

Redefining Private Equity Real Estate Risk

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Risk Estimation for Real Estate

- Private equity real estate volatility and correlation are hard to estimate
- Real observations of total returns are very few
- More data than assets required for stable correlation estimation



Not a New Problem

Lots of early research on the measurement problems

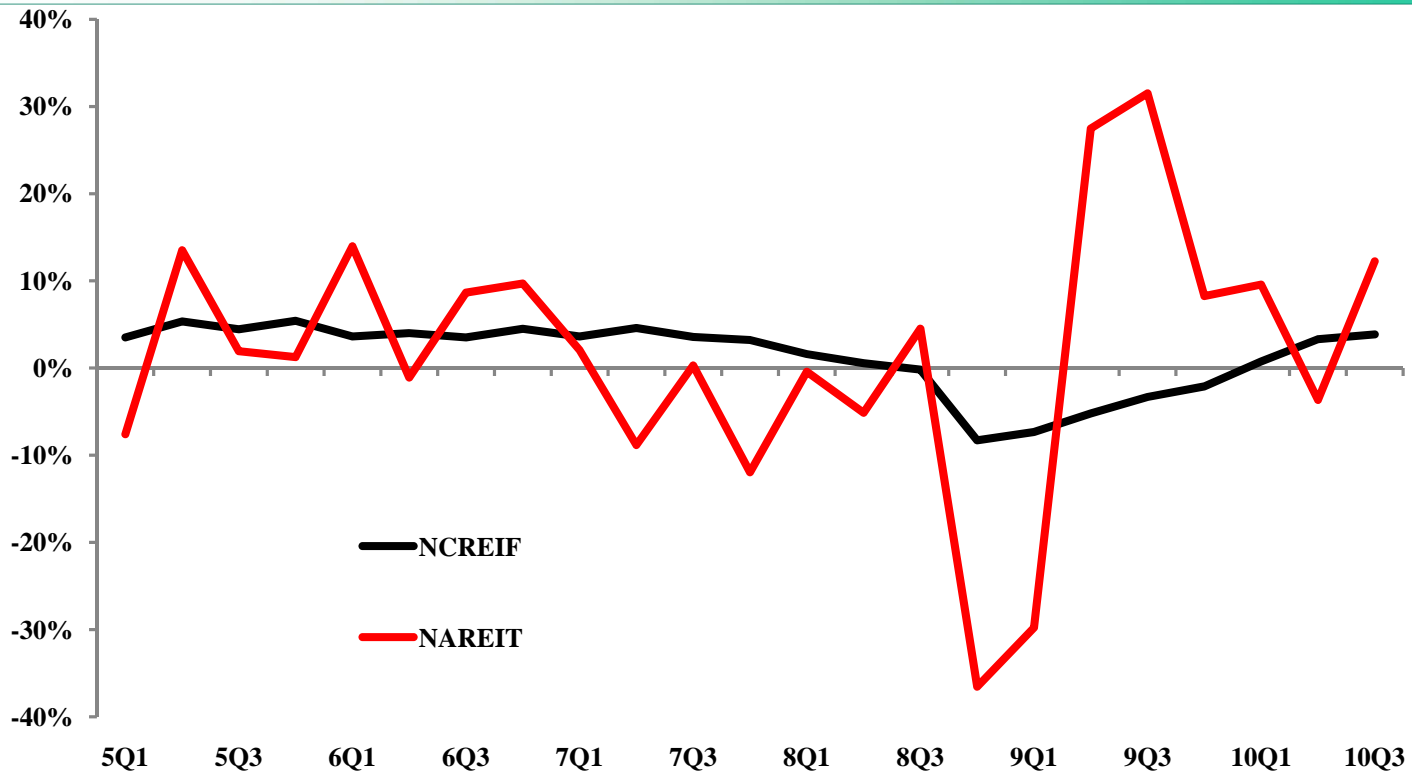
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Risk Estimation for Real Estate

- Even the broad market is hard to measure
- Real estate indices are biased because of appraisal smoothing
 - Appraisals only “work” efficiently in equilibrium
 - It breaks down during soft markets and leads to price distortions during bubbles
- Appraisal smoothing also leads to serial correlation in returns

Public Versus Private Real Estate Returns



This Is Not a New Problem

- Much published and unpublished research on this issue but no real solution
 - Appraisal-based pricing remains the cornerstone of the industry's primary benchmark - NCREIF
- In U.S. Moody's/Real CPPI repeat sales index similar to S&P/Case-Shiller but extremely small and unreliable sample
- Hedged REITs – limited success

