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Direct Real Estate and REITS
The Saga Continues:
Episode MMMLVII - Rise of the Clones

Richard Gold and Emilian Belev
Northfield Information Services, Inc.
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Traditional Real Estate Performance Measurement Indexes

- **REIT based (E.g. NAREIT)**

- **Appraisal / Direct Transaction Based (E.g. NCREIF NPI and TBI)**
  - Good for:
    - Long-term trends
      - Absolute Returns
  - Not good for:
    - Short-term analysis
    - Uncertainty of returns
      - Appraisal Smoothing and serial correlation
    - Components of risk and their contribution at the property or portfolio levels

Public Versus Private Property Returns

NCREIF vs. NAREIT Quarterly Returns
(94Q1 - 15Q3)
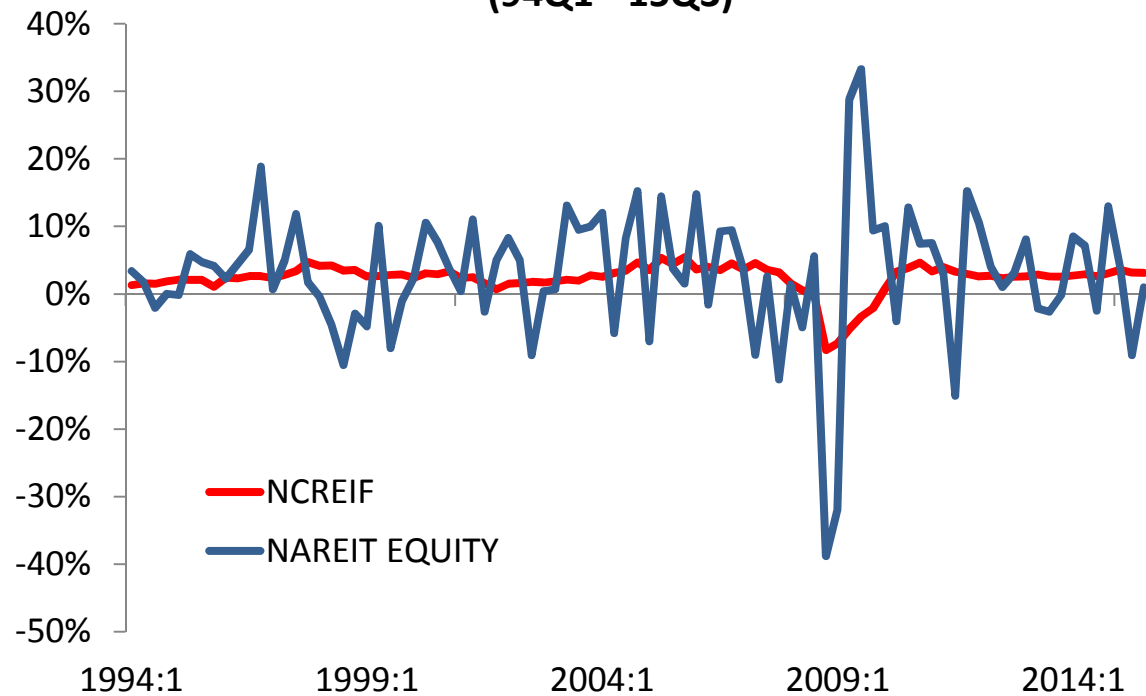
Annual Standard Deviation
NCREIF: 4.5%   NAREIT: 20.0%
Correlation: .22

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Modeling Real Estate Performance: Risk and Return

- **Goal:** Pursue an investment strategy incorporating ex-ante risk-adjusted strategies alongside profitability estimates increasing the need for consistent and reliable methodologies of future performance and risk, rather than look back to unreliable appraisal based data

- **Challenge:** Typical institutional investor hold assets, many countries, regions, market, submarkets, and sectors; b) price time series are non-existent

- **Solution:** Factor models are designed specifically to estimate and manage portfolio risk

    - Any asset class is exposed to various economic factors and exchange rates

    - A subset of factor exposures relevant for each asset

    - Plus... idiosyncratic / asset-specific risk

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Why a Factor Model for Illiquid Assets?

- Factor models

  – Relate the returns of each asset to a set of underlying economic drivers

  – Each asset's risks expressed as a series of exposures to a set of common drivers plus idiosyncratic/asset-specific risk

  – Once factor sensitivities are determined it is possible to infer cross-asset relationships as well as portfolio behavior from a comparatively small number of common economic drivers

- Law of One Price: Changes in Prices of Similar Things Must Move Similarly

- **Generates endogenous rather than appraisal-based metrics**

Northfield's Risk Factor Model

- Factors into General Risk Drivers:

Equity / Credit Factors:
- Industry
- Location
- Fundamental
- Macro

Currency Factors

Interest Rates:
- Movements of the different segments of the risk-free yield curve

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Real Estate Property Risk Approach

- A "bottom-up" property-by-property model

- Each property is treated as a composite asset with:
  - Risks based on "steady-state" Cash Flow (CF) assumptions for existing and expected leases: main exposures are to interest rate risk factors and credit premium (spread) changes for tenants; spreads link to economic risk factor and idiosyncratic influences

  - Risks related to mortgage financing (if property is levered) ; main exposure is to interest rate risk factors

  - Risks of future fluctuations in rents which are linked to the industrial and economic risk factors specific for the given location

- As a result, each component has risk exposures to the common risk factors plus idiosyncratic risks

