

ON THE USE OF EQUITY REIT RETURNS FOR DERIVING A DISCOUNT RATE  
FOR UNSECURITIZED COMMERCIAL REAL ESTATE

by

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DAVID A. DEUTSCH

Submitted to the Department of Urban Studies and Planning on January 15, 1993 in partial fulfillment of the requirements for the degree of Master of Science in Real Estate Development

ABSTRACT

Problems with appraisal-based return series combined with certain similarities between commercial real estate, bonds and stock suggest that equity REIT returns provide an accurate source of real estate pricing information. A model for deriving a discount rate for unsecuritized commercial real estate was developed. The model is a three factor Arbitrage Pricing model that measures the sensitivity of equity REIT returns to a small stock portfolio, a bond portfolio and a real estate portfolio. To circumvent limitations of appraisal-based return series for commercial real estate, a synthetic index was created which capitalized the FRC-NCREIF index by an equally weighted average of quarterly capitalization rates published by the American Council of Life Insurance.

The synthetic FRC/ACLI total return index had similar volatility and dispersion as the NAREIT equity total return index but exhibited lower mean quarterly returns. The correlation between the NAREIT equity index and the FRC/ACLI index was .2662.

In tests of the three factor model using both the FRC-NCREIF index and the synthetic FRC/ACLI index the real estate factor was not statistically significant. Accordingly, that factor was dropped from the pricing model. A case study was conducted using the modified pricing model for deriving an appropriate cost of capital in the first quarter of 1990, for a hypothetical neighborhood shopping center located in a mid-Atlantic state. The pricing model produced an unlevered discount rate of approximately 14%

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To my dog Zeke, whose life I wish I had while writing this thesis.

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**CHAPTER ONE**

The commercial real estate market does not bring to mind scenes of frenetic activity on the floor of the New York Stock Exchange nor does it spark wonder at how hundreds of billions of dollars can change hands every day as in the bond markets. The path of a commercial real estate transactions is a long road, marked by protracted negotiations, extensive investigation and incomplete information. The commercial real estate market is a private one, consisting of "lumpy" assets which trade infrequently and where there are sometimes pronounced informational asymmetries between buyers and sellers. In short, it falls far short of the classic definition of an efficient market where prices rapidly incorporate new information. While on one hand the inefficiencies of the commercial real estate market appeal to those who participate in it--they believe it will permit them to earn excess profits--it also handicaps them. Commercial real estate investors do not enjoy the pricing information available in public markets, so at any particular point in time, it is impossible for them to know the "true" market value of their assets. The best they can do, short of an actual transaction, is to get an appraisal.

The lack of accurate pricing information provides a great impediment to investors contemplating an acquisition; it is almost impossible for them to derive a value of equity. Consequently, real estate investors tend to forsake the Net Present Value technique for the internal rate of return (IRR) as their standard measure of investment performance. By using an IRR, investors look inward--they let their projections tell them what the expected rate of return is--instead of looking to the market to determine their appropriate cost of capital. Without a systematic means to measure their cost of capital, real estate investors can pursue projects which they should reject and reject projects which they should pursue.

In spite of the limitations of the commercial real estate market, an accurate source of commercial real estate pricing information is available to real estate investors in the form of equity REIT returns.

In this thesis, I develop an Arbitrage Pricing Theory based model to derive a cost of capital for real estate investors and conduct a case study to test it.

The literature review in Chapter Two summarizes current financial theory regarding asset pricing. The correct measurement for any investment is to discount expected future cash flows and arrive at a present value. In calculating the proper rate of discount for these cash flows, mean-variance theory dictates that the only relevant risk is the marginal risk contribution an asset makes to a well diversified portfolio. In other words, an investor should only be compensated for bearing non-diversifiable risk. William Sharpe used this concept to develop the Capital Asset Pricing Model (CAPM) using the idea that the price of an asset depends only on that asset's covariance with portfolio of all risky assets. Empirical and theoretical inconsistencies in the CAPM led Stephen Ross to develop the alternative Arbitrage Pricing Theory (APT). Sharing with the CAPM a view that return is a linear function of risk, the APT postulates that what determines an asset's price is its sensitivity to certain macroeconomic factors.

To properly estimate an asset's risk, according to either the CAPM or the APT, requires a large set of pricing data such as is found in public securities markets. The second section in Chapter Two explores the difficulty posed by the lack of continuous pricing data for commercial real estate and discusses recent attempts to construct a proper return series for measuring real estate performance. The initial solution was to use appraisal-based return series such as the Russell-NCFREIF index. However, "smoothing" in appraisal based indices produced so little volatility that they aroused suspicion. The death knell of these indices came as they failed to reflect any drop in the commercial real estate market until 1991. Recent efforts have tried to "volatilize" the FRC-NCREIF index so that it appears to follow a random walk. The volatility these techniques introduce into appraisal-series suggest that equity REITs can indeed proxy for unsecuritized commercial real estate.

Chapter Two then compares commercial real estate with stocks and bonds. Qualitatively, it seems real estate shares enough characteristics with stocks and bonds that economic factors which affect those markets should also affect commercial real estate. However, the durability of real estate as an asset may make it vulnerable to systematic factors which do not impact stocks and bonds. If this is the case, and assuming equity REITs are a proper proxy for unsecuritized real estate, one can use equity REITs to derive a discount rate which incorporates systematic factors for stocks, bonds and real estate.

The final section of Chapter Two focuses on recent studies suggesting that equity REIT residuals contain a unique real estate factor not priced in the stock and bond markets.

Chapter Three develops a model for deriving a discount rate for commercial real estate. Using a small stock index, a bond index and a real estate index, the model dictates that the returns for an equity REIT is a combination of the risk free rate and the sensitivities of the REIT to the risk premium for each index.

A key feature in the model is the availability of a sufficiently accurate return series for commercial real estate. In the spirit of recent attempts to volatize the FRC-NCREIF, I have created a synthetic return series by capitalizing the income component of the FRC-NCREIF index with quarterly capitalization rates published by the American Council of Life Insurance. I present the methodology for constructing this synthetic series as well as contrast it to the "unvolatilized" FRC-NCREIF index in the first part of Chapter Four.

The second part of Chapter Four contains the results of testing the significance of the three factor model. The hypothesized presence of common real estate factors does not appear in the equity REIT residuals. However, both the bond and stock market are shown to have significant impacts on REIT returns which suggest a two factor model is appropriate for deriving a discount rates from equity REITs.

The third part of Chapter Four applies the two factor model for deriving a cost of capital for a theoretical neighborhood shopping center in a mid-Atlantic state.

The final section of Chapter Four presents evidence that previous work linking the residuals in equity REIT returns with the FRC-NCREIF index suffered from using the wrong proxy for the stock market factor. The correlations between the REIT residuals and the FRC-NCREIF index disappear when a small stock index is used in place of the S & P 500 index.

This study argues that when for deriving a cost of capital for unsecuritized commercial real estate, equity REIT returns provide the best alternative to do so. Similarities between real estate and bonds suggest that a bond factor should be included in cost of capital calculations for real estate. The major drawback in using equity REITs is the relatively small portion of commercial real estate they represent. REIT holdings are weighted toward strip retail and multi-family residential properties located near a coast. However, if, as is currently anticipated, institutions choose to convert some of their commercial real estate holding into REITs, then equity REITs would provide a rich source of information for deriving a cost of capital for commercial real estate.

**CHAPTER TWO**

Few studies have addressed the problem how to apply currently accepted financial theory in order to value commercial real estate. The four main sections in this chapter review the academic literature to help clarify the issues involved. The first briefly summarizes the theory behind discounted cash flow analysis and explains why such procedures produce the best investment decisions. The second section explores current financial theories on asset pricing and how the lack of an auction market for real estate affects the implementation of those theories. The third section discusses the relationship between commercial real estate and other capital markets. It argues that real estate is much more volatile than appraisals suggest and that equity REIT returns approximate unsecuritized real estate closely enough to justify their use for pricing unsecuritized real estate. Finally, the fourth section explores recent work which suggests commercial real estate is subject to systematic factors may not be captured in the stock and bond markets.

## **2.1 Discounted Cash Flow**

The use of discounted cash flow techniques has permeated modern corporate finance. Techniques for discounting projected cash flows in order to estimate the feasibility of a project have become a standard part of any graduate or undergraduate course in basic finance. Brealey and Myers' *Principles of Corporate Finance* [2] offers an excellent treatment of the material.

Two principles underlie discounted cash flow theory. The first is that "a dollar today is worth more than a dollar tomorrow." This notion refers to the fact that by having money today, a person has the ability to use it. Whether he or she chooses to spend or invest his or her money, a person is better off by having the use of money in the present rather than having to wait for it. Assuming that the person chooses not to consume the dollar but to invest it, the value of the dollar in the present is the return that could be earned on the dollar by investing it immediately. In other words, today's value

or the present value, of one dollar that someone will receive in one period in the future is that dollar discounted by the percentage return he expects to get if he had use of the money today. Mathematically this is expressed as:

$$PV = \frac{\$1}{1 + r} \quad (2.1)$$

where  $r$  = the expected percentage return.

How one determines  $r$  stems for the second principle of discounted cash flow analysis. Namely, "a safe dollar is worth more than a risky one." Investors expect to be more highly compensated for risky investments than for safer ones. Thinking in terms of the one period example above, the present value of that dollar depends on what type of investment the person would have undertaken if he had the money. If the person would have invested the money in a risk free asset such as T-bills, than he would have expected to earn less than if he would have invested the dollar in the common stock. Consequently, the discount rate ( $r$ ) for the T-bill investment would be lower than for the stock investment and the present value of the dollar invested in the risk-free investment would be greater than the present value of the dollar invested in the risky asset.

Discounted cash flow (DCF) analyses expand on the basic principles of discounting and present value by modeling the future cash flows from an investment, discounting them back to the present, summing together the discounted cash flows and subtracting the original investment to see if it appears to be profitable. The results of this process is known as the Net Present Value (NPV) of an investment. Mathematically, NPV is represented as:

$$NPV = \sum_{t=0}^n \frac{CF_t}{1 + r} - CF_0 \quad (2.2)$$

The key question for purposes of this paper is how should one derive a discount rate for commercial real estate which appropriately captures the riskiness of the cash flows.

## 2.2 Current Financial Theory and Its Applicability to Commercial Real Estate

So far I have used the term "risk" without offering a formal definition. Typically, finance theory equates risk with uncertainty. That is, when contemplating actions in the future, it is impossible for any person to be certain what will be the actual outcome and therefore the more uncertain a particular outcome, the greater the riskiness of the venture. Economists have quantified risk by developing a statistical definition.

Given a normal distributions of likely outcomes, the expected outcome is defined as the mean of all possible outcomes, where the formula for specifying the mean is:

$$\mu = \frac{\sum_{i=1}^n X_i}{n} \quad (2.3)$$

where

$\mu$  = the population mean

$X_i$  = observation (i)

n = number of observations

Risk is defined then as the probability of an actual outcome deviating from the mean, or expected, outcome. More formally, it is defined as the variance of an outcome around the mean--symbolically:

$$\sigma^2 = \frac{\sum_{i=1}^n [(X_i - E(X))]^2}{n - 1} \quad (2.4)$$

where

$\sigma^2$  = the population variance

$X_i$  = observation (i)

$E(X)$  = the expected value of X (the mean)

n = number of observations

By taking the square root of the variance, one can calculate the standard deviation ( $\sigma$ ). For a normal distribution, approximately 66% of the time the actual outcome will fall within one standard deviation from the mean and approximately 95% of the time it will fall within two standard deviations. While economists often assume that investment returns are normally distributed, this is not strictly correct; it is generally accepted that return series are positively skewed.

Because standard deviation offers a more intuitive measurement (%) it tends to be used more often than variance in discussions of risk and return relationships.

When contemplating the expected risks and returns for an investment, economists assume investors are risk averse and therefore, demand compensation for undertaking riskier investments by pricing those investments so they yield greater expected returns. Harry Markowitz elaborated on this idea by demonstrating [20] that a person could achieve the same expected return with less risk if he invested in a diversified portfolio than if he chose to invest in a non-diversified portfolio. Markowitz noted that when combining assets into a portfolio, the variance of the portfolio was not simply the sum of the variances of the individual assets but instead, was the sum of the variances and the covariances between the assets. Formally, for a portfolio with assets  $i$  ( $i=1,2,\dots,n$ ) and  $j$  ( $j=1,2,\dots,n$ ) with weights  $w_i$  and  $w_j$  variance of the portfolio was specified as:

$$\sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n w_i w_j \sigma_{ij} \quad (2.5)$$

where  $\sigma_{jj} = \sigma_j^2$ .

It is easier to understand the variance/covariance relationship by examining a two-asset portfolio.

$$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \sigma_1 \sigma_2 \quad (2.6)$$

since

$$\rho_{12} \equiv \frac{\sigma_{12}}{\sigma_1 \sigma_2} \quad (2.7)$$

then

$$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \rho_{12} \sigma_1 \sigma_2 \quad (2.8)$$

where

$\sigma_p^2$  = variance of the portfolio

$\sigma_1^2$  = variance of asset (1)

$\sigma_2^2$  = variance of asset (2)

$\sigma_{12}$  = covariance of assets (1) & (2)

$\rho_{12}$  = correlation coefficient for assets (1) & (2)

$w_1$  = weight of asset (1) in the portfolio

$w_2$  = weight of asset (2) in the portfolio

If  $\rho_{12} < 1$ , the variance of the portfolio will be less than the weighted average of the individual assets.

