

Modelling Private Equity Real Estate Risk in a Securities Market Framework

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February, 2013

What is Risk?

Statisticians believe that risk is the uncertainty of return:

- Imagine you accept a gift of a lottery ticket with the condition that you cannot give away or sell the ticket.

According to statisticians, you just did something very risky:

- The uncertainty of the economic outcome of a lottery drawing is very high, even though you had nothing to lose.

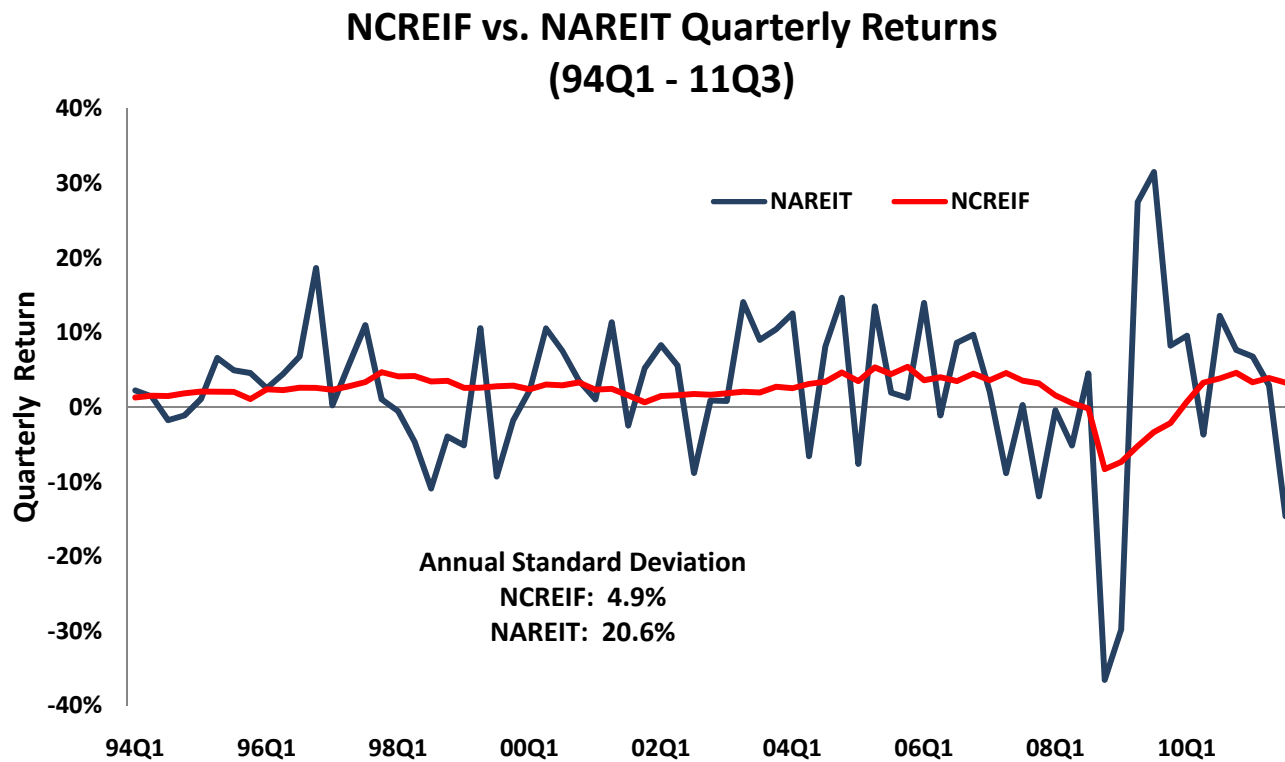
You jump off a 50 story building:

- In this case the “potential for loss” is total: your life
- However, uncertainty is very low. We’re all pretty confident of what the outcome is going to be.
 - You might not like the outcome but that is not risk.

Risk & Private Equity Real Estate

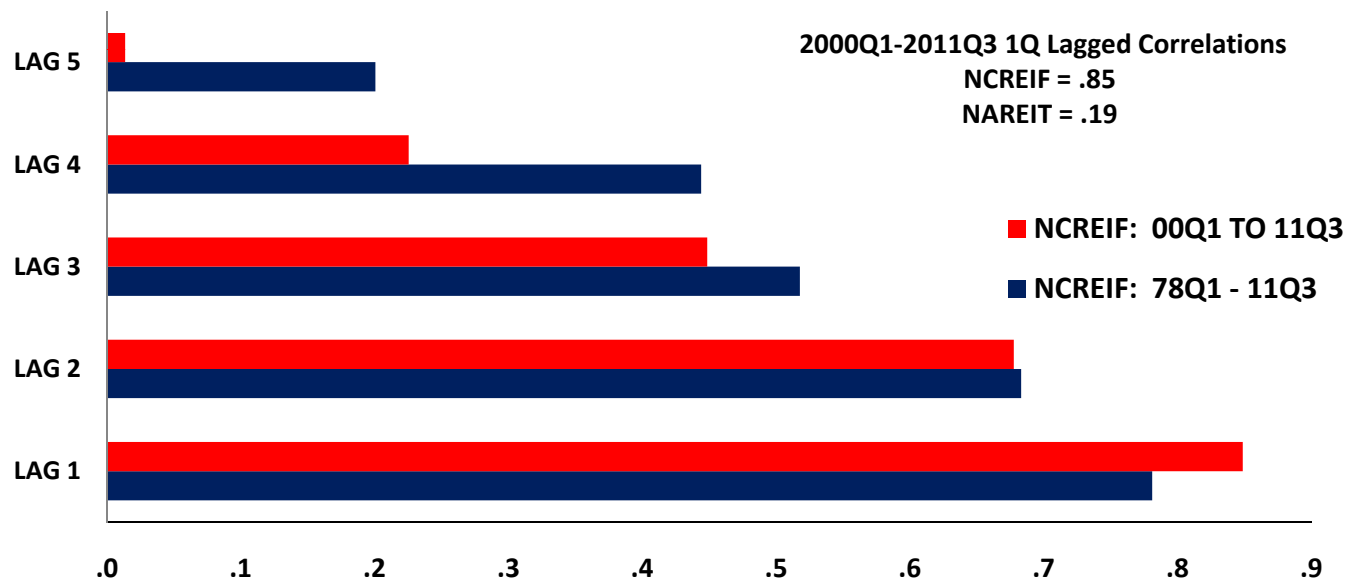
- Current indices (NCREIF, IPD, etc.) do not use observable prices:
 - Appraisal-driven & therefore appraisal-biased
 - Smoothed, dampened, & suffer from serial correlation
 - Repeat Sales Indices: Sample size & little property-level info
- Current indices:
 - Good for:
 - Long-term trends & absolute returns (See: Cheng, Lin, & Liu 2011)
 - Not good for:
 - Short-term analysis
 - Uncertainty of returns
 - Risk components and/or their contribution at the property and/or portfolio levels