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Real Estate Model Structure
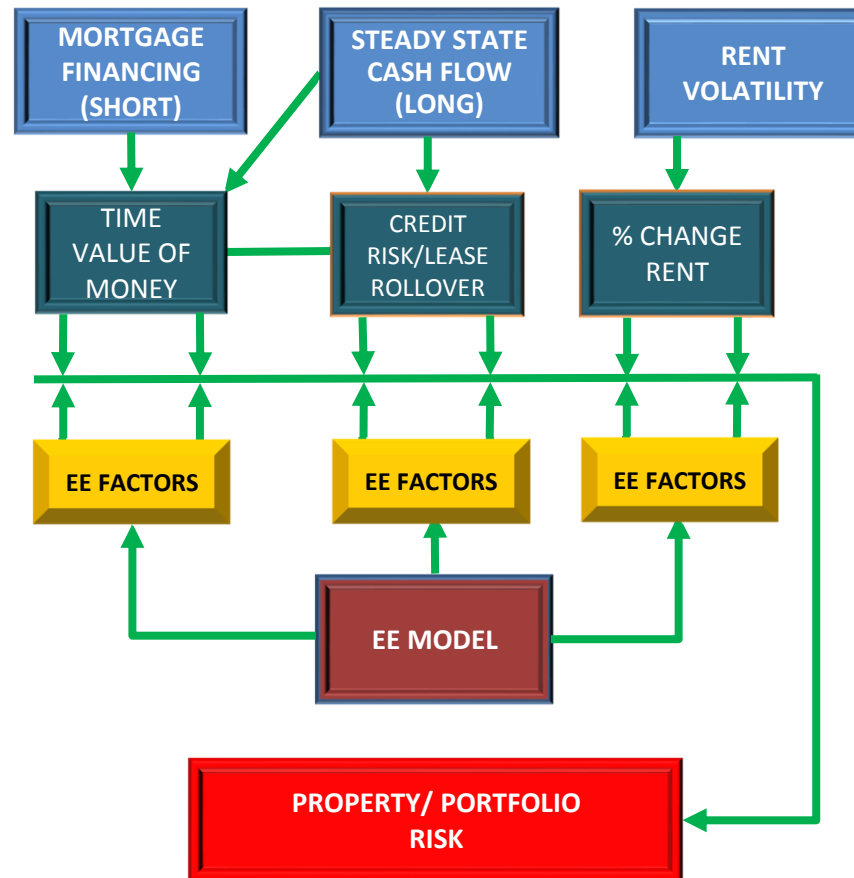
Metro Employment Profiles Differ

EMPLOYMENT SHARES BY SECTOR AND REGION - 2016Q1			
	WASH D.C.	**SAN JOSE**	**CHICAGO**
CONSUMER	60.3%	67.5%	68.4%
ENERGY	0.2%	0.0%	0.1%
INDUSTRIAL	5.3%	11.2%	9.3%
INTEREST SENSITIVE	26.4%	13.3%	19.7%
NON-ENG MINING	5.1%	5.2%	1.5%
TECH & HEALTH	2.8%	2.8%	0.8%

Different Employment Profiles Generate Different Weightings &
Exposures to EE Factors
(Northfield's Industry Definitions Derived Using Cluster Analysis)

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Summary Overview of Risk Model

- Proposed methodology that:

    – Puts real estate risk assessment on par with other asset classes

    – Poses data requirements that are not burdensome

    – Analyzes each property by cash flow, rent volatility, and financing

    – Relates behavior of each asset to a set of common economic drivers

    – Infers relationships between investment assets

    – Offers integrated and consistent risk measurement across asset classes

So the Force May Be with Us – But How Strong is it?

- Several additional questions need to be asked and answered before we can claim victory

  - What is the relationship between real estate and other asset classes?

  - Can we match the "Dark Side" using the Northfield approach?

  - What about REITs? Can Northfield's appraisal-free model mimic REIT behavior?

  - Can Northfield's approach offer a unique solution that provides the missing link between liquid and illiquid real estate?

  - Are synthetics substitutes possible? Can you own real estate by creating a portfolio of stocks and bonds? Can you mimic various real estate indices using stocks and bonds? What about residential returns?

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Real Estate, Stocks and Bonds

- Taken at face value indices such as NCREIF and IPD seem to suggest that real estate is a good diversifier
  - Low or negative correlation with other asset classes
  - Low volatility and high absolute returns relative to equities and bonds
- Appraisal smoothing impacts risk and return metrics
- Correlations between real estate and bonds estimated in previous studies are counterintuitive.
- Real estate should be positively correlated with treasury securities due to their inverse relationship with interest rates. Also improving credit spreads diminish the discount rates on both property cash flows and bond coupons making higher positive correlation between real estate and corporate bonds the most plausible outcome.
- Equity returns should also be positively correlated with real estate
  - Improving economy leads to better cash flows and lower risk

Real Estate, Stocks and Bonds (cont.)

