THE EVOLUTION OF REAL ESTATE PORTFOLIO MANAGEMENT PRACTICES IN THE PENSION FUNDS OF THE UNITED STATES OF AMERICA

by

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ABSTRACT

Real estate capital markets are generally seen as lagging securities markets by ten to twenty years in the application of modern portfolio theory. This applies to both the efficiency of the market itself, as well as to the level of sophisticated market analysis. This has important implications to portfolio managers in the face of increasing competition for optimal returns. Modern portfolio theory has provided the methodology for structuring such optimal portfolios for over three decades.

This thesis reviews how modern portfolio theory is itself an evolution of increasingly sophisticated principles, which by no coincidence are applied to stock equity and fixed income bond markets first, before finding application in real estate. The thesis reviews the literature for examples applying to real estate. A trend becomes apparent that demonstrates the increasing level of sophistication that has been employed for research and implementation in analyzing real estate equity investments, particularly in the face of institutional entrants to the market.

A particular segment of the institutional market, the pension fund industry, was surveyed in 1990 for the level of sophistication in its real estate portfolio management. The results serve to test eight hypotheses, which when aggregated, demonstrate that perceptible changes have occurred in the sophistication of portfolio management techniques on the part of the pension industry.

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THESIS

By most accounts of the academic literature on real estate investment, this class of asset was considered a non-traditional investment in the financial world less than twenty years ago (Melnikoff {34} p.407). In fact, real estate as an investment wasn't even noticeably addressed in the literature until 1960, when The Appraisal Journal published two articles on the subject.[1] It is difficult to pin-point a single exogenous event that brought real estate into the realm as an investment grade asset suitable for portfolio acquisition. On an individual investment basis, however, the 1961 revision to the Internal Revenue Code, Sections 856-8, which created the raison d'etre for the real estate investment trust (REIT), can be considered as the major impetus. Similarly, the enactment of the Employee Retirement Income Security Act (ERISA) in 1974 provided an indirect push for increasingly wealthy life insurance companies in their role as fiduciaries for pension funds and various pension funds to invest in real estate. ERISA established rules and guidelines for these sizeable investors to minimize the risk of catastrophic losses within their portfolios by exhorting them to prudently diversify their investments. The

[1]See F.Case, Comparable Real Estate Investment Experience, *The Appraisal Journal* 28:337-344,July 1960; and J.D.Landauer, Real Estate as an Investment, *The Appraisal Journal* 38:426-434, October 1960.

literature on real estate up to that time had extolled the virtues of the cyclical nature of real estate in terms of its value as an inflation hedge, and its high residual value from appreciation due to its unique economic features (Hartzell, Hekman,and Miles {22},p.238).

Although ERISA had the effect of indirectly coaxing the markets' increasingly wealthier investors and lenders, such as pension funds, into real estate as an investment, there were a great many reasons why this did not occur overnight. From the standpoint of equity investment, there are five possible explanations:

1) TAX EXEMPTION: Pension funds are tax-exempt if they operate in accordance with Departments of Labor and Treasury regulations. The four primary sources of value to real estate are:

a) Cash Flow Return including the
b) Amortization Return; and
c) Gain from Tax Shelter, and
d) Return from Appreciation

Because many real estate deals concentrated an inordinate amount of their attention on the sheltering of ordinary income, real estate looked relatively overpriced to the tax-exempt pension funds. Since the Tax Reform Act of 1986 (TRA) significantly reduced these tax benefits, a further impetus for pension fund investing in real estate equity has emerged; as a result they should now be able to better compete for individual projects or multi-project portfolios, given the more level tax-benefit playing field.

2) VARIABILITY/VOLATILITY of RETURNS: As the primary measure of risk, the perception of volatility in real estate returns (because of economic cycles) made the fiduciary role of pension funds less likely to consider the asset class.

3) LABOR INTENSITY: Pension funds have been passive investors, who looked at real estate as a labor intensive, management challenge in deriving returns. Professional management existed to alleviate this burden, but their fee structure served to further reduce the expected real return.

4) LACK OF INFORMATION: In comparison with other capital markets, investors and lenders have found that while information sources of investment-required data may be available on single properties, the data required for portfolio inclusion, primarily for the purposes of diversification, is scarce or severely limited.

5) LACK OF SOPHISTICATED ANALYSIS: Pension funds have grown accustomed to the very sophisticated theories on investment analysis that have governed investments in the stock and bond markets (Conroy, Miles and Wurtzebach {10},p.607). The combination of these have formed the basis for what has become known as Modern Portfolio Theory (MPT) with the following theories and models by time frame and authors that conceived them:

Portfolio Efficient Frontier	1952	Markowitz
Capital Asset Pricing Model	1964	Sharpe
Arbitrage Pricing Theory	1976	Ross
Options Pricing Model	1973	Black&Scholes

Options Pricing Model	1979	Cox, Ross, & Rubenstein
(expanded to consider market inefficiencies)	1979	Rendleman & Barter

Mortgages and construction loans, as direct real estate investments were likewise viewed askance by the pension funds, as the cost and administrative burdens of first originating, and then servicing them made the vehicles unworthy for the time and effort, when compared with investing in stocks and bonds (Brueggeman,Fisher and Stone {8},p.607). (There were several other reasons for the funds' reluctance to invest in these instruments as well, and they will be dealt with later.)

Despite the pessimistic rationale for not investing in real estate, some 39,375 pension funds alone, as of 1 July 1989, reported over $113.5 billion of their $2.2 trillion of assets invested in tax-exempt real estate assets (Money Market Directory {38} p.xiv; and Pension & Investment Age {26} p.33). This includes over $90.3 billion in real estate equity (79.6%), $17.9 billion in hybrid debt assets (15.7%), and $5.3 billion in mortgage assets (4.7%). A more current gauge comes from *Pensions & Investments* (Ring {42} p.1), wherein the total discretionary tax-exempt assets handled by the universe of professional money managers is reported at $2.174 trillion as of 1 January 1990. Real estate equity is reported at 6% or roughly converted, $130 billion, although equity real estate is quoted further along in the article as $102.57 billion. Regardless, the investment in real estate equity over the past ten years

has more than doubled, and shows signs of keeping pace with its current allocation within the mixed asset portfoios.

There is a generalized axiom within the real estate community that in relation to the other capital markets, real estate is nominally twenty years behind the other asset markets in terms of sophisticated market analysis. For example, Blake Eagle of the Frank Russell Company, when asked about the relevance of modern portfolio theory to equity real estate investing, commented that, "We'll end up with a few good well-accepted principles and methods. We're now where the stock market was during the 1960's - and that's what happened there." (Lewis {31},p.160). This perception may be due to the very unique nature of real estate in relation to other capital markets. Among the factors that differentiate real estate in a relative sense are:

a) Indestructibility and Immobility
   - 0 Adaptability of use over time

b) Capital intensity
   - 0 Imperfect divisibility
   - 0 High transactional costs
   - 0 Illiquidity

c) Heterogeneity of the product
   - 0 Locational differences
   - 0 Exclusively privatized transactions
   - 0 Property-specific financing
   - 0 Infrequency of trades

d) Local versus a national,or international orientation
   - 0 Availability of property-specific data
   - 0 Nuances of local governmental controls
   - 0 Regional economic volatility
   - 0 Responsiveness to market forces of supply and deman

e) Informational lag of ex-post data

- 0 Non-public information of transactions
- 0 No national market exchange

The real estate industry changes at an ever-increasing pace. Evidence of this general condition can be seen in areas of change from entrepreneurialism to institutionalization; fragmented entities to vertically integrated corporations; direct investment and total ownership to securitization; and from local, regional franchise to globalization. It should be noted that the real estate industry is not being singled out in this regard, but is rather the continuation of business trends begun in the decade of the 80's.

With this growth and refinement occurring in the real estate market, one would expect a similar sophistication in the investment analysis of real estate as a preferred portfolio asset. Interesting insight into the developments of this aspect of the emerging industry over the last thirty years has been tracked by Ricks (1964), Wiley (1976), Farragher (1982), and Page (1983), which were all consolidated and compared by Webb {49} using survey data from 1982-83. Webb concluded that although the largest investors in real estate (pension fund managers and life insurance companies) had in fact improved on their quality of investment criteria, that improvement was only marginal, and in essence yielded suprising results in many areas as to

the lack of sophistication in techniques for investment analysis.

This study attempts to determine if the real estate investment community has made perceptible changes in portfolio management methods since Webb's 1982 study. After all, the investment in real estate (mortgages, mortgage securities, and equity) by the pension funds has risen from a liberally estimated $40 to $56 billion in 1982 (Webb {49},p.496) to over $113.5 billion in 1989 (MMD {38},pp.xix,xx). This compares with total pension fund asset base of $135 billion in 1971 when there was virtually no investment in real estate equity, and one year after both Fama's {13} treatise on the efficiency of capital markets and PRISA began its marketing effort to pension funds (Melnikoff {34}. Today it is estimated that over $1 billion in U.S. tax-exempt funds are being committed to real estate investment per month! However, two ensuing stock market crashes, a bond market collapse, and a major lending debacle related to real estate in the savings and loan community have caused extreme anxiety within the community of portfolio management in the ensuing years. With the magnitude of tax-exempt cash being allocated to real estate equity investments, along with the endogenous volatility of the real estate market over the last five years in particular, the author makes the general hypothesis that the evolution of real estate portfolio management practices have improved significantly in their level

of sophistication since Webb's (49) survey in 1982.

There is a renewed awareness and interest in becoming refamiliarized with portfolio management techniques, as evidenced by the Pension Real Estate Association (PREA) conducting its first annual Institute of Portfolio Management in 1990 at the Massachusetts Institute of Technology (33). The author wishes to acknowledge the assistance and support of Professor Marc A. Louargand of MIT, who as the driving force behind the first annual MIT/PREA Institute, involved me in the early stages of the conference, so that this study could be conducted to help serve the educational content of the Institute. To the extent that this paper can shed further insight on where a significant portion of today's money managers stand in their sophistication of real estate analysis, it will have met its goal.

CHAPTER 1

REAL ESTATE: THE ASSET

Within the universe of assets the one inextricable link among them is their individual ability to possess value from which exchanges of other goods and services can be made. As such an asset, real estate derives its value from the rights, interests, and benefits in the ownership of the physical form of real property. The economic precepts of real estate (relative scarcity, longevity, locational importance, and adaptability of use) allow it to be considered a suitable investment vehicle on its own merits, as well as a significant component of portfolio wealth.

To be sure, investment in real estate has its disadvantages too. For one, it is relatively an illiquid investment in its pure equity form, and this difficulty of converting the investment to cash requires high transactional costs in terms of time and money. Secondly, its fortunes are inextricably linked to economic cycles, although the real estate cycles may or may not be phased with the underlying economic cycle. As such, it is by nature a longer term investment, nonetheless dependent on short and long term fluctuations. Lastly, it is a manually intensive and complex investment with a distinctively local/regional flavor from a managerial, as well as a transactional standpoint. These unique features of the real estate asset create both opportunities and risks which must be

thoroughly comprehended and analyzed by any serious investor.

The difference between investment analysis and portfolio analysis may seem to be an insignificant flirtation with semantics. However, the differences are significant in the very foundation of this thesis. Investment analysis exists to predict the future prospects of returns for specific types of assets, while portfolio analysis concerns the prediction of the amount and variability of returns from a group of diverse assets. These returns, represented in the forms of periodic receipts, tax-sheltered income, amortization of principal, and terminal residual value, enable an exchange value to be placed on real estate. These same returns when coupled with an assessment of their variability allows the value of real estate to be compared with that of other assets. In this latter context a portfolio of assets can be produced to satisfy any financial objective. Just how this is done requires the use of extensive mathematics under significant, qualified assumptions.

Real estate investment analysis is predicated on a simple objective: to maximize wealth through the highest returns relative to their attendant risks (Jaffe and Sirmans {28},p.382-3). The returns and risks vary separately and jointly over the life cycle: from acquisition to development and through a managerial holding period, and on along to redevelopment and/or

disposition. While there exist a multitude of decision-making approaches to real estate investment, today all are focused either on the return or the risk component, or both. The track record of real estate investment throughout the 1970's indicates a heavy reliance on the return component for investment analysis and decision-making (Jaffe and Sirmans {28},p.381). Risk was largely subjective, and those successful in the business were given credit for their gut-instincts: skills acquired through extensive familiarity of the local markets. Despite the existence of quantitative models, this attitude still remains quite prevalent today (Jaffe and Sirmans {28}, p.392; and Ross, Firstenburg and Zisler {45},p.1). Regardless of the approach, one factor in the analysis remains key, and that is in comparing the investment to something else, i.e. the opportunity cost of not investing in something else.

In order to accommodate the tenure and variability of the multiple aspects of returns, and benefits (depreciation, tax-loss carry-forwards) derived from real estate investment, a framework for the measurement of investment performance had to be developed in order to facilitate the comparison of investment alternatives. The quantitative technique that allows for this standardization has become known as the discounted cash flow (DCF) method. It has become prevalent in every finance text since the 1970's, although in one case,

Brueggeman et al.{8}, the term itself is never mentioned. The technique focuses on the valuation of cash flows expected over the holding period of the investment. As is highlighted below, the cash flow returns are themselves subject to a probability distribution, which is most often deterministic, i.e. a specific value for each cash flow variable that is inputed. The cash flows are partitioned into the following categories for real estate:

Cash Flow (CF) from:
- Operations
- Tax Savings (Payments)
- Refinancing
- Disposition net of reversion

| All in terms of Monthly, Quarterly, or Annual Terms

These cash flows when discounted by a utility rate of return, i.e. hurdle rate, internal rate of return (IRR), financial rate of return (FMRR), etc., yields a value, a present value (PV) or net present value (NPV), that an investor would be willing to pay for the net income-producing capacity of the asset. Alternatively, DCF can used by a lender (construction loan, mortgage) to determine a proper yield for the use of their capital. The general mathematical form of the discounted cash flow looks as follows:

$$PV_e = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \ldots + \frac{CF_{n-1}}{(1+r)^{n-1}} + \frac{CF_n}{(1+r)^n} + \frac{TP_n}{(1+r)^n}$$

And $PV_{rei} = PV_e + PV_m$

Where
- PV_{rei} = present value of the real estate investment
- PV_e = present value of the equity returns
- PV_m = present value of mortgage

CF	= periodic equity cash flow to an investor over a holding period from 1 to n.
TP	= net reversionary cash flow (terminal price minus amortization of mortgage).
r	= specific rate of return measure

The DCF method has been commonly utilized for comparative rankings of investment opportunities across a spectrum of investment vehicles. However, a complete picture of an investment's potential, as previously discussed, can not be complete without an appreciation for the variety and multitude of risks involved. In real estate the generic term, risk, is used to cover all those factors which may influence the expected return in a negative or positive way. Another way of saying the same thing is that risk encompasses all those factors that will produce a return other than the one expected. In this sense risk is pervasive throughout every stage of real estate's life cycle, as well as every accounting category that is required to derive a periodic cash flow.

