Northfield’s Risk Management Principals

• Risk is about the future not the past. Every aspect of the asset owner’s portfolio must be examined in an *explicitly forward-looking modeling framework over multiple time horizons*. Simply relying on historic measures of fund volatility or tracking error is just not good enough.

• 100% of all assets in a fund must be reviewed regularly in granular detail. In today’s world with such high reliance on alternative asset classes, dealing only with risk at the asset allocation level is grossly inadequate.

• *If you own an asset, you need to understand how it impacts risk at both the asset class and portfolio levels. If you don’t, then you might have bought a pig in a poke.*
Introduction

• In the spirit of the previous slide, I will cover how Northfield models risk for:
  – U.S. and global REITs
  – The critical distinction between public and private real estate investment vehicles and why they need to be treated differently
  – Private equity real estate
  – Briefly look at the question of leverage and its impact on property risk
  – I will not be covering CMBS and single family mortgage pools but leave those for a later discussion

Risk = Uncertainty of Return = Standard Deviation
Main Concepts for Today

- Investment practitioners rely on a decomposition of portfolio risk into factors to guide investment decisions.
- While investment risk is usually unambiguous, it is not necessarily the case for real estate:
  - While total risk for publically-traded REITs may be easily determined.
  - Risk for appraisal-based private equity real estate is not.
- Biased risk estimators lead to a host of risk decomposition and allocation problems:
  - This is an issue for private equity real estate and appraisals.
Implicit Decomposition in Factor Specification

- All factor models rely on a simple linear representation of asset (or portfolio) returns

\[ R_t = \sum_{i=1}^{n} B_i F_{it} + \varepsilon_t \]

- \( R_t \) = the asset return in period \( t \)
- \( B_i \) = the factor exposure to factor \( i \)
- \( F_{it} \) = the return to factor \( i \) in period \( t \)
- \( \varepsilon_t \) = the error term in period \( t \)

In times series models we observe the \( F \) values and statistically estimate the \( B \) values. In “fundamental” models we observe the \( B \) values and statistically estimate the \( F \) values. In blind factor (PCA) models we jointly estimate both.
Implicit Decomposition in Factor Specifications

• Let’s assume we have two categories of factors called “red factors” and “blue factors”. We could write such a model as to have \( G \) red factors and \( H \) blue factors.

\[
R_t = \sum_{i=1}^{g} B_i F_{it} + \sum_{i=g+1}^{g+h} B_i F_{it} + \epsilon_t
\]

If we had a reason to do so, we could define the blue factors as being “net” of the influence of the red factors. For example, if inflation and interest rates were both factors in the model, we might choose to put inflation in the red group and redefine “nominal interest rates” as “interest rates net of the effect of inflation and other red factors (e.g. real interest rates).
Implicit Decomposition in Factor Specifications

• We accomplish this structuring of the decomposition by using a two step estimation procedure

\[ R_t = \sum_{i=1}^{g} B_i F_{it} + \zeta_t \]

\[ \zeta_t = \sum_{i=g+1}^{g+h} B_i F_{it} + \epsilon_t \]

\( \zeta_t \) = the residual return at time \( t \) net of red factors only

Since we have defined and estimated the blue factors net of the red factors the risk decomposition will naturally allocate more risk to the red factors and less to the blue factors
Why do “staged” Model Estimation?

• You have more data for some factors than others.
  – You have a universe of 1000 stocks broken into 50 industries
  – You will have 1000 data points for estimating the return to a factor like P/E or size, but only an average of 20 data points to estimate the return to a particular industry group.

• You have two or more factors that are highly correlated
  – Statistical estimation procedures often produce unstable results when independent variables are correlated.
  – By defining one factor net of another correlated factor, we structurally remove their natural correlation

• You have particular strategies where it makes sense
  – There has been a long debate about whether countries/regions or sectors/industries are more important to global equity portfolios.
  – In fact, that is what we do in the Northfield REIT models
Northfield REIT Risk Models

• In fact this two step approach is exactly how Northfield estimates both its Global and U.S. REIT models

• In both the U.S. and Global REIT Models the regional effect is thought to dominate the property type effect once the global industry effect is taken into account
  – A rising tide lifts all boats
    – If Asia is doing well – all properties in the region tend to do well
  – For many years the dearth of REITs in many locations made it difficult to target land uses
  – Common legal structure of REITs adds to regional homogeneity and behavior