Public Versus Private Property Returns



Appraisal Bias Remains an Issue

Return Persistence Lagged NCREIF Correlations



One Solution - Factor Models

- Possible to estimate correlations for a large number of assets from a small number of common economic drivers
- Each asset's risks expressed as a series of exposures to a set of common drivers plus idiosyncratic/asset-specific risk
- No need for appraisals to determine volatility/risk as well as future cash flows (CF) and Net Operating Income (NOI)

Northfield's Everything Everywhere Model

- Factor Model updated monthly using:
 - Over 61,000 equities
 - 450,000 fixed income securities
 - 1.3 million municipal bonds
 - 1 million mortgage-backed pools
 - 300,000 CMOs
 - 68 developed and emerging markets
 - 57 currencies

Northfield's EE Factor Model

- Parsimonious: each security is only exposed to factors such as:
 - Region
 - Industry/sector
 - Interest rates
 - Oil prices
 - Currency
 - Value / growth
 - Market development
 - Company size
 - 5 “statistical factors”
 - Denomination currency
- Observations are exponentially weighted to give recent data points greater emphasis

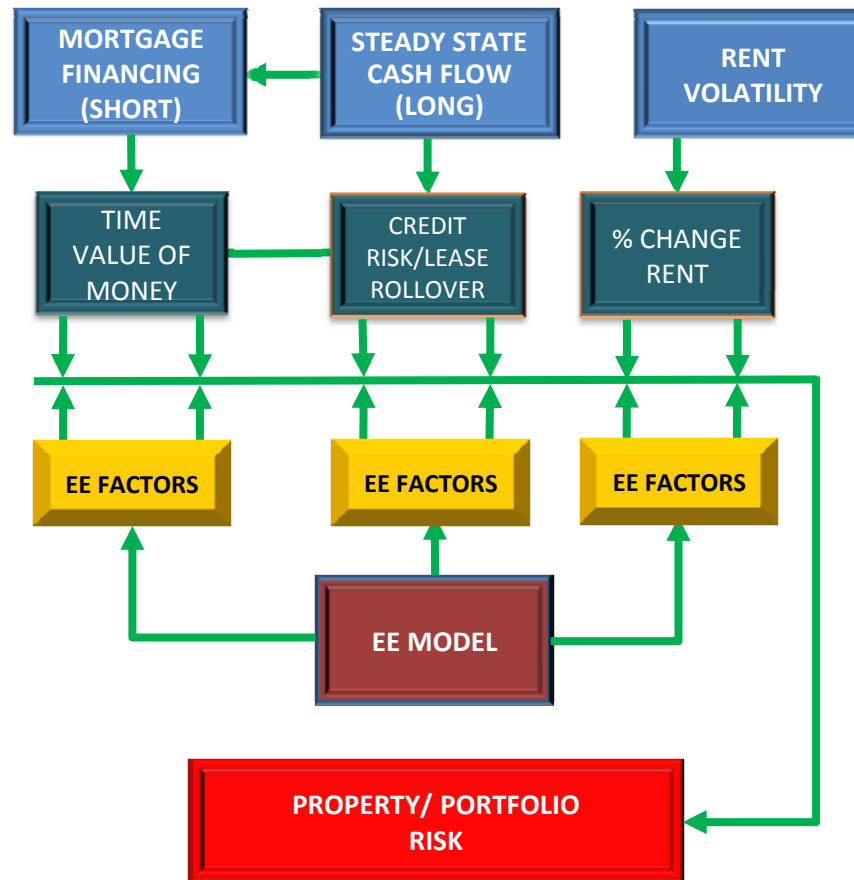
Northfield's Factor Model

- Credit Risk – (Merton Style Approach)
 - EE tracks credit related yield spreads for each economic and each rating agency level
 - Credit risk equivalent to a partial exposure to the firm's equity
 - Credit spread has an implied default rate

Northfield's Property Risk Approach

- If you own it, you should know its risk and your position's risk
- A “bottom-up” property-by-property/granular model
- Each property is treated as a composite asset with:
 - Risks based on “steady-state” Cash Flow (CF) assumptions for existing and expected leases
 - Represents the underlying structure of a property's cash flow excluding rent growth
 - Risks related to mortgage financing (if property is levered)
 - Risks of future fluctuations in rents
- Each component has risk exposures to the EE Factor Model's common factors plus idiosyncratic risk