- By economic intuition as well as mathematically, real estate and bonds returns are not independent.
  - They are driven by the same factors (interest rates, economy), co-varied movements in a one period setting can only be captured using techniques such as factor risk models
  - However, this does not mean that a linear relationship of appraisal-based real estate and bond returns is the one that holds over multiple periods; hence using regression/correlation than the changes in appraised values vs. changes in interest rates or the stock market should be done with great caution.
- Bottom line: real estate can't have it both ways:
  - Either it has bond-like and equity-like characteristics
  - Or the math of cap rates and cash flows is wrong
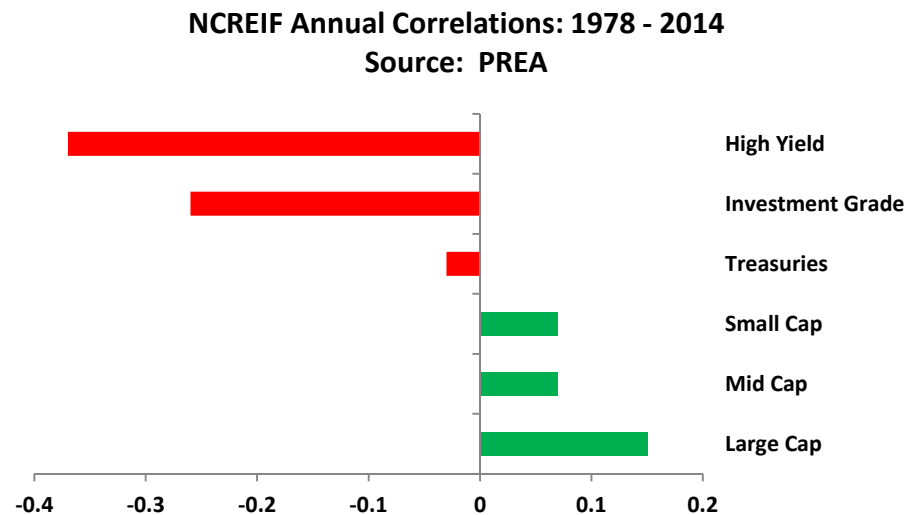 - We choose the former

NCREIF: Return Persistence/Serial Correlation

The Culprit – Serial Correlation
NCREIF Total Returns Lagged Correlations
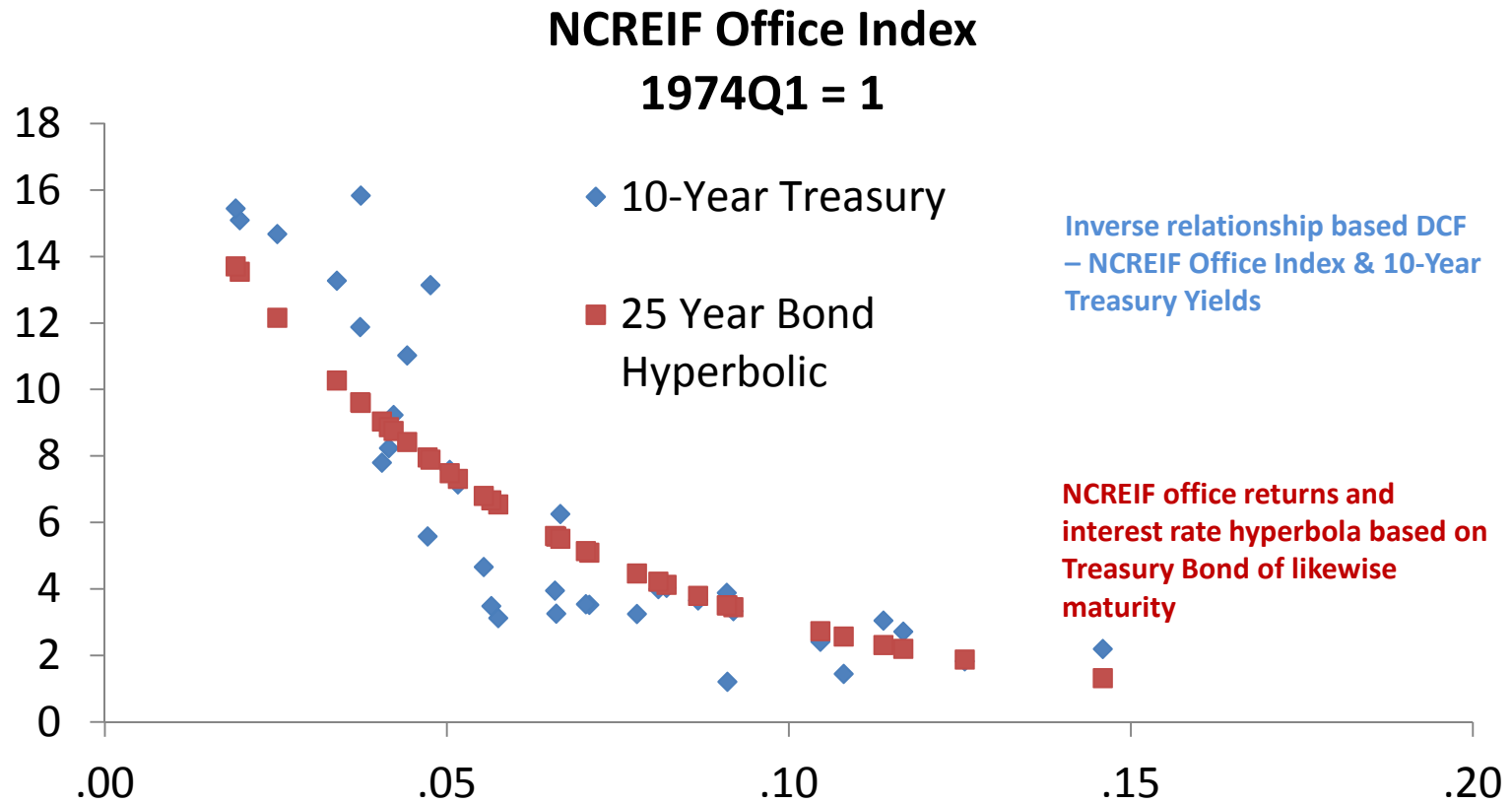**1978:1 - 2015:4**
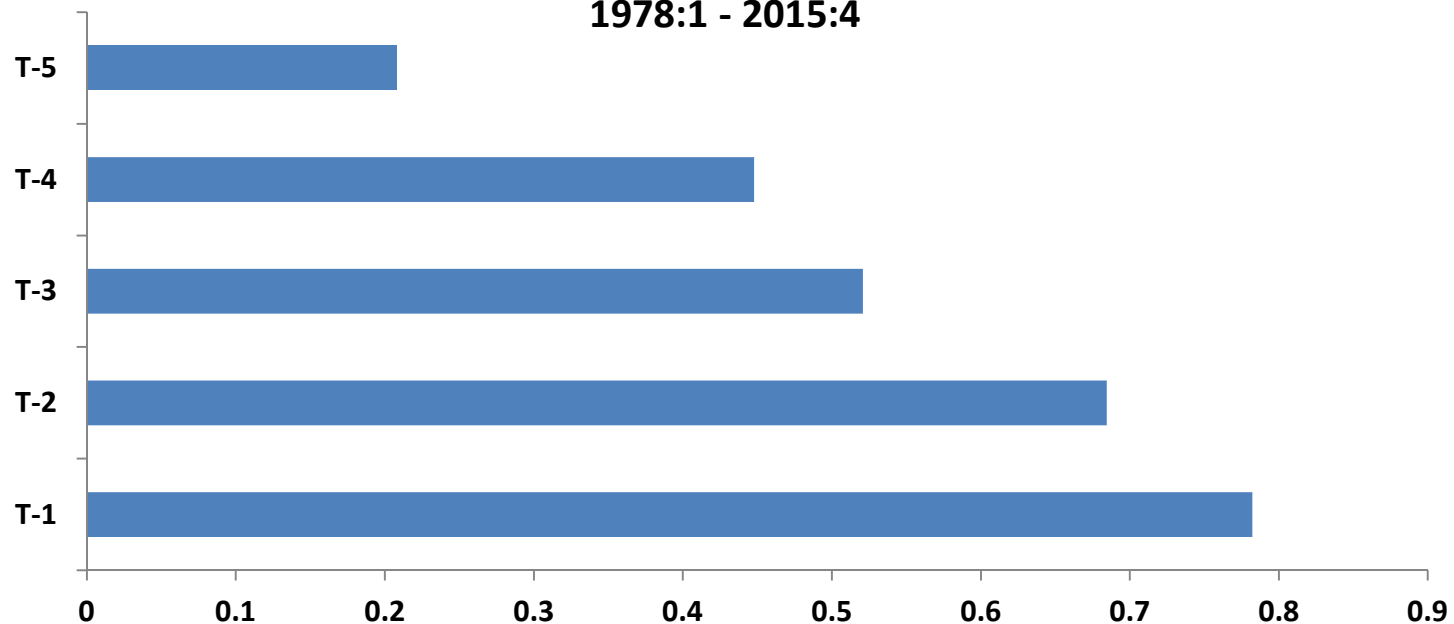
Examples of Previous Correlation Findings