Since often the covariances are negatively correlated, the variance of the portfolio could be less than the sum of the variance of each asset. As one assembles a large portfolio of assets ( $n$ ), the number of covariance terms, specified by  $n^2 - n$ , begins to far outweigh the variances in defining the risk of a portfolio and soon the overriding issue when adding an additional asset is not the variance of its expected return, but the asset's covariance with the other assets in the portfolio.

Markowitz further argued that one could assemble an investment portfolio which was "efficient". An efficient portfolio would be one whose expected return and standard deviation would place it on the efficient frontier. The efficient frontier is that "locus of points in mean-standard deviation space of all the portfolios that minimize variance for a given level of expected rate of return." [16] In other words, the efficient frontier is the parabola formed from all the possible portfolios which minimize variance for a specified expected return (figure 2.1). A risk-free asset can be introduced into this model and is represented by a line that is tangent to the efficient frontier (figure 2.2). The line represents the expected return/standard deviation combinations which can be produced by creating portfolios consisting of different proportions of the risk-free asset and an efficient portfolio. The intercept represents a portfolio of only the risk free asset while the tangency point corresponds to 100 % investment in the efficient portfolio. The points on the line extending beyond T are the  $E(r)/STD$  combinations which a person could achieve by borrowing at the risk free rate and investing the proceeds in the efficient portfolio.

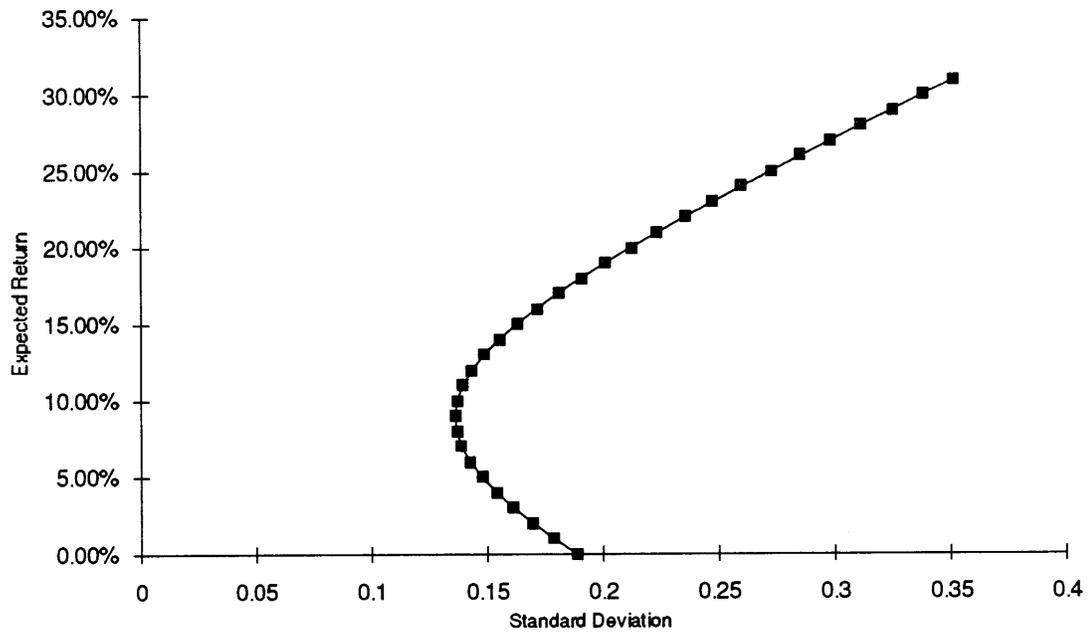
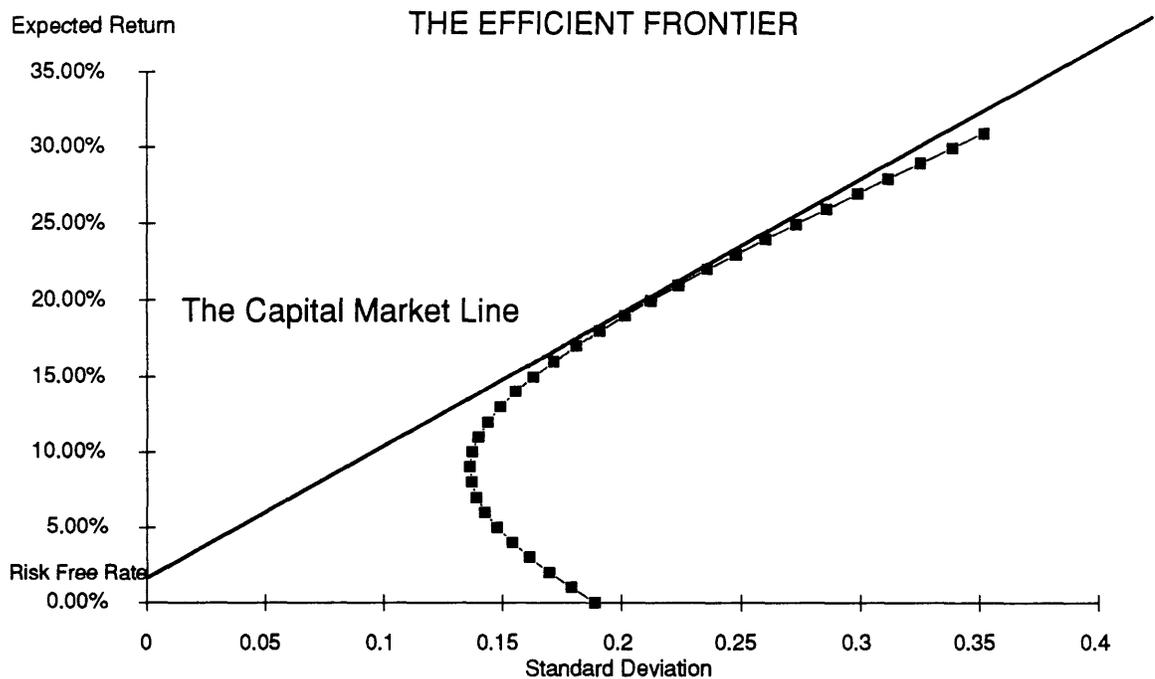
**FIGURE 2.1****THE EFFICIENT FRONTIER**

FIGURE 2.2



Theoretically, if a person has two portfolios which lie on the efficient frontier, he can achieve any point on the frontier by varying the weight he holds of each portfolio. In this case, an investor need not be compensated for incurring unsystematic risk by choosing to hold an inefficient portfolio. For example, why should a person be compensated for holding a single risky asset ( $j$ ) with expected return  $\mu_j$  and standard deviation ( $\sigma_j$ ) when he could hold a portfolio of assets with the same expected return but whose standard deviation was smaller. ( $\sigma_p < \sigma_j$ )?

William Sharpe utilized the concept that a person should only be compensated for non-diversifiable, or systematic, risk when he developed the Capital Asset Pricing Model [25]. The CAPM is a static, equilibrium model of asset pricing that requires several strong assumptions--such as homogeneous investor expectations, zero net supply of a risk

free asset, investors want to hold only efficient portfolios and the existence of a universally held market portfolio--for which critics have attacked the model.<sup>1</sup>

Sharpe hypothesized that investors could measure any asset's systematic risk by running a simple regression with the risk premium for asset (i) as the dependent variable and the risk premium for the market (m) as the independent variable. The estimated coefficient ( $\beta$ ) would measure the asset's sensitivity to the market. In other words, an asset's beta represents the ratio of the asset's covariance with the market to the variance of the market. More formally,

$$\beta = \frac{\sigma_{i,m}}{\sigma_m^2} \quad (2.9)$$

where i = asset i, m = the market.

In other words, the CAPM describes the risk premium for any asset with a linear equation whose slope is that asset's beta. Therefore an asset with a beta of 1 should have the same risk premium as the market as a whole since it is equally risky. On the other hand, an asset with a beta of .5 deserves only one-half the market risk premium while an asset with a beta of 2 demands a premium twice that of the market in general.

For evaluating a prospective investment, the CAPM specifies that the expected return on an investment should be the risk free rate plus a systematic risk premium, or,

$$E(r_i) = E(r_f) + \beta [E(r_m) - E(r_f)] \quad (2.10)$$

where  $E(r_f)$  = the expected risk free interest rate

$E(r_m)$  = the expected return on the market.

---

<sup>1</sup>In spite of this criticism, it still describes a degree of economic reality that combined with its ease of use, make it the only pricing model to see widespread practical application.

The CAPM has enjoyed such widespread popularity because it elegantly provides a framework for deriving the risk premium an investment requires. However, empirical difficulties in verifying the CAPM have led researchers to develop various modifications and derivations of the theory. In spite of these attempts to fit the CAPM to empirical results, significant anomalies have remained. A recent article by Fama and French [8] has cast serious doubt on the validity of the CAPM. Using data from 1941 to 1990, Fama and French found that contrary to the CAPM's central prediction, average return for a stock was not related to its beta. They found that a stock's average return could be best explained by size (as measured by market equity) and the ratio of a stock's book equity to market equity (BE/ME). As the results of Fama and French's study were "not economically satisfying", they felt that size and BE/ME actually proxied for other factors which imply that a multi-factor asset pricing model, such as the Arbitrage Pricing Theory, provides the proper framework for pricing risky assets.

Developed by Steven Ross [22], Arbitrage Pricing Theory (APT) employs a weaker set of assumptions than the CAPM. Ross developed the APT because he felt that the CAPM reliance on a theoretical market portfolio of all risk assets made it untestable. This problem was first elaborated by Richard Roll [21] who recognized that systematic risk was a worldwide phenomenon and that the hypothetical market portfolio must include all risky assets--stocks, bonds, real estate, precious metals and even human capital. So many assets were contained in the market portfolio that it would be impossible to identify them all. And, if by chance it were possible to distinguish each asset, it would still be impossible to measure their variances since most would not trade in measurable markets. Therefore, assuming that the S & P 500--or some other stock market index--could proxy for the market portfolio was taking too narrow a view of the system. The estimates obtained using stock market indices as proxies could not be viewed as reliable.

Perhaps more important than doubts concerning the testability of the CAPM, Ross felt that several of the assumptions underlying the CAPM were so tenuous that they made the theory unviable. The CAPM relied on these assumptions because it is an equilibrium based economic model. Ross could avoid such a strong assumption set by basing the APT on arbitrage. The APT dictates that an asset's return depends on that asset's sensitivity to various macroeconomic factors. According to the theory, an investor can create a portfolio which will provide a hedge to any specified economic factor. Any other portfolio, or individual asset for that matter, which also hedges that factor must earn the same return as the first portfolio or an investor could earn risk free profits by selling the overpriced portfolio (asset) and buying the underpriced portfolio (asset).

The APT further specifies that the price for any asset is the linear combination of the risk premia investors demand for each risk factor which affects that asset. Formally, this is expressed as:

$$r_i = r_f + \beta_1 \gamma_1 + \beta_2 \gamma_2 + \dots + \beta_n \gamma_n + \varepsilon \quad (2.11)$$

where

$r_i$  = return on asset (i)

$r_f$  = the risk free return

$\beta_n$  = the sensitivity of asset (i) to factor (n)

$\gamma_n$  = the risk premium associated with factor (n), and

$\varepsilon$  = the error term

The APT is not without its critics however. Unlike the CAPM which specifies the factor which drives returns, the APT leaves that question unaddressed. Financial economists point out that while it is fine to say several factors generate returns, a "true" economic theory should specify what those factors are. For this reason, some economists feel the APT is not really a theory at all. These criticisms ignore the fact that in practical

application, it is better that a theory work than that it be academically "right". The appeal of the APT stems from the fact it seems intuitively correct. Experience dictates that factors other than just "the market portfolio" drive returns and a model which attempts to capture that fact deserves attention.

At this point, it is unclear if an APT approach will replace the CAPM as the standard capital asset pricing paradigm. The many dissatisfactions financial economists have with both models suggest that a new, dynamic model will probably emerge as the new paradigm. At the moment though, what is clear is that in spite of its theoretical weaknesses, the CAPM has enjoyed such widespread use because it is both easy to implement and it yields discount rates that seem consistent with reality. These qualities will insure that the CAPM sees continued practical application for quite some time. The weakness of the CAPM, or the APT, as they apply to real estate, stems from the fact the statistical techniques on which the models depend require a continuous and efficient market such as the market for public securities. Since the majority of real estate does trades in private, localized markets characterized by non-fungible assets, informational asymmetries, high transaction costs and infrequent trading, it is difficult to use the CAPM to price real estate.

One solution to circumventing the limitations in estimating systematic risk for real estate has been to use appraisal-based indices such as PRISA or the FRC-NCREIF series. These returns are constructed using appraisals as a proxy for actual market prices. Being dependent on the appraisals, the companies which construct the indices must go to great lengths to circumvent the problems caused by a lack of market pricing.

The construction of the Russell-NCREIF Index as described in an article by Brueggeman and Giliberto [3] provides an interesting illustration of how one company builds its appraisal-based return series.

