# Stocks Are from Mars, Real Estate Is from Venus

*The cross-section of long-run investment performance.*

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In portfolio planning and asset management, nothing is more fundamental than an understanding of the determinants of long-run investment performance across individual assets or types of assets. Explaining the cross-section of expected total return—in other words, the "opportunity cost of capital" or DCF discount rate—is central to any rational approach to strategic or tactical portfolio policy, as well as to the selection of individual assets for purchase or sale. Should investors expect and require a higher ex ante internal rate of return (IRR) for an investment in an apartment or office building, in a larger or smaller property, or in a property in a larger or smaller city?

In the equities sector of the investment industry, the classical Capital Asset Pricing Model (CAPM) that identified beta has recently been augmented by multi-factor models, including the widely employed model of Fama and French. The Fama-French model, also known as the three-factor model, adds two stock characteristics—size (market capitalization) and book-to-market ratio—to traditional beta as the key determinants of long-run investment performance, and therefore, of required ex ante total return expectations. The result is a reasonably effective model of the cross-section of stock returns.

Institutional investors in the real estate sector have tried for the last two decades to find a similarly effective model of the cross-section of real property returns. In a voluminous literature, early progress was made by Geltner [1989], Liu et al. [1990], and Chan, Hendershott, and Sanders [1990], among others, in exploring the ways in which a classical CAPM could explain real estate returns. More recent studies, ranging from Ling and Naranjo [1997] to Breidenbach, Mueller, and Schulte [2006], have attempted to extend the model into specific property sectors or market segments.

The overall implications of the previous research can be summarized in two major conclusions. First, at the institutional real estate investment asset class level, the classic single-factor CAPM works relatively well, if carefully and thoughtfully applied. For example, a single-factor CAPM predicts institutional real estate investment performance consistent with the real estate national wealth beta when beta is defined with respect to a national wealth portfolio consisting of stocks, bonds, and real estate, and when real estate returns are corrected for appraisal-based smoothing. Such a model suggests an equilibrium risk premium for expected total return of around 300 bps per annum for institutional real estate compared to a risk premium of about 800 bps per annum for large-cap stocks.[1]

The second conclusion is that a much less satisfactory understanding exists of what, if anything, determines the cross-section of property returns within the institutional real estate asset class—for example, whether, why, and by how much northeastern office buildings or southwestern apartment properties should have different expected returns or (in a world of rational expectations) different average long-term ex post total return performance.[2] Thus, the industry understands fairly well the "big picture"—what the typical or average real estate investment's expected return should be—but not very well how a given property's or market segment's expected return should differ from that average within the institutional core real estate asset class.[3]

Our study seeks to further this understanding of micro-level real estate performance in two major ways. First, we use the property-level National Council of Real Estate Investment Fiduciaries (NCREIF) Index database to construct custom-defined historical indexes.[4] These indexes are created solely from core institutional properties, that is, properties with major redevelopments are filtered from the indexes, and are divided into subindexes characterized along dimensions relevant to the measurement of institutional property investment performance. These dimensions are motivated by the Fama-French factors of asset size and book-to-market ratio and are modified for real estate investment. While the Fama-French stock-size factor is directly applied to property size (value), the book-to-market ratio is replaced by a tier classification in which the property's location is stratified by the level of institutional property investment present in the respective metropolitan statistical area (MSA). These customized NCREIF-based indexes are used to construct an equilibrium asset pricing model that explains the historical cross-section of the long-term investment performance of core institutional properties represented by the NCREIF index core-property population.

We find that the model captures quite well the historical cross-section of the NCREIF property portfolio total returns. The model differs dramatically, however, from similar stock market models in that the market beta has a zero risk premium and the Fama-French-like factors in the model place a return premium, or price discount, on larger rather than smaller assets and on higher-tier MSA locations. These results are exactly the opposite of the Fama and French findings of higher returns on smaller stocks and of the greater return premium (price discount) on stocks with a HIGHER book/market ratio (or a lower market/book ratio). We also find that property type (e.g., apartment versus office) is a powerful predictor of long-run average investment performance even after controlling for the risk factors.

Either a Mars-versus-Venus type of discrepancy exists between the risk perceptions and preferences of equity and real estate investors, or over the long run the real estate market has performed ex post in a manner contrary to investors' ex ante expectations. The former conclusion begs the question of why such a difference between the equity and real estate markets exists, and if real estate risk perceptions and preferences are rational. For example, does beta really not matter at the micro-level—at the level of the individual real estate investment—when it seems to matter at the asset class level? Why should larger properties and properties located in larger MSAs be perceived as riskier or requiring a larger return premium? The latter conclusion—that long-run ex post performance does not reflect ex ante expectations—suggests that real estate investors lack rational expectations. Regardless of the explanation, some form of informational inefficiency appears to be operating at the micro-level of the cross-section of property returns. This, in turn, suggests possible opportunities for arbitrage in the sense that some property segments may offer higher, and others lower, returns than what may be warranted by rational definitions and expectations about risk.