- Real estate's purported low/negative correlation of real estate with other asset classes has been the impetus for adding property to investment portfolios

- A publication by Merrill Lynch in 2012 indicated that using quarterly returns, the correlation between direct real estate was -.14 with the Barclays Agg Bond Index and .19 with the S&P between 2002 and 2011.

- Same conclusions by Clarion Partners in 2011 and Pepperdine University in 2009.

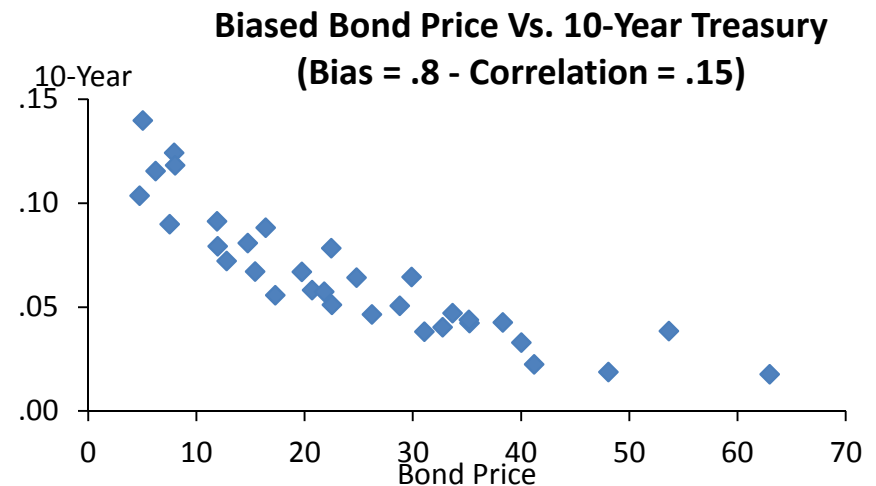- The Pension Real Estate Association's own study using annual data:

NCREIF Annual Correlations: 1978 - 2014
Source: PREA

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NCRIEF Office Index and 10 Year Treasury Rates

NCREIF Office Index
1974Q1 = 1

♦ 10-Year Treasury

■ 25 Year Bond
Hyperbolic

Inverse relationship based DCF – NCREIF Office Index & 10-Year Treasury Yields

NCREIF office returns and interest rate hyperbola based on Treasury Bond of likewise maturity

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Serial Correlation – Another View

- Take a transparent instrument like Treasuries

- Progressively smooth it by introducing bias in Period t from Period t-1
  - .2
  - .5
  - .8

- Introduces serial correlation and it begins to mimic NCREIF
  - NCREIF AR1 term ≈ .8

- Bonds are similar to Real Estate
  - Biased bond series behaves like RE in relation to Treasuries
  - Similar correlation to other studies

Biased Bond Price Vs. 10-Year Treasury (Bias = .8 - Correlation = .15)

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Next Step: Hyperbolic Curve Transformation

- Transform the hyperbolic curve relationship into a linear one.