If real estate trading were continuous, an index could be constructed by computing a holding period return. Mathematically, this is expressed as:

$$r = \frac{P_1 - P_0 + D}{P_0} \quad (2.12)$$

where  $P_0$  = Value of index at time  $t$ ;

$P_1$  = Value of index at time 1, and

$D$  = Value of any dividends received.

Unfortunately, this formula is difficult to apply to real estate because of the lack of a continuous market. Whereas each security in an index such as the Standard & Poor's 500 trades every day, the properties in a real estate index rarely trade at all. As mentioned, the solution has been to use appraisals. However, the appraisal process is both costly and time consuming, making it infeasible to have a property appraised more than once per quarter.<sup>2</sup> This creates the problem of how to reconcile the cash flows, which occur throughout a quarter, with the quarterly valuations. For a return series to be accurate, it must discount the various cash flows back to the date of the appraisal. The exact formula for constructing a holding period return given the constraints of appraisals is:

$$V_1 - C_{N+1} = V_0(1 + r) + \sum_{j=1}^N C_j(1 + r)^{1-t_j} \quad (2.13)$$

$V_0$  = appraised value at beginning of quarter

$V_1$  = appraised value at end of quarter

$N$  = number of cash flows during the quarter (excluding end of quarter payments)

---

<sup>2</sup>Typically, an outside appraisal is commissioned yearly while in-house staff prepares interim quarterly valuations.

$C_j$  = amount of  $j$ th cash flow

$t_j$  = timing of the  $j$ th cash flow (expressed as a fraction with the number of days into the quarter as the numerator and the total number of days as the denominator)

$C_{N+1}$  = cash flow at time 1

$r$  = holding period return.

It would be a Herculean task to reconcile every cash flow necessary to compute the true holding period return. In addition, since it is mathematically impossible to solve for  $r$ , arriving at a solution requires a calculation intensive, iterative process that is too cumbersome for everyday use. These problems lead to the use of an equation which approximates  $r$ :

$$r = \frac{V_1 - C_{N+1} - V_0 - \sum_{j=1}^N C_j}{V_0 + \sum_{j=1}^N C_j (1 - t_j)} \quad (2.14)$$

However, even utilizing this simplified formula is troublesome because of the recurring problem of timing all the cash flows for the thousands of properties with constitute the FRC-NCREIF index.

Therefore, the Frank Russell Company employs another set of simplifying assumptions. They assume that any capital contributions (CI) or disbursements from partial sales or refinancing (PS) occur at the midpoint of the quarter. Recognizing that operating expenses are normally monthly flows, the Russell Co. modifies the quarterly

NOI figure used in the denominator by multiplying it by .33. They incorporate these modifications into the following formula:

$$r = \frac{V_1 - V_0 - CI + PS + NOI}{V_0 + .5(CI - PS) - .33NOI} \quad (2.15)$$

Bruggeman and Giliberto describe (2.15) as representing "the best, simplified, approximation to the internal rate of return presented in [2.13] above, given the assumptions made regarding periodic receipt and disbursement of cash within quarterly intervals." In making this assessment however, Brueggeman and Giliberto refer to the problem of reconciling asynchronous cash flows with appraisals--they do not address the even greater problems caused by being forced to use appraisals.

Appraisals are simply someone's best estimate of what the most likely transaction price would be. The criteria appraisers use in determining that estimate is predominantly ex post--past capitalization rates, past sales, past prices for construction.<sup>3</sup> However, market transactions reflect investors ex ante expectations of future income which the appraisal process tends to ignore. Consequently, appraisal-based return series such as the FRC-NCREIF index seem to be out of touch with reality. They display far less volatility--especially as compared to market based indices--than one observes in the real world.

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<sup>3</sup>This assumes that real estate markets are not weak form efficient and therefore, past prices can be used to predict current values. There may be some validity to this notion; given real estate's large transaction costs, investors may not be able to capitalize on the correlation between past and future prices thereby preventing the arbitrage condition which would normally eliminate such correlations. However, if the value of new information is zero, future prices will be unpredictable. The further into the past an appraiser must delve for information sharply diminishes the reliability of any resulting estimation.

Geltner [12] provides a good description of the process whereby appraisals "smooth" the volatility found in true values. Geltner describes how an appraiser can never be fully confident of what the true market value of a property is and, given the ex post nature of the appraisal process, will look to past appraisals on the property to support his opinion of the current market value. When property owners rely on internally generated appraisals three quarters out of the year, they will often introduce this type of bias into their valuations. The smoothing caused by this "lack of confidence" produces values that are "moving averages of true values and returns that are moving averages of true returns."

Geltner further explains that taking a moving average of a stochastic process creates smoothed values which do not accurately represent the true variability for any given period of time. Consequently, an index using appraisals will start out with raw data that does not accurately reflect the market. Since moving averages tend to be autocorrelated, indices of markets which are weak form efficient<sup>4</sup> should nevertheless exhibit autocorrelation if smoothing is present. Since the FRC index displays such autocorrelation, Geltner claims it demonstrates the presence of smoothing in the series.

Rapidly changing market conditions can also introduce bias into appraisals. Downturns exacerbate the stickiness normally associated with commercial real estate prices. Without the benefit of market makers, the commercial real estate market is vulnerable to the disequilibrium between buyers and sellers which occurs in a bad market. In a declining market, the lack of buyers can become so acute that an owner could not sell even if he so desired. This can lead to a situation similar to what has existed since the commercial real estate market crashed in the late 1980's where there have been so few transactions that for all intents and purposes, there is no market for

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<sup>4</sup>Markets which are weak form efficient incorporate all past information into current prices. Since only new information can affect prices, and since the new information has an expected value of zero, future prices must be unpredictable.

commercial real estate. While most owners would recognize that "true" values have dropped, there is not a mechanism to price such changes. The only method for changing market conditions to manifest themselves is through appraisals. But since appraisers rely so heavily on ex post data, the lack of transactions seriously hampers their ability to provide accurate valuations.

A more sinister problem that also affects appraisals occurs when an owner has a strong disincentive to recognize a change in the market; because he normally hires the appraiser, an owner can easily create pressure to value his property artificially high. These factors combine to create a situation where although the "true" value for commercial real estate has changed, there is not a system to measure the movement.

One final element behind the seeming lack of volatility for commercial real estate are the high transaction costs required to sell a piece of property.<sup>5</sup> It would not be unusual for each party in a commercial real estate deal to incur transaction costs of 400 to 500 basis points. These costs dwarf those for trading public securities. The transaction cost differential between securities and real estate allow securities prices to incorporate new information far more quickly than can commercial real estate. For example, assuming large institutions have transaction costs on securities of ten basis points or less, if such an institution acquired a piece of information which it believed would cause the price of a security it owned to fall twenty basis points, it could liquidate its position without the transaction costs wiping out any profit. Imagine the same scenario for a piece of commercial real estate. The only way for commercial real estate prices to manifest new information is if the information were of such magnitude that it would cause a price movement large enough to overcome 400 basis points of transaction costs. Since this is unusual, an owner will not sell until he has accumulated information to the point he believes it becomes profitable for him to trade. The limitations imposed by

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<sup>5</sup>I owe this observation to my thesis advisor, Marc Louargand.

these high transaction costs result in few transactions which in turn, bias downward commercial real estate's apparent volatility.

Ross and Zisler [23] attempted to estimate real estate's true volatility. In the introduction to their article, they noted

Recently, there have been a number of analyses of the equity real estate market, and, almost without exception, these analyses simply treat existing data as though they were the same as data on returns from the stock and bond markets. Unfortunately, nothing could be further from the truth...It is misleading simply to report on equity real estate returns without addressing the significant impact the lack of a continuous auction market and the necessary use of appraisals can have on results.

They regressed two appraisal-based series on dummy variables to remove the autocorrelations introduced by the appraisals. They then manipulated the residuals to arrive at a volatility measure they felt was more realistic. They concluded that the true volatility for unlevered real estate lay somewhere between 9% to 13%--approximately that of corporate bonds.

Ross and Zisler's study suggested real estate returns behave like a securitized asset. A current article by Fisher, Geltner and Webb [9] reinforces this conclusion. They employ two different approaches to volatilize the FRC-NCREIF index and then compare their results with the NAREIT equity index.

Their first approach adjusts the FRC-NCREIF index so that its returns become uncorrelated through time--in effect, they make the FRC-NCREIF index follow a random walk. Their second approach consists of constructing a hedonic pricing equation based on sales data of properties sold out of the FRC-NCREIF index. This technique permits only yearly data points making it is significantly less volatile than the random walk model. Both models share the same general trend as the NAREIT equity index; namely, values peak between 1984 and 1986 followed by a steady decline thereafter (the

NAREIT equity index shows a sharp rise in the first quarter of 1991 in contrast to the other indices).

The articles by Ross and Zisler, and Fisher, Geltner & Webb imply that perhaps equity REITs provide a better real estate return series than those that are appraisal-based. REITs are a securitized form of real estate ownership which resemble closed end mutual funds. There are three types of REITs. Mortgage REITs primarily hold mortgages collateralized by real estate; equity REITs own fee or leasehold interests in income properties; and hybrid REITs possess a combination of both mortgages and equity. A REIT issues shares which can be publicly traded. Designed as an investment mechanism where small investors could own real estate they otherwise could not afford, a REIT is exempt from paying income taxes on its earnings as long as it meets several criteria such as the fact it must distribute at least 95% of its earnings as dividends. More important, REITs is the only form of real estate ownership which trades in a continuous market. Therefore, they offer the only real time source for real estate price information.

### **2.3 The Relationship between Commercial Real Estate, Bonds and Common Stock**

Many real estate professionals vehemently deny that REITs are real estate. They claim that the securitization process exposes REITs to macroeconomic factors which influence the stock market but which do not affect unsecuritized real estate. Comparing securitized and unsecuritized real estate would be like comparing apples to oranges. In effect, they view commercial real estate as a separate asset class distinct from other capital assets. Is this a claim that can stand up to scrutiny? After all, an investor has a wide selection of possible investment opportunities; to attract capital, assets must compete with each other and it seems unrealistic to expect that different assets are not somehow related. Commercial real estate advocates point to the seemingly low

correlation between appraisal-based returns on real estate as compared to securitized investments as proof of real estate's distinctiveness. However, the similarities between certain types of securities and the return generating components of a real estate investment question cast doubt on this argument. The returns to commercial real estate come from current income and residual value; it is not clear then why real estate should be free of the same systematic risks which move prices in the stock and bond markets. This section examines the similarities between bonds, stock and real estate to propose that the three assets are similar, and that REIT returns can be used to measure unsecuritized real estate.

Froland studied the relationship real estate has with other capital markets. [10] Troubled by suggestions capital markets did not influence real estate prices, he tested for the effect stock and bond returns have on capitalization rates for real estate. He found that debt instruments and the earnings price ratio for common stocks exhibited significant correlations with cap rates (they had respective correlation coefficients of .92 and .52). Furthermore, 65% to 70% of cap rate variations could be attributed to the current yield on mortgages while required returns on stocks explained an additional 25% to 30%.

These results make intuitive sense--the income component for commercial real estate returns resembles a bond; it is secured by a contract calling for fixed payments which have priority over the equity holders in a business, is for a definite term and does not offer any opportunity for appreciation.<sup>6</sup> Therefore, it is reasonable to suggest that the same factors which determine bond prices would also affect the value of the income stream for a commercial real estate project.

At any moment in time, the price of a bond is the present value of the expected cash flows (interest and principal). A bondholder is exposed to three main types of risk.

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<sup>6</sup>This assumes that the lease does not contain a percentage rent clause or other similar covenant allowing the landlord to benefit from a growth in the tenant's business and that any rent increases are designed to keep pace with inflation.

[7] The first is interest rate risk. This takes two forms. The first is the effect a change in interest rates has on the bond's price. Since a bond's value is the present value of future cash flows, an increase in interest rates will cause the value of a bond to decrease while a drop in interest rates will have the opposite effect. The second part of interest rate risk is reinvestment risk. Assuming the bond holder intends to keep the bond to maturity, a change in interest rates affects his ability to reinvest the coupon payments at the same rate as the original bond. If interest rates drop, investments of equivalent risk will offer lower yields so he will not obtain the yield to maturity forecasted when he bought the bond. The longer the term of the bond, the more the expected yield depends on the interest from reinvested coupon payments. In a similar fashion, the greater the coupon rate, the more the expected bond yield depends on reinvestment. A particular bond's reinvestment exposure can be viewed as a function of its term and coupon rate.

The second major risk a bondholder faces is credit risk. This is the risk that the credit quality of the issuing entity will erode over time. All else being equal, an adverse change in the quality of the issuer will cause investors to discount the cash flows at a higher rate and the price of the bond will drop. If the investor decides to keep the bond to maturity, he does not have to realize the capital loss, but he will nevertheless be forced to accept an interest rate that will not adequately compensate him for the increased riskiness of the bond's cash flows. If the decline in the credit quality of the issuer is sufficiently severe, a bondholder could also face the possibility of the issuer defaulting and the bondholder losing his principal. As one's ability to forecast the credit worthiness of an issuer is an inverse function of time, longer bonds carry greater credit risk than shorter bonds.