## DATA

The real estate data used in our study was contributed by the NCREIF database. The database is populated by investment managers and plan sponsors who own or manage real estate in a fiduciary setting so the database represents institutional-quality commercial real estate. The dataset was begun in 1978 with 233 properties totaling $580 million in market value and expanded rapidly reaching 4,756 properties valued at $201 billion in 2006 Q1. For the study, we used the 1984-2003 period because it encompassed an entire real estate cycle.[5] An additional consideration was that the years prior to 1984 contained an insufficient number of property observations. The income, capital, and total returns in our study were calculated directly from property-level data following the same return formula used by NCREIF.

## METHODOLOGY

Our study is composed of two parts. The first involves organizing the NCREIF property-level data to create custom-defined portfolios, or subindexes, and the second involves testing various asset pricing models on these portfolios.

### Portfolio Creation

The standard NCREIF index is reported, in addition to the aggregate national all-property level, for portfolios or subindexes based on property-type sector and geographic location. We reconstituted the NCREIF subindexes to reflect definitions of portfolios that might correspond more closely to institutional investment styles and risk perception criteria. Thus, for each quarter in the sample period, we eliminated any property whose capital improvement expenditures exceeded 20% of property value as of the beginning of the quarter. By following this rule, we eliminated properties that might not represent the institutional core real estate investment style.[6]

More importantly, we defined subindexes based on two factors that reflect typical institutional investor considerations and that could be viewed as approximate real estate analogs of the factors used in the Fama-French three-factor CAPM. These two factors are property size—defined as large, medium, and small property values relative to the average of the NCREIF population each period—and the property's MSA tier—defined as upper, middle, and tertiary based on the relative number of NCREIF properties in the MSA in which the property is located.

The property-level data of the NCREIF index was used to construct the portfolios and historical return subindexes. Six major property types were tracked separately in each of the size and tier portfolios: central business district (CBD) office, suburban office, warehouse, R&D space, retail (excluding malls), and apartment properties. Two aggregate portfolios were constructed, differentiated by the income yield—high versus low—of the properties. The result was a total of 38 portfolios or subindexes created from the database, including 18 each for the size and tier factors. The six property types were categorized into three classes based on size and tier for a total of 36 portfolios plus the two aggregate portfolios grouped by high- versus low-income-yield-generating property.[7]

*Size selection.* The size portfolios were created based on the market value of the properties using high and low cutoff values to ensure an equal number of properties would be in each size class. The distribution of the value of properties was considered normal around the average value.[8] The low and high cutoffs were 58% and 142%, respectively, of the average market value. These values were updated annually to reflect any change in capital value over the year, and were applied within each of the six property-type categories. The result was a portfolio of 18 subindexes, each representing one of six property types and one of three size classifications.

*Tier selection.* The tier portfolios were created based on the total investment value of the NCREIF index in a particular Core-Based Statistical Area (CBSA). A CBSA is defined by the US Census Bureau which has used this terminology since 2000. Each property in the study is defined based upon its CBSA classification in 2003 Q4. We ranked all CBSAs in order of the total NCREIF investment value for each of the six property types, dividing the list into three tiers ranging from Tier I with the greatest NCREIF investment to Tier III with the least. The rank distribution was set so as to ensure sufficient numbers of properties in all tiers, especially in Tier III. The rankings were calculated in 2003 Q4 and fixed for the entire study period. Each of the six property types was analyzed separately and ranked. Just as in the size selection process, 18 subindexes were defined with each representing one of the six property types and one of the three tier classifications.

### Asset Pricing Models

We developed the asset pricing models in our study using the common two-stage procedure.[9] First, time series regressions were run separately for each of the 36 portfolios to estimate the risk factor loadings on each portfolio. These estimates of factor loadings were then used as the explanatory variables in a cross-sectional regression of the portfolios' long-run average total returns in excess of T-bills. The purpose of the regression was to evaluate how well the risk factors can explain the returns. The procedure is summarized as follows:

*Time series regression.* This regression was run separately for all portfolios across the 80 quarters spanning 1984-2003 in order to estimate the beta of the portfolio relative to the aggregate of all NCREIF properties and to estimate the factor betas. The regression equation is

$$Ri_t - Rf_t = \alpha i_t + \beta Mi(Rm_t - Rf_t) + \beta IMIIIi(RIMIII_t) + \beta LMSi(RLMS_t) + \varepsilon i_t$$

where

$Ri_t$ = total teturn of portfolio $i$ at time $t$;

$Rf_t$ = risk-free rate at time $t$;

$Rm_t$ = total return of the aggregate of NCREIF properties at time $t$;

$RIMIII_t$ = total return of Tier I properties at time $t$ minus total return of Tier III properties at time $t$; and

$RLMS_t$ = total return of large properties at time $t$ minus total return of small properties at time $t$.

