A RISK-ADJUSTED PERFORMANCE HISTORY OF PUBLIC AND PRIVATE MARKET REAL ESTATE INVESTMENT 1978 – 1997

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ABSTRACT:

Since the inception of the Real Estate Investment Trust ("REIT"), the relative efficiency of the public and private real estate markets has been the subject of debate. Consequently, a determination of the more efficient real estate investment vehicle will probably have a significant effect on the future flow of capital into all real estate assets. This thesis proposes to identify which real estate investment medium, public or private, has provided greater efficiency to its investors as measured by risk adjusted total return over the 20 year period from 1978-1997.

The initial objective of this thesis was to create a publicly traded real estate equity index(the "Thesis index") for comparison to the existing National Association of Real Estate Investment Trusts ("NAREIT") equity index in an effort to replicate the returns of the latter. This equity Thesis index is an annual weighted compilation of the total returns of each existing equity REIT, as identified by a query of the Compustat database, for each given year from 1978 through 1997. Returns were calculated as of the calendar year end commencing in 1978 and continuing through calendar year end 1997.

The core objective of this thesis was to ultimately compare the de-levered Thesis index to the existing National Council of Real Estate Investment Fiduciaries ("NCREIF") index in order to determine which index has provided a greater risk adjusted return over the time series in question. Given the disparities in the risk profiles of the underlying indices and the need to ensure a homogeneous comparison, adjustments to the Thesis index have been made in order to compensate for leverage in the REIT capital structure, for the presence of development risk in the current REIT asset base, and for the respective weight of each real estate asset class within the NCREIF index.

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Title: Associate Professor

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CHAPTER 1

Introduction

The Research Topic and Its Importance:

Since Congress passed the Real Estate Investment Trust Act of 1960, both the public and private real estate markets have enjoyed periods of relative prosperity and have suffered periods of relative poor performance. As an example, the public real estate equity market (as proxied by the NAREIT index) significantly outperformed the private real estate equity market (as proxied by the NCREIF index) in both 1991 and 1996, with the NAREIT index beating the NCREIF index by a combined total of 66.25 points within those two years. Conversely, the NCREIF index outperformed the NAREIT index in both 1987 and 1990 by a combined total of 29.29 points within those two years. Since 1978, the NAREIT index has outperformed the NCREIF index, on a compounded basis, with average annual compounded returns of 15.11% compared to the NCREIF's 9.01%[1]. However, this fact alone does not establish the public real estate market, as measured by the NAREIT, as the more efficient investment vehicle due to discrepancies within the construction methodologies of the indices themselves. By adjusting for the differentiating risk profiles of the two indices, this thesis will provide an understanding of the risk-adjusted efficiency of the public and private real estate markets as represented by the respective Thesis (detailed herein) and NCREIF indices.

The market for privately held institutional commercial real estate equity as of December 31, 1998 was $557.2 billion[2]. This private equity was invested in numerous ownership structures ranging from direct fee simple ownership to limited liability entities such as trusts, limited liability companies ("LLC's"), limited partnerships ("LP's"), and corporations. The percentage of this $557.2 B investment universe represented by pension funds is approximately 26%[3]. Historically, most pension funds have filled the real estate allocations of their portfolios by establishing relationships with specialized pension fund advisors. These advisors then invest on behalf of the funds through commingled fund or separate account vehicles, with the advisor receiving fees and potentially a participation in the profits of the project upon divestment. During the real estate recession of the late 1980's and early 1990's, many pension funds suffered excessive losses while investing within this framework.

The questions that this thesis seeks to address are twofold. The poor performance of this system of capital intermediation in the late 1980s and early 1990s exposed an investment structure that contained agency problems and inherent conflicts of interest. These conflicts called into question the efficiency of the private equity market (as it was then structured) as a long term manager and operator of institutional real estate. This thesis seeks to quantify the efficiency differential between this traditional private equity market structure and the corresponding public equity market structure that has recently achieved a critical mass and experienced significant maturation.

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[1] Calculated based upon NAREIT and NCREIF annual published returns 1978 – 1997.
[2] Roulac Capital Flows Database
[3] Roulac Capital Flows Database

History and Growth of the Public Real Estate Equity Market:

Congress passed the Real Estate Investment Trust Act of 1960 in an effort to provide small investors with the ability to invest in a diversified pool of real estate assets that they could not afford to purchase individually. Mutual funds had been providing these diversification benefits to investors with regard to industrial equities since Edward G. Leffler created the Massachusetts Investors Trust in 1924, and the real estate industry lobby sought to access this pool of untapped capital. The first generation of REITs experienced an initial level of success in the early 1970's prior to the recession of 1974. The majority of these REITs were mortgage REITs that specialized in borrowing short from banks and lending long to consumers of debt through construction and permanent loans. This strategy proved very profitable until short-term interest rates rose, raising the mortgage REITs' cost of capital, while at the same time numerous construction loans defaulted. This convergence of events forced the liquidation of many REITs such that of the 154 REITs in existence in 1973, only 68 remained by the end of 1975[4].

The growth of the REIT industry was slow but steady through the 1980's until the collapse of the private real estate market late in the decade, continuing into the early 1990's. A dearth of liquidity resulting from the Tax Reform Act of 1986 and the failure of the S&L industry created a significant disconnect between the private market valuation of real estate assets and the public market valuation of the same. Real estate owners were forced to go public in order to both re-capitalize their existing portfolios and access additional capital, thereby allowing them to take advantage of the deeply depressed private market real estate valuations.

The subsequent wave of public equity REIT offerings resulted in a significant shift in the ownership of real estate

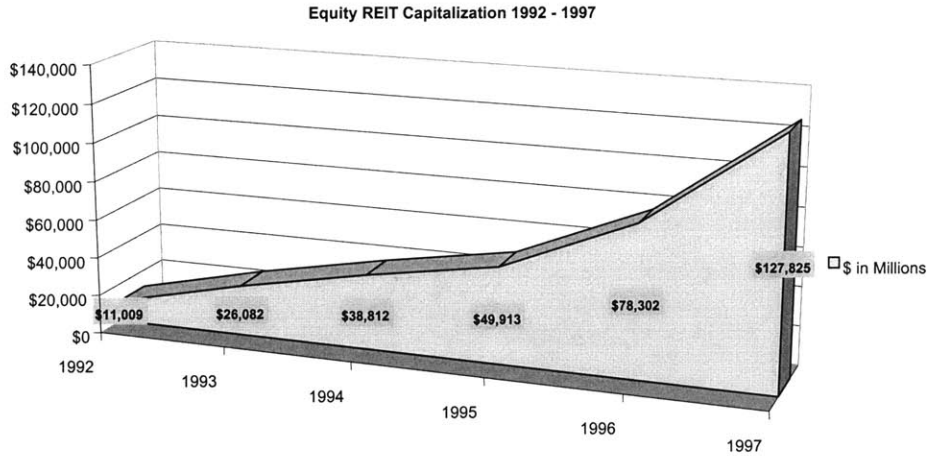


Figure 1

equity. This IPO boom fueled the torrid pace of market capitalization growth within the equity REIT sector from a total capitalization of $11B at calendar year end 1992 to a total market capitalization of $127.8B at the end of the thesis time series of calendar year end 1997[5]. The critical mass that has recently been achieved by this third generation of the equity REIT industry, coupled with the high profile nature of many REIT acquisitions, has called into question the traditional private ownership structures of real estate equity. For the first time, the public real estate equity market has emerged as a legitimate alternative to the private real estate equity market for the pension fund investment dollar. The definitive risk adjusted performance superiority of one of these markets will greatly influence the future course of real estate capital flows.

Respective Advantages of Public and Private Real Estate Equity Ownership:

Many factors affect the decision as to how to best own specific real estate investments. In addition to efficiency and performance, various forms of real estate ownership offer specific benefits and/or present specific problems when utilized. Factors associated with various forms of real estate equity ownership include control, tax status, liability and liquidity.

In the public equity realm, the REIT structure provides investors certain advantages in comparison to privately held real estate equity. First, the public market provides a theoretically constant availability of capital that, based upon forward-looking expectations, potentially prices investment risk more efficiently than the private market. This availability of capital provides REITs with the ability to take advantage of positive NPV projects at any time, with the subsequent cost of capital reflecting the inherent risk of the transaction. Additionally, this forward-looking perspective helps to instill a level of discipline in the management of the REIT that is not externally mandated in the private equity market. Second, equity REITs provide investors with an ownership vehicle that is considerably more liquid than equity that is held in whole assets. This relatively superior liquidity reduces the risk of ownership to the REIT investor (and potentially reduces the resulting cost of capital to the REIT itself) as divestment can be achieved within a shorter time period with lower transaction costs than is generally possible in the private equity market. The cost associated with these benefits is that REITs are bound by very strict laws of governance in order to maintain their tax-exempt status. These restrictions dictate the REIT's concentration of stock ownership, available sources of income and the distribution of the same, and they can severely hinder the decision making flexibility of management.

Conversely, potentially the greatest benefit of private market equity ownership is the relative freedom from the management constraints of public market scrutiny and regulation. Private market owners of real estate equity are not restricted by any of the limitations imposed upon the REIT structure. This allows private owners to buy and sell any and all types of assets and invest and divest, as they deem optimal. At the same time, potentially the greatest historical deficiency in the private market ownership of institutional real estate, when intermediated by advisors, has

[4] Mullaney

been the difficulty of creating an effective alignment of interest. Aligning the interests of investor and advisor, as demonstrated by both the pension fund advisors of the 1980s and the previous generations of externally managed REITs, has proven to be quite difficult to achieve. Historically, the inherent agency conflicts that exist between owners and managers with regard to fees and divestment in the private equity market, coupled with the accompanying lack of liquidity, have likely had a negative impact on the performance of real estate owned in this format.

Though the relative advantages of both public and private markets as outlined above play a significant role in the capital allocation decisions of investors, they are merely contributing factors to the most important determinant of real estate investment: ex post total return. This thesis utilized total return in order to determine relative market efficiency due to the all-encompassing nature of this investment measure over the time period from 1978-1997. Reliance on either the yield or appreciation return component would likely have skewed the analysis in the favor of the public and private equity market respectively due to the distribution requirements of the former and the reliance on appreciation of the latter. Total return captures all facets of the investment and reflects the comprehensive performance of the investment ex post.

Plan of Action:

The first phase of this thesis focused upon the creation of a public real estate index that encompasses the entirety of the equity REIT universe from 1978 to 1997 as identified by the Compustat database. Compustat was utilized, in conjunction with the graphical interface known as FactSet, in order to derive the financial records of all equity REITs, exclusive of healthcare REITs, in existence at each successive calendar year end from 1978 to 1997. By weighting the individual total returns of each REIT according to its percentage of the total market capitalization of the Thesis index as a whole, an annual total return was achieved for the entire Thesis index. This process was repeated for each year within the time series, and the annual returns for the Thesis index were subsequently generated.

The second phase of this thesis involved comparing the Thesis index to the existing NAREIT index in an attempt to replicate the historic performance of the latter. The NAREIT index has been in existence since 1972. The index has a vested interest in the positive performance and growth of the REIT industry. Therefore, through subtle decisions such as the timing of the listing and de-listing of various firms, it was hypothesized that NAREIT might have shown a bias towards decisions that created an upward revision in the performance of the index. The goal of this phase of the thesis was to identify and comprehend any differences between the two indices that may have resulted from such biases.