The final risk facing a bondholder is inflation risk. Under Fisher's law (which states that the interest rate is approximately the real rate of interest plus a premium for expected inflation), an increase in the inflation rate will cause interest rates to rise and the

bond price to drop. More important, since a bond pays fixed payments, the value of the cash flows will erode faster than the investor had originally expected.

These same forces should also impact commercial real estate returns. Like a bond, if interest rates rise, the value of commercial real estate should fall. Like a bondholder facing declining interest rates, the owner of the property cannot easily reinvest rental income back into the property and therefore cannot obtain his projected yield to maturity. If an economic downturn affects the credit quality of its tenants, the value of a property should fall similar to how the market value of bond would drop. And finally, if inflation rises unexpectedly, then the value of the lease payments will fall.<sup>7</sup>

The similarity between commercial real estate and bonds casts further doubt on the wisdom of using appraisal-based return series for evaluating real estate performance. If these series were accurately reflecting real estate returns then they should exhibit far greater correlations with bond returns than they do.

While the income component for commercial real estate returns resembles a bond, the residual component has the same attributes as common stock. Ownership of a piece of commercial real estate entitles the owner to any income after payment of superior claims such as operating expenses and debt payments. In return for taking the "end of the line" position, the owner has unlimited upside potential, and if he takes title correctly, limited downside liability. While there are more ownership options available to equity holders in commercial real estate than are available to stockholders, the basic concept of equity is similar in either case.

One important characteristic separates real estate equity and common stock equity. Stock investors implicitly value the expected dividend stream from a stock as a perpetuity. While this may not seem realistic--there are few companies which have even

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<sup>7</sup>Although many buildings may not have this exposure because of inflation adjustment clauses.

been able to survive for one hundred years--it is *theoretically* possible for a company to exist forever. This premise underlies the American legal theory that views a corporation as a fictitious individual who enjoys an infinite life span. Although land is thought of in a similar fashion, the structures on a property are not thought of as perpetual.

Eventually, all building will become obsolete. When that happens, they will either be leveled or left to slowly decay, but in either case, the revenue stream produced by the building will cease. Presumably once a property gets to this point, the owner would take steps to revitalize it. In effect, the owner has an option to redevelop the property. This is not the same as owning a perpetuity. Purchasing commercial real estate entitles the owner to a *finite* income stream with an option to redevelop. Owning a stock is purchasing an expected stream of *perpetual* dividends. The value of the embedded option in a piece of commercial real estate can be quite pronounced. The difference in discounted value between a long term ground lease (99 years) and a perpetuity is on the order of one percent, yet the embedded options in a fee interest can command a premium of as much as forty percent. [4]

Although embedded options differentiate commercial real estate from stocks, the expected life for a commercial property is sufficiently long that one can equate rental income from a property with the dividend stream for a stock. It seems logical then, that commercial real estate should share some pricing characteristics with common stock.

As with a bond, the basic valuation concept for pricing a stock is the discounted cash flow model. [24] Unlike a bond with set payments and maturity date however, the cash flows available to a stock holder carry far greater risk. Since they are a claim on the residual cash flow of a business entity, there is no guarantee that they will be paid. For bearing this risk, investors will discount the dividends at a higher rate than they would require for the bonds of the same company. In addition, stock ownership also gives the investor the right to share in any growth the company has. Since most stocks offer relatively low dividend yields compared to fixed income instruments, this expected

growth component constitutes a major part of the expected return to a stock investor. In terms of present value, the price of a stock reflects investors' view of the present value of expected dividends plus the present value of expected growth opportunities.

An investor in any particular stock will then face two types of risk. The first is unsystematic risk that--as previously discussed--can be diversified away by holding a portfolio of stocks. Unsystematic risk would include management's ability to run the company, quality of products or services offered and the overall demand for a company's products controlling for general economic conditions and industry growth. It is these factors on which fundamental stock analysts tend to concentrate. These analysts make judgments regarding expected earnings as a function of management, product, organization and financial structure.

The other form of risk is systematic which cannot be mitigated. Systematic risk factors would include the overall state of the economy, unanticipated inflation, energy shocks and political changes. According to portfolio theory, since an investor can diversify away unsystematic risk, the return on any one security should reflect that security's sensitivity to macroeconomic conditions. Whether its a single factor model such as the CAPM, or a multi-factor model such as APT, an investor will only be compensated for bearing systematic risk.

It seems that many of the same types of risk borne by a common stock investor are also borne by a commercial real estate investor. For example, three components of unsystematic risk for a common stock are management capability, product differentiation and capital structure. Most types of commercial real estate carry these risks as well. As has become apparent in the overbuilt markets across the country, successful commercial real estate projects require strong management. To put in place the elements for a well managed property--such as an effective tenant relations program, innovative leasing strategy, regular maintenance regimen and cost control program--requires good organizational and motivational skills. However strong a property's management, a

successful project must still differentiate itself as does any other product. Location, age, design and construction quality are vital for any property. Finally, a property owner, theoretically, has the same options regarding capital structure as does the financial manager of a company. The amount and type of debt placed on a property have the same effect they would for company--magnifying the returns in good times and exacerbating the losses in bad times. It appears that fundamentally, owning commercial real estate is similar to owning a business; qualitatively, it seems commercial real estate equity should behave much like a common stock.

Assuming this is true, commercial real estate shares systematic risks similar to those which effect common stocks. Since any commercial property depends on its tenants, then economy wide macroeconomic factors should effect commercial real estate as they effect common stock. Just as the state of the economy changes a stock's market capitalization rate, so should the same changes alter the discount rate for commercial property. Changes in interest rates can send the stock market up or down on what it portends for the economy--by the same token, interest rate changes should also produce similar reactions in commercial real estate, being dependent on the economy. Viewed in this light, it seems commercial real estate should be much more correlated with the stock market than current return series indicate.

Given the similarities between unsecuritized real estate and common stock, we can use equity REIT returns to provide return information on real estate. Contrary to what many in the real estate industry believe, equity REITs are real estate. An article by Hartzell, et al, implicitly comes to the same conclusion. In their article, Hartzell, et al, state that "Equity real estate has the same attributes as common stock." [15] They proceed to estimate the duration for unsecuritized real estate by adapting the dividend discount model used for calculating the duration for common stocks. They found that appraisal-based returns yield "duration levels of zero." Equity REIT returns, on the other hand, had durations of between two to four years, while unsecuritized commercial real

estate, depending on the average lease term, had durations ranging from .06 years to 14.3 years. The similarity of the durations for unsecuritized real estate and equity provide further support for using equity REITs to price unsecuritized real estate.

## **2.4 Systematic Factors Unique to Commercial Real Estate**

In spite of all the similarities between commercial real estate, stocks and bonds, real estate is exposed to systematic risks to which the other assets are not.<sup>8</sup> Such risks originate from the physical nature of real estate; it is a highly durable asset with almost complete spatial fixity. This exposes it to two systematic risk factors. First of all, any large scale change in supply takes years to work its way through the system. Office buildings provide a case in point. The tremendous influx of capital to finance office buildings in the 1980's lead to overbuilding in almost every single market in the United States. No matter how well the economy performs, the tremendous supply of vacant space will harm office buildings returns for years to come. The increased competition for tenants coupled with reduced rents have left owners of older buildings to face continuing rental problems as tenants move to newer projects. Without the increase in office employment that overcame the last office glut in the 1970's, owners of class B and C buildings face the real possibility of massive long term vacancies. If a only a few older buildings in a limited number of markets faced this problem, one could conceivably

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<sup>8</sup>One item must be noted in any discussion of systematic risk. The theoretical system is a global one. After all, a person can easily invest in financial markets throughout the world, therefore, an investor should not be compensated for bearing risk specific to any one country. This concept is often overlooked in when deriving costs of capital. Most techniques specify systematic risk as United States systematic risk without accounting for the fact some of this risk could be diversified away with a global portfolio. It is understandable how this mistake gets made--the U. S. economy is so large it is difficult not to think of it as "the system". Nevertheless, not including the global economy when defining systematic risk ignores today's reality.

attribute the plight of these buildings to unsystematic risk factors. However, the oversupply of office space is so widespread that the leasing risk encountered in older buildings cannot be diversified away. The durability of real estate makes supply shocks a source of systematic risk unique to real estate.

A second type of real estate systematic risk comes from demographic and technological changes. Large regional malls provide the example in this case. For forty years after World War II, developers and owners of regional malls enjoyed great profitability as American shopping and living patterns changed. Downtown shopping districts gave way to malls, anchored by department stores, located near the suburban homes of the middle class. Now, American shopping tastes seem to be changing again--this time away from malls and toward "power centers"--collections of discount retailers housed in large (80,000+ sq. ft.) buildings. If this trend progresses, it will leave the owners of malls with an asset that has become functionally obsolescent and which will certainly not provide the return investors anticipated when they bought such properties. The failure of such properties will not be due to issues of quality, management or location, but rather to fundamental changes in shopping patterns. Functional obsolescence is a systematic risk to which only an asset as durable as real estate is exposed. Given that there are few--if any--assets as durable as real estate, I think it is fair to say that shifts in lifestyle patterns constitute a systematic risk to real estate not shared by other financial assets.

Giliberto [13] tested equity REIT returns for the presence of such a factor. He regressed the residuals from an equity REIT portfolio against the residuals of the FRC-NCREIF index after removing stock, bond and seasonal factors from each series. He used the following equation for determining the residuals:

$$R_{i,t} = \alpha + \beta_1 R_m + \beta_2 R_b + D_i + \epsilon_k$$

where

$R_{i,t}$  = return for asset  $i$  in quarter  $t$

$R_m$  = the stock market return

$R_b$  = the bond market return

$D_i$  = Dummy variable for quarter  $i$

$\varepsilon_k$  = error term

Giliberto found that significant correlation existed between the current FRC residuals and the current and lagged equity REIT residuals. The highest correlations occurred between the current FRC residuals and the one and two period lagged REIT residuals (.45 and .43 respectively) which makes sense since it seems likely that appraisals lag the market by three to six months. Regressing the FRC-NCREIF residuals and the lagged ( $t$ ,  $t-1$ ,  $t-2$ ,  $t-3$ ) equity REIT residuals produced an  $R^2$  of 47% which he interpreted as an indication that REIT returns provide information on the underlying real estate market.

Two aspects of Giliberto's study have great impact on its validity. First of all, Giliberto chose the S&P 500 as the stock market proxy despite the fact that most REITs are considered small stocks. The components in the REIT residuals which he claims are real estate factors may in fact be small stock factors which the S&P 500 do not explain. Secondly, Giliberto, by regressing REIT residuals against residuals from the FRC-NCREIF index assumes that an appraisal-based index accurately reflects real estate returns. As this paper has explained, appraisals are not reliable indicators and their use casts doubts on the robustness of Giliberto's results. Nevertheless, Giliberto took an interesting tack; accurately implementing his methodology however, requires the development of a better return series for unsecuritized real estate (which does not utilize equity REITs).

## 2.5 Conclusion

The reliance on appraisal-based return series have led real estate researchers and practitioners to conclude commercial real estate is negatively correlated with bonds and stocks. However, this flies in the face of research which suggests otherwise. For example, Froland demonstrated that capitalization rates for commercial real estate are functions of returns in the bond and stock markets. This fact, combined with the qualitative similarities shared by commercial real estate, bonds and stocks suggest their returns should be positively correlated. The existence of smoothing in the appraisal-based returns typically used to calculate the correlation between real estate and other assets classes seriously undermines the validity of conclusions reached with appraisal-based series. Recent efforts by Ross & Zisler and Fisher, Geltner & Webb to correct for appraisal smoothing have produced return series with a volatility characteristic of securitized investments. Finally, the synthetic index created by Fisher, Geltner & Webb shares the same general trend as the NAREIT equity index. This finding, along with the others previously mentioned, strongly implies the NAREIT equity index is the best available proxy for unsecuritized commercial real estate. Using equity REIT returns should therefore, provide robust cost of capital estimates.

**CHAPTER THREE**

This chapter develops a model for using equity REIT returns for the derivation of a discount rate for unsecuritized real estate. The model utilizes an arbitrage pricing model framework as suggested by Giliberto [12] for deriving the sensitivities of real estate to different factors. Rather than use factors such as those of Chen, Ross and Roll, [5] this model opts for stock, bond and real estate market indices to serve as proxies for the actual underlying economic factors. Recognizing that the use of indices sacrifices some of the explanatory power of the APT, the model does so because indices provide a practical means to derive the appropriate risk premia.

### **3.1 The Model**

According to the Arbitrage Pricing Theory, the return for an asset is a linear combination of the risk free rate plus risk premia for the asset's sensitivity to various economic factors; although, it does not specify what those factors are. Consequently, a great deal of research has gone in to identifying the proper macroeconomic agents. Difficulties in testing the APT arise because not only must the factors be estimated, but then one must also measure the corresponding risk premium for the factors.