One Solution - Factor Models

- Factor models
 - Relate the returns of each asset to a set of underlying economic drivers
 - Once factor sensitivities are determined it is possible to infer cross-asset relationships
- Law of One Price: Changes in Prices of Similar Things Must Move Similarly

Factor Models con't

- 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 flow (CF) and Net Operating Income (NOI)

Portfolio Risk

- Multiple asset types
 - Stocks, bonds, private, public, etc.
 - Some liquid, some illiquid
- Many countries, regions, market, submarkets
- However, Northfield’s “Everything Everywhere” Model (EE) is designed specifically for this task
 - Any asset class is exposed to various economic factors plus exchange rates
 - A subset of factor exposures relevant each asset
 - Plus... idiosyncratic / asset-specific risk

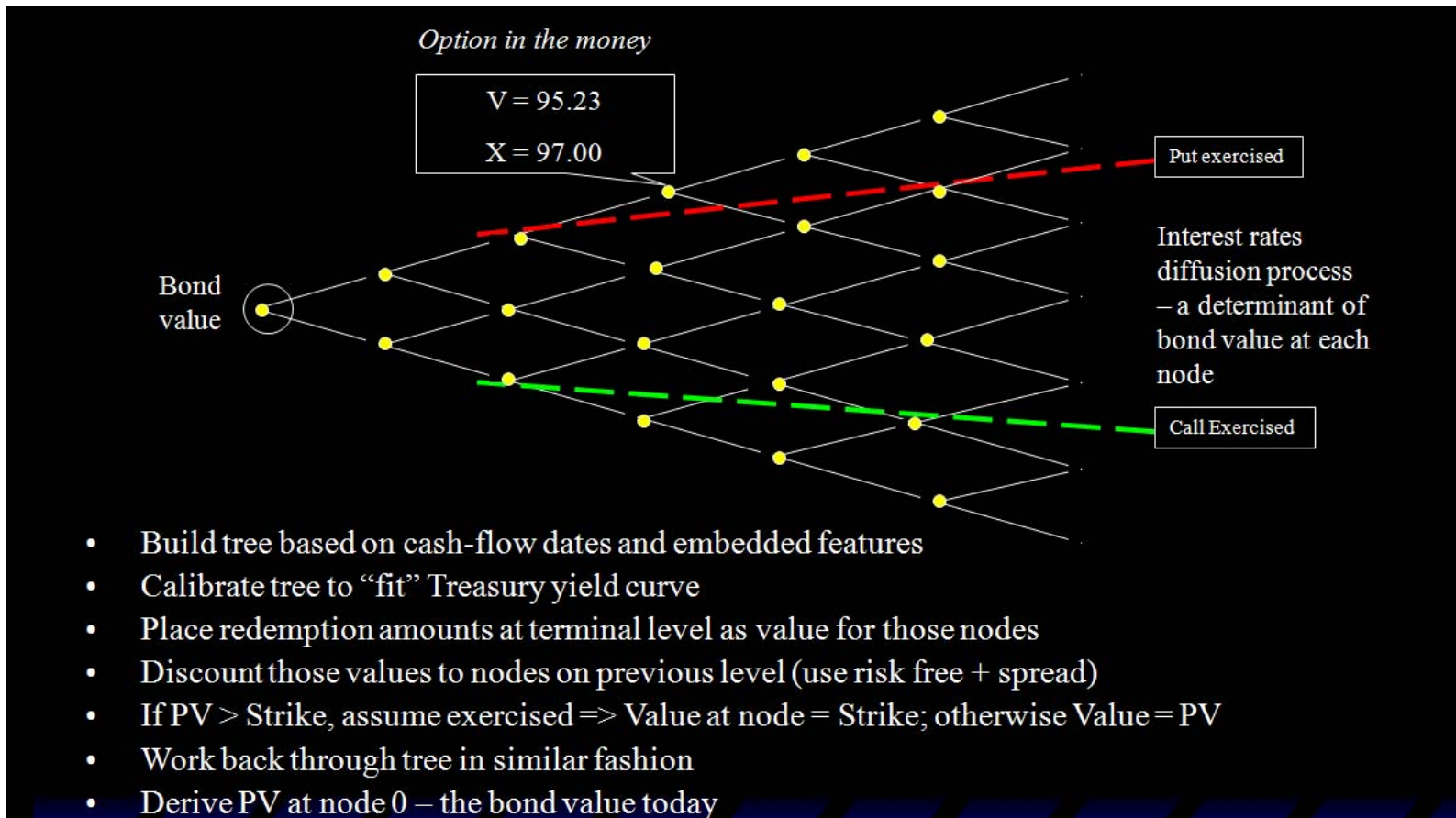
EE Model

- Factors include:
 - Six economic sectors
 - Forward looking measures of economic activity but also are real estate demand drivers
 - Five geographic regions – global coverage
 - also shape future economic and real estate demand
 - Investor outlook/sentiment factors:
 - Relative returns of large cap to small cap stocks
 - Relative returns of developed to emerging country stocks