- Restate the DCF of $1 to the present moment into an independent variable.

- Estimate a linear regression. Slope coefficient is secondary to a significant statistical relationship between the dependent and independent variables.

- Critical: Find a power of the discount cash flow model resulting in a zero intercept. Ensures relationship conforms to an actual DCF model.

$$\text{NCREIF Index Value}_{it} = \beta * (1/(1+r_t)^k)$$

Where:

NCREIF Index Value$_{it}$ = Index value in period t where 1974Q1 = 1

r_t = Long-Term Treasury Rate

k = Input parameter which minimizes absolute value of intercept (i.e. makes it zero). Equal to the useful life of the property cash flows implied by the index. Can be solved iteratively or heuristically.

Bonds, Real Estate, and Interest Rates - Derivation

$$P_1^* = w.P_1 + \sum_{i=1}^{n} k_{-i} * P_{1-i}^*$$

$$P_1^* - P_0^* = w(P_1 - P_0) + (k_{-1} * P_0^* - k_{-n} * P_{-n}^*)$$

$$P_1 = P_0 + DUR_{RE} * \Delta INT + (CONVEX_{RE}/2) \Delta^2 INT$$

$$P_1^* - P_0^* = w(DUR_{RE} * \Delta INT + (CONVEX_{RE}/2) \Delta^2 INT) + (k_{-1} * P_0^* - k_{-n} * P_{-n}^*)$$

$$k_{-n} \text{ and } (CONVEX_{RE}/2) \Delta^2 INT \text{ are small}$$

Linear

$$\Delta P_{RE}^* = k_{-1}P_0^* + wDUR_{RE}\Delta INT + \epsilon$$

$$\Delta P_{RE}^* = k_{-1}P_0^* + w\frac{DUR_{RE}}{DUR_B}\Delta P_B + \epsilon$$

Non-Linear

$$Return_{RE} = k_{-1} + w\frac{P_{B0}}{P_0^*}\frac{DUR_{RE}}{DUR_B}Return_{Bond} + \frac{\epsilon}{P_0^*}$$

Inferred Useful Lives Per Sector

These are the inferred from the hyperbolic regressions that provide the best fit:

Property Types	R-squared	Implied Useful Life
Industrial	85 %	30 years
Retail	85 %	35 years
Office	82 %	25 years
Apartment	83 %	28 years
Hotel	76 %	30 years

This R-Squareds are good news not only as magnitudes but also as a ranking !

Correlation with Equities

- Previous studies known to us only considered contemporaneous correlations between equities and commercial real estate indexes

- The reasoning that there might be a lag can be one or combination of:

  - Appraisal professionals incorporating information regarding the economic environment into valuations

  - The stock market is a lead signal for the real economy. As the real economy picks up, so does pricing for commercial real estate but not simultaneously. Also given the nature of a building's cash flow, it takes time for changes in demand to manifest themselves as changes in rent and occupancy.

- Leading or not the correlation between equities and real estate is just as important to a long-term investor, where those effects will be fully reflected in returns over their investment horizon.

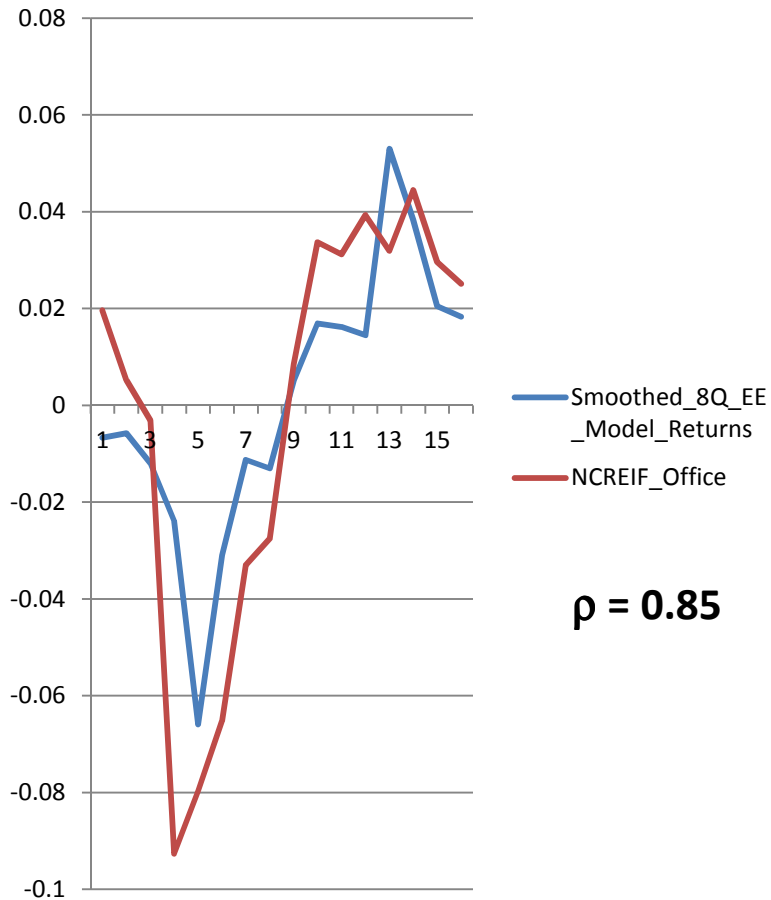- Correlated annual returns for NCREIF and the S&P500 Index lagging the S&P by one year.