Researchers have employed two basic approaches to test the APT. The first method, exploratory analysis, uses a step by step procedure where different models are regressed against a portfolio. Each model has one more factor so that a large increase in the power of the model signifies that the marginal contribution of the added factor is important. Unfortunately, such tests have not been very successful. In their study, Lehman and Modest [18] conclude that this method "provide[s] very little information regarding the number of factors which underlie the APT. As the analysis suggests, the tests have little power to discriminate among models with different numbers of factors." In addition, "it has been difficult to demonstrate significant risk premiums on the factor portfolios that are constructed from this analysis." [1]

The second approach to testing the APT is to identify specific factors, construct portfolios which should hedge the risk caused by those factors, test the hedging effectiveness of the portfolios and then estimate risk premium associated with these portfolios [1]. Using this method, Chen, Roll and Ross [5] identified four relevant factors. These are (1) unanticipated changes in industrial production (2) unanticipated changes in the risk premia demanded for corporate bonds, (3) unanticipated changes in interest rate and the term structure and (4) unanticipated changes in inflation. The procedure for conducting these tests is complex. First, various portfolios of stocks are constructed. Next, the factors betas are estimated by regressing the returns for each portfolio (using the prior 60 months) using the following equation:

$$r = \alpha + \beta_{MP}MP + \beta_{UI}UI + \beta_{UPR}UPR + \beta_{UTS}UTS + \varepsilon(3.1)$$

where

$\beta_i$  = sensitivity of asset i to factor k

MP = monthly growth rate in industrial production

UI = changes in unanticipated inflation

UPR = changes in risk premium between bonds

UTS = changes in the term premium (between long and short term government bonds)

They then make a second pass regression to estimate the factor premiums using this equation:

$$r = \gamma_0 + \gamma_{MP}\beta_{MP} + \gamma_{UI}\beta_{UI} + \gamma_{UPR}\beta_{UPR} + \gamma_{UTS}\beta_{UTS} + e(3.2)$$

where  $\gamma$  = the risk premium for factor i.

This approach is cumbersome. It requires gathering a great deal of data and then manipulating it into a usable form. While appropriate for an academic study or large institutions, I fear the process is too involved for widespread practical use. In order to circumvent the difficulties with using the APT with macroeconomics factors, one can substitute market indices as proxies for the underlying macroeconomic factors. What economic integrity the use of indices sacrifices, the model gains from using indices because they are readily available and provide easily measured risk premia.

The pricing model uses three factors: a stock market index such as the S & P 500 or NYSE small stock index, a bond market index such as the Lehman Bros. Corporate/Government Index and a real estate index such as the FRC-NCREIF index. In so doing, it incorporates an implicit assumption that these markets are at least partially segmented and therefore each possesses a certain amount of systematic risk unique to that asset type. The implications of these assumptions will be explored later in the chapter.

The expected return on an asset then, should consist of the risk free rate plus premia for the sensitivity of the asset to these factors according to the following equation:

$$r = r_f + \beta_{sm}(r_{sm} - r_f) + \beta_b(r_b - r_f) + \beta_{re}(r_{re} - r_f) \quad (3.3)$$

Where

$\beta_i$  = sensitivity of asset i to factor j.

$r_{sm}$  = return on stock market index

$r_b$  = return on bond index

$r_{re}$  = return on real estate index

$r_f$  = return on the risk free asset

Given (3.3), it should be relatively simple to perform the regressions to arrive at estimates of the factor betas. Unfortunately, real estate trades infrequently and Dimson [6] has demonstrated that assets subject to infrequent trading will exhibit biased betas.

Thinly traded shares tend to exhibit downward biased betas while frequently traded shares have upwardly biased betas. Although his work referred to stocks, I think it appropriate to adapt his methodology to real estate. Dimson demonstrated that one could obtain "true" estimates of beta by regressing an assets returns against leading, current and lagged market returns. The resulting betas are then summed to produce a "consistent" beta estimate. More formally,

$$\hat{\beta} = \sum_{k=-n}^n \hat{\beta}_k \quad (3.4)$$

where

$\hat{\beta}$  = the unbiased estimate of beta

$\hat{\beta}_k$  = estimate of beta at time n

In order to apply this technique to the real estate factor, it becomes necessary to separate that component from the stock and bond returns. Therefore (3.3) is modified to:

$$r = \alpha + \beta_{sm}(r_{sm} - r_f) + \beta_b(r_b - r_f) + e \quad (3.5)$$

If commercial real estate is subject to systematic factors, the residual should now exhibit them. Consequently, the residuals from (3.5) can be used to estimate an asset's beta to real estate systematic risk according to Dimson's procedure with the equation:

$$e_{i,t} = \alpha + \hat{\beta}_{t-1}(r_{re,t-1} - r_{f,t-1}) + \hat{\beta}(r_{re,t} - r_{f,t}) + \hat{\beta}_{t+1}(r_{re,t+1} - r_{f,t+1}) + \epsilon \quad (3.6)$$

where

$r_{re,t}$  = return of real estate index at time t

$r_f$  = the risk free return

$e_{i,t}$  = the error term from equation (3.5) for asset  $i$  at time  $t$ , and

$\varepsilon$  = the error term

Recall from (3.3) that

$$\hat{\beta} = \sum_{t=-1}^{+1} \hat{\beta}_t$$

so,

$$\hat{\beta} = \sum_{t=-1}^{+1} \hat{\beta}_t \quad (3.7)$$

The real estate beta can then be used in equation (3.3) so that for any asset  $i$ :

$$E\{r_i\} = r_f + \beta_{sm}(r_{sm} - r_f) + \beta_b(r_b - r_f) + \hat{\beta}_{re}(r_{re} - r_f) \quad (3.8)$$

This process assumes that the real estate index used is transaction based. Since the two major indices currently available (PRISA and FRC-NCREIF) are appraisal based, one must correct for the correlation the use of appraisals introduces into these series. In addition, drawing upon the findings of Liu, et al, [19] to make the assumption that real estate may be partially integrated with the bond and stock markets, one must also remove the effects of those markets from the return series. Using the method suggested by Giliberto, the appraisal based index is regressed on the following equation:

$$r_{re} - r_f = \alpha + \beta_{sm}(r_{sm} - r_f) + \beta_b(r_b - r_f) + D_i + e \quad (3.9)$$

where

$r_{re}$  = return from the appraisal based real estate index

$r_{sm}$  = return from the stock market index

$r_b$  = return from the bond index

$r_f$  = the risk free return

$D_i$  = a dummy variable for the quarter where most outside appraisals occur (for the FRC-NCREIF) this would be the fourth quarter )

$e$  = the error term

The residuals from equation (3.8) should contain the real estate systematic risk factor substituting them for the market return in equation (3.6) gives:

$$e_{i,t} = \alpha + \hat{\beta}_{t-1}(e_{re,t-1}) + \hat{\beta}_t(e_{re,t}) + \hat{\beta}_{t+1}(e_{re,t+1}) + \varepsilon \quad (3.10)$$

where

$e_{i,t}$  = residual of equation (3.5) at time t

$e_{re,t}$  = residual from equation (3.8) at time t

The beta estimates so obtained are then summed and substituted into the  $\beta_{re}$  term in equation (3.3) in order to arrive at the appropriate discount rate for an asset.

The three factor model can be adapted to account for the effect of leverage in a fashion similar to that used in the case of a one factor model. A one factor model draws upon the Modigliani-Miller proposition regarding the irrelevance of capital structure to show that beta of an asset is simply a weighted average of that assets debt and equity betas:

$$\beta_{asset} = \frac{D}{V} \beta_{debt} + \frac{E}{V} \beta_{equity} \quad (3.11)$$

where

E = market value of equity

D = value of debt, often taken as book value

V = E + D

Assuming  $\beta_{\text{debt}} = 0$ , (3.11) becomes

$$\beta_{\text{asset}} = \frac{E}{V} \beta_{\text{equity}} \quad (3.12)$$

The assumption that  $\beta_{\text{debt}} = 0$  is an important one and should be made with care. One can assume the debt beta is zero, if there is sufficient cash flow so the debt holders are absolutely sure their debt will be paid. In other words, the risk premium that debt commands over treasuries must be predominantly due to inflation, reinvestment or horizon risks, not credit risk. As the credit portion of the debt's risk premium increases, continued assumption of a zero debt beta will produce upwardly biased estimates of the equity beta. That is, keeping the debt beta zero forces the equity portion of the asset to carry components of systematic risk actually held by the debt holders. If this occurs, it will produce an improperly high cost of equity capital. Given the relatively high debt levels associated with commercial real estate (often in excess of 75%), it is important not to blindly assume the debt beta will be zero.

If the approach specified in equation (3.11) is expanded to fit the three factor model the various factor betas for an asset should also be weighted averages of the debt and equity betas.

$$\beta_{sm,a} = \frac{D}{V} \beta_{sm,d} + \frac{E}{V} \beta_{sm,e} \quad (3.13)$$

$$\beta_{b,a} = \frac{D}{V} \beta_{b,d} + \frac{E}{V} \beta_{b,e} \quad (3.14)$$

$$\beta_{re,a} = \frac{D}{V} \beta_{re,d} + \frac{E}{V} \beta_{re,e} \quad (3.15)$$

The simplicity of the relationship between the beta of an asset and the betas of its debt and equity provide a useful tool to correct for the effects of leverage when deriving a discount rate. Since it is unlikely that the capital structure of any particular equity REIT will match the capital structure of an unsecuritized piece of real estate equations (3.11-3.13) enable one to "unlever" the REIT to obtain an estimate of the betas for the underlying asset. Once this is accomplished, the asset beta can then be "relevered" to match the expected debt and equity levels of the property in question.

### 3.2 Conclusion

The three factor model provides the framework for a real estate investor to price systematic risk factors which influence real estate returns. Implementation of the model depends on the assumption that equity REIT returns provide acceptable estimates for commercial real estate returns. Although the model uses the Arbitrage Pricing Theory as its foundation, in its form it resembles a multi-factor CAPM. That is, it calculates expected real estate returns as a linear combination of a commercial real estate asset's sensitivity to bond, stock and real estate markets using return indices to proxy for these markets. Its explicit incorporation of all the factors affecting real estate should produce

robust cost of capital estimates which in turn, will allow real estate investors to make better investment decisions.

**CHAPTER FOUR**

The validity of the three factor model can only be only be ascertained by using it to price an asset. However, before this can be done, one must decide what is an appropriate index for representing real estate. If one accepts the various arguments that appraisal based return series do not accurately reflect commercial real estate then it is inconsistent to use such an index in the three factor model. The next logical choice would be to use a market based series such as the NAREIT equity REIT index but this is problematic; since I have postulated that REIT residuals should contain any unique real estate risk factors, it is not valid to use an equity REIT index as an independent variable in a regression equation. What is needed to test REIT residuals is a non-securitized index that is "unsmoothed". I have attempted to construct such an index by capitalizing the FRC income series with capitalization rates published by the American Council of Life Insurance. The first part of this chapter summarizes my methodology for creating this index and compares this synthetic index to the FRC-NCREIF data. Part two summarizes tests of the three factor model while part three provides a case study in deriving a discount rate for a hypothetical shopping center located in the mid-Atlantic region of the United States. The final part of this chapter presents a tangential issue; attempts to replicate Giliberto's [13] findings that a relationship exists between the residuals from equity REITs and the FRC-NCREIF index suggest that this relationship stems from a small stock factor not found in the S&P 500 rather than from a real estate factor.

#### **4.1 "Volatilizing" the FRC-NCREIF Index**

Given that appraisals may seriously understate the volatility of commercial real estate, the residuals in an appraisal based index may not capture the systematic risk that I am postulating exists for commercial real estate. Unfortunately, as I have already discussed, the commercial real estate market forces one to use an appraisal based index.

I have tried to overcome this problem by "volatilizing" the FRC-NCREIF index. I constructed a new index by converting the income component of the FRC-NCREIF to a dollar value. I then capitalized that amount by an equally weighted average of ACLI capitalization rates to arrive at a new market value for the index. I selected the cap rates for the property size which corresponded to the average size property for the FRC-NCREIF for that quarter. For example, if the average size industrial property in the FRC-NCREIF index for the first quarter of 1978 was \$2,500,000, then I chose the cap rates for industrial properties valued between \$1,000,000 and \$3,999,999. I then used the values implied by the ACLI cap rates to construct a holding period return:

$$r = \frac{V_t + D_t - V_{t-1}}{V_{t-1}} \quad (4.13)$$

where

$r$  = quarterly holding period return

$V_t$  = capital value at time (t)

$V_{t-1}$  = capital value at time (t-1)

$D_t$  = income at time (t)

My methodology raises some problems since it fails to correct the timing of the income as the FRC-NCREIF index attempts to do. In addition, as it is a derivative of the FRC-NCREIF index, it is vulnerable to any reporting error which that series may possess. Finally, the ACLI cap rates are averages for properties located throughout the country. As such, they do not correspond with the locations of the properties included in the FRC-NCREIF index and may misrepresent the appropriate cap rates for those properties. In spite of these problems, this method has the advantage of producing a return series that is transaction based. Admittedly, it is not the same as having a true transaction series, but I

think it provides a better glimpse of the return structure for commercial real estate than the current appraisal based series.