Real Estate Model Structure



Steady State Cash Flow

- Integrating real estate investment positions into a factor model starts with modeling risk from cash flows without considering rent volatility (Steady State Cash Flow)
- A convenient framework:
 - Consider lease units within properties to be long credit bonds bringing in rent cash flows or Property Asset Securities
 - Each tenant determines aggregate quality of the cash flow
 - Represent mortgage financing as short bonds generating outgoing cash flows - interest and principal repayments or Financing Securities

Steady State Cash Flow

- Assume economic life of property: 40-50 years
- Named lead tenants and then all others collectively
 - For current lease period, consider operating expenses and expected losses from defaults given the credit of the tenant
 - Generic tenants have credit rating of market
- Forecast volatility in steady-state cash flow growth:
 - CF adjusted for probability of lease renewal. Non-renewed leases are assumed to be taken over by a “generic” tenant
 - CF adjusted for potential tenant default
 - Expected downtime between leases incorporated into CFs for non-renewals
 - Adjust least default rates losses for the probability of generic tenant in second and subsequent leases

Steady State Cash Flow

Property Asset Securities - Cash Flows

- Cash flows are based on projected NOI (Net Operating Income) which changes with projected inflation
- NOI estimation should take into consideration changing projected vacancy (normally vacant space is more expensive to landlord)
- Vacancy is projected to move from current to a long term equilibrium structural vacancy
- Renewal rate of existing tenants also varies with occupancy

Steady State Cash Flow

Repeat yearly to form expected CF stream

- Different discount rates apply to each year's CF according to the current or assumed yield curve
- All CF streams exposed to the three factors that describe changes in yield curve conditions (time value of money)
- Each CF stream's idiosyncratic risk - function of location, property condition, and downtime time between leases

Idiosyncratic risks diversify.

- Apartment complex with 200 can have less property-specific risk than an office building with three investment grade tenants even though the individual office tenants have much better credit

Steady-State Cash Flow Inputs

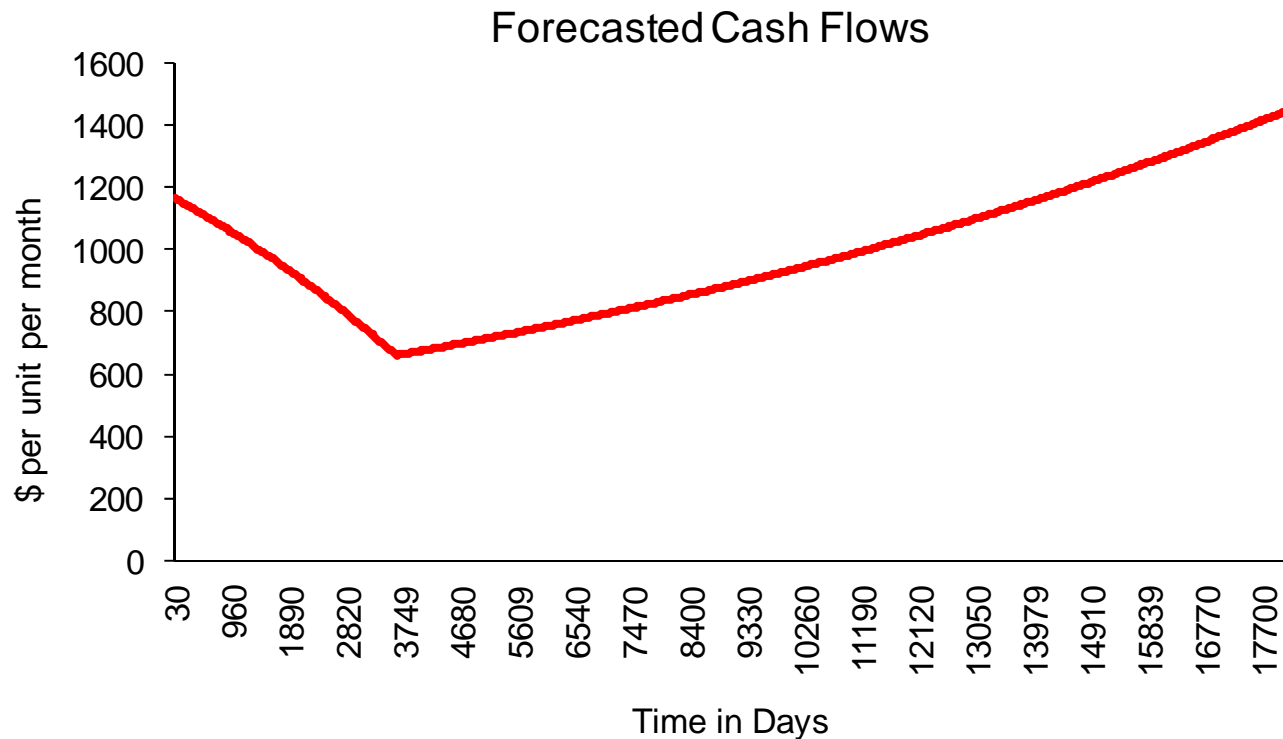
Inputs for Forecasting Steady-State Cash Flows:

- Tenant quality
 - Credit ratings of lead tenants and “generic” tenants
- Current rent (tenant-level)
- Operating expenses as % of rents
- Current occupancy / vacancy
- Structural vacancy & reversion
- Probability of lease renewal
- Down-time between leases
- Useful life of building

***All Inputs Taken
Directly From Argus***

Steady State Model – Occupancy Mean Reversion

Properties with low starting vacancy rates will exhibit weak initial cash flow growth as their vacancy mean reverts. 100% leased building with multiple tenants is risky.