In these regressions, the factor returns were defined as equally weighted portfolios across the six property types. By defining beta with respect to the NCREIF database, we avoid the need to deal with appraisal smoothing because with similarly appraised properties on both sides of the regression the smoothing cancels out and leaves an unbiased beta estimate. While the aggregate NCREIF Index is not an approximation of the market portfolio suggested by CAPM theory, the beta with respect to NCREIF can serve well as a measure of the relative market risk under the assumption that the real estate portfolios' true market-portfolio-based betas equal their betas with respect to NCREIF times the beta of the aggregate NCREIF Index with respect to the true market portfolio. This seems a plausible assumption for purposes of modeling the relative market risk within the institutional real estate asset class.

*Cross-sectional regression.* This asset pricing model regresses the long-run average risk premium [Avg($Ri$-$Rf$)] of the 18 portfolios onto the estimated risk factors from the time series regression. These risk factors are $\beta Mi$, $\beta IMIIIi$, and $\beta LMSi$, as well as dummy variables for each property type with the exception of CBD office. The CBD office factor is the suppressed property type and is, in effect, included in the model intercept. The regression equation is

$$\begin{aligned} Avg(Ri - Rf) = {} & \gamma 0 + \gamma 1\beta Mi + \gamma 2\beta IMIIIi + \gamma 3\beta LMSi \\ & + \gamma 4Apti + \gamma 5Subi + \gamma 6Whri \\ & + \gamma 7R\,\&\,Di + \gamma 8Reti + \varepsilon i \end{aligned}$$

where

$Ri$ = average total return of the portfolio;

$Rf$ = average risk-free rate;

$\beta Mi$ = market beta of the portfolio estimated from the time series regression;

$\beta IMIIIi$ = tier beta of the portfolio estimated from the time series regression;

$\beta LMSi$ = size beta of the portfolio estimated from the time series regression;

$Apti$ = 1 if the portfolio represents apartments, and zero otherwise;

$Subi$ = 1 if the portfolio represents suburban office properties, and zero otherwise;

$Whri$ = 1 if the portfolio represents industrial warehouses, and zero otherwise;

$R\&Di$ = 1 if the portfolio represents R&D plus flex properties, and zero otherwise; and

$Reti$ = 1 if the portfolio represents retail properties, and zero otherwise.

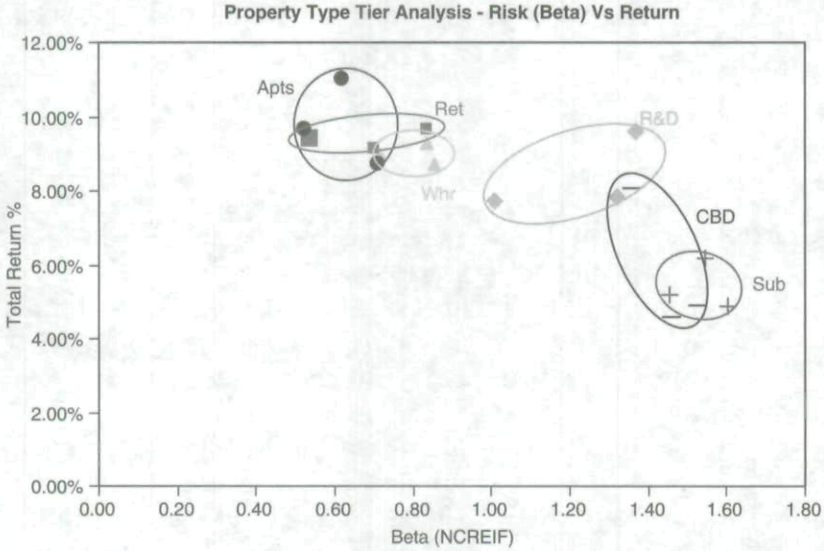
The cross-sectional regressions were run separately over both the tier- and size-set of portfolios, with 18 data points each.