[5] NAREIT

The third phase of this thesis compared the Thesis index to the NCREIF index in an effort to determine the relative efficiency of one of these equity markets. In order to make this comparison, adjustments were made to the Thesis index to ensure that the comparison reflected similar risk profiles between the indices. The first adjustment was the de-levering of the Thesis index at the firm level, through a weighted average cost of capital calculation, in order to compensate for the fact that REITs generally maintain a significant debt component in their capital structure while the NCREIF is a 100% equity index. The second adjustment was the weighting of the asset mix of the Thesis index such that it reflected the asset mix of the corresponding NCREIF index. Post adjustment, the two indices were expected to be comparable to the point that it allowed for the determination of superior market efficiency based upon risk adjusted total return.

Summary of Findings:

Upon completing the construction of the Thesis index, the index's computed returns were compared to both the NAREIT and NCREIF indices. While the potential for bias exists in any comparison between indices constructed from different data sources and utilizing different methodologies, the writers diligently sought to identify and quantify the effects of any and all biases that potentially had an effect on the results of these comparisons.

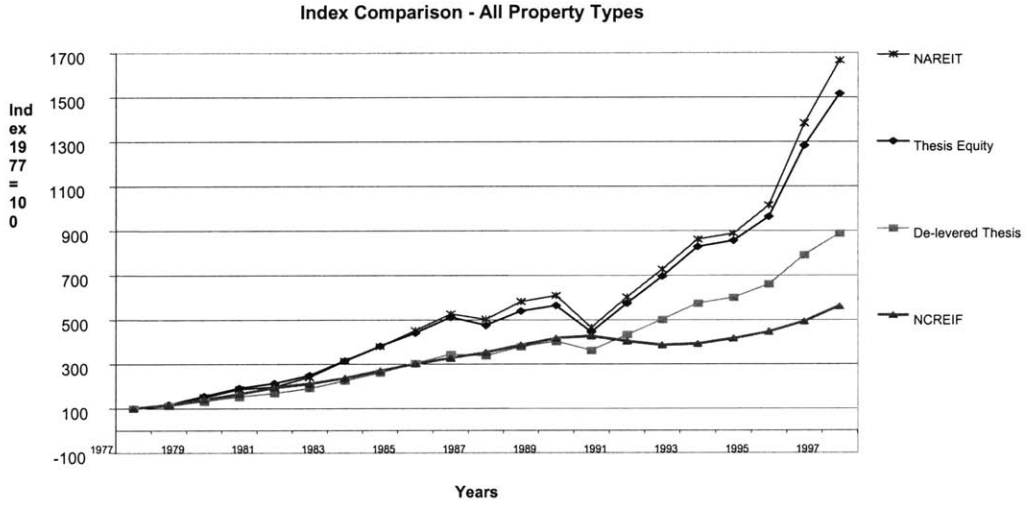
The comparison between the unadjusted Thesis equity index and the NAREIT equity index showed that the NAREIT index outperformed the Thesis index, as measured by annual average compounded total return, by a total of 55 basis points per annum. These differences can be explained primarily by the different compounding periods of the indices. The NAREIT Index was historically compounded monthly, whereas the Thesis index was compounded annually. It is estimated later herein that this alone accounts for the 55 basis point differential.

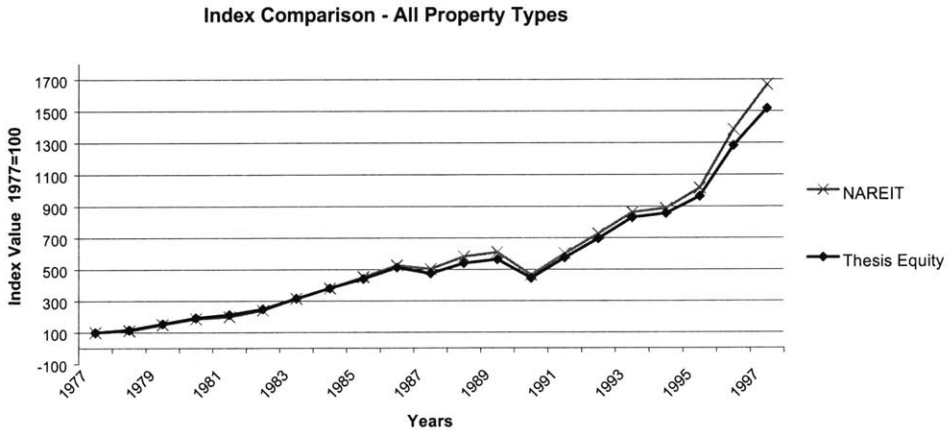
Index	Unadjusted Annual Compound Return
NAREIT Index	15.11 %
Thesis index	14.56 %
Spread	55 bps

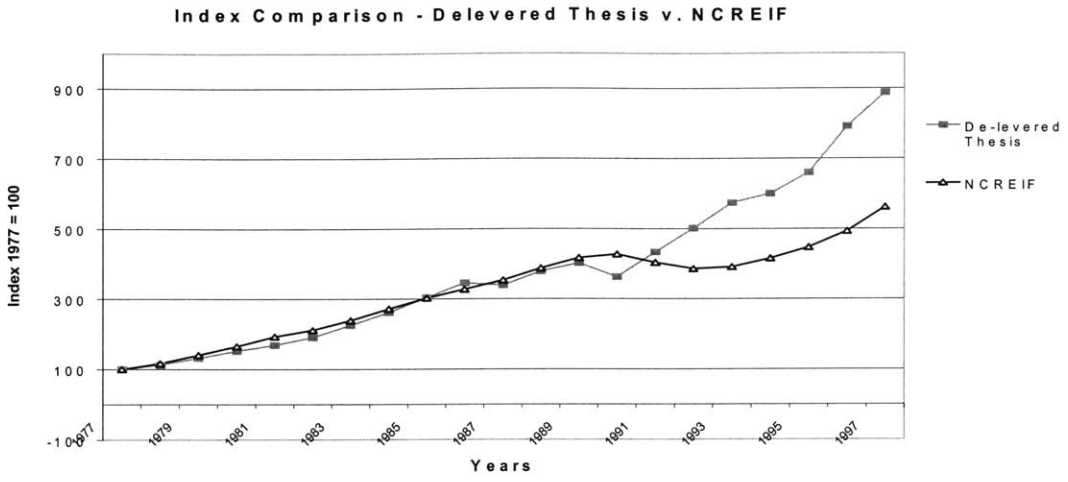
The comparison between the de-levered Thesis index and the NCREIF index showed that the de-levered Thesis index outperformed the NCREIF index on a risk-adjusted basis, as measured by annual average compounded total return, by a total of 253 basis points per annum. This broad-based comparison provides an initial measure of the comparative returns of the public and private markets and serves to highlight the superior performance of the public market as observed in this study.

Index	Risk-Adjusted Annual Compound Return
NCREIF Index	9.01 %
De-levered Thesis index	11.54 %
Spread	253 bps

The resulting indices can be expressed graphically by the following:






Index Comparison - Delevered Thesis v. NCREIF
900
700
500
300
100
-100
Index 1977 = 100
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
Years
De-levered Thesis
NCREIF

CHAPTER 2

Literature Review

Overview:

The public real estate equity market, as represented by REITs, has achieved a significant level of market capitalization within the last decade and has therefore attracted increasing levels of interest from the investment community. Despite the recent significance of the public real estate equity market, the literature analyzing public and private real estate equity market performance is not extensive. It is hoped that this analysis will add to the fundamental understanding of the relative risk adjusted performance of public real estate markets. The literature review undertaken in this research has focused upon a synopsis of the history of the REIT market, private and public real estate market performance comparisons, and index creation and measurement.

Brief History of the REIT Market:

A concise synopsis of the history of Real Estate Investment Trusts is compiled in REITs, *Building Profits with Real Estate Investment Trusts*, Mullaney, John A. (1998). Publicly traded REITs were created as an investment vehicle with the adoption of the "Real Estate Investment Trust Act" signed by President Eisenhower towards the end of his administration. During the evolution of the REIT vehicle, there has been what Mullaney (1998) refers to as three distinct generations of Trusts. The Mortgage REIT boom of the late 1960's early 1970's is defined as the first generation. The second generation (in the 1980's) is described as resulting from the tax law changes brought about by the Tax Reform Act of 1986. The most important of these changes are identified as the elimination of real estate tax shelters and the approval of REIT self-governance. The third generation was born into the environment of the early 1990's with its dearth of liquidity in the private markets and its divergence in pricing of real estate assets between the public and private markets. While tremendous buying opportunities existed at this time, traditional private market capital sources had withdrawn from the marketplace. The only avenue available to private real estate firms to access capital was to take their portfolios public and capitalize on the arbitrage pricing offered by the public market. This market dynamic coincided with the creation of the umbrella partnership REIT (UPREIT) which allowed private firms to go public without immediately incurring substantial tax liabilities for the existing property owners. These factors converged to create this third generation of REITs, and they have allowed this generation to establish capitalization mass that should ensure the continuation of this ownership structure into the future.

A decade by decade analysis of the evolution of the public REIT market is provided in "The Evolution of the Public and Private Market in Investing in the New Real Estate Capital Markets" by B. Ziering, B. Winograd and W. McIntosh (1997). Ziering et. al., describe the rise and fall of the mortgage REITs of the 1960's and 1970's. In their observation, the 1980's witnessed a reduction in the level of debt within the REIT capital structure as well as the replacement of mortgage REITs by equity REITs as the public investment vehicle of choice. The 1990's are specifically characterized by the migration of firms into the areas of geographic (early 1990's) and property type

specialization, increased attention from established stock analysts and improved financial reporting which allowed for performance benchmarking as well as company to company and property type to property type analysis.

Private and Public Market Performance Comparison:

There are a limited number of writings that are comparable to the subject matter covered in this thesis. Some of these writings compare risk adjusted returns to broad market based indices, Chen, J. and Peiser, R. (1999) as well as Sanders (1997). Lieblich, F. Pagliari, J. and Webb, J. (1997) focused on income and appreciation return comparisons between NCREIF and NAREIT, however their analysis does not correct for the effect of NAREIT leverage on the comparative returns.

In "Defining Commercial Property Income and Appreciation Returns for Comparability to Stock Market-Based Measures" by M. Young, D. Geltner et. al. (1995) the authors correctly emphasize the temptation to compare broad indices and benchmarks at face value. For example, the NCREIF Property Index (NPI) measures un-levered total returns using stabilized NOI, and appraisal based appreciation returns. Young, Geltner et al. state that these basic NPI numbers should not be compared directly to broad stock market based performance measures. They find that even direct comparison to public real estate specific benchmarks is problematic. For example, the NAREIT measures of total return are levered returns and contain property types not directly comparable to the NPI. Therefore, their conclusion is that comprehensive measurements of comparative returns must be adjusted to compensate for these inconsistencies.

In *Real Estate Investment Trusts, Structure Analysis and Strategy* "Public and Private Real Estate – Performance Implications for Asset Allocation" by D. Geltner and J. Rodriguez (1997), the above referenced issues of index comparison are addressed. The authors set out to de-lever REIT returns utilizing a modified weighted -average cost of capital model. This model used aggregated balance sheet financial values in determining the capital structure for the entire REIT universe, and provided "...at least a usable approximation ... for property (un-levered) returns implied by the REIT share market values." To address the remaining issue of appraisal based appreciation returns, Geltner and Rodriguez then used an un-smoothing procedure. In theory, un-smoothing corrects for the timing and informational inefficiencies in appraisal based appreciation measures. This procedure applies a reverse filter to recover the true underlying property returns from an appraisal-based index. The time period of their analysis began in 1974 and ended in 1993[6]. These results show the adjusted "Public" real estate as having a mean return of 11.62% and the adjusted "Private" real estate returning an average of 7.88%, a difference of 374 basis points in favor of the public market.[7] This thesis attempts to perform a similar analysis, though the Thesis index will be constructed on a firm by firm basis as opposed to being derived from the existing NAREIT index. Our thesis does

[6] NCREIF only provides returns from 1978, the authors accessed the Evaluation Associates Index (EAI) to backfill the missing data years for the private market.