• In the US investors allocate by land use and then by geography
  – Larger REITs traditionally rewarded:
    – Economies of scale: Lower overhead and financing costs
    – Portfolio diversification
Northfield U.S. REIT Model

Model Specification

160+ REITS
Weekly data
- Model estimated over last 104 weeks

9 Industry Indices
- Diversified
- Mortgage
- Healthcare:
- Industrial
- Office
- Hotels
- Residential
- Retail
- Self-Storage

9 Geographic Regions
- East North Central
- Southwest
- West North Central
- Mountain
- Northwest
- Pacific
- Mideast
- Southeast
- Unclassified

Equally-Weight U.S. Real Estate Index
Size Index
The U.S. Model is estimated using a two step process

1. STEP I: Regress individual REIT returns against:
   a) An equal-weighted index of all REITs in Northfield’s universe
   b) A “pure” or residual return industry sector series. This series is the return of each industry sector factor that cannot be explained by the market index factor. It is obtained by running a simple regression of each industry sector index against the U.S. REIT index and obtaining its residual.
   c) A size factor equal to the difference in equally weighted average returns between the largest and the smallest REIT companies in the top and bottom quartiles

2. STEP II: Residuals from Step 1 are regressed against nine regional factors based on the REIT’s property exposure in a region

- The standard deviation of the residuals from Step 2 is security-specific risk
- A REIT can only participate in one industry sector
- Mortgage REITs tend to be unstable so “caveat emptor”
Northfield Global REIT Model

Model Specification

440+ REITS
Weekly data
- Model estimated over last 104 weeks

10 Industry Indices
- Diversified
- Healthcare
- Self-Storage
- Industrial
- Office
- Residential
- Retail
- Lodging/Resorts
- Specialty
- Industrial/Office Mixed

3 Geographic Regions
- North America
- Europe
- Asia

Global Real Estate Index
Size Index
5 Statistical Factors (PCA)
Currency Beta (Return Relative to the U.S. Dollar)
Northfield Global REIT Model (con’t)

• The Global Model uses a three step estimation process as well as a final currency beta representing the return of each REIT’s currency against U.S. Dollar.
  1. STEP I: Individual REIT returns are regressed against the FTSE EPRA/NAREIT Index
  2. STEP II: The residuals of the first equation are regressed against:
     a) A “pure” or residual return sector series. This series is the return of each sector factor that cannot be explained by the market index factor. It is obtained by running a simple regression of each FTSE EPRA/NAREIT sector index against FTSE EPRA/NAREIT global index and obtaining its residual.
     b) A size variable obtained by creating two indices representing top and bottom quartiles of the global REIT market. Size factor returns are equal to top quartile minus bottom quartile.
     c) Regional dummy variables
  3. The residuals from the second regression are then used to create the covariance matrix that is then employed in the final step: the estimation of 5 Statistical Factors using Principal Components Analysis (PCA)
     a) Each security’s beta sensitivity to each of the five statistical factors is then estimated
  4. Each currency factor represents the return of each currency against U.S. Dollar.
Northfield Global REIT Model (con’t)

• The security-specific risk for each security is calculated by taking the standard deviation of the residual return remaining after the estimation of the statistical factors.
• No causality is assigned to the statistical factors.
  • They are transitory
  • Users can assign their own attribution but Northfield does not
• REITs can only be in one region
• Size variable is a market momentum variable
## U.S. Model – Risk Decomposition Report

Random Portfolio of 20 Equally-Weighted REITs  
Data Through January 31, 2014

<table>
<thead>
<tr>
<th>Factor</th>
<th>PortExp</th>
<th>BenchExp</th>
<th>ActiveExp</th>
<th>FactorVar</th>
<th>VarContr</th>
</tr>
</thead>
<tbody>
<tr>
<td>REIT Market</td>
<td>0.882</td>
<td>0.944</td>
<td>-0.062</td>
<td>338.632</td>
<td>1.665</td>
</tr>
<tr>
<td>East North</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>0.044</td>
<td>0.074</td>
<td>-0.030</td>
<td>794.775</td>
<td>0.832</td>
</tr>
<tr>
<td>Residential</td>
<td>0.088</td>
<td>0.056</td>
<td>0.031</td>
<td>214.993</td>
<td>0.569</td>
</tr>
<tr>
<td>Northeast</td>
<td>0.253</td>
<td>0.183</td>
<td>0.070</td>
<td>91.935</td>
<td>0.612</td>
</tr>
</tbody>
</table>