## RESULTS

The first indication that the risk-return performance of real estate assets is different from that of stocks is shown in Exhibits 1 through 3. For each of the three exhibits, relative market risk, which equals beta with respect to the aggregate NCREIF index, is on the horizontal axis and the 1984-2003 average annual total return is on the vertical axis. Exhibit 1 shows the 18 portfolios created from the tier-based indexes with ellipses drawn around each of the six property types. The general downward slope of the plotted points indicates a negative relationship of average return to risk as measured by the market beta. This differs from the stock market where the market beta is the classic measure of risk and has a positive relationship to long-run average realized returns. The fact that the property-type

**EXHIBIT 1**

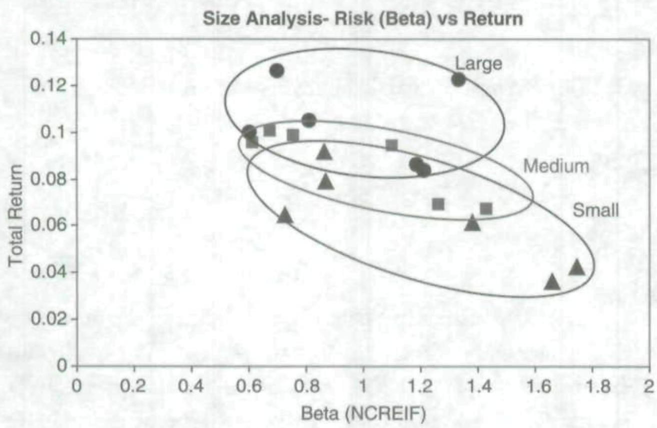
**Long-Run Average Annual Total Return and Risk for 18 MSA Tier-Based Portfolios 1984–2003**




*Risk equals beta with respect to the All-Property NCREIF Index. Figure shows clustering of six property types and a negative return-versus-beta relationship.*

**EXHIBIT 2**

**Long-Run Average Annual Total Return and Risk for 18 Property Size-Based Portfolios 1984-2003**




*Risk equals beta with respect to the All-Property NCREIF Index. Figure shows clustering of three sizes of properties and a negative return-versus-beta relationship.*

ellipses do not significantly overlap suggests that the property types perform differently in risk-return space.

Exhibit 2 shows the 18 size-based portfolios. Ellipses are drawn around each of the three property-size classes. The fact that the ellipses are arrayed from top to bottom in order from largest to smallest property size and are only partially overlapping with minimal overlap between the largest and smallest properties indicates that property size is a positive determinant of long-run average return. The general downward slope of the ellipses suggests that, controlling for property size, the effect of the market beta is, again, negative. In both of these respects, the real estate portfolios are not behaving like stock portfolios (after the market beta is controlled for) in which smaller stocks tend to outperform larger stocks and higher-beta stocks tend to outperform lower-beta stocks.[10] Unlike equity investors, real estate investors appear to require a premium in expected return for larger properties, and no premium—with perhaps even a lower return being acceptable—for properties that have greater covariance with aggregate real estate returns.

Exhibit 3 shows the 18 portfolios defined by MSA-tier level with ellipses grouping together each of the three tier levels. The downward slope with respect to beta remains apparent, but without controlling for property size and type, no clear relationship emerges between city tier and long-run total return as evidenced by the three ellipses which largely overlap one another.

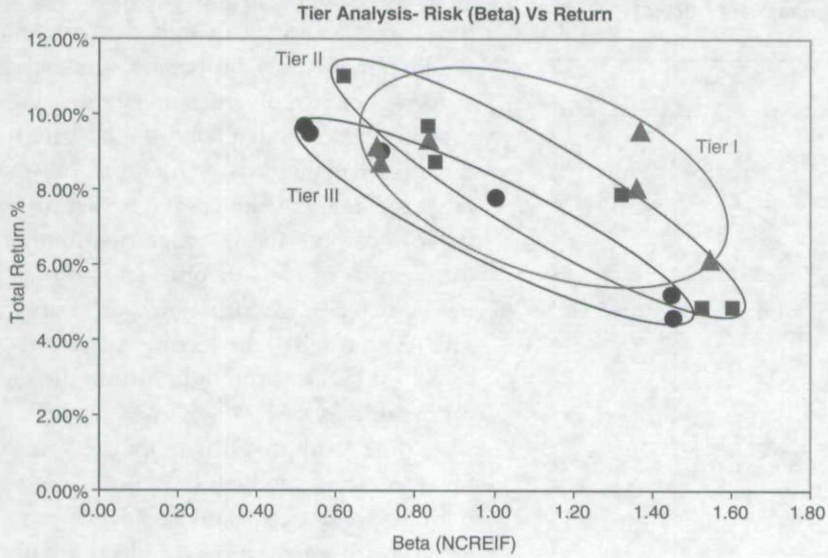
When we regress the portfolio long-run average excess returns onto the portfolios' market betas, as in a classic single-factor CAPM, we see that such a measure of systematic risk utterly fails to explain the realized risk premia. The regression has a strongly statistically significant intercept and a strongly statistically significant negative coefficient on the market beta measure of risk. This is surprising because the fundamental theory underlying the classic CAPM makes both intuitive and economic sense—based on portfolio theory and basic equilibrium considerations—and because the single-factor CAPM works well at the "big picture" level in explaining the cross-section of the aggregate returns of the major asset classes.