[7] The same results were published in "The Similar Genetics of Public and Private Real Estate and the Optimal Long-Horizon Portfolio Mix" D. Geltner, J. Rodriguez, and D. O'Conner; *Real Estate Finance Journal* (1995).

not require an adjustment for smoothing due to the annual nature of the data and the long time series of twenty years.

Index Creation and Measurement:

A very useful paper regarding index construction, including discussions of de-levering, un-smoothing, and REIT based index construction is "Value Indices of Commercial Real Estate: A Comparison of Index Construction Methods"; Fisher, J., Geltner, D., and Webb, R. (1994). As stated on page 137 "Value indices that trace the peaks and valleys through time of market prices for different asset classes provide useful information not only to historians and economists but also to practitioners and investors dealing with commodities and capital assets of various types."

The recent paper, "The NAREIT Index of REIT Industry Performance", by Grupe. M. and DiRocco, C. provides a detailed analysis of index construction, and in particular the methodology used in the historic construction of the NAREIT index. Finally, the article provides the details of the recent revisions to the NAREIT methodology, which have increased the calculated return periods from monthly to daily.

Some of the techniques utilized in the construction of the Thesis index are outlined in *The Handbook for Financial Market Indices, Averages, and Indicators*; Berlin, Howard (1990) inclusive of the total return index.

An insightful guideline to what constitutes the characteristic of a preferred index can be found in *The International Guide to Securities Market Indices*, Shilling, H. (1996). According to Shilling these characteristics include:

- The index should be relevant and appropriate. That is, the index should track the relevant markets, market segments, individual securities and investment styles.
- The index should be comprehensive, or broad based, incorporating to the extent appropriate, the markets, security types, individual securities that represent the investment opportunities available to investors.
- The index should be investable and market participants should be able to replicate it.
- The index should be transparent.
- The index should be constructed so that each security's return is weighted according to its market value at the beginning of the period the return is measured.

These specific guidelines were used in the layout and the construction of the Thesis index.

CHAPTER 3
Methodology

Identification of a Data Source:

For the purpose of this thesis, public real estate equity was defined as the aggregated market capitalization of all outstanding shares of common stock within the equity REIT universe as identified by Compustat within the FactSet interface under industry code #4890. This definition specifically focused upon the REIT ownership vehicle and did not include real estate equity held by other publicly traded entities such as C-Corps. The desire to achieve consistency with the NAREIT index resulted in this exclusion of C-Corps. Additionally, the private real estate equity market was defined as the aggregated value of all institutional real estate equity as identified within the NCREIF index.

The creation of the Thesis index presented the most difficult task in the completion of the thesis objectives previously outlined. The process entailed the identification of a comprehensive data source, the acquisition of the appropriate data from the source in question and the verification of the data's accuracy thereafter. A significant challenge to creating the Thesis index was the location of an accurate data set that encompassed the required universe of equity REITs for the time series 1978-1997. No such data has been compiled historically on a firm by firm basis, to the knowledge of the writers, therefore extensive research was required in order to obtain the necessary data series.

The first step in identifying a data source involved contacting NAREIT directly regarding the historic data that it archives on behalf of its member firms. It was determined through discussion that NAREIT does not maintain an extended database of member firm financial records for any time series beyond the most recent five-year period. It was further determined through inquiry that NAREIT utilizes third party data providers, specifically SNL Securities and Wilshire Equator, to track any historical data to which the trade group might need access.

Discussions with industry participants, coupled with the examination of previous index research, identified Compustat as the most comprehensive source for historical financial records of publicly traded securities available to the writers. Given the breadth of the Compustat database and the difficulty in utilizing the Compustat interface, a specific interface software application called FactSet was utilized for the express purpose of querying the Compustat database.

De-Levering Methodology Utilizing a Weighted Average Cost of Capital Calculation:

The NCREIF is an all equity index while both the Thesis and the NAREIT indices reflect the return amplifying effects of leverage in their capital structure. Subsequently, the effect of this leverage had to be negated in the Thesis index prior to its comparison to the NCREIF index. In order to de-leverage the Thesis index, a weighted average cost of capital calculation ("WACC") has been utilized. The WACC is traditionally used in financial application to

adjust for the higher ex ante required equity return that results from the increased risk associated with increasing levels of debt in the capital structure. For the purpose of this thesis, ex post return components have been input into the WACC equation in order to remove the effects of leverage from the capital structure of the REITs in question on a firm by firm basis as follows:

$$R_{a,t} = (R_{e,t} \times W_{e,t}) + (R_{d,t} \times W_{d,t}) + (R_{p,t} \times W_{p,t})$$

Equation 1

Where R_e, R_d and R_p represent the ex post returns on common equity, debt and preferred equity respectively, and W_e, W_d and W_p represent their corresponding weights within the capital structure as a percentage of total market capitalization. These individual return components were calculated as follows:

Common Equity-

$$R_{e,t} = ((p_t - p_{t-1}) + d_t)/p_{t-1} \qquad W_{e,t} = (E_{t-1}/(E_{t-1} + D_t + PP_t)$$

Where:

p_t = stock price at year end t

p_{t-1} = stock price at year end t-1

d_t = total dividends in year t

E_{t-1} = Total equity capitalization at year end t-1

D_t = Total debt outstanding at year end t

PP_t = Total preferred equity capitalization year end t

Debt-

$$R_{d,t} = i_t/D_t \qquad W_{d,t} = (D_t/(E_{t-1} + D_t + PP_t)$$

Where:

i_t = gross interest expense in year t

D_t = total debt outstanding in year t

Preferred Equity-

$$R_{p,t} = pd_t/PP_t \qquad W_{p,t} = (PP_t/(E_{t-1} + D_t + PP_t)$$

Where:

pd_t = total preferred dividends paid in year t

PP_t = total preferred capitalization at year end t

Returns on equity have been weighted by the equity's ending capitalization from the previous year (t-1). However, year (t) weighting was specifically chosen for debt and preferred stock. It was determined that weighting based upon the previous year's total debt had the potential to substantially understate the amount of leverage found in the current year's capital structure. In that there was little or no appreciation component applicable to either debt or preferred stock, current year weighting of the debt and preferred components was deemed to be the best methodology given the available data. It is recognized that a potential bias exists in that if $D_t > D_{t-1}$ for any given

firm i, then this would tend to increase the weight of leverage, and subsequently decrease the de-levered returns in periods of positive total returns. This potential bias would tend to decrease the de-levered returns represented in this thesis, leading to more conservative results.

The weighted return on common equity, return on debt and return on preferred equity for the Thesis index was substituted into the WACC equation above as the three pertinent pieces of the REIT capital structure. The equation was then solved for the resulting return on the underlying real estate assets ("$R_{a,t}$"). This return on assets is the equivalent of the ex ante Thesis index return that would be expected if the existing debt were removed and the underlying assets were unencumbered as is the case in the NCREIF index.

Querying the Data Source:

Having established the financial components necessary to complete the de-levering of the equity thesis database, the next step in the methodology was to capture this information in the Compustat database query for each individual REIT stock within every year of the time series. Therefore, prior to querying the Compustat database, a field of categories consisting of all of the necessary financial information was compiled. Given the focus of the thesis upon annual returns, the data in question was sought as of the calendar year end for each of the 20 years in the time series. The financial categories that were ultimately queried are as follows: total assets, total debt, gross interest expense, total long and short term debt, interest capitalized, preferred stock at liquidation value, preferred dividends, common shares outstanding, common dividends per share, closing price at calendar year end and both the price and date of the first and last trade for each specific entity. The various categories were identified using the Compustat Industrial annual data array item codes as provided within FactSet.

The initial Compustat query was executed utilizing a universe defined by SIC code #6798, which is the designation for Real Estate Investment Trusts. This SIC based query captured the entirety of the REIT universe, as opposed to just the required equity REITs, because there existed no way to further focus the query beyond the general REIT category. In addition, due to the tendency of REITs to change investment classification over time, it was necessary to generate an initial database that was as broad and comprehensive as possible. This initial query generated a REIT universe of 289 current and historical entities over the course of the time series. During the data verification process, it was determined that this universe was insufficient in its comprehensiveness in that it failed to identify a significant portion of the historic REIT universe.

The data verification process in question involved manually checking query results from specific years of the time series against both Moody's Bank and Finance Manual and the chronologically corresponding REIT factbook/handbook which is produced by NAREIT on an annual basis. This manual confirmation also included examining a random sample of REIT annual reports for the years 1996, 1997, and 1998. This random sample showed that the 1998 data was incomplete as of this writing and was therefore excluded from the time series. This incompleteness was likely due to the fact that some REITs based their accounting upon a fiscal year that commences

in 1998 but does not close until the second, third or fourth quarter of 1999. The 1996 and 1997 sample data was confirmed by sample audit and deemed accurate, therefore 1997 was utilized as the final year of the time series.

Discrepancies between the NAREIT factbook/handbook and the Compustat query were noted, with further research undertaken in an effort to identify their source. This cross-referencing process identified a significant number of firms that were absent from the database query and thereby necessitated the expansion of said query. In addition, this process also identified numerous entities that were present in the query but were not listed in the chronologically corresponding NAREIT factbook/handbook. The majority of these additional firms were captured by the query due to their misclassification as REITs.

Subsequently, the breadth of the initial Compustat query was expanded by utilizing the FactSet industry code #4890 in lieu of SIC code #6798. The utilization of the FactSet code resulted in an expansion of the identified REIT universe from 289 REITs to 433 REITs. This query was deemed superior to the previous SIC based query in that many acknowledged entities that were not present in the SIC query were accounted for in the FactSet industry code query. Though this expanded universe was considered to be an improvement, the verification process again identified REIT entities that were still not present in this second query expansion.

The Compustat query was expanded a third and final time by including research data available outside of the Compustat library through the FactSet industry code. This final query expanded the universe of identified REITs to 621 entities over the 20-year time series. In addition, firms were again present in the query that were not REITs, but were either OTC traded development companies or foreign real estate entities instead. These extraneous entities were then removed from the database. This final adjusted database query was utilized as the gross final REIT database and served as the foundation upon which the equity index was constructed.

Table 1

Step	Requirement	Result
Step #1	Identify a data source	Selection of Compustat with FactSet Interface
Step #2	Identify necessary financial information	Identified WACC components and firm earnings/share information
Step #3	Query the datasource	Utilized FactSet Industry Code #4890 in lieu of SIC code
Step #4	Data verification	Adjustments to database composition and preferred stock
Step #5	Segregate Individual REIT Data for each year of the time series	Classified REITs based upon investment type, listed exchange, property type and legal structure

Equity REIT Universe Database Creation:

Upon completion of the aggregated REIT database, numerous refinements, adjustments and deletions were made in order to arrive at the final database of equity REITs to be utilized in the creation of the Thesis index. The first adjustment involved classifying all of the captured REITs in the aggregate database with regard to investment type. REITs were characterized with regard to investment type as equity, mortgage or hybrid REITs. The NAREIT definition of each classification was used whereby if 75% or more of a REIT's assets were either equity or mortgage within a given year, the REIT itself would be so classified for that year. Upon annual identification, all mortgage and hybrid REITs were eliminated from that year's database due to the predetermined equity focus of the Thesis index.

