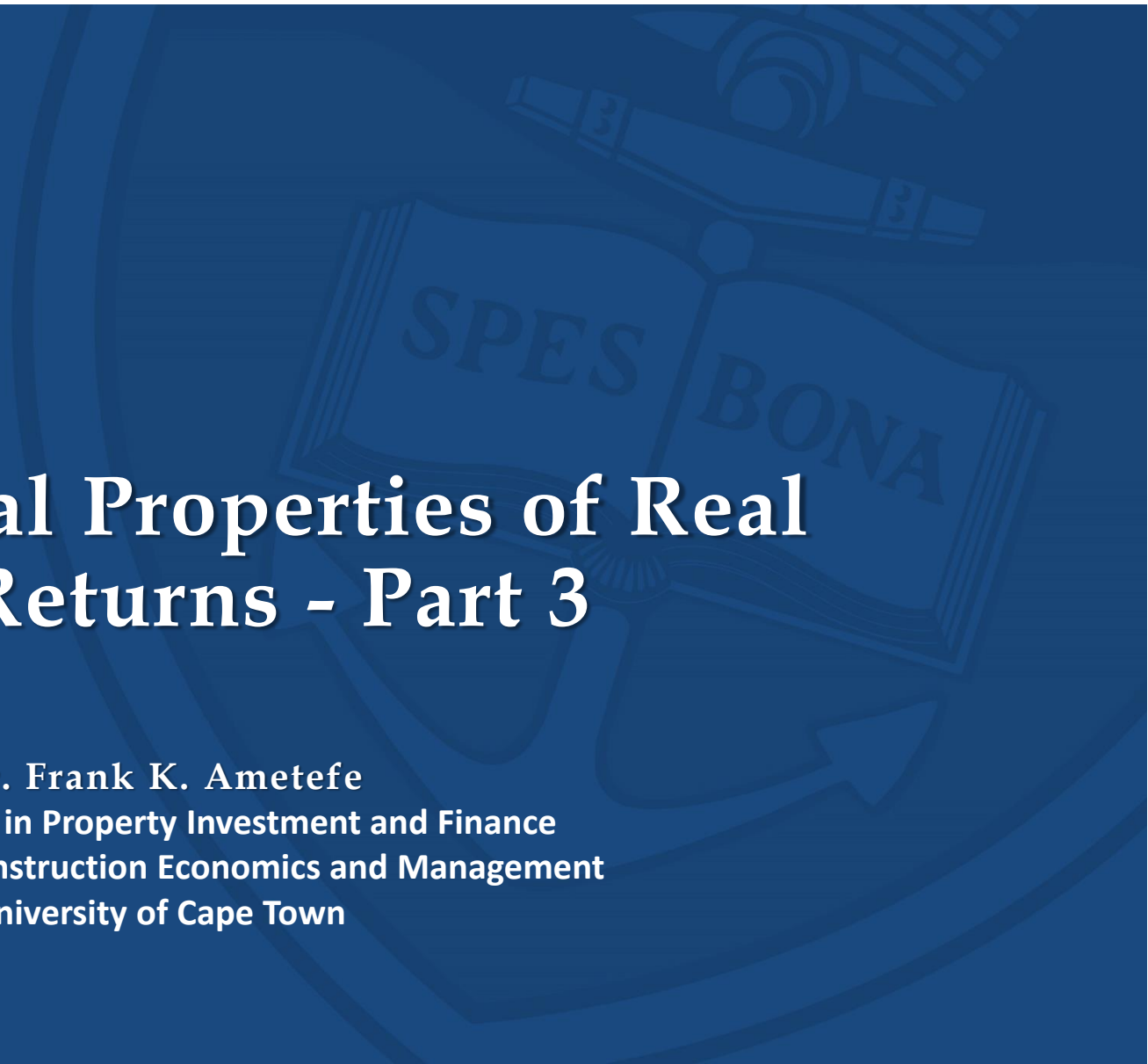


The background of the slide features a large, faint watermark of the University of Cape Town crest. The crest is circular and contains a shield with a book and a quill. The book is open, and the words "SPES BONA" are visible on its pages. The quill is positioned above the book. The entire watermark is rendered in a lighter shade of blue than the background.

Distributional Properties of Real Estate Returns - Part 3

Dr. Frank K. Ametefe
Senior Lecturer in Property Investment and Finance
Department of Construction Economics and Management
University of Cape Town

WHY ARE REAL ESTATE RETURNS NOT NORMALLY DISTRIBUTED?

