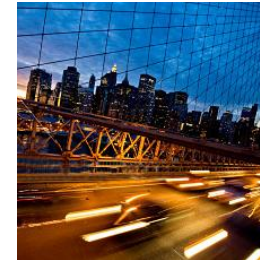June 2010

Building and Monitoring an Optimal Real Estate Portfolio

A case study

Nadja Savic de Jager
Porntawee Nantamanasikarn

CBRE INVESTORS
CB RICHARD ELLIS INVESTORS

Aim

- To develop a tool for a fund manager to build, monitor, and rebalance a real estate portfolio by applying Modern Portfolio Theory and our in-house forecasts of property market performance.

- This tool will help optimize the portfolio by identifying sales candidates and potential acquisitions that enhance risk-return profile of the portfolio.

- To verify that the portfolio is compatible with a fund's investment objectives.

- Must be flexible enough to be used by various investment initiatives with different investment horizons.

- Must be flexible enough to allow users to specify various inputs including leasing structures that vary across countries.

Modern Portfolio Theory

- Markowitz introduced two important concepts:

  - The effect of diversification

  - Risk/return trade-off on the portfolio as a whole

- Merton (2003) and Campbell and Viceira (2002) provided important extensions of the Markowitz:

  - Investment contexts require the consideration of multiple horizons rather than a single horizon.

  - Prospective future cash flows typically offer a more useful perspective for assessing the reward and risk of long-horizon investment strategies than do future wealth prospects.

  - Long-horizon prospects for investment returns have time-variant, predictive components. Therefore, strategic asset allocation should always be a dynamic rather than a static process.

Challenges: Modern Portfolio Theory and Real Estate Investment

Unlike stocks and bonds

- Real estate investment markets are not as efficient. Transaction costs are high.

- Real estate investors can actively manage each individual asset. Stock and bond investors can't.

- Less reliable data for the property markets
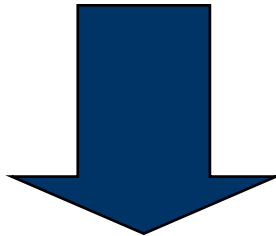
- Long-term hold for real estate investors with clear exit strategy.
- Real estate investors are more concerned about the risk of not achieving target returns by the exit date **(shortfall risk),** rather than the volatility of returns before the exit date.
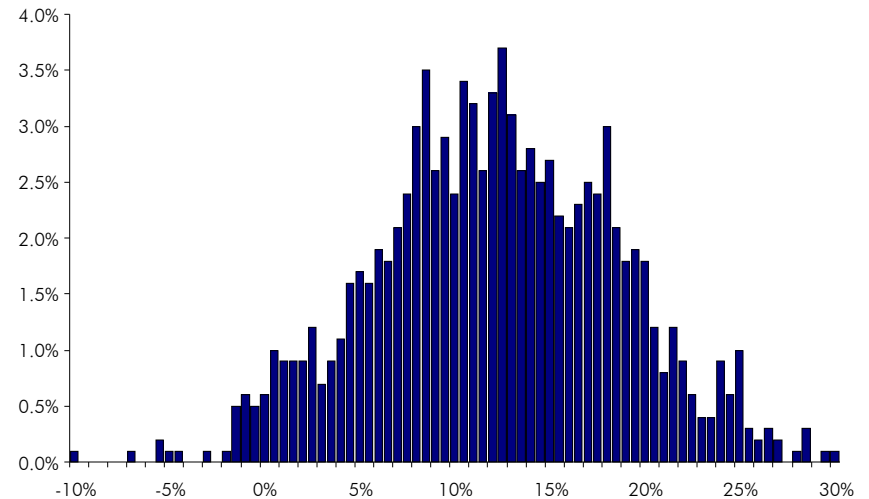
Methodology

- Monte Carlo Simulation
  - Vary rent growth and exit yield assumptions to generate IRR **distribution** of individual properties and portfolio.

- Then compute measures of risk (standard deviation, probability of negative IRR, VaR) based on that IRR probability distribution.

Point forecast

Forecast Distribution

The Tool Allows Us to Answer These Interesting Questions

- Is return/risk of a specific property lower or higher than its peers in the portfolio?

- How does a specific property contribute to risk/return profile of the entire portfolio?

- Should we use more or less leverage for a specific property?

Rent and Yield Scenarios Generation

- Vector Auto Regression (VAR) of inflation, rent growth, and yield change

- Annual sample: 1980-2009

- 11 segments ("City Office", "South-East Industrial", "Rest of UK Standard Retail", etc.)