Metro Employment Profiles Differ

EMPLOYMENT SHARES BY SECTOR AND REGION - 2011Q1

Sector	U.S.	San Jose	D.C.
Interest Sensitive	23.5%	14.6%	29.0%
Technology	15.9%	28.7%	10.9%
Energy	0.6%	0.0%	0.0%
Non-Energy Minerals	1.8%	1.3%	0.2%
Industrial	9.3%	7.0%	6.6%
Consumer	48.9%	48.4%	53.3%

Different Employment Profiles Generate Different Weightings & Exposures to EE Factors

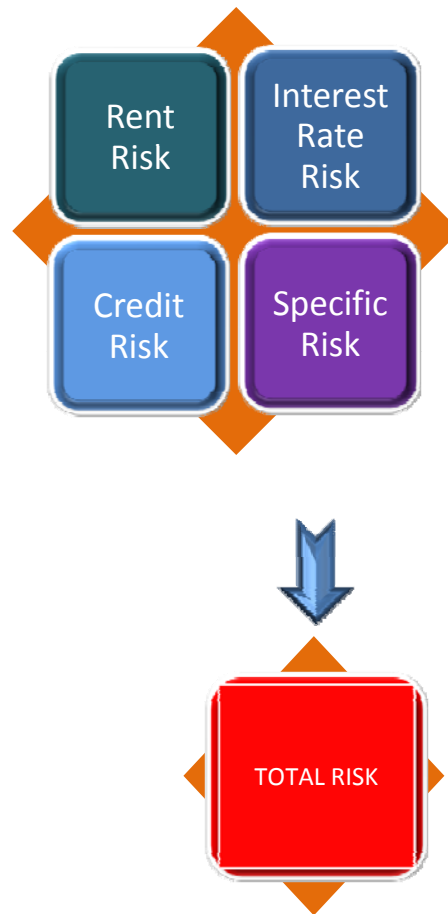
Rent Change Regression

- Function of:
 - Employment-weighted sector returns for:
 - Industrial
 - Consumer
 - Technology & Health Care
 - Interest Rate Sensitive
 - Non-energy Mining
 - Energy Mining
- Auto/Serial Corrected
- Additional factors where appropriate
- Appropriate lags and long-term moving averages
 - Rents do not typically change overnight in response to a shift in fundamentals

Rent and Occupancy Volatility

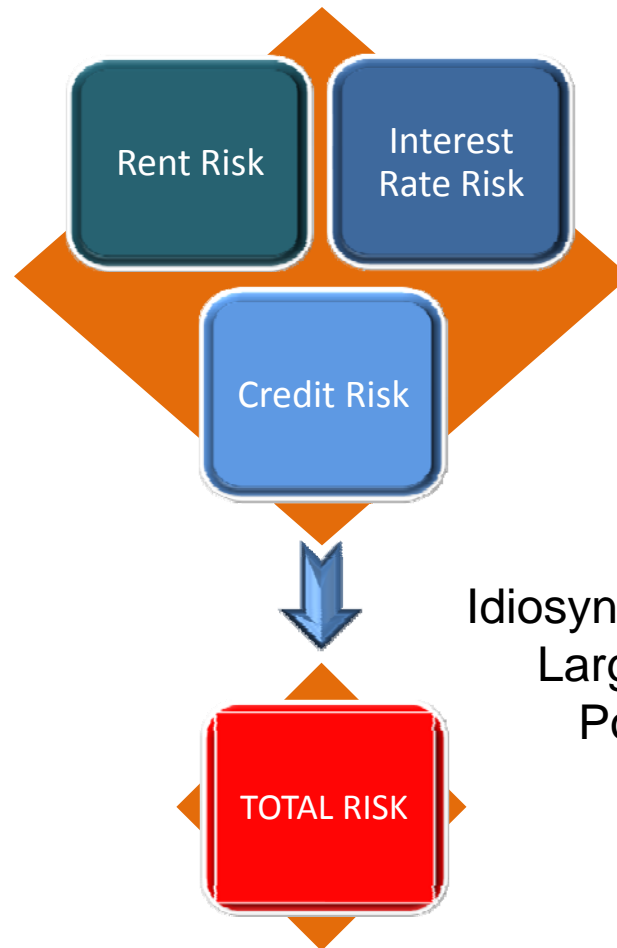
- Demand volatility varies across geographies:
 - Local employment profiles differ
- London, Tokyo and NY, financial sector employment concentration.
 - Financial bubbles hit office demand hard
- All risk exposures related to rent/occupancy risks are scaled to reflect the nature of a property
- 100 year triple net lease for 100 years - zero exposure, but...apartment complex with short-term leases greater exposure
- This scalar is roughly the annual percentage of lease turnover

Components of Property-Level Risk



Risk is not additive unless using variance.

Components of Portfolio Risk



Idiosyncratic Risk Still Present But Largely Diversified Away as Portfolio Size Increases

Risk is not additive unless using variance.