TABLE 4.1 - DESCRIPTIVE STATISTICS  
(Quarterly Data)

	Mean Return	Standard Deviation	Minimum Value	Maximum Value
FRC- NCREIF	2.57%	1.60%	- 1.64%	6.43%
FRC/ACLI	2.06%	6.12%	-14.20%	20.30%
Equity REITs	3.63%	7.11%	-14.60%	22.70%
Small Stocks	5.07%	11.50%	-28.50%	25.10%
S&P 500	4.07%	8.22%	-22.70%	21.30%
Lehman Index	2.57%	4.57%	- 8.35%	18.10%
T-Bills	2.18%	0.63%	1.37%	3.77%

Sources: National Association of Real Estate Investment Trusts, National Council of Real Estate Investment Fiduciaries and Ibbotson Associates Stocks, Bonds, Bills and Inflation 1990 Yearbook and Author's calculations.

TABLE 4.2  
CORRELATIONS  
(Quarterly Data)

---

	R-N Index	FRC/ ACLI	Equity REITs	Small Stocks	S&P500	Lehman Index	T-Bills
FRC- NCREIF	1.000						
FRC/ ACLI	-.163	1.000					
Equity REITs	.0317	.2662	1.000				
Small Stocks	-.0642	.2964	.7444	1.000			
S&P500	-.1401	.2586	.7083	.8127	1.000		
Lehman Index	-.2910	.3420	.4019	.2342	.3355	1.000	
T-Bills	.4957	.0200	-.0446	-.0516	-.1556	.0768	1.00

---

Source: Author's calculations.

Table 4.1 provides the descriptive statistics for the returns on the FRC-NCREIF index, the derivative series (FRC/ACLI index), and other financial series. The volatility between the two real estate series is immediately apparent. While the FRC-NCREIF index has mean quarterly return of 2.576% and standard deviation of 1.599%, the FRC/ACLI index has a mean quarterly return of 2.062% and standard deviation of 6.12%. The volatility of the FRC/ACLI series far more closely resembles that of bonds than that of the FRC-NCREIF.

One of the most interesting results is the similarity between the NAREIT equity index and the FRC/ACLI series. The two series have almost the same standard deviations and maximum & minimum values. However, the quarterly mean return for FRC/ACLI of 2.06% is significantly less than the equity REIT index's mean of 3.63%. In addition, one would expect the series to be more highly correlated than they are.

One reason for the low correlations could be a lag in the time the ACLI cap rates incorporate changes in the capital markets. Often mortgage agreements are negotiated months prior to the actual closing of the loan. It is possible the ACLI data reflects cap rates from the previous quarter. If this were the case, greater correlations should occur between current the FRC/ACLI and lagged REIT returns. Unfortunately, the correlations under this scenario did not behave as postulated; indeed, they were actually lower.

Another possibility for the relatively low correlation between the FRC/ACLI series and the NAREIT index is measurement error introduced by the FRC data. The FRC/ACLI index is a total return series. The income portion is based on the income percentage return of the underlying FRC-NCREIF index which is then multiplied by the previous quarter's FRC-NCREIF to produce an dollar value. Since the income portion of the FRC-NCREIF is based on the total FRC-NCREIF index it is almost always a constantly increasing amount. The income component would tend to dampen the swings in the FRC/ACLI index caused by changes in cap rates. This could be sufficient to throw

the FRC/ACLI series out of phase with the equity REIT index thereby reducing the correlation between the series.

The FRC/ACLI index performed poorly compared to all other securitized investments. It under performed T-Bills from 1978 through the first quarter of 1991.<sup>1</sup> Although much of the under performance relative to T-Bills can be accounted for by removing the 14% drop in the first quarter of 1991, this statistic seems intuitively correct. It seems logical that the general decline in the commercial real estate market since 1990 has wiped out the decade's earlier gains. In retrospect, it is reasonable to assume the average investor in commercial real estate would have fared better if he had kept his money in T-Bills.

The volatility in the FRC/ACLI index tends to support the qualitative similarities between bonds, common stock and real estate discussed in chapter three. The relationship between the return series is best demonstrated graphically. Graphs 4.1 to 4.6 plot the FRC-NCREIF and FRC/ACLI indices against the Lehman bond index, the NYSE small stock index, the NAREIT equity Index and each other. These graphs confirm that real estate, as measured by the FRC/ACLI index, exhibits a greater correlation with stocks and bonds than the FRC-NCREIF index.

Table 4.2 provides the correlation matrix between the return series. As the graphs demonstrate, positive correlations exist between the FRC/ACLI returns and the stock & bond markets. The FRC/ACLI returns have a correlation coefficient with the Lehman bond index, the NYSE small stock index and the S&P 500 index of .3420, .2964 and .2586 respectively. This finding stands in stark contrast to the correlations between the FRC, bonds and stocks. The FRC-NCREIF returns have a correlation coefficient of -.291 with the Lehman index, -.0642 with the small stock index and -.1401 with the

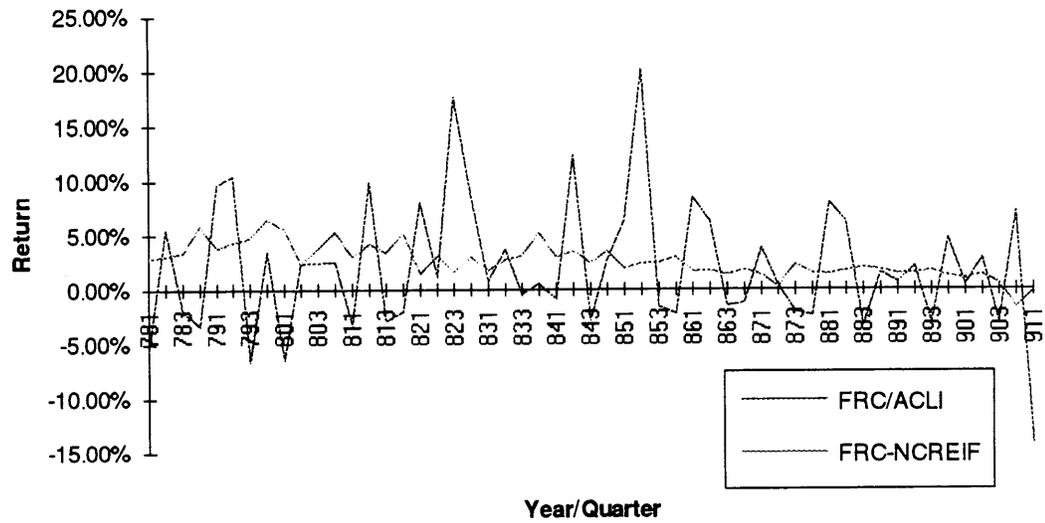
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<sup>1</sup>This ignores the considerable tax benefits real estate enjoyed prior to the 1986 Tax Reform Act.

S&P 500. The different correlations that the two real estate indices have with the stock and bond indices indicate how severely an appraisal based series may underestimate the correlation real estate has with other financial instruments. The correlations between the FRC/ACLI returns, and small stocks may also help to explain the puzzling phenomenon of REITs. Typically, researchers have failed to provide a good explanation of why equity REIT returns should behave so radically different than usecuritized real estate. The usual explanation is that REITs are similar to a close end mutual fund and therefore exhibit the same discounts or premiums to underlying asset values which characterize closed end funds. The FRC/ACLI returns suggests that perhaps the difference between unsecuritized real estate and equity REITs is not as great as indicated by the FRC-NCREIF index.

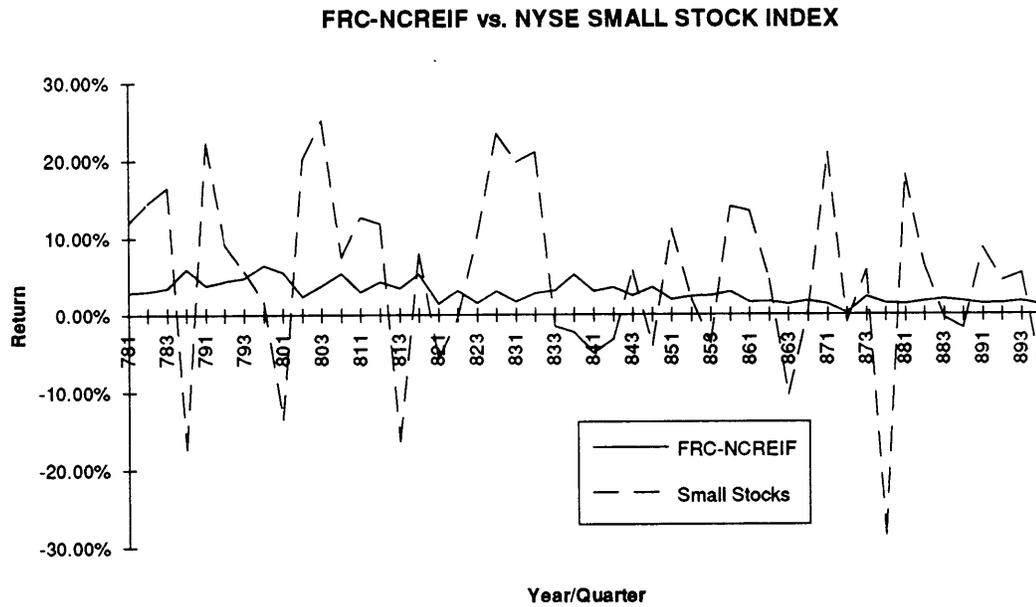
FIGURE 4.1

## FRC-NCFREIF vs. FRC/ACLI - Total Return



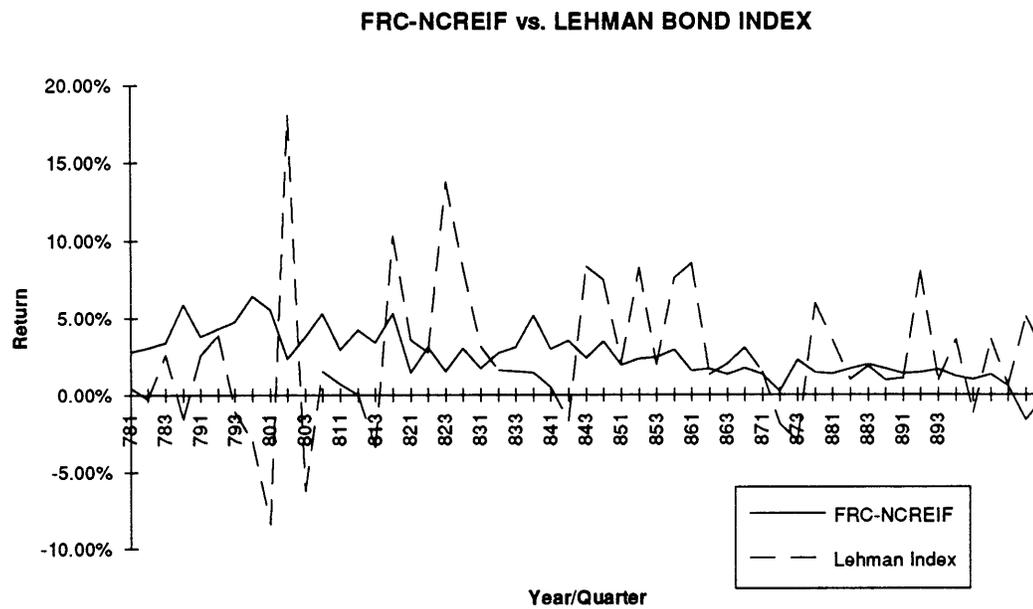
Source: National Council of Real Estate Investment Fiduciaries, American Council of Life Insurance and Author's calculations.

FIGURE 4.2



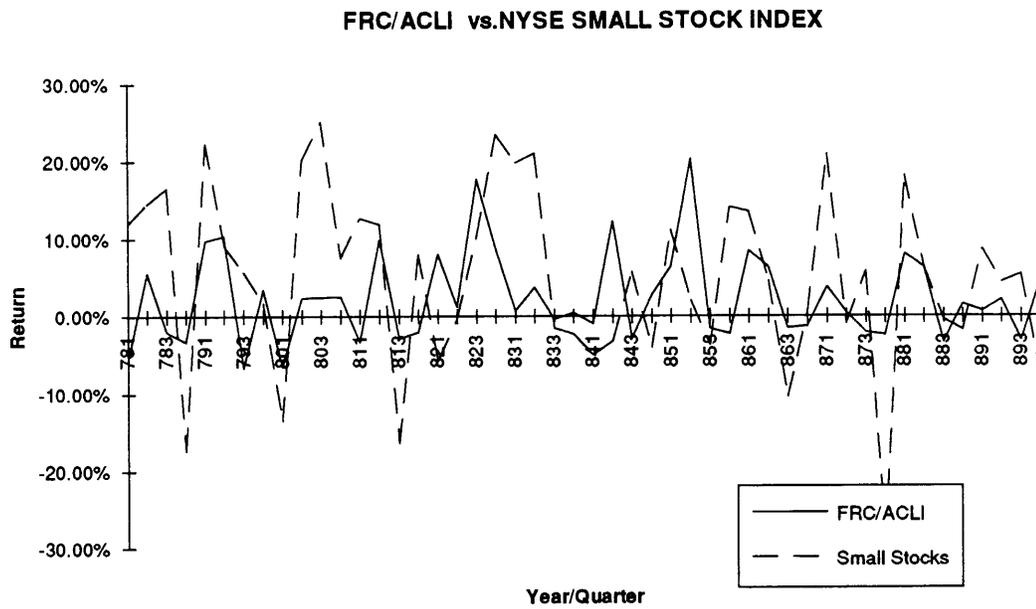
Sources: National Council of Real Estate Investment Fiduciaries and Ibbotson's Stocks, Bonds, Bills and Inflation 1990 Yearbook.