This process of REIT investment classification was undertaken for each year for which this data was available. The point of reference for this information was the NAREIT factbook/handbook which tracks all tax qualified REITs and classifies the same on an annual basis. The need to perform this time consuming verification process for each year within the time series stemmed from the constantly evolving nature of the firms that comprise the REIT industry. REITs often changed classifications from year to year, moving from mortgage to hybrid to equity and potentially back again over the twenty-year period. In addition, many REITs lost their qualified tax status and reverted to C-Corps during the course of the time series only to re-qualify at a later date. When this scenario unfolded, the REIT was removed from the index when it lost its qualified tax status and was added back to the index when its qualified tax status was reinstated. Best efforts were used by the writers to identify these changes in investment focus for REITs over the time series and thereby regulate the inclusion and exclusion of firms based upon their equity focus.

The second form of REIT classification focused on the equity exchange upon which the various REIT issues were traded. The goal of this step was to identify and eliminate any and all firms that were traded OTC or on secondary stock markets. The reason for this step was to mirror the selection criteria utilized by NAREIT in identifying the firms that comprise its index. NAREIT defines its universe of included REITs as all tax qualified REITS with outstanding common shares that maintain majority voting rights and are traded on the national exchanges of the NYSE, NASDAQ or AMEX, specifically excluding operating partnership units[8]. This criteria eliminated a number of smaller REITs that were traded OTC and eliminated any potential effects of operating partnership units.

Though it has tracked REITs by investment type historically, NAREIT has paid less attention to the property/asset mix of REITs at the individual firm level. This fact notwithstanding, the third level of entity classification of the qualified equity REIT universe attempted to further categorize these firms based upon property type. This step was taken in an attempt to eliminate any property mix bias in the final risk adjusted comparison between the NCREIF index and the Thesis index. The property categories identified were residential, office, industrial, lodging, retail,

[8] Grupe, et al

self-storage, healthcare and diversified. Upon classification, healthcare REITs were excluded from the Thesis index because the NAREIT index is calculated both with and without their exclusion.

Property type classifications were determined by manually reviewing the NAREIT handbook for the years 1993-1998. Unfortunately, prior to 1993, NAREIT did not provide any comprehensive property category information on individual REITs. Therefore, if supplemental information was not identified in earlier NAREIT handbooks, the property type classification associated with an individual REIT in 1993 was carried back with that entity to its inception. That being said, pre-1993 NAREIT handbooks were examined in order to categorize REITs that ceased to exist prior to 1993. These older NAREIT handbooks were examined in an effort to extrapolate the most probable categorization of those REITs previously not identified. A 75% of assets test was utilized to classify these REITs by property type. That is, if a REIT held 75% or more of its asset value in a particular property category, then the REIT was classified within that group. While this methodology for pre-1993 entities was not perfect due to the potential for REITs to change property focus, it was deemed a reasonable approach given the lack of reliable data. Lastly, for those early REITs for which absolutely no substantive information was available, industry experts were consulted for their opinions as to the most appropriate historic category for the REITs in question[9].

Finally, the equity REIT database was classified based upon entity legal structure. The attempt was made to identify all REITs as Umbrella Partnership REITs ("UPREITs"), traditional REITs, or DownREITs. This information was garnered in an effort to determine any resulting biases resulting from the legal structure of the Thesis index components. This classification process concluded the database compilation.

Table 2

	Equity REIT Database Classifications	Categories
Classification #1	Investment type	Equity, mortgage or hybrid
Classification #2	Traded exchange	NYSE, Nasdaq, Amex, OTC
Classification #3	Property type	Office, Industrial, Residential, Retail, Lodging, Self-Storage, Healthcare and Diversified
Classification #4	Legal Structure	Traditional, UpReit, DownReit

Equity REIT Data Modification:

The next step in the methodology was to undertake an examination of the historic financial data captured by the Compustat query. The financial data was to provide both the annual weights and the annual returns for the Thesis index. This data was to be utilized in de-levering and weighting the Thesis index in order to provide an equitable comparison with the NCREIF index. Given the importance of these two adjustments, it was essential that best efforts were made to achieve the maximum accuracy of this financial data.

In confirming the accuracy of the various queried categories, the only data that showed signs of inconsistency was the preferred stock. Further examination resulted in the identification of inconsistencies with preferred stock liquidation values in relation to preferred dividends. REITs with disproportionate preferred stock liquidation values were specifically identified, and those firms were then researched individually, within the corresponding years, in Moody's Bank and Finance Manual in an effort to determine the accuracy of the Compustat data. For the firms in question, the liquidation value of preferred stock was stated as the par value of said stock times the number of outstanding shares. This resulted in some of the stated preferred liquidation values being substantially under reported[10]. All firms showing disproportionate yields on preferred stock were researched to determine a more appropriate liquidation value for the underlying preferred stock. Where a stated liquidation value was provided, that value (number of shares outstanding times liquidation value per share) was manually input into the database. If no such liquidation value was provided, then, if available, the price at the given year-end was multiplied by the number of shares outstanding. If a year end price was not available then the mean price for the given year was utilized. If neither of these options was available, then the stated face rate on the preferred stock was utilized. For the situations where none of these options were available the information regarding preferred stock was deleted for the respective firm in that year. This resulted in approximately ten deletions over the twenty-year time series.

Excluding the liquidation value of preferred shares issue, the financial data was generally consistent with anticipated values. Random audits of various REIT's financial statements were undertaken to corroborate the Compustat data, and that data was determined to be quite accurate excepting only the aforementioned preferred stock.

Equity REIT Data Augmentation:

The raw data from FactSet provided stock price, dividends, preferred dividends and interest on an annual basis, however no specific data was provided on when the firm entered the database. For example, a REIT may have come into existence in the third quarter of a given calendar year. Therefore, it was initially assumed that the respective returns for that year would need to be annualized in order to determine a total return for that partial year. This fact was the same with regard to partial year issues stemming from mergers, acquisitions and REIT failures. This required the identification of the date of a REIT's entry into the public markets, as well as the date of its exit from the same, regardless of the reason for the exit.

It was anticipated at the outset that the annual nature of the FactSet data might be a significant source of bias in the Thesis index. Therefore, the ability to annualize partial year returns was sought at the time of the initial data queries. As the fundamental information involved in this task, the date of entry and exit for each REIT in the

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[9] Carr, Ostrower

[10] This was primarily due to the stated par value on convertible and cumulative preferred shares (generally .01/sh.).

database was sought. This date of entry and exit (if applicable) was identified for each REIT post 1984[11] by FactSet, and pre-1985 data was researched in Moody's Bank and Finance Manuals.[12] The post 1984 FactSet data was utilized in the calculation of annualized returns, i.e. returns post 12/31/84. These aforementioned dates were then available to quantify annualized returns for each of these partial year return components. The generalized formula used for this augmentation was as follows:

$$\text{Return}_x \; / \; (\#\text{ of days}/360) = \text{Annualized Return}_x$$[13]

Equation 2

These calculated annualized partial year returns were then available to be substituted for each individual return component for the year of entry and exit from the public market.

Total Return Calculations:

The definition of total return utilized in quantifying the returns of the Thesis index is the sum of the current annual yield and the current annual appreciation. The current annual yield is defined as the annual dividend per share divided by the previous year ending price per share. The appreciation return is defined as the current year ending share price less the previous year ending share price divided by the previous year ending share price. The total return of each firm that was in existence during the course of a given year was then weighted based upon its percentage of the total equity index market capitalization of the previous year, i.e. the beginning of the period. The weighted returns of each individual REIT were then summed to determine an index total return for a given year of the time series. This calculation can be expressed as:

$$\text{Total Equity Index Return} = \sum_{i=1}^{N} \left[\left((p_{t,i} - p_{t-1,i} + d_{t,i}) / p_{(t-1),i} \right) \times \left(E_{(t-1),i} / \sum_{j=1}^{N} E_{(t-1),j} \right) \right]$$

Equation 3

Where:

p_t = stock price at year end t, Firm i

p_{t-1} = stock price at year end t-1, Firm i

d_t = total dividends in year t

$E_{(t-1),i}$ = Equity capitalization at year end t-1, Firm i

$\Sigma E_{(t-1),j}$ = Total equity capitalization at year end t-1, Firm i to j

and de-levered index returns can be expressed as:

$$\text{Total De-levered Index Return} = \sum_{i=1}^{N} \left[Ra_{t,i} \times \left(K_{t,i} / \sum_{j=1}^{N} K_{t,j} \right) \right]$$

Equation 4

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[11] The earliest date of trading data was November 5, 1984, therefore complete first day of trading data effective January 1, 1985 forward was utilized for annualization calculations.

[12] The Moody's data was incomplete and therefore was not included in the annualization calculations.

[13] In that returns were weighted by the prior year equity capitalization this effectively precluded the initial period annualized returns (weight = 0). However, the annualization did allow for the capture of returns of firms leaving the index.

Where:

$Ra_{t,i}$ = WACC at year end t, Firm i

$K_{t,i}$ = Total Market Capitalization at year end t, Firm i

$\Sigma K_{t,j}$ = Total Market Capitalization at year end t, Firm i to j

and Total Market Capitalization = $E_{(t-1),i} + D_{t,i} + PP_{t,i}$

CHAPTER 4

The Thesis Index versus the NAREIT Index:

Equity REIT Database for NAREIT Comparison:

The completion of the equity REIT database created the foundation of historical firm-specific financial data from which the Thesis index was constructed. The initial reason for the creation of the Thesis index was to compare it to the existing NAREIT index in an effort to verify the historic performance of the latter. Given that both indices are leveraged, and both indices reflect the universe of equity REITs for any given period of time, the indices were expected to demonstrate relatively similar return performance prior to any adjustments. That being said, it was also expected that the index comparison would naturally exhibit some deviation with regard to the timing and magnitude of the resultant returns. The anticipated deviation stemmed mostly from the data-intensive bottom up construction technique utilized in constructing the Thesis index. The initial goal of this thesis was to generate a new index based upon historic annual firm by firm data. This goal was achieved and the following are the potential sources of bias and the results that stem from the comparison of the Thesis index to the NAREIT index.

Sources of Potential Bias:

In the Thesis index comparison to the NAREIT, the most significant bias identified was the variation in both the number and length of the individual index return periods over which the comparison was made. This differential was founded in the fact that the NAREIT index has historically been calculated on a monthly basis (though it is now calculated on a daily basis) with these monthly returns compounded to determine an annual return. Conversely, the Thesis index was calculated on an annual basis and therefore did not benefit from the effects of such frequent compounding. Furthermore, the Thesis index construction methodology required the use of the previous year's market capitalization in determining the equity weight used to calculate a firm's annual contribution to the total return of the index. It was assumed that this use of the previous year's market capitalization in determining the current period's weighted return would create an additional bias by eliminating the effect of anticipated price increases in initial public offerings by eliminating all partial year returns. Both of these biases have been addressed as follows:

1. Annualization Bias

Though the general pool of firms from which the two indices were constructed were the same, a potential source of bias existed in the timing of the listing and de-listing of firms within each index. NAREIT index methodology has historically listed new REIT issues in the month following a firm's IPO. Also, NAREIT has included firms that have been de-listed, due to liquidation, merger or acquisition, up until their final day of trading. With regard to the Thesis index, accurate information pertaining to stock pricing on the first and last trading day for each firm was available through FactSet for the REIT universe post-1985 only. By definition, the Thesis index equity weight calculations were based upon the previous year's ending market capitalization ($period_{t-1}$). Unfortunately, the

corresponding number of shares outstanding, which was necessary to weight the equity value of the firm within the Thesis index, was not available for firms as of their first day of trading. This fact meant that equity weights for firms that commenced or ceased trading during the course of a given year could not be calculated due to the absence of a previous year or final ending market capitalization ($price_{t-1}$ x $shares\ outstanding_{t-1}$). This inability to calculate an equity weight for partial years eliminated the inclusion of all partial year returns from the Thesis index. Subsequently, it was believed that the expected partial year price appreciation following REIT initial public offerings was not being captured by the Thesis index.