Inflation: $\quad Dlog(RPI_t) = \alpha + \beta * Dlog(RPI_{t-1})$

Rent growth: $\quad Dlog(R_t) = \alpha + \beta * Dlog(R_{t-1}) + ... \gamma * Dlog(R_{t-n})$

Yield change: $\quad Dlog(Y_t) = \alpha + \beta * Dlog(Y_{t-1}) + ... \gamma * Dlog(Y_{t-n}) + \delta * Dlog(R_t/RPI_t) + j * Dlog(RPI_{t-1})$

- The model is then solved forward stochastically using bootstrap method

Advantages of This Approach

1. Risk and return are forward looking.

2. IRR calculations take into account asset-specific characteristics.

3. Can adjust market rent and yield forecasts to reflect asset-specific characteristics.

4. No restrictive assumption about the distribution of the error terms, such as normality.

5. The (negative) correlation between rent and yield is preserved.

6. The (positive) correlation of rent and yield between markets is preserved.

Results: Correlations of Rent Growth and Yield Scenarios
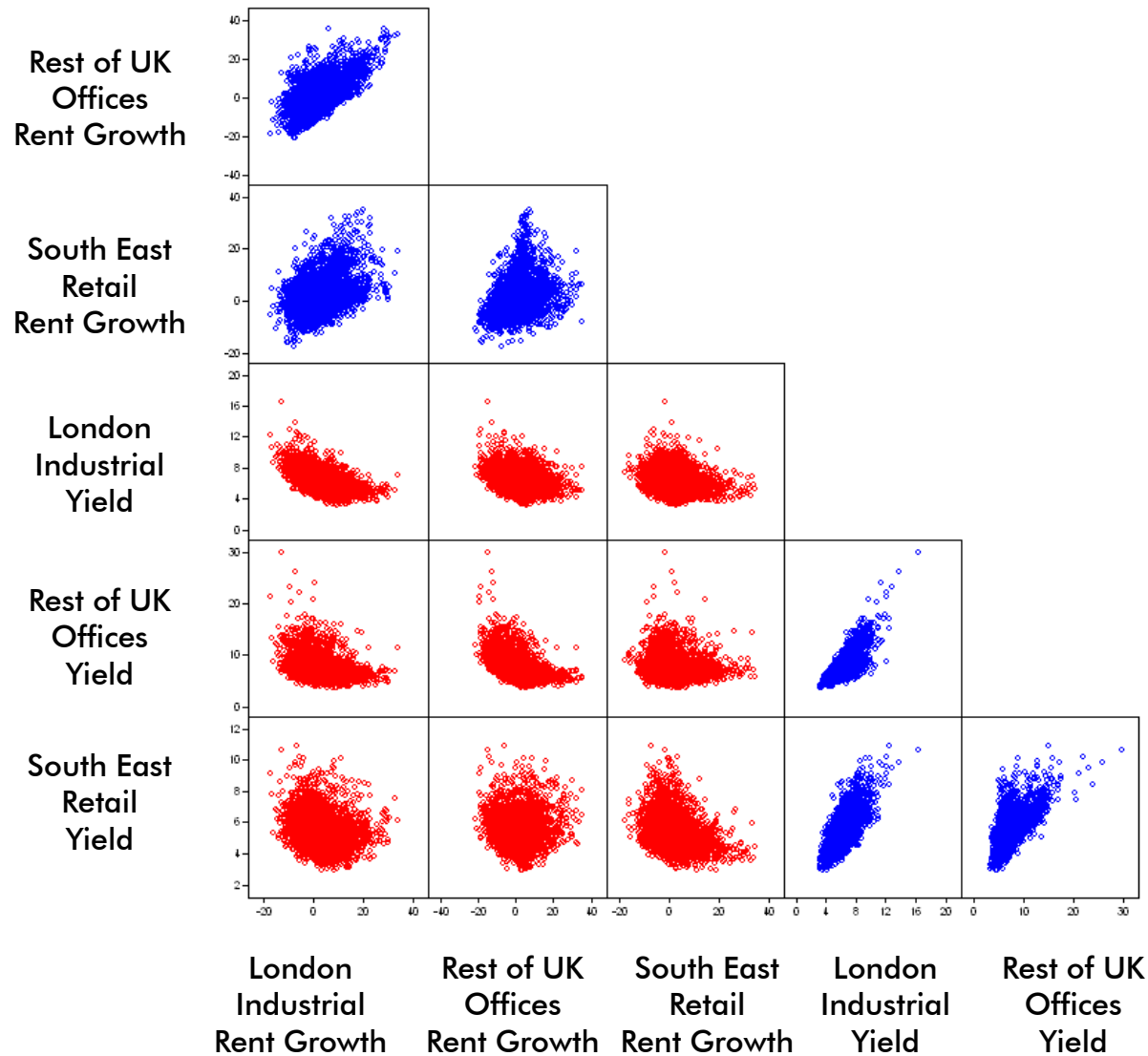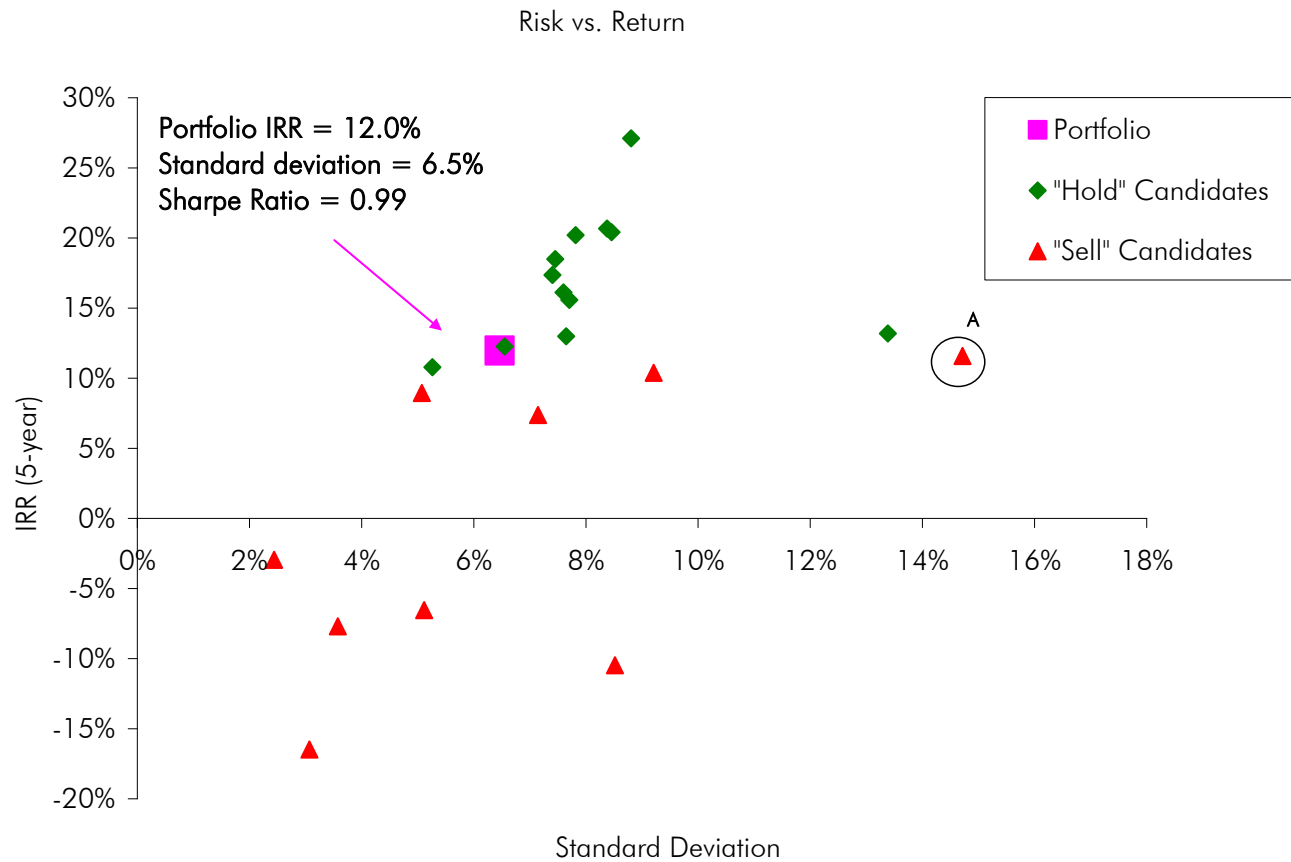
Results: Probability Distribution of Portfolio's IRRs