Model Results



Model Results – Portfolio Profile

Portfolio:

- “Core” portfolio – as defined by investment strategy
- Conservative leverage (<15%)
- 14 properties
- Apartment, industrial, office, and retail
- 10 metro areas
 - Boston, New York, Washington, D.C., Miami, Seattle, Sacramento, San Jose, Inland Empire, San Diego, Phoenix

Model Results – Portfolio Profile

PORTFOLIO PROFILE				
Metro	Apartment	Office	Industrial	Retail
Boston		1		
DC		2		
Inland Empire			1	
Miami		1	1	
New York	1	1		1
Phoenix	1			
Sacramento				1
San Diego	1			
Seattle			1	
San Jose				1

Model Results: Model Output

Portfolio Risk Report

Subject Portfolio					
Factor	PortExp	BenchExp	ActiveExp	FactorVar	VarContr
ENGLISH-SPEAKING COUNTRIES	0.1133	0	0.1133	339.108	5.7848
INDUSTRIAL SECTOR	0.0007	0	0.0007	446.687	0.0475
CONSUMER SECTOR	0.0045	0	0.0045	211.55	0.2336
TECHNOLOGY&HEALTH SECTOR	0.0007	0	0.0007	239.033	0.0375
INTEREST RATE SENSITIVE SECTR	0.0008	0	0.0008	357.689	0.0447
NON-ENERGY MINERALS	0.0085	0	0.0085	774.214	0.4068
ENERGY MINERAL SECTOR	0	0	0	450.202	0
S B WORLD GOVT BOND INDEX	-0.0041	0	-0.0041	69.4732	-0.0168
OIL PRICES IN USD	-0.0013	0	-0.0013	1106.85	0.0189
DEVELOPING MARKET	0.0402	0	0.0402	169.136	-0.584
SIZE	-0.0249	0	-0.0249	55.0837	-0.5048
VALUE/GROWTH	-0.1033	0	-0.1033	6.8313	-0.3732
TREASURY CURVE FACTOR1	-27.3504	0	-27.3504	0.3925	295.7643
TREASURY CURVE FACTOR2	-232.3808	0	-232.3808	0.0037	170.6205
TREASURY CURVE FACTOR3	-1754.4193	0	-1754.4193	0	-93.3204
Factor Tracking Variance					378.1592
Stock Specific Tracking Variance					0.4298
Total Tracking Variance					378.589
Tracking Error					19.4574
Total Risk of Portfolio					19.4574

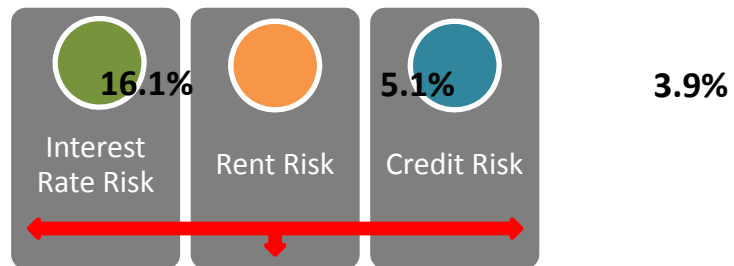
Model Results: Model Output

Individual Property Risk Report

Apartment Building - San Diego, CA					
Factor	PortExp	BenchExp	ActiveExp	FactorVar	VarContr
ENGLISH-SPEAKING COUNTRIES	0.1961	0	0.1961	339.108	14.686
INDUSTRIAL SECTOR	0.0012	0	0.0012	446.687	0.1011
CONSUMER SECTOR	0.0084	0	0.0084	211.55	0.5707
TECHNOLOGY&HEALTH SECTOR	0.0011	0	0.0011	239.033	0.072
INTEREST RATE SENSITIVE SECTR	0.0014	0	0.0014	357.689	0.1116
NON-ENERGY MINERALS	0.0001	0	0.0001	774.214	0.0053
ENERGY MINERAL SECTOR	0	0	0	450.202	0.0001
S B WORLD GOVT BOND INDEX	-0.0117	0	-0.0117	69.4732	-0.0469
OIL PRICES IN USD	-0.0027	0	-0.0027	1106.85	0.0342
DEVELOPING MARKET	0.0626	0	0.0626	169.136	0.7945
SIZE	-0.0341	0	-0.0341	55.0837	-0.9026
VALUE/GROWTH	-0.1605	0	-0.1605	6.8313	-0.8097
TREASURY CURVE FACTOR1	-17.1647	0	-17.1647	0.3925	116.1395
TREASURY CURVE FACTOR2	-319.564	0	-319.564	0.0037	244.5631
TREASURY CURVE FACTOR3	-2452.5646	0	-2452.5646	0	-102.3807
Factor Tracking Variance					272.9382
Stock Specific Tracking Variance					24.9445
Total Tracking Variance					297.8826
Tracking Error					17.2593
Total Risk of Portfolio					17.2593