- **Factor Tracking Variance**: 5.870
- **Stock Specific Tracking Variance**: 11.397
- **Total Tracking Variance**: 17.267
- **Tracking Error**: 4.155
- **Total Risk of Portfolio**: 18.594
- **Total Risk of Benchmark**: 19.708
- **R-Squared**: 0.957
Private Equity Real Estate

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

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

- “Location, Location…” is not an obvious quantity nor is it constant over time

- Current indices (NCREIF, IPD, etc.) do not use observable prices:
  - Appraisal-driven and therefore suffer from appraisal bias
    - Smoothed, dampened: exhibit serial correlation
    - Repeat Sales Indices: small sample sizes & little property-level info

- Current indices:
  - Good for:
    - Historic trends and long-term absolute returns (See: Cheng, Lin, & Liu 2011)
  - Not good for:
    - Short-term & mid-term analysis, asset allocation
    - Uncertainty of future returns (risk)
    - Risk components and its contribution at the property and portfolio levels
Public Versus Private Property Returns

NCREIF VERSUS NAREIT
1994Q1 - 2013Q3

Source: NCREIF & NAREIT
Appraisal Bias

RETURN PERSISTENCE REMAINS AN ISSUE
LAGGED QUARTERLY BETAS
2003Q4 – 2013Q3

Source: NCREIF
Correcting for Autocorrelation

Standard Deviation - Last 20 Quarters of Available Data

- **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%

**Source:** NCREIF

No Leverage
Northfield’s Private Property Risk Approach

• A “bottom-up” property-by-property model that is not appraisal-based
• Each property is a “composite asset” with three attributes:
  — 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
• A second less “granular” approach employing “generic” properties can be employed
• A third but even less informative approach is to use a basket of “like kind” REITS weighted by geography and property type
Private Real Estate Model Structure

- **Mortgage Financing (Short)**
- **Steady State Cash Flow (Long)**
- **Rent Volatility**

**Risk Factors**

- **Time Value of Money**
- **Credit Risk**
- **Change in Rent**

**EE Model**

**Property/Portfolio Risk**
Components of Property-Level Risk

- Rent Risk
- Interest Rate Risk
- Credit Risk
- Asset Specific Risk

TOTAL RISK
## Model Results – A Sample Portfolio: 15% Gearing

### PORTFOLIO PROFILE

<table>
<thead>
<tr>
<th>Metro</th>
<th>Apartment</th>
<th>Office</th>
<th>Industrial</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Budapest</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Frankfurt</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rome</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>London</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Marseilles</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Amsterdam</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Paris</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Bucharest</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockholm</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
## Model Results – Everything Everywhere Model

### Portfolio Risk Report / Euro-Based Investor

<table>
<thead>
<tr>
<th>Factor</th>
<th>PortExp</th>
<th>BenchExp</th>
<th>ActiveExp</th>
<th>FactorVar</th>
<th>VarContr</th>
</tr>
</thead>
<tbody>
<tr>
<td>S B WORLD GOVT BOND INDEX</td>
<td>-0.02</td>
<td>0</td>
<td>-0.02</td>
<td>44.41</td>
<td>-0.24</td>
</tr>
<tr>
<td>OIL PRICES IN USD</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>746.77</td>
<td>-0.11</td>
</tr>
<tr>
<td>TECHNOLOGY&amp;HEALTH SECTOR</td>
<td>0.01</td>
<td>0</td>
<td>0.01</td>
<td>161.43</td>
<td>0.23</td>
</tr>
<tr>
<td>VALUE/GROWTH</td>
<td>-0.05</td>
<td>0</td>
<td>-0.05</td>
<td>6.47</td>
<td>0.28</td>
</tr>
<tr>
<td>INTEREST RATE SENSITIVE SECTR</td>
<td>0.01</td>
<td>0</td>
<td>0.01</td>
<td>204.85</td>
<td>0.52</td>
</tr>
<tr>
<td>CONSUMER SECTOR</td>
<td>0.05</td>
<td>0</td>
<td>0.05</td>
<td>134.21</td>
<td>2.16</td>
</tr>
<tr>
<td>ENGLISH-SPEAKING COUNTRIES</td>
<td>0.05</td>
<td>0</td>
<td>0.05</td>
<td>213.65</td>
<td>2.41</td>
</tr>
<tr>
<td>SWEDISH KRONA</td>
<td>0.14</td>
<td>0</td>
<td>0.14</td>
<td>47.22</td>
<td>3.77</td>
</tr>
<tr>
<td>CONTINENTAL EUROPE</td>
<td>0.07</td>
<td>0</td>
<td>0.07</td>
<td>208.25</td>
<td>5.57</td>
</tr>
<tr>
<td>UK POUND</td>
<td>0.46</td>
<td>0</td>
<td>0.46</td>
<td>85.70</td>
<td>26.14</td>
</tr>
<tr>
<td>TREASURY CURVE FACTOR1</td>
<td>-26.68</td>
<td>0</td>
<td>-26.68</td>
<td>0.30</td>
<td>251.95</td>
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<tr>
<td>TREASURY CURVE FACTOR2</td>
<td>-235.01</td>
<td>0</td>
<td>-235.01</td>
<td>0.00</td>
<td>199.02</td>
</tr>
<tr>
<td>TREASURY CURVE FACTOR3</td>
<td>-1735.99</td>
<td>0</td>
<td>-1735.99</td>
<td>0.00</td>
<td>-120.53</td>
</tr>
</tbody>
</table>

