

Commercial Real Estate Price Index Measurement

Concepts, Methods and Policy Relevance

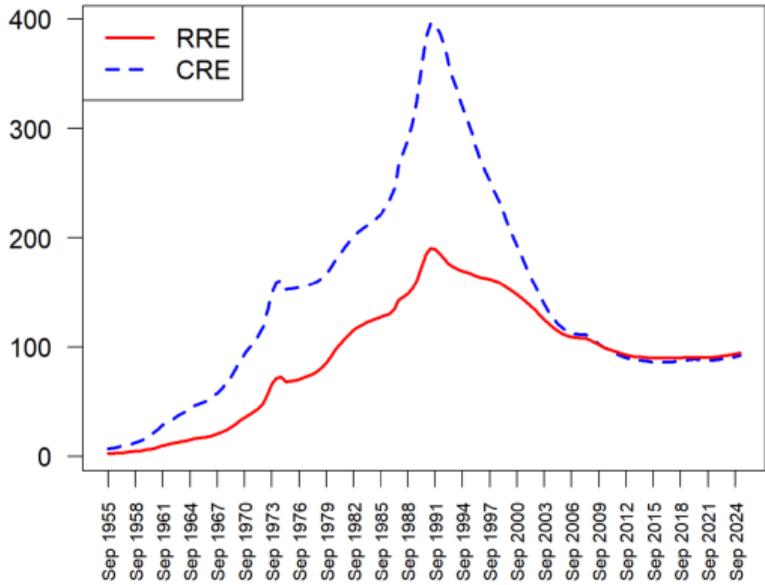
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Workshop on Property Price Indices and Real Estate Statistics

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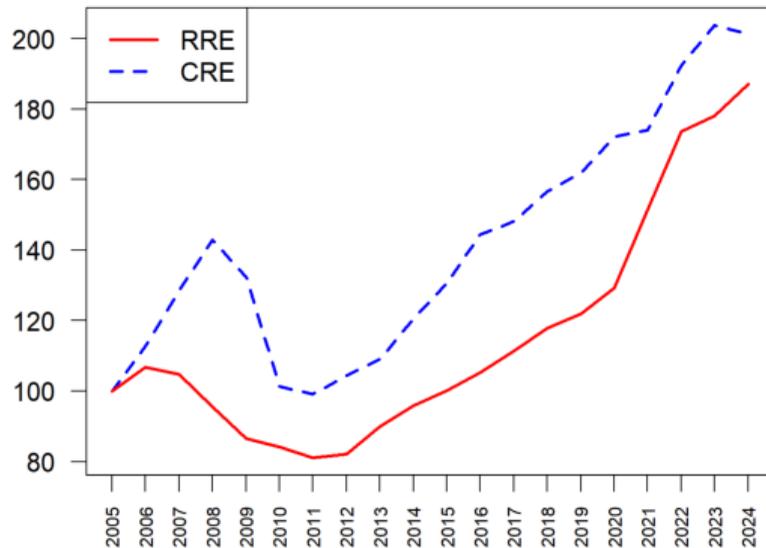
Why Do We Need CRE Price Indices?



CRE peaked higher and collapsed more severely.

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USA CRE and RRE Price Indices (2005 = Base)



