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The Cost of Equity Capital for REITs: An Examination of Three Asset-Pricing Models

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ABSTRACT

The purpose of this study is to determine a reliable asset-pricing model that can be used in practice to estimate the cost of equity capital for Real Estate Investment Trusts (REITs). While the cost of equity is an important concept for all industries, it has particular relevance for REITs, as the current environment has forced many REITs to explore new methods of increasing earnings. Hence, it is vital that REITs have an accurate benchmark on which to base new investment and capital budgeting decisions.

The first research model employed is the traditional Capital Asset Pricing Model (CAPM). In the CAPM, the total excess returns for each REIT in the sample are regressed against the total excess returns of the broad market index. The second research model incorporates the two firm-specific factors developed by Fama and French, SMB (small minus big) and HML (high minus low). In the third model, two additional macroeconomic factors are included to represent the change in expected inflation and the change in risk premium. Using factors that are of a pervasive macroeconimic nature is in line with the Arbitrage Pricing Theory of Ross.

The results indicate that the Fama-French model (FFM) is superior to the other two models in predicting excess total returns (cost of equity) for the research sample of equity REITs. This conclusion is based upon a nonparametric test comparing the fitted coefficients of determination (R^2's) from each of the regressions. Furthermore, the range of cost of equity estimates produced by the FFM seems rational given the specific characteristics of equity REITs.

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CHAPTER ONE

Introduction

When creditors and owners invest capital in a company, they incur an opportunity cost equal to the return that could have been earned on an alternative investment of similar risk. This opportunity cost is known as the firm's cost of capital. A company's cost of capital is often referred to as its "hurdle rate" when used to evaluate a commitment of capital to an investment or project, as it is the minimum rate of return the company can earn on existing assets and still meet the expectations of its capital providers. Depending on the level of risk for a given prospective investment relative to the company's overall risk profile, the actual discount rate may be at, above, or below the company's overall cost of capital.

The term *capital* in the context of a company's cost of capital refers to the components of the entity's capital structure, including long-term debt, preferred equity, and common equity. Depending on the complexity of the capital structure, a company may have additional subcategories of capital, or related forms such as warrants or options. Each component of an entity's capital structure has a unique and specific cost, which depends primarily on its respective risk.

Determining the cost of debt or preferred equity for a company is relatively straightforward. When a firm issues debt or preferred stock, it promises to pay the holder of the security a specified stream of future payments. Market rates for bonds and preferred stock of a similar maturity and risk level can be easily identified in the marketplace. Knowing the promised payments and the current market price of a security, it is a simple matter to calculate

the expected return to debt or preferred equity holders. With common equity, however, the situation becomes much more complex.

Estimating the cost of equity capital for a firm is at once the most critical and the most difficult element of most business valuations and capital expenditure decisions. The expected returns on common equity have two components: (1) dividends or distributions, and (2) changes in market value (capital gains or losses). Because these return expectations cannot be directly observed, they must be estimated from current and historical evidence. Therefore, it is necessary to look to the investment markets for the necessary data to estimate the cost of capital for any company, security, or project.

Historically, two principal approaches have been utilized to estimate a company's cost of equity capital: (1) a discounted cash flow model such as the Gordon Growth Model, and (2) a model which attempts to measure the cost of equity as a premium over some observable market rate. The first approach focuses on projections of future cash flows for a particular company and estimates the cost of equity capital as the rate that equates the current price with the present value of the cash flows. The problem with this approach is that it is very sensitive to the estimated growth rate that is employed. Furthermore, it does not incorporate systematic influences that affect capital markets and the relative returns for alternative companies (Elton, 1994). The second approach recognizes that the cost of equity should be related to a benchmark return in the capital markets, but it supplies no guidance as to what magnitude or degree a company's cost of equity should differ from a benchmark rate.

The Capital Asset Pricing Model (CAPM) was the first rigorous theoretical model used to estimate how a specific company's return should differ from an observable market rate. However, soon after it was developed researchers began to find obvious mispriced securities and

to question the general applicability of the theory[1]. A fundamental criticism of the CAPM is that the pure-form equation almost always has an intercept above the riskless rate. Therefore, the model systematically understates the true cost of equity capital for any stock having a beta below one, while systematically overstating it for any stock having a beta above one (Elton, 1994).

An alternative and potentially more complete explanation of differential rates of return and the cost of equity capital was proposed by Stephen Ross in 1976 – the Arbitrage Pricing Theory (APT). In the APT model, the cost of capital for an investment varies according to that investment's sensitivity to each of *several* risk factors. The model itself does not specify what the risk factors are, but general applications consider only risk factors that are of a pervasive macroeconomic nature. Most academicians consider the APT model richer in its informational content and explanatory power than the CAPM.

A recent model which is gaining acceptance was developed by Eugene Fama and Ken French in the early 1990s. Fama and French propose that a security's expected return depends on the sensitivity of its return to the market and the returns on two portfolios meant to mimic these additional risk factors. The additional mimicking portfolios are SMB (small minus big) and HML (high minus low). SMB is the difference between the returns on a portfolio of small stocks and a portfolio of big stocks, measured in terms of equity capitalization. The motivation for including SMB is to capture the size premium present in historical common equity returns. The other factor, HML, is the difference between the returns on a portfolio of high-book-to-market-equity stocks and low-book-to-market-equity stocks. This "relative distress factor" assumes that the earnings prospects of firms are associated with a risk factor in returns.

[1] See Chapter Four – Literature Review.

Irrespective of its theoretical framework, a model designed to estimate the cost of equity must be flexible and easily employable in order to be used by practitioners. A model can be theoretically sound, but if it cannot be readily applied in practice, the model will have limited value and appeal. Moreover, the model must produce results that are both accurate and stable over time. While no model will work perfectly in every instance, it should produce sensible results on a consistent basis. The main objective of this study is to develop a particular multi-factor pricing model that can be used in practice to effectively estimate the cost of equity capital for Real Estate Investment Trusts (REITs).

REITs present an interesting case study for examining the cost of equity capital. For one, the requirements and limitations of the REIT structure make the industry unique with respect to other equities. Furthermore, the relatively young industry has been continually evolving since its inception in 1960, with most of the growth occurring over the past decade. More importantly, the decline in REIT share prices and the ensuing capital crunch beginning in 1998 have caused the real estate industry to reexamine the value of the REIT structure. Hence, now more than any other time in the industry's history, it is vital that REITs have an accurate benchmark on which to base capital budgeting and investment decisions.

Existing research in real estate indicates that single factor models such as the CAPM are not sufficient for examining the risk-return relationship or real estate-related assets[2]. Furthermore, financial literature indicates that equity REITs may possess risk-return characteristics that differ from ordinary equities. For example, real estate investments are often viewed as a hedge against the effects of inflation. Therefore, it follows that real estate portfolio returns may be the result of a multi-factor return generating function.

[2] Ibid.

This study employs three different models to estimate the cost of equity for a defined sample of equity REITs. The first model is the traditional CAPM, with the total return on the market portfolio as the only explanatory variable in the time-series regression. This model will serve as the basis for comparison of the other two models. For the second model, the two Fama-French factors are added. In the third model, two macroeconomic variables are combined with the three existing factors, in line with Arbitrage Pricing Theory. The relative ability of the models in explaining time-series variations in equity REIT returns measured using a nonparametric test based upon the fitted coefficients of determination (R^2's) from each of the regressions.

The pages that follow will be organized around the three research models for which it is the objective of this study to explore. Prior to the presentation of the models, however, Chapter Two will present a detailed overview of REITs, including classifications, the evolution of the modern REIT industry, and specific legal requirements. Chapter Three will provide the theoretical background of the three models employed in this study. In Chapter Four, a literature review is presented which outlines important existing research relating to REITs and the theoretical models. Chapter Five will describe in detail each of the research models, the sample and selection criteria of the equity REITs, and the empirical results that are obtained. Finally, the results are summarized in Chapter Six, as well as some thoughts on further research on this subject.

CHAPTER TWO

Real Estate Investment Trusts – An Overview

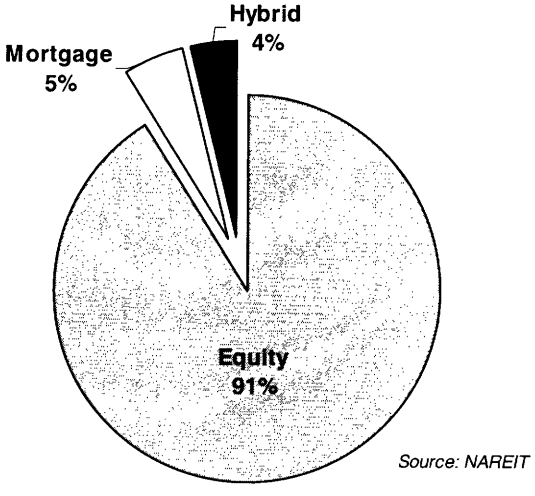
The Real Estate Investment Trust (REIT) was formally established by the Real Estate Investment Trust Act of 1960. Congress created the REIT vehicle to provide individual investors with the benefits of owning and financing commercial real estate on a tax-advantaged basis. Due to the high level of both resources and knowledge that is required, few individual investors are able to directly own or finance commercial real estate properties. The REIT security allows investment in real estate without the substantial long-term commitment typical of other real estate investment alternatives. Furthermore, the fact that most REIT stocks are publicly traded provides additional liquidity and access to information.

There exist two principal classifications of REITs: Equity REITs and Mortgage REITs. Equity REITs acquire ownership interest in real property and derive most of their income from the rental stream produced. Alternatively, Mortgage REITs purchase mortgage obligations on real property and, thus, become creditors with liens given priority over equity positions. A third classification, Hybrid REITs, combines elements of both Equity and Mortgage REITs. As of year-end 1999, Equity REITs comprised about 91% of total REIT capitalization, Mortgage REITs about 5%, and Hybrid REITs 4% (NAREIT, See Figure 2.4).

Figure 2.4

REIT CLASSIFICATIONS

% of Total Capitalization, Year-End 1999



Source: NAREIT

INDUSTRY DEVELOPMENT

The first REIT was actually formed in 1963. Despite a rather slow start, REITs experienced their first significant growth during the late 1960s and early 1970s. Specifically, total REIT assets increased by nearly 2000% from 1968 to 1973 (Han and Liang, 1995). This period of expansion was attributable to the strong demand for construction and development funding which was not being satisfied by traditional capital sources. REITs were able to provide long-term capital sourced from short-term paper and bank financing. Since there existed large spreads between the rates charged for construction and development loans and short-term interest rates, many REITs enjoyed very high returns during this period.

Continued demand for capital allowed mortgage REITs to enjoy high profits until interest rates began to rise in 1972 and 1973. The previously high spreads began to disappear, and eventually became negative, forcing many REITs to operate at a net loss. Furthermore, overbuilding in the real estate industry forced many developers to default on their existing loans. REIT valuation was severely affected, and the NAREIT Index dropped by over 56% from January 1973 to January 1975 (NAREIT).

The REIT industry witnessed several significant structural changes in the late 1970s and early 1980s. Due to the negative experiences of the previous recession, REIT leverage was greatly reduced. Average leverage ratios declined from 64% in 1972 to 55% by 1984. Short-term debt also declined from 44% of total assets in 1972 to 8% in 1984. Furthermore, construction and development loans as a percent of total REIT assets declined from 53% to 6% over the same time period (Han and Liang, 1995).

A major impact on the growth of REITs was the passing of the Tax Reform Act (TRA) of 1986. The TRA eliminated the tax advantages of real estate limited partnerships by lengthening

depreciation schedules and replacing accelerated depreciation with the straight-line method. Furthermore, the new law no longer allowed non-cash losses from passive investments (such as real estate) to shelter ordinary income. These changes made investment in REITs comparatively attractive to direct ownership of real estate.

The REIT industry believed that the tax law changes would allow REITs to play a much more significant role in real estate investment. In preparation, the industry, led by the National Association of Real Estate Investment Trusts (NAREIT) and a dedicated group of REITs and associated law and accounting firms, convinced Congress to include a package of REIT "modernization" amendments to the 1986 tax reform legislation. These proposals allowed for important changes such as REIT subsidiaries, expansion of the prohibited transaction safe harbor for REITs that needed to sell or dispose of properties, and greater flexibility by REIT management to make short-term investments of newly raised capital. Of these 13 new amendments, none was more important than the alteration of the independent contractor requirement, permitting REITs to perform property management services that were "usual and customary" for their tenants (Garrigan, 1998).

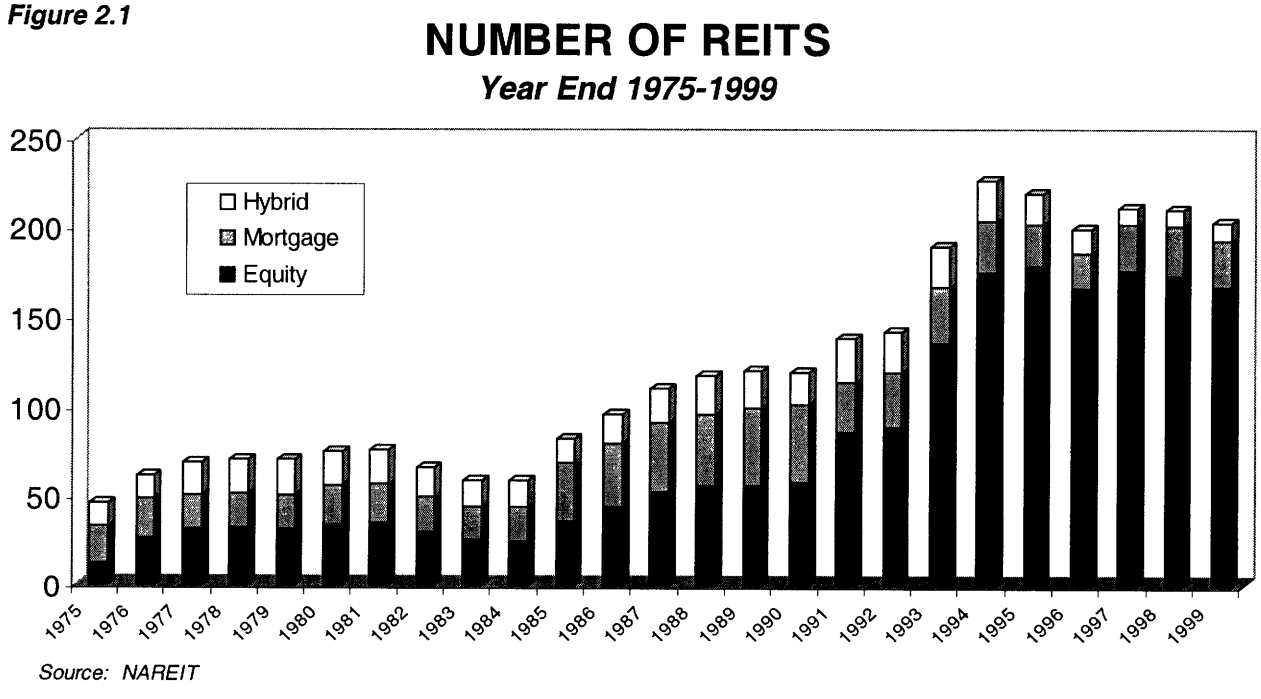
Improvements in the external environment coupled with much-needed capital structure revisions allowed REITs to slowly recover from the crisis in the mid-1970s. Most of this recovery occurred in the late 1980s through the mid-1990s, as the modern REIT industry began to take shape.

THE MODERN REIT INDUSTRY

The real estate industry witnessed a severe recession in the late 1980s and early 1990s. As a result, traditional capital suppliers such as banks, savings and loan institutions, and life insurance companies all exited the real estate capital markets in the face of weak demand and massive over-building. The liquidity crisis led to a dramatic reduction in value of existing properties, and provided an opportunity for the REIT industry to expand. Healthy, low-leveraged balance sheets and unparalleled access to inexpensive equity capital enabled REITs to replace previous capital sources, which led to a period of record growth.