 - Relative returns of “value” stocks (high dividend) with “growth” stocks (no-dividend)

EE Model con't

- Changes in oil prices
- Changes in bond market index returns
- Changes measures of the interest rate yield curve:
 - “Shift” the average level of interest rates
 - “Twist” the spread between long-term and short-term rates
 - “Butterfly” the curvature of the yield curve
- EE incorporates a very detailed binomial model of the range of possible future interest rate conditions. This is important for working out possible mortgage pre-payment scenarios

Bond Pricing in EE



EE Model con't

- Credit Risk
 - 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
 - Firm-specific credit problems can be addressed by adjusting the idiosyncratic asset-specific risk of the affect financial instruments

Real Estate in EE

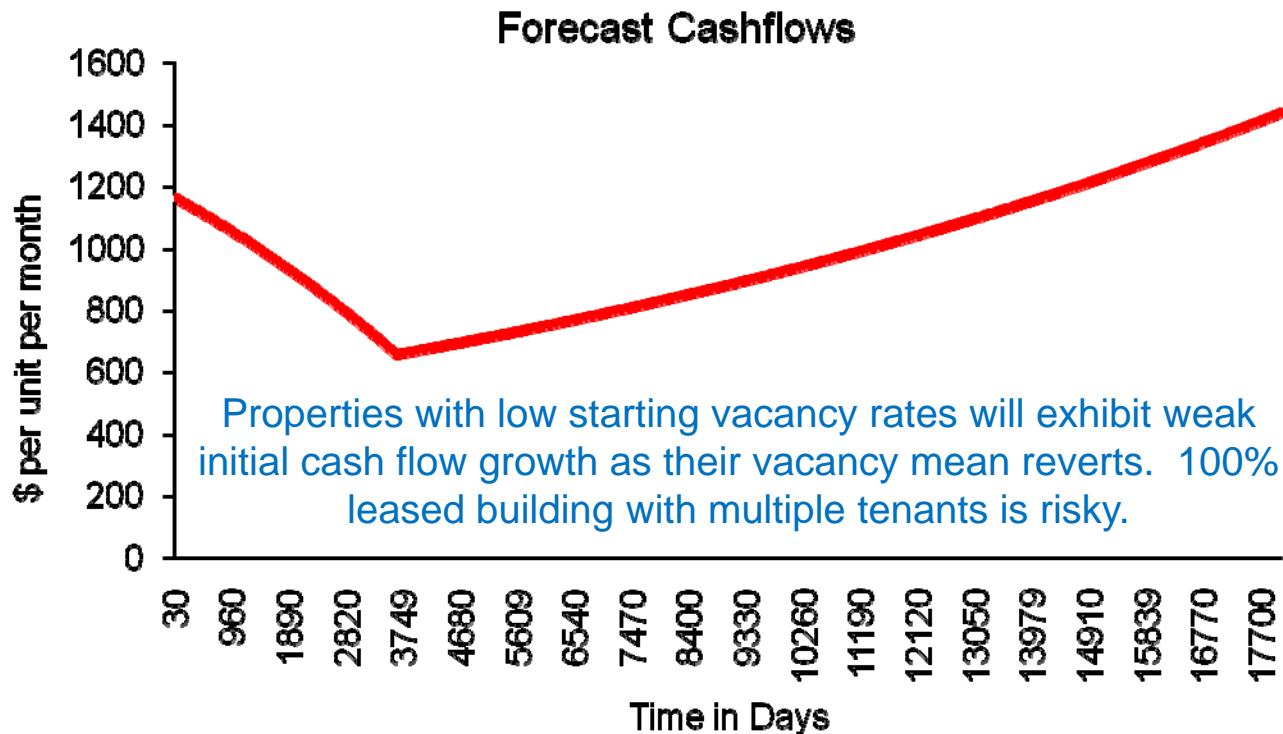
- Integrating real estate investment positions into EE starts with modeling risk from cash flows without considering rent volatility
- A convenient framework:
 - Consider lease units within properties to be long (junk) bonds bringing in rent cash flows; herein referred to as Property Asset Securities
 - Represent mortgage financing as short bonds generating outgoing cash flows - interest and principal repayments; herein referred to as Financing Securities

