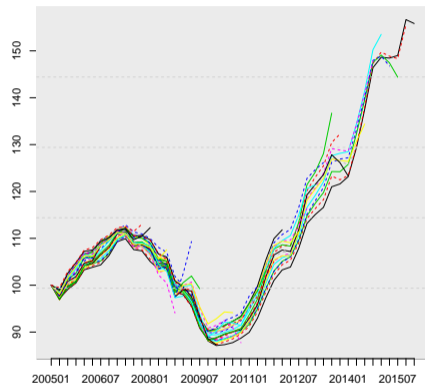
$$p_{it} - p_{is} = \mu_t - \mu_s + \epsilon_{it} - \epsilon_{is}$$
$$\mu_{t+1} - \mu_t = \rho(\mu_t - \mu_{t-1}) + \eta_t$$

- standard repeat sales model is a special case of above model
- Related work
 - Frequency conversion (Bokhari and Geltner, JREFE, 2012)
 - Local linear trend and hierarchical repeat sales models (Francke, JREFE, 2010; Francke and van de Minne, JREFE, 2017)

Results from Structural Time Series RS Model



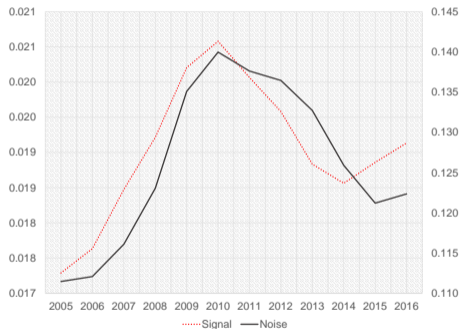
(a) Los Angeles



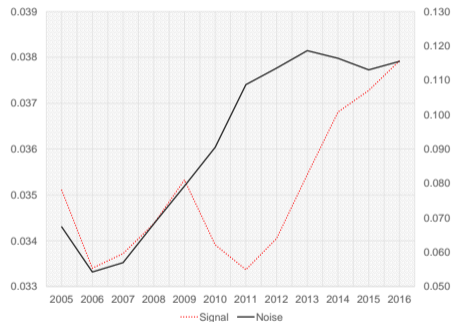
(b) San Francisco

Stochastic volatility

Strong evidence for fat tails (degrees of freedom around 8)

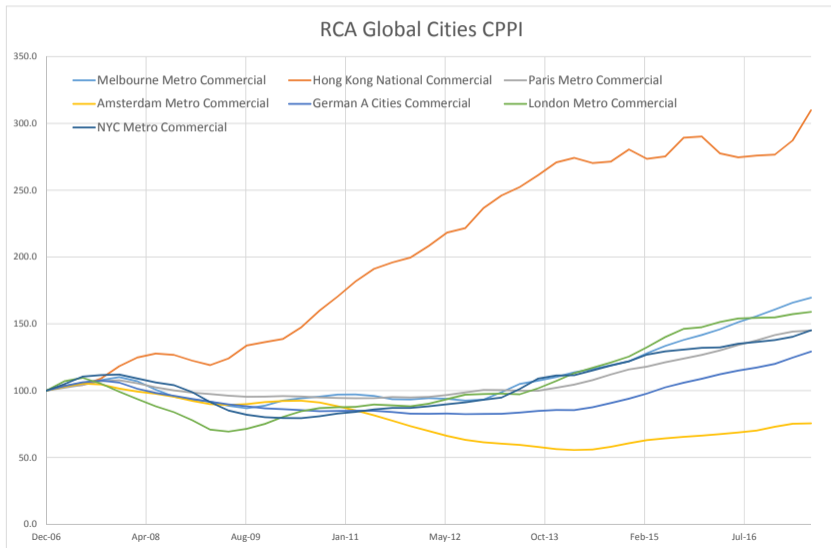


(a) Los Angeles



(b) San Francisco

Some real stuff





Questions?

Paper: *Revisions in Granular Repeat Sales Indices*

Marc Francke, David Geltner, Alex van de Minne, and Bob White

<http://ssrn.com/abstract=3016563>

Marc Francke

University of Amsterdam, Real Estate Finance Group

<http://www.uva.nl/en/profile/f/r/m.k.francke/m.k.francke.html>

m.k.francke@uva.nl