FIGURE 4.3



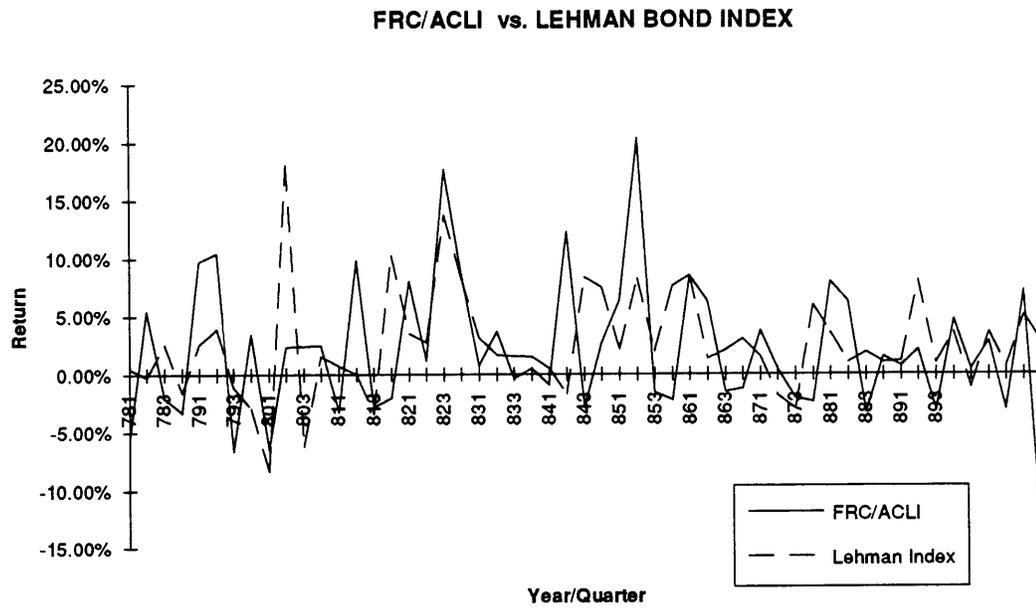
Source: National Council of Real Estate Investment Fiduciaries, American Council of Life Insurance.

FIGURE 4.4



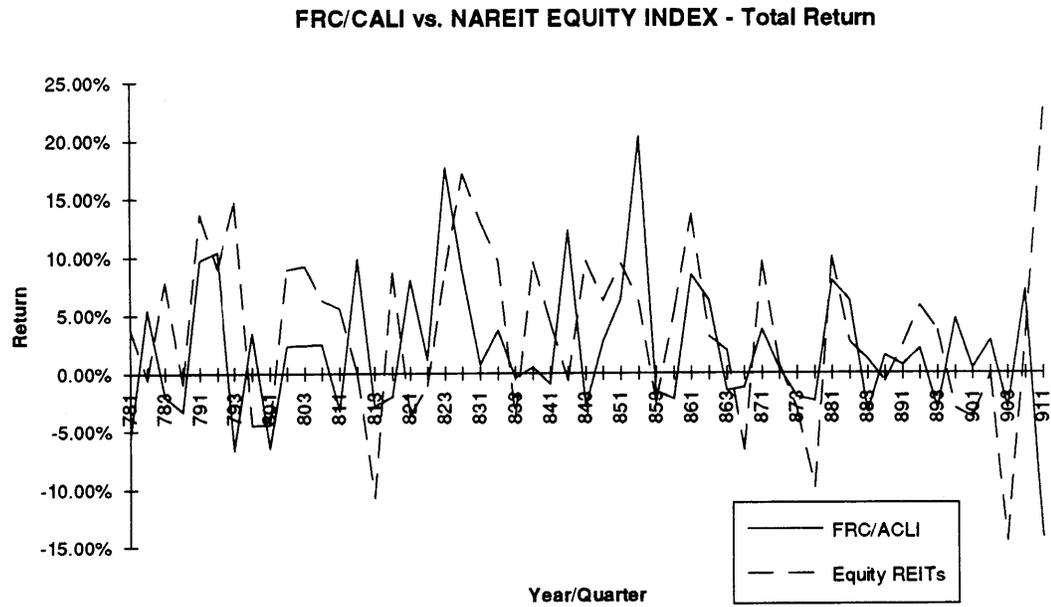
Source: National Council of Real Estate Investment Fiduciaries, American Council of Life Insurance and Author's calculations.

FIGURE 4.5



Source: National Council of Real Estate Investment Fiduciaries, American Council of Life Insurance and Author's calculations.

FIGURE 4.6



Source: National Council of Real Estate Investment Fiduciaries, American Council of Life Insurance, National Association of Real Estate Investment Trusts and Author's calculations.

## 4.2 Testing the Three Factor Model

The tests of the three factor model involve a two step process. Step one tests for the significance and sensitivity of stock and bond market factors in equity REIT returns. The second step test for the presence of a real estate factor in the equity REIT residuals.

Assuming that equity REITs provide an adequate proxy for commercial real estate, and that commercial real estate shares characteristics with bonds and stocks, an APT model dictates that the premium for a REIT is a linear combination of its sensitivities to stock and bond factors. I regressed the equity REIT premia on the premia for the NYSE small stock index and the Lehman Corporate/Government bond index:

$$r_{reit,t} - r_{f,t} = \alpha + \beta_{ss,t}(r_{ss,t} - r_{f,t}) + \beta_{b,t}(r_{b,t} - r_{f,t}) + \varepsilon \quad (4.1)$$

where,

$r_{reit,t}$  = realized return on the equity REIT portfolio at (t)

$r_{ss,t}$  = realized return on the NYSE small stock index at (t)

$r_{b,t}$  = realized return on Lehman bond index at time (t)

$r_{f,t}$  = the risk free rate at time (t)

$\beta_{r,ss}$  = the REIT portfolio's sensitivity to the small stock factor

$\beta_{r,b}$  = the REIT portfolio's sensitivity to the bond factor, and

$\varepsilon$  = the error term

Accordingly, the null hypotheses are:

$$H_{00}: \beta_s = 0$$

$$H_{a0}: \beta_s \neq 0$$

and

$$H_{01}: \beta_b = 0$$

$$H_a: \beta_b \neq 0$$

To test for the hypothesized presence of systematic real estate factors in the error term above, I controlled for stock and bond influences in the FRC/ACLI index by regressing that index on the small stock and bond portfolios.

$$r_{RA,t} - r_{f,t} = \alpha + \beta_{RA,s}(r_{SS,t} - r_{f,t}) + \beta_{RA,b}(r_{b,t} - r_{f,t}) + \varepsilon \quad (4.2)$$

where,

$r_{RA,t}$  = realized return on the equity REIT portfolio at (t)

$r_{SS,t}$  = realized return on the NYSE small stock index at (t)

$r_{b,t}$  = realized return on Lehman bond index at time (t)

$r_{f,t}$  = the risk free rate at time (t)

$\beta_{RA,ss}$  = the REIT portfolio's sensitivity to the small stock factor

$\beta_{RA,b}$  = the REIT portfolio's sensitivity to the bond factor, and

$\varepsilon$  = the error term

Next, I regressed the error term from (4.1) on the error term from (4.2):

$$\varepsilon_{reit,t} = \alpha + \beta_{reit,FA} \varepsilon_{FA} + \mu \quad (4.3)$$

where

$\varepsilon_{reit,t}$  = residual from equation (4.1) at time (t)

$\varepsilon_{FA,t}$  = residuals from (4.2) at time (t)

$\beta_{reit,FA}$  = sensitivity of  $\varepsilon_{reit,t}$  to  $\varepsilon_{FA,t}$

$\mu$  = the error term

If there is not a common real estate factor in these residuals than:

$$H_{02}: \beta_{\text{reit,FA}} = 0$$

$$H_{a2}: \beta_{\text{reit,FA}} \neq 0$$

The results of these regressions are displayed in Table 4.3 and 4.4.

**TABLE 4.3 Regression Results**  
**First Quarter 1978 to Fourth Quarter 1989**

$$r_{i,t} - r_{f,t} = \alpha + \beta_{i,ss}(r_{ss,t} - r_{f,t}) + \beta_{i,b}(r_{b,t} - r_{f,t}) + \varepsilon$$

Dependent Variable	$\alpha$ (t stat)	$\beta_{ss}$ (t stat)	$\beta_b$ (t stat)	Adj. R <sup>2</sup>
Excess Returns on				
NAREIT Equity Index	.0044 (0.71)	.388* (7.20)	.337* (2.54)	.60
FRC/ACLI Index	-.0026 (-0.33)	.118 (1.67)	.357* (2.06)	.134

\*significant at the 5% level

**Table 4.4**  
**Regressions of error terms**  
**First Quarter 1978 to Fourth Quarter 1990**  
**(T-statistics in parenthesis)**

$\varepsilon_{\text{reit},t} = 0.00 - .0227\varepsilon_{\text{FA},t} + \mu$
$(0.00) \quad (0.20)$

These results suggest that factors influencing bonds and small stocks also influence commercial real estate. It is unlikely that a causal relationship exists between small stocks and bonds in respect to real estate. Rather, the betas probably reflect the sensitivity of equity REITs to the same factors which influence stock and bond prices.

Interestingly, a real estate factor is not present in the REIT residuals. There are several possible explanation for this result. The first, and most obvious, is that real estate does not possess systematic risk factors. A second explanation is that the FRC/ACLI index I constructed is not an accurate representation of commercial real estate returns and therefore is not an appropriate regressor. To see if the FRC-NCREIF index produced a different result, I substituted it or the synthetic FRC/ACLI index and ran the same procedure. I report the results of this test more fully later in section 4.4, however, as with the FRC/ACLI index, the beta coefficient was not significant.

It is not surprising that a real estate factor did not show up in the residuals. A regression equation is only as good as the independent variables used in it. Unfortunately, to conduct a robust test for the presence of a systematic real estate factor in equity REIT returns requires an accurate commercial real estate return series. The lack of robust data forces researchers to jury rig what data they do have in order to better reflect what they perceive to be the reality of the market. My attempt to construct a synthetic series is a case in point (and an unsophisticated one at that). While I believe it offers a better picture of the commercial real estate market than the FRC-NCREIF index, it is not particularly robust. Consequently, a systematic real estate factor may exist in REIT residuals but it cannot be tested until a more accurate return series is developed.

In spite of the limitations with the data, I have found no evidence to support the existence of pricing factors in REIT residuals; it makes no sense to use a model designed to price a factor that is not there. It appears then, that only the small stock and bond factors are relevant when deriving a discount rate from equity REIT returns. In the next section, I use this approach to see what discount rate my model produces.

### 4.3 CASE STUDY - Deriving A Discount Rate

Let's assume it is the first quarter of 1990 and we are contemplating the purchase of a neighborhood shopping center in a mid-Atlantic state that is anchored by a supermarket and a drug store. We have already created our ten year cash flow projections--now we need to derive the appropriate cost of capital. First we must identify equity REITs whose assets match our acquisition target as closely as possible. Because the amount of real estate owned by REITs is a small percentage of all the commercial real estate assets in the United States, it is unlikely the REITs we find will precisely match our target. Therefore, we must select REITs whose properties most closely resemble the target in terms of type, size and location.

Beta estimates for individual stocks are vulnerable to large sampling errors so it important to identify as many REITs as possible.[2] Reviewing the portfolios of REITs who own properties along the mid-Atlantic coast, we find two REITs--New Plan Realty Trust and Federal Realty Trust--who meet our specifications. Although they own properties in states other than the target region, in addition to holding a few non-retail properties, they are a reasonably good match. This leaves us with only two comparable REITs. To increase the reliability of our estimates, we will also add IRT Property Company. Even though the majority of IRT's properties are in the southeast, it nevertheless predominantly owns shopping centers and the need to increase our sample justifies its inclusion. Table 4.5 summarizes the financial data from our three comparable REITs.

**TABLE 4.5**  
**Selected Financial Data**  
**(12/31/89)\***

	<b>New Plan Realty Trust</b>	<b>Federal Realty Trust</b>	<b>IRT Property Company</b>
# of shares outstanding (1/1/90)	34,845,000	16,347,000	12,212,000
Share Price (1/1/90)	\$18.75	\$22.00	\$12.50
Market Value of Equity	\$653,343,750	\$359,634,000	\$256,321,699
Book Value of Debt	\$ 22,971,259	\$261,068,000	\$103,671,699
Firm Value (Debt + Equity)	\$676,315,000	\$620,702,000	\$256,321,699
Debt/Value	3.4%	42.1%	40.4%
Equity Value	96.6%	57.9%	59.6%

Source: 10-K's.

\*6/30/89 for New Plan.

New Plan and Federal have similar total values although New Plan carries significantly less debt. Federal and IRT have virtually identical debt levels of 42.1% and 40.4% respectively.

