Face Off:
Factor Models
vs.
Commercial Real Estate Risk Premiums

Northfield Webinar
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Agenda

- Challenges of Commercial Real Estate in Risk Factor Models

- Northfield's Approach

- Comparison with Appraisal Index Approach

- CRE Cap Rates Review

- Value Added by Cap Rates in a Risk Factor Model

- Summary
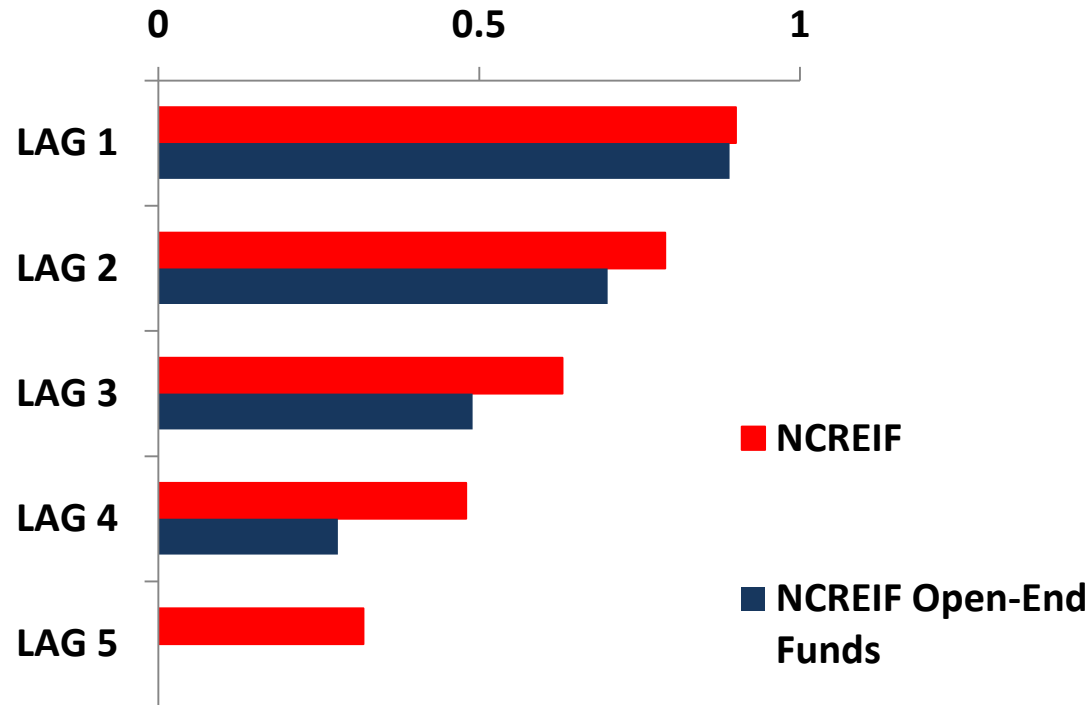
Commercial Real Estate and Factor Models

- "Fama-French" is not common jargon in real estate investment departments

- Unlisted investment experts tend to think of risk in terms of <u>first</u> distributional moment, *i.e.* return, not volatility

- "Location, Location…" is not an obvious quantity

- Estimation of duration of cash flows pertaining to unlisted assets are often over-simplified in the practice of ALM for pensions and insurance

- Broad asset class indexes, or marketable-proxies, attempt to battle the "quantification" aspect while compromising on each investment's idiosyncratic nature and appraisal bias