**Factor Tracking Variance**: 371.33  
**Stock Specific Tracking Variance**: 3.99  
**Total Tracking Variance**: 375.32  
**Tracking Error**: 19.37  
**Total Risk of Portfolio**: 19.37
# Model Results – Geospatial Risk

## Country Risk
(All Leverage Removed)

<table>
<thead>
<tr>
<th>Country</th>
<th>Risk</th>
<th>Property Count</th>
<th>Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Romania</td>
<td>15.9</td>
<td>1</td>
<td>Residential</td>
</tr>
<tr>
<td>Sweden</td>
<td>16.4</td>
<td>1</td>
<td>Retail</td>
</tr>
<tr>
<td>Germany</td>
<td>17.6</td>
<td>2</td>
<td>Residential, Office</td>
</tr>
<tr>
<td>France</td>
<td>19.8</td>
<td>2</td>
<td>Retail, Office</td>
</tr>
<tr>
<td>Netherlands</td>
<td>19.9</td>
<td>1</td>
<td>Industrial</td>
</tr>
<tr>
<td>U.K.</td>
<td>20.3</td>
<td>4</td>
<td>Office(2), Industrial, Residential</td>
</tr>
<tr>
<td>Italy</td>
<td>20.4</td>
<td>2</td>
<td>Industrial(2)</td>
</tr>
<tr>
<td>Hungary</td>
<td>20.7</td>
<td>1</td>
<td>Retail</td>
</tr>
</tbody>
</table>
Expected Annualized Risk by Asset Class

- 12 Month Ex Ante as of November 2013 per Northfield’s EE model
- Bond Index: Barclay’s U.S. Aggregate Bond Index
- VGK: Vanguard European Equity Index (Approximately 506 Holdings)
- REIT Portfolio: 93 European Equity REITs
NYC Office Building: Risk & LTV

Leverage > 95% results in little chance of covering debt resulting in lower risk: no equity to lose and insufficient cash flow just waiting to hand back keys.

For every percent increase in leverage over 60%, risk increases by over 3.2% until 95% LTV.
Assuming You Are Still Awake......
Conclusions

- REIT risk models within a factor model framework are straightforward and exhibit robust results.
- Northfield’s multistage REIT models show that individual REITs have exposures to:
  - REIT Benchmark
  - Property type
  - Geographic region
  - Market momentum conditions
  - REITs in our Global Model have additional exposures to:
    - Transitory Statistical Effects
    - Currency exposures if held in conjunction with other global REITs and/or held outside of an investor’s local currency
- Output from the models can be optimized and investors can actively manage their positions once they understand their exposures.
Conclusions (con’t)

- Private equity real estate is a much more complex animal
- Appraisal-based risk metrics are biased and cannot be used “out of the box”
  - Even after correcting for “serial correlation” appraisal-based series have a host of issues at the asset level, asset allocation, and for ERM
- However, it is possible to transform a property into a composite asset:
  - Risks based on “steady-state” cash flow
  - Risks related to mortgage financing (if any)
  - Risks of future fluctuations in market rents
  - Each component has risk exposures to common risk factors plus idiosyncratic risks
- While interest rate risk is clearly an importantly factor, private equity real estate risk is also influenced by a host of other factors including credit quality, lease duration, and industry and market factors.
- *If you own or are considering owning an asset, you should know as much about the investment as possible. Otherwise you are taking on a different risk profile than you initially assumed.*