The success of the REIT structure set off an IPO frenzy in the early 1990s. Nearly two-thirds of all publicly traded equity REITs in existence today have been formed since 1990. In 1993 and 1994 alone, 95 companies went public raising over $16.5 billion in equity (NAREIT). The total number of REITs increased from 119 at the beginning of the decade to a high of 226 by year-end 1994 (see Figure 2.1). Total market capitalization in nominal terms went from $8.74

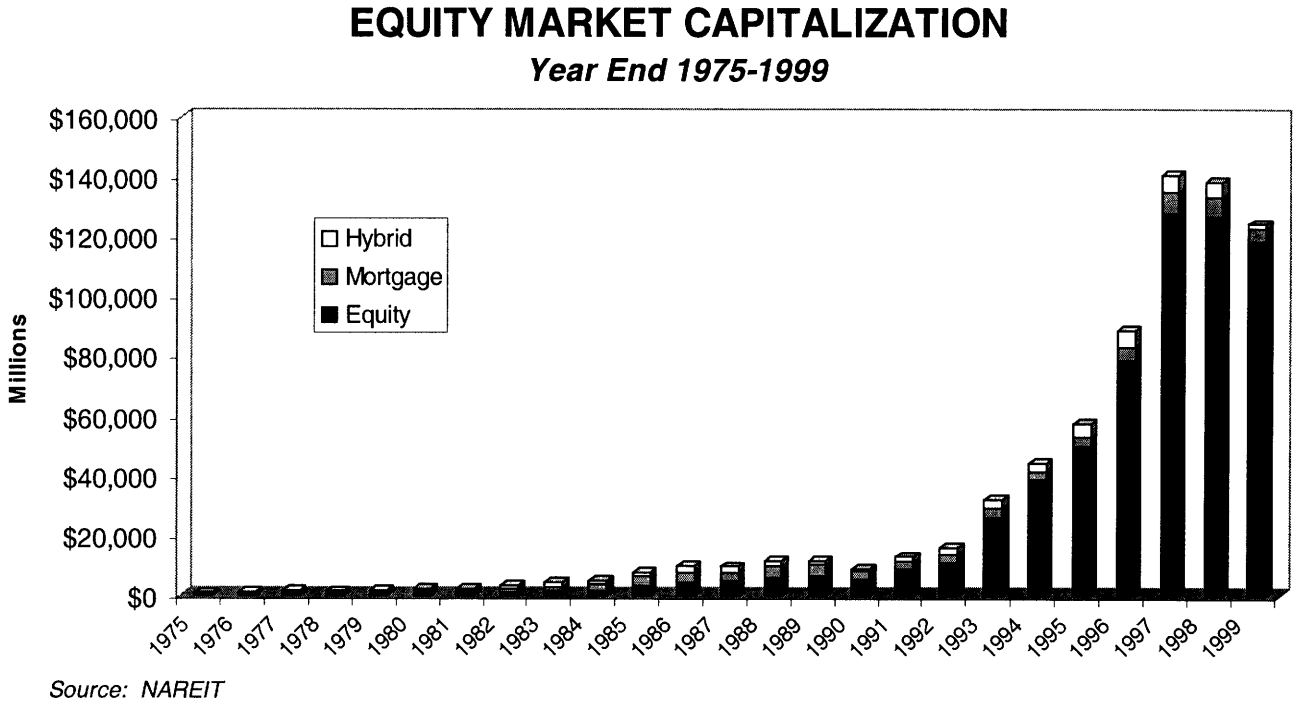
Figure 2.1



Source: NAREIT

billion in 1990 to a high of $140.5 billion at year-end 1997 (see Figure 2.2)[3]. At year-end 1999, there were a total of 203 REITs with a total market capitalization of $118,233 million.

Figure 2.2



Source: NAREIT

A significant event that helped pave the way for the IPO explosion was the advent of the umbrella partnership (UPREIT) structure first used in the 1992 offering of Taubman Centers. Using the UPREIT structure enabled owners of "low tax basis" properties to defer or, at best, eliminate capital gains liabilities. The UPREIT is a structure in which a partnership is established to hold title to the assets and liabilities of the firm. The partnership, in turn, is owned by the REIT and the existing investors in the company that is going public. The REIT itself is owned by its shareholders. An additional advantage to the UPREIT structure is the future possibility of using UPREIT equity interests as currency in tax-deferred acquisitions (Garrigan,

[3] Total market capitalization equals price of shares multiplied by the number of shares outstanding.

1998). However, an important drawback of the structure is that, because of differing tax liabilities, it creates a conflict between owners of UPREIT units and common shareholders. Nevertheless, without the creation of the UPREIT structure, many of the top real estate companies could not (or would not) have chosen to go public. Of the 100 largest REITs, 52 are organized using the UPREIT format (NAREIT).

The ability of REITs to take advantage of deflated property prices resulted in high returns for shareholders. For the period 1979 through 1997, equity REITs had a total annual return of nearly 15% versus 9% for direct property investment (NAREIT, see Table 2.3)[4]. However, by 1998, liquidity began to return to the real estate markets and share price multiples of REITs began to increase. This resulted in higher capital costs, and many REITs found it increasingly difficult to find accretive acquisition opportunities. For the first time, many REITs became net sellers of assets. Share prices began to fall, and the sector moved from trading at greater than a 20% premium to net asset value (NAV) to trading at greater than a 20% discount (Riddiough, 2000). While REITs still provided an attractive dividend yield, the total annual returns for the NAREIT Index for 1998 and 1999 were –19% and –7%, respectively.

OUTLOOK

As the real estate environment began to change in the late 1990s, it became evident that the context of the 1992 to 1996 period of growth for REITs would not be the context of the future. Changes in the macroeconomic environment will test the viability of the REIT structure in new ways, as REITs are forced to produce increasingly more challenging levels of earnings growth in order to meet the expectations of Wall Street.

[4] Total annual return equals price appreciation plus dividend income.

Table 2.3

Investment Performance of All Publicly Traded REITs[1]

(Percentage changes, except where noted, as of December 31, 1999)

	COMPOSITE				EQUITY				MORTGAGE				HYBRID			
	Return Components			Dividend	Return Components			Dividend	Return Components			Dividend	Return Components			Dividend
Period	*Total*	*Price*	*Income*	*Yield[2]*	*Total*	*Price*	*Income*	*Yield[2]*	*Total*	*Price*	*Income*	*Yield[2]*	*Total*	*Price*	*Income*	*Yield[2]*
Annual																
1988	11.36	1.24	10.11	10.03	13.49	4.77	8.72	8.57	7.30	(5.12)	12.42	13.19	6.60	(2.87)	9.47	9.61
1989	(1.81)	(12.06)	10.25	10.19	8.84	0.58	8.26	8.42	(15.90)	(26.19)	10.28	13.56	(12.14)	(28.36)	16.22	10.22
1990	(17.35)	(28.49)	11.15	11.34	(15.35)	(26.45)	11.10	10.15	(18.37)	(29.18)	10.81	13.48	(28.21)	(38.88)	10.67	13.18
1991	35.68	23.10	12.58	9.19	35.70	25.47	10.22	7.85	31.83	13.93	17.91	13.49	39.16	27.08	12.08	8.89
1992	12.18	2.87	9.31	7.88	14.59	6.40	8.19	7.10	1.92	(10.80)	12.72	11.21	16.59	7.21	9.38	7.36
1993	18.55	10.58	7.96	7.29	19.65	12.95	6.70	6.81	14.55	(0.40)	14.95	10.89	21.18	12.44	8.75	7.69
1994	0.81	(6.41)	7.22	8.04	3.17	(3.52)	6.69	7.67	(24.30)	(33.83)	9.53	13.52	4.00	(5.95)	9.95	8.31
1995	18.31	9.12	9.19	7.49	15.27	6.56	8.71	7.37	63.42	46.80	16.62	9.02	22.99	13.10	9.89	7.70
1996	35.75	26.52	9.23	6.22	35.27	26.35	8.92	6.05	50.86	37.21	13.65	8.50	29.35	19.70	9.65	6.72
1997	18.86	11.85	7.01	5.73	20.26	13.33	6.93	5.48	3.82	(3.57)	7.40	9.41	10.75	2.79	7.96	7.35
1998	(18.82)	(23.82)	5.00	7.81	(17.50)	(22.33)	4.83	7.47	(29.22)	(34.29)	5.07	10.49	(34.03)	(42.16)	8.13	13.07
1999	(6.48)	(14.06)	7.59	8.98	(4.62)	(12.21)	7.59	8.70	(33.22)	(40.12)	6.90	13.53	(35.90)	(43.43)	7.53	17.24
Quarter																
1998:Q4	(3.94)	(5.49)	1.56	7.81	(2.92)	(4.43)	1.51	7.47	(18.04)	(19.54)	1.50	10.49	(7.21)	(10.09)	2.88	13.07
1999:Q1	(5.10)	(6.81)	1.71	8.03	(4.82)	(6.56)	1.74	7.96	(6.47)	(7.44)	0.97	8.08	(15.14)	(17.38)	2.24	11.74
Q2	10.58	8.56	2.02	7.39	10.08	8.11	1.97	7.34	21.35	18.70	2.65	7.10	10.51	7.46	3.05	10.94
Q3	(9.28)	(11.23)	1.95	8.39	(8.04)	(10.01)	1.97	8.27	(31.91)	(33.21)	1.30	9.35	(14.55)	(17.15)	2.60	13.23
Q4	(1.76)	(4.31)	2.54	8.98	(1.01)	(3.44)	2.43	8.70	(13.60)	(18.41)	4.81	13.53	(20.00)	(23.09)	3.09	17.24
Historical (compound annual rates)																
1-Year	(6.48)	(14.06)	7.59		(4.62)	(12.21)	7.59		(33.22)	(40.12)	6.90		(35.90)	(43.43)	7.53	
3-Year	(3.37)	(9.87)	6.50		(1.82)	(8.24)	6.41		(21.12)	(27.61)	6.48		(22.34)	(30.45)	8.12	
5-Year	7.70	0.22	7.49		8.09	0.79	7.30		3.88	(5.24)	9.12		(5.71)	(14.56)	8.84	
10-Year	8.10	(0.54)	8.64		9.14	1.08	8.06		1.41	(9.65)	11.06		0.90	(8.73)	9.63	
15-Year	6.81	(2.17)	8.98		9.77	1.63	8.14		(0.07)	(11.08)	11.01		0.30	(9.74)	10.04	
20-Year	10.28	0.59	9.70		12.34	3.20	9.14		4.27	(7.25)	11.52		6.15	(4.03)	10.18	

Source: NAREIT

[1] *Includes all REITs that trade on the New York Stock Exchange, American Stock Exchange and NASDAQ National Market List. Data prior to 1999 are based on published monthly returns through the end of 1998.*

[2] *Dividend yield quoted in percent for the period end.*

As mentioned earlier, REITs were able to grow earnings through purchasing properties at relatively high capitalization rates then packaging and reselling them to the public at yields that were 200 to 400 basis points lower. This practice of "positive spread investing" became increasingly more difficult as the real estate markets moved further into recovery. By 1998, heightened competition for properties drove prices up (and capitalization rates down) to the point that the large yield spreads had all but disappeared. No longer able to grow through acquisition,

REITs were forced to devise more creative strategies to increase earnings. This has led to much riskier strategies such as increased real estate development, movement into new markets, and joint venture agreement with other public and private real estate companies.

In the current environment, it is extremely important that REIT management can accurately measure and thoroughly understand the company's cost of capital. The decline in REIT share prices and the ensuing capital crunch beginning in 1998 have caused real estate investors to question the true value of the REIT structure. Hence, as REITs continue to explore new methods of increasing earnings, it is vital they have an accurate benchmark on which to base investment decisions. The goal of this study is to identify a model that can be used by REIT industry practitioners to accurately estimate the cost of equity capital.

REIT LEGAL STRUCTURE

The advantage of the REIT form of organization is that it is exempt from corporate-level taxation. It is estimated that the overall value of the REIT tax shield is about 2-5% of industry equity market capitalization, although higher for firms with lower-than-average payout ratios. (Gyourko and Sinai, 1999). There are, however, numerous conditions that must be met in order to qualify for tax-preferred status. The primary drawback of the REIT structure is the limited ability to retain earnings, an important issue given the capital-intensive nature of real estate.

The conditions for REITs are contained in Sections 856 to 860 and related sections of the Internal Revenue Code. These conditions can be subdivided into organizational, asset-related, income-related, distribution requirements, and compliance requirements. Below is a summary of the qualifying factors.

Organizational Requirements

The entity must file an election form to be taxed as a Real Estate Investment Trust with its annual tax return. A REIT must be a corporation, trust, or association with transferable shares and be taxable as a domestic corporation. It may not be a financial institution or insurance company. The REIT must have at least 100 or more persons that own its stock or beneficial interests. Furthermore, no more than 50% of the total outstanding shares may be held either directly or indirectly by any group of five or fewer individuals during the last half of the REIT's taxable year. For this purpose, corporations, partnerships, and pension funds are "looked through" to their ultimate individual shareholders or beneficiaries.

Asset Requirements

At least 75% of the value of the REITs assets must consist of real estate, cash, or Government Securities. Not more than 25% of total asset value may consist of securities, other than those included in the 75% test. The REIT may not have more than 5% of its assets invested in the securities of one issuer. Moreover, a REIT may not hold more than 10% of the outstanding voting non-real estate shares of any one issuer.

Income Requirements

At least 75% of a REITs gross income must be derived from rents from real property or interest on mortgages secured by real property, gains from the sale of real property not held for sale in the ordinary course of business, dividends from qualified REITs, gain from sale or qualified REIT stock, refund of taxes on real property, or gain from sale of foreclosed property.

At least *95%* of a REIT's gross income must come from sources that satisfy the 75% test, dividends, interest, or gain from the sale of stocks or securities. In addition, not more than 30% of the REIT's income can be derived from the sale or disposition of stock or securities held less than six months, or real property held less than four years (other than property involuntarily converted or foreclosed upon).

Distribution Requirements

Currently, at least 95% of a REIT's taxable income (excluding net capital gains) must be distributed to shareholders in the form of dividends. However, pursuant to the 1999 REIT Modernization Act, this requirement will return to the 90% level that applied to REITs from 1960 through 1980 beginning in 2001.

Compliance Requirements

Shareholders of the REIT must be polled annually to determine ownership of the outstanding shares and to ascertain whether or not the REIT has fulfilled the requirements of the "five or fewer" ownership rule. In addition, the quarterly "asset" and "income" tests must be supported by sufficient accounting records.

CHAPTER THREE

The Theoretical Models

THE CAPITAL ASSET PRICING MODEL

The Capital Asset Pricing Model (CAPM) was developed by William Sharpe in 1964[5]. The CAPM is part of a larger body of economic theory known as Capital Market Theory (CMT). CMT also includes security analysis and portfolio management theory, a normative theory that describes how investors *should* behave in selecting stocks for individual portfolios. The CAPM, however, is a positive theory as it describes the market relationships that *will* result if investors behave in the manner prescribed by portfolio theory (Pratt, 1998).

Capital market theory divides total risk into two components, systematic risk and unsystematic risk. Systematic risk represents the uncertainty of future returns due to the sensitivity of a particular investment to movements in the returns of the market portfolio. Alternatively, unsystematic risk is a function of the particular characteristics of an individual company, a specific industry, or the type of investment interest. The total risk of an investment depends on both systematic and unsystematic risk factors. However, capital market theory makes the assumption that investors can diversify away unsystematic risk by holding stocks in large, well-diversified portfolios. Therefore, in the CAPM, the only risk that affects the expected return on a stock (and hence the cost of equity capital) is systematic risk.

[5] See Sharpe, W.F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance*, (1964) 19, 425-42.