### Multi-factor Equilibrium Asset Pricing Model

The classic single-factor CAPM does not work as well within the equity asset class as it does between the broad asset classes, but it does work better within the equity asset class than within the real estate asset class. The beta, or covariance-based systematic risk, of individual assets is difficult to measure reliably or precisely

## EXHIBIT 3

**Long-Run Average Annual Total Return and Risk for 18 Property MSA Tier-Based Portfolios 1984-2003**




*Risk equals beta with respect to the All-Property NCREIF Index. Figure shows clustering of three MSA tiers and negative return-versus-beta relationship.*

from an ex ante perspective. Perhaps both stock market and real estate investors use more tangible characteristics of individual assets to guide their perceptions of risk. In the case of the stock market, the Fama-French factors for a stock's size, or market capitalization, and its book-to-market ratio are readily observable and understood by all investors, and may influence the risk perception and/or liquidity of the stock, particularly in down markets. When risk factors are estimated based on the returns to a portfolio of small-minus-large stocks (SML) and a portfolio of high-minus-low book/market ratio stocks (HML), and these risk factors are added to the market beta, long-run average stock returns are predicted fairly well.[11]

Using multi-factor analysis, we sought evidence of a similar situation in a portfolio of real estate properties. Property size, measured by market value, and MSA location, which acts as a proxy for both liquidity and the demand for institutional real estate properties, are individual asset characteristics that are readily observable and understood by all investors. These property characteristics may be related to risk or value perceptions in a manner similar to their Fama-French equity market counterparts.[12]

Note, however, that we have reversed the construction of the factors. Our size factor is defined as the return of the large property portfolio minus the return of the small property portfolio, exactly the reverse of the Fama-French size factor which is defined as the return on the SML stock portfolio. Our tier factor is defined as the returns of the top tier (Tier I) minus the bottom tier (Tier III) portfolios, even though we would expect larger cities, or MSAs, with more NCREIF investment to be perceived as less risky and/or more liquid investment locations, other things being equal.

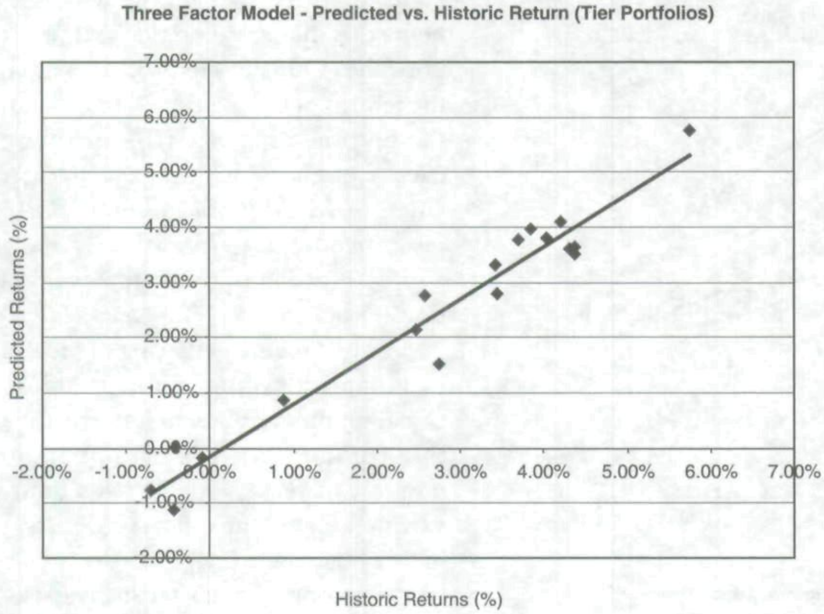
Based on the clustering of the real estate portfolios in Exhibit 1 and on casual empirical observations of institutional investors' perceptions about property markets, we included dummy variables for the property-type sectors in our final asset pricing model.[13] Perhaps no property characteristic is as tangible and readily observable as the manner of its usage; for example, an office building compared to an apartment building. If property market investors do not care about beta, perhaps they are using property type as a proxy for risk, in general, or for a specific type of risk that they perceive is associated with property type.

The results of the multi-factor asset pricing model tests are shown in Exhibits 4 through 7. For both the tier-based and size-based portfolios, the model explains very well the cross-section of long-run average excess returns over T-bills within the NCREIF institutional core-property population over the 1984-2003 long cycle. The adjusted $R^2$ of the models is extremely high at 91% and 94%, respectively. This is also demonstrated by the graphs of historic versus projected returns shown in Exhibits 4 and 5.

But as the saying goes, there is a catch—the signs on the risk factors are all wrong! That is, they are the opposite of what they are in the stock market and of what intuition and theory would lead us to expect. The coefficient on the market beta risk factor is insignificant in the tier-based portfolios, and negative and significant in the size-based portfolios. The coefficients on the size and tier factors are all positive and significant, although they are defined as the opposite of their signs in the stock market and opposite to expectations for a positive return.[14] These results hold regardless of whether the property-type dummy variables are included.