Risk & Private Equity Real Estate

- Current real estate performance indices do not use observable prices:
  - Appraisal-driven and therefore appraisal-biased
    - Smoothed, dampened: Exhibit serial correlation
    - Repeat Sales Indices: Small sample size & little property-level info
- Current indices:
  - Good for:
    - Long-term historic trends and absolute returns (See: Cheng, Lin, & Liu 2011)
  - Not good for:
    - Short-term analysis for trading, new investment, asset allocation
    - Uncertainty of future returns
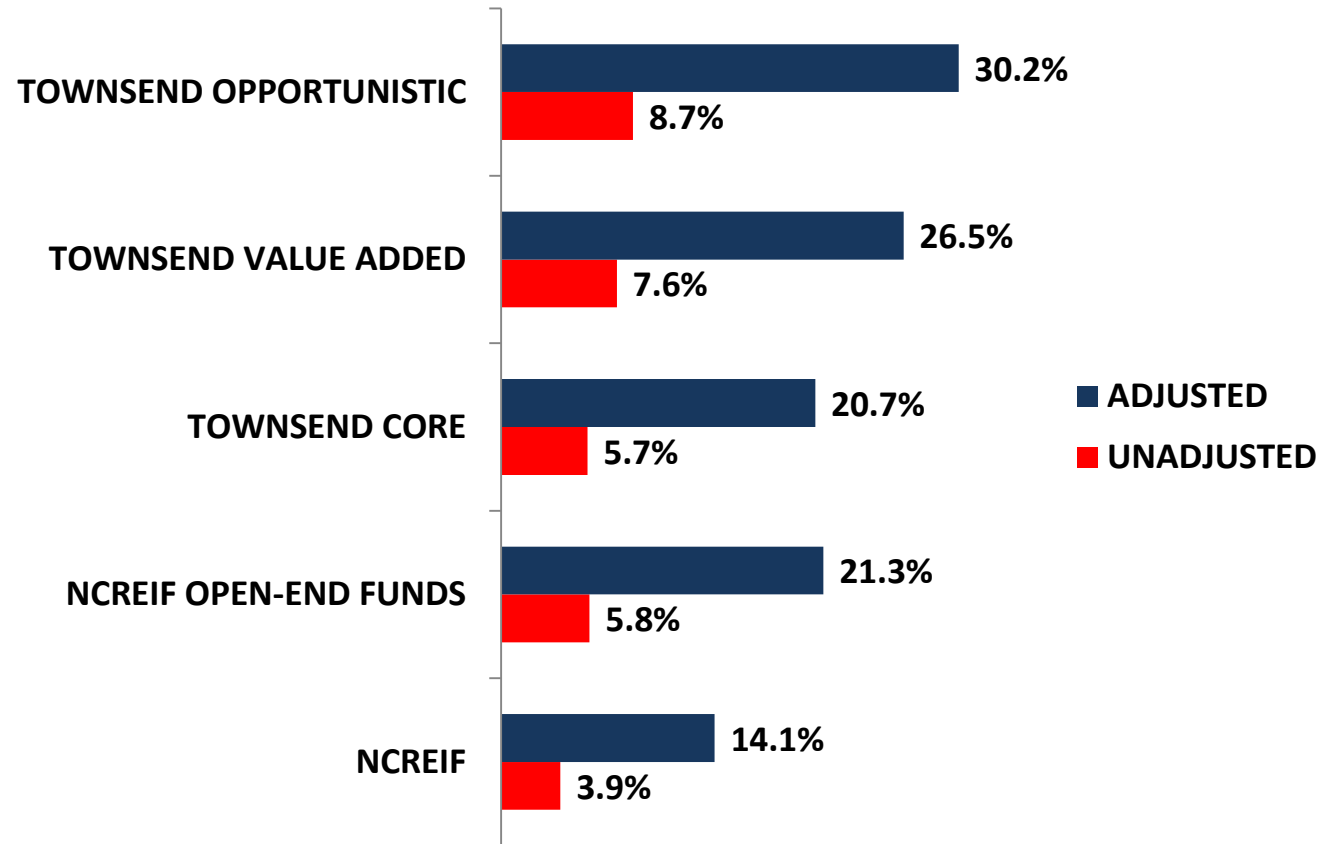   - Risk components and their contribution at the property and portfolio levels

Appraisal Bias Remains an Issue

RETURN PERSISTENCE REMAINS AN ISSUE
LAGGED QUARTERLY BETAS
2003:4 – 2013:3

Correcting for Autocorrelation

Standard Deviation - Last 20 Quarters of Available Data

Chart showing Adjusted vs Unadjusted standard deviation:

- TOWNSEND OPPORTUNISTIC: Adjusted 30.2%, Unadjusted 8.7%
- TOWNSEND VALUE ADDED: Adjusted 26.5%, Unadjusted 7.6%
- TOWNSEND CORE: Adjusted 20.7%, Unadjusted 5.7%
- NCREIF OPEN-END FUNDS: Adjusted 21.3%, Unadjusted 5.8%
- NCREIF: Adjusted 14.1%, Unadjusted 3.9%