The CAPM leads to the conclusion that the equity risk premium (the required excess return for a security above the risk-free rate) is a linear function of the security's beta coefficient. This function is described in the following equation:

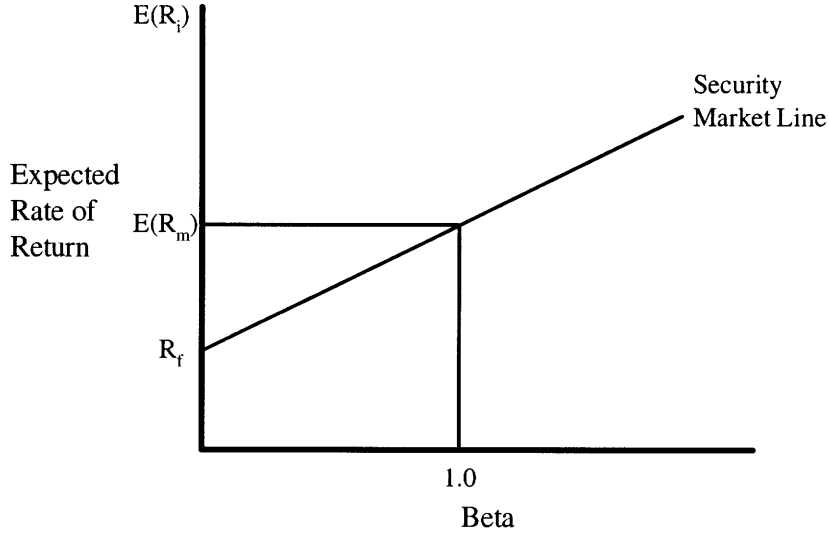
$$K_{Ei} = R_f + B_i [E(R_m) - R_f] \quad (1)$$

where:

K_{Ei}	=	Cost of equity (expected return) for firm *i*
R_f	=	Risk free rate of interest
B_i	=	The sensitivity of stock *i* return to the market return
$E(R_m)$	=	Expected return on the market

This relationship can be seen graphically in Figure 3.1 below:

Figure 3.1



The above figure shows that the beta for the market as a whole is 1.0. Therefore, from a numerical standpoint, the factor beta has the following interpretations:

Beta > 1.0 The rates of return for the subject company tend to move in the same direction and with greater magnitude than the market returns. Many high tech companies are examples of stocks with high betas.

Beta = 1.0 Movements in the rates of return for the subject tend to equal movements in the rates of return for the market portfolio.

Beta < 1.0 When the market rates of return fluctuate, rates of return for the subject company tend to also fluctuate, but to a lesser extent. Examples of low beta stocks include equity REITs and utilities.

Beta < 0 Rates of return for the subject company tend to move in the opposite direction from changes in the market portfolio. Stocks with negative betas are very rare.

The CAPM, like most economic models, offers a theoretical framework for how relationships should exist if certain assumptions hold. It is imperative that anyone who chooses to employ the CAPM to predict returns or estimate the cost of equity understands the assumptions underlying the model. The extent to which these assumptions are or are not met in a real world application will have an impact on the usefulness of the CAPM for the valuation of projects or investments. The main assumptions are listed below.

1. Investors are risk averse.
2. Rational investors seek to hold fully efficient (fully diversified) portfolios.
3. All investors have identical investment time horizons.
4. All investors have identical expectations about such variables as expected rates of return and how capitalization rates are generated.
5. There exist no transaction costs.
6. There are no investment-related taxes
7. The borrowing and lending rates are equivalent.
8. The market has perfect divisibility and liquidity.

Since its inception, the simple yet powerful linear prediction of the CAPM has been the subject of a large body of empirical research, and a number of studies have been published which provide both theoretical and empirical criticisms of the model[6]. These studies show that stock returns may be related more to firm-specific variables such as size, price-to-earnings ratio, book-to-market equity ratio, and the leverage ratio. Recently, Fama and French (1992) found that the CAPM beta fails to describe average stock returns over the past fifty years if just two firm-specific variables are introduced: size and book-to-market equity.

A fundamental criticism of the CAPM is that the pure-form equation almost always has an intercept above the riskless rate. Therefore, the model systematically understates the true cost of equity capital for any stock having a beta below one, while systematically overstating it for any stock having a beta above one (Elton, 1994). Since real estate as an asset class tends to have a beta less than one, the CAPM is not a useful indicator of the true cost of equity for real estate companies. In a recent study, Chen, Hsieh, Vines, and Chiou (1998) determine that the insignificance of the market beta in their analysis leads to the rejection of the CAPM for equity REITs[7].

Despite criticisms, financial theorists and practitioners alike have generally held that using the CAPM is the preferred method to estimate the cost of equity capital. Its relevance to business valuations and capital budgeting is that businesses, business interests, and business investments are a subset of the investment opportunities available in the total capital market. Hence, the determination of the prices of businesses, theoretically, should be subject to the same

[6] See Brennan (1970 & 1971), Black (1972), Roll (1977), Breeden (1977 & 1989), Basu (1977 & 1983), Banz (1981), Reinganum (1981), Keim (1983), Brown (1983), Rosenburg et al. (1985), Chen et al. (1988), Bhandari (1988).

[7] See *Literature Review* chapter for additional studies on REITs and the CAPM.

economic forces and relationships that determine the prices of alternative investment assets (Pratt, 1998).

THE FAMA-FRENCH MODEL

The Fama-French Model (FFM) is a multiple linear regression model developed by Eugene Fama and Ken French in the early 1990s[8]. The FFM can be thought of as a multivariate extension of the CAPM. The intuition is that there exist other factors that impact security prices in addition to the movement of the market and the risk free rate. Fama and French propose that a security's expected return depends on the sensitivity of its return to the market and the returns on two portfolios meant to mimic these additional risk factors (Fama and French, 1997).

The additional mimicking portfolios are SMB (small minus big) and HML (high minus low). SMB is the difference between the returns on a portfolio of small stocks and a portfolio of big stocks, measured in terms of equity capitalization. The motivation for including SMB is to capture the size premium present in historical common equity returns. Many empirical studies performed since the CAPM was originally developed indicate that the realized total returns on smaller companies have been substantially greater than predicted returns over a long period of time[9].

The other factor, HML, is the difference between the returns on a portfolio of high-book-to-market-equity stocks and low-book-to-market-equity stocks. This "relative distress factor" assumes that the earnings prospects of firms are associated with a risk factor in returns. Firms that the market judges to have poor earnings prospects, signaled by low stock prices and high

[8] See Fama, E.F., and K.R. French. "The Cross-Section of Expected Stock Returns." *Journal of Finance* (1992) 47, 427-65, and "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics* (1993) 33, 3-56.

[9] See Banz (1981), Huberman and Kandel (1987), Berk (1995), etc.

ratios of book-to-market equity, have higher expected stock returns (hence, a higher cost of equity capital) than firms with strong earnings prospects (Fama and French, 1992).

The expected return equation of the Fama-French Model is the following:

$$K_{Ei} = R_f + B_{i1}[E(R_m) - R_f] + B_{i2}[E(SMB)] + B_{i3}[E(HML)] \quad (2)$$

where:

K_{Ei}	=	Cost of equity (expected return) for firm *i*
R_f	=	Risk free rate of interest (20-year T-Bond)
B_{i1}	=	The sensitivity of stock *i* return to the market return
$E(R_m)$	=	Expected return on the market
B_{i2}	=	The sensitivity of stock *i* to the return of a portfolio that mimics SMB
$E(SMB)$	=	Expected return on a portfolio that mimics SMB
B_{i3}	=	The sensitivity of stock *i* to the return of a portfolio that mimics HML
$E(HML)$	=	Expected return on a portfolio that mimics HML

Fama and French use six value-weighted portfolios formed on size and book-to-market equity to construct the two specific risk factors in their model. Each year, all NYSE stocks on the Center for Research in Securities Pricing (CRSP) tapes are ranked based upon price times number of shares. The median NYSE size is then used to split NYSE, AMEX and NASDAQ stocks into two groups, small (S) and big (B). In addition, they also divide the stocks into three book-to-market equity groups based upon the bottom 30% (Low), middle 40% (Medium), and top 30% (High) of the ranked values.

In their analysis, Fama and French define book common equity as the COMPUSTAT book value of shareholders' equity plus balance-sheet deferred taxes and investment tax credit minus the book value of preferred stock. The ratio of book-to-market equity is book common equity for the fiscal year ending in calendar year *t-1*, divided by market equity at the end of December of *t-1* (Fama and French, 1993). It is interesting to note that only firms with ordinary

common equity (as classified by CRSP) are included in the tests. This means that ADRs, REITs, and units of beneficial interest are excluded.

Fama and French then construct the six portfolios from the intersections of the two size and three book-to-market equity groups. Monthly value-weighted returns on the six portfolios are calculated from July of year t to June of $t+1$, and the portfolios are reformed in June of $t+1$. The portfolio SMB is the difference each month between the simple average of the returns on three small-stock portfolios (S/L, S/M, and S/H) and the simple average of the returns on the three big stock portfolios (B/L, B/M, and B/H). Thus, SMB is the difference between the returns on small-and big-stock portfolios with about the same weighted-average book-to-market equity. This ensures the difference will be largely free of the influence of the book-to-market equity factor, focusing instead on the different return behaviors of small and big stocks (Fama and French, 1993).

The portfolio HML is defined in the same manner as SMB. HML is the difference each month between the simple average of the returns on the two high book-to-market equity portfolios (S/H and B/H) and the average of the returns on the two low book-to-market equity portfolios (S/L and B/L). The two components of HML are returns on high and low book-to-market equity portfolios with about the same weighted-average size. As a result, the difference between the two returns should be largely free of the size factor in returns. Evidence of the success of this simple procedure is reflected in the extremely low correlation between the two monthly mimicking returns (Fama and French, 1993).

The results of Fama and French's initial study (1992) indicate that the CAPM beta does not help explain the average returns on NYSE, AMEX, and NASDAQ stocks for the period 1963 through 1990. However, the two additional risk factors, SMB and HML, are statistically

significant predictors of returns over the same period. Similar results were obtained in subsequent studies by Fama and French, as well as other researchers. The lack of support for the CAPM is not surprising, as much of the financial research completed in the past 15 years arrives at the same conclusion. However, the work of Fama and French is significant in that it shows how two easily-measured variables can be used in practice to predict the cost of equity capital.

THE ARBITRAGE PRICING MODEL

The concept of Arbitrage Pricing Theory (APT) was introduced by Stephen Ross in 1976[10]. Similar to the FFM, APT can also be thought of as a multivariate extension of the CAPM. In the APT model, the expected return (cost of equity) for an investment varies according to that investment's sensitivity to a variety of risk factors, one of which may be a CAPM-type market risk. The model itself does not specify what the risk factors are, but most applications consider risk factors that are of a pervasive macroeconomic nature. Examples of common risk factors used include unanticipated inflation, the unanticipated change in the term structure, the unanticipated change in risk premium, and the unanticipated change in the growth rate in industrial production.

In APT, as in the CAPM, there exist two sources of risk for any individual stock. First is the risk associated with the macroeconomic factors which cannot be eliminated through diversification, or systematic risk. Second is the risk arising from the possible events that are unique to the specific company, or unsystematic risk. As with the CAPM, it is assumed that this company-specific risk can be eliminated through holding stocks in large, well-diversified

[10] See Ross, S.A. "The Arbitrage Theory of Capital Asset Pricing." *Journal of Economic Theory* (1976), 341-60.

portfolios. Therefore, the expected risk premium on a stock is affected only by factor or macroeconomic risk (Brealey & Myers, 2000).

The econometric estimation of the Arbitrage Pricing Model (APM) with multiple risk factors yields the following formula:

$$K_E = R_f + B_{i1}[E(K_1)] + B_{i2}[E(K_2)] + \ldots + B_{in}[E(K_n)] \quad (3)$$

where:

K_E	=	Cost of equity (expected return) for firm i
R_f	=	Risk free rate of interest (20-year T-Bond)
B_{in}	=	The sensitivity of stock i return to the return of a portfolio that mimics K_n
$E(K_n)$	=	Expected return on a portfolio that mimics factor K_n

Notice that the APT formula makes two important statements (Brealy & Myers, 2000):

1. If a value of zero is plugged into each of the factor betas, the expected risk premium is zero. A diversified portfolio that is constructed to have zero sensitivity to each macroeconomic factor is essentially risk-free, and therefore must be priced to offer the risk-free rate of interest. If this did not hold, investors could make an arbitrage profit.

2. A diversified portfolio that is constructed to have exposure to a factor will offer a risk premium which will vary in direct proportion to the portfolio's sensitivity to that factor. For example, if portfolio A is twice as sensitive to a factor as portfolio B, portfolio A must offer twice the risk premium. If this did not hold, investors could make an arbitrage profit.

If the arbitrage pricing relationship as it is described above holds for all diversified portfolios, then it must generally hold for individual stocks. Each stock must offer an expected return commensurate with its contribution to portfolio risk. In the framework of APT, this contribution depends on the sensitivity of the stock's return to the unexpected variations in the specified macroeconomic factors.

Most academicians consider the Arbitrage Pricing Model (APM) richer in its informational content and explanatory and predictive power than the CAPM. Empirical research suggests that the multivariate APM explains expected rates of returns more effectively than the univariate CAPM[11]. In fact, some researchers (Roll and Ross, 1980) propose APT as a testable alternative, and perhaps natural successor to the CAPM.

[11] See Chen (1983), Bower et al. (1984), Chen et al. (1986), and Berry et al. (1988).

CHAPTER FOUR

Literature Review

REITs and the CAPM

Much research has been done comparing the returns of REITs to the returns of the overall stock market. Although the results of these studies vary, essentially, the findings suggest that REIT risk-adjusted returns have been superior to those of other stocks from the-mid 1960s through the early 1980s, with a small number of aberrations. However, stock market portfolios have dominated REIT returns since the mid-1980s.

One of the first studies to specifically compare the performance of equity REITs with that of common stocks was by Smith and Shulman (1976). They tracked the quarterly returns of 16 equity REITs over eleven years from 1963 to 1974. These returns were contrasted against those of the S&P composite index and a sample of closed-end funds by employing various measures including comparing geometric mean returns, goodness of fit (R^2), and CAPM. The findings revealed that equity REITs underperformed the broader market and fared about the same as the closed-end funds. However, by reducing the holding period by one year (thus eliminating 1974, a year in which the stock market experienced particularly high negative returns) equity REIT's outperformed the S&P composite index.

In a subsequent study, Burns and Epley (1982) demonstrate that adding equity REITs to a portfolio of common stocks results in a more efficient portfolio frontier. The data examines quarterly returns, which include 35 REITs (10 equity REITs) from the first quarter of 1970 through the fourth quarter of 1979. The study explores various combinations of assets in order to obtain the highest efficient portfolio frontier. Previous studies indicate that the correlation

coefficients between real estate and stocks is generally rather low. Hence, combining these assets produces a more efficient portfolio. Accordingly, the results from the period between 1970 through 1979, confirm that the outcome of combining portfolios of both REITs and stocks surpasses single-asset portfolios at all points along the efficient frontier in terms of risk and return. Furthermore, this mixed asset portfolio outperformed the S&P 500 index during the same period.

The findings of Walther (1986) and Kuhle (1987) reveal that REIT stocks outperformed the S&P index during the 1977-1984 period, but underperformed the index from 1973-1976. These results are also supported by research by Sagalyn (1990). This study examines the ex-post real returns of REITs over the period from 1973 to 1987 and shows that equity REITS exhibited less volatility with higher returns in comparison to the S&P 500 index.

A study by Howe and Shilling (1990) suggests that REITs have underperformed the CRSP Equally-Weighted index from 1973 to 1987. In agreement with this, Gobel and Kim (1989) examine the returns of 32 REITs over a four-year period from 1984-1987. They compared their findings to the S&P 500 index, the Consumer Price Index, and Treasury bills. Their results indicate that the sample of REITs underperformed the S&P 500 index over the study period.