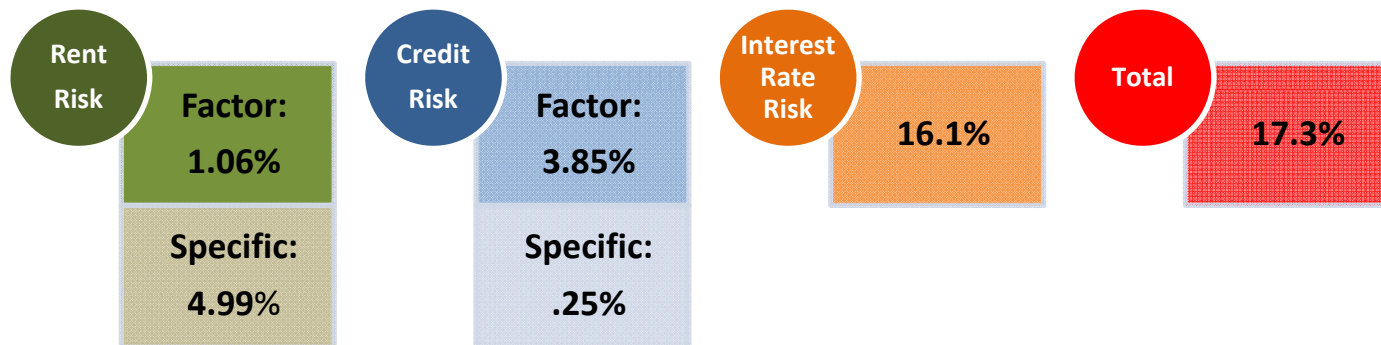
Model Results – Risk by Source

Risk Profile: Apartment Building – San Diego, CA



Model Results – Property Risk

Risk Profile: Apartment Building – San Diego, CA



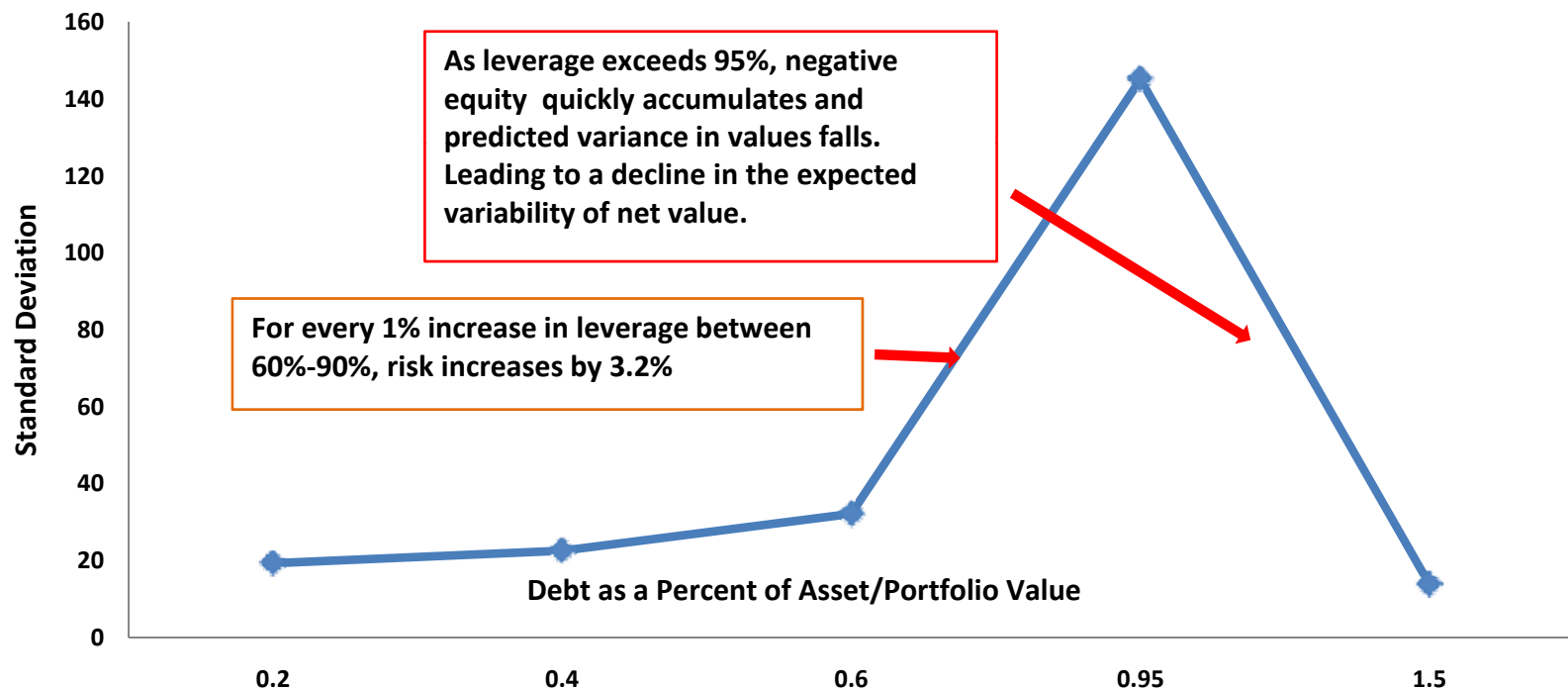
Model Results – Incremental Risk

Average Incremental Contribution to Risk by Location
(All Leverage Removed)

Incremental Risk by Metro Area			
Metro Area	Std Dev	# Props	Properties
San Diego	2.12	1	Apartment
Phoenix	2.14	1	Apartment
NYC	2.44	3	Apartment, Office, Retail
DC	2.55	2	Office
Miami	2.58	2	Industrial, Office
Sacramento	2.60	1	Retail
San Jose	2.65	1	Retail
Seattle	2.65	1	Industrial
Inland Empire	2.65	1	Industrial
Boston	2.85	1	Office