CRE and RRE price indices can follow different paths

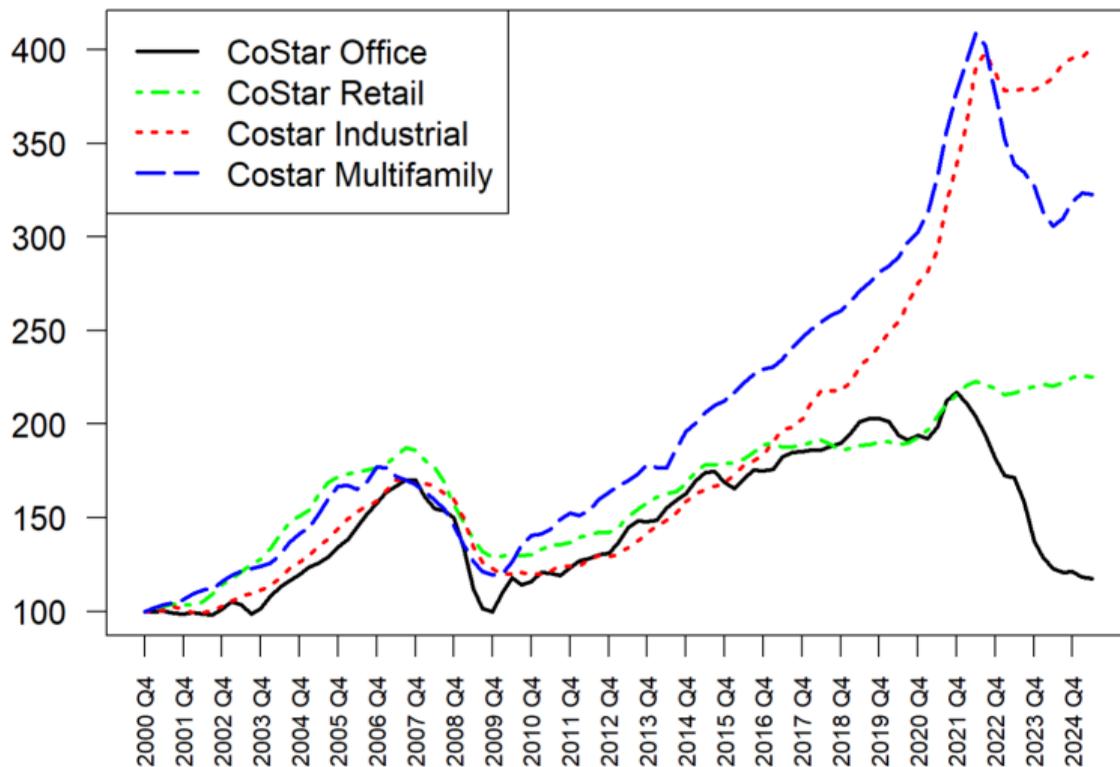
Why Do We Need CRE Price Indices?

- Real estate is central to financial and economic stability
- CRE loans are large, concentrated, and highly leveraged
- CRE markets are more cyclical than RRE
- CRE downturns propagate through:
 - Bank balance sheets
 - Collateral values
 - Investment and employment
- Macroprudential policy requires timely CRE indicators

CRE vs RRE: Structural Differences

- RRE: households, widely distributed asset types
- CRE: institutional investors, concentrated asset classes.
- CRE properties larger and more heterogeneous
- CRE markets more cyclical and more leveraged

Disaggregation Matters: CRE Subtypes



Office, industrial, retail and multifamily evolve differently – especially after COVID pandemic.

Residential Market Structure



Residential properties tend to be similar in types (houses and apartments).

Choice of Index Method Less Important in RRE Markets

Stratification, repeat sales and hedonic methods tend to produce similar inflation paths.

Structural properties of RRE:

- Large transaction volumes
- Houses and apartments traded in most regions
- Quality variation relatively continuous
- Stable transaction mix

Minimal Quality Controls in RRE

- Separate houses and apartments
- Control for size
- Regional dummies often approximate location

Key points:

- Similar property types exist in many regions.
- Large volume of transactions.
- Stratification compares broadly comparable assets.

Commercial Real Estate Markets



CRE assets are heterogeneous and spatially concentrated.

Why Simple Stratification Breaks Down in CRE

Asset structure differs strongly by location:

- High-rise office buildings concentrated in major cities
- Smaller offices dominate secondary regions
- Shopping malls vs corner shops
- Industrial assets clustered

Number of transactions low.

Problem:

- Regional stratification may compare fundamentally different asset qualities.
- Low transaction numbers → relative composition of sales varies over time → we are comparing "apples and oranges".

Composition Bias in CRE

Thought experiment:

- Quarter 1: one prime CBD office tower sold
- Quarter 2: two small suburban warehouses sold

Median price collapses — but quality mix changed.

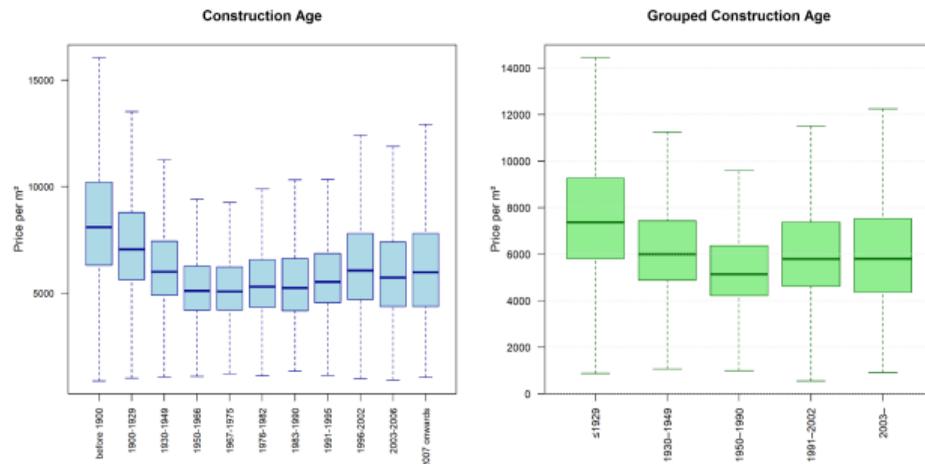
Conclusions:

- ① Simple stratification indices are unstable in heterogeneous and thin markets.
⇒ We need Hedonic or Repeat Sales indices.
- ② We need to differentiate between different CRE types.
- ③ We need to collect more information on each property to describe it better.