Legend: ADJUSTED, UNADJUSTED

Northfield's Property Risk Approach

- A "bottom-up" property-by-property model that is not appraisal-based
- Each property is a composite asset with:
  - Risks based on "steady-state" cash flow assumptions for existing and expected leases
    - Uses lease structure, renewal, credit quality of tenants, vacancy dynamics, revenue and expense schedules
  - Risks related to mortgage financing (if any)
    - Takes into consideration floating rate, fixed rate, interest-only, balloon clauses, prepayment behavior, etc.
  - Risks of future fluctuations in market rents
    - Takes into consideration the combined impact of lease rollover, vacancy, renewal, and market volatility of rents
- Each component has risk exposures to common risk factors plus idiosyncratic risks
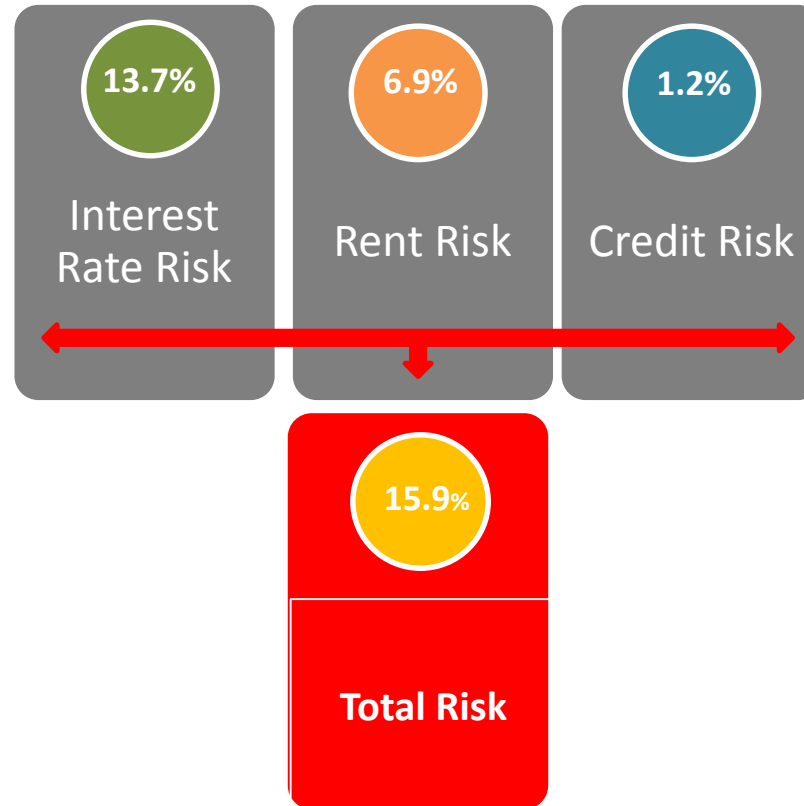
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Real Estate Model Structure
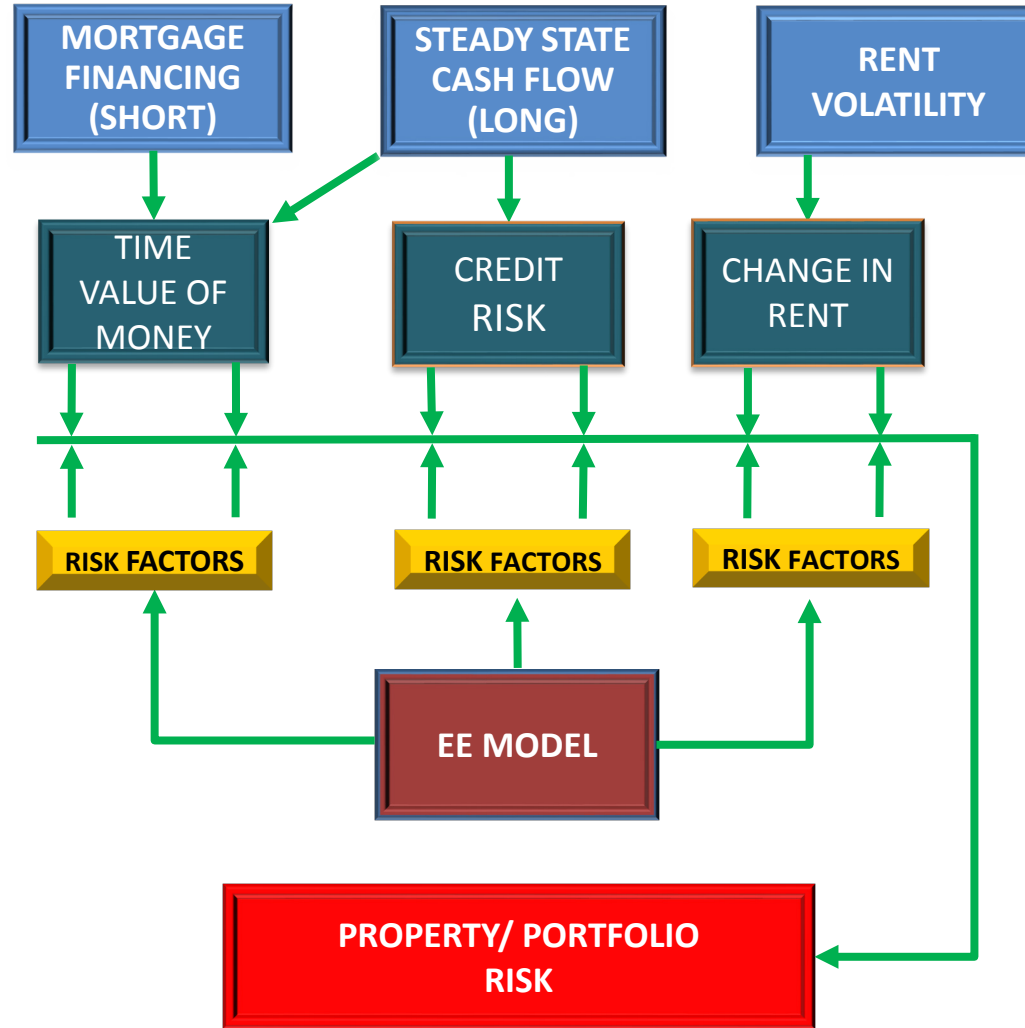
Components of Property-Level Risk
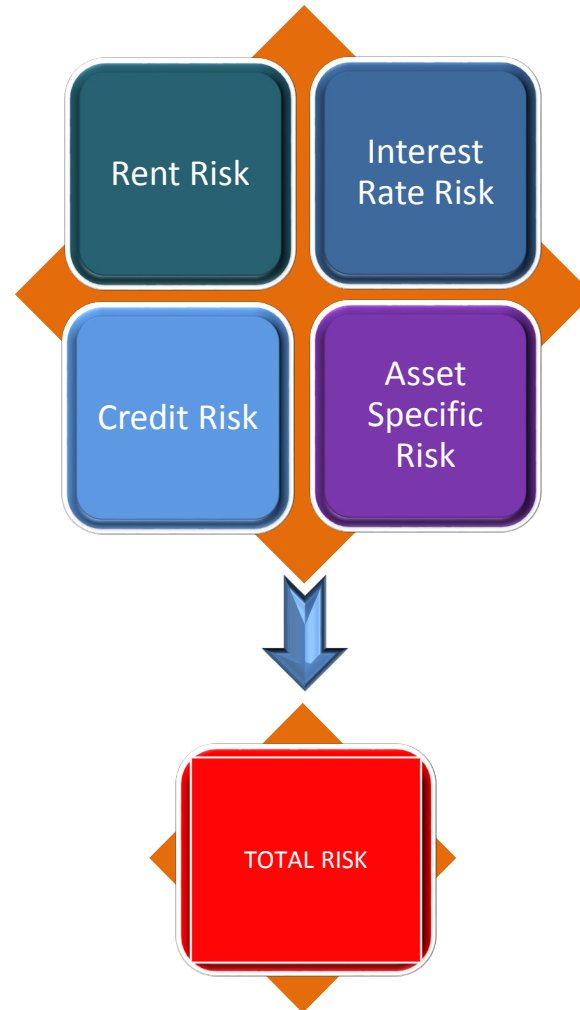
Property Risk by Source