This potential bias was tested by annualizing the partial year appreciation and income returns after January 1, 1985. This particular annualization procedure allowed for the capture of the partial year returns for firms leaving the index. Firms entering the index through initial public offerings would not represented in that those companies weights would be zero for that partial year. These annualization results are represented graphically as follows:

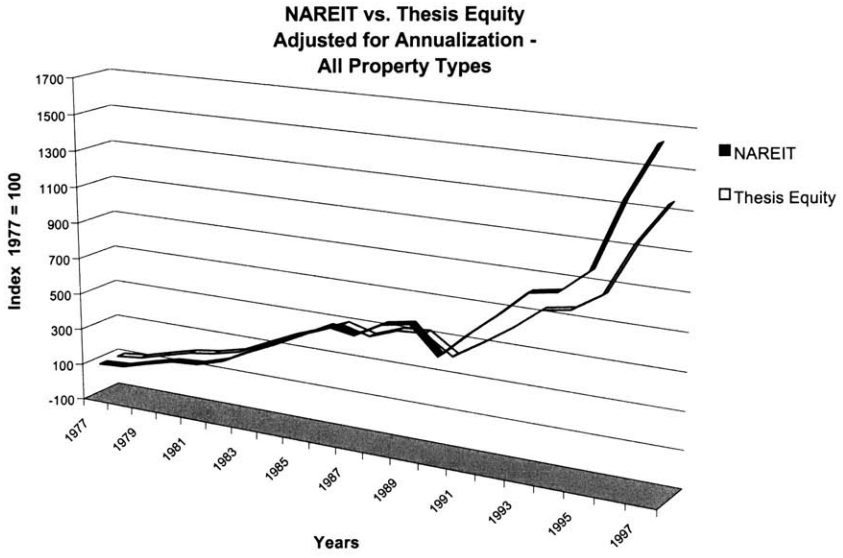


Figure 3

These results were not as representative of the NAREIT index as the original thesis construction without annualization. The primary divergence in the indices occurred in the early 1990's. This time period was a period of substantial initial public offerings (IPO's), and therefore an additional test was constructed to capture the impact of IPO's.

To quantify the effect of this potential shortcoming, an additional Thesis index methodology was employed that allowed for the inclusion of the year to date performance of any equity REIT that came into existence for a partial year post-1985. This theoretically more aggressive modified equity weight calculation utilized the initial day of trading stock price times the number of shares at the end of that year. This was then used as the equity capitalization

for the IPO firms. The theory being that it was unlikely that a firm would issue additional shares in the period immediately after the IPO. If this premise were true, then the end of first day trade stock price times number of shares at year end would provide a proxy for the initial market capitalization. This construction of an initial period market capitalization allowed for the calculation of an index weight for partial year returns. At the same time, the equity weights for the remainder of the Thesis index continued to be calculated by utilizing the appropriate previous year ending capitalization. The partial year returns were then added to the full year returns to determine the total return for the aggregate annualized index. The new equity weight utilized for partial year calculations was as follows:

$$W_{eIPO,t} = (E_{IPO,t}/(E_{IPO,t}+D_t+PP_t) \quad \text{as opposed to} \quad W_{e,t} = (E_{t-1}/(E_{t-1}+D_t+PP_t)$$

Where:

$E_{IPO,t}$ = (# shares at year end t) x (P of stock at end of first day trading) = IPO Equity Market Capitalization

It was expected that this change in the calculation of the index equity weights would cause the Thesis index return to increase. The increase was expected to result from two separate effects taking place simultaneously. First, the utilization of the current capitalization in the denominator of the total return calculation allowed for the inclusion of annualized partial year returns for the period post-1985, thereby capturing the anticipated "IPO pop" of the new REIT issues of the 1990's. Secondly, the use of current year equity capitalization increased the WACC weight upon the equity component in years of increasing equity value. Subsequently, the weighted returns are more heavily influenced by the higher equity returns while less weight is applied to the lower debt and preferred returns. As will be demonstrated in the Thesis index comparison with the NAREIT index hereafter, this expected outcome did not materialize.

2. Compounding Bias:

The final bias identified between the Thesis index and the NAREIT index was the issue of compounding. As previously stated, the Thesis index was constructed from annual data and therefore exhibited the effects of the annual compounding of its returns. Conversely, the NAREIT index has been historically constructed utilizing monthly data and therefore exhibited the effects of the monthly compounding of its returns. The effects of this monthly compounding have been quantified by summing the NAREIT monthly return figures to create uncompounded annual returns therefrom. Subsequently, the annual returns were compounded like the Thesis index returns. The annual average difference between the monthly compounded NAREIT and the annually compounded NAREIT was approximately 55 basis points per annum. This calculated bias was equivalent to the differential between the Thesis equity and NAREIT indices.

The Thesis Index Comparison with the NAREIT Equity Index Results:

As stated, the first objective of this thesis was to create an equity REIT index consisting of the returns of all identifiable firms that had been publicly traded between 1978 and 1997. The first reason for undertaking this task was to compare this new index to the existing NAREIT index in order to identify any differences between the two and then subsequently try to determine the sources of these differences. The results are as follows:

Levered Thesis Index Comparison with the NAREIT Equity Index: Broad Index Comparison

The Thesis index was initially compared to the NAREIT index on a gross basis. Both indices included the full effects of leverage and both indices contained all of the property types excepting healthcare. The returns showed that the NAREIT index outperformed the Thesis index by an annual average of 55 basis points per annum in this broadest of public index comparisons.

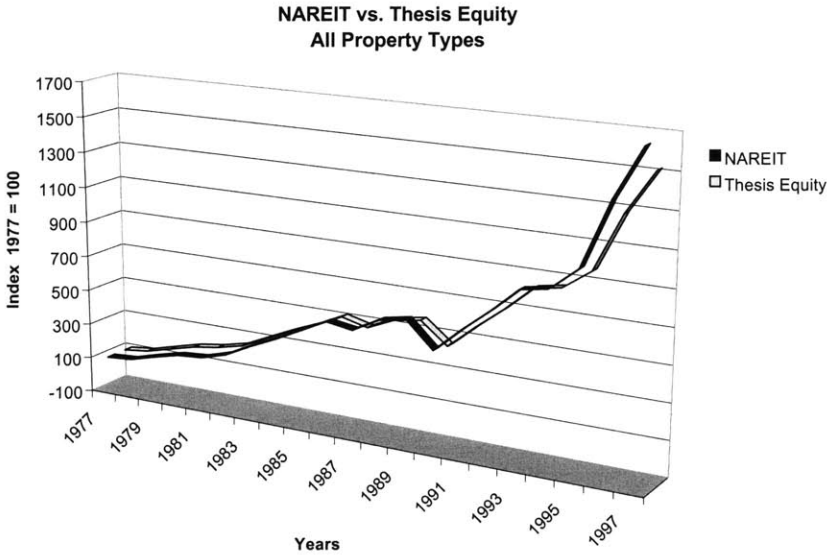


Figure 4

Levered Thesis Index Comparison with the NAREIT Equity Index: Annualized & Weighted with $W_{e,t}$

The second public index comparison was between the Thesis index, calculated with an equity weight of $W_{e,t}$ to allow for partial year annualization, and the NAREIT equity index. Given the Thesis index's previously discussed inability to calculate partial year returns, it was believed that the full effect of REIT IPO's and liquidations were failing to be captured by the index. Reliable partial year data was available post-1985 only, so the annualized comparison was constructed by overlaying re-weighted and annualized data over the original time series for the period 1985-1997. After this overlay of annualized data adjustments for the final 13 years of the time series, the average annual return of the Thesis index fell by 130 basis points. This decrease in the return of the Thesis index demonstrated that, contrary to expectation, an "IPO pop" in the initial period for the firms that went public in the early 1990's was non-existent. Furthermore, a number of these firms were researched individually, and it was determined that the year ending stock price for many was lower than the stock price at the end of the first day of trading.

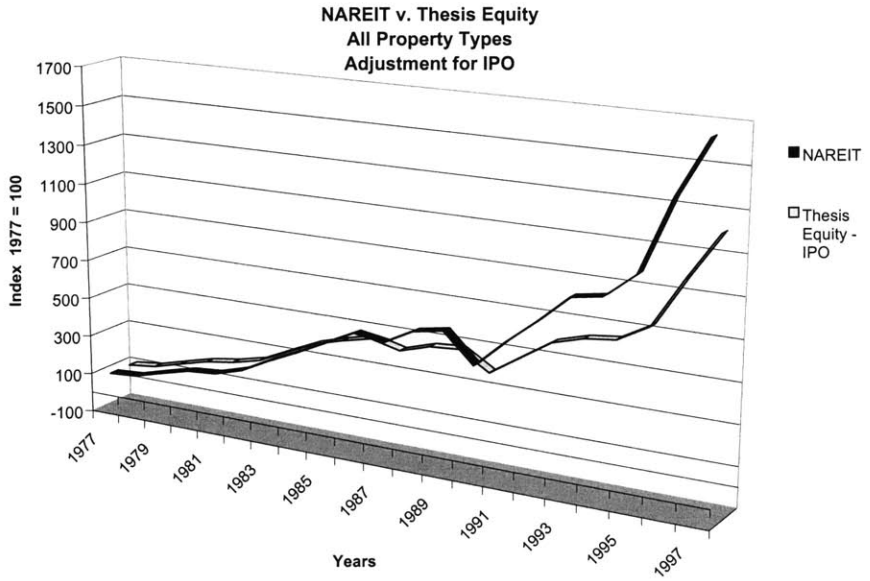


Figure 5

Results:

In examining the differences between the Thesis index and the NAREIT index, it was clear that the Thesis index clearly under-performed the NAREIT. However, adjusting for the effects of 20 years of monthly compounding, as opposed to simple annual compounding, this average annual differential was effectively eliminated. The Thesis index was under performing the NAREIT index by an average of 55 basis points annually. The differential between annual compounding and monthly compounding was calculated to be approximately 55 basis points. Therefore, the Thesis index using annual data provides a good representation of the equity REIT universe. The differentials between the Thesis and NAREIT indices are explained by the differential in compounding periods and the cumulative effect of that compounding differential over the twenty year time series. This result validates the methodology of the equity Thesis index creation.

CHAPTER 5

Thesis Index Versus the NCREIF Index:

Equity REIT Database Augmentation for NCREIF Comparison:

From the outset it was acknowledged that the Thesis index was different from the NCREIF index with regard to leverage and property type weight. Subsequently, it was determined in the thesis planning stage that both of these factors would have to be adjusted for in order to ensure a fair and accurate comparison between the two indices. The de-leveraging of the Thesis index was performed utilizing a weighted-average cost of capital calculation. The property type weighting proved to be a more difficult issue to resolve due to data set and sample size complications. These two property type issues related to the historic inclusion of a unclassified property component within the NCREIF index and the lack of "pure play" (defined as REITs that maintain a minimum of 75% of their asset value in one property type) property REITs in the 1970's and 1980's.