The task of explicitly quantifying the plethora of risks in any individual real estate project, to say nothing of a portfolio of real estate investments, at first appears intimidating. Several simplified methods have been utilized, nonetheless, to aid in quantifying risk in order to facilitate decision making (Pyhrr et al.{40}). Some of the more common risk assessment techniques are:

Payback Period: How long will it take to recover the initial cash investment under deterministic cash flow conditions?

Risk-Adjusted Discount Rate: Adjusting upwards the required rate of return from the investment.

Risk-Adjusted Forecasts: Adjusting downward the benefits (CF) expected from the investment.

Sensitivity Analysis: Assigning different input variables to represent deterministic assessments of risk, in order to gauge the impact of any combination to the ultimate measure of performance.

Probability Distributions: Probablistic assignments to each uncertain variable in combination with them all to simulate the probable outcome for all variables, individually and aggregately, on the ultimate performance measure.

Utility Assignment: The investor specifies preferences of risk and return in the form of a preference matrix. Input variables are weighted as high, probable, and low, and the performance measure for each is computed.

While these methods help serve to explicitly identify various risks, their treatment is mostly subjective and unsophisticated (i.e. scientifically unsupportable). Nonetheless, all are still being utilized today in real estate, as well as other investments. Pyhrr et al.{40} appropriately relates much of what the rest of the industry instinctively feels in their commentary:

Real estate decision makers have always claimed to take calculated risks, but few have made it clear just how they calculate those risks. Without the knowledge of how to deal explicitly with risk in decision making, people typically concentrate on a few key assumptions about the future, examine a few rules of thumb, mull over the situation, and then make a decision. Although some of the risk considerations may be explicit, the mathematics of risk are often left largely to the four horsemen of the implicit decision-making apparatus:

judgement, hunch, instinct, and intuition.

Pyhrr, Cooper, Wofford, Kapplin, and Lapides {40} p.75.

CHAPTER 2

MODERN PORTFOLIO THEORY

It is the interdependency of expected return and composite risk that modern portfolio theory (MPT) provides a paradigm for analysis: not only for the analysis of a particular property for evaluation of its investment potential against other opportunities, but also for the analysis of a particular property, as it complements other investments (either of like or dissimilar type) by marginally increasing the overall portfolio return and/or reducing the overall variability of that portfolio return. It represents a conceptual framework based on that found in other endeavors, where the scientific method of observable measurement of data has been beneficial in explaining and predicting behavior.

MPT was not invented necessarily by one person at one particular place in time. Rather it has come to symbolize a body of research that has developed over time as an evolution of previous quantitative work. As its basis, MPT relies on the quantitative techniques of capital budgeting, but structured not solely from a reliance on the "return" component of capital investments, but also to one that considers and includes the measurability of the total "risk" component. This interdependency between the two components can then be compared to other assets of similar type in order to

derive a quantitative rationale for the investment decision. MPT then goes a step further by analyzing the inter-relationships between assets of more than one class, such as stock-equities, fixed-income bonds, real estate, precious metals, classic art works, etc. It is capable of ultimately providing an answer to the question of optimal allocation of capital across all asset classes.

The earliest credit for the auspicious beginnings of MPT is given to Markowitz, who as a doctoral graduate student, researched the application of probability theory to see how equity securities moved in price and time to one another. In this way he began to develop the idea that an asset's value was indeed the product of return and risk, that both could be quantified, and that an efficient set of assets could be developed into a portfolio[2]. He thereby altered the consideration for an investment as is graphically displayed on the next page in Figure 1.

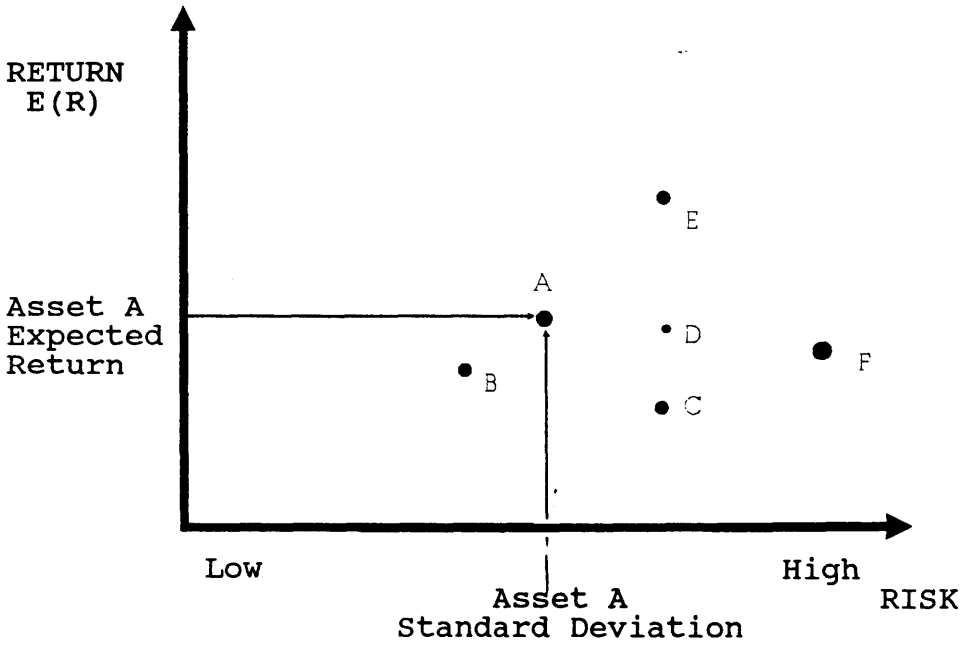
Up to this time, in order for an investor to realize his objective to maximize his wealth, it was considered nothing short of prudence not to put all one's eggs in a single basket. There were plenty of investment opportunities out there in the capital markets, one just needed to select the opportunity that

2 As a result of his doctoral research, he first published his idea in "Portfolio Selection," *The Journal of Finance*,7, March 1952, pp.77-91. The theory was further developed and produce in his book: (Harry M. Markowitz) Portfolio Selection:Efficient Diversification of Investment, (New York: John Wiley & Sons, 1959).

FIGURE 1

EVOLUTION OF DIVERSIFICATION

THE RISK/RETURN SPACE



NAIVE DIVERSIFICATION

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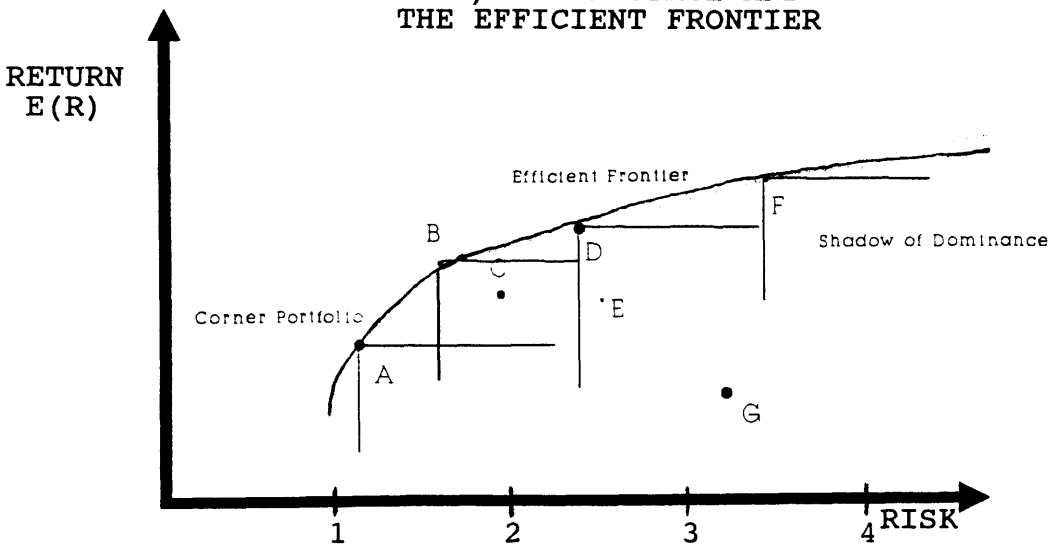
RISK/RETURN SPACE AND
THE EFFICIENT FRONTIER



EFFICIENT DIVERSIFICATION

gave the highest return for a reasonable risk. A portfolio could be diversified by educated decisions among various asset types and industries/services wherein the asset was utilized. Markowitz challenged this approach, which has become known as naive diversification of a portfolio, and embarked on a theory to quantify both the reward and risk. In order to construct a model for this theory, Markowitz set down the following assumptions.[3]

1. An investor's objective is to maximize the utility of terminal wealth.

2. To do this investors make choices on the basis of return and risk. Returns are measured by the expected return or mean of the expected returns, and risk is measured by the variance of those expected returns. Implicitly, to attain a greater expected return, an investor must accept a greater degree of risk.

3. A rational investor in the quest of the objective will have a goal to diversify away the risk to the most optimal extent possible.

4. All investors have homogeneous expectations of returns and risks.

5. Investors have identical time horizons in which terminal wealth will be realized.

6. Information is freely and simultaneously available to all investors.

[3] The simplifications for these have been derived from Harrington {20} pp.27-35.

Markowitz' argument acquiesced that there was nothing in the model that could increase the expected return or reduce the inherent risk of any single investment. However, the combination of carefully selected investment assets could be derived such that the overall portfolio return could be higher, and the attendant portfolio risk eliminated, to the extent possible, i.e. the greatest return for the given risk, or conversely, the least risk for a given return. Such a model could then evaluate the benefit (or cost) of an additional investment asset to the overall portfolio.

The mathematical constructs for the development of the model were divided into two predominant aspects of investment selection: expected return and risk variability of those expected returns. The expected return of the portfolio was the weighted average of all possible returns, and as such is a linear function.

$$E(R_p) = \sum_{j=1}^{n} w_j * R_j$$

where,

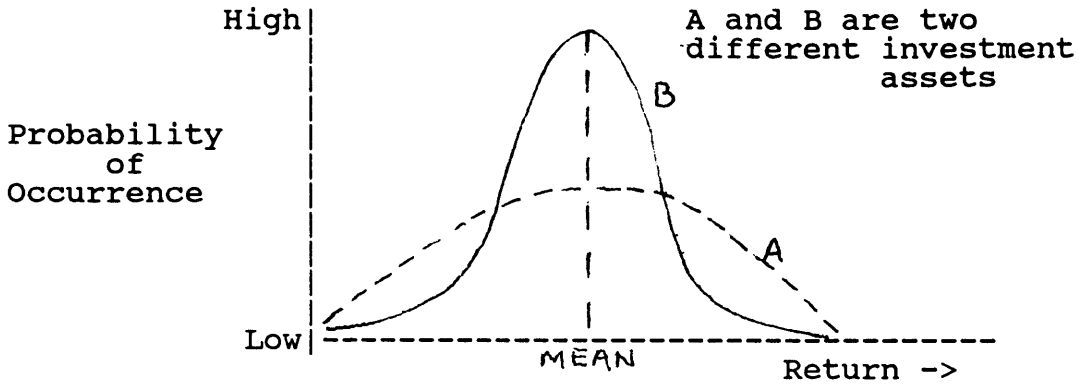
$E(R_p)$	is the expected portfolio return,
j	is an asset,
w_j	is the proportion of asset j in the portfolio,
R_j	is the return of asset j

The individual asset's risk has previously been mentioned as being the probability that the investor will not receive the expected rate of return, i.e. the variance or its more widely used root, the standard deviation. These can be expressed in mathematical and graphical terms, as follows:

$$\text{Variance} = \sigma_j^2 = \sum_{j=1}^{n} (R_j - E(R_j))^2 * P_j$$

where P_j is the probability of return, R_j.

$$\text{Standard deviation} = \sigma_j^2 = \sqrt{\sigma_j^2}$$



However, in the context of a portfolio, the portfolio risk is generally argued to be the variance, or standard deviation of the return relative to the expected return. Since an asset must be considered for its benefit to the other assets in the overall portfolio, <u>covariance</u> must account for the inter-relationship as well. The general form for this portfolio risk is:

$$\sigma_p = \sqrt{\sum_{i=1}^{n} (w_i^2 * \sigma_1 2) + 2 \sum_{i=1}^{n} \sum_{j=i+1}^{n} (w_i * w_j * \rho_{ij})(\sigma_i \sigma_j)}$$

w_i = proportion of the portfolio allocated to asset i,
w_j = proportion of the portfolio allocated to asset j,
σ_{ij} = correlation coefficient between assets i and j,
σ_i or $_j$ = standard deviation of asset i or j to the expected return, where $\sigma_i^2 = \sum_{i=1}^{N} \frac{(R_i - E(R_i))^2}{N}$

$(\rho_{ij} * \sigma_i * \sigma_j)$ = covariance between any two assets

The true genius of Markowitz' development was the application of the covariance of the assets within the portfolio. A fundamental aspect of portfolio theory is the idea that the riskiness inherent in any single asset held in a portfolio is different from the riskiness of that asset held in isolation (Weston and Brigham {52} p.355). By using the covariance two or more assets could be tracked together in an absolute sense, as they varied over time. Using the same notation that has been developed thus far, covariance in a mathematical sense is expressed as:

$$Cov_{ij} = \sum_{i=j=1}^{N} \frac{[Ri - (Ri)] * [Rj - (Rj)]}{N}$$

where $(R_{i \text{ or } j})$ is the mean

Theoretically, the covariance can range from positive infinity to negative infinity. By convention two assets with a positive covariance are said to have their returns "move together". Conversely, two assets whose returns are countercyclical have a negative covariance. The difficulty in using such an absolute measure is that an investor has difficulty gauging just how beneficial is the magnitude of the covariance, either negatively or positively. Thus, the need for a relative measure of covariance was useful to facilitate the interpretation of the movement in the returns of the two or more assets. This relative measure is the coefficient of correlation, ρ, and as is defined in the equation of portfolio risk above, it is equal to the covariance

divided by the product of the two assets' standard deviations.

$$\rho_{ij} = Cov_{ij} / \sigma_i * \sigma_j$$

The coefficient of correlation only ranges from +1 to -1, since two assets in combination can not move more than the identity of that combination. Perhaps a more intuitive understanding of this coefficient can be explained by its association with another widely known statistical measure, the correlation of determination.