The findings from a research study performed by Martin and Cook (1991) determine through using generalized stochastic dominance that stock portfolios generated slightly higher risk-adjusted returns for the period between 1980-1990. Han and Liang (1995) studied eight REIT portfolios during 1970-1993. Their results indicate that REIT stock performance was slightly worse than the stock market portfolio. More recently, Chen and Peiser (1999) conclude

that equity REITs underperformed both the S&P 500 index and the S&P Midcap 400 index over the period 1993 through 1997.

REITs and the FFM

Up to this point, there have been no previous research projects which specifically use the Fama-French model to estimate the returns of equity REITs. However, Fama and French completed a study in 1997 which employs both the CAPM and the FFM to examine the cost of equity for 48 industries, including Real Estate, for the period 1963 through 1994[12]. Unfortunately, the Real Estate industry used in the study did not include REITs. Fama and French used four-digit SIC codes to form their industry groups, and because REITs have their own SIC code separate from other real estate companies, they were included in a general Finance industry. The results from the study are worth noting, however, as they provide additional rationale for employing the FFM in our research.

Not surprisingly, the results from the 1997 study show large differences between the cost of equity estimates obtained using CAPM and those using the FFM. For the five-year estimates, the CAPM and FFM figures differ by more than 2% for 19 industries and by more than 3% for 15 industries (Fama and French, 1997). These differences are attributable to the SMB and HML slopes in the three-factor regressions. Those industries with slopes close to zero consequently produce results similar to the CAPM. Examples of industries where this occurs is Food, Machinery, Electrical Equipment, Boxes, Building Materials, and Insurance.

Industries for which the CAPM and FFM produced significantly lower estimate for the cost of equity include health industries (Health Services, Medical Equipment, and Drugs) and

[12] See Fama, E.F., and K.R. French. "Industry Costs of Equity." *Journal of Financial Economics* (1997) 43, 153-93.

high-tech industries (Computers, Chips, and Laboratory Equipment). This result is largely due to strong negative risk loadings on the HML factor. The FFM identifies these as industries with strong growth prospects over the sample period and rewards them with comparatively lower costs of equity.

Conversely, many industries, including Real Estate, have cost of equity estimates using the FFM that are at least 2% higher than those obtained using the CAPM. Specifically, Fama and French estimated the industry cost of equity *premium* for Real Estate to be 5.99% using the CAPM and 11.16% using the FFM . This dramatic difference is a function of the low beta of real estate assets and the lack of significance of the CAPM in predicting returns for real estate companies. Other industries where similar discrepancies also observed include Textiles, Banking, Steel, and Autos. The FFM assigns high costs of equity for each of these industries because their returns covary with the returns on small stocks (they have large positive slopes on SMB) and because they behave like distressed stocks (they have large positive slopes on HML).

REITs and APT

There have been a number of research studies done in the past which attempt to link the returns from real estate to market-level factors. Many studies indicate that certain variables such as inflation and interest rates may be significant in predicting returns to real estate[13]. In recent years, researchers have used Arbitrage Pricing Theory to examine macroeconomic influences using publicly traded REITs as the real estate proxy. The results from these studies vary widely depending on the sample of REITs chosen and the time period examined. However, in most

[13] See Hartzell et al. (1987), Fama and Schwert (1977), Rubens et al. (1989), Brueggeman et al. (1984), Ibbotson an Siegel (1984), and Miles and Mahoney (1997).

cases, multifactor models are more effective at predicting REIT returns than the single-factor CAPM.

Titman and Warga (1986)

Titman and Warga's is the first study to specifically examine the risk-adjusted performance of REITs using both the CAPM and APT. Since it was generally viewed that the returns from REITs, as well as real estate in general, were sensitive to inflation and interest rates, Titman and Warga set out to examine whether the APM provided more accurate measures of risk-adjusted returns.

The research sample consists of 16 equity and 20 mortgage REITs listed on the NYSE and AMEX in 1973. The study examines the returns over two sample periods, January 1973 through December 1977, and January 1978 through December 1982. The single index, or CAPM, models employ both the CRSP Value-Weighted index and Equally-Weighted index as the market proxy. Two types of multiple-index models are also examined. The first includes a portfolio of long-term government bonds along with the (Equally-Weighted or Value-Weighted) market portfolio in a two-factor model. In addition, a model using five-factor portfolios formed with maximum likelihood factor analysis is also examined. In theory, these portfolios are designed to mimic changes in inflation, interest rates, and any other macroeconomic variables that generate returns on capital assets.

The results of the study suggest that the single-index and multiple-index models can provide very different estimates of the performance of REITs. In particular, the performance measures are almost always higher for the models that included the Value-Weighted index as a benchmark portfolio than they are for the models that include either the Equally-Weighted index

or the five-factor analysis portfolios. The five-factor model generates performance measures that are substantially lower than those generated with the Value-Weighted market index. However, since the single-factor model that employs the Equally-Weighted index as its benchmark portfolio generates performance figures that are very similar to those produced by the five-factor model, the above mentioned difference can not be attributed to the additional factors.

Titman and Warga conclude that neither the CAPM or APT-based techniques are powerful enough to provide reliable evaluations of the investment performance of real estate portfolios. The main reason for their result may be due to the research sample. The returns for the chosen REITs over the period examined were extremely volatile. Therefore, even large measures of abnormal performance were not statistically different from zero.

Chan, Hendershott, and Sanders (1990)

The purpose of this study is to examine the notion that real estate both provides substantial risk-adjusted excess returns and serves as a hedge against inflation. Instead of using traditional appraisal-based returns, Chan et al. analyze monthly returns of eighteen to twenty-three equity REITs traded between 1973 to 1987. In their analysis, they use both the CAPM and the APM to assess the relative riskiness of real estate returns.

The macroeconomic factors identified in this study are the same variables specified by Chen, Roll, and Ross (1986). They include (1) industrial production growth, (2) the change in expected inflation, (3) unexpected inflation, (4) the difference between the returns on low-grade corporate bonds and long-term Treasury bonds, and (5) the difference in the returns between the long-term Treasury bonds and the one-month T-Bill rate. REIT excess returns (returns over the

risk-free rate) are regressed against excess returns of portfolios whose returns mimic the individual prespecified factors to evaluate REIT risk-adjusted performance.

The study found that using a simple CAPM framework shows evidence of excess REIT returns over the study period, most notably in the 1980s. However, this effect is eliminated when using the multifactor arbitrage pricing approach. Furthermore, the APM shows that three factors consistently drive both REIT and general stock market returns: changes in the risk and term structures and unexpected inflation. Moreover, since unexpected inflation is shown to have a negative impact, REITs are not a hedge against unexpected inflation, as is often believed to be the case.

McCue and Kling (1994)

The purpose of this study is to identify and examine the relationship between the macroeconomy and commercial real estate returns. More specifically, McCue and Kling set out to determine the channels of influence followed by macroeconomic variables, the extent to which the macroeconomic variables explain real estate returns, and how real estate returns react to shocks in the macroeconomy.

Unlike previous research into real estate returns which use commingled real estate fund data, McCue and Kling employ equity REIT data as the real estate data series. They examine monthly returns of the NAREIT Composite index for the period from May 1974 through December 1991. The four factors used as proxies for the macroeconomic variables include prices (the Consumer Price Index), short-term nominal interest rates (the three-month Treasury Bill rate), output (the Federal Reserve's Industrial Production Index), and investment (the

McGraw Hill Construction Contract Index). They utilize a vector autoregressive model for the period examined, and estimate the coefficients by ordinary least squares.

McCue and Kling found that the macroeconomy explains nearly 60% of the variation in equity REIT returns. Of the macroeconomic variables employed, nominal interest rates explain the greatest percentage of variation, nearly 36% of the total. Conversely, the price, output, and investment variables explain very little of the variation in returns. Shocks to nominal rates are significantly negative, while shocks to investment and output are significantly positive. A shock to prices results in a decline in REIT returns.

Chen, Hsieh, and Jordan (1997)

This aim of this study is to follow and expand the work of Titman and Warga (1986) and Chan, Hendershott, and Sanders (1990) by utilizing Arbitrage Pricing Theory to explain real estate returns. Chen et al. utilize two empirical implementations of APT: the factor loading model and the macrovariable model. The study compares the ability of these two models to explain the observed returns of equity REITs over three six-year periods, January 1974 – December 1979, January 1980 – December 1985, and January 1986 – December 1991. The sample includes 14, 12, and 27 equity REITs for each respective period.

The procedure utilized to determine the factor risk premiums is essentially identical to the widely-used approach pioneered by Fama and MacBeth (1973). The factor premiums can be interpreted as the predicted or fitted values from running a cross-sectional weighted least squares regression of a prespecified industry portfolio on the factor loadings each month. For the macrovariable model, the study uses the following variables: (1) the unanticipated inflation rate, (2) the change in expected inflation, (3) the unanticipated change in term structure, (4) the

unanticipated change in risk premium, and (5) a market index residual derived from regressing the market index on the other four macrovariables.

The results of the study indicate that the five-factor macrovariable model is superior in explaining equity REIT returns for two of the three time periods examined, January 1980 – December 1985 and January 1986 – December 1991. In the remaining period (January 1974 – December 1979) the hypothesis of equal performance could not be rejected. The macrovariable model is also determined to be superior when the three periods are considered together. Regarding the variables themselves, coefficients on the unanticipated inflation rate, the unanticipated change in term structure, and the market residual are all significant at the 10% level in the later two periods examined. None of the macrovariables are found to be significant in the first period, the period for which both models have equal performance.

Chen, Hsieh, Vines, and Chiou (1998)

This study examines whether any of the common factors prevailing among ordinary equities is useful in explaining the cross-sectional variation in equity REIT returns. The difference between this and previous studies is most of the existing work investigating the relative performance of REITs examines only time-series returns. Cross-sectional tests are designed to explain differences in the returns across various assets in a specific time period.

Chen et al. employ four different pricing models to explain the returns of equity REITs. The first is the traditional CAPM. The other three are multi-factor models differing in the number and type of explanatory factors included. In the firm-specific variable model, the factors are attributes unique to individual firms, namely firm size and the book-to-market equity ratio. The macroeconomic variable model employs the same economic time-series variables used by

Chen, Hsieh, and Jordan (1997). For the combined model, all the variables associated with the other three models are combined together as factors.

The results of the study show that the regression coefficient associated with the market beta is not significantly different from zero. Therefore, the data does not support the market index as a relevant variable for explaining cross-sectional variation of equity REIT returns, and CAPM is rejected. The study also shows that firm size is significantly priced among equity REITs over time. The significance remains even when all of the other factors are present. The book-to-market equity ratio is not significant in either of the two pricing models.

The results also indicate that the macroeconomic variables used are generally insignificant in equity REIT pricing. The only exception is the unanticipated change in term structure. The risk premium is negatively significant at the 5% level in the macroeconomic variable model, but significance disappears in the combined model. In summary, Chen et al. found that none of the macroeconomic variables are significant in explaining the cross-sectional variation of equity REIT returns when the two firm-specific models are also included.

CHAPTER FIVE

The Research Models

This study employs three asset-pricing models to estimate the cost of equity capital for REITs. The first model is the traditional CAPM, where the total excess returns for each REIT in the sample are regressed against the total excess returns of the broad market index[14]. The second research model incorporates the two firm-specific factors developed by Fama and French, SMB and HML. Again, ordinary least squares regression is used to estimate the required returns. In the third model, two additional macroeconomic factors are included to represent the change in expected inflation and the change in risk premium. Using factors that are of a pervasive macroeconimic nature is in line with the Arbitrage Pricing Theory of Ross.

The goal of this study is to determine a model which produces results that are accurate and consistent as to be used in practice. Therefore, our starting point for the research sample was all 130 equity REITs in the four major property sectors: Office/Industrial, Retail, Residential (Multifamily), and Diversified, as of December 31, 1999. Since the REIT industry has gone through such dramatic changes in recent years, we imposed three additional criteria for the final sample to insure accurate results. The first criterion was the existence of sixty consecutive monthly returns from January 1995 through December 1999 on the Center for Research in Security Prices (CRSP) tapes. This is to allow for the estimation of the betas in the regression equations.

The second criterion was that each REIT have a Standard Industrial Classification (SIC) code of 6798 for the entire sixty-month period. This is to ensure the company was organized as

[14] Excess returns are monthly returns in excess of the one-month risk free rate.

a REIT for the complete sample period. The unique requirements and limitations of the REIT structure make these companies very different from other equities. Since the goal of this study is to develop a model for equity REITs, we want to examine the historical returns of only those companies organized as a REIT.

The third and final criterion is that the company has the same CRSP Permanent Number for the entire sample period. The total research sample of 49 equity REITs is listed in Appendix A. In order to determine a proxy for the overall REIT market, the total excess returns of the NAREIT Value-Weighted indexes for all REITs and equity REITs are also examined.

THE RISK FACTORS

The most important element in estimating asset returns is the *unexpected* change in the variables that affect asset prices. For instance, it is generally held that earnings expectations are important in affecting the value of a company, and that earnings expectations are fully reflected in the current share price. Thus, changes in expectations result in changes in the share price and are directly reflected in returns. If an investor wants to predict the return for a company over a certain period of time, the most important earnings variable is how earnings *expectations* change – the actual earnings estimate or the error in the forecast becomes almost irrelevant.

Because only innovations or unanticipated changes in the variables are required, we use realized total returns rather than stated yields or levels for our risk factor data[15]. There are statistical tolls and methods that can be utilized to estimate the innovations from data such as yields on Government Bonds and the level of the Consumer Price Index (CPI)[16]. However, such methods are not very efficient for use in practice, as continually updating the results becomes

[15] Assuming efficient markets, actual returns are, by definition, innovations.

cumbersome and time consuming. Using returns as opposed to yields enables the research database to be updated easily using published data, and the factor premiums and coefficients to be recalculated as needed.

The first two models used in this study, the CAPM and Fama-French Model, dictate which risk factors are to be used to estimate stock returns. Conversely, the third model based upon Arbitrage Pricing Theory does not specify which factors are to be employed. Therefore, we draw upon previous research results for both general equities and REITs in defining the risk factor variables for this model. As mentioned in a previous section, most applications of the Arbitrage Pricing model consider risk factors that are of a pervasive macroeconomic nature. The most common risk factors used are those first defined by Chen, Roll, and Ross (1986) and include changes in expected inflation, changes in unexpected inflation, the unanticipated change in the term structure, the unanticipated change in risk premium, and the unanticipated change in the growth rate in industrial production.

Based upon recent studies dealing specifically with real estate, notably Chan, Hendershott, and Sanders (1990) the unanticipated change in industrial production is not included in our model. Despite the fact that their study also found no significant role in the change in expected inflation for equity REIT returns, the variable is retained in our model due to the amount of empirical findings related to the impact of inflation on real estate. Furthermore, since it has been shown that changes in expected inflation are highly correlated with changes in unexpected inflation, we do not add an additional factor for this risk.

We also do not include an additional variable for the change in term structure. This is due to the fact that our variable for the change in expected inflation is the one-year Treasury

[16] See Fama and MacBeth (1973).

Bond less the one-month Treasury Bill. Since, theoretically, the change in term structure can be measured by the difference between any two points on the yield curve, this factor captures some of this effect. Moreover, the high correlation between the change in term structure factor and the change in expected inflation factor would cause erroneous results.

Of the common factors used in Arbitrage Pricing Models, we employ only two: the change in expected inflation and the change in the risk premium (which we label as Confidence Risk). Because of the overwhelming significance of the two Fama-French factors and their universal applicability, they are retained for our combined model. Furthermore, we also use the market premium from the CAPM in order to assess its significance in the presence of additional factors.

Each of the risk factors used in this paper is identified and discussed below.

1. Market Risk (MKP)

In the CAPM model, the MKP is the only risk factor employed. This follows from Capital Market Theory which states that all systematic risk is represented by the single market beta coefficient.