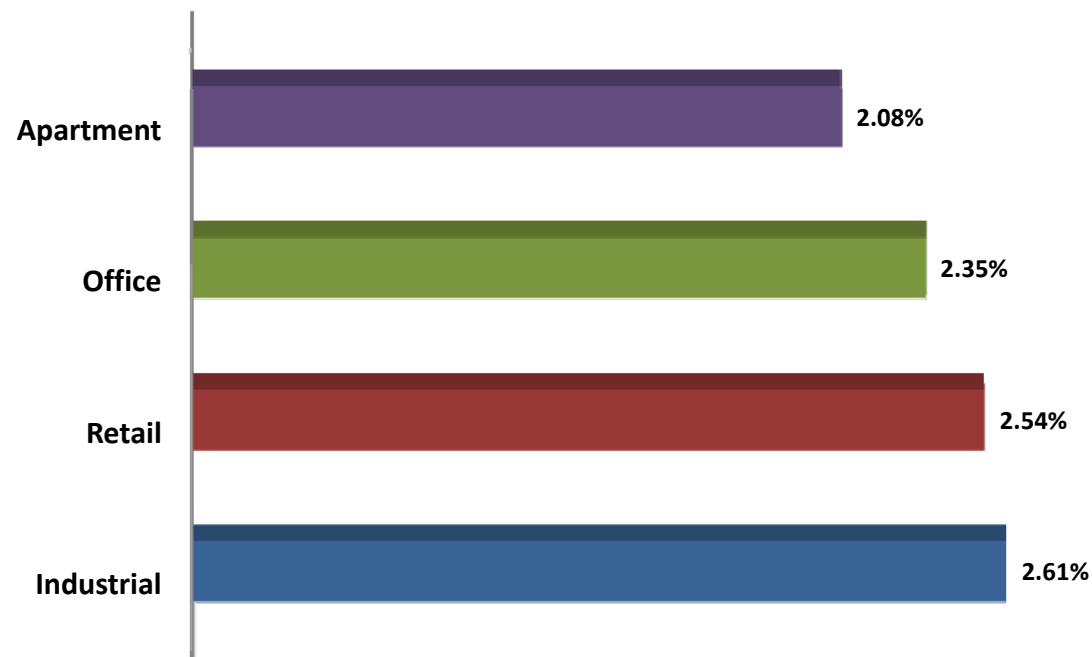
Effects of Leverage on Equity Risk

NYC Office Building
Risk (Std Dev) Per Percent Debt/Equity Ratio



Model Results – Incremental Risk

**Incremental Risk by Property Type
Per Percent of Portfolio Share
(All Leverage Removed)**



Model Results: Portfolio Risk by Acquisition

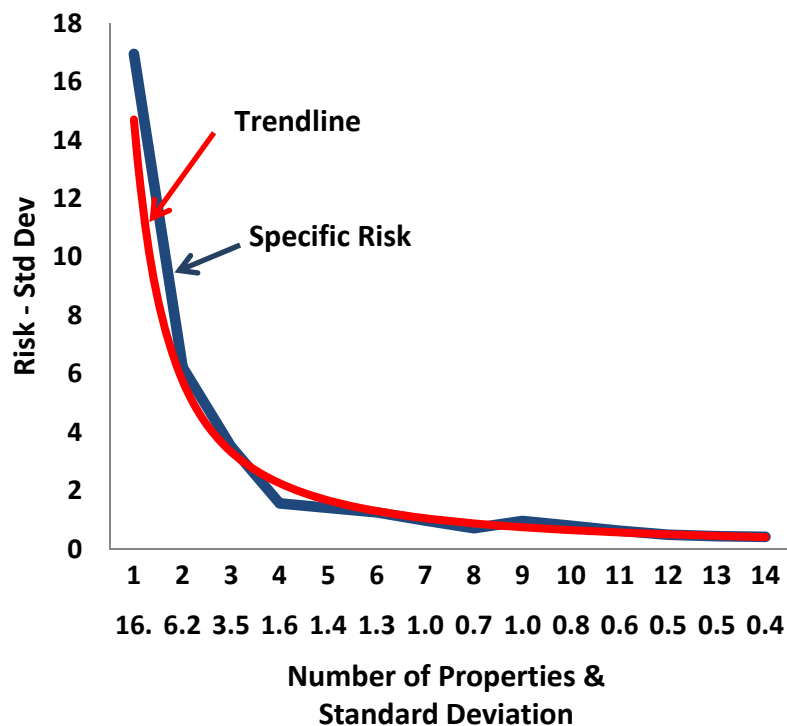
Portfolio Acquisition Schedule and Impact on Risk (Standard Deviation)					
Location	Property Type	Individual Property Total Risk	Individual Property Specific Risk	Portfolio Total Risk	Portfolio Specific Risk
New York City	Multifamily	13.1	16.9	13.1	16.9
Inland Empire	Industrial	18.9	4.6	15.3	6.2
Seattle	Industrial	18.9	4.5	16.2	3.5
Miami	Office	18.3	1.8	17.0	1.6
Miami	Industrial	19.0	9.8	17.1	1.4
New York City	Office	32.1	10.8	19.3	1.3
New York City	Retail	19.7	2.9	19.4	1.0
San Jose	Retail	18.9	1.6	19.3	0.7
San Diego	Multifamily	17.3	24.9	18.8	1.0
Boston	Office	22.5	4.7	19.3	0.8
D.C.	Office	18.5	3.1	19.1	0.6
Sacramento	Retail	18.6	0.7	19.1	0.5
D.C.	Office	30.3	3.7	19.8	0.5
Phoenix	Multifamily	12.8	8.1	19.5	0.4