Sample Apartment Building

www.northinfo.com

Disadvantages of the Appraisal Index Risk Factor Approach

- Likelihood of any single property to sit at the mean is very small. Analyzing risk at the individual property (or tenant) level is not possible.

- Index matrix approach does not allow changes to assumptions (lease, tenants, gearing) to observe their effect on risk for a particular building.

- Factors specific to real estate give no insight on hedges that use liquid investments (even if REIT-based) to manage risk from illiquid investment risk.

- ***The de-smoothing of index series is an additional layer of estimation error in correlations. At 90% confidence of de-smoothed series at the individual index level, we get to 35% joint confidence after adding only 10 markets. This error does not diversify since it is in the factor correlation matrix.***

- Silo models for each asset class make the covariance matrix a patched quilt of many segments which can make the overall variance unstable at the portfolio level.

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Investing 101

- A basic identity by which any long-term investment is valued:

$$Value\ of\ Investment = \frac{Periodic\ Cash\ Flow}{Discount\ Rate}$$

$$Discount\ Rate = \frac{Periodic\ Cash\ Flow}{Value\ of\ Investment}$$

$$Cap\ Rate = Discount\ Rate = 10\text{-}Year\ Treasury + Risk\ Premium$$

- Even appraisers don't disagree; actually it is Appraisal Theory 101. The Cap Rate is essentially an E/P Ratio and is nothing more than the Risk Free rate plus a Risk Premium.
- The challenge is that appraisal-based Cap Rates suffer from the same problems as appraisal-based indices which we have discussed *ad nauseum*.
- However………

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Cap Rates vs. CRE Return Indices

- Just like Return Indices, Cap Rates are aggregates calculated per particular market (location, property type)

- *Unlike Return Indices, Cap Rates are an ingredient rather than the final product of valuation.* Thus they can be used in the valuation of specific properties by utilizing the actual characteristics of the properties – vacancy, useful life, lease terms, expenses, rent levels, etc.. This gives rise to specialized calculation of risk factor exposures for the particular CRE investments.

- Like Return Indices, Cap Rates can be either based on actual transactions or based on appraisals

- Unlike Return Indices, the impact of appraisal smoothing is mitigated to an extent in the context of a risk factor model. More on this next…

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Cap Rates: Even if sometimes appraisal-based…

- Being a ratio of two normal variables (NOI and the Property Value), cap rates follow the Cauchy Distribution which has more mass in the tails than a normal distribution.

- Thus, in a risk factor regression against a normal factor it will register higher factor sensitivities. It is a natural "de-smoother".

- Any-error does not accumulate in the factor correlations which means it gets diversified at the portfolio level, which is in stark contrast as using the indices as risk factors.

- Let's also recall that the Cap Rate is the ingredient , not the final product of valuation / risk factor sensitivity calculation; when used in conjunction with market based tenant credit spreads the estimation error gets diversified further.