The correlation coefficient, ρ, itself is the square root of the statistical coefficient of determination, r^2. This measure, r^2, may be interpreted as the proportion of variation in the dependent variable, E(R), that has been accounted for by the relationship between $R_{i \text{ or } j}$ and $\sigma_{i \text{ or } j}$, expressed in a regression line. Mathematically, another way of notating this:

$$r2 = \frac{\text{explained variation}}{\text{total variation}} = \frac{1 - \text{unexplained variation}}{\text{total variation}}$$

Since r^2 can equal from 0 to 1, r or ρ can range from -1 to +1.

When ρ is positive, therefore, the covariance will be positive, and the overall second term in the σ_p equation will be positive. This is another way of saying that the overall variance of the portfolio will increase when the correlation coefficient of the assets are positively correlated. Similarly, the overall portfolio variance, i.e. risk, will be reduced when assets are negatively correlated. With this construct Markowitz provided the theoretical framework under which

portfolios could be developed among different assets to at best eliminate risk (variation) and at the least, minimize it. An optimal portfolio could then be developed using an investor's utility information in the form of isoquants, to locate the point of tangency along the efficient frontier and the highest isoquant. Since the major premise of utility theory is the notion of diminishing marginal utility, these isoquants are also curved, as well as that of the efficient frontier. This facilitates the location of an optimal portfolio, by creating a more distinctive tangency of the two curves.

An important point to note is that with N assets, there are N variance terms, yet (N^2 - N) covariance terms. As an example, if a portfolio contained 30 investment assets, then one would have to compute 30 variance terms, but 870 covariance terms in order to calculate the portfolio risk. This excruciating process of determining these statistical measures was enough to ensure that Markowitz techniques would not find ready acceptance in the pre- personal computer days of the 1950's and 60's. Other reasons existed as well. The Wall Street capital market workers, the researchers, the analysts, and the asset managers were all rankled by the assumptions of Markowitz' theory. For if the assumptions were true, then of what value did their services add to the process (Harrington (20) p.25)? If the complexity of investment information was available to everyone, and understood by everyone who had access

to it, then the entire brokerage community would be relegated to simply order-taking. The mistrust of the underlying assumptions of MPT, along with the complexity of calculations required to ensure a technically efficient portfolio made the theory unacceptable to the majority of the financial community in general.

However embattled the Markowitz portfolio theory may have found itself on Wall Street, it offered academe a framework which could be expanded through research. This occurred throughout the 1960's and eventually a modification to the basic model emerged that could help simplify the tedium of calculation, as well as help to explain the dimensions of risk. In 1970, Professor William F. Sharpe of Stanford University published the culmination of his work since the early 1960's on the subject[4], entitled Portfolio Theory and Capital Markets (New York: McGraw Hill, 1970), wherein he developed a capital asset pricing model (CAPM). The CAPM built directly upon Markowitz' work and utilized a mathematical mechanism, linear regression, that would ultimately allow an asset's performance in terms of return and risk to be compared to the performance of the overall market of assets, without the tedium of thousands of combinations of correlation coefficients.

As the name, CAPM, implies, Sharpe sought to

[4] See William F. Sharpe, "A Simplified Model of Portfolio Analysis," *Management Science*, 9(January 1963), pp.227-293; and "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *The Journal of Finance*, (September 1964), pp.425-442.

quantifiably explain the price of an asset within the context of an overall market equilibrium. The market could be composed of all assets in the securities market for instance, or the combination of asset classes to form an imaginary universal market. The fundamental concepts were the same, but inherently the model was couched in terms of a single investment entity (asset or portfolio of them) against a broad market which included the investment entity. He proposed that there was a further division of risk because of the asset's role in the broader market that hadn't been addressed before. The specific risk of an asset had been dealt with under the Markowitz model. However, Sharpe reasoned that there was in addition a market related, or system-level risk that existed when assets were combined. Markowitz had demonstrated how the specific risk of an individual asset could be minimized for a given rate of return by combining the asset with another whose variance was lower. In so doing an optimal return could be attained with a correspondingly lower variance and the portfolio wind up on the efficient frontier. Yet it was Sharpe's treatment of the market or systematic risk that brought into context the possibility of a risk free asset with some nominal return. If such an asset could exist, then it meant that the shape of the efficient frontier could be significantly different than what Markowitz had shown. Furthermore, somewhere on the efficient frontier there had to exist a point, representing the overall

optimal mix of return and risk, when all of the market assets were taken together. At such a point, no further optimization of return and risk within the market was possible, unless an investor could borrow at the risk free rate to buy more of the market's optimal portfolio. This relationship is expressed in the accompanying Figure 2 on the following page.

Referring to Figure 2, R_f indicates the risk free asset, i.e. an asset that has no risk associated with a nominal return over a finite period of time. This became the foremost assumption in Sharpe's CAPM in addition to those of Markowitz' portfolio theory. Sharpe's additional assumptions are summarized below in sequence with Markowitz' from which they follow.

7. There is a risk free asset and investors can borrow and lend unlimited amounts at this rate.

8. Market imperfections do not exist. There are no taxes, transaction costs, or restrictions on short sales. Investors act to keep the market in equilibrium.

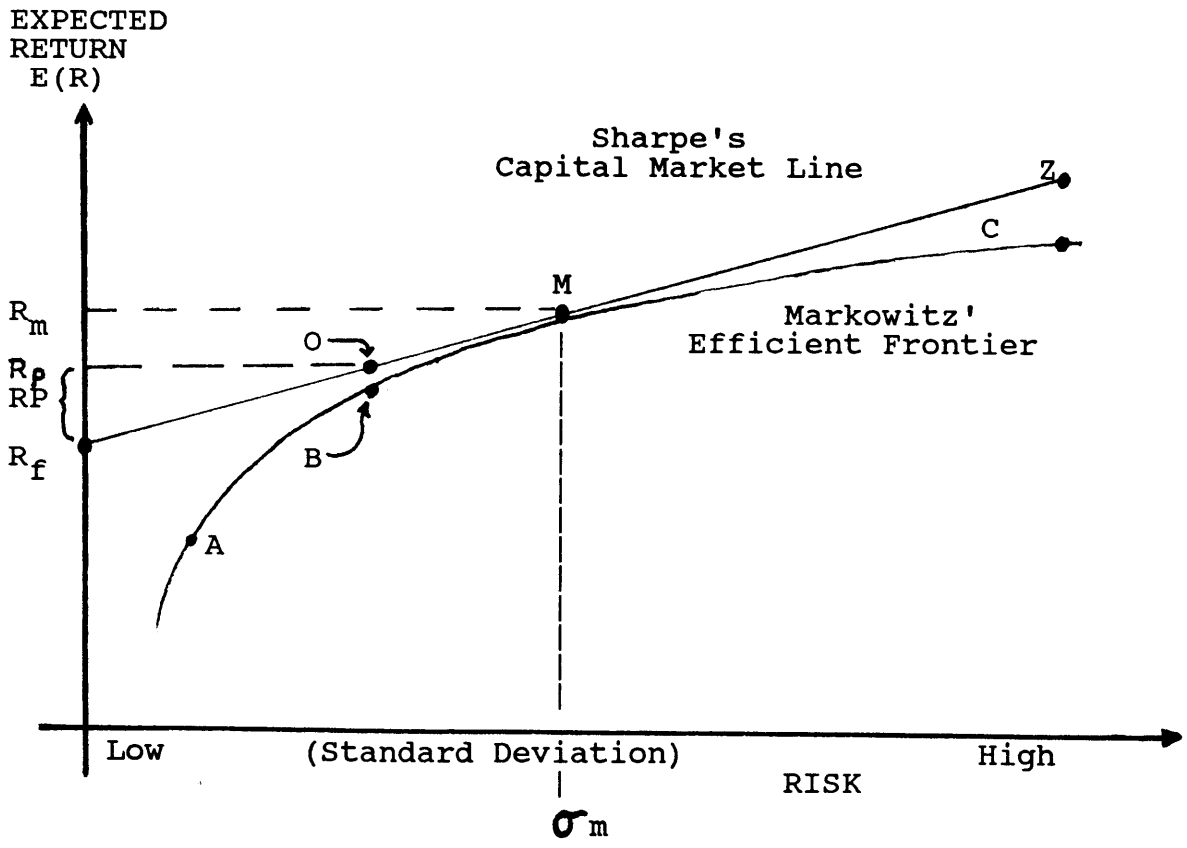
9. Total asset quantity is fixed, and all assets are marketable and divisible.

The recognition of the possibility of a risk free asset had major implications to the Markowitz efficient frontier. By combining this risk free asset with assets further out on the efficient frontier, say at M, the overall efficient frontier between R_f and M would be elevated from its position from A to M. The incremental increase, when integrated from 0 to M, provides a new efficient frontier for portfolios that is referred to as

FIGURE 2

RISK / RETURN SPACE

MPT and CAPM Efficient Frontiers



the capital market line (CML).

Another important advancement that was made under Sharpe's model was the idea that an index could be devised out of all possible assets which had some risk involved with their expected returns. This is called the market portfolio and as such it represents the full complement of collective, investment assets whose overall return and risk place it on the efficient frontier. No other combination of assets can provide for a better return/risk efficiency, because no other asset exists from which to derive benefits. The only way to obtain more return for incrementally more risk that is beyond the efficient frontier (from point M to point O) is to leverage the portfolio by borrowing at R_f.

The development of the market index or market portfolio was significant from several standpoints. First was that risk could now be defined as the covariability of an asset's returns in relation to the market's returns. Secondly, this first significant attribute allowed for more facility in calculating the myriad number of covariances that were so restricted under the Markowitz theory. Since investors require additional compensation for taking on investments of higher risks, they won't require any additional compensation (reward) for risk that can be eliminated, such as diversification can accomplish by having portfolios positioned along the CML. In this sense

investors will only be compensated for the systematic risk of the overall market, not by the full risk of the asset. This provides incentives for the portfolio manager to be as efficiently diversified as the market, M, will provide. This compensation that an investor can hope to receive for this efficient diversification is termed the risk premium. From Figure 2 it is graphically denoted as RP, or the difference between R_p (expected portfolio return) and R_f (risk free return). Lastly, the development of the CAPM allowed for the mathematical explanation of the portfolio return and risk through comprehendible, graphical terms.

The expected returns from any efficient portfolio, i.e. one that lies along the CML, could be represented by:

$$E(R_j) = E(R_f) + \frac{[E(R_m) - E(R_f)]}{\sigma_m} * \sigma_j$$

where σ_j is the volatility of an asset in the portfolio to that of the overall market. This formula indicates the linear relationship under the assumptions of Markowitz and Sharpe between the expected return of the portfolio and the risk free rate, as well as the market rate of return. Individual assets behave linearly with respect to their individual riskiness to the overall market riskiness and to the overall market return according to this general formula.

$$E(R_j) = \alpha + \beta_i(R_m) + \epsilon$$

where: α is the unique rate of return of asset j,

β_i is asset j's riskiness to the overall movement within the market, and

ϵ is the specific error term associated with asset j.

This β, or beta coefficient, is defined as a normalized covariance in the following regard:

manner: $$\beta_j = \frac{\text{covariance } (R_m, R_j)}{\text{variance } (R_m)}$$

Sharpe defined the $_m$, or overall market beta as 1.0, or an identity. Thus, if $\beta_j = 1$, then the asset or specific portfolio of assets moves in complete synchronization with the overall market. A beta less than one, $\beta < 1$, would mean that the asset or portfolio moved less volatile with the underlying market. Conversely, a beta greater than one, $\beta > 1$, would indicate an asset or specific portfolio of assets with greater systematic risk than the underlying market.

CAPM has become one of the most widely used frameworks for asset investment and allocation throughout the 1970's and 80's. This is not to say that it has been the most relied upon decision making tool across the investment spectrum, however. This is due in part to a plethora of academically sound criticisms of its basic assumptions (Harrington (20) pp.24-47). It was for the latter reason, however, that academe pursued other theories in order to relieve the reliance on so many assumptions. One of these that has gained considerable prominence in the literature is the Arbitrage Pricing Theory (APT).

Stephen A. Ross first introduced the concept of APT in 1976.[5] In the 1980's the theory gained in stature as Ross teamed with Richard Roll in supplying empirical evidence that strengthened the theory.[6] Whereas the CAPM is an equilibrium theory of asset pricing based on one "factor", that being "the market", APT recognizes that the pricing issue is multi-dimensional and seeks explanation of pricing behavior from a number of factors. In essence there is no limit to the quantity of the factors that might be considered, for which the following generalized equation pertains.

$$E(R_j) = R_f + \beta_{j1}[E(R_1) - R_f] + \ldots + \beta_{jz}[E(R_z) - R_f]$$

where: E( )= an expected variable
j = an asset
z = a factor
R_j = return on an asset j
R_f = risk free rate of return
R_z = return on a portfolio with an average sensitivity to a factor z, that systematically affects all returns
β_j = sensitivity to a particular asset j to a particular factor z

In comparison to the nine assumptions under CAPM, the APT borrows four (numbers 1,2,7, and 9) from Markowitz' theory and CAPM, and sets down two of its own (Harrington {20} p.193).

[5] See Stephen A. Ross, "The Arbitrage Pricing Theory of Capital Asset Pricing," *Journal of Economic Theory*, 13 (December 1976), pp.341-360.