It is understood that the different property types that make up the respective indices' asset mixes exhibit different levels of risk with regard to cash flow. For example, a single tenant industrial property with a long term, triple net, credit tenant lease involving minimal improvements provides a more certain cash flow than does a multi-tenanted office property with shorter term leases and significant improvement costs upon lease expiration. That being the case, the Thesis index returns were segregated by property type in an attempt to facilitate an unbiased property weighted comparison to the NCREIF index. These Thesis index returns were weighted with respect to the corresponding ex post property weights for the NCREIF index for each year from 1978-1997. To determine the appropriate weights for each year, the total market capitalization for each of the four general NCREIF property categories (apartments, industrial, office and retail) was divided by the total market capitalization of the NCREIF composite in its entirety. The resulting fractions represent the percentage of the NCREIF index constituted by each property type. In undertaking this process, it was noted that the resultant NCREIF property weights failed to sum to 100%. On average over the twenty-year time series, these weights equated to 96%. Subsequently, given the need to weight the Thesis index to a total of 100%, each of the actual NCREIF property type weights were proportionally grown to equate to a total of 100%. This growth correction was achieved by dividing each individual NCREIF property type weight by the sum of the four appropriate individual NCREIF property type weights. The weights of these four property types subsequently equated to 100% of the NCREIF index capitalization for each year, and the individual weights were then multiplied by the historic property returns in order to generate a re-weighted NCREIF index. The result was a re-stated NCREIF index that consisted solely of the previously outlined property types: office, industrial, residential and retail. This is the adjusted NCREIF index to which the property weighted Thesis index has been compared. (See Appendix 3 for weight calculation).

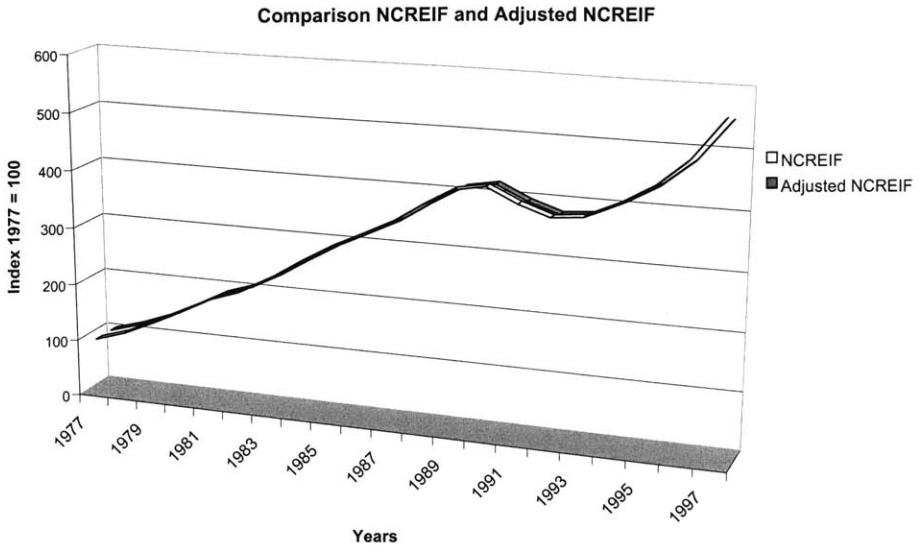


Figure 6

Potential Sources of Bias in Thesis Index Comparison with NCREIF Index:

In the Thesis index comparison to the NCREIF index, the potential for more biases existed than in the comparison to the NAREIT due to the greater diversity in both the index methodologies and the underlying assets. This thesis set out to specifically address the two pre-acknowledged biases of capital structure and property mix. These two issues were addressed respectively by de-levering the Thesis index and applying the NCREIF's property weights to the Thesis index prior to comparison. While the de-levering was quite effective in adjusting for risk, the minute sample size of tax qualified "pure play" REITs prior to 1990 weakened the significance of this property weight adjustment.

Theoretical Development Premium Calculation:

A third pre-acknowledged bias, the development activity of REITs, has been addressed theoretically through the use of option theory. The option based approach to understanding this bias was utilized for two reasons. First, the significance of the development bias was determined to be less than anticipated ex ante due to the lack of REIT development activity in the first 14 years of the time series. Second, the quantitative data that exists for this early equity REIT development activity is minimal at best.

That being said, it was acknowledged that the NCREIF index represents a portfolio of stabilized institutional real estate assets while the Thesis index consists of REITs, some of which have utilized development in order to increase FFO and generate higher returns for their shareholders during the 1990's. This development component within the REIT asset structure theoretically raises the risk profile of the Thesis index and would thereby require an increase in the ex ante expected return. In seeking to address this issue, discussions with REIT industry experts revealed that equity REITs undertook no significant level of development during the first two generations of their existence in the

1970's and 1980's. However, in the 1990's, a number of participants in this third generation of REITs have begun to maintain a development pipeline that makes up a significant portion of their asset base. This is likely due to the origins of the 1990's generation of REITs as private developers, coupled with the dearth of new supply actually developed in the early 1990's. The combination of these two factors makes the REITs of today better suited to undertake development projects than their predecessors. This fact is reflected in the higher multiples at which development oriented REITs are currently trading in comparison to their more static peers[14]. This is potentially a sign that investors recognize the future growth potential, and associated higher risk, of these firms as afforded by their access to development opportunities. The lack of historic REIT development, coupled with the current positive view of such development activities, eliminated the need, and/or ability, to adjust the Thesis index itself for development risk. This fact notwithstanding, a theoretical calculation that seeks to quantify the effect of potentially higher risk due to development activity has been performed in order to address the potential effects of the higher risk profile of development oriented firms.

Modern option theory was used to formulate a calculation to quantify the potential effects of development on the expected returns of investors. Option theory can be applied to the analysis of real estate development transactions through the valuation of undeveloped land as an American call option on a piece of built real estate. The theory is based upon the premise that the owner of the land has the right, but not the obligation, to build upon the land at some time in the future. The cost of the option is the cost of the land while the strike price is the replacement cost of the built real estate asset. The call option is "in the money" when the pricing of the built asset exceeds the cost of its construction[15].

In the mid-1960's, William Sharpe, John Lintner and Jack Treynor created the theory of the capital asset pricing model ("CAPM") as a means to calculate expected risk premiums for assets based upon the co-variance of the returns of a particular asset to the returns of the market as a whole. The CAPM can be subsequently used to calculate a risk premium for an instrument based upon an underlying asset, such as an American call option, with the application of an adjustment factor. The adjustment factor is in effect a measurement of the increase in the risk premium brought by the exercising of the development call option. Intuitively, $(\Delta C/\Delta S)(S/C)$ represents the increase in risk premium brought by the "leveraging" of the land used in the development. This leveraging increases the risk associated with the development option. At a strike price of K, where K is equal to replacement/construction cost, the option is in the money so long as the built property value is greater than replacement cost. The development option will not be exercised if K < Replacement Cost. The option premium, i.e. the land leveraging effect, is highest at K = replacement cost. It is this value of $(\Delta C/\Delta S)(S/C)$ which is used for the risk premium adjustment factor.

The CAPM states that the expected return on assets is represented by:

[14] Penobscot Group
[15] Timothy Riddiough

$$E_a = r_f + \beta_x(E_m - r_f);$$

where $\beta_x(E_m - r_f)$ represents the risk premium associated with an asset. This risk premium could be provided with a Beta adjustment to correct for additional attributes to the asset. Let E_a represent the expected return on land and let β_x represent the Beta for built real estate. The CAPM equation with the development adjustment factor becomes:

$$E_a = r_f + \beta_x(E_m - r_f)\ (\Delta C/\Delta S)(S/C)$$

Equation 5

The historic Beta for built real estate over a long time series, such as the one involved in this thesis, ranges from 0 to 0.3.[16] In this light, the writers have chosen a very conservative Beta of 0.5, thereby allowing for a theoretically overstated adjustment factor that would represent a most extreme case.

An adjustment for the value of the development option, and the corresponding adjustment in the risk premium is represented by:

$$(\Delta C/\Delta S)(S/C)$$

Where : C = Land Value
S = Built Real Estate Value
S/C = Ratio of Value Built Real Estate to Land Price
$(\Delta C/\Delta S)$ = Slope of an option value line

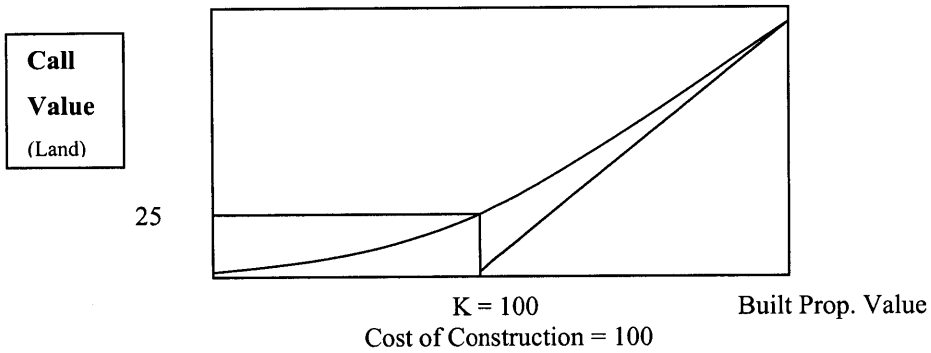


Figure 7

Assume[17]:

$(\Delta C/\Delta S) = 0.7$ and that $(S/C) = 4$
$\beta_x = 0.5$
$E_m - r_f = .06$
$r_f = .06$

---

[16] Timothy Riddiough

[17] These assumptions are conservative and similar results could be obtained via option pricing mathematics. The Beta of 0.5 is in the highest range of published findings on real estate Betas. The value of 0.7 is a visual estimation of the slope of the option value curve, the actual value could be determined but is beyond the scope of this analysis. S/C = 4 assumes that 25% of the project cost is the value of the unimproved land.

Therefore: $(\Delta C/\Delta S) \times (S/C) = 0.7 \times 4 = 2.8$; and

$E_a = r_f + \beta_x (E_m - r_f) (\Delta C/\Delta S)(S/C) = .06 + 0.5(.06)(2.8) = 14.4\%$ for a 100% development firm.

And $E_a = r_f + \beta_x (E_m - r_f) = .06 + 0.5(.06) = 9.0\%$ for a 0% development firm.

Therefore: 14.4% - 9.0% = 5.4% premium on development (Assume 6%).

A 6% risk premium adjustment is within the scope of observed real world application. For example, required returns for development in the range of 15 to 20 % would correspond with a required return on an existing asset of 9 to 14%.

If one assumes that 25% of the firms within the Thesis index are development oriented, and that 25% of those firms' activities are purely development related, then the expected ex ante risk premium for the index as a whole would be 38 basis points over the NCREIF index, e.g.: .06 x .25 x .25 = 0.38%, or 38 basis points. This fact assumes that the NCREIF contains absolutely no developmental risk premium.

Additional Biases:

Of the additional biases identified during the comparative analysis between the Thesis index and the NCREIF index, the three most significant were the relative fee structures of the indices, the lack of complete 1998 equity REIT data, and the cumulative effects of monthly (as opposed to annual) compounding. The fee issue represents a significant difference in the two indices as the REIT share prices, and subsequent returns, reflect the post fee performance of the internally managed REIT universe. Conversely, the externally advised NCREIF index reflects the performance of the underlying assets on a pre-fee basis. Assuming a conservative fee structure of 50 basis points per annum on gross asset value, disregarding any back-end profit participation, this fee effectively reduces the annual posted returns by the amount of the fee itself. With regard to the time series utilized, it is acknowledged that inclusion of the poor performance of the REIT industry in 1998 would have a negative effect upon the returns of the Thesis index, even given the 20 year length of the time series in question. An attempt to quantify this potential effect has been included herein in order to address this potential bias. Finally, the significant cumulative effect on the returns of the respective indices resulting from monthly versus annual compounding have been quantified and adjusted for.