Transactional Cap Rates

U.S. Cap Rates by Property Type – Percent
Source: RCA & CBRE
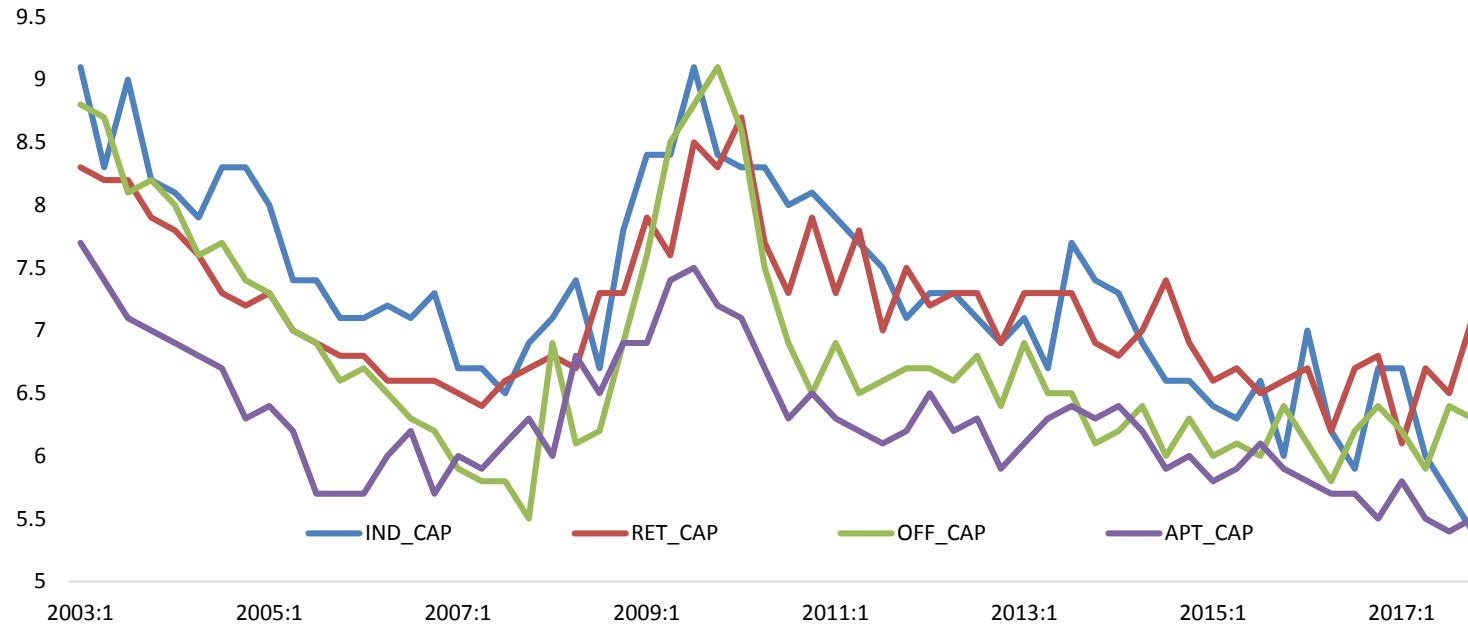
Cap Rates across property types have generally followed suit nationally. Apartment caps tend to be the lowest and industrial and retail caps the highest.   Differences are more apparent at the local level.

Transactional Cap Rates

- Transaction-based cap rates, while not perfect, are backed by an actual sale rather than appraisal-based time series.

- Real estate transaction-based cap rates are not perfect.
    - Some Cap Rates may be based on trailing NOI and others expected NOI or they might be part of a portfolio sale and their NOI or value allocation may not be spot on.
    - Sample sizes and characteristics (Small vs Large, Class A vs Class B, East Coast only, etc.) might impact the data especially for small areas such as Metros..

- Assuming this is the best estimate available, this means that since we know the Risk-Free rate, we can back out the Risk Premium