In the multifactor models, including the MKP factor makes the CAPM a special case. In the FFM and APM, the MKP represents that part of the total market return that is not explained by the other variables and an intercept term. Therefore, if the risk exposure to all of the other factors is exactly zero, than the MKP is proportional to the total market return. Under these extremely unlikely conditions, a stock's exposure to MKP would be exactly equal to its CAPM beta. By retaining the MKP, the FFM and APM can be viewed as extensions or generalizations of the CAPM.

2. Size Factor (SMB)

The Size Factor is used to capture the size premium that exists in common equity returns. This factor was constructed by Eugene Fama and Ken French and represents the difference between the returns on a portfolio of small stocks and a portfolio of big stocks, measured in terms of equity capitalization. See Chapter Three for a complete description of the derivation of SMB.

We expect SMB to have a significant impact on the cost of equity for REITs. Correcting for the size disparity is important for this industry, as the average REIT is much smaller than the average company listed on the NYSE. Furthermore, Colwell and Park (1990) and McIntosh, Liang, and Tompkins (1991) find the small firm effect exists within the REIT industry.

3. Relative Distress Factor (HML)

The Relative Distress Factor (HML) is the other Fama-French factor employed in this study. HML is used to account for the return premium that exists for companies with relatively high book-to-market-equity ratios. The factor is measured as the difference between the total returns on a portfolio of high-book-to-market-equity stocks and low-book-to-market-equity stocks.

The Relative Distress Factor assumes that the earnings prospects of firms are associated with a risk factor in returns. Firms that have high book-to-market-equity ratios (a low stock price relative to book value) tend to have low earnings on assets, and the low earnings persist for at least five years before and five years after the ratio is measured. Conversely, firms with low book-to-market-equity ratios (a high stock price relative to book value) tend to have persistently high earnings (Fama and French, 1993). Consequently, firms that the market judges to have poor

earnings prospects, have higher expected stock returns (a higher cost of equity capital) than firms with strong earnings prospects.

Research by Fama and French indicate that, despite the fact that the size effect has attracted more attention, the book-to-market equity ratio has a consistently stronger role in predicting returns (Fama and French, 1992). Given that HML is significant in measuring the returns for other equities, we expect it to be an important factor in measuring the cost of equity for REITs.

4. Change in Expected Inflation (EXI)

The Change in Expected Inflation represents the unanticipated changes in investors' outlook on inflation. There are many options that can be used to proxy inflation expectations. Several studies use the forecast for the Consumer Price Index or various estimates from professional surveys. However, as mentioned previously, determining the innovations from a time-series of yields is not efficient for a model designed to be used in practice. Therefore, we use the excess return on the one-year U.S. Treasury Bond to proxy the Change in Expected Inflation. Existing interest rate literature indicates that the movements in short-term U.S. Government securities are primarily due to changes in inflation expectations[17]. Hence, the one-year Bond can be thought of as representing investors' expectations for inflation for the next year.

Most stocks have negative exposures to changes in expected inflation. Thus, a positive inflation surprise causes a negative contribution to return, whereas a negative inflation surprise (a

[17] See Fama (1975).

deflation shock) contributes positively toward returns (Burmeister, 1994)[18]. Alternatively, companies that have large asset holdings, such as real estate, may actually benefit from increased inflation. Several research studies indicate that unsecuritized real estate provides an effective hedge against the expected and unexpected components of inflation[19]. Studies which examine the relationship between REITs and inflation have not been as conclusive, however. Some studies show that REITs and inflation are unrelated, while others indicate that REITs provide a hedge against the temporary or permanent components of certain inflation measures[20].

5. Confidence Risk (CON)

Confidence Risk is the unanticipated changes in investors' willingness to undertake relatively risky investments. CON is measured as the difference between the rate of return on relatively risky (Baa) and relatively safe (Aaa) corporate bonds. In any month when the return on Baa-rated bonds exceeds the return on Aaa-rated bonds by more than the long-run average, this measure of Confidence Risk is positive. The intuition is that a positive return difference reflects investor confidence because the required *yield* on relatively risky bonds has fallen with respect to relatively safe bonds. Most equities have a positive exposure to CON, and small stocks generally have greater exposure than large stocks (Burmeister, 1994).

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[18] In this study, EXI is measured in terms of returns, not yields. Therefore, the relationship to unanticipated changes in inflation is the same as stated, but the sign on the coefficients is the opposite.

[19] See Chapter Four.

[20] For *unrelated*, see Murphy and Kleiman (1989), Chen et al. (1990), Park et al. (1990), and Yabaccio et al. (1995). For *related*, see Gyourko and Linneman (1988), Chen and Tzang (1988), and Chatrath and Liang (1998).

Table 5.1 provides a summary of the risk factors and their derivation.

Table 5.1

Glossary and Measurement of Risk Factor Variables

Symbol	Variable	Data Source or Measurement
Panel A: Basic Data Series and Source		
$Market_t$	Stock market index	Total return on value-weighted portfolio of all NYSE, AMEX, and NASDAQ stocks (CRSP)
$1MoTB_t$	Treasury-bill rate	U.S. Treasury Bill total returns (Ibbotson Associates, 2000)
SMB_t	FF size factor	Total average return on three small portfolios minus three big portfolios (Ken French)
HML_t	FF distress factor	Total average return on two value portfolios minus two growth portfolios (Ken French)
$1YrTB_t$	Treasury-bond rate	U.S. Treasury Bond total returns (CRSP)
Aaa_t	Aaa-rated industrial bond	Total return on Lehman Bros. Investment Grade Aaa Long Index (Datastream)
Baa_t	Baa-rated industrial bond	Total return on Lehman Bros. Investment Grade Baa Long Index (Datastream)
Panel B: Derived Risk Factors		
$\boldsymbol{MKP_t}$	Market Risk	$Market_t - 1MoTB_t$
$\boldsymbol{SMB_t}$	Size Factor	1/3 (small value + small neutral +small growth) - 1/3(big value + big neutral + big growth)
$\boldsymbol{HML_t}$	Relative Distress Factor	1/2 (small value + big value) - 1/2 (small growth + big growth)
$\boldsymbol{EXI_t}$	Change in Expected Inflation	$1YrTB_t - 1MoTB_t$
$\boldsymbol{CON_t}$	Confidence Risk	$Baa_t - Aaa_t$

Factor Risk Premiums

In order to determine the premiums required for each of the various risk factors, we first compiled the total monthly returns for each variable over the 27-year period from January 1973 through December 1999[21]. Next, we perform the necessary operations to derive the returns for each of the risk factors. For example, the total returns for each month for the 30-day Treasury

Bill is subtracted from those of the CRSP Value-Weighted Index to determine the monthly Market Risk (MKP) returns. After the 324 monthly returns for each of the derived factors are compiled, the simple arithmetic mean is computed[22]. The mean monthly premium was then annualized to ascertain the factor risk premium. Table 5.2 below lists each factor and associated annual risk premium.

Table 5.2

Factor Risk Premiums

%, for the period 1/73 - 12/99

	Avg. Monthly Return	*Standard Deviation*	*Annual Premium*
Market Risk - MKP	0.61	4.61	**7.27**
Size Factor - SMB	0.12	2.87	**1.46**
Relative Distress Factor - HML	0.30	2.93	**3.56**
Change in Expected Inflation - EXI	0.11	0.58	**1.28**
Confidence Risk - CON	0.09	1.05	**1.04**

THE CAPITAL ASSET PRICING MODEL

Estimating the cost of equity capital for each REIT using the CAPM is relatively straightforward. As mentioned previously, the required rate of return is composed of only two factors, the risk-free rate and the company's relationship to the market's general risk premium. Regarding the risk-free rate, the general consensus of practitioners is to use the 20-year U.S. Treasury yield to maturity as of the effective day of valuation for the following reasons (Pratt, 1998):

[21] The sample period was determined by data availability. Specifically, the data series for the Lehman Brothers Investment-Grade Corporate Bond Index begins in January 1973.

[22] Following common practice, the arithmetic mean is used as opposed to the geometric mean [see Pratt (1998), Ibbotson (2000), and Brealey and Myers (2000)].

1. It most closely matches the often-assumed perpetual lifetime horizon of an equity investment.

2. The longest-term yields to maturity fluctuate considerably less than short-term rates and thus are less likely to introduce unwarranted short-term distortions into the actual cost of capital.

3. People are generally willing to recognize and accept the fact that the maturity risk is impounded into this base, or otherwise risk-free, rate.

4. For compiling historical data, 20 years was the longest U.S. Treasury obligation issued during the early part of the twentieth century.

Many analysts use a 30-year yield, but as a practical matter it usually is not greatly different than the 20-year yield.

The second factor in the CAPM is the Market Risk Premium (*MKP*). Since the expected total return on equities is much more risky than the interest and maturity payments on U.S. Treasury obligations, investors require a comparatively higher return for investing in equities. This excess return is known as the Market Risk Premium.

In practice, a common method for estimating the expected *MKP* is to use historical data. It is important to note, however, that doing so assumes the amount of excess return investors expect for the future time horizon is approximately equal to the excess returns that have actually been achieved in the historical period for which the premium was computed. As shown in Table 5.2, the average market premium from 1973 to 1999 was 7.27%[23].

The specific application of Equation (1) used for estimating the cost of equity capital in this study is identified below:

$$K_{Ei} = R_f + B_i\,[E(MKP)] \qquad (1a)$$

[23] Ibbotson Associates reports the 72-year (1926-1997) historical premium as 7.5%.

where:

K_{Ei} = Cost of equity (expected total return) for REIT *i*
R_f = Risk free rate of interest (20-year T-Bond)
B_{il} = The sensitivity of REIT *i* excess return to the excess market return
E(MKP) = Expected excess return on the market

Given the calculated market risk premium of 7.27% and the 20-year Treasury yield of 6.69% as of December 31, 1999, the estimated cost of equity for the average U.S. public company ($B = 1.0$) is about 14%:

$$K_E = 6.69 + 1.0\,(7.27)$$
$$= 13.96\%$$

In Equation (1a), B_i is the sensitivity of REIT *i* to the return on the CRSP Value-Weighted Index. We estimate B_i for each REIT in the research sample by examining the historical relationship between the REIT and the broad market for the 60-month period January 1995 through December 1999. The value is estimated by fitting the time-series regression in the form:

$$R_{it} - R_{ft} = a_i + B_i(MKP) + e_{it} \qquad (5)$$

where:

$R_{it} - R_{ft}$ = Total return for REIT *i* in month *t* less the total return on the one-month T-Bill in month *t*
a_i = Intercept for REIT *i*
MKP = Total excess return on the CRSP Index in month *t*
B_i = The sensitivity of REIT *i* excess return to the excess market return
e_{it} = Residual for REIT *i* in period *t*, assumed to have a mean of zero

Results

The results from the CAPM regression equation and the estimated cost of equity for each REIT in the research sample, the entire research sample (average returns), and the two NAREIT indexes are displayed in Table 5.3.

Table 5.3 - CAPM Model Regression Results

$$R_i - R_f = a_i + B_i(MKP) + e_i$$

	Coefficients		t - statistics			
REIT	*a*	*B*	*t(a)*	*t(B)*	R^2	K_E
NAREIT Index						
All REITs	-0.399	0.399	-0.913	4.030	0.22	**9.59**
Equity REITs	-0.334	0.376	-0.772	3.841	0.20	**9.42**
Office / Industrial						
Duke-Weeks Realty Corporation	-0.007	0.471	-0.010	3.014	0.14	**10.12**
Spieker Properties, Inc.	1.127	0.052	1.507	0.308	0.00	**7.07**
Liberty Property Trust	-0.093	0.506	-0.141	3.381	0.16	**10.37**
Mack-Cali Realty Corporation	0.271	0.517	0.391	3.294	0.16	**10.45**
Highwoods Properties, Inc.	-0.412	0.544	-0.542	3.163	0.15	**10.64**
CarrAmerica Realty Corporation	-0.261	0.544	-0.368	3.388	0.17	**10.64**
HRPT Properties Trust	-0.715	0.441	-1.078	2.939	0.13	**9.90**
First Industrial Realty Trust, Inc.	-0.034	0.623	-0.044	3.585	0.18	**11.22**
Koger Equity, Inc.	0.833	0.437	0.818	1.897	0.06	**9.87**
Pacific Gulf Properties, Inc.	0.190	0.470	0.277	3.018	0.14	**10.10**
Keystone Property Trust	1.241	0.482	0.994	1.706	0.05	**10.20**
Average	*0.195*	*0.463*	*0.375*	*3.934*	*0.21*	***10.05***
Retail						
Kimco Realty Corporation	0.060	0.368	0.088	2.380	0.09	**9.36**
General Growth Properties, Inc.	0.486	0.065	0.678	0.403	0.00	**7.17**
New Plan Excel Realty Trust, Inc.	0.455	0.304	0.538	1.588	0.04	**8.90**
Regency Realty Corporation	0.269	0.235	0.394	1.521	0.04	**8.40**
Developers Diversified Realty Corporation	-0.355	0.211	-0.546	1.437	0.03	**8.23**
Macerich Company, The	-0.358	0.397	-0.513	2.518	0.10	**9.58**
Taubman Centers, Inc.	0.120	0.223	0.196	1.618	0.04	**8.31**
Realty Income Corporation	0.330	0.237	0.474	1.502	0.04	**8.41**
CBL & Associates Properties, Inc.	0.168	0.075	0.288	0.565	0.01	**7.23**
Chelsea GCA Realty, Inc.	-0.005	0.331	-0.006	1.758	0.05	**9.10**
Mills Corporation, The	-0.179	0.426	-0.184	1.936	0.06	**9.79**
Glimcher Realty Trust	-1.033	0.478	-1.226	2.509	0.10	**10.17**
Commercial Net Lease Realty, Inc.	-0.752	0.513	-1.090	3.284	0.16	**10.42**
JP Realty, Inc.	-0.601	0.307	-0.831	1.875	0.06	**8.92**
Saul Centers, Inc.	0.045	0.246	0.065	1.568	0.04	**8.48**
Crown American Realty Trust	-1.399	0.401	-1.331	1.683	0.05	**9.61**
Mid-Atlantic Realty Trust	0.319	0.312	0.401	1.736	0.05	**8.96**
Acadia Realty Trust	-1.855	0.348	-2.350	1.946	0.06	**9.22**
Kranzco Realty Trust	-1.142	0.409	-1.238	1.956	0.06	**9.66**
Ramco-Gershenson Properties Trust	-0.553	0.266	-0.940	1.993	0.06	**8.62**
Malan Realty Investors, Inc.	0.550	0.054	0.725	0.314	0.00	**7.08**
Average	*-0.259*	*0.296*	*-0.578*	*2.918*	*0.13*	***8.84***
Residential (Multifamily)						
Equity Residential Properties Trust	0.061	0.476	0.089	3.063	0.14	**10.15**
Apartment Investment & Mgmt. Co.	1.232	0.308	1.678	1.850	0.06	**8.93**
Camden Property Trust	-0.077	0.359	-0.107	2.216	0.08	**9.30**
BRE Properties, Inc.	0.680	0.108	0.982	0.686	0.01	**7.47**
Gables Residential Trust	0.222	0.187	0.374	1.388	0.03	**8.05**
Essex Property Trust, Inc.	1.075	0.330	1.515	2.053	0.07	**9.09**
Summit Properties Inc.	-0.117	0.222	-0.187	1.565	0.04	**8.30**
Mid-America Apartment Communities, Inc.	-0.532	0.387	-0.846	2.719	0.11	**9.51**
Town and Country Trust, The	0.127	0.501	0.208	3.618	0.18	**10.33**
Associated Estates Realty Corporation	-1.536	0.372	-1.745	1.864	0.06	**9.39**
Average	*0.114*	*0.325*	*0.234*	*2.962*	*0.13*	***9.05***
Diversified						
Vornado Realty Trust	0.814	0.255	0.898	1.241	0.03	**8.54**
Crescent Real Estate Equities, Inc.	-0.393	0.796	-0.420	3.754	0.20	**12.48**
Washington Real Estate Investment Trust	-0.377	0.270	-0.725	2.297	0.08	**8.66**
Colonial Properties Trust	-0.299	0.414	-0.518	3.168	0.15	**9.70**
Pennsylvania Real Estate Investment Trust	-0.146	0.107	-0.207	0.668	0.01	**7.47**
Transcontinental Realty Investors, Inc.	-0.110	0.439	-0.104	1.832	0.05	**9.88**
Boddie-Noell Properties, Inc.	-0.325	0.114	-0.456	0.704	0.01	**7.52**
Average	*-0.119*	*0.342*	*-0.271*	*3.431*	*0.17*	***9.18***
TOTAL SAMPLE AVERAGE	**-0.061**	**0.346**	**-0.143**	**3.566**	**0.18**	**9.20**

As expected, the CAPM systematically understates the cost of equity capital for equity REITs. The average cost of equity estimate for the research sample is 9.20%, with a standard error (s.e.) of 3.07%. Using standard convention of plus or minus two standard errors from the mean, the average cost of equity falls between 3.06% and 15.34%. In addition, the MKP factor is only significant at the 5% level in less than 45% of the individual time-series regressions. It is significant at the 10% level in 65% of the regressions.