1. Quantification of Fee Effect

A significant difference between the NCREIF index and the NAREIT or Thesis indices is the fact that NCREIF returns are reported on a pre-fee basis, while the returns of both public market indices are theoretically reported on a post-fee basis. Given the historic fee structure of the third party advisory business, in which fees were generally calculated based upon assets under management, the effect of this bias is likely to be quite significant. Most advisory firms utilized fee structures that paid them an annual asset management fee of approximately 50 to 100 basis points of the gross asset value of the portfolios in question. This structure would serve to reduce the posted

annual NCREIF returns by an amount equal to the annual amount of the fee. This fact would further increase the performance gap, identified herein, between the assets purchased and managed by the private and public markets.

2. Elimination of 1998 REIT Data

The lack of comprehensive REIT data for calendar year 1998 eliminated the significant downward revision of the NAREIT and Thesis indices that would have resulted from the inclusion of 1998's data. 1998 was a poor year with regard to REIT performance, with the total return for the NAREIT index, inclusive of health care falling by –17.5 %. The magnitude of this loss was deemed significant in the context of this comparative analysis, subsequently a secondary analysis has been performed in which the NAREIT's negative return for 1998 has been assumed by the Thesis index. The goal of this assumption was to quantify the cumulative effect that this negative year would have on the new index as a whole. Since comprehensive financial data for 1998 did not exist, a theoretical 1998 de-levered WACC calculation was performed in lieu thereof. This theoretical WACC utilized the 1997 weights for debt, common equity and preferred equity (50%, 44%,and 6% respectively), and corresponding rates of5%, -17.5% and 6%.[18] The theoretical de-levered WACC that resultedfor 1998 was – 5.0%. This compared to a positive NCREIF return for the year of 16.13%. The cumulative effect on the compounded annualized returns was a new de-levered Thesis value of 10.69% and a revised NCREIF of 9.34%. That is, inclusive of the 1998 data, the public market still significantly outperformed the private market.

3. Effects of NCREIF Quarterly Compounding

The final bias identified between the Thesis index and the NCREIF index was, as with the NAREIT index, the issue of compounding. As previously stated, the Thesis index was constructed from annual data and therefore exhibited the effects of the annual compounding of its returns. Conversely, the NCREIF index has been historically constructed utilizing quarterly data and therefore exhibited the effects of the quarterly compounding of its returns. The effects of quarterly compounding have been quantified by adding the NCREIF quarterly return figures to create uncompounded annual returns therefrom. Subsequently, the annual returns were compounded annually like the Thesis index returns. The annual average difference between the quarterly compounded NCREIF and the annually compounded NCREIF was 40 basis points.

[18] The actual 1997 weights were 54.4% - debt, 39%- equity, and 6.6%-preferred. The actual 1997 rate on debt was 5.7%, rate on preferred was 6.8%. Therefore, the overstating of the weight of equity, and understating the rate on debt and preferred should produce a conservative result in a year of substantially negative equity returns.

The De-levered Thesis Index Comparison with the NCREIF Index Results:

The core objective of this thesis was to compare the Thesis index to the NCREIF index, with the two indices serving as proxies for the public and private real estate markets respectively, in an effort to determine the more efficient vehicle for the ownership of real estate equity. Given the previously discussed disparities in the makeup and methodologies of the two indices, the Thesis index was adjusted in order to make the comparison between the two as similar as possible.

De-levered Thesis Index/NCREIF Index Comparison: All Property Types

The first de-levered Thesis/NCREIF comparison focussed upon the broadest scope of the two indices in question. The de-levered Thesis index consisted of all property types, excluding healthcare, as did the unadjusted NCREIF index. Subsequently, the only factor adjusted for in this initial comparison was the effect of leverage. When compared on an all equity risk-adjusted basis, the Thesis index outperformed the NCREIF index by an annual average of 253 basis points.

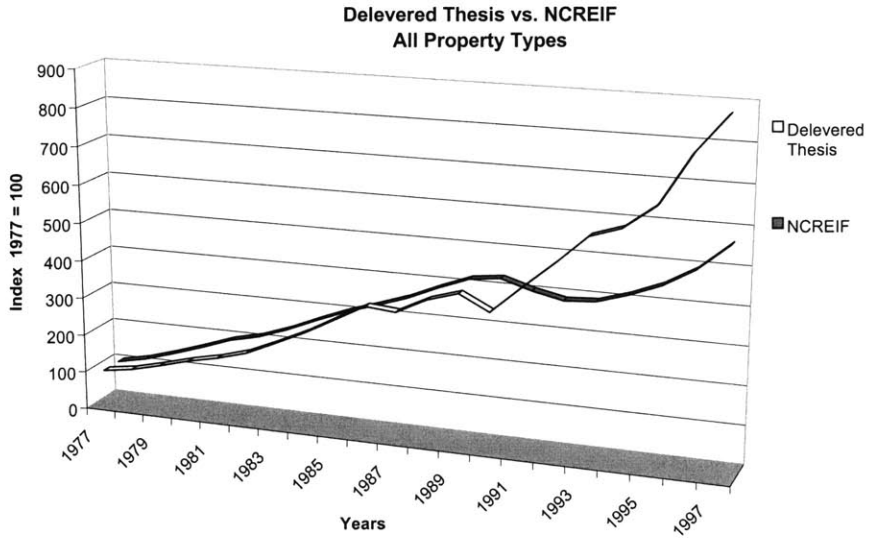


Figure 8

De-levered Thesis Index/Adjusted NCREIF Comparison: Apartment, Office, Industrial and Retail Only

This de-levered Thesis index/Adjusted NCREIF index comparison reduced the property universe to include only apartment, office, industrial and retail, or "core", property types. In doing so, it necessitated the utilization of the Adjusted NCREIF index. When reduced to this four-property type universe, the de-levered Thesis index outperforms the Adjusted NCREIF index by an annual average of 257 basis points.

Given the pre-disclosed sample size problems that are manifest in the property type weighted comparison that follows, this core property type comparison is deemed to represent the most significant risk-adjusted index comparison between the public and private real estate equity markets as proxied by the de-levered Thesis and adjusted NCREIF indices.

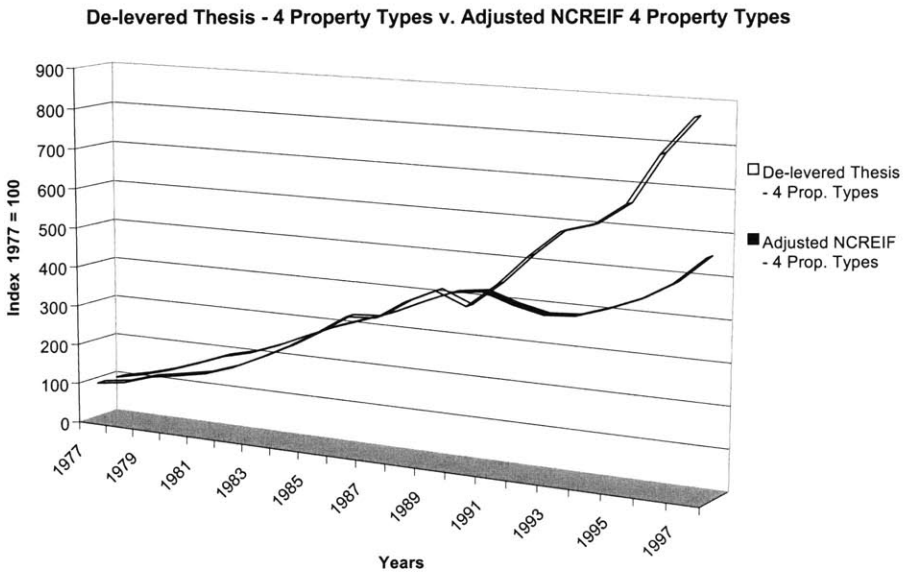


Figure 9

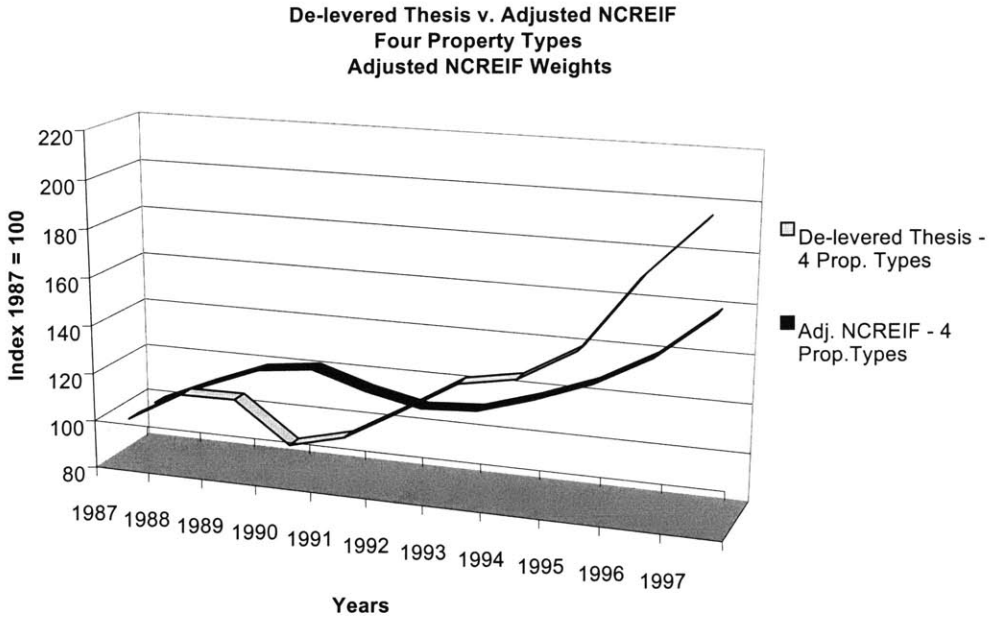
De-levered Thesis Index/Adjusted NCREIF Index Comparison: Based Upon Adjusted NCREIF Property Weights

The final broad index comparison was made between the de-levered Thesis index and the Adjusted NCREIF index, with both indices weighted by NCREIF property type. The goal of this comparison was to create a de-levered Thesis index that not only consisted of just the four core property types, but was also weighted based upon the respective Adjusted NCREIF property weights for each. This weighting would have theoretically eliminated any bias in the index comparison stemming from differing property type allocations. Unfortunately, the lack of "pure play" REITs prior to the 1990's made it impossible to achieve a statistically significant sample size for each of the four property types over the entire 20 year time series. Compounding this problem was the fact that NCREIF did not track multifamily as a separate property type until 1984. Subsequently, this analysis was instead performed over a reduced 10-year time series from 1988-1997. Even this time series proved less significant than anticipated, however, as the number of pure play REITs identified at year-end 1988 were as follows:

Table 3 – Pure Play REITs, Year-End 1988

Apartment REITs	Office REITs	Industrial REITs	Retail REITs
4	3	4	12

Furthermore, prior to 1988, the Thesis index was quickly reduced to just apartment and retail REITs, with only retail maintaining a significant sample size. Though the comparison is less significant than was anticipated at the outset of this thesis, the 10-year results show the de-levered property type weighted Thesis index outperforming the adjusted property-type weighted NCREIF index by an annual average of 128 basis points.