[6] Their two works that have been most influential are "An Empirical Investigation of the Arbitrage Pricing Theory," *Journal of Finance*, 35 (December 1980), pp.1073-1104; and "The Arbitrage Pricing Theory Approach to Strategic Portfolio Planning," *Financial Analysts Journal*, 40 (May - June 1984), pp.14-26.

10. The number and identity of factors that are significant to the systematic pricing are shared by all investors, and

11. There are no riskless arbitrage opportunities.

The theory has been tested solely on stock-equities market data, and has produced anywhere from four to nine factors of systematic risk. The four most significant ones, as deduced by Ross and Roll in their 1983 study dealt with:

a) Inflation
b) Industrial production
c) Risk premiums of bonds
d) Term structure of interest rates.

While the exact factors are not so significant to this thesis, it does bring to the forefront the perception that previous theories may have been lacking in their ability to provide for making ex-ante decisions based on anything other than a single, ex-post factor, such as the trend of the S & P 500 index. The significance of APT to this thesis, however, is the recognition that ex-post data is only useful to ex-ante decisions when the underlying factors that produce that data are fully understood. Otherwise, decisions made on investments under an economic scenario yesterday, have no validity for similar decisions under a different scenario tomorrow.

The one last model of asset pricing that has entered the fold (keeping modern portfolio theory "modern" through the evolutionary process) is options pricing. As an option is the right of an asset's owner

to buy or sell that asset over any future time period, the underlying principle behind the theory is that such a right can be monetized. In so doing, an asset's efficiency in producing income is increased, as some marginal liquidity is squeezed from the asset at a point in time where its price volatility is pegged. The overall effect is to dampen the trading volatility of the asset's price (which would consume large amounts of capital if bought or sold outright) in favor of stripping the right of future ownership or sale and trading it (which consumes but a small portion of capital that underpins the value). Developed by Black and Scholes {6} in their seminal article in 1972, the model once again sought application to the more efficient markets of Wall Street. As a result, an entire futures market has continued to develop particularly in the United States to take advantage of market inefficiencies in expectations. The five underlying components to the asset's value are:

1. The current market price of the asset,
2. The length of the option's temporal duration,
3. The exercise price at the end of option period,
4. The risk free interest rate, and
5. The variance of the asset's price over the option period.

In theory once the asset's price can be determined along with its volatility, then the option pricing model can aid in achieving better positioning along the efficient frontier.

All of the asset pricing models serve to fulfill this last goal in search of the objective for maximizing terminal wealth. In a sense they all come back to roost on Markowitz' original work with its core assessment of integrated risk and reward, and the optimization of that assessment through the mechanism of portfolio diversity. To the extent that various asset classes, or assets of the same class, can be combined to yield this type of benefit, modern portfolio theory offers a methodology for determining how to do so. However, in order to reach the ultimate level of an optimally allocated portfolio, the issues regarding the what, where, and when dimensions must be comparatively understood within each asset class as well as between the classes.

CHAPTER 3

MPT APPLICATION TO REAL ESTATE

Investment literature is replete with criticism of the pricing models and portfolio theories, in large part because of their underlying assumptions. While it is not of concern to this thesis why the bond and stock-equity markets find disagreement with MPT, it is cogent to understand the differences within the asset class of real estate. To this end, a comparison with the other two capital markets is unavoidable.

Certainly real estate is not a normal capital market, partly because investment literature assumes the stock-equities market <u>is</u> the normative market. Today, real estate is arguably the third most important asset class for institutional investors because of traditional asset allocation (MMD {38} p.xx). However, there is evidence in terms of real estate's overall contribution to the nation's wealth portfolio, that would indicate that under MPT, real estate investments should occupy at least a plurality of an efficient portfolio (Ibbotson and Siegel {27} p.224; Miles {36} p.71; Ross and Zisler {44} p.2; Webb and Ruebens {50} p.466). Therefore, there has been a tremendous effort by the real estate community (academe and practitioners) over the last 20 years to explain real estate, as an investment, in the terms understood by the major money managers, whose job it is to determine the appropriate allocations to

various investment classes within a mixed-asset portfolio. Such understanding only comes about through the facility in which different assets can be more readily compared. From Friedman's (15) first suggestion for the use of MPT in real estate investing to the composite study of Zerbst and Cambon (54) on real estate's comparable returns and associated risk measures with stocks and bonds over several time periods, the real estate community has sought to compare assets' performances under the same assumptions with the knowledge that the underlying assets had stark differences. The closer an asset's qualities were in matching up to the assumptions of the model, then the greater the bias was for explaining the results. Another way of saying this is that the better real estate's performance was in comparison to the equities and bond markets, the less credible were the models of MPT to account for the inherent differences between real estate and the comparative assets.

Perhaps the single biggest shortcoming of real estate in comparison to bonds and stocks is the idea of market efficiency. The underlying assumptions of the equilibrium theories of Markowitz, Sharpe, and Ross were enumerated in the previous chapter, and all are in relative agreement with the conditions that Fama (13) aggregated in "Efficient Capital Markets: A Review of Theory and Empirical Work," Journal of Finance, May 1970.

The case against real estate market efficiency begins with the issue that real estate markets are regionalized at best, and at the very least highly localized. The implication is that various economic factors within these regional markets lead to increased informational costs, that perhaps inhibit certain investors from participating fully in the market. This is in contrast to the national market for stock-equities and bonds which allows for the consolidation of faster and diverse transactional information. Such readily available and current information provides all investors access to the markets from any geographic location.

Real estate transactions, however, are much less frequent and much more complex than most of those found in other capital markets. This latter difference points up another significant variation, e.g. the heterogeneity of the product. Despite the heterogeneity of the firms underlying the stocks and bonds traded in the capital markets, the investment product is nonetheless homogenized. The real estate equity product on the other hand is a deal-based transaction that is not a structured, "clean" transaction. Such transactions are discrete selections on the basis of ones and twos, not thousands and millions. This brings in the issue of the divisibility of the asset, which for real estate has much less to offer, other than hybrid forms of equity investments (e.g. REITs, Real Estate Limited

Partnerships,(RELPS), etc.). At stake in terms of market efficiency is the constraint on capital flows that could result indirectly from this relative indivisibility. For institutional grade properties such indivisibility of interests could translate to sizeable, nominal amounts of capital being required for market participation. As Gau (16) has noted, such market segmentation could very well lead to less market competition and greater market inefficiency.

The divisibility issue concerning real estate investment influences the holding period investment decision as well, which for real estate is recognized to be a long-term investment from the initial commitment of monies. Not all investors share identical time horizons, however. Some may hold that horizon to be finite until the end of the construction and lease-up period, others until the second, sustaining year of positive cash flow, and still others 10, 20, or 40 years. With such variable expectations of holding periods, the same real estate assets are thus priced differently. This could lead to a further market segmentation with similar results to those argued previosly.

Perhaps most significant in terms of the CAPM, is the issue that real estate has no nationally accessible, composite index. As was pointed out in Chapter 2, the provision of the CAPM that allowed for the systematic risk component of an asset (the risk premium or market

price of risk, to be computed in the first place) was that an overall market basket of return and risk could be computed. Referring to Figure 2, this indicates that R_m can be found along the capital market line at a Beta equal to 1.0, since the relative risk of the market is:

$$\frac{\text{Covariance}\ (R_m, R_m)}{\text{Variance}\ (R_m)} = \frac{\text{Variance}\ (R_m)}{\text{Variance}\ (R_m)} = 1.0$$

The use of such a market index allowed practitioners of MPT to significantly reduce the computational load in conducting an investment analysis on a particular asset in order to assess its marginal contribution to the overall portfolio. Only in this way can the efficiency of the portfolio be optimized. However, the CAPM itself came under fire through a number of scholarly works, particularly over the issue of this idea of an index. Harrington ({20}, p.75) for example, cites the work of Roll[7] and contends that since a true market index contains all assets, the ability to collect such data is impossible. In addition, testing such historical data in an expectational model will yield only disappointing results. Thus, in a mixed-asset portfolio the capital market line may be more shallow, the intercept for the risk free return higher, and the efficient frontier possibly non-linear. Therefore, can a specific asset class, particularly one such as real estate equity where the market inefficiencies are at least taken at face

[7] Richard Roll,"A Critique of the Asset Pricing Theory's Tests, Part 1: On Past and Potential Testability of the Theory,"*Journal of Financial Economics*, March 1977.

value, ever hope to be explained by MPT? The answer lies in the ability of the theory to provide insights that aid the portfolio manager in the decision-making process and the flexibility of the theory to allow for adaptation.

The research into real estate portfolio management ironically has not been focused on the real estate portfolio, but rather on real estate as an integral component of a mixed-asset portfolio. Throughout the 1970s and 80s the emphasis has not been on the development of MPT application to the real estate portfolio, but rather on the appropriateness of real estate into an historically, MPT-generated, mixed-asset portfolio that has been governed by stock-equities primarily, and fixed-income securities or bonds, secondarily. Manifestation of this can be seen in the evolution of market indices to which portfolio performance is compared. Stock equity indices, such as the S & P 500, have spawned not only similar indices for real estate, such as the FRC/NCREIF and Liquidity Fund, but the mixed asset Ballard, Biehl & Kaisor (BB & K) index as well. This latter fund, consisting of about 30% each of U.S. stocks, bonds, and real estate, as well as 10% of foreign equities, attempts to define a weighted market basket of institutional grade assets. Strategically, portfolio analysis should begin at the mixed asset level and work lower into the separaate asset classes. The benefits of MPT consciousness have

come to real estate through association and accomodation within the mixed asset portfolio.

The results of this research, summarized below, present an historical rationale as to why real estate equity should have been included into the theoretical mixed-asset portfolio of the past. Real estate equity investment has:

- Offered higher returns and lower, composite risk than stock equities and bonds. (Brueggeman, Chen and Thibodeau {7}; Ibbotson and Siegel {27}; Zerbst and Cambon {54}).
- Offered diversification through negative correlations with stock equities and bonds. (Brueggeman, Chen and Thibodeau {7}; Hartzell, Hekman and Miles {22}; Miles and McCue {37}; Ross and Zisler {44}; Webb and Ruebens {50} and {51}).
- Offered a significant inflation hedge, well in excess of stock equities and bonds. (Brueggeman, Chen and Thibodeau {7}; Hartzell, Hekman and Miles {23}; Rubens, Bond and Webb {50}).
- Been understated in its risk component (variability of returns) in relation to stock equities and bonds due to the differences in valuation methods (i.e. appraisal functions versus auction market prices). (Friedman {15}; Gilberto {17}; Hartzell {21}; Webb and Ruebens {50}).

Largely because these studies were done to convince mixed-asset portfolio managers of the benefit of significant allocation to real estate investment, concurrent studies were undertaken to assess the benefits of different subclasses of real estate under the concept of an efficient frontier for real estate portfolios. The limitations of the nature of real estate for consideration of a direct application of MPT, were well recognized by Ricks {41} in 1969 and Friedman {15} in 1970. Yet over 17 years later, Gau was still

exhorting his colleagues to "...look to variations of these pricing models (CAPM, APT and MPT) for real estate rather than explore alternative theoretical approaches based on any perceived inefficiency." (Gau (16) p.10). This would indicate to the most casual observer that there still exists some kind of institutionalized reluctance to buy into MPT as an aid to real estate portfolio management.

Nonetheless, one of the significant evolutionary outgrowths of attempting to apply MPT to real estate per se, was the formulation of a representative national index. Originally begun as an index to both serve as an industry benchmark for commercial real estate performance and an aid in the rating of portfolio managers, its data base now serves as the industry's closest surrogate for a real estate equity portfolio. The index commenced tracking on the last day of 1977, and originally consisted of 236 unlevered, income-producing, and nonfarm properties valued at $594.4 million. Today the portfolio has grown to over 1220 properties valued at over $ 15.9 billion. Its data is still based on unlevered, income-producing, and nonfarm properties that are held in tax-exempt portfolios. The data is aggregated and reported quarterly by members of the National Council of Real Estate Investment Fiduciaries (NCREIF) in two components:

1) Net operating income, and
2) Quarterly change in market value (per appraisals).

The data is further segmented, mutually exclusive, as follows:

Property Type	Geographic Region
Office buildings	East
Office/Showrooms/R & D	Midwest
Warehouses	South
Retail buildings	West

While the FRC/NCREIF index does deduct portfolio management fees, it does not reflect fees paid to real estate advisory firms and consultants. Despite the many restrictions of the index, the data base has progressively grown under consistent restrictions. This standard has been important, as real estate researchers have been able to focus the practice of MPT theories <u>within</u> the asset class of real estate equity, as well <u>between</u> the asset classes previously discussed. The concept of a standard index also helps to alleviate some of the major concerns over the real estate market's supposed inefficiency. Two of these sited by Jaffe and Sirmans ({28} p.383) are poor data sources and a lack of generality of market behavior. The FRC/NCREIF index is the largest of its kind in real estate, and has shown the ability to grow in relation to its content and diversity. In addition there are several other real estate indices[8], only one of which, the EAFPI, is based on all-equity, tax-exempt commingled real estate funds (CREFs).

[8] Ross, Firstenburg and Zisler {45} site two: the EAFPI from Evaluation Associates and the Unlevered Equity REIT Index (ULREIT) from Goldman Sachs & Company. Brueggeman, Fisher and Stone {8} site three additional ones from the National Association of REITS (NAREIT): the Equity REIT Share Price Index (EREIT); the Mortgage REIT Share Price Index; and the Hybrid REIT Index.

With these indices researchers began a long process of reconciling the return and risk results from real estate with those from comparable indices of stock equities and bonds. This effort culminated with the Zerbst and Cambon (54) work which summarized the individual efforts of the past, while also attempting to normalize those results across the institutional investment spectrum. The issue of optimal mixed-asset allocation in the context of MPT was the next logical area for research.