The range for the total sample is 7.07% (Spieker Properties) to 12.48% (Crescent Real Estate Equities). The estimate for many of the REITs is less than their respective unsecured borrowing costs. The highest average property sector estimate is for the Office/Industrial sector at 10.05% (s.e. = 3.7%). The Retail sector has the lowest estimate at 8.84% (s.e. = 3.2%). Since the REITs are organized in terms of equity market capitalization, we can examine the relationship between the cost of equity estimate and company size within each property sector. In the CAPM results, there is little evidence to support the claim that larger companies enjoy a lower cost of equity capital.

The best and most widely used measure of the explanatory ability of a linear regression model is the coefficient of determination, denoted by R^2. The R^2 for the CAPM is 0.18, indicating the model only explains 18% of the variation in the average returns for the research sample. The range of R^2's for the individual REITs in the research sample is 0.00 (three REITs) to 0.20 (Crescent Real Estate Equities). The extremely low coefficients of determination indicate the lack of predictive ability of the CAPM, and suggest the model is not particularly useful for estimating the cost of equity for REITs.

THE FAMA-FRENCH MODEL

The method for estimating the cost of equity capital using the Fama-French Model (FFM) is identified as the following application of Equation (2):

$$K_{Ei} = R_f + B_{i1}[E(MKP)] + B_{i2}[E(SMB)] + B_{i3}[E(HML)] \quad (2a)$$

where:

K_{Ei} = Cost of equity (expected return) for REIT i
R_f = Risk free rate of interest (20-year T-Bond)
B_{i1} = The sensitivity of REIT i excess return to the excess market return
$E(MKP)$ = Expected excess return on the market
B_{i2} = The sensitivity of REIT i excess return to the return of a portfolio that mimics SMB
$E(SMB)$ = Expected return on a portfolio that mimics SMB
B_{i3} = The sensitivity of REIT i excess return to the return of a portfolio that mimics HML
$E(HML)$ = Expected return on a portfolio that mimics HML

The factor sensitivities (B's) are calculated the same way as in the CAPM model. The historical total monthly excess returns for each REIT are regressed against the total excess returns for the market-portfolio, the SMB portfolio, and the HML portfolio for the 60-month period January 1995 through December 1999. The values are estimated by fitting the following time-series regression equation:

$$R_{it} - R_{ft} = a_i + B_{i1}(MKP) + B_{i2}(SMB) + B_{i3}(HML) + e_{it} \quad (7)$$

where:

$R_{it} - R_{ft}$	=	Total return for REIT i in month t less the total return on the one-month T-Bill in month t
a_i	=	Intercept for REIT i
MKP	=	Total excess return on the CRSP Index in month t
B_{i1}	=	The sensitivity of REIT i excess return to the excess market return
SMB	=	Total return the SMB portfolio
B_{i2}	=	The sensitivity of REIT i excess return to the SMB portfolio return
HML	=	Total return on the HML portfolio
B_{i3}	=	The sensitivity of REIT i excess return to the HML portfolio return
e_{it}	=	Residual for REIT i in period t, assumed to have a mean of zero

Results

The results from the Fama-French regression equation and the estimated cost of equity for each REIT in the research sample, the entire research sample (average returns), and the two NAREIT indexes are displayed in Table 5.4.

Table 5.4 - Fama-French Model Regression Results

$$R_i - R_f = a_i + B_{i1}(MKP) + B_{i2}(SMB) + B_{i3}(HML) + e_i$$

	Coefficients				t - statistics					
REIT	a	B_1	B_2	B_3	$t(a)$	$t(B_1)$	$t(B_2)$	$t(B_3)$	R^2	K_E
NAREIT Index										
All REITs	-0.205	0.601	0.412	0.581	-0.564	6.316	3.735	5.051	0.49	**13.73**
Equity REITs	-0.140	0.566	0.408	0.552	-0.382	5.919	3.683	4.777	0.47	**13.36**
Office / Industrial										
Duke-Weeks Realty Corporation	0.025	0.695	0.143	0.535	0.037	3.921	0.696	2.500	0.22	**13.85**
Spieker Properties, Inc.	1.318	0.246	0.404	0.559	1.809	1.291	1.828	2.429	0.11	**11.06**
Liberty Property Trust	0.055	0.663	0.315	0.447	0.084	3.881	1.594	2.166	0.24	**13.56**
Mack-Cali Realty Corporation	0.511	0.658	0.467	0.466	0.759	3.739	2.288	2.190	0.26	**13.82**
Highwoods Properties, Inc.	-0.224	0.697	0.382	0.462	-0.298	3.539	1.675	1.943	0.22	**13.96**
CarrAmerica Realty Corporation	-0.027	0.804	0.503	0.737	-0.042	4.718	2.549	3.580	0.34	**15.89**
HRPT Properties Trust	-0.770	0.768	0.034	0.723	-1.268	4.833	0.185	3.765	0.32	**14.90**
First Industrial Realty Trust, Inc.	0.224	0.644	0.450	0.199	0.291	3.206	1.935	0.819	0.23	**12.74**
Koger Equity, Inc.	1.338	0.639	0.946	0.759	1.413	2.579	3.294	2.537	0.24	**15.42**
Pacific Gulf Properties, Inc.	0.364	0.734	0.403	0.713	0.571	4.400	2.085	3.537	0.30	**15.16**
Keystone Property Trust	1.786	0.616	0.988	0.626	1.477	1.948	2.696	1.639	0.17	**14.84**
Average	*0.418*	*0.651*	*0.458*	*0.566*	*0.903*	*5.380*	*3.264*	*3.870*	*0.41*	***14.11***
Retail										
Kimco Realty Corporation	0.231	0.516	0.352	0.442	0.343	2.929	1.724	2.078	0.17	**12.53**
General Growth Properties, Inc.	0.603	0.327	0.304	0.673	0.882	1.830	1.467	3.116	0.15	**11.91**
New Plan Excel Realty Trust, Inc.	0.566	0.518	0.276	0.560	0.674	2.356	1.084	2.107	0.11	**12.85**
Regency Realty Corporation	0.548	0.481	0.577	0.732	0.896	3.004	3.110	3.784	0.27	**13.63**
Developers Diversified Realty Corp.	-0.091	0.436	0.540	0.673	-0.155	2.831	3.026	3.614	0.26	**13.05**
Macerich Company, The	-0.062	0.589	0.583	0.616	-0.096	3.483	2.973	3.013	0.27	**14.02**
Taubman Centers, Inc.	0.264	0.380	0.309	0.447	0.442	2.439	1.709	2.371	0.14	**11.50**
Realty Income Corporation	0.485	0.495	0.369	0.688	0.742	2.893	1.860	3.327	0.20	**13.28**
CBL & Associates Properties, Inc.	0.343	0.203	0.351	0.399	0.601	1.362	2.027	2.212	0.11	**10.10**
Chelsea GCA Realty, Inc.	0.358	0.618	0.737	0.876	0.481	3.174	3.265	3.723	0.29	**15.38**
Mills Corporation, The	-0.007	0.697	0.401	0.726	-0.008	2.793	1.386	2.408	0.15	**14.93**
Glimcher Realty Trust	-0.625	0.746	0.804	0.854	-0.831	3.789	3.526	3.594	0.33	**16.33**
Commercial Net Lease Realty, Inc.	-0.769	0.920	0.132	0.932	-1.304	5.965	0.737	5.000	0.42	**16.89**
JP Realty, Inc.	-0.628	0.489	0.025	0.406	-0.864	2.576	0.114	1.768	0.11	**11.73**
Saul Centers, Inc.	0.199	0.506	0.367	0.691	0.306	2.976	1.862	3.364	0.21	**13.37**
Crown American Realty Trust	-1.074	0.633	0.649	0.724	-1.048	2.359	2.088	2.236	0.15	**14.82**
Mid-Atlantic Realty Trust	0.415	0.586	0.272	0.688	0.540	2.915	1.170	2.834	0.17	**13.80**
Acadia Realty Trust	-1.698	0.482	0.322	0.402	-2.141	2.325	1.341	1.606	0.11	**12.10**
Kranzco Realty Trust	-0.772	0.574	0.701	0.597	-0.868	2.469	2.600	2.126	0.19	**14.02**
Ramco-Gershenson Properties Tr.	-0.416	0.338	0.263	0.248	-0.701	2.179	1.465	1.320	0.11	**10.42**
Malan Realty Investors, Inc.	0.789	0.145	0.447	0.351	1.047	0.737	1.954	1.472	0.08	**9.65**
Average	*-0.064*	*0.509*	*0.418*	*0.606*	*-0.172*	*5.253*	*3.726*	*5.179*	*0.44*	***13.16***
Residential (Multifamily)										
Equity Residential Properties Trust	0.144	0.698	0.230	0.562	0.216	3.992	1.136	2.658	0.24	**14.10**
Apartment Investment & Mgmt. Co.	1.421	0.494	0.397	0.541	1.982	2.636	1.827	2.388	0.16	**12.79**
Camden Property Trust	0.057	0.489	0.280	0.377	0.079	2.598	1.287	1.658	0.13	**11.99**
BRE Properties, Inc.	0.904	0.291	0.456	0.554	1.361	1.676	2.268	2.642	0.15	**11.45**
Gables Residential Trust	0.316	0.300	0.205	0.316	0.528	1.918	1.135	1.673	0.08	**10.29**
Essex Property Trust, Inc.	1.282	0.617	0.468	0.784	1.982	3.648	2.386	3.837	0.28	**14.65**
Summit Properties Inc.	0.212	0.366	0.621	0.525	0.372	2.458	3.598	2.916	0.26	**12.13**
Mid-America Apartment Comm.	-0.331	0.483	0.383	0.338	-0.532	2.972	2.035	1.723	0.19	**11.97**
Town and Country Trust, The	0.297	0.633	0.343	0.404	0.495	4.031	1.886	2.131	0.26	**13.23**
Associated Estates Realty Corp.	-1.348	0.580	0.405	0.590	-1.549	2.546	1.537	2.145	0.14	**13.60**
Average	*0.295*	*0.495*	*0.379*	*0.499*	*0.668*	*4.278*	*2.827*	*3.570*	*0.32*	***12.62***
Diversified										
Vornado Realty Trust	1.190	0.544	0.758	0.886	1.433	2.503	3.013	3.377	0.24	**14.90**
Crescent Real Estate Equities, Inc.	-0.051	1.047	0.685	0.778	-0.058	4.507	2.545	2.773	0.32	**18.07**
Washington REIT	-0.295	0.405	0.194	0.359	-0.573	3.009	1.246	2.207	0.16	**11.19**
Colonial Properties Trust	-0.180	0.652	0.297	0.620	-0.337	4.670	1.837	3.673	0.32	**14.08**
Pennsylvania REIT	-0.211	0.502	0.043	0.876	-0.342	3.102	0.231	4.480	0.29	**13.52**
Transcontinental Realty Investors	-0.153	0.582	-0.016	0.307	-0.141	2.051	-0.048	0.896	0.07	**11.99**
Boddie-Noell Properties, Inc.	-0.152	0.264	0.355	0.448	-0.216	1.432	1.662	2.010	0.09	**10.72**
Average	*0.021*	*0.571*	*0.331*	*0.610*	*0.057*	*5.907*	*2.956*	*5.229*	*0.45*	***13.50***
TOTAL SAMPLE AVERAGE	**0.130**	**0.547**	**0.407**	**0.576**	**0.366**	**5.896**	**3.784**	**5.139**	**0.47**	**13.31**

The predictive ability of the regression model is greatly improved with the addition of the two Fama-French factors. The SMB factor is significant at the 5% level in nearly 40% of the individual REIT regressions, and significant at the 10% level in 63% of the regressions. The HML factor is significant at the 5% level in nearly 80% of the regressions, and significant at the *1%* level nearly half of the time. At the 10% level HML is significant in nearly 90% of the regressions. With the addition of the two Fama-French factors, the MKP factor also gains significance. The MKP factor is significant at the 5% level in 84% of the regressions, and significant at the 10% level in all but four of them. The resulting coefficient of determination is 0.47 for the total research sample. This indicates that the FFM explains approximately half of the variation in REIT returns over the 60-month sample period, nearly a 30% improvement over the CAPM.

The FFM cost of equity estimate using the average returns for the total research sample is 13.31%. In order to calculate the estimate error, the following equation is used:

$$s.e.(K_E) = [var_{(MKP)} \times MKP^2 + var_{(SMB)} \times SMB^2 + var_{(HML)} \times HML^2 + 2cov_{(MKP,SMB)} \times MKP \times SMB + 2cov_{(SMB,HML)} \times SMB \times HML + 2cov_{(MKP,HML)} \times MKP \times HML]^{1/2} \quad (8)$$

where:

$s.e.(K_E)$	=	The standard error of the cost of equity estimate
$var_{(MKP)}$	=	Variance in the monthly returns for MKP, 1/95 – 12/99
MKP	=	The historical MKP risk factor premium
$var_{(SMB)}$	=	Variance in the monthly returns for SMB, 1/95 – 12/99
SMB	=	The historical SMB risk factor premium
$var_{(HML)}$	=	Variance in the monthly returns for HML, 1/95 – 12/99
HML	=	The historical HML risk factor premium
$cov_{(MKP,SMB)}$	=	Covariance in monthly returns for MKP and SMB, 1/95-12/99
$cov_{(SMB,HML)}$	=	Covariance in monthly returns for SMB and HML, 1/95-12/99
$cov_{(MKP,HML)}$	=	Covariance in monthly returns for MKP and HML, 1/95-12/99

The result of Equation (8) is 0.973%. Using standard convention of plus or minus two standard errors from the mean, the average cost of equity falls between 11.36% and 15.26%. The standard error is considerably less, and the actual estimate is much more reasonable than that provided by the CAPM.

The range for the research sample is 9.65% (Malan Realty Investors) to 18.07% (Crescent Real Estate Equities). The relatively low estimate for Malan Realty Investors is misleading, as the coefficient of determination for the regression (0.08) was tied for the lowest in the sample. However, it is interesting to note that the CAPM and the FFM indicate that Crescent Real Estate Equities has the highest cost of equity in the research sample. Furthermore, the Office/Industrial sector is again shown to have the highest average estimate at 14.11%. The lowest average estimate is for the Multifamily sector at 12.62%. As with the CAPM, it is difficult to ascertain a size premium in the estimates. However, there is some indication of the effect within the Office/Industrial sector.