Office Cap Rate Decomposition

Contributions to Office Cap Rate
10-Yr Treasury's & Risk Spread's Share
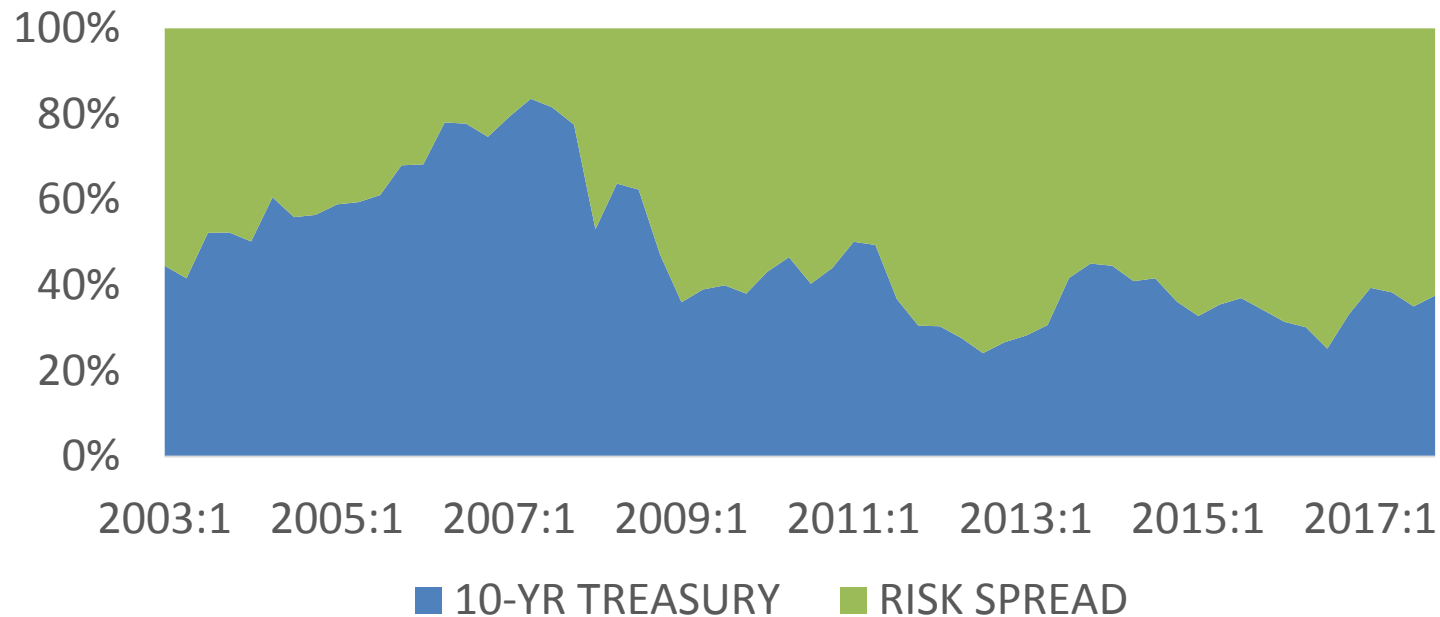
Not surprisingly, risk spreads as a percent of total narrowed just before the Great Financial Crisis, peaked quickly, and has now remained in a fairly narrow range.

BB Corporates & Cap Rates Spread Are Highly Correlated

BB Corporate & Cap Rate Spreads - Percent

Legend: BB CORPORATE, IND, RETAIL, OFFICE, APTMT
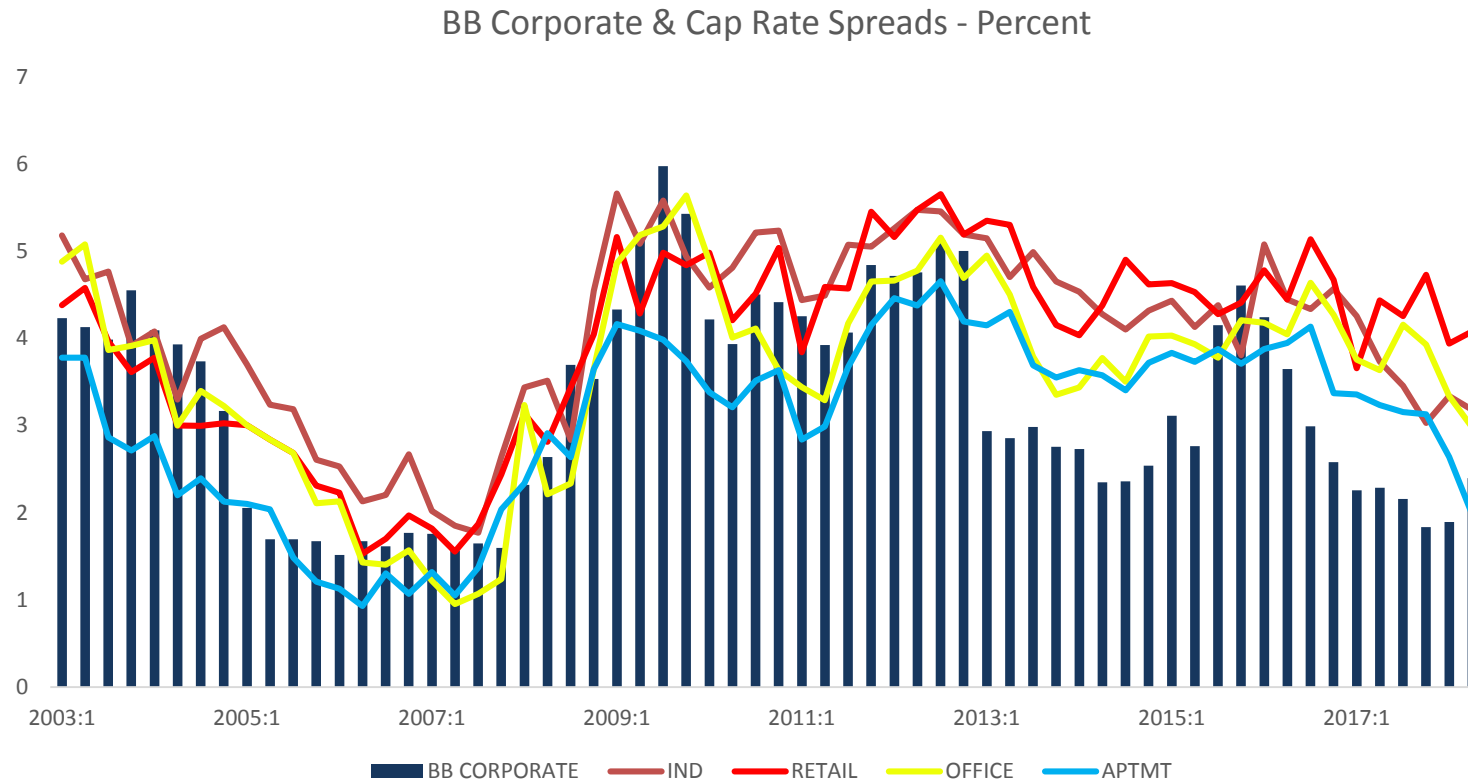
BB Corporate and Cap Rate Spreads move closely together. However, the question is whether there is something left on the table if you just use BB spreads?

