REAL ESTATE MATHEMATICS

Applied analytics and quantitative methods for private real estate investing

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Real Estate Mathematics
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Private real estate allocations in multi-asset investment portfolios

By Greg MacKinnon, Pension Real Estate Association

A wide variety of commercial real estate investment strategies can be employed within a multi-asset portfolio depending on the needs of the specific investor. For instance, opportunistic investment strategies tend to be alpha-oriented, attempting to generate excess risk-adjusted return, while core strategies tend to be geared towards diversification and ongoing income-generation. This chapter looks at commercial real estate investment from the perspective of a strategic asset-allocation decision.

In setting policy portfolios, it is typical to consider the investment characteristics of an asset class in general, rather than specific strategies that could be employed within the class. Hence, the focus is on the broad characteristics of equity investment in institutional-quality commercial property. Higher risk developments, turnaround situations and other strategies within the opportunistic and value-add spaces can certainly provide benefits to a portfolio if executed properly, but are not the focus here as the decisions involved with each investment are situation-specific. Rather, the chapter examines decisions taken from a portfolio-level: what benefits might an allocation to the broad real estate market provide to a mixed-asset portfolio, and how much should that allocation be?

The average institutional real estate allocation was 3.7 percent in 2010, although this varied by type of investor (see Table 1.1). A number of institutional investors have zero allocations to real estate, bringing down the overall average; among members of the Pension Real Estate Association (PREA), a trade association of the institutional real estate community whose members presumably have a high interest in the asset class, the average allocation to real estate was 9.8 percent in 2010. It appears that once an institution makes a commitment to real estate as a viable asset class, real estate is allocated a significant portion of the overall portfolio.

<table>
<thead>
<tr>
<th>Table 1.1: Average real estate allocations of institutional investors, 2010</th>
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<tbody>
<tr>
<td>All investors</td>
</tr>
<tr>
<td>Public plans</td>
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<td>Corporate plans</td>
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<tr>
<td>Others</td>
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The value of the global institutional-grade commercial real estate market has been estimated at $23.9 trillion, versus a total equity market capitalisation of $58 trillion. An investor wishing to take a market-neutral approach would therefore need to have a sizeable allocation to property. Apart from its sizeable role in the universal market portfolio, several key arguments are often used to promote a real estate allocation, specifically real estate’s provision of steady income, potential as an inflation hedge, good risk-adjusted returns and diversification benefits.

In Figure 1.1 it is apparent that over the long-term price appreciation accounts for little of the total return to real estate, with income dominating.

As well as being the dominant source of long-run returns, income returns from a diversified portfolio of real estate tend to be relatively stable. Using the variance of quarterly returns to the transaction-based index (TBI) as a measure of real estate risk for the 1984–2011 period:

\[
\frac{\sigma^2_{\text{price}}}{\sigma^2_{\text{total}}} = \frac{0.00204}{0.00207} = 98\% \text{ of variance from prices}
\]

\[
\frac{\sigma^2_{\text{income}}}{\sigma^2_{\text{total}}} = \frac{0.000009}{0.00207} = 0.4\% \text{ of variance from income}
\]

with the remainder of total risk arising from the correlation of income and price. Obviously, in a well-diversified real estate portfolio, income accounts for the majority of returns to real estate but very little of the risk. For institutional investors with ongoing cash outlay commitments, the provision of a stable income stream is an important advantage of the asset class that lends itself to higher real estate allocations.

Figure 1.1: *Income dominates as long run source of returns*


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2 Figures as of 2010 and May 2011, respectively. Sources: Prudential Real Estate Investors’s A Bird’s Eye View of Global Real Estate Markets: 2011 Update and World Federation of Exchanges
Mathematical concepts in building a real estate multi-manager portfolio

By Edward Casal and Tiffany Thomas, Aviva Investors

Introduction

Real estate multi-manager (REMM) is a service whereby clients engage a team of real estate professionals to create a portfolio of investments in a variety of underlying private real estate funds in order to achieve their return objectives and risk tolerance level. A multi-manager seeks to construct a portfolio that is diversified by geography, stage and sector. Each underlying private real estate fund may be dedicated to a particular geography, stage or sector (a specialist fund), or may invest across different geographies or property types to provide a degree of internal diversification. Client mandates are typically invested over a number of vintage years, allowing investment across various phases of the market cycle in order to avoid market-timing risk.

REMM clients range from corporate and government pension plans to high-net-worth investors. They invest either through a separate account structure or through a commingled fund structure. The commingled fund structure is often referred to as a ‘fund of funds’ because the fund invests in other funds which are generally specialised in nature. In either case, separate account or fund of funds, the analytical processes on behalf of the client are the same.

This chapter will discuss the mathematics of real estate analysis, as well as areas that are specific to multi-managers, including investment process overview, model allocation development, investment analysis, portfolio construction and asset management.

Investment process overview

The REMM methodology combines top-down analysis and bottom-up analysis. The three main components of a multi-manager process are (i) research and strategy, (ii) investment implementation, and (iii) asset management. In each case, the manager seeks to maximise the opportunity set while limiting the amount of risk exposure.

Research and strategy often involves a broad assessment of opportunities and focuses on macroeconomic, geopolitical, capital market and property market fundamentals. Ultimately, this leads to development of model portfolios for each client with country and sector weightings that are based on total return forecasts. Demographic drivers, economic growth and real estate cycle considerations are examined to develop projections of potential future returns for an underlying strategy. This comes together to form a model allocation, which is based on the multi-manager’s view of potential outcomes over the medium to long term.

The investment implementation stage takes the model allocation that has been developed and constructs an actual investment portfolio for a client. This ‘bottom-up’ stage often takes two to four years of dynamic analysis, investment, re-evaluation, analysis and further investment of property, funds and managers selected. Simple mathematical analysis regarding
Developing a model allocation

historical costs and returns can serve as a valuable tool with which to probe a manager’s philosophy and actual capabilities. Deep financial analysis also helps to eliminate the ‘truth bias’, the implicit assumption that one generally believes they are being told the truth unless one is shown some reason to believe otherwise.

Portfolio construction in private real estate is an imprecise science as historical data can be extremely poor, particularly when allocating capital globally. Nevertheless, the multi-manager must take into account the risks being taken within a portfolio, their impact on value and the potential amount and timing of cash-flow distributions. Further, covariance of returns based on common susceptibility to individual economic factors is a key factor in building portfolio diversification.

During the asset management stage the REMM re-evaluates the status of the investment portfolio on a periodic basis. Factors for evaluation include projected returns, liquidity and financial leverage as well as geographic, sector, currency and manager risk. The portfolio may be rebalanced by selling an interest or reinvesting distributions into strategies considered more favourable.

The objective of developing a portfolio allocation model is based on Harry Markowitz’s modern portfolio theory (MPT), using a mean-variance model. MPT assumes that investment returns are normally distributed and can be measured on a continuous basis. In the case of private real estate funds, neither assumption holds true. First, given the private nature of the investment vehicles, returns are not publicly available and are further protected by confidentiality agreements. Where data is available, it is not measured on a continuous basis but rather on a quarterly or annual basis. The lack of availability and the infrequency with which returns are measured present a significant challenge in the direct application of many portfolio allocation techniques.

Finally, where large samples of data can be tested, it does not appear that such returns are normally distributed. While a normal distribution is characterised by symmetry around a

Figure 18.1: Non-normal real estate return distribution

![Non-normal real estate return distribution](image)