Appraisal- v. Transaction-Based Real Estate Indexes

- To understand why the returns of private market assets such as direct real estate are not normally distributed, it is important to understand how the returns of direct real estate are generated.
- There are two main types of real estate indexes available to market participants, allowing them to calculate the returns of real estate assets:
 - *Appraisal-based indexes:* These are derived from the property values estimated by appraisers, which may track a particular sub-population.
 - *Transaction-based indexes:* These are estimated based on actual contemporaneous property sales of sample properties that trade in each period.



Appraisal-Based Real Estate Indexes

- Methods for appraising real estate:

- ***Sales Comparison Approach:*** Properties are evaluated against comparable properties that have been recently sold.
- ***Cost Approach:*** Assumes that a buyer will not pay more for a property than it would cost to build an equivalent one.
- ***Income Approach:*** Here, several years of net operating income are projected for a specific property or portfolio of properties and then discounted using an appropriate discount rate.



Advantages of Appraisal-Based Models

- All properties can be appraised as frequently as desired.
- Appraisal-based index models do not suffer from a small sample size problem.

Disadvantages of Appraisal-Based Models

- **Appraisals are inherently subjective and backward-looking.**
- **Appraisal-based indices are smoothed compared with actual changes in real estate market values.**
- **Quality of appraisals depends on quality of available data.**

Examples of Appraisal-Based Indexes

- *National Council for Real Estate Investment Fiduciaries (NCREIF) Property Index (NPI)*
 - NCREIF collects data and maintains data on real estate income and pricing data and uses this to publish the NACREIF Property Index (NPI) which tracks the performance of core institutional property markets in the United States.
 - Most valuations are appraisal-based. The change in value of each property is calculated on an “as if” basis. For properties which are actually sold over the period, the actual transaction price is used in place of the beginning or ending value.
 - NACREIF indexes are also available geographically by region, division, state and zip code.
 - NACREIF also publishes data on the performance of farmlands and timberlands.

Examples of Appraisal-Based Models

- *MSCI Property Indexes*

- The constituents of the MSCI Property Indexes are real estate investments that are held in professionally managed portfolios e.g., insurance and pension funds, sovereign wealth funds, listed property companies including REITs, unlisted pooled funds etc.
- The MSCI Property Indexes are primarily based on real estate valuations, and where available, property transacted prices, supplied by its data providers. Groupings of MSCI property indexes include regional and market indexes and sector indexes.
- MSCI Property Indexes measure the performance of global, regional and individual national markets by calculating and aggregating the performance of individual properties. Currently, the index covers over 30 countries (See [index guide](#))

Transaction-Based Real Estate Indexes

- ❑ Transaction-based real estate indexes are estimated based on actual contemporaneous sales of properties that trade in each period.
- ❑ These are a good basis for determining real estate returns provided:
 - They are based on enough data and rigorous econometric methods.
 - Any differences in properties trading in different periods are controlled for.
 - Statistical noise is minimized.



Transaction-Based Real Estate Indexes

- Methods used to estimate transaction-based property price indexes:
 - ***Hedonic Pricing Method:*** Hedonic price indexes infer the prices of properties that have not been recently traded by directly modelling the heterogeneity of real estate assets.
 - ***Repeat Sales Method:*** The repeat sales method regresses the percentage price changes observed in properties onto a sequence of time-dummy variables.



Example of Transaction-Based Real Estate Indexes

- **NCREIF Transaction-Based Property Index**
 - The Transaction Based Index (TBI) was launched by the Massachusetts Institute of Technology Centre of Real Estate (MIT/CRE) in February 2006 and published quarterly until 2011, when NCREIF took over its production and publication (with a slightly modified methodology). It is now referred to as the NACREIF Transaction Based Index (NTBI).
 - The index is produced by combining the NCREIF appraisal-based index with the regression time-dummy coefficients reflecting the differences between appraisals and transaction prices.
 - The NTBI project essentially uses the hedonic approach, based on the properties sold from the NCREIF Index database, regressing their transaction prices onto their recent appraised values and time-dummy variables.

What to do if data is not normally distributed

- Check for outliers and make a decision to delete these observations.
- Conduct a logarithmic transformation to “normalise” the distribution.
- Employ non-parametric statistics to yield inferences. Below are some parametric tests and their non-parametric equivalents:

Parametric Test	Non-Parametric Equivalent
One sample t-test	One Sample Wilcoxon Signed Rank Test
Two Sample t-test	Mann-Whitney U Test
Paired Samples t-test	Two Sample Wilcoxon Signed Rank Test
One-Way ANOVA	Kruskal-Wallis Test