## EXHIBIT 4

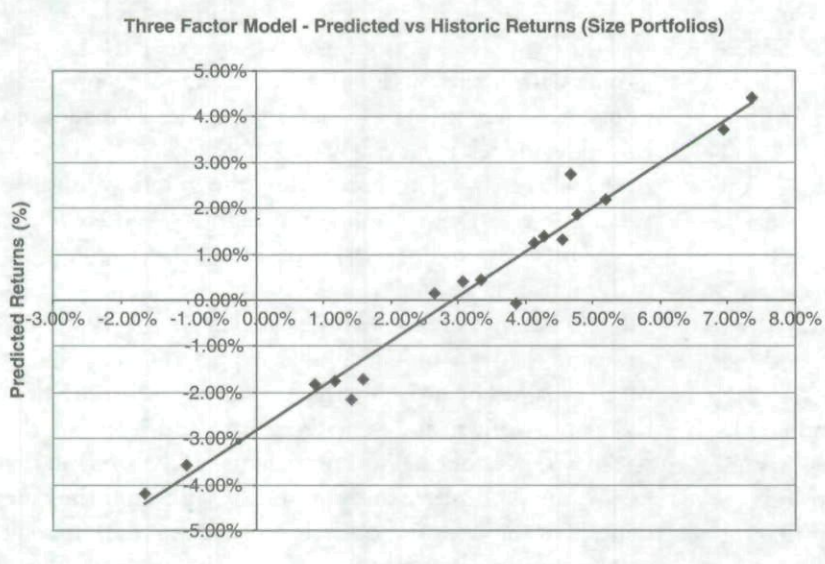
**Predicted-versus-Historic Total Return Risk Premium on 18 Tier-Based Portfolios**




*Risk premium over T-bills derived using three-factor CAPM plus property-type dummy variables,* $R^2 = 91\%$.

## EXHIBIT 5

**Predicted-versus-Historic Total Return Risk Premium for 18 Size-Based Portfolios**




*Risk premium over T-bills derived using three-factor CAPM plus property-type dummy variables,* $R^2 = 94\%$.

In a further exploration we also added an income factor to the model. The idea was that we are examining core properties that are valued as stabilized income producers, and the market may have exhibited a preference for higher-yielding properties. An income factor was created by generating separate high-income and low-income portfolios (based on the relative magnitudes of their income-only returns), and calculated as the total return of the low-income-return properties minus the total return of high-income-return properties in each period. Although we did run this four-factor model, the income factor proved to be insignificant and did not alter the signs on the other variables.

The result that is perhaps the least difficult to explain, and which is most consistent with theory or expectations, is that the property-type dummies proved collectively to be the most significant determinant of the long-run average returns on core properties. The risk premiums of the dummy variables decreased in a consecutive manner in the following order: apartments, retail, R&D, warehouse, suburban office and CBD Office. Regardless of the characteristics of these property types that support a rational basis for discerning differential investment risk, the physical appearance of these property types perhaps suggest varying connotations of risk and solidity in the minds of investment officers and trustees of pension funds. Perhaps apartment buildings are viewed as riskier because the tenants are not large, creditworthy corporations with long-term leases and are thus perceived by the market as the polar opposite of stabilized CBD office buildings.

## CONCLUSION

Two alternative explanations of our findings present themselves and the preferred explanation may be largely a matter of the investor's philosophy. (A third, less desirable, explanation will be noted shortly.)

The first approach is to believe in the market and the empirical results presented to us by the experience of the NCREIF population

# EXHIBIT 6

**Cross-Sectional Regression of Long-Run Average Total Return Risk Premium Across 18 MSA Tier-Based Portfolios**

| Regression Results - Three Factor Model by Tier | | | | | | |
|---|---|---|---|---|---|---|
| Variables | Coefficients | Std. Error | t (df=9) | p-value | 95% lower | 95% upper |
| Intercept | 0.0028 | 0.0229 | 0.121 | 0.9066 | -0.0491 | 0.0547 |
| Beta NCREIF | -0.0041 | 0.0156 | -0.263 | 0.7981 | -0.0395 | 0.0312 |
| Beta Tier | 0.0073 | 0.0029 | 2.538 | 0.0318 | 0.0008 | 0.0139 |
| Beta Size | 0.0179 | 0.0047 | 3.817 | 0.0041 | 0.0073 | 0.0285 |
| Dummy Apartment | 0.0486 | 0.0138 | 3.525 | 0.0065 | 0.0174 | 0.0798 |
| Dummy Suburban Office | 0.0092 | 0.0057 | 1.615 | 0.1408 | -0.0037 | 0.0221 |
| Dummy Industrial (Wharehouse) | 0.0344 | 0.0114 | 3.012 | 0.0147 | 0.0086 | 0.0603 |
| Dummy Industrial (R&D) | 0.0306 | 0.0061 | 5.000 | 0.0007 | 0.0168 | 0.0445 |
| Dummy Retail | 0.0405 | 0.0128 | 3.164 | 0.0115 | 0.0116 | 0.0695 |
| $R^2$ | 0.951 | | | | | |
| Adjusted $R^2$ | 0.908 | | | | | |
| Std. Error | 0.006 | | | | | |