Real Estate in EE (con't)

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 is inversely related to vacancy

Property Asset Securities: CF Example Low Initial Vacancy



Real Estate in EE (con't)

Property Asset Securities - Cash Flows

- Inputs for Forecasting Rent Cash Flows:
 - Current rent and expenses (NOI)
 - Current occupancy / vacancy
 - Structural vacancy & reversion
 - Down-time between leases
 - Growth of rent and expense cash flows over time
 - Useful life of building

Direct Property / Real Estate

- A “bottom-up” property-by-property approach
- Each property is treated as a composite asset
 - a package of risk exposures to the EE common factors plus idiosyncratic risks

The Elements of Property Risk

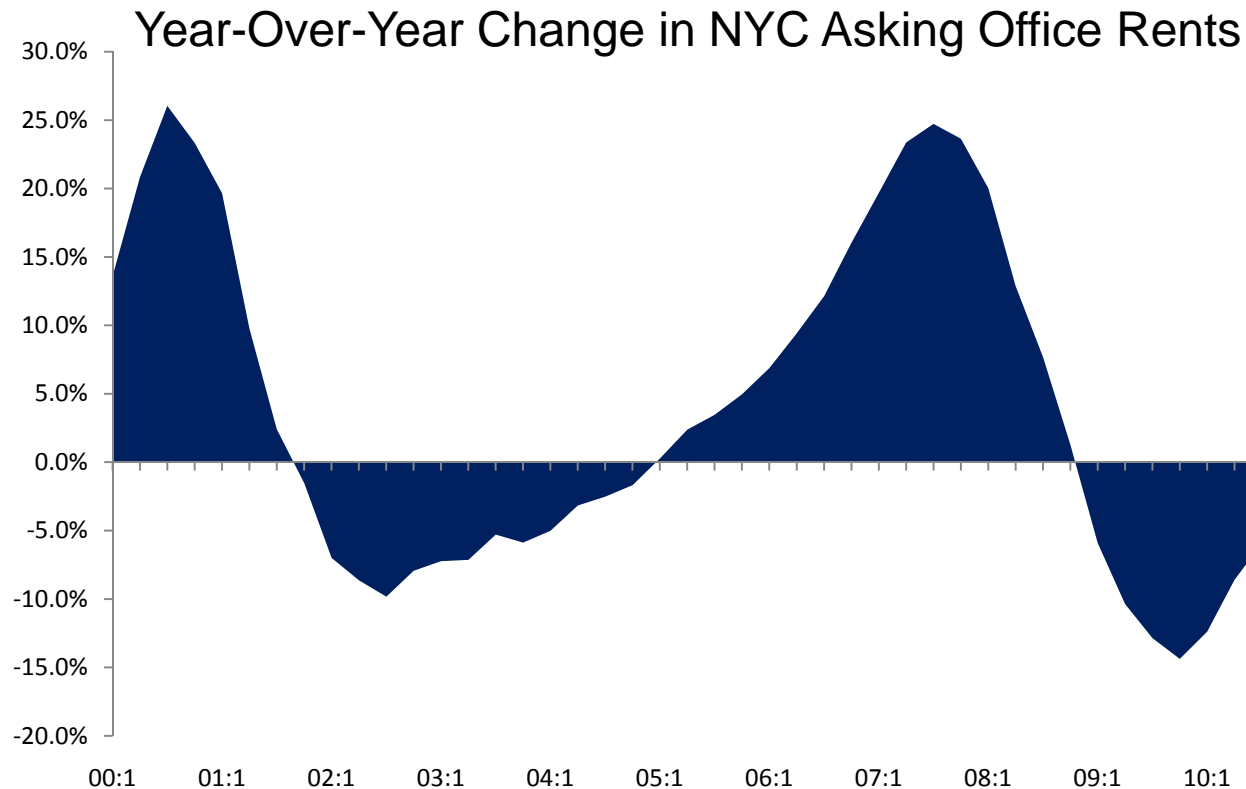
- Three basic property risk exposures:
 - Risks based on “steady-state” Cash Flow (CF) assumptions for existing and expected leases
 - Risks of future fluctuations in rents and occupancy
 - Risks related to mortgage financing