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What About Correlation with Equities ?

NCREIF Lags S&P500 - 1 year Correlations
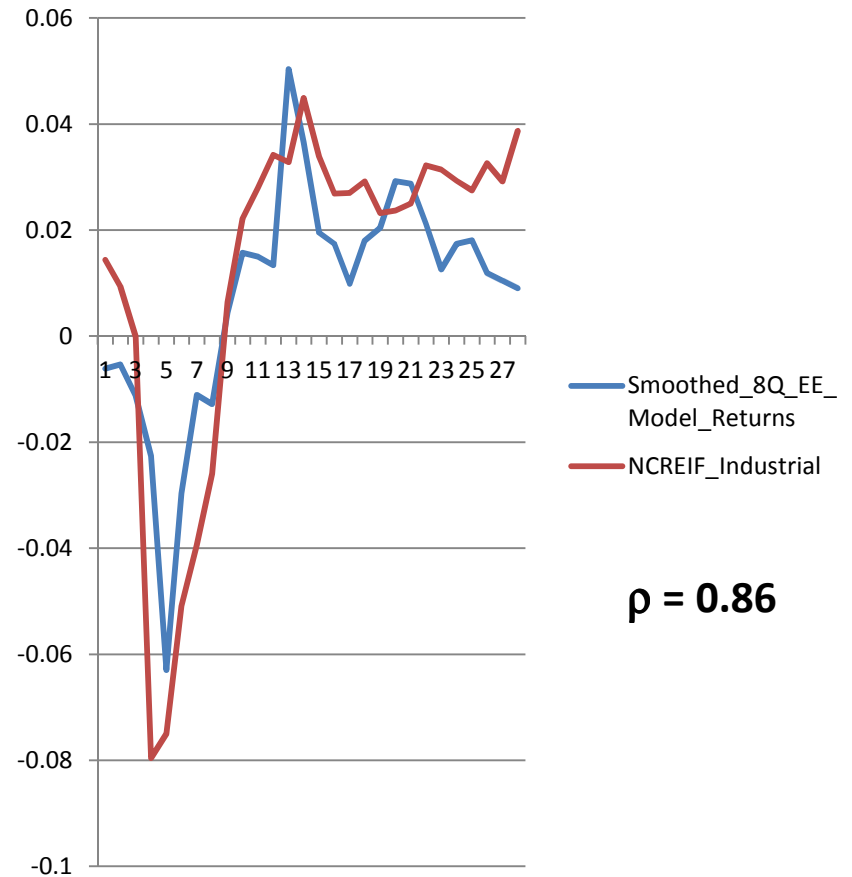
NCREIF	.46
Office	.48
Hotel	.51
Apartment	.50
Industrial	.46

The Northfield Direct RE Model and NCREIF

Quarterly 2006 - 2012

Quarterly 2006 - 2014

ρ = 0.85

ρ = 0.86

The Northfield Direct RE Model and REITs

Quarterly 2006 - 2014

Unsmoothed_EE_Model_Returns

iShares_tracking_DJ_US_REITs

ρ = 0.68
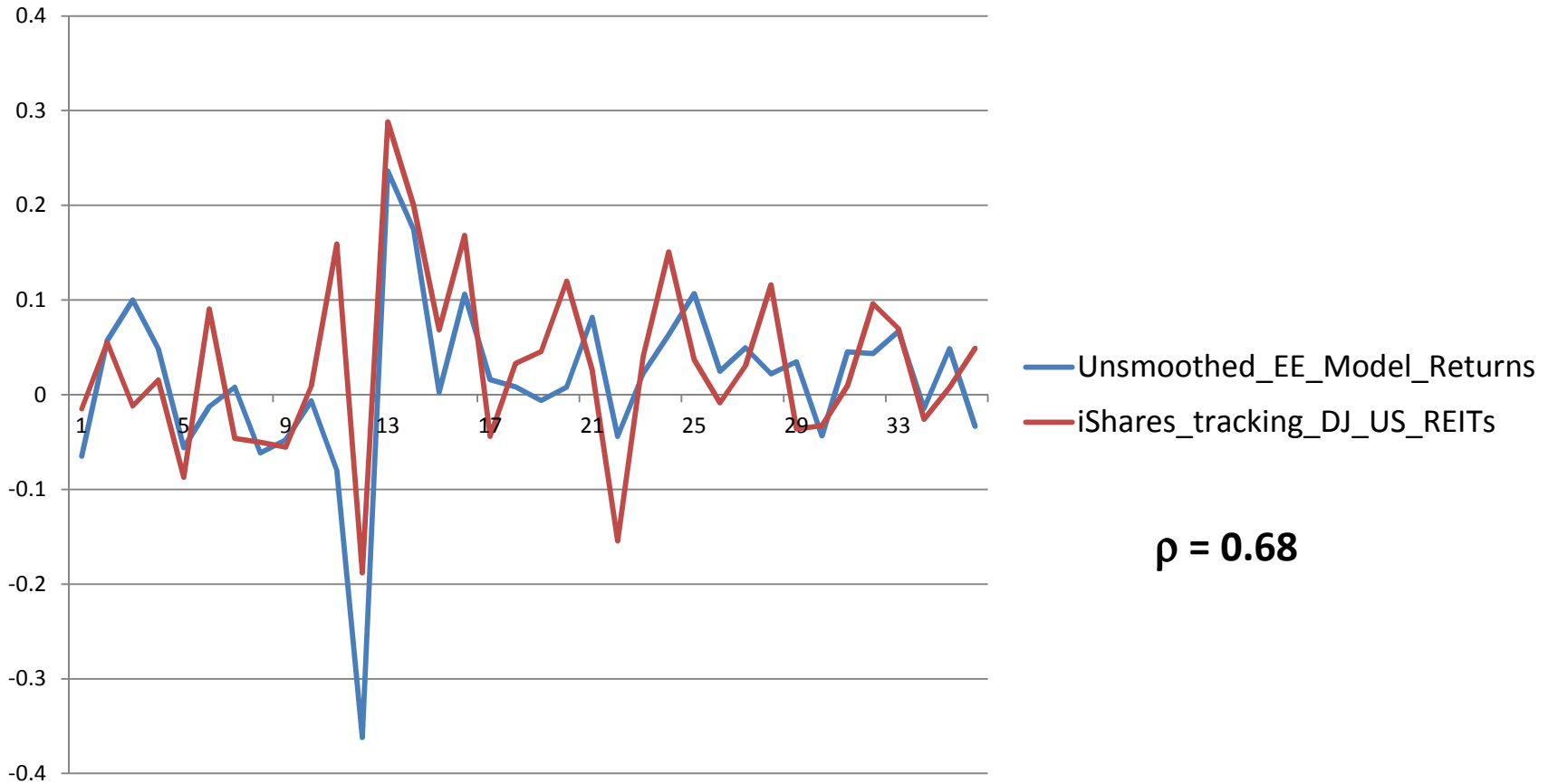
Northfield Model Observations:

- Northfield's Direct Real Estate Model:

    - Highly correlated with both direct and indirect real estate indices, results not found in any prior industry or academic factor model work

    - Provides a bridge and reconciles the performance discrepancy between publicly- and privately-owned real estate, which has not been done in any prior study, or at least not to this degree

    - Achieves these high correlations without relying on any private and/ or public real estate indices. Instead, the model works through explicit and observable economic payoff drivers that build the investment in a bottom-up granular fashion

- **To our knowledge: the coincidence of these facts is unprecedented**

Hedge of a Direct Real Estate Investment

From prior analysis and additional work Northfield has done, it can be shown that REIT returns can be expressed as a function of:

A. The Northfield Risk Model Factors explaining Direct Real Estate

B. A select Small Cap stock portfolio (with which unexplained returns Step A have some correlation)

C. REIT-specific factors captured as residuals form the previous two stages

Therefore, to back into the Direct Real Estate component, we start with a broad REIT portfolio, short Small Cap portfolio, and optimize by trading specific REITS in and out of the mix to mimic the Direct Real Estate benchmark.

The resulting "Long REIT / Short Stock" portfolio is a tradable basket of securities that correlates with a particular Direct Real Estate portfolio or investment

Mimic Real Estate with Stocks and Bonds

- We take a portfolio consisting of property types and geographies that approximate NCREIF content (any portfolio can be subjected to this process)

- Run Northfield Real Estate Model to generate a set of synthetic real estate securities (lease streams, rent stocks, mortgages)

- Use and optimization algorithm which uses the Real Estate portfolio as a benchmark, and the manipulated portfolio is a set of US Treasury Bonds and Large Cap stocks. The goal is for the stock/bond portfolio to replicate the risk characteristics of the Real Estate portfolio

- Make the analysis account for different lease structures of the leases; in our example we take the two ends of the spectrum – leases adjust at renewals, and leases adjust every year

Synthetic Liquid Real Estate Results

- The optimal portfolio ends up containing some Treasuries, and some Large Cap Stocks, as our intuition and experience has suggested for years.

- For the case of lease-end renewal lease rate resets, we are able to achieve a ***Beta of .99*** of the synthetic real estate portfolio consisting of stocks and bonds to the actual real estate portfolio, which is the benchmark.

- For the case of annual renewal lease rate resets, we are able to achieve a ***Beta of .96***