Using Ibbotson's *Stocks, Bonds, Bills and Inflation Yearbook* [17], I derived the arithmetic average risk premium for small stocks of approximately 13.8%. Because the Lehman Bros. index is much shorter time series than the small stock data, we also use the Ibbotson yearbook to compute a bond premium of 2.2%.<sup>2</sup>

Using monthly prices from 1/1/1989 to 1/1/90, I then estimated the bond and stock betas for the three REITs. The results of these regressions are summarized in Table 4.6. The beta estimates produced some interesting results. Leverage usually increases beta so one would expect Federal and IRT to share similar small stock betas. Instead, Federal has a small stock sensitivity more closely resembling New Plan--who has less than one-tenth Federal's Debt/Value ratio. This sample is far too small to draw any binding conclusions however, the small stock betas for the REITs deviate markedly from theory.

**TABLE 4.6**  
**Regression Results\***

<b>Firm</b>	<b>Small Stock Beta (t-stat)</b>	<b>Bond Beta (t-stat)</b>	<b>Adj. R<sup>2</sup></b>
New Plan Realty Trust	.522 (5.11)	.227 (1.38)**	.3087
Federal Realty Investment Trust	.480 (5.27)	.341 (2.33)	.3502
IRT Property Company	.727 (6.27)	.109 (0.59)***	.3909

\* All coefficients statistically significant at the 95% confidence level unless otherwise noted.

\*\* P-value of .1729,\*\*\*Not statistically significant

<sup>2</sup>The bond premium is calculated by dividing the total return index from a portfolio of long term corporate bonds by the return index for 30-day T-bills.

The next step requires unlevering the assets. Operating under the assumption leverage affects an asset's sensitivity to systematic risk, it is vital that we derive the asset's factor sensitivities free from the influence of debt. Once the asset's betas have been estimated, it is any easy task to "relever" them to the projected debt level.

Recall equation (3.10):

$$\beta_{\text{asset}} = \frac{D}{V} \beta_{\text{debt}} + \frac{E}{V} \beta_{\text{equity}}$$

where

E = market value of equity

D = value of debt, often taken as book value

V = E + D

Given the relatively low debt levels for all three REITs, I have assumed that the beta for debt equals zero and therefore (3.10) reduces to:

$$\beta_{\text{asset}} = \frac{E}{V} \beta_{\text{equity}}$$

Using (3.10), I calculated the asset betas for the three equity REITs. This step demonstrates why it is vital to find comparable companies whose assets are as closely related to the target as possible. The asset betas calculated for this procedure proxy for the asset in question. If, for example, 50% of Federal Realty's assets were industrial properties and 50% were retail properties, its asset betas would measure the factor sensitivities for a fictional hybrid property. It would be impossible to distinguish the retail from the industrial properties in this beta estimate so using such a beta can lead to spurious conclusions. Unfortunately, few REITs have "pure" asset mixes and so there will always be some spillover from different property types. Nevertheless, enough

REITs specialize by property type that one may be able to find REITs whose assets provide an adequate match to the target.

Unlevering the assets and calculating their mean gives an asset beta for small stock of .405 and .208 for bonds. This means that one can expect an unlevered neighborhood shopping center will demand two risk premiums; one approximately 40% of that required for small stocks and a second that is approximately 21% of that provided by long-term corporate bonds. Assuming a ten year holding period, the appropriate risk free instrument is a ten year treasury bond. At the beginning of 1990, ten year treasuries provided a yield of approximately 7.96% per year, accordingly, we can calculate the expected return for an unlevered neighborhood shopping center:

$$\begin{aligned} E\{r\} &= 7.96\% + (.405 \times 13.8\%) + (.208 \times 2.2\%) \\ &= 7.96\% + 5.59\% + 0.46\% \\ &\approx 14\% \end{aligned}$$

One assumption we consistently made in the above procedure was that the debt beta equaled zero. Is this a reasonable assumption? After all, a zero beta debt implies there is sufficient excess cash flow to insulate the debt from systematic risk. The more highly leveraged an asset (or company) becomes, the more the debt coverage diminishes; the debt increasingly resembles equity and is exposed to systematic risk. Consequently, as debt is placed on a property, its beta to the stock and bond markets should increase. According to Modigliani-Miller propositions I & II (without taxes)<sup>3</sup>, the debt betas

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<sup>3</sup>I have ignored taxes for two reasons. First of all, under the 1986 Tax Reform Act, losses from most real estate activities could no longer be deducted against active income. Second, real estate investments typically are not subject to two levels of taxation. Modification of the M&M arguments to include taxes arise because of corporate taxes. If this layer of taxation is not applicable, there is not a tax advantage to debt.

should increase until, in the limit, they equal the beta of the asset. Let's look at the proposed mortgage for the property. Priced at 9.80%, it carries a risk premium above comparable treasuries of 184 basis points. If the two-factor model holds, then the risk premium is a linear combination of the risk premiums for stock and bond factors. (As the security for the mortgage is the property, the less secure the debt becomes, the more vulnerable it becomes to the systematic risk factors affecting commercial real estate.) This presents a problem in that it leaves us with one equation and two unknowns. Furthermore, It is difficult to perform regressions testing for the sensitivity of the debt to our stock and bond factors because the financial system has not yet securitized commercial mortgages to anywhere near the same extent it has residential mortgages. Without an effective return series for the dependent variable we cannot estimate the betas.

It might be possible to develop estimates for commercial real estate debt betas by studying the cross-sectional behavior of debt betas for equity REITs. However, such a study is beyond the scope of this paper but would prove an interesting topic for future research.

#### **4.4 The Effect of a Small Stock Index on the Residuals of Equity REITs and the FRC-NCREIF Index.**

Because the typical REIT is fairly small [14], using the S&P500 index to remove the stock market influence from equity REIT returns probably does not accurately capture the stock portion of REIT returns. A better test for the presence of real estate factors in the residuals in equity REIT returns should use a small stock index rather than the S&P500. Consequently, I replicated Giliberto's study [13] except using the NYSE small stock index to control for the stock factor.

Recall from chapter two that Giliberto regressed the NAREIT equity REIT index and the FRC-NCREIF index on the S & P 500 index, a bond index and a dummy variable.<sup>4</sup> He then regressed the residuals from the FRC-NCREIF series on the residuals from the equity REIT index. He found that a regression of current and lagged REIT residuals had an  $R^2$  of .47 in explaining the variability of the FRC residuals. He concluded that REIT residuals contained real estate factor(s) in common with unsecuritized real estate.

Table 4.5 summarizes the results of my regressions as well as those performed by Giliberto. In regressing the equity REIT series against the S&P 500 index and the Lehman corporate/government bond index, I produced results consistent with Giliberto. When I regressed the FRC-NCREIF index against these same factors, I produced an  $R^2$  of .09, less than one-half that found by Giliberto. Although, I was able to virtually match Giliberto's results with the residuals. However, running the same procedure with the NYSE small stock index in place of the S & P 500 produced different results. The strong correlations between the residual series were sharply reduced and the  $R^2$  of the regression equation fell from approximately .48 to .115. In addition, the only REIT residual to retain any strong statistical significance was for the current period (t-statistic of 2.07)

These results suggest that the real estate factor(s) which Giliberto attributed to equity REIT residuals was instead a small stock component(s) not found in the S & P 500. In addition to the greatly reduced  $R^2$ , the disappearance of the statistical significance of the lagged equity REIT residuals in predicting current FRC-NCREIF residuals casts further doubts on Giliberto's conclusion regarding links between equity

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<sup>4</sup>For REITs, the dummy variable captured elevated returns in the first quarter due to the "January" effect on small stocks. For the FRC-NCREIF index, the dummy variable was used to pick up the influence of outside appraisals. Giliberto found through empirical testing that this effect was strongest in the fourth quarter.

REITs and unsecuritized real estate (as measured by the FRC-NCREIF index). The lag time necessary for market data to find its way into appraisals suggests that the lagged REIT residuals should be more significant in explaining variations in the FRC residuals than the current period REIT residuals.

While it appears that some relationship exists in the residuals series for REITs and the FRC-NCREIF index, it is not clear that this indicates the presence of systematic risk factors unique to real estate.

**CHAPTER FIVE**

Commercial real estate is a capital asset and to suggest otherwise is unrealistic. Commercial real estate projects compete for capital just like any other investment. Portfolio theory indicates asset pricing reflects the asset's risk which cannot be eliminated by owning a well diversified portfolio so for capital to flow to commercial real estate, it must offer adequate compensation for bearing this risk. The techniques for measuring systematic risk and devising efficient portfolios rely on the real time data provided by securitized assets trading in continuous public markets. In spite of the enormous amount of wealth commercial real estate represents in the United States, the majority of it trades in discontinuous private markets. In an attempt to overcome the resulting lack of real time price information, practitioners have turned to appraisals to develop return series for use in portfolio and pricing models. As appraisals have been shown to be smoothed, the use of appraisal-based return series has led to inaccurate estimates of the risk, portfolio benefits and pricing of commercial real estate. The massive influx of institutional money into commercial real estate and the subsequent unanticipated crash of the commercial real estate market have taught investors the fallacy of relying on appraisals. This has created a dire need for an accurate, real time measure of commercial real estate returns.

Equity REIT returns provide such a time series. Historically, the real estate industry has viewed REITs with suspicion. Trading on securitized markets, REITs have the volatility of stock--a volatility people in real estate claimed did not apply to commercial real estate. What the real estate industry failed to account for was how the high transaction costs of real estate dampened its observed volatility. Unanticipated events affect commercial real estate just like they impact any other capital asset. Transaction costs of several hundred basis points simply prevent commercial real estate investors from acting on these events except in the most extreme circumstances. Recent studies by Geltner and Ross & Zisler have attempted to "volatilize" appraisal-based indices to give a more accurate picture of the "true" returns to real estate. These studies

show unlevered commercial real estate to have a volatility similar to bonds. Recognizing most commercial real estate is substantially levered, and that leverage increases volatility, it is not unreasonable to expect a typical piece of commercial real estate to have a "true" volatility comparable to stocks. The Geltner study demonstrates commercial real estate returns have the same general pattern and depth of movements as the NAREIT equity index. My attempts to "volatilize" the FRC-NCREIF index also showed strong similarities with the NAREIT equity index. The recent work on the volatility associated with commercial real estate, combined with the results of this paper, leads to the conclusion equity REITs provide an usable time series after all.

Studies have shown strong correlations between REIT , small stocks and bonds. This seems intuitively correct; the contractual nature of leases resemble bonds while the potential for appreciation in commercial real estate is similar to a stock. Thinking of real estate in these terms makes one wonder how the notion of real estate as a separate asset class gained such a widespread following. The resemblance of real estate to stocks and bonds suggests that a two factor model which incorporates an asset's sensitivity to small stocks and bonds is an appropriate way to value real estate. The model I have developed in this paper is an attempt to do just that. In the model, the return to commercial real estate is a linear combination of the risk free rate and sensitivity of the asset to stock and bond movements.

Tests of the model show it is valid using equity REIT returns as a proxy for commercial real estate. In a case study of applying the model to derive the required cost of capital for neighborhood shopping center in a mid-Atlantic state, it gives plausible results. However, the model prices equity at a higher rate than is typical for commercial real estate, especially if debt is used on a project. In light of recent experience, the demand imposed on equity returns by the model is a consistent measure of the riskiness of real estate. Perhaps more important, the model graphically demonstrates leverage is not free; its use produces exponentially increasing returns on equity which implies many

real estate practitioners failed to adequately account for the risk involved with even "moderate" debt levels.

Finally, in spite of its similarities with other financial instruments, commercial real estate may have unique systematic risk. The nature of this risk is related to the durability of real estate. With an expected life of decades and complete spatial fixity, a real estate project is exposed to long-term supply, demographic and lifestyle changes that are impossible to diversify. Recent work by Giliberto on the presence of such factors in REIT residuals lead me to initially develop a three factor model designed to specifically account for this risk. Because of the problems with appraisal-based returns, I used the synthetic FRC/ACLI return series to test for the presence of unique real estate factors in REIT residuals. My failure to find evidence of any such factors lead me to duplicate Giliberto's original work. Substituting a small stock index in place of the S&P 500 caused most of the most of the purported relationship between equity REITs and the FRC-NCREIF index to disappear. This suggests that the real estate factor in REIT residuals is really a small stock factor not found in the S&P 500 index.

Do equity REIT returns provide an accurate measure of the commercial real estate market? Ross and Zisler [23] claimed "probably not", but I think that is too hasty of a condemnation. REITs return are the only real time measure of commercial real estate performance available. Much of the real estate industry's reluctance to recognize this stems from the relatively small amount of property held in the REIT format. Few REITs own "institutional" quality properties thereby casting suspicion on their suitability to estimate the cost of capital for such properties. My response is that REITs are the best option available. They provide a macro perspective on real estate; the NAREIT equity index began to decline at the end of 1986--well before the commercial real estate industry felt the depths of its problems. REITs also indicate that real estate markets are much more volatile than appraisal based return series suggest--an observation also borne out by the recent real estate collapse. Consequently, REITs yield what I believe are

fairly accurate cost of capital estimates. Finally, the past year has seen an enormous movement toward securitization as large private real estate companies, institutions and investment advisors all give serious consideration to securitizing their holdings. As more "institutional" quality properties are securitized, it will become increasingly difficult to claim REITs are not real estate. I can easily envision the day, in the not to distant future, when equity REITs become the standard tool for estimating the cost of capital for commercial real estate.

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