Steady State Cash Flow

- Assume property life – 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
- Forecast change in rents using regression-based estimates integrating EE model factors:
 - CF adjusted for probability of lease renewal. Non-renewed leases are assumed to be taken over by a “generic” tenant
 - Expected downtime between leases incorporate into CFs for non-renewals
 - Adjust least default rates losses for the probability of generic tenant in second and subsequent leases
 - Assumes inflation-adjusted or user supplied rental growth after 10th year.

Little Volatility in Values: But Big Changes in Rents





Steady State Cash Flow con't

- Repeat yearly for the useful life of the building 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 will have exposure to the three factors that describe changes in yield curve conditions (time value of money)
 - Each CF stream can be assigned a value for idiosyncratic risk according to location, property condition, ability to sub-divide and vacancy time between leases
- Idiosyncratic risks diversify.
 - A complex of 500 apartments may 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 Risk

- Projected Cash Flow risk is specific to
- The tenant
 - Industry / business
 - Credit Rating
 - The local / national / regional economy
- “Tenant CF risk” is combined to generate composite CF
- So, each building will have specific exposures to the relevant EE factors
- So, location is not the only risk...
- Tenant risk is just as important and can be more so.

Tenant-Related Systematic Risks

- Example: A New York office building
 - Occupied by energy companies
 - Exposed to:
 - Global market for oil and natural gas
 - Less sensitive to finance
 - Exposed to exchange rates
 - Exposed to interest rates
- Safer cash flows than an average building in Manhattan during the financial meltdown!
- Investors often buy a building in a particular market without realizing that its risk profile is similar to a building they already own!



Steady State Cash Flow con't

- For CF and Net Operating Income (NOI) projections require property specific information:
 - Average lease length
 - Operating expenses as % of rents
 - Expected vacancy rates
 - Expected renewal rates of existing tenants
- Major tenants' lease-by-lease data
 - remaining lease period
 - renewal options
 - escalation clauses
- NOTE: These data are important to anyone interested in attempting to truly comprehend real estate risk
- Macro-level data alone does not help



Rent and Occupancy Volatility

- Rent and occupancy levels are driven by supply and demand – obviously!
- Each property “package” will include a set of risk exposures to represent rent and occupancy volatility
 - Supply of commercial space changes slowly with little immediate relationship to the EE risk factors.
 - Decisions made several years previously result in new supply today. Long lead times between construction, completion and letting.
 - Demand for commercial space is elastic
 - Can be captured by relating percentage changes in rents to the broad economic factors of the EE model

Rent and Occupancy Volatility con't

- Demand volatility modeled as a function of the structure of employment in the local economy;
 - Government, finance, auto manufacturing, chemicals etc.
 - London, Tokyo and NY, financial businesses are an above average share of local employment.
 - Popping of financial bubbles hits office demand hard.
 - Houston is dominated by the energy industry and employment in that sector impacts office demand - unlike Boston which has virtually no employment in the energy sector
 - All the risk exposures related to rent/occupancy risks are scaled to reflect the nature of a property
 - A property that has a triple net lease for 100 years will have zero exposure, while an apartment complex with short-term leases would have its exposures scaled accordingly. This scalar is roughly the annual percentage of lease turnover

Rent and Occupancy Volatility con't

- Rental change is typically modeled using the metro's employment demand profile, building stock, and vacancy rate
- Office demand will be skewed towards non-manufacturing, non-retail employment sectors such as finance
- Once estimated, we substitute the weighted EE factors into the rental change equation for the employment index

Mortgage Financing

- Mortgage financing is modeled as a “short” bond holding
 - A set of factor exposures to outgoing cash flows
- “Steady State” Net Operating Income (NOI) is represented as incoming CFs – a long bond
- EE’s binomial interest rate model is used to model the cash flows.
- Multiple mortgages and on one property can be accommodated including cross-collateralization across properties