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Is There Anything Left Over?

Property Type Spread Minus BB Corporate Spread = f(EE_Factor)

PROPERTY TYPE	MOVING AVG	EXOGENOUS VAR	LAG	BETA	T-STAT	DW	AR
APARTMENT	Y	EE_FACTOR_2	2	10.07	2.38	2.03	1
INDUSTRIAL	y	EE_FACTOR_1	2	18.24	2.56	2.00	1
OFFICE	y	EE_FACTOR_2	2	7.44	2.02	1.75	1
RETAIL	y	EE_FACTOR_2	2	12.61	2.28	2.08	1

Why use property-specific spreads? Aren't BB Corporate spreads a sufficient proxy?
Simply test: Subtract BB Corporate spreads from property cap rates spreads and see if any factors are significant and pass the "smell" test.

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Can We Explain The Change In Spreads?

Simple Test: Can Risk Factors Help Explain Changes in Property Risk Spreads?
A Simple one Variable Model: 2007:1 – 2017:4

DEP	MOVING AVG	EXOGOGENOUS VAR	BETA	T-STAT	DW	AR
APARTMENT	Y	EE_FACTOR_3	-3.44	-5.02	2.11	1
INDUSTRIAL	y	EE_FACTOR_3	-5.09	-5.04	2.26	1
OFFICE	y	EE_FACTOR_3	-6.48	-4.31	1.62	1
RETAIL	y	EE_FACTOR_3	-3.90	-3.27	2.01	1

Regress the change in spreads:

(Cap Rate – 10-Year Treasury) – (Cap Rate\1 – 10-Year Treasury\1)

Against risk factors from Northfield's Everything Everywhere model

Actual Cap Rate - Fitted Cap Rate By Land Use

ABSOLUTE ERRORS (bps) - FITTED CAP RATES
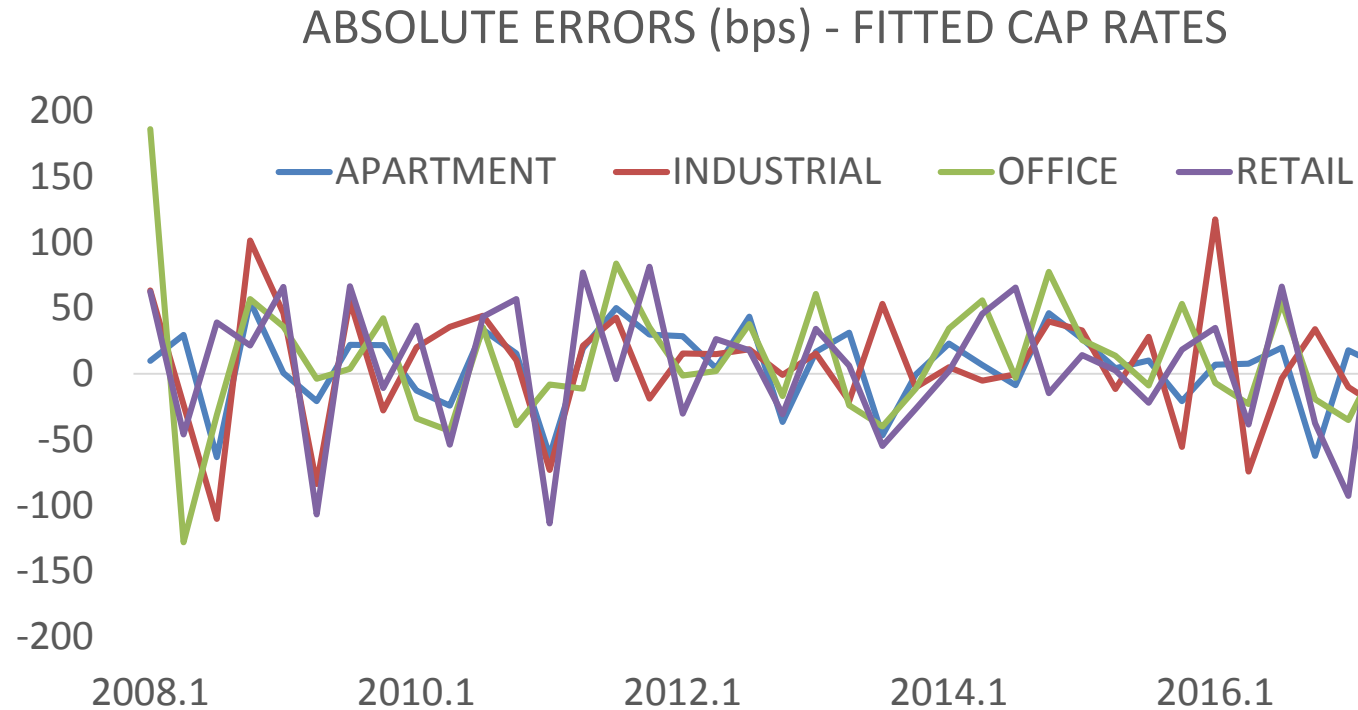
Cap Rate = 10-Year Treasury + (Risk Premium{1} + Fitted Change in Spread)