- Both portfolios are similar in the sense of having equities to bonds in the ratio approximately of 1 to 3, with the more frequent lease reset portfolio having bonds with shorter duration, and stocks with higher "equity market" exposures.
  - Similar results can be achieved using ETFs instead of individual stocks.
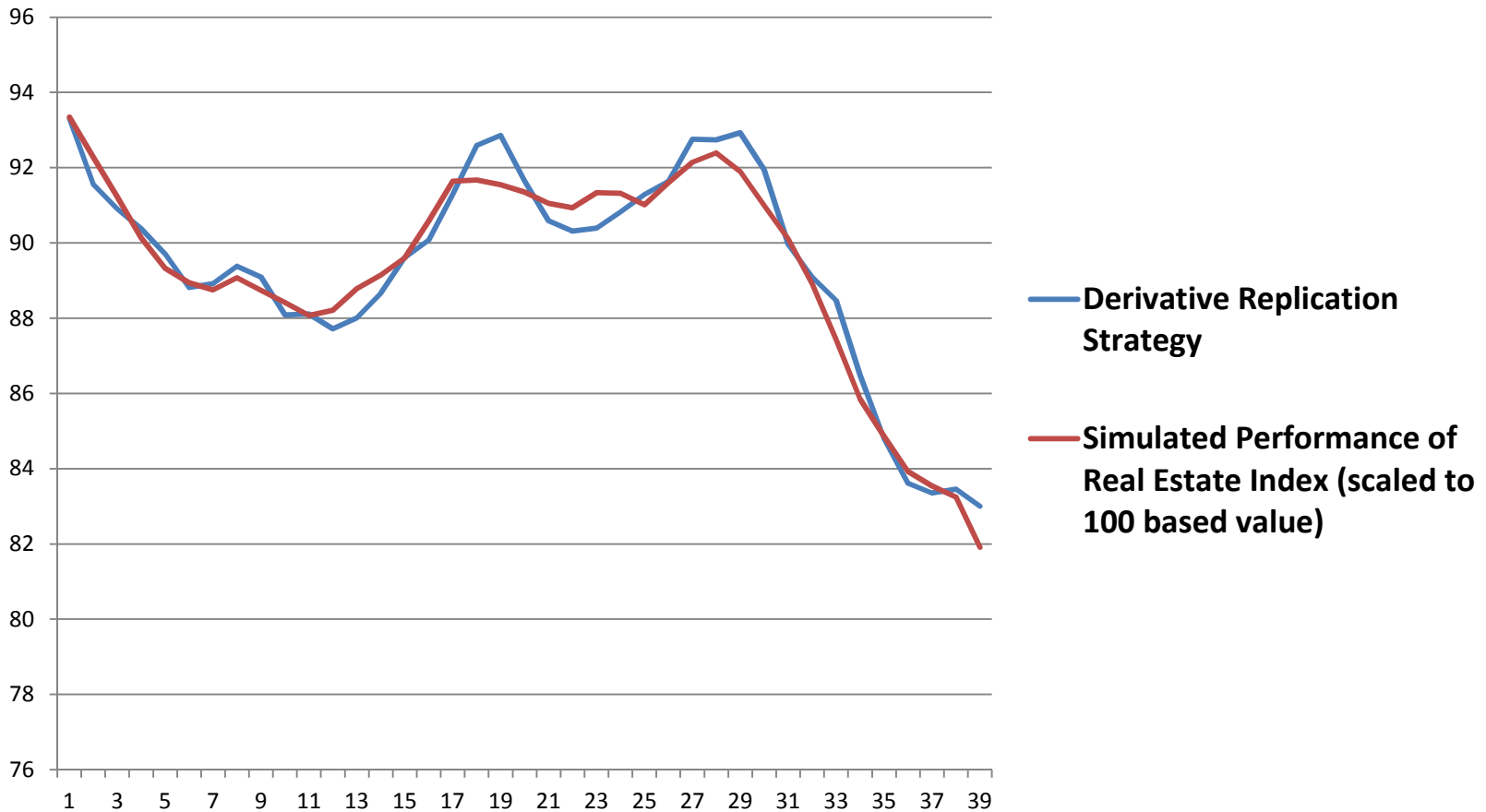
Can We Hedge the NCREIF Benchmark?

- Most institutional real estate investor's and advisor's performances are measured against this benchmark, or another index that is based, partially or fully, on appraisal data

- All such indexes exhibit a high degree of smoothing, which can be expressed, as we have seen, in either Auto-Regressive or Moving-Average (MA) form.

- The Moving-Average formulation is appealing as it is unambiguous

- It also is embedded daily in a familiar investment form: derivatives.

- ***Can we use derivatives to engineer the "smoothed" benchmark performance ? Yes.***

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Derivatives Usage for Index-like Performance

- Many real estate managers are measured against appraisal based indexes like NCREIF; short- and mid-term investors in real estate funds are often subject to payoffs based on appraisals; what can this "Synthetic Real Estate" method offer them ?

- We can achieve the index-like smoothed pattern of payoffs using the previously shown synthetic real estate portfolio and liquid derivatives which the marketplace has known well for a long time.

- Our solution for "investable smoothing" is innovative and simple. This procedure can be applied to any real estate index or real estate portfolio. Hedges could be geared towards particular horizons by adjusting the expiration and the terms and conditions of the derivatives.

Index-like Smoothing with Derivatives

Legend:
- **Derivative Replication Strategy**
- **Simulated Performance of Real Estate Index (scaled to 100 based value)**

What About Residential Real Estate Indices

- We showed that Commercial Real Estate consists of three economic pieces – two bond-like and one equity-like. What about Residential Real Estate ?

- Residential is not purchased for investment purposes, so there are no "lease stream bonds"

- However, it can be demonstrated that Residential Real Estate can be conveniently analyzed in terms of three components similarly to Commercial Real Estate

- In effect, we build up an intuitive economic relationship that explains residential RE values and links them to implied economic rents and mortgage rates. Given the better availability of transaction data for residential real estate we were able to test the relationship and it holds very well with a correlation coefficients to independent variables in the range of **0.7**

Application to Hedging / Investing / Risk

- Northfield Real Estate Model has strong empirical validation vis-à-vis both private and public real estate benchmarks. This provides the mechanism for replicating private real estate payoffs using publicly traded investments

- *The resulting basket of securities could be a convenient beacon for any ETF provider who wants to offer synthetic exposure to real estate markets, an investor looking for low cost hedge of real estate exposure, investors attempting to put capital to work immediately rather than "parking" it in cash for extended periods. real estate managers looking to use modern quantitative techniques, and market makers in derivatives looking to broach the illiquid investor and asset owner space.*

- *With regards to residential real estate applications can extend to specific products geared towards hedging house price volatility, and bank mortgage, and mortgage backed security collateral value risk*

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Conclusions

- Traditional real estate metrics suffer from structural deficiencies which limit their use.
  - Appraisal smoothing
- Composite asset approach eliminates these barriers and allows the integration of illiquid and liquid assets into a single homogeneous model.
- Northfield's direct real estate model can be shown to be highly correlated with both direct and indirect real estate indices, results not found in any prior industry or academic factor model work
  - Allows us to create synthetic solutions to a host of traditionally unapproachable problems.
- Northfield's methodology can also be extended to the residential sector helping investors and bank hedge residential mortgage and pricing risk.