THE ARBITRAGE PRICING MODEL

The method for estimating the cost of equity capital using the combined Arbitrage Pricing Model (APM) is summarized as the following application of Equation (3):

$$K_{Ei} = R_f + B_{i1}[E(MKP)] + B_{i2}[E(SMB)] + B_{i3}[E(HML)] + B_{i4}[E(EXI)] + B_{i5}[E(CON)] \quad (3a)$$

where:

K_{Ei}	=	Cost of equity (expected return) for REIT *i*
R_f	=	Risk free rate of interest (20-year T-Bond)
B_{i1}	=	The sensitivity of stock *i* excess return to the market excess return
$E(MKP)$	=	Expected excess return on the market
B_{i2}	=	The sensitivity of stock *i* excess return to the return of a portfolio that mimics SMB
$E(SMB)$	=	Expected total return on a portfolio that mimics SMB
B_{i3}	=	The sensitivity of stock *i* excess return to the return of a portfolio that mimics HML
$E(HML)$	=	Expected total return on a portfolio that mimics HML
B_{i4}	=	The sensitivity of stock *i* excess returnto the return of a portfolio that mimics EXI
$E(EXI)$	=	Expected total return on a portfolio that mimics EXI
B_{i5}	=	The sensitivity of stock *i* excess return to the return of a portfolio that mimics CON
$E(CON)$	=	Expected total return on a portfolio that mimics CON

The factor sensitivities (*B*'s) are calculated the same way as in the CAPM and Fama-French model. The historical total monthly excess returns for each REIT are regressed against the total excess returns for the market-portfolio, the SMB portfolio, the HML portfolio, the EXI portfolio, and the CON portfolio for the same 60-month period. The values are estimated by fitting the following time-series regression equation:

$$R_{it} - R_{ft} = a_i + B_{i1}(MKP) + B_{i2}(SMB) + B_{i3}(HML) + B_{i3}(HML) + B_{i3}(HML) + e_{it} \quad (9)$$

where:

$R_{it} - R_{ft}$	=	Total return for REIT i in month t less the total return on the one-month T-Bill in month t
a_i	=	Intercept for REIT i
MKP	=	Total excess return on the CRSP Index in month t
B_{i1}	=	The sensitivity of REIT i excess return to the market total return
SMB	=	Total return the SMB portfolio
B_{i2}	=	The sensitivity of REIT i excess return to the SMB portfolio return
HML	=	Total return on the HML portfolio
B_{i3}	=	The sensitivity of REIT i excess return to the HML portfolio return
EXI	=	Total return on the EXI portfolio
B_{i4}	=	The sensitivity of REIT i excess return to the EXI portfolio return
CON	=	Total return on the CON portfolio
B_{i5}	=	The sensitivity of REIT i excess return to the CON portfolio return
e_{it}	=	Residual for REIT i in period t, assumed to have a mean of zero

Results

The results from the Arbitrage Pricing Model regression equation and the estimated cost of equity for each REIT in the research sample, the entire research sample (average returns), and the two NAREIT indexes are displayed in Table 5.5.

Table 5.5 - Arbitrage Pricing Model Regression Results

$$R_i - R_f = a_i + B_{i1}(MKP) + B_{i2}(SMB) + B_{i3}(HML) + B_{i4}(EXI) + B_{i5}(CON) + e_i$$

	Coefficients						t - statistics							
REIT	a	B_1	B_2	B_3	B_4	B_5	$t(a)$	$t(B_1)$	$t(B_2)$	$t(B_3)$	$t(B_4)$	$t(B_5)$	R^2	K_E
NAREIT Index														
All REITs	-0.182	0.606	0.405	0.585	-0.440	0.160	-0.463	6.137	3.498	4.938	-0.237	0.093	0.49	**13.37**
Equity REITs	-0.070	0.576	0.393	0.562	-1.053	-0.115	-0.178	5.828	3.391	4.736	-0.565	-0.066	0.47	**11.98**
Office / Industrial														
Duke-Weeks Realty Corporation	-0.129	0.685	0.145	0.521	1.180	2.919	-0.178	3.758	0.677	2.380	0.343	0.918	0.24	**18.28**
Spieker Properties, Inc.	1.778	0.312	0.317	0.624	-6.550	-1.771	2.328	1.626	1.409	2.710	-1.810	-0.529	0.17	**1.39**
Liberty Property Trust	0.025	0.667	0.302	0.448	-0.271	1.701	0.036	3.776	1.460	2.112	-0.081	0.552	0.24	**14.99**
Mack-Cali Realty Corporation	0.456	0.652	0.474	0.459	0.656	0.505	0.627	3.570	2.215	2.095	0.191	0.159	0.26	**15.12**
Highwoods Properties, Inc.	-0.250	0.705	0.360	0.466	-0.616	2.341	-0.308	3.468	1.513	1.909	-0.161	0.660	0.22	**15.64**
CarrAmerica Realty Corporation	0.464	0.864	0.431	0.800	-6.221	-3.657	0.688	5.101	2.172	3.938	-1.947	-1.238	0.39	**4.67**
HRPT Properties Trust	-0.836	0.764	0.036	0.716	0.535	1.159	-1.276	4.637	0.186	3.627	0.172	0.404	0.32	**16.73**
First Industrial Realty Trust, Inc.	0.504	0.680	0.406	0.236	-3.667	-1.829	0.614	3.292	1.679	0.952	-0.942	-0.508	0.25	**6.46**
Koger Equity, Inc.	0.685	0.555	1.049	0.673	8.553	4.233	0.693	2.234	3.607	2.259	1.827	0.978	0.29	**30.03**
Pacific Gulf Properties, Inc.	0.385	0.742	0.389	0.719	-0.677	0.807	0.559	4.289	1.918	3.464	-0.208	0.268	0.30	**15.18**
Keystone Property Trust	1.760	0.623	0.969	0.629	-0.497	2.076	1.349	1.902	2.525	1.599	-0.080	0.363	0.17	**16.39**
Average	*0.440*	*0.659*	*0.443*	*0.572*	*-0.689*	*0.771*	*0.882*	*5.257*	*3.020*	*3.803*	*-0.291*	*0.353*	*0.42*	***14.08***
Retail														
Kimco Realty Corporation	0.651	0.550	0.329	0.486	-3.902	-6.384	0.938	3.151	1.608	2.322	-1.186	-2.098	0.24	**1.27**
General Growth Properties, Inc.	0.955	0.393	0.205	0.732	-6.222	1.415	1.338	2.191	0.974	3.401	-1.840	0.452	0.21	**5.93**
New Plan Excel Realty Trust, Inc.	0.475	0.502	0.299	0.545	1.509	-0.138	0.524	2.203	1.120	1.994	0.351	-0.035	0.12	**14.52**
Regency Realty Corporation	0.552	0.500	0.536	0.743	-1.545	3.385	0.849	3.062	2.800	3.792	-0.502	1.188	0.30	**15.28**
Developers Diversified Rlty Corp.	0.200	0.487	0.467	0.719	-4.829	0.423	0.323	3.121	2.556	3.844	-1.642	0.156	0.29	**7.71**
Macerich Company, The	0.249	0.642	0.506	0.665	-5.085	0.303	0.365	3.742	2.519	3.229	-1.572	0.101	0.31	**8.25**
Taubman Centers, Inc.	0.361	0.406	0.266	0.467	-2.284	1.688	0.565	2.530	1.417	2.428	-0.755	0.604	0.16	**10.51**
Realty Income Corporation	-0.143	0.402	0.494	0.598	9.167	1.906	-0.217	2.442	2.559	3.026	2.951	0.664	0.32	**26.22**
CBL & Associates Properties, Inc.	0.148	0.181	0.375	0.375	2.300	1.860	0.242	1.182	2.083	2.036	0.795	0.695	0.13	**14.77**
Chelsea GCA Realty, Inc.	0.472	0.638	0.708	0.894	-1.889	0.164	0.588	3.163	2.998	3.696	-0.497	0.047	0.29	**13.29**
Mills Corporation, The	0.334	0.735	0.360	0.768	-3.990	-3.294	0.327	2.866	1.198	2.496	-0.825	-0.737	0.17	**6.75**
Glimcher Realty Trust	-0.472	0.770	0.771	0.877	-2.337	-0.257	-0.582	3.780	3.234	3.592	-0.609	-0.072	0.33	**13.27**
Commercial Net Lease Realty, Inc	-0.568	0.951	0.089	0.962	-3.034	-0.374	-0.900	5.997	0.479	5.053	-1.014	-0.135	0.43	**12.88**
JP Realty, Inc.	-0.324	0.558	-0.085	0.463	-6.265	3.247	-0.429	2.943	-0.381	2.038	-1.754	0.983	0.18	**7.58**
Saul Centers, Inc.	-0.044	0.487	0.379	0.666	2.213	3.781	-0.063	2.806	1.866	3.199	0.676	1.249	0.24	**19.92**
Crown American Realty Trust	-0.486	0.682	0.611	0.787	-5.656	-8.485	-0.455	2.543	1.944	2.446	-1.118	-1.814	0.21	**-0.71**
Mid-Atlantic Realty Trust	0.380	0.568	0.306	0.676	1.509	-2.188	0.460	2.737	1.260	2.715	0.386	-0.605	0.18	**13.35**
Acadia Realty Trust	-1.515	0.502	0.301	0.425	-2.117	-1.805	-1.776	2.343	1.197	1.651	-0.524	-0.483	0.12	**7.70**
Kranzco Realty Trust	-0.807	0.580	0.683	0.599	-0.389	2.165	-0.842	2.411	2.423	2.074	-0.086	0.516	0.19	**15.79**
Ramco-Gershenson Properties Tr.	-0.435	0.330	0.278	0.242	0.672	-0.864	-0.679	2.054	1.475	1.254	0.222	-0.308	0.11	**10.33**
Malan Realty Investors, Inc.	0.924	0.205	0.336	0.393	-5.075	6.708	1.202	1.060	1.485	1.696	-1.394	1.992	0.18	**10.50**
Average	*0.043*	*0.527*	*0.391*	*0.623*	*-1.774*	*0.155*	*0.109*	*5.290*	*3.350*	*5.210*	*-0.944*	*0.089*	*0.45*	***11.19***
Residential (Multifamily)														
Equity Residential Properties Tr.	0.476	0.729	0.203	0.598	-3.385	-4.326	0.675	4.113	0.980	2.816	-1.013	-1.401	0.27	**5.58**
Apartment Investment & Mgmt. Cc	1.591	0.529	0.344	0.571	-3.206	1.107	2.073	2.740	1.521	2.467	-0.882	0.329	0.17	**10.10**
Camden Property Trust	0.261	0.529	0.219	0.412	-3.766	1.188	0.340	2.741	0.967	1.780	-1.036	0.353	0.15	**8.71**
BRE Properties, Inc.	1.120	0.319	0.423	0.583	-2.817	-1.423	1.573	1.781	2.016	2.716	-0.835	-0.456	0.16	**6.61**
Gables Residential Trust	0.651	0.333	0.173	0.354	-3.611	-3.976	1.039	2.113	0.940	1.876	-1.216	-1.448	0.14	**1.87**
Essex Property Trust, Inc.	1.065	0.586	0.509	0.753	3.104	0.779	1.537	3.364	2.497	3.608	0.945	0.256	0.29	**19.17**
Summit Properties Inc.	0.381	0.384	0.602	0.545	-1.926	-1.746	0.624	2.503	3.348	2.959	-0.666	-0.652	0.27	**8.02**
Mid-America Apartment Cmtys	-0.315	0.495	0.360	0.346	-0.967	1.644	-0.472	2.944	1.830	1.717	-0.305	0.561	0.20	**12.51**
Town and Country Trust, The	0.296	0.617	0.377	0.395	1.252	-2.824	0.462	3.831	1.997	2.044	0.412	-1.006	0.28	**11.82**
Associated Estates Realty Corp.	-1.751	0.540	0.443	0.543	4.318	4.813	-1.899	2.330	1.633	1.956	0.989	1.192	0.17	**23.73**
Average	*0.378*	*0.506*	*0.365*	*0.510*	*-1.101*	*-0.476*	*0.792*	*4.223*	*2.603*	*3.550*	*-0.487*	*-0.228*	*0.33*	***10.81***
Diversified														
Vornado Realty Trust	1.731	0.624	0.649	0.964	-7.936	-1.562	1.996	2.864	2.544	3.687	-1.931	-0.411	0.29	**3.79**
Crescent Real Estate Equities, Inc	0.129	1.082	0.631	0.809	-3.294	0.968	0.135	4.514	2.248	2.813	-0.729	0.232	0.33	**15.13**
Washington REIT	-0.300	0.393	0.219	0.351	0.963	-1.997	-0.545	2.836	1.351	2.116	0.369	-0.827	0.17	**10.28**
Colonial Properties Trust	-0.306	0.632	0.327	0.601	2.014	-0.026	-0.533	4.378	1.936	3.471	0.741	-0.010	0.32	**16.46**
Pennsylvania REIT	-0.574	0.448	0.117	0.823	5.346	0.997	-0.883	2.739	0.610	4.200	1.735	0.350	0.32	**20.95**
Transcontinental Realty Investors	-0.215	0.577	-0.012	0.300	0.603	0.886	-0.183	1.959	-0.034	0.851	0.109	0.173	0.07	**13.63**
Boddie-Noell Properties, Inc.	-0.129	0.251	0.386	0.441	0.987	-3.096	-0.171	1.322	1.739	1.941	0.276	-0.936	0.11	**8.71**
Average	0.048	0.572	0.331	0.613	-0.188	-0.547	0.120	5.709	2.821	5.098	-0.100	-0.313	0.45	**12.71**
TOTAL SAMPLE AVERAGE	**0.201**	**0.559**	**0.389**	**0.587**	**-1.166**	**0.064**	**0.527**	**5.829**	**3.464**	**5.104**	**-0.645**	**0.038**	**0.48**	**11.98**

The addition of the two macroeconomic variables to the regression model does not improve the predictive ability of the model. The EXI factor is not significant at the 5% level for any of the REITs in the sample, with one exception. The factor is significant at the 10% level for only four of the REITs. It is interesting to note, however, that the sign of the coefficient is negative in over 63% of the individual regressions, as well as in the regressions for the total sample average and the NAREIT indexes. This may indicate that equity REITs do provide some degree of a hedge against inflation. Notwithstanding, since the factor is not significant in the model, the actual effect and its magnitude is inconclusive. The other macroeconomic factor, CON, is also only significant at the 5% level for one REIT in the research sample, and two at the 10% level. The sign on this coefficient appears to be random.

The insignificance of the two additional variables results in a coefficient of determination (R^2) of 0.478, an improvement of only 0.004 over the FFM. The mechanics of the regression equation make it impossible for the addition of more variables to result in a smaller R^2. If the additional variables are significant at all, the R^2 should always increase. Hence, the increase in our model of less than half of one percent is inconsequential.

Another indication of the lack of validity and reliability of the combined APM is the wide variation in cost of equity estimates. The range of estimates is –0.71% (Mid-Atlantic Realty Trust) to 30.03% (Koger Equity, Inc.). Obviously, a negative cost of equity is impossible (although desirable). The model results in an estimate of less than 5.0% for five REITs in the research sample, and over 20% for four of them.

CHAPTER SIX

Conclusions & Recommendations for Further Research

Project and asset valuation is central to the success of any firm. Unfortunately, the process is plagued with uncertainty. First of all, there exists inaccuracy regarding the level of future cashflow estimates. But even perfectly projected cashflows are subject to the uncertainty pertaining to the correct discount rate, or "hurdle rate", used to compute the present value of an asset or investment. This "hurdle rate" is often the estimate of a firm's cost of capital, or the minimum rate of return the company can earn on existing assets and still meet the expectations of its capital providers. The uncertainty in the discount rate is a function of the difficulty in estimating the return expectations of equity holders, or the cost of equity capital.

Estimating the cost of equity capital for a firm is at once the most critical and the most difficult element of most business valuations and capital expenditure decisions. The expected returns on common equity have two components: (1) dividends or distributions, and (2) changes in market value (capital gains or losses). Because these return expectations cannot be directly observed, they must be estimated from current and past market evidence. Therefore, it is necessary to look to the investment markets for the necessary data for estimating the cost of capital for any company, security, or project.