What About Granular Geographies ?

- Is it possible to extend the analysis to metro areas?
- For transaction-based data sample size and quality become an issue
  - For some metros there are no transactions in a given quarter or too few for an unbiased sample
- Two options:
  - Employ a hedonic model to "smooth" the series and fill in the missing observations
  - Employ an appraisal-based cap rate
  - Both have issues:
    - "Smoothed" uses a hedonic to adjust individual and missing observations
    - Appraisal-based" non-transactional but offers insights

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Metro Office Results

Hedonic/Transaction-Smoothed Model

- 20 out of 62 metros with significant T-Stats on Northfield EE Factor variable
- Hedonic betas show greater variation that appraisal-based cap models
- Hedonic cap equations have lagged exogenous variables

METRO	MA	EXOGENOUS VAR	LAG	BETA	T-STAT	DW
Boston	Y	EE_FACTOR_3	N	-9.37	-3.73	2.13
Los Angeles	Y	EE_FACTOR_3	Y	-7.36	-2.49	2.50
Portland	Y	EE_FACTOR_2	Y	-3.18	-2.00	1.73
San Francisco	Y	EE_FACTOR_3	Y	-3.92	-2.12	1.75
Tampa	Y	EE_FACTOR_3	Y	-5.02	-2.81	2.24

Appraisal-Based Cap Rates

- 56 out of 62 metros with significant T-Stats on Northfield EE Factor variable
- Appraisal-based betas exhibit much smaller spread across metros
- Appraisal-based show more contemporaneous relationship with EE Factors

DEP	MA	EXOG	LAG	BETA	T-STAT	DW
Boston	Y	EE_FACTOR_2	N	-3.15	-2.98	1.65
Los Angeles	Y	EE_FACTOR_3	N	-3.61	-3.18	1.90
Portland	Y	EE_FACTOR_3	N	-4.03	-3.42	1.90
San Francisco	Y	EE_FACTOR_2	N	-3.59	-3.17	1.70
Tampa	Y	EE_FACTOR_2	N	-3.84	-3.48	1.88

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How Do Cap Rates Fit into the Northfield Model?

- We demonstrated that the tenant credit spreads are highly correlated to cap rates. However, they are not perfectly correlated. Which means that using the spread between the two can add value to the precision with which the risk factor model closes the gap between the economic necessity and actual valuations.

- The incremental spread of the cap rates over tenants spreads also tend to be significantly influenced by the risk model factors. However, both that factor related component as well as idiosyncratic changes will be equally useful in the context of the overall risk model.

- Northfield already uses a rent volatility synthetic security to incorporate market rent impact on cash flows. We can take the same synthetic security approach with regards to the cap rates spread's impact on the discount rate.

- The cap spread impact, naturally, has to scale through the effective duration of the real estate property investment, which is specific to its leases, resets, useful life, current and long term vacancy, etc.

Conclusions

- While data shows that Northfield's real estate model has captured a significant part of the discount rate volatility pertaining to CRE investments, our new research shows that cap rate data can add value

- The utilization of the cap rates dovetails very well with Northfield's approach to observe the specificity of each individual CRE investment and any idiosyncratic influences at play in the local market

- The enhancement will not require any change in the format of the model output, for any existing clients.

- The addition of cap rate spreads closes the loop between the risk factor model theory and the empirical data, to the extent that observable CRE performance data represents arm's-length transaction economics

- We are expanding the analysis to other countries

Question and Answer Session

- For any follow up questions that do not get answered during the live session, please send your inquiry to:

  - Emilian Belev, Head ERM Analytics, emilian@northinfo.com
  - Rick Gold, Senior Risk Analyst: Unlisted Assets, rgold@northinfo.com

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