Controlling for quality in Hedonic CRE Price Indices

- Floor area
- Building age
- Energy efficiency
- Distance to CBD
- Travel time to employment centres
- Proximity to transport
- Zoning and usage restrictions

Example: Construction Age



- Age can be a good variable to signal "building quality".
- In some countries, period properties catch a premium
⇒ age should not be entered linearly.
- Including age as a factor variable works well generally.
- If CRE data volume is low, reducing factor levels is a good idea.

Why Geospatial Variables Matter

- Distance to CBD is a quality measure
- High-rise offices clustered in CBD
- Closeness to transport hubs important
- Retail industry is sensitive to pedestrian flows

Without explicit controls:

- Quality shifts appear as price inflation.

Geospatial data let us construct new amenity variables:

- distance measures (to CBD, to transport stops, etc)
- density measures (e.g. number of shops in area, number of restaurants in area)

⇒ Geospatial variables help us to control for the quality of the properties.

CRE Index Challenges

- Low transaction numbers
- Confidential deals
- Share deals (not clear what proportion is RE)
- interior fittings often included in price
- Appraisal vs transaction data
- Small samples in submarkets
- CRE markets are heterogeneous
- Fire Sales
- Quality is spatially concentrated
- Composition shifts distort simple measures

From Structural Complexity to Methodological Solution

How do we construct a robust CRE price index?

Two Main Approaches

- Repeat Sales Methods
- Hedonic Methods

Both aim to control for quality differences.
They differ in how quality is treated.

Repeat Sales: Basic Idea

- Observe the same property at two points in time
- Quality assumed constant between sales
- Price difference reflects pure market change

Key assumption: no structural change between transactions.

Repeat Sales: Estimation

For property i sold at times t and s :

$$\ln p_{i,s} - \ln p_{i,t} = \delta_s - \delta_t + \varepsilon_i$$

- $\delta_t = \log$ price index at time t
- Estimated via regression across all repeat pairs

Index obtained by exponentiating $\hat{\delta}_t$.

Strengths of Repeat Sales

- Controls for time-invariant unobserved quality
- Does not require detailed characteristics
- Conceptually elegant
- Widely used in residential markets

Limitations in CRE Markets

- Few repeat transactions in thin markets
- Large assets trade infrequently
- Renovations violate constant-quality assumption
- Sample selection bias:
 - Only more liquid assets reappear

Works well in dense markets. Problematic in heterogeneous CRE submarkets.

Hedonic Framework

$$\ln p_n = \sum_{c=1}^C \beta_c z_{c,n} + \delta_t + \varepsilon_n$$

- $z_{c,n}$ = observable characteristics
- δ_t = time effect
- Controls quality directly

Time Dummy Method

Estimate over full sample:

$$\ln p_n = \sum_c \beta_c z_{c,n} + \sum_t \delta_t d_{t,n} + \varepsilon_n$$

- Index: $P_t = \exp(\hat{\delta}_t)$
- Uses all data simultaneously

Issue: characteristic shadow prices (β_c) may become stale over time.

Rolling Time Dummy (RTD)

- Estimate model over moving window (e.g. 3–5 years)
- When new period arrives:
 - Drop oldest period
 - Re-estimate model
- Allows characteristic effects to adapt over time

Why RTD Is Suitable for CRE

- Handles heterogeneous asset mix
- Controls observable characteristics directly
- More stable in small samples than stratification
- Reduces characteristic coefficient shadow price (β_c) staleness
- The window length can be chosen depending on the number of observations available per period

RTD vs Repeat Sales in CRE

- Repeat Sales:
 - Strong when many resale pairs exist
 - Weak in thin markets
- RTD Hedonic:
 - Works without resale pairs
 - Requires detailed characteristics
 - Explicitly controls quality dimensions

In heterogeneous and thin markets, RTD is often the more robust option.

Methodological Takeaway

- CRE markets require direct quality control
- Simple stratification often insufficient
- Repeat sales elegant but data demanding
- Hedonic RTD flexible and robust