However, incredible results were being generated from this exercise, which showed that real estate should be dominate any portfolio along the efficient frontier. Brueggeman, Fisher and Stone (8) derived a portfolio for the lowest coefficient of variation that consisted of 0% stocks, 9% bonds, 10% T-bills, and 81% real estate equity as represented by the FRC Index. Similarly, Webb and Rubens (50) derived the optimal portfolio for a 0% tax-bracket investor as 0% bonds, 0% common stocks (NYSE), 6% common stocks (small), 11% farmland, and 83% commercial real estate. Two years later, in 1988, Webb and Rubens (51) again showed that by using standard risk measures on restricted portfolios that include four financial assets and two real estate assets (farmland and residential) from 1967 to 1982 that real estate's appropriate allocation to mixed-asset portfolios should have been on the order of 79% to 90%! These types of studies served to reinforce the feeling in the mixed

asset portfolio management community that:

1) They had probably missed a good opportunity by not being invested in real estate from 1967 to 1982,

2) Something was wrong in the way returns and risks for real estate were measured,

3) There must be significant differences in the fundamenta of real estate that makes an apples-to-apples comparison of it to other capital assets under MPT meaningless.

4) Maybe there was further opportunity in real estate, but since there is such differentiation among real estate products, are certain products better than others?

The last issue led researchers to look for answers within the real estate asset class. With MPT providing the conceptual and analytical comparative framework, and the increasing capital budgets of large institutional investors looking for diversified avenues of investment, real estate researchers began to look inward to make a contribution.

IMPORTANCE of DIVERSIFICATION

If asset allocation has been the major issue of large investors, and modern portfolio theory the mechanism that allows for the efficient construction of one, then diversification in terms of quantifiable analysis/rationale has become the solution to address the issue. It has been pointed out that from a strategic perspective, the goals that flow from an ultimate investment objective are driven from the top, downward to the asset classes. This type of strategic thinking for real estate investment decisions has only

recently come to the fore in the industry literature (Furstenburg and Wurtzebach {14}, and Gordon {18}). Thus, diversification of the mixed-asset portfolio implicitly requires the quantitative rationale of diversifying within an asset class. The converse way of describing this process is to say that each asset class requires an efficient frontier of portfolios in order for the aggregated mixed-asset portfolio to likewise be efficient. This bottoms-up approach then allows for an unbiased allocation of funds for investment into the various asset classes in theory. However, in practice the relative illiquidity, indivisibility, heterogeneity and magnitude of real estate equity investment restricts its advantages. Nonetheless, the issue of intra-diversification has been the most significant development in the application of MPT to real estate in the last decade.

There are only a few examples of intra-diversification research for real estate equity prior to 1980. Miles and McCue {37} cite two relating to apartment buildings, one with farmland, two with residential real estate and farmland, one with REITs and Ricks'{41} seminal article on various subclasses financed by loans from life insurance companies. The authors cite the increasing influence of pension funds and their requirement under ERISA to utilize MPT to responsibly diversify. At stake was the common practice within the real estate community to naively diversify.

This practice held that by virtue of real estate's distinct differences to other asset classes, elaborated in Chapter 1, that diversification could be achieved through the melding of properties across geographic boundaries and property types. The geographic areas would diversify the macroeconomic issues, while the property type would do the same for microeconomic ones. The Miles and McCue study was not only significant in drawing from Markowitz' analysis to an increasingly popular real estate subclass (commercial, income-producing buildings), but also because it analyzed the dimension of lease structure as a suitable determinant for diversification analysis. The results of the study showed that naive diversification did indeed lower risk, and was a very good hedge against expected inflation, though not against unexpected inflation (confirming work also done by Brueggeman, Chen and Thibodeau [7] published in the same issue). The surprising result, however, was that systematic risk accounted for only 10 - 15% of the total risk of a real estate investment in commercial properties, orders of magnitude below bonds and stock equities. This gave further credence to the belief that the commercial real estate market at least, and possibly all of real estate, was relatively inefficient, and thus could offer a higher risk index (the inverse of the coefficient of variation) for the premium of information and/or investment management expertise. Thus, broadly

designed, naive diversification might not only be non-beneficial, it could be counter- productive, as well. Naive diversification within such an inefficient market however, could provide significant opportunity for higher returns at possibly lower risk. Only through a Markowitz analysis under the MPT umbrella would one know.

Hartzell, Hekman and Miles {22} sought more exacting categories of the real estate sub-asset class in pursuit of efficient portfolio goal. In so doing they built upon the basic work of Miles and McCue {37}, likewise including lease maturity as a component of leasing strategy, as well as property type, and geographic dispersion as elements of diversification. However, they went a step further by also modeling the property size and the metropolitan statistical area (SMSA), as components of diversification. Their conclusions were very similar, if not the same to all of those previously discovered by Miles and McCue {37}. Even the low level of systematic risk was confirmed, once the data for the appreciation component was geometrically smoothed (to account for appraisal bias). This confirmation of intra-real estate diversification, however, was significant for the additional determinant components of diversification that were considered. Two years later, Hartzell, Schulman and Wurtzebach {24} marginally improved upon the geographic determinant by analyzing the effects of dividing the United States into

eight, more economically related areas. Since the geographic component under the concept of naive diversification was provided as surrogate for macroeconomic issues anyway, this later work was continuing to search for refinement of the factors important in comprehending MPT's validity to real estate. Again, the results indicated that this was a better modelling representation, as all eight regions produced lower coefficients of correlation than the previous four, arbitrarily assigned classifications.

Still troublesome to some researchers was the low level of systematic risk that the Miles and McCue {37} data had first shown, and later confirmed by Hartzell, Hekman and Miles {22}. For if systematic risk within any component of a naively diversified portfolio is large, then it only stands to further minimize the unsystematic or specific risk by naively diversifying across those components. However, if the systematic risk is low, i.e. specific risk is high, then the cost of diversifying across components might not be worth the effort. This is because the real estate investment is largely project specific and requires expertise within the locale and an inordinate amount of managerial intensity. Rather, if there is such a large specific risk component, then there are bound to be opportunities for exploiting the market inefficiencies within a geographic area, property type, lease structure, etc. Cole, Guilkey, Miles and Webb {9} tackled this issue

head on by first reviewing the Miles and McCue {37} data, then establishing a ratio of total portfolio variance to the average variance of the individual properties in each diverse subcategory (geographic and property type). This ratio then represented the systematic risk to the total risk. The resulting low ratios indicated that the risk in all subcategories (East, West, South, North, Office, Industrial, and Retail) was in fact largely (> 80%) unsystematic or specific. They thus set upon the development of ten, independent (i.e. independent from the traditional geographic versus property type categories) subcategories of diversification. Some included only geographic descriptions, others only property type descriptions, and still others a combination of both.

All were developed from an intuitive sense for how a real estate portfolio manager might think of property classifications (i.e. Oil sensitive, Benefitting from Trade Restrictions, Yuppieland, New South, etc.). Once again, the Markowitz analysis was employed to derive mean/variance/coefficients of correlation in order to construct an efficient frontier of portfolios. The results showed a composite of high, low, and negative correlations across the board. The conclusion is as one might predict from other works; namely, that it is better to define one's own multiple, discriminating subcategories for diversifying and abide by a methodology, than to broadly and blindly diversify

naively and thus further risk inefficiency.

There is ample evidence that shows that over the past 20 years, MPT has progressively been gaining in stature among real estate academicians, as the composite theory itself is adapted, manipulated and evolved. Just how MPT has been utilized for real estate equity decisions of the industry's newest and largest players, however, remains to be analyzed in the following chapters.

CHAPTER 4

MPT SIGNIFICANCE TO INSTITUTIONAL REAL ESTATE INVESTORS

Institutional real estate asset managers are increasingly being forced to defend their recommendations and/or positions for asset allocations within the mixed asset portfolios, according to multiple sources in attendance at the first annual PREA Institute {33} on the management of real estate portfolios in June, 1990. By most accounts benchmark portfolios serve as surrogates of optimal portfolios, and as references, lead portfolio managers into accepting certain allocations as normative. As an example, consider *Pensions & Investments* {41} approach to modeling the performance of the universe of U.S. tax-exempt asset managers. As reported in their annual survey (Ring {42} p.1) effective 1 January 1990, the aggregated portfolio and associated benchmark portfolio looked as follows in Figure 3.

FIGURE 3
AGGREGATED PORTFOLIO vs. BENCHMARK PORTFOLIO COMPOSITION
for U.S. Tax-Exempt Money Managers
01 January 1990

AGGREGATED PORTFOLIO	BENCHMARK PORTFOLIO
48% Common Stocks	48% S & P 500 Stock Index
29% Bonds	30% Shearson-Lehman-Hutton Government/Corporate Bond Index
12% Cash	16% 90 day T-bill Return
6% Real Estate Equity	6% FRC/NCREIF Property Index

While the benchmark portfolio grew 21.2% over the year, the aggregated portfolio only grew 15.5% over the same period. The amount run by the top 100 grew 13.8%, and the top 500 by 14.9%. For 1989 anyway, given that the standard volatility of the overall market represents a beta of 1.0, MPT explains how investing in the representative market basket would have yielded better performance than investing under whatever diversification strategies were used. This has major implications for the money managers whose added value comes from their supposed professional knowledge, insight, and abilities to capitalize on market inefficiencies.

An analysis of the tax-exempt portfolio's performance is typically made on the performance of an asset class against its market's index. Thus, if a plan's real estate return was 8%, while the FRC/NCREIF index showed 5.8%, then more of the plan's funds might logically be invested in real estate. However, when one understands that the FRC/NCREIF index has steadily declined throughout the 1980's, and that in the 4th quarter of 1989 its returns were actually less than ten-year treasuries for the first time in the index' history (*Institutional Real Estate Letter* {3} p.3), the portfolio acquisition manager needs to reevaluate such decisions against the return/risk ratio of other assets. It is incumbent upon the real estate portfolio managers to be able to defend the maintenance, increase, or

decrease of their allocations in terms understood by the other portfolio managers of competing assets. MPT provides for this common language.

While the benchmark provides a test of performance, it can also serve as a misguiding rationale for the allocation of funds to the various asset classes. Real estate equity perhaps suffers the most in this regard. A 5% allocation in any one asset class is generally considered to be the minimum necessary to carry any positive effect for diversification (Hemmerick {26} p.15). ERISA sought to minimize the incidence of catastrophic loss partially through the limitation of pension plans to invest no more than 10% of plan assets in the employer's securities and real estate. A truly efficient portfolio would consider investments probabilistically in terms of the wealth portfolio on a regional, national, or even global level. As has been stated this would amount to a plurality of any U.S. portfolio's real estate equity holding of between 40 and 50% (Miles {36}. Most recently a commonly referred to allocation of 10 to 15% has been recommended for such an allocation. At the PREA Institute, most participants agreed with the observation that a 10% allocation for real estate equity was commonly used, purely by taking the average of a subjectively minimal allocation of 5% to a subjectively maximum (that anyone would believe) of 15%. The fact is that there is little in the literature that supports these figures. Real estate equity

allocation has been "backed into" rather than strategically derived. This is one area where the use of MPT can ultimately aid in decisions of portfolio acquisitions.

Such strategic decision making employing MPT will thus require the same strategic disciplines to be utilized tactically across the various asset classes. Despite the encompassing study and effort by Zerbst and Cambon {54}, one prominent researcher at the PREA Institute observed that there has never been a study conducted that truly treated stocks, bonds, and real estate (equities, securities, or mortgages) in an apples-to-apples fashion. There is nonetheless a pervasive feeling that MPT is the framework that can offer the promise of such comparison (Gau {16}). If that is so, then real estate portfolio managers can ill afford not to be versed in its usage, and conversely, plan sponsors can not afford to have their real estate portfolio managers operating in a structural vacuum. Again, MPT is the tool for the construction of the structure.

It has been pointed out in the previous chapter that researchers in the real estate field throughout the 1970's concentrated their efforts largely on the issue of real estate's contribution to the efficiency of a large (institutional) mixed asset portfolio. It has also been reviewed that their primary contribution throughout the 1980's has been on the issue of

efficiency within the real estate portfolio, particularly as such research has aided in the development of strategies for diversification. Throughout these two decades, MPT has provided the researcher with the tool for structured analysis. Yet a further issue arises, however, that calls into question the transferability of the research from the halls of academe to the corridors of investment managers within the financial capitols. Fortunately, several researchers have pulsed the trend of MPT usage at selective points over the last twenty years.

The dawning of the 1970's brought forth the argument of the efficiency of real estate as a capital market (Friedman {15} and Fama {13}). The pros and cons of this issue have been discussed in Chapter 2; however, of particular interest of that era was Pellatt's {39} proposal of real estate investments utilizing a Monte Carlo simulation technique. Advocating the use of this technique within the structure of Markowitz portfolio theory, he noted that as of 1972:

> The most overwhelming conclusions ... after reviewing both the literature and the practice of real estate investment analysis are twofold:
> 1. Almost all methods of analysis rely upon general industry 'rules of thumb' calculations ... Almost no analytical methods employ present value calculations.
> 2. Virtually no methods of analysis ... apply sophisticated computational techniques or statistical tests of validity.

Two years previously, Wiley (53) had conducted one of the first comprehensive surveys of institutional investment practices, which from his bibliography Pellatt apparently did not refer. Rather Pellatt referred to a less ambitious study by Ricks (41) in 1964. Nonetheless, Wiley's conclusions supported Pellatt's statements, in that only 7% of Wiley's respondents reported using an after-tax, net present value (NPV) measure of analysis. Similarly, only 18% reported using an after-tax measure of the internal rate of return. The before-tax figure for NPV was still a less than convincing 32%, and the IRR was not surveyed in the before-tax regard.

A decade after the Wiley survey and the Pellatt proposal, Webb (49) again surveyed the institutional market (life insurance companies and pension funds) for perceptible signs of increased sophistication in the analysis of real estate acquisition. Citing the increasingly dominant role of these institutions in the real estate market due to their large amounts of perpetual capital influx, Webb tested a similar thesis akin to this one. Webb's implicit reasoning was that if the largest institutional actors were not employing the relatively sophisticated techniques of MPT for their real estate portfolios (particularly their real estate equity investments), then MPT was probably not being used elsewhere, as smaller institutional investors were significantly more restricted in their ability to enter

the market in any significant way. Because of the latter issue, Wall Street had responded with a number of investment vehicles, which could wring out some of the real estate equity benefits in terms of real estate mutual funds (CREFs), securities (REITs), mortgage securities (FNMA, GNMA), limited partnerships (RELPs), and regular mortgage pools. Edwards {11} detailed such options for institutional investors and summarized the pros and cons of each in a qualitative fashion. Regardless, numerous studies have shown that no such vehicle has replicated the performance in a Markowitz sense of a direct equity investment in real estate, in terms of its portfolio contribution.