*Risk premium is the premium over T-bills derived by regressing tier-based portfolios onto three-factor CAPM plus property-type dummy variables with the Office CBD property type in the intercept.*

# EXHIBIT 7

**Cross-Sectional Regression of Long-Run Average Total Return Risk Premium across 18 Size-Based Portfolios**

| Regression Results - Three Factor Model by Size | | | | | | |
|---|---|---|---|---|---|---|
| Variables | Coefficients | Std. Error | t (df=9) | p-value | 95% lower | 95% upper |
| Intercept | 0.0292 | 0.0170 | 1.720 | 0.1196 | -0.0092 | 0.0677 |
| Beta NCREIF | -0.0294 | 0.0109 | -2.697 | 0.0245 | -0.0541 | -0.0047 |
| Beta Tier | 0.0204 | 0.0046 | 4.424 | 0.0017 | 0.0099 | 0.0308 |
| Beta Size | 0.0420 | 0.0033 | 12.556 | 0.0000 | 0.0344 | 0.0495 |
| Dummy Apartment | 0.0463 | 0.0112 | 4.134 | 0.0025 | 0.0210 | 0.0716 |
| Dummy Suburban Office | 0.0249 | 0.0057 | 4.414 | 0.0017 | 0.0122 | 0.0377 |
| Dummy Industrial (Wharehouse) | 0.0248 | 0.0087 | 2.860 | 0.0188 | 0.0052 | 0.0444 |
| Dummy Industrial (R&D) | 0.0337 | 0.0054 | 6.252 | 0.0001 | 0.0215 | 0.0459 |
| Dummy Retail | 0.0342 | 0.0102 | 3.354 | 0.0085 | 0.0111 | 0.0573 |
| $R^2$ | 0.967 | | | | | |
| Adjusted $R^2$ | 0.938 | | | | | |
| Std. Error | 0.006 | | | | | |

*Risk premium is the premium over T-bills derived by regressing size-based portfolios onto three-factor CAPM plus property-type dummy variables with the Office CBD property type in the intercept.*

of core institutional properties as indicated in our analysis. In this perspective, "the market is right", and so even though the asset pricing model we have found does not seem to make intuitive or theoretical sense, it must in fact represent aspects of risk, or proxies for risk that investers really care about and that make sense for them to care about. The reader may wish to think about what, or why, or how this could be.[15] The implication of this approach is that we have a good model of the cross-section of expected returns within the institutional core real estate asset, as the multi-factor model provides a good fit.

The second approach is to admit that the market seems to have acted irrationally from a risk and return perspective, within the core institutional property asset class, during the 1984-2003 long cycle. This suggests that, unless the real estate market has gotten more efficient and rational since then, there may be substantial opportunities for a type of "arbitrage", in the sense that certain types and locations of properties appear to provide more return for less risk, while others provide less return for more risk. One would be tempted by our findings to want to buy large apartment buildings in large Tier I cities, and sell small CBD office buildings in small Tier III cities.[16]

Interestingly, anecdotal evidence suggests that investors have done exactly this sort of trade in recent years with large properties and apartments in Tier I cities being priced at higher and higher levels. Perhaps the market recognized the potential for arbitrage and moved to correct the relative mispricing. Yet, if the institutional core real estate market was inefficient or irrational during the 20 years from 1984 to 2003, can it be expected to be efficient and rational in the future? And if recent history indicates that a rational basis for the cross-section of property returns did not exist, how will differential returns across properties be predicted in the future?

A third explanation for our findings is the classic escape route of empirical analysis—our study could be flawed. We were able to analyze only 20 years of returns. If the real estate market is subject to a long cycle of this duration, then we have studied only one observation, one cycle.[17] Thus, it is possible that we simply do not have sufficient history to make this analysis. Another possibility is that we may have not identified an important factor in the risk model. Perhaps with more data and/or an omitted variable, we could explain the cross-section of real estate returns within the core institutional asset class in a way that makes intuitive and economic sense. But for now, based on the analysis reported herein, we are forced to conclude that "stocks are from Mars and real estate is from Venus!"