This study examines three specific asset-pricing models in an effort to determine a reliable pricing model that can be used in practice to effectively estimate the cost of equity capital for Real Estate Investment Trusts (REITs). While this subject is important for all industries, it has particular relevance for the REITs, as the current competitive environment has

forced many REITs to explore new methods of increasing earnings. Hence, it is vital that REITs have an accurate benchmark on which to base new capital budgeting and investment decisions.

The first research model employed is the traditional CAPM, where the total excess returns for each REIT in the sample are regressed against the total excess returns of the broad market index. The second research model incorporates the two firm-specific factors developed by Fama and French, SMB and HML. In the third model, two additional macroeconomic factors are included to represent the change in expected inflation and the change in the risk premium. Using factors that are of a pervasive macroeconimic nature is in line with the Arbitrage Pricing Theory of Ross.

The results indicate that the Fama-French model is far superior to the other two models in predicting excess total returns (cost of equity) for the research sample of equity REITs. This conclusion is based upon a nonparametric test comparing the fitted R^2's from each of the regressions. Furthermore, the range of cost of equity estimates seems rational given the specific characteristics of equity REITs.

It is important to recognize that, despite the superiority of the FFM, it still an imprecise measurement tool. While the coefficient of determination for the sample average regression equation is much higher than that of the CAPM, the model still predicts less than half of the variation of excess REIT returns. Moreover, the standard error of the average regression is 0.97%. Using standard convention of plus and minus two standard errors results in a total estimate range of 11.36% to 15.26%. While the standard error is much less than for the CAPM, the wide range for the discount rate will result in a large degree of uncertainty in the subsequent asset or investment valuation.

Another issue which affects the validity and reliability of the FFM (as well as other models) is the historical time period over which the factor risk premiums are calculated. The risk premiums vary substantially over certain time periods, which results in very different cost of equity estimates for the same firm. The general consensus is to use focus on long-term history, as short-term observations may lead to illogical forecasts. Furthermore, using more observations in the calculation results in a lower standard error of the estimate. Alternatively, there are several arguments for focusing on recent history. For instance, return patters tend to change over time, and the recent past may be most relevant to investors. In addition, the longer periods include "major events" that have not repeated over time. This study uses data over a 27-year period from January 1973 through December 1999 to calculate the factor risk premiums.

As with any asset-pricing (or cost of equity) model, the FFM is at best a guide – a starting point for any valuation analysis. The ultimate discount rate must reflect the risks inherent in the specific company, project, or asset, as well as the cash flows themselves. The results of this analysis indicate that the Fama-French model provides a much better guide than the CAPM or the particular Arbitrage Pricing Model used in this study when estimating the cost of equity capital for REITs.

Recommendations for Further Research

While the REIT industry has been in existence since the 1960s, most of the growth has occurred within the past decade. The modern REIT industry emerged through the IPO frenzy of 1993-94, when nearly two-thirds of all REITs in existence today were formed. The industry continues to evolve as real estate markets mature and increased competition forces many firms to

sharpen their focus. The relative youth and volatility of the REIT industry brings into question the validity of using historical data to predict future. As time passes, and the industry matures, continued research should provide useful insight regarding expected REIT returns and cost of equity capital.

Concerning the specific asset pricing models, the multifactor Arbitrage Pricing Model presents a unique case in that the theory does not specify what risk factors, or how many, are to be used. Most applications consider risk factors that are of a pervasive macroeconomic nature, and existing research has indicated that five total factors seems to be the optimal number. In addition to multiple factors, there are several options available to measure each factor. It is not unreasonable to assume that the method of measurement employed can noticeably affect the significance of a particular factor.

In this study, we chose the unanticipated Change in Expected Inflation (EXI) and the Confidence Risk (CON) as our macroeconomic variables. This selection is based upon the findings of previous studies, as well as availability of time-series data. Exploring the existence and significance of other pricing factors, as well as ways to measure their effects, provides another avenue for future study.

Continued research regarding the application of the Fama-French Model is also important, especially with respect to the SMB and HML factors. For instance, the long-term historical size premium that exists in ordinary equity returns has not been evident in recent history. In fact, the premium is slightly negative for the past five years (1995 through 1999). This may be due to the current bull market, or it may signal that the market is becoming more efficient. Regardless, if the premium diminishes over time, so does the rationale for using the SMB factor.

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EQUITY REIT RESEARCH SAMPLE

(Ranked by equity market capitalization; December 31, 1999)

Rank	Company	Ticker Symbols	Current Exchange	Property Subsector	Equity Market Capitalization (1) $ (Millions)	% of Sector	% of Industry
Office / Industrial							
1	Duke-Weeks Realty Corporation	DRE	NYSE	Mixed	2,452.95	6.385	1.999
2	Spieker Properties, Inc.	SPK	NYSE	Office	2,314.18	6.024	1.886
3	Liberty Property Trust	LRY	NYSE	Mixed	1,657.45	4.314	1.351
4	Mack-Cali Realty Corporation	CLI	NYSE	Office	1,521.82	3.961	1.240
5	Highwoods Properties, Inc.	HIW	NYSE	Office	1,466.00	3.816	1.195
6	CarrAmerica Realty Corporation	CRE	NYSE	Office	1,427.16	3.715	1.163
7	HRPT Properties Trust	HRP	NYSE	Office	1,187.17	3.090	0.967
8	First Industrial Realty Trust, Inc.	FR	NYSE	Industrial	1,045.23	2.721	0.852
9	Koger Equity, Inc.	KE	AMEX	Office	450.46	1.173	0.367
10	Pacific Gulf Properties, Inc.	PAG	NYSE	Industrial	418.80	1.090	0.341
11	Keystone Property Trust	KTR	AMEX	Industrial	126.69	0.330	0.103
	Sector Totals				**14,067.93**	**36.619**	**11.464**
Retail							
1	Kimco Realty Corporation	KIM	NYSE	Shopping Centers	2,052.13	7.853	1.672
2	General Growth Properties, Inc.	GGP	NYSE	Regional Malls	1,447.53	5.539	1.180
3	New Plan Excel Realty Trust, Inc.	NXL	NYSE	Shopping Centers	1,397.57	5.348	1.139
4	Regency Realty Corporation	REG	NYSE	Shopping Centers	1,154.62	4.418	0.941
5	Developers Diversified Realty Corporation	DDR	NYSE	Shopping Centers	789.41	3.021	0.643
6	Macerich Company, The	MAC	NYSE	Regional Malls	708.79	2.712	0.578
7	Taubman Centers, Inc.	TCO	NYSE	Regional Malls	572.74	2.192	0.467
8	Realty Income Corporation	O	NYSE	Free Standing	553.21	2.117	0.451
9	CBL & Associates Properties, Inc.	CBL	NYSE	Regional Malls	514.28	1.968	0.419
10	Chelsea GCA Realty, Inc.	CCG	NYSE	Shopping Centers	470.09	1.799	0.383
11	Mills Corporation, The	MLS	NYSE	Regional Malls	413.16	1.581	0.337
12	Glimcher Realty Trust	GRT	NYSE	Regional Malls	305.93	1.171	0.249
13	Commercial Net Lease Realty, Inc.	NNN	NYSE	Free Standing	301.55	1.154	0.246
14	JP Realty, Inc.	JPR	NYSE	Regional Malls	275.64	1.055	0.225
15	Saul Centers, Inc.	BFS	NYSE	Shopping Centers	187.50	0.718	0.153
16	Crown American Realty Trust	CWN	NYSE	Regional Malls	144.14	0.552	0.117
17	Mid-Atlantic Realty Trust	MRR	NYSE	Shopping Centers	143.00	0.547	0.117
18	Acadia Realty Trust	AKR	NYSE	Shopping Centers	117.56	0.450	0.096
19	Kranzco Realty Trust	KRT	NYSE	Shopping Centers	93.06	0.356	0.076
20	Ramco-Gershenson Properties Trust	RPT	NYSE	Shopping Centers	91.13	0.349	0.074
21	Malan Realty Investors, Inc.	MAL	NYSE	Shopping Centers	69.17	0.265	0.056
	Sector Totals				**11,802.20**	**45.164**	**9.618**
Residential (Multifamily)							
1	Equity Residential Properties Trust	EQR	NYSE	Multifamily	5,335.36	23.266	4.348
2	Apartment Investment & Mgmt. Co.	AIV	NYSE	Multifamily	2,662.01	11.608	2.169
3	Camden Property Trust	CPT	NYSE	Multifamily	1,224.08	5.338	0.998
4	BRE Properties, Inc.	BRE	NYSE	Multifamily	1,013.66	4.420	0.826
5	Gables Residential Trust	GBP	NYSE	Multifamily	605.79	2.642	0.494
6	Essex Property Trust, Inc.	ESS	NYSE	Multifamily	565.56	2.466	0.461
7	Summit Properties Inc.	SMT	NYSE	Multifamily	441.03	1.923	0.359
8	Mid-America Apartment Communities, Inc.	MAA	NYSE	Multifamily	408.32	1.781	0.333
9	Town and Country Trust, The	TCT	NYSE	Multifamily	283.09	1.234	0.231
10	Associated Estates Realty Corporation	AEC	NYSE	Multifamily	169.68	0.740	0.138
	Sector Totals				**12,708.57**	**55.419**	**10.356**
Diversified							
1	Vornado Realty Trust	VNO	NYSE		2,793.27	25.944	2.276
2	Crescent Real Estate Equities, Inc.	CEI	NYSE		2,233.13	20.741	1.820
3	Washington Real Estate Investment Trust	WRE	NYSE		535.38	4.973	0.436
4	Colonial Properties Trust	CLP	NYSE		515.47	4.788	0.420
5	Pennsylvania Real Estate Investment Trust	PEI	NYSE		194.04	1.802	0.158
6	Transcontinental Realty Investors, Inc.	TCI	NYSE		107.94	1.003	0.088
7	Boddie-Noell Properties, Inc.	BNP	AMEX		48.61	0.451	0.040
	Sector Totals				**6,427.85**	**59.701**	**5.238**
	TOTAL RESEARCH SAMPLE				**45,006.55**	**--**	**36.676**

(1) Equity market capitalization does not include operating partnership units or preferred stock.

Property Sectors and Relative Weights in the NAREIT Real-Time Index

(Ranked by equity market capitalization; December 31, 1999)

#	REIT	Equity Mkt. Cap.(1) $ millions	% of Total
38	Office / Industrial	38,417.40	31.307
	Office (21)	*23,904.28*	*19.480*
	Industrial (10)	*8,485.42*	*6.915*
	Mixed (7)	*6,027.71*	*4.912*
50	Retail	26,131.75	21.295
	Shopping Centers (31)	*12,000.37*	*9.779*
	Regional Malls (12)	*11,213.24*	*9.138*
	Free Standing (7)	*2,918.13*	*2.378*
28	Residential	25,027.11	20.395
	Multifamily (22)	*22,931.66*	*18.687*
	Manufactured Homes (6)	*2,095.45*	*1.708*
20	Diversified	10,766.71	8.774
15	Lodging / Resorts	6,495.11	5.293
4	Self Storage	4,691.61	3.823
13	Health Care	4,652.17	3.791
8	Specialty	4,480.86	3.652
24	Mortgage	2,050.06	1.671
	Home Financing (14)	*1,106.63*	*0.902*
	Commercial Financing (10)	*943.43*	*0.769*
200		**122,712.77**	**100.000**

(1) Equity market capitalization does not include operating partnership units or preferred stock.

AVERAGE TOTAL RETURNS

January 1995 - December 1999

Rank	Company / Index	Ticker Symbols	Current Exchange	Average Monthly Return	Average Annualized Return
Indexes					
	CRSP Value-Weighted Index			2.08	24.96
	NAREIT Composite Index (All REITs)			0.68	8.17
	NAREIT Composite Index (Eq. REITs)			0.71	8.50
Office / Industrial					
1	Duke-Weeks Realty Corporation	DRE	NYSE	1.19	14.32
2	Spieker Properties, Inc.	SPK	NYSE	1.63	19.57
3	Liberty Property Trust	LRY	NYSE	1.17	14.00
4	Mack-Cali Realty Corporation	CLI	NYSE	1.55	18.58
5	Highwoods Properties, Inc.	HIW	NYSE	0.91	10.92
6	CarrAmerica Realty Corporation	CRE	NYSE	1.06	12.72
7	HRPT Properties Trust	HRP	NYSE	0.44	5.23
8	First Industrial Realty Trust, Inc.	FR	NYSE	1.42	17.02
9	Koger Equity, Inc.	KE	AMEX	1.98	23.73
10	Pacific Gulf Properties, Inc.	PAG	NYSE	1.39	16.66
11	Keystone Property Trust	KTR	AMEX	2.46	29.52
	Sector Average			*1.38*	*16.57*
Retail					
1	Kimco Realty Corporation	KIM	NYSE	1.09	13.06
2	General Growth Properties, Inc.	GGP	NYSE	1.01	12.14
3	New Plan Excel Realty Trust, Inc.	NXL	NYSE	1.38	16.53
4	Regency Realty Corporation	REG	NYSE	1.08	12.91
5	Developers Diversified Realty Corporation	DDR	NYSE	0.41	4.96
6	Macerich Company, The	MAC	NYSE	0.72	8.64
7	Taubman Centers, Inc.	TCO	NYSE	0.91	10.90
8	Realty Income Corporation	O	NYSE	1.14	13.68
9	CBL & Associates Properties, Inc.	CBL	NYSE	0.71	8.51
10	Chelsea GCA Realty, Inc.	CCG	NYSE	0.96	11.54
11	Mills Corporation, The	MLS	NYSE	0.95	11.36
12	Glimcher Realty Trust	GRT	NYSE	0.18	2.16
13	Commercial Net Lease Realty, Inc.	NNN	NYSE	0.52	6.21
14	JP Realty, Inc.	JPR	NYSE	0.33	3.92
15	Saul Centers, Inc.	BFS	NYSE	0.87	10.45
16	Crown American Realty Trust	CWN	NYSE	(0.32)	(3.79)
17	Mid-Atlantic Realty Trust	MRR	NYSE	1.26	15.07
18	Acadia Realty Trust	AKR	NYSE	(0.86)	(10.31)
19	Kranzco Realty Trust	KRT	NYSE	(0.05)	(0.55)
20	Ramco-Gershenson Properties Trust	RPT	NYSE	0.31	3.67
21	Malan Realty Investors, Inc.	MAL	NYSE	1.06	12.68
	Sector Average			*0.65*	*7.80*
Residential (Multifamily)					
1	Equity Residential Properties Trust	EQR	NYSE	1.27	15.24
2	Apartment Investment & Mgmt. Co.	AIV	NYSE	2.16	25.93
3	Camden Property Trust	CPT	NYSE	0.94	11.25
4	BRE Properties, Inc.	BRE	NYSE	1.28	15.31
5	Gables Residential Trust	GBP	NYSE	0.95	11.39
6	Essex Property Trust, Inc.	ESS	NYSE	2.04	24.48
7	Summit Properties Inc.	SMT	NYSE	0.67	8.03
8	Mid-America Apartment Communities, Inc.	MAA	NYSE	0.53	6.34
9	Town and Country Trust, The	TCT	NYSE	1.38	16.53
10	Associated Estates Realty Corporation	AEC	NYSE	(0.50)	(6.01)
	Sector Average			*1.07*	*12.85*
Diversified					
1	Vornado Realty Trust	VNO	NYSE	1.65	19.86
2	Crescent Real Estate Equities, Inc.	CEI	NYSE	1.35	16.18
3	Washington Real Estate Investment Trust	WRE	NYSE	0.49	5.87
4	Colonial Properties Trust	CLP	NYSE	0.81	9.68
5	Pennsylvania Real Estate Investment Trust	PEI	NYSE	0.45	5.38
6	Transcontinental Realty Investors, Inc.	TCI	NYSE	1.04	12.43
7	Boddie-Noell Properties, Inc.	BNP	AMEX	0.28	3.37
	Sector Average			*0.87*	*10.40*
TOTAL RESEARCH SAMPLE				0.93	11.17