In addition to the survey of the level of sophistication in real estate analysis, Webb {49} also provided a track as to this level by comparing four previous studies on similar, though not identical, surveys of institutional investors between 1972 and 1982-83. His analysis showed two significant results relevant to this thesis. The first was that the practice of MPT principles had clearly been on the rise in terms of assessing returns. However, on the complementary issue of risk, it did not appear that institutional investors as a whole, or pension managers in part, dealt with risk in terms of MPT, but rather through indirect adjustments to returns. Given Webb's treatment of the successive surveys up to and including his own, these previous surveys will not be further

dealt with here.

The momentum gained from the application of MPT to real estate research did not stop in the early 1980's. The desire to make ex-ante decisions of investment utilizing MPT principles in testing ex-post data, has always enticed the research community; and one unexpected opportunity presented itself to Hartzell and Webb (25) involving the stock market crash in the U.S. in 1987. Finding themselves in the midst of a survey of institutional investors on their expectational factors of real estate equity investors, the stock market lost over 20% of its market capitalization in one day, as the Dow Jones Industrial Average lost 508 points. The authors were quick to spot the opportunity to gauge the change in expectations of real estate investment given this tremendous exogenous occurrence. Their results have significant support to this thesis.

Among the 236 institutions surveyed by Hartzell and Webb, 110 responded (46.6%). Of these 42 of 56 (75%) were from real estate consultants and advisors, but only 19 of 100 were from pension fund sponsors. The reasons that were given for the lack of pension responses were:

a) that as sponsors they didn't participate in surveys,
b) didn't manage their real estate decisions (consultants or advisors did), and/or
c) didn't have enough expertise to comment.

The third response was quite unexpected given the increasing plurality of the funds in the marketplace. However, the article indicates that 41 of 42 real estate advisors and 18 of 19 pension sponsors actually answered the questions, of which the major portion heavily involved MPT principles of Markowitz (total returns, volatility of those returns, and cross correlations with other asset classes). This indicates that 60 out of 156 pension sponsors, consultants, and advisors (38.5%) are at least using the rudiments of MPT, otherwise they would not have been able to fill out the survey.

One last conclusion that is ascertainable from the data is that pension sponsors are slightly more conservative in their expectations than either their institutional life insurance or consultant/advisor kin. The sponsors' expectations of total return, appreciation potential, and inflation were all below the other institutional investors surveyed. Likewise, their expectations of cross correlation coefficients with other assets and inflation were more conservative than any other group. Although the reason for this is not directly apparent, it is nonetheless not surprising. The closer a fiduciary is to the source of the investment capital (i.e. their own), the more cautious that fiduciary might be expected to be. Also, as more recent market participants, pension funds might logically proceed with greater caution.

Modern portfolio theory has been shown to have

found increasingly intensive use in real estate equity investment in the three spanning decades between Markowitz' initial theory and Webb's survey of its usage. Hartzell and Webb have confirmed to a certain degree that institutional investors in real estate equity are also utilizing the techniques to assess their expectations. The degree to which pension funds have marginally committed to these techniques since Webb's study is assessed in the following chapter.

CHAPTER 5

RESULTS AND ANALYSIS OF A SURVEY:

REAL ESTATE PORTFOLIO ACQUISITION CRITERIA in the U.S. PENSION FUND INDUSTRY

THESIS OBJECTIVE AND HYPOTHESES

This chapter presents the results of a survey of the U.S pension community's real estate decision making criteria. If the level of sophistication with respect to modern portfolio theory is rising, then a corresponding change in the types and level of sophistication would also be expected. Such an undertaking requires a benchmark for comparison, and the Webb {49} study of 1982-3 provides such a vehicle. This thesis gauges the marginal level of technical sophistication by the application of the principles and techniques found in modern portfolio theory. Whereas Webb concerned his study with real estate investments in equity, mortgages, and construction loans, this thesis considers only the real estate equity investment in consideration of its uniqueness as a portfolio asset.

The survey responses shown herein were generated by a questionnaire to 419 pension plan sponsors, consultants, and advisory firms, who by nature of their size and/or business could be expected to manage pension portfolios that include real estate equity. By its very nature then, the survey was biased toward the larger entities in the pension fund population. This issue is dealt with in the following section. The format of the questionnaire and the cover letter that introduced

its purpose are shown in Appendix A, and the results of the survey that follow, refer to the question numbering of the survey.

The survey was designed to test a number of hypotheses that together would either support, or fail to support, the primary thesis. The questions sought responses that were both factual and attitudinal, and from the responses descriptive statistics were used to infer generalized conclusions. The hypotheses tested all flow from a generalized hypothesis that the changes in the industry will have manifested themselves in more sophisticated techniques than found in the Webb survey. This general hypothesis is expressed specifically as:

1. Real estate portfolio managers have shifted from a bottoms-up, deal-based, tactical mentality to a strategic, top-down approach in allocating funds.

2. Real estate portfolio managers have become more sophisticated in their diversification strategies.

3. Real estate portfolio managers have adopted more sophisticated techniques for return measures.

4. Real estate portfolio managers have adopted more sophisticated techniques for risk measures.

5. Real estate portfolio managers measure their performance against both mixed asset and real estate market indices.

6. Real estate holding periods have increased in the face of several negative market conditions over the last seven years.

7. Real estate portfolio managers have increased their investment horizons by searching and investing in a global real estate market.

METHODOLOGY AND INHERENT BIAS

From 18 - 20 June 1990, the Center for Real Estate Development at the Massachusetts Institute of Technology hosted the first annual Institute for Real Estate Portfolio Management, that was sponsored by the Pension Real Estate Association (PREA). In preparation for that instruction the survey found in Appendix A was prepared so that students of the Institute might have an appreciation for the state of portfolio management within their field. In mid-Spring of 1990 survey questionnaires were sent to portfolio managers at pension plan sponsor organizations and real estate advisory firms. Selection of the former was based on *Pensions & Investments'* {5} survey of the 1,000 largest pension plan sponsors whose data was reported as of 30 September 1989. Selection of the latter was based on an earlier survey, also by *Pensions & Investments* {26}, for data as of 30 June 1989.

The 419 questionnaires were mailed to 318 plan sponsors and 101 advisory firms. The 318 plan sponsors were selected based on the magnitude of their mixed asset poirtfolio. Those which had $1 billion or more of tax-exempt assets under management, as reported by *Pensions & Investments* {5}, were selected for the

survey. These 318 sponsors out of an estimated 39,375 total, control $1.584 trillion out of the estimated $2.174 trillion in tax-exempt pension funds. This equates to 0.8% of the sponsors controlling 72.9% of the pension asset population. Of those defined contribution funds that *Pensions & Investments* singled out with at least $1 million in real estate equity, all were included in this survey. Of those defined benefit funds with at least $4 million in real estate equity, all lie in the top 200 and therefore were surveyed. Since the survey went to an addition 118 funds, it is not unreasonable to expect that all sponsors with at least $1 million in equity real estate were surveyed, thus representing a significant segment of the population. It is also assumed that given the barriers to investing in real estate equity, $1 million is not an unrealistic figure as an allocation to real estate equity. For example, a $1 million real estate equity investment in portfolios where 5% or 10% is allocated to real estate, would indicate a mixed asset portfolio size between $20 and $10 million, respectively.

The distribution of questionnaires and responses is shown in Table 1. The survey yielded an overall response that was better both in nominal and percentage terms than Webb's {49}, and nominally somewhat better than the focused survey of state pension sponsors of Elebash and Christianson {12}. The latter survey claimed an impressive 82% for the targeted audience.

TABLE 1

DISTRIBUTION OF QUESTIONNAIRES AND RESPONSES

TYPE	SURVEYED	RESPONDED	% RESPONSE
Sponsors	318	83	26.1 %
Advisors	101	42	41.6 %
Total	419	125	29.9 %

Not all of the respondents held real estate equity in their portfolios. This feedback was important, because only those funds investing in real estate (equity or mortgages) were asked to continue answering the questionnaire. All others were asked to send their responses back in self-addressed envelopes, so as not to adversely impact the response rate. Table 2 summarizes the distribution of responses that reported having real estate in their portfolio, then breaks this distribution further, by indicating the number of explicit responses for amounts of equity and mortgages in the portfolios.

TABLE 2

DISTRIBUTION OF RESPONSES REPORTING REAL ESTATE AND FURTHER SUBDIVIDED BY MANAGERS REPORTING SPECIFIC AMOUNTS OF EQUITY & MORTGAGES

			SPECIFIC RESPONSES FOR	
TYPE	RESPONSE	WITH R.E.	EQUITY	MORTGAGES
Sponsors	83	61	56	29
Advisors	42	41	39	19
Total	125	102	95	48

A comparison of Tables 1 and 2 shows that there were 23 respondents who did not have any real estate in their portfolios, or 18.4% of the total responses. 22 of these were sponsors, while one was an advisor, which didn't possess any tax-exempt real estate equity. It was from the combination of these 102 respondents whose subsequent data provided for the remainder of these results. Nonetheless, the percentages that will be used in describing the descriptive tests in the RESULTS section, are based on the total sample size of 125.

Tables 3 & 4 provide the statistical composition of the respondents. A significant caveat to bear in mind when reviewing Table 3 is that many plan sponsors utilize the expert services of the advisory firms to manage their portfolios. Thus, the possibility that there is double counting of fund assets is extremely high.

TABLE 3

STATISTICAL SUMMARY OF EQUITY AND MORTGAGE MEANS
(Dollar figures are in Millions)

	RESPONSES	EQUITY AVERAGE	MORTGAGE AVERAGE
TOTAL	125	$ 1,183	$ 888.3
THOSE REPORTING REAL ESTATE	102	$ 1,449	$ 1,089

TABLE 4

COMPOSITION OF REAL ESTATE PORTFOLIOS
(Dollar Figures are in Millions)

TYPE	EQUITY RESPONSES	EQUITY TOTAL (MEAN)	MORTGAGES RESPONSES	MORTGAGES TOTAL (MEAN)
SPONSORS	56	$ 42,586 ($ 760)	29	$ 56,107 ($1,935)
ADVISORS	39	$105,286 ($2,700)	19	$ 54,930 ($2,891)
TOTAL	95	$147,872 ($1,557)	48	$111,036 ($2,313)

While the sample is considered to be representative of institutional real estate portfolio investors, it is obviously biased toward large portfolios since that was the targeted population. For example, sponsors reported an average portfolio of real estate equity of $760 million, while *Pensions & Investments* (5) reports that 138 of the 200 funds with assets in real estate equity have an average of $343 million. Similarly, sponsors reported an average portfolio holding in "mortgages" of $1.94 billion, whereas *Pensions & Investments* reports a mean of $1.60 billion when pure mortgages along with mortgage backed securities are lumped together, and only $174 million if only mortgages are considered. Real estate pension advisors' responses demonstrated the same bias. *Pensions & Investments* (26) reported that a sample of 92 such firms held $90.145 billion in real estate equity for an average holding of $980 million. Thirty nine respondents to this survey, however,reported

total holdings of $105.286 billion or an average of $2.7 billion. Another result of interest is that both the overall sample mean, and the sample mean for those reporting real estate in their portfolio holdings, indicate that the means are substantially above the industry averages for both equity and mortgages. Therefore, the sample appears to be biased to the industry's largest portfolios, and thus conclusions from the study may not logically be inferred to smaller portfolios. To the extent that the objective is to measure the rate of change in attitudes since the Webb survey, this sample bias may lead to an overestimation of that change. Conversely, one could expect that increases in sophistication might take place first in the larger portfolios. With a greater amount of assets, the best in expert management can be hired, and/or the more able a fund is to conduct its own research. The competition to provide effective services in this regard drives the level of sophistication for investment analysis higher. Further, larger portfolios are able to compete for educated human capital that can implement sophisticated investment techniques.

RESULTS

Several of the survey results and their significance to industry practioners were previously presented by Louargand {32} at the MIT/PREA Institute {33}. Some of the analysis in this section draws on

that paper, however, much of it is de novo.

Questions germane to any one hypothesis were scattered through out the questionnaire. This is best illustrated in the first hypothesis.

HYPOTHESIS 1:

Real estate portfolio managers have shifted from a bottoms-up, deal-based, tactical mentality to a strategic top-down approach in allocating funds.

Several questions that were delivered at the front-end of the survey posed subliminal ideas as to strategy in terms of returns, risks, diversification, and forecasting. Questions 16 and 20 at the latter half of the survey were designed as the key tests of the hypothesis. It was hoped that after a respondent reviewed the earlier, more technically oriented questions, a more introspective and honest answer would result for the two tests.

The second to the last question of the survey asked whether a formal, written strategic plan was used for real estate investing. 54% of the total respondents, and 68% of those respondents who answered the question, answered in the affirmative. **(Subsequently, these response percentages will be similarly referred to in the manner of 54% (of the total) and [68%] (of those responding).** Further, when asked whether any optimal portfolio model was used to allocate funds to real estate, the affirmative response was 26% [34%]. However, when asked if such a model was used to allocate

funds across real estate asset types, only 13% [17%] indicated so. Only two respondents went on to provide a descriptive title of the model, while very few others indicated that they used anything more than an unnamed in-house model.

Certainly one of the basic, professional initiatives in implementing a strategic methodology of investing is to formulate what your objective(s) is in a complex but descriptive market, what the immediate and long term goals are, what strengths play in your favor, and what barriers stand in your way. While the results in this regard are encouraging, one would also expect a higher usage of quantitative, decision-making aids, such as an optimal portfolio model, to make what amounts to very quantitative decisions, such as investing millions of dollars for a stream of various cash flows. The ratios of the results are particularly interesting. One half to two thirds of the respondents utilize a written strategic plan. Only half again use a model to aid in the allocation of funds to real estate within a mixed asset portfolio. Still only half again use a model to optimize their intra-real estate holdings. This may provide further proof that the level of sophistication in analysis of real estate in the portfolio context lags that of stock equity and bond analysis. A search of the literature does not reveal any benchmark in which to compare this test.