Model Results: Incremental Risk

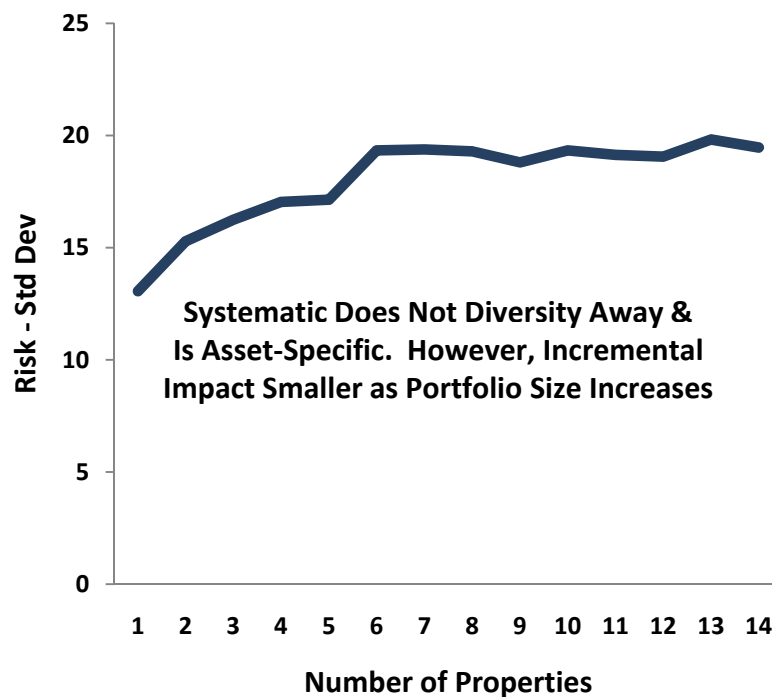
Idiosyncratic Risk Quickly Disappears

Total Risk Can Still Increase as Portfolio Grows

Incremental Idiosyncratic Risk

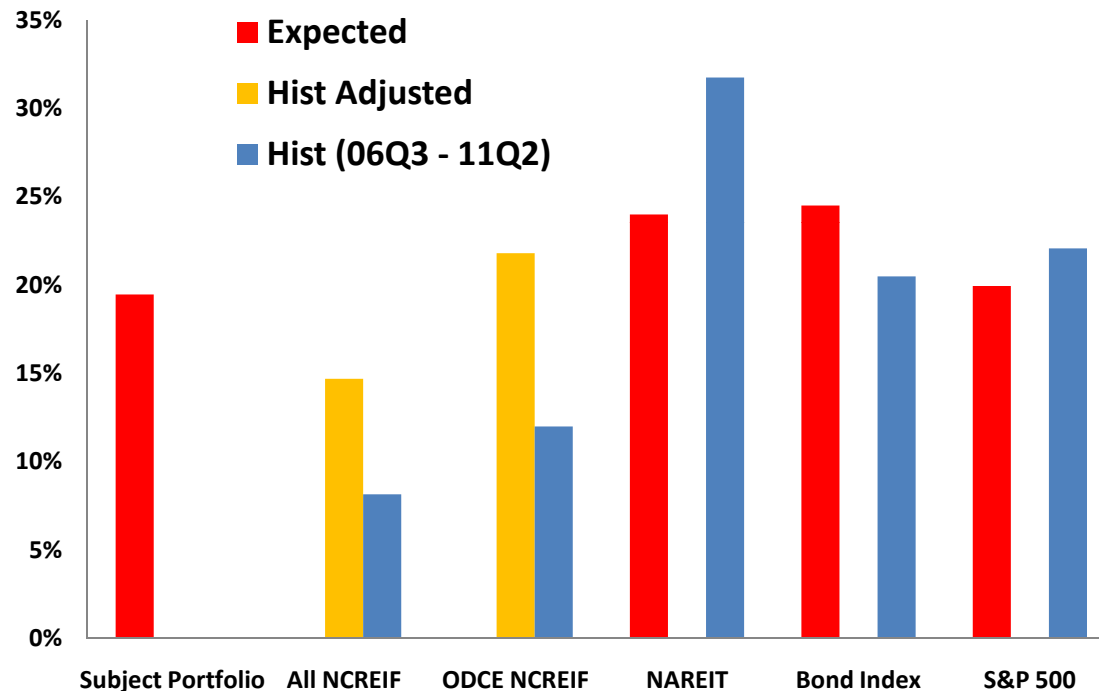


Incremental Total Risk



Expected One Year Equity Risk by Asset Class

Expected Annualized Risk by Asset Class



Expected One Year Annualized Risk as of 2011Q3

Bond Index: Historic Barclay's 30 Year Treasury Bellweather Bond Index

Expected NIS-Generated 30-Year Bond Index

Summary

- Propose methodology:
 - Puts real estate risk assessment on par with other asset classes
 - Data requirements not burdensome
 - Each property analyzed by cash flow, rent volatility, and financing
 - Factor model relates behavior of each asset to a set of common economic drivers
 - Infer relationships between investment assets
 - Integrated and consistent risk measurement across asset classes now possible

Conclusions

Results are consistent with expectations

- Shape of cash flows mimics leasing and expense behavior
- Interest rate risk dominates –long-term cash flow stream: similar to bond behavior
- Credit risk represents significant percent of total risk: similar to real world experience during recent downturn
- Leverage risk a function of term, call option, coupon rate, fixed versus floating

Results show higher expected risk than historic NCREIF or ODCE but:

- Adjusted NCREIF and ODCE risk much higher than published data suggest
- *Methodology elevates private equity real estate's role in a mixed asset portfolio because it puts it in the same risk framework already being used by other asset classes*

Applications

Portfolio Management

- Knowing what risks/exposures you are taking
- Targeting markets
- Portfolio Construction
- Quantified and defensible risk-adjusted return estimates
- Integration of real estate into broader portfolio analytics

Look at some new interesting things

- Adding or subtracting a property
- Changing financing structure
- Hedging some or all of the interest rate risk
- Portfolio impacts of specific events such as credit risk (within and across asset classes)

Additional Applications

- Advisory Searches/RFPs – improved insight in manager/consultant capabilities
- Due diligence/reviews of existing managers/consultants
- Internal risk management