Sample Retail Risk Report

Factor	PortExp	BenchExp	ActiveExp	FactorVar	VarContr
CONTINENTAL EUROPE	0	0	0	386.993	0
ENGLISH-SPEAKING COUNTRIES	-0.0542	0	-0.0542	362.002	-0.5386
SCANDINAVIA	0	0	0	460.326	0
SOUTH AMERICA & MEXICO	0	0	0	339.245	0
ASIA	0	0	0	448.205	0
INDUSTRIAL SECTOR	-0.0005	0	-0.0005	495.013	-0.0163
CONSUMER SECTOR	0.1781	0	0.1781	247.761	3.5384
TECHNOLOGY&HEALTH SECTOR	0.042	0	0.042	283.12	0.7083
INTEREST RATE SENSITIVE SECTR	-0.004	0	-0.004	387.061	-0.0397
NON-ENERGY MINERALS	0.0008	0	0.0008	910.28	0.065
ENERGY MINERAL SECTOR	0.0001	0	0.0001	491.944	0.0037
S B WORLD GOVT BOND INDEX	-0.1373	0	-0.1373	68.6834	0.9918
OIL PRICES IN USD	0.017	0	0.017	1255.9	1.037
DEVELOPING MARKET	-0.0417	0	-0.0417	176.162	1.665
SIZE	0.0177	0	0.0177	63.1763	-0.0352
VALUE/GROWTH	0.3341	0	0.3341	7.4438	0.0378
TREASURY CURVE FACTOR1	-23.8879	0	-23.8879	0.3247	143.2184
TREASURY CURVE FACTOR2	-180.072	0	-180.072	0.0036	52.0653
TREASURY CURVE FACTOR3	-2171.04	0	-2171.04	0	-44.3526
Factor Tracking Variance					158.3483
Stock Specific Tracking Variance					18.6123
Total Tracking Variance					176.9606
Tracking Error					13.3027
Total Risk of Portfolio					13.3027

Future Enhancements

Enhanced credit risk analysis:

Introduce a combination of Merton style credit framework and factor model approach to calculating credit risk factor exposures

Implement effects of rating transition probabilities

Enhanced linkage between rents and EE Factors:

Bridge equation rather than direct substitution

Review

We have:

- Estimated term-structure risk exposures for projected rent cash flows
- Estimated term-structure risk exposures for the financing structure
- Estimated credit risk of tenants
- Estimated rent volatility for building

Review

We have proposed a model of the risks for the following pieces:

- Projected income cash flows
- Financing structure
- Credit risk of tenants
- Volatility of rent and occupancy

We now estimate:

- Value and risk of a property
- Contribution to variance from common factors
- Same effects for portfolios

We can then also look at some new and interesting things:

- Effect of adding or subtracting a portfolio
- Effect of changing the financing structure
- Effect of hedging some or all of the interest rate risk using the bond markets

Applications

- Risk Management
 - Relative risk across asset classes
 - Marginal impacts of investment decisions
 - Within asset class
 - Across asset classes
- Valuation
- Hedging Strategies
 - Synthetic products
 - Eliminating credit or interest rate risk
- Mean Variance Optimization
 - Portfolio construction
- Benchmarking
 - Synthetic properties (levered or unlevered) can be constructed
 - Weighted by market cap

Summary (con't)

- This makes the Direct Property / Real Estate Model unique
- Limitations of appraisal-based building valuation eliminated
- Results suggest that direct property risk is greater than REITs but less than equities
- Detailed information about each property and major tenants incorporated and available for analysis
- Each property analyzed by cash flow, rent/occupancy volatility, and financing
- Employs factor model to relate 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

- Traditional real estate benchmark is not robust
 - Significantly understate absolute and timing of risk
 - Leads to ad hoc risk and allocation targets
 - Reduces confidence in asset class
- Factor models offer a unique solution
 - Relate behavior of each asset to a set of common economic drivers, and infer relationships between investment assets
 - Real estate risk is measured 3 different ways
 - Credit risk
 - Rent change risk
 - Interest Rate Risk

Conclusions con't

- Results are consistent with expectations
 - Shape of cash flows consistent with leasing and expense behavior
 - Credit risk represents a significant % of total risk consistent with real world experience during recent downturn
 - Leverage risk a function of term, call option, coupon rate, fixed versus floating
- Initial results show that real estate risk greater than corporate bonds but less than equities
- Methodology should elevate consideration of private equity real estate's role in a mixed asset portfolio because it frees it from its dependency on appraisal-based valuations