## ENDNOTES

Future research on this topic should involve the exploration of illiquidity as a factor priced by the market. This can be tested by comparing the residuals in the three-factor model with transaction activity (i.e., level and volatility). This could also suggest potential momentum or herding around a preference for specific property types. Due to the limited history of the NCREIF data, only one real estate cycle was analyzed in our study and presented in this article. Repeating this study using data from the next long real estate cycle would enhance the market's understanding of whether betas change through the cycles. It is possible that the recent changes in the market, including the dramatic increase of institutional capital invested in real estate, has resulted in a structural change in the pricing of risk. This and the development of real estate derivatives could substantially change institutional core real estate betas going forward.

We thank Cate Polleys and the members of the NCREIF Research Committee for advice and feedback, and we thank NCREIF for providing the data used in this study.

[1]See Li and Price [2005], Geltner [2005], and Geltner et al. Chapter 22 [2007].

[2]See Sivitanides et al. [2001], Hendershott and MacGregor [2005a], Breidenbach et al. [2006], and Geltner et al. Chapter 22 [2007].

[3]Institutional core real estate refers to the income-stabilized prime properties favored by large institutions that are typical of the NCREIF membership. Institutional core real estate represents the vast majority of the properties constituting the NCREIF index. The real estate investment marketplace seems to distinguish and price a risk differential between institutional core and non-institutional properties, characterized as "value-added" and "opportunistic" properties.. Non-institutional properties are generally smaller, older, less favorably located, or of a less traditional usage type, such as a hotel, and typically require some sort of physical or managerial development, rehabilitation, or repositioning. Non-institutional properties are apparently viewed as riskier in the marketplace and are priced to provide higher ex ante returns as value-added or opportunistic fund investments.

[4]Breidenbach et al. [2006] use the NAREIT index for the risk benchmark because, as we did, they found the NCREIF beta to be insignificant. The NAREIT index may be problematic, however, due to differences between the stock market and the private property market microstructure.

[5]The 1984-2003 period is symmetric in that it begins a few years before the previous peak in the property market and ends a few years before what will probably prove to be the next peak in the property market, thus presenting a fair picture of long-run average (full-cycle) real estate performance. Excluding years after 2003 also resolved our trepidation about including the recent unprecedented upsurge in institutional property prices.

[6]Core properties should have stabilized incomes, thus excluding substantial redevelopment or rehabilitation projects characterized by large capital expenditures compared to property value.

[7]Data and time constraints did not permit a further subdivision of the 38 portfolios by sorting on the betas of individual properties, as was done in the original Fama-French study [1992]. However, the individual portfolios (subindexes) do display a range of beta values within both the size and MSA-tier indexes which provides a graphical picture of the relationship of beta and return after controlling for size or tier.

[8]The assumption that the distribution is normal is not substantive in this analysis and is used only as a device to place boundaries around the three discrete size categories. Changing these boundaries would not change the conclusions.

[9]This involves using a time series regression to arrive at the various portfolio factors and then testing whether these risk factors explain the cross-section of mean returns by using a cross-sectional regression. See Campbell et al. [1997] for an excellent review.

[10]In the original Fama-French [1992] article, higher-beta portfolios did not consistently outperform lower-beta portfolios when size and book-to-market ratio were controlled for. But subsequent development of the theory, as summarized in Fama-French [2004], has resulted in a three-factor model which includes the classic market beta as well as size and book-to-market ratio effects. Each of the three factors has been shown to have a significant positive impact on long-run return.

[11]The evidence and possible rationales for the three-factor model are reviewed in Fama and French [2004].

[12]The analogy between property size (market value) and stock size (market capitalization) is straightforward. The analogy between a property location's metro tier and a stock's book-to-market ratio is less direct and less precise. The general point, however, is that both measures are readily observable and understood by investors, and arguably can be perceived as related to the risk or liquidity of the assets in question.

[13]Tests of the models without the property-type dummy variables resulted in the same coefficient signs on the risk factors as when the property-type dummies are included, but with a weaker fit and higher positive intercepts; thus, when the dummy variables are exluded, a less reliable asset pricing model results.

[14]The finding that larger properties provide higher average returns has been noted previously. In an industry white paper, Esrig and Giliberto [2001] observed that NCREIF office buildings worth more than $75 million significantly outperformed smaller office buildings, especially during the down market of the early 1990s. They suggest that such large properties can only be purchased by a relatively small number of large institutional investors, resulting in lower demand, lower price, and higher return. In essence, they are suggesting that the property-size effect is proxying for a type of illiquidity premium.

[15]These factors could be a proxy for the illiquidity and downside risk (i.e., the long-tailed effect) that are not directly captured in our model.

[16]Perhaps this could be accomplished by selling short the new index-based derivatives that are currently being developed. See Geltner and Fisher [2007].

[17]The long institutional core real estate cycle may be even longer than commonly thought. See Kaiser [1997].

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