Portfolio IRR

Baseline
9.5%

Mean = 12.0%
Stdev = 6.5%
Sharpe Ratio = 0.99

5th Percentile
1.1%
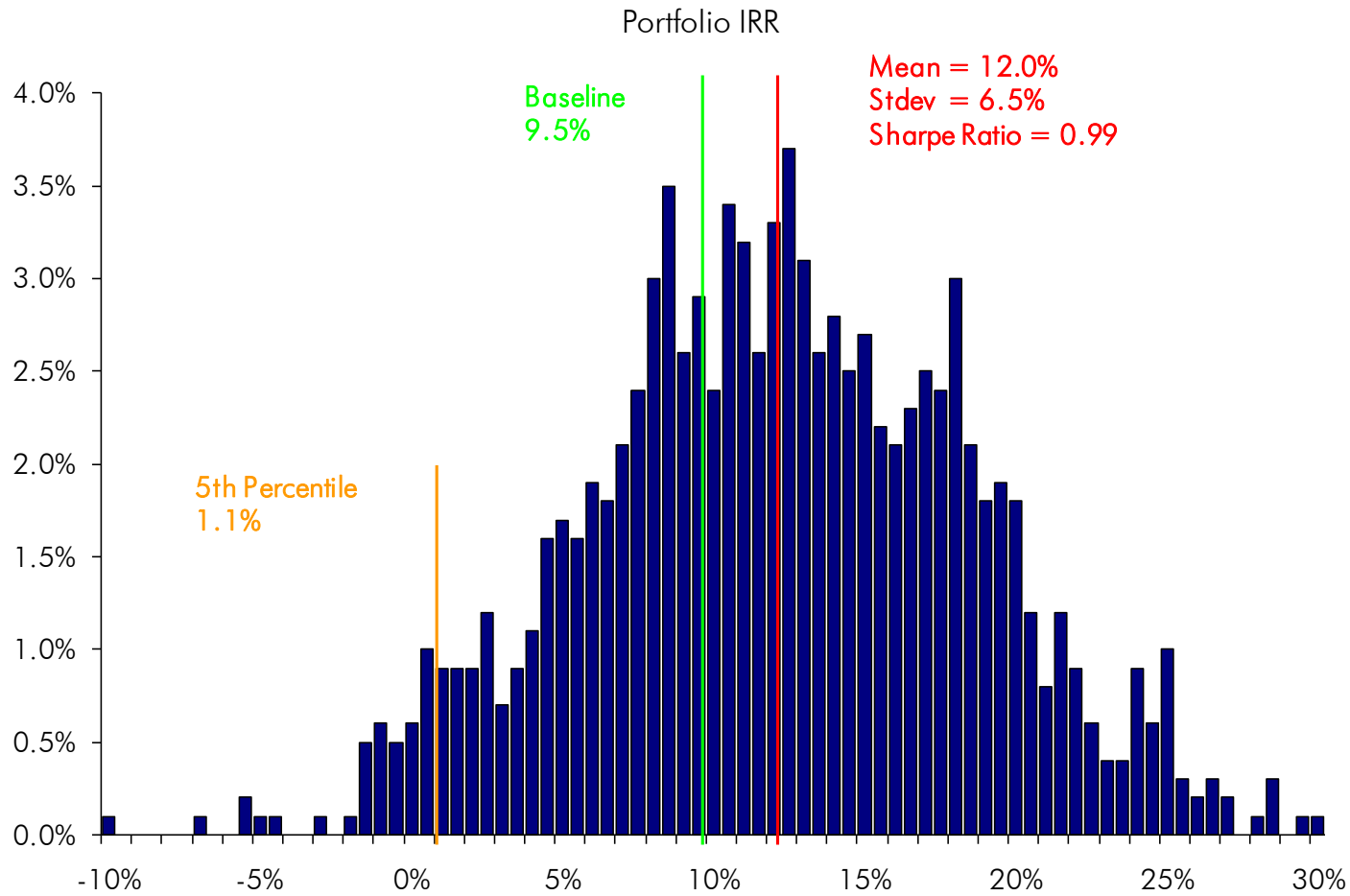
Hold/Sell Analysis

- A property contributes positively to the risk-adjusted return of a portfolio if it increases the Sharpe Ratio of the portfolio.

- A specific property is identified as a "hold" candidate if the following condition holds:

$$\left(\frac{R_i - RF}{\sigma_i} \right) \geq \left(\frac{R_p - RF}{\sigma_i} \right) corr\left(R_i, R_p \right)$$

Results: Risk and Return Profile

Risk vs. Return

Portfolio IRR = 12.0%
Standard deviation = 6.5%
Sharpe Ratio = 0.99

IRR (5-year)

Standard Deviation

Legend:
- ■ Portfolio
- ◆ "Hold" Candidates
- ▲ "Sell" Candidates

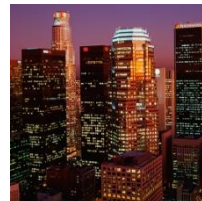# Conclusions

- Real estate investors are more concerned about the risk of not achieving the return by the exit date (shortfall risk) rather than the volatility of property returns.

- Applying the method to an actual portfolio, we find that the IRR distributions at both property and portfolio level have characteristics of skewness and kurtosis, proving once again that the normality assumption doesn't hold, signifying that models relying on this assumption will give erroneous results.

- We find out that the probability of negative IRR for the portfolio is less than 5% and that at a 90% confidence level we can say that portfolio will not generate a return lower than 3.85%. Moreover, the portfolio IRR generated considering the sensitivity of yield and rental values is higher than the IRR computed by the valuation software, suggesting that there is upside potential to the return from the baseline IRR.

- Taking into account all asset-specific characteristics, this approach generated a significant number of sale candidates: 9 out of the 22 properties in the portfolio. There is one property that has return comparable to the portfolio return but has a much higher risk. Yet this property is identified as a hold candidate because it as a low correlation with the portfolio as a whole.

- This tool developed in this paper can be used as part of the new holistic risk management process.

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