As a subset of the strategic planning process, the questionnaire also attempted to ascertain the motivational goals for investing in real estate equity. This is helpful in understanding not only the strategic focus of the pension funds, but also the further applicability of modern portfolio theory to real estate portfolios. To construct this picture, Question 14 posed a selection of represented goals, and respondents were asked to rank all seven of them. The results are contained in Table 5, and indicate that real estate investments are driven by yields, with the most frequent number one choices being *total expected return* and *cash flow from operations*.

TABLE 5
PERFORMANCE GOALS FOR THE REAL ESTATE EQUITY PORTFOLIO
(Listed in descending order by results)
Please rank your goals and/or preferences for your equity real estate portfolio.
(1 = most important ..... 7 = least important)

	Ranking							Cum.
Criterion	1	2	3	4	5	6	7	Rank
Total Expected Return	50	17	21	8	1	0	1	1
Cash Flow From Operations	22	22	16	7	10	7	9	2
Inflation Hedging	8	22	14	14	12	19	4	3
Low/ Negative Correlation with Stock Returns	18	11	11	7	5	9	30	6
Potential for High Appreciation	5	9	15	19	21	10	12	6
Residual Value	3	10	15	19	18	20	8	6
Risk Aversion	5	11	11	15	18	13	17	7
Other	2	0	1	1	0	0	1	8

Much of the most recent literature has focused on real estate ability to hedge against inflation. In Chapter 3 it was clear that while researchers had found this to be the case for anticipated inflation, real estate was lackluster against unanticipated inflation. Nonetheless, this survey showed that a primary goal of the pension portfolio managers was this hedging ability. While much of the literature has also focused on real estate's impact on a mixed asset portfolio, respondents were mixed on the importance of achieving *low or negative correlation with stock market returns*. That goal was ranked in the highest two categories by 29 respondents, but also by 39 respondents in the bottom two categories. This may reflect the issue that the respondents are from larger firms where the real estate portfolio manager might not be as integrally involved in the decisions of mixed asset allocation. The remaining three characteristics show a fairly even distribution of responses that show these goals to be important, but not primary characteristics. Perhaps most representative of this group is the fact that although pension funds are recognized as the most risk averse group among institutional investors, risk aversion is important, but clearly takes a back seat to an overall expected return from the investment itself. Of those responses listed under *OTHER*, most sought diversification and versatility of the investments as their top or significant goal.

HYPOTHESIS 2:

Real estate portfolio managers have become more sophisticated in their diversification strategies.

Diversification techniques have been the subject of considerable study since the publication of Webb's survey in 1984, as discussed in Chapter 3. This indicates the desire on the part of the institutional real estate community to further understand the concept of an optimal portfolio that is efficiently diversified. The application of the concept has traditionally been considered naive, as portfolio managers needed not to have "run any numbers" to know that property investments in different regions and by different uses of the structures would by definition be diversified. As was referred to in Chapter 3, Brueggeman, Chen and Thibodeau {7} along with Miles and McCue {37}, quantitatively showed that there were high enough levels of unsystematic risk both within a region and within property types, that perhaps made a strategy of naive diversification more costly than it needed to be. If high levels of unsystematic risk could be found within any given region, then they could certainly be found in any other region or between regions. An issue that emerged from my observation of this was whether there were any additional criteria that should be or were being used to more efficiently diversify the portfolio.

The issue had some basis for comparison in Webb's {49} study, wherein respondents indicated that they in fact diversified by geographic region (61.9%) and

property type (61.1%), while 38.1% used some form of limitation on the amounts allocated to the different criteria of investment. While a whopping 38.8% claimed to make no systematic attempt to diversify, the sub-sample of just pension managers reported this figure as only 5.9%. The latter was based on a small sample of 17, however.

Table 6 shows the survey's unrestricted choice from a set of diversification criteria. A more diverse set of geographic and property criteria were offered. **The results are listed in comparison with Webb's sub sample of pension managers.** Respondents could select any number of the criteria that they felt they utilized.

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TABLE 6

EXPLICIT DIVERSIFICATION CRITERIA IN EQUITY PORTFOLIOS
(Percentages are affirmative responses)

Do you use any of the following as explicit criteria for diversification in your equity real estate portfolio?

Criterion	Webb ('82-83)	Survey Results ('90)
Property type	88.2%	85.3%
Property size	NA	69.6%
Property age	NA	16.7%
Tenant type or business		32.4%
Lease Terms	NA	30.4%
Fixed allocation	47.1%	4.9%
Region	94.1%	69.6%
State	NA	21.6%

Metropolitan area	NA	37.3%
Metropolitan sub-market		24.5%
Economic location	NA	39.2%
Other	NA	12.7%
No systematic diversification criteria are used	5.9%	7.8%

There is a much larger group who diversify across property type, and a smaller group who use the recent concepts of metro and sub-metro differentiation, tenant and lease diversification and economic location. While there was little change among pension managers in the total lack of diversification criteria, it must be remembered that Webb's overall result showed 38.1% who fell into this category. This is the most significant change in terms of the sophistication in diversifying portfolios, and is closely followed by the size of those using economic location criteria, a relatively recent concept in the literature, as well as financial diversification techniques.

Once portfolio managers were conditioned to this area of interest, they were later asked to rank their top five diversification criteria. These rankings are shown in Table 7 along with the raw frequency distribution. The results indicate that respondents are divided between economic location and region as the appropriate way to achieve locational diversification. Offered a similar set of choices for differentiating

between properties, they stuck with property type. Tenancy characteristics demonstrated strength as secondary or lower criteria. There was also a fairly large response for property size as a secondary criteria, but this may reflect portfolio allocation constraints as much as any concepts of performance diversification.

TABLE 7

FREQUENCY DISTRIBUTION AND RANKING
OF DIVERSIFICATION CRITERIA FOR EQUITY PORTFOLIOS
(Listed in descending order by results)

Please rank your top five criteria for diversification in your real estate portfolio.
(1 = most important ..... 5 = leastimportant)

Criterion	Ranking 1	2	3	4	5	No Response	Cum. Rank
Property type	54	22	9	5	0	6	1
Economic location	13	17	21	10	6	32	3
Region	12	32	14	3	3	74	3
Metro area	7	11	11	7	5	55	4
Property size	0	12	16	14	11	71	5
Tenant type	1	5	11	17	11	29	6
State	0	1	6	5	8	72	7
Lease terms	2	3	8	9	14	40	8
Metro sub-market	1	6	6	6	5	50	9
Property age	1	3	3	8	7	59	10
Other	8	1	2	1	3	81	11
None (Don't use any criteria for diversification.)	2	0	0	0	1	90	12

It appears that the concepts raised in the literature in the past few years are being adopted at a fairly fast rate. If so, increased attention to diversification across financial and occupancy variables may be a trend for the future that has already begun.

HYPOTHESES 3:

Real estate portfolio managers have adopted more sophisticated techniques for return measures.

It was pointed out under the first hypothesis that the primary goals of the pension funds are targeted at returns. To assess this particular hypothesis, Webb's survey {49} is once again invoked for its historical comparisons. Webb compared both before tax, as well as after tax measures and reasoned that the after tax measures showed a clearer pattern of progressive sophistication of techniques away from rules of thumb to the more quantitative comparability of net present value and internal rates of return. For the purposes of this hypothesis, no tax distinctions were made, but the wider variety of choices in Question 17e, were designed to reflect Webb's after tax measures as well as some additional derivatives of those measures. Though not strictly comparable, the results in Table 8 demonstrate a marginal improvement in the level of sophistication in the intervening years since Webb's study. This is particularly true, if it can be assumed that users of partitioned IRR's, FMRR's, and Annualized Holding Period Returns (HPR's) have at least the same level of

comprehension as that for the Internal Rate of Return (IRR).

TABLE 8

TECHNIQUES FOR MEASURING REAL ESTATE RETURN
(Grouped in descending order of results)

What attributes do you use in monitoring your real estate performance?

MEASURE	PERCENT RESPONSE WEBB	Survey Results
Internal Rate of Return (IRR)	65%	61%
Holding Period Return (HPR)	NA	10%
Risk Adjusted Return	NA	5%
Partitioned IRR	NA	3%
Financial Managem't Rate of Return (FMRR)	NA	1%
Cash on Cash	63%	45%
Net Present Value	48%	11%
Payback Period	26%	1%
Discounted Payback	NA	3%
Broker's Rate of Return	21%	2%

If the previous assumption can be accepted, then this sample shows that 80% use such measures of IRR, versus 65% in the early 1980s. A parallel shift is seen in the fact that only 45% of the sample uses cash on cash compared to 63% in Webb's sample; and that only 2% reported using a Brokers Rate of Return (After Tax Cash

Flow + Equity Buildup / Initial Equity) whereas Webb's sample reported 21%. A similar decrease is evident in the statistic for the Payback Period. These changes indicate an increasing level of sophistication the part of real estate managers, and a tendency to treat real estate performance in the same way that traditional financial analysts look at portfolios of securities and bonds, or capital budgeting projects.

HYPOTHESIS 4:

Real estate portfolio managers have adopted more sophisticated techniques for risk measures.

In order to test this hypothesis, Webb's exact question was replicated. An interesting aspect of his study was the division of statistics reported separately for pension managers and life insurance companies, as well as compositely. Table 9 reports on the results of this survey, and Table 10 consolidates these results with Webb's results, both overall and for just the pension managers.

There were two additional measures added in this questionnaire that directly relate to modern portfolio theory: Mean/Variance and Beta coefficients. Taken all together, there are two striking changes in the results. The first is the significantly consistent lack of any specific adjustment for risk by one out of five managers. There appears to be a component in the population which treats return and risk intuitively.

TABLE 9
RISK ADJUSTMENT TECHNIQUES IN EQUITY PORTFOLIOS
(Percentages of Affirmative Responses)

How do you adjust for riskiness in your analysis of equity real estate investments?
(Respondents checked only those that applied.)

TECHNIQUE	OFTEN	SOMETIMES	SELDOM	NEVER
Adjust upwards the return req'd from the project	43.1	12.7	2.9	5.9
Adjust downward the benefits expected from the project	16.7	14.7	10.8	10.8
Use Sensitivity analysis	48.0	8.8	0.0	5.9
Use Probability distributions	4.9	13.7	6.9	21.6
Use Mean/Variance analysis	6.9	2.9	11.8	28.4
Use Beta coefficients	2.9	2.0	3.9	38.2
Other	8.8			
No explicit risk adjustment is made	22.5			

TABLE 10
COMPARATIVE RESULTS OF RISK ADJUSTMENT TECHNIQUES

TECHNIQUE	WEBB		SURVEY RESULTS
	TOTAL	PENSIONS	PENSIONS
Increase Return	71%	82.3%	55.8%
Decrease Benefits	40%	52.9%	31.4%
Sensitivity Analysis	21%	29.4%	56.8%
Probability Distr.	18%	5.9%	18.6%
Mean/Variance	NA	NA	9.8%
Beta Coefficients	NA	NA	4.9%
No risk adjustment	21%	5.9%	22.5%
No response			43.1%

Another perceptible change during the 1980's is the acceptance of sensitivity analysis as a viable tool for risk adjustment. Responses that this technique was used **OFTEN** rose from about 13% in Webb's survey to 48% in this one. It should also be pointed out that these percentages are based on the sample of 102 respondents with equity real estate. Many of those chose not to answer any of these question at all. Certainly these results indicate a much stronger reliance on quantitative methods in adjusting for risk; and the additional adjustments (i.e. choices for the question) that were used in this survey also indicate the beginning of some implementation of MPT practices. The results are perhaps even more dramatic given the large part of the sample that chose not to answer any of the questions.

HYPOTHESIS 5:

Real estate portfolio managers measure their performance against both mixed asset and real estate market indices.

This hypothesis represents an expectation that performance measurement is based on the capital asset pricing model (CAPM), and thus is further evidence of the application of modern portfolio theory to real estate. In order to test this, two questions, numbers 13 and 17, were surveyed which would indicate the use and reliance on significant investment indices.

A robust 83.5% of the respondents said they monitored their real estate performance against a real

estate index. This was followed by 49.5% who indicated such monitoring was done against a formal, written benchmark under their strategic plan, providing even more credence to Hypothesis #1. 27.8% indicated that a stock equities index was used, and 7.2% used a mixed asset index like the B B & K to monitor performance.

With these results in mind it was particularly surprising to discover the results of Question 13, which asked whether respondents believed that the FRC/NCREIF Index approximates the actual volatility of their real estate portfolios. Only 30.5% said it did, while 17.9% said they didn't use the index at all. This latter figure is relatively consistent with the results in the previous paragraph. However, a full 51.6% indicated an explicitly negative response. If about 7 out of 8 managers monitor their results against a real estate index (most of whom indicated it was the FRC/NCREIF one), and the majority of the respondents have little faith that such an index models their portfolios' volatility, then the industry still has data problems to sort out, if it uses a standard of performance which doesn't match its needs. Nonetheless, the data clearly shows that the important concept of a market index as a tenant of modern portfolio theory, has gained widespread use throughout the industry.

Two additional questions were asked that relate to the hypotheses on diversification, risk, and this one on performance evaluation. Questions 18 and 19 surveyed

the attitudes of real estate portfolio managers on relative risk and diversifying benefits of real estate equity compared to the more widely recognized stock indices. The results which are listed in Tables 11 and 12 indicate that the vast majority of portfolio managers feel that their portfolios are low to negatively correlated with stock market returns, and less risky than a market index of stocks. This is consistent with the finding of Elebash and Christiansen (12) that 79% of state pension funds find real estate equity to be attractive because it adds diversification benefits to a mixed asset portfolio.

TABLE 11

RELATIVE CORRELATION OF REAL ESTATE TO A STOCK RETURNS
(Percentages of Affirmative Responses)

Negatively Correlated	30.9%
Not Correlated	40.2%
Mildly Correlated	32.0%
Highly Correlated	0.0%

TABLE 12

RELATIVE RISK OF REAL ESTATE EQUITY PORTFOLIO TO A STOCK MARKET INDEX
(Percentages of Affirmative Responses)

Much Less Risky	24.0%
Somewhat Less Risky	55.2%
About As Risky	8.3%
Somewhat More Risky	11.5%
Much More Risky	1.0%

HYPOTHESES 6:

Real estate holding periods have increased in the face of several negative market factors over the last seven years.

The financial markets in the United States in the late 1980's witnessed a period of volatility seldom experienced prior to that time. Since 1986 there has been a significant change in the capital gains tax regulations, two seismic collapses of the stock equities market, a significant faltering of the bond market as the result of proper regulatory intervention in high yielding, low grade "junk" bond financing, and a significant, multi-regional real estate bust that has resulted in a financial debacle in the banking industry. One of the benefits of real estate equity investments that rewards investors for its relative illiquidity is the inherent shelter from dramatic capital swings that occur with sudden economic and financial dislocations. While not all of these recent, negative market factors have necessarily impacted all types of institutional grade real estate, it has given pause to many real estate portfolio managers to reassess some of their underlying assumptions about the various types of assets they hold.

One of these assumptions has been the ten year holding period which every study up through Webb has confirmed. Whereas Webb was concerned with the possibilities of longer holding periods, and thus increased the number of choices to reflect holding

periods out to 40 years, this questionnaire left the answer open ended. Rationally it would have appeared that holding periods would have marginally increased in light of the extreme volatility in the capital markets. Of the 88 who responded to Question 10, 53 chose a single figure, the distribution for which looked as follows:

5 years 3
7 years 2
10 years 46
15 years 2

Of the 36 who reported a range for the holding period, the distribution is catalogued in Table 12. It shows the mean for the front end of the range as 6.5 years, with a median of 7 years and a mode of 5 years. At the back end of the range, the mean is 11.4 years with a mode and mode of 10 years. Graphically, this conveys the idea that perhaps holding periods have begun to decrease for indeterminate reasons. The range is significant between 6.5 and 10 years.

TABLE 12

FREQUENCY DISTRIBUTION OF HOLDING PERIODS
FOR THOSE RESPONDENTS SPECIFYING A RANGE

FRONT END		FAR END	
YEARS	RESPONSES	YEARS	RESPONSES
1	1	5	1
3	2	7	2
5	13	10	21
7	11	15	10
10	8	20	1

As was pointed by a few respondents, the holding periods vary depending on the type of property held. While this is certainly true enough, it is of particular interest that 20 years was the maximum figure mentioned and it was from only one respondent. Thus, from all observations it appears that holding periods have marginally begun to decline. One possible explanation could be that this sample of larger investors, who maintain "core" properties, often referred to as "trophy" properties, has become more sophisticated in tracking the cyclical nature of their core markets and are responding to that cycle accordingly in the interests of profits and increasing efficiency. There is, however, no data from this survey to support this contention.

HYPOTHESIS 7:

Real estate portfolio managers have increased their investment horizons by searching and investing in a global real estate market.

For this final hypothesis Webb again supplies the baseline of data for comparison. Table 13 provides the results of this survey, along with those of Webb's. Again, his results are tabulated in an overall institutional sense, as well as for the pension managers separately.

TABLE 13

INTERNATIONAL REAL ESTATE EQUITY INVESTMENTS
(Frequency of Explicit Responses)

COUNTRY	WEBB		SURVEY RESULTS
	TOTAL	PENSIONS	PENSIONS
N.AMERICA			
CANADA	14	1	9
MEXICO	2	0	1
PUERTO RICO	0	0	1
EUROPE			
UNITED KINGDOM	2	0	5
FRANCE	2	0	1
BELGIUM	0	0	1
ITALY	0	0	1
SPAIN	0	0	1
OTHER	0	0	1
PACIFIC RIM			
AUSTRALIA	4	0	2
JAPAN	0	0	1
HONG KONG	0	0	1
SINGAPORE	0	0	1

Considering the sample size, the results do show a substantial increase in interest for international real estate investment. This is particularly noteworthy since the survey, as pointed out earlier, is biased toward the largest portfolios. Of this population of 102, only 13 indicated they held property or mortgages in other countries, while 86 explicitly stated that they did not. However, of the 86 that did not invest in property elsewhere, 18, or 21%, indicated that they were actively considering that possibility.

Webb cited several reasons why investing internationally was not attractive. These included the

issues of political risk, foreign exchange problems, legal problems, lack of expertise, and tax consequences. He also speculated that institutional investors also felt that there were plenty of real estate equity opportunities right here in the U.S., that they did not do business internationally, or that rent controls were stricter elsewhere, thereby limiting the opportunity for increased cash flow (#2 investment criteria). An effort was made in this questionnaire to test the correlation between the decision to invest overseas and maintaining a business office there.

There were 30 different respondents who indicated they either held property overseas or were actively considering doing so. Of those, 15, or 50%, indicated they had a physical presence or formal ownership affiliation in those countries. Many of the respondents wrote personal notes on the return questionnaire that indicated this was indeed significant in their decision.

It is also noted that many of the reasons formerly cited by Webb, are similar to those heard for the lack of significant investment in equities and bonds overseas between a decade and two decades ago. This is another indication of the general lag in adoption of new techniques of analysis between real estate and other investment communities.

CHAPTER 6

CONCLUSIONS

The rate of change in institutional portfolio management attitudes about real estate is far from instantaneous. Only in theoretical markets does information arrive and become homgeneously absorbed into the expectations process in real time. Real markets take longer to adjust to new ways of forming expectations. This survey illustrates that portfolio managers have adopted new ways of looking at real estate risk and performance during the 1980s. The rate at which they have made these changes is perhaps slower than might be expected, but the change demonstrates the process of maturation and sophistication taking place in the institutional real estate industry.

The eighty three pension sponsors and forty two advisory management firms that responded to this survey represent a cross section of the most capable participants in the market for real estate equity investment. The results show that portfolio managers substantially implement their real estate investment in a strategic sense, although the acquisition of property within the real estate portfolio is still determined largely by the attractiveness of the individual deal structure. They are paying much more attention, however, to the analysis of these deals in terms of refinements in techniques of diversification. Naive diversification of the real estate portfolio

solely by property type and geographic region are yielding to other considerations such as tenant type, property size and economic location.

Real estate portfolio managers have also noticeably improved upon the level of refinement for assessing both return and risk, separately and jointly. The use of the basic and more complex variants of the internal rate of return, along with Monte Carlo type simulations of mean/variance and sensitivity analyses, are far more quantitatively significant in this regard than the subjective adjustments of returns to compensate for risk that had prevalently been used in the past. When considered jointly, the results show that most respondents are analyzing their real estate portfolio's return and risk in terms of market indices, which demonstrates a clear conceptual leap, if not a practical one, to a major tenant of portfolio theory.

There are nonetheless some surprises in the results that run counter to certain expectations as the industry emerged from the 1980s. Despite the extremely short term volatility of the national capital markets, wherein longer holding periods for real estate were held to be virtuous, respondents indicated a slight change in their horizons from a longer, 10-plus year preference to one more likely between 7 to 10 years. While portfolio investors in fixed income securities and stock equity have looked increasingly to the international markets for further benefits of diversification, real estate

portfolio managers have apparently not committed to participate in such an arena to any significant degree. The results show nonetheless that pension funds have begun to ivestment in the global market over the last eight years. This may lend further evidence to the belief that the multi-faceted, domestic real estate market is sufficiently inefficient, so as to allow investors plenty of opportunities for reaping profits without the competitive necessity of looking elsewhere. It may just also demonstrate another factor of the ten to twenty year lag condition within the real estate community toward adopting more sophisticated techniques of analysis in comparison with other capital markets on Wall Street.

APPENDIX A

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CENTER FOR REAL ESTATE DEVELOPMENT

Building W31-310
Cambridge, Massachusetts 02139
Telephone: (617) 253-4373 Fax: (617) 258-6991

May 1, 1990

Dear Investment Professional:

We are conducting survey research into the current state of real estate portfolio management. The Center for Real Estate Development in conjunction with the Pension Real Estate Association (PREA) is undertaking an annual Real Estate Institute to be staged here at MIT each June. This year's curriculum focuses on real estate portfolio management. We ask that you participate by returning the enclosed questionnaire to us by May 31, 1990. All responses will be used in aggregate form only, and no organization or firm will be identified in any way. No data will be reported in a form which would allow identification of its source. In addition to its use in our curriculum, we expect that our survey results will be reported in a journal widely circulated in the industry.

The questions are designed to replicate part of the survey done by James Webb in 1982 in which you may have participated. We hope to be able to identify the evolution of portfolio management practice by comparing these results over time.

We have selected you as the person in your organization most likely to be able to provide the answers to our questions. If you believe that someone else could respond more fully, please pass the survey on to them and ask that they return it to us. Feel free to call me at either of the numbers below if you have questions about the survey. You may fax the completed survey to me at my fax number shown below or return it in the enclosed envelope.

We would appreciate your firm or organization identification on our survey form so that we can track our responses. We reiterate that no information will be used in any way which could identify your organization in the presentation of our results. We will return a summary of our results to you by the end of June if you identify your organization.

Thank you very much for helping us to gain insight into current portfolio management practices.

Sincerely,

Marc Louargand

617-253-3988
508-371-1169
508-371-1169 FAX

MIT CENTER FOR REAL ESTATE DEVELOPMENT
INSTITUTIONAL PORTFOLIO SURVEY

Organization Name:_____

1. Is your organization a: pension plan sponsor __ investment advisory firm ___
   other ___ (please specify) _____

2. Do you hold real estate in your portfolio? yes ___ no ___ If not, please stop here and return the survey in the envelope provided. Thank you very much for your participation.

3. What is the approximate value of your real estate portfolio? equity $_____ mortgages $_____

4. Do you use any of the following as explicit criteria for diversification in your equity real estate portfolio?
   a. property type ____ b. property age ____ c. property size ___ d. region ____
   e. state ____ f. metropolitan area ____ g. metropolitan area sub-market ____
   h. economic location ____ i. tenant type or tenant business ____ j. lease terms ____
   k. fixed allocation by category ____ l. no systematic diversification criteria are used ____
   m. other _____

5. Do you now hold property or mortgages on property in other countries?
   property: yes____ no ____ mortgages: yes ____ no ____

6. If you answered "no" above, are you actively considering acquisitions in other countries?
   property: yes____ no ____ mortgages: yes ____ no ____

7. If you answered "yes" to question 5, in what countries do you have investments?
   property:_____
   mortgages:_____

8. If you answered "yes" to question 5 or 6, does your organization maintain a physical presence or a formal ownership affiliation in any other country? (e.g., branch office, subsidiary, joint venture partnership entity, etc.) yes____ no ____ If yes, in which countries?
   _____

9. How do you adjust for riskiness in your analysis of equity real estate investments? (check those that apply)

	Often	Sometimes	Seldom	Never
a. Adjust upwards the return required from the project	_____	_____	_____	_____
b. Adjust downwards the benefits expected from the project	_____	_____	_____	_____
c. Use sensitivity analysis	_____	_____	_____	_____
d. Use probability distributions	_____	_____	_____	_____
e. Use Mean/Variance analysis	_____	_____	_____	_____
f. Use Beta coefficients	_____	_____	_____	_____

   g. Other methods (please specify) _____

   h. No explicit risk adjustment is made _____

10. When evaluating equity real estate investment proposals, on what holding period ("time horizon") do you usually base your analysis? _____ years

11. Do you use formal forecasts of GNP growth, inflation, and other macroeconomic activity in your investment decision-making process? (please check those that apply)
   a. In-house economist's forecasts _____
   b. D.R.I. _____
   c. WEFA _____
   d. Other service (please identify)_____
   e. No formal forecasts are used _____

12. Do you use any real estate market forecasting services?
   a. yes ____ please identify _____ b. no ____

13. Do you believe that the Frank Russell Company Index (FRC) approximates the actual volatility of your real estate portfolio? a. yes _____ b. no _____ c. don't use the FRC Index _____ over →

14. On a relative scale, please rank your goals and/or preferences for your equity real estate portfolio. (rank from 1 = most important to 7 = least important)
___ a. cash flow from operations
___ b. residual value at end of holding period
___ c. total expected return
___ d. inflation hedging
___ e. risk aversion
___ f. low or negative correlation with stock market returns
___ g. potential for high appreciation
___ h. other (please specify) _____

15. Please rank your top five criteria for diversification in your real estate portfolio. (1 = most important 5 = least important)
___ a. property type
___ b. region
___ c. state
___ d. metropolitan area
___ e. metropolitan area sub-market
___ f. economic location
___ g. age of property
___ h. size of property
___ i. tenant type or tenant business
___ j. lease terms (maturity, etc.)
___ k. other (please specify) _____
___ l. don't use any criteria for diversification

16. Do you use any "optimal portfolio model" to help you:
a. Allocate funds to real estate yes ____ no ____
b. Allocate funds across real estate asset types yes ____ no ____
If so, does the model have a name or descriptive title?
_____

17. How do you monitor your equity real estate portfolio's performance? (please check all that apply)
a. versus stock market index ___ (S&P500, Wilshire 5,000 etc.)
b. versus real estate index ___ (FRC, Liquidity Fund, etc.)
c. versus mixed asset index ___ (BB&K, etc.)
d. versus strategic plan benchmarks (formal written targets) ___
e. versus performance attributes:
cash-on-cash return ___ broker's rate of return ___ payback ___ discounted payback ___
Net Present Value ___ Internal Rate of Return (IRR) ___ partitioned IRR ___
Financial Management Rate of Return (FMRR) ___ risk-adjusted performance measure ___
annual holding period return (HPR) ___

18. Do you think that your equity real estate portfolio returns are:
___ negatively correlated with stock market returns
___ not correlated with stock market returns
___ mildly correlated with stock market returns
___ highly correlated with stock market returns

19. Do you think that your equity real estate portfolio is:
___ much less risky than a market basket of stocks (an index portfolio)
___ somewhat less risky than a market basket of stocks
___ about as risky as a market basket of stocks
___ somewhat more risky than a market basket of stocks
___ much more risky than a market basket of stocks

20. Do you have a formal (written) strategic plan for real estate investing?
yes ___ no ___

21. What is your primary source of strategic advice for real estate investing?
a. in-house staff ___
b. investment advisory firm ___
c. consultants ___
d. other ___ please specify) _____

please return to Marc Louargand/ MIT-CRED/ W31-310/ Cambridge, MA 02139
or fax both sides to 508-371-0521 Thank you for your response.

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