De-levered Thesis Index/NCREIF Index Comparison: Twenty Year Retail Data Series

Given the small sample size of pure play REITs in the preceding analysis, the goal of eliminating property type bias for the index comparison over the full 20 year time series was deemed unobtainable. The sample size of retail REITs was by far the most significant over the time series, with the constant presence of a minimum of at least 7 firms. Therefore, the logical full time series property type comparison was made between the de-levered retail Thesis index and the NCREIF retail index. This comparison was analyzed over the full 20-year time series during which the de-levered Thesis retail index outperformed the NCREIF retail index by an annual average of 132 basis points.

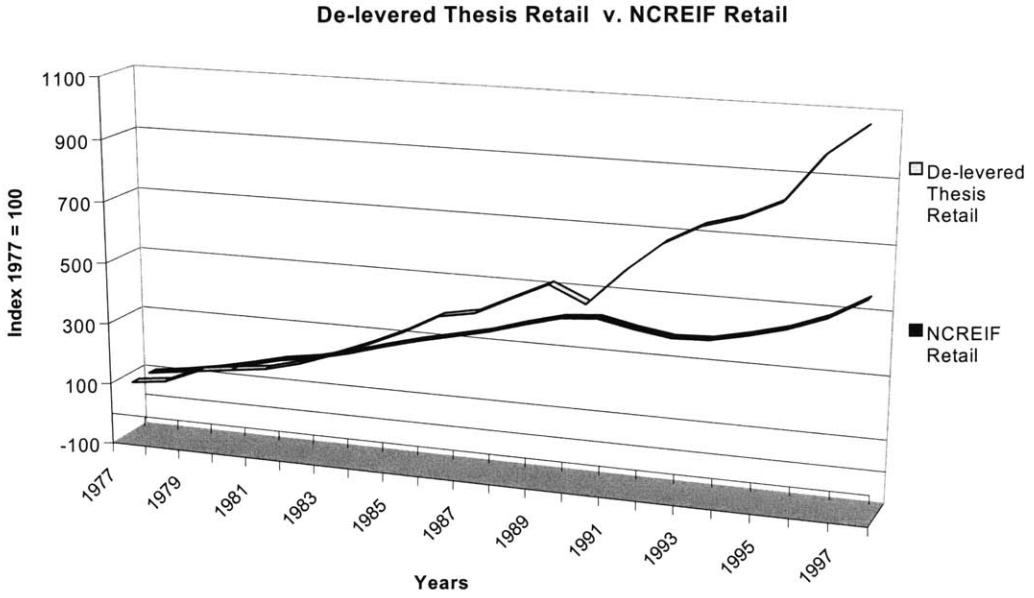


Figure 11

Results:

The results of the de-levered Thesis index comparison to the NCREIF index imply that the public real estate equity market has provided a superior risk-adjusted return in relation to the private real estate equity market over the 20 year time series indexed. Though the elimination of property type bias was not achieved with significance for the full 20-year time series, this fact does not fully discount the Thesis index's greater average annual total returns over this period.

As previously stated, the 20 year comparison between the de-levered Thesis index and the Adjusted NCREIF index, with both indices sorted by the four core property types, is believed to be the most significant measure of market efficiency analyzed in this thesis. Subsequently, in order to create a final index comparison, adjusted for all of the identified biases pertinent to the 1978-1997 time series, the two core property indices that were deemed most significant were adjusted by the net bias effect.

First, the theoretical development premium calculated using option theory and the CAPM called for an additional ex ante risk premium of 38 basis points per annum to be deducted from the Thesis index returns. In reality, this premium would only be applicable to the last 7 years of the time series in question. However, in order to continue the conservative methodology employed herein, this premium has been applied over the full 20-year time series. Second, a downward adjustment to the NCREIF index would result from a conservative theoretical annual fee structure of 50 basis points. This adjustment would reduce the stated annual returns of the NCREIF index by the same amount. Finally, the average effect of the compounding differential would reduce the NCREIF index returns by an average annual amount of 40 basis points. These three adjustments have the net effect of lowering the average annual NCREIF returns by 50 basis points. Therefore, the re-stated average annual returns for the de-levered core property type comparison, when adjusted for the applicable biases, result in the following returns and indices:

Table 4

Comparative Thesis Index/NCREIF Index Comparison 4 Property Types (Unweighted)
With 50 BPS Net Bias Adjustment
Summary Table of Results 1978 - 1997

	Thesis Rate Equity	Thesis De-levered Rate Assets	NCREIF Compounded	Adjusted WT NCREIF Compounded	NCREIF with 50 bps Adj. Wt.	NAREIT Equity	Risk Free **
Compounded	1458.78%	775.79%	461.86%	448.78%	400.43%	1567.14%	307.10%
Annualized Return	14.72%	11.46%	9.01%	8.89%	8.38%	15.11%	7.27%
Average Return	15.40%	11.65%	9.23%	9.09%	8.59%	16.02%	7.30%
STD	12.58%	6.58%	6.87%	6.66%	6.66%	14.17%	2.67%
Sharpe Ratio*	64.57%	66.63%	28.42%	27.24%	19.73%	61.77%	

**Source: Federal Reserve Bank St. Louis 1 yr T-Bill Avg. Dec.

*Average return less annualized return risk free divided by standard dev.

Based upon the above unbiased comparison, with the de-levered Thesis and Adjusted NCREIF serving as respective proxies, the public real estate equity market has outperformed the private real estate equity market on a risk-adjusted basis over the past twenty years. The de-levered public market return, corrected for biases, was 308 basis points greater than the corresponding private (NCREIF) market return. In addition to this risk-adjusted performance superiority, the Thesis index also benefits from lower volatility and a significantly higher Sharpe ratio than either NCREIF measure.

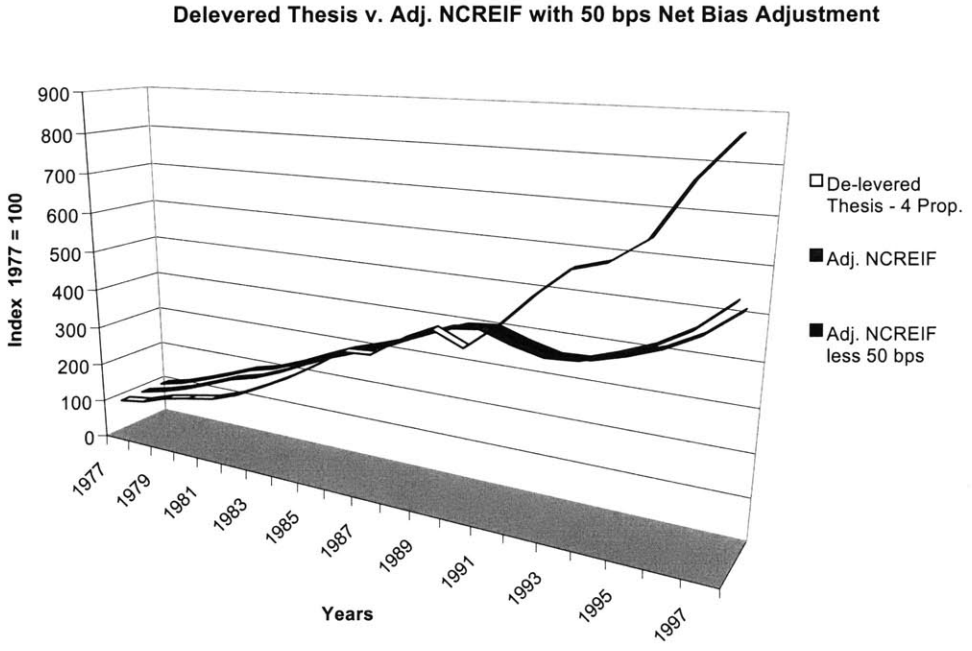


Figure 14

CHAPTER 6

Conclusion:

The primary goal of this thesis was the firm by firm construction of a Real Estate Investment Trust (REIT) total return equity index (the "Thesis index"). This Thesis index was constructed in order to facilitate a comparison with the National Association of Real Estate Investment Trusts (NAREIT) total return equity index. The resulting Thesis index served as a proxy for the "Public" real estate equity market for the purpose of creating a risk adjusted comparison between said index and the NCREIF index.

The second step in facilitating this public versus private market comparison was the de-levering of the equity returns of the Thesis index. This was accomplished by using a modified Weighted Average Cost of Capital (WACC) calculation. These de-levered returns were then compared to the published total returns of the National Counsel of Real Estate Industry Fiduciaries (NCREIF). The NCREIF Index is a measure of un-levered total returns for institutional grade property and served as a proxy for the "Private" real estate market in this study. The resulting comparison between the de-levered Thesis index and the NCREIF index provided significant insight into the deviation in financial performance between the public and private markets as measured by total return.

It was expected that this broad-based index measurement comparison would allow for the absolute measurement of the respective returns of the public and private real estate equity markets. However, given that the data underlying the respective indices was not perfectly homogeneous, additional segmentation and clarification of the Thesis index was undertaken. The NCREIF index consists of four primary property types: Apartment (multi-family), Industrial, Office, and Retail. In contrast, both the broad-based Thesis index and the NAREIT index contain numerous additional property types including: hotel/lodging, manufactured housing, self-storage, and specialty. In that differing property types contain different risk and return profiles, the inclusion of the additional property types in the NAREIT/Thesis indices precluded a direct comparison between the public and private markets. Subsequently, these extraneous asset classes were excluded from the Thesis index in its most significant comparison to the NCREIF index. In addition, consideration was given to the fact that the returns of the NCREIF index are accounted for on an asset by asset basis, while the NAREIT/Thesis returns are accounted for on a firm by firm basis. Finally, many public firms were not property type specialists and tended to hold diversified property type portfolios instead. Therefore, firms not holding at least 75% of their asset value in one of the four core property types were deleted from the modified Thesis index when the same was compared to the NCREIF index. This adjustment provided for a homogeneous comparison between the returns of the public and private markets.

A comprehensive comparison between the public and private real estate equity markets required that the total returns of the public market, limited to the four core property types, be weighted by the corresponding NCREIF proportions for those same property types. Unfortunately, in the early years of the time series, there were few public firms that specialized in one of the four respective property types. In addition, NCREIF provided no specific property

classification for the multi-family sector prior to 1984. Due to the limited sample size of property specific public market firms, a truly significant property segmented comparative analysis could only be performed for the last ten years of the time series (1988- 1997), and therefore the results were not as comprehensive as would have been achieved in a twenty-year time series.

The final differentiating factors that had to be compensated for in order to ensure a consistent basis of comparison between the public and private markets were the systematic biases present in the respective indices. These biases included the differences in periodic compounding, the public market development risk premium, and the quantification of effect of the private market fee structure[19]. The net effect of these biases ultimately served to reduce the NCREIF index annual total returns by 50 basis points.

The Twenty Year Time Series Results:

The results of the broadest index comparison measure showed that the annual NAREIT equity return is 55 basis points greater than the Thesis equity return on an annualized basis. The majority of this differential appears to result from the monthly compounding of the returns within the methodology of the NAREIT index in contrast to the annual compounding in the Thesis index. The all-inclusive property type, de-levered Thesis index return outperformed the NCREIF index return by 253 basis points on an annualized basis. At the same time, the de-levered annualized Thesis index returns also produced a superior Sharpe ratio than the private (NCREIF) market.

Comparative Thesis Index - All Firms
Summary Table of Results 1978 - 1997

	Thesis Rate Equity	Thesis De-levered Rate Assets	NCREIF Compounded	NAREIT Equity	Risk Free **
Compounded	1416.01%	788.02%	461.86%	1567.14%	307.10%
Annualized Return	14.56%	11.54%	9.01%	15.11%	7.27%
Average Return	15.35%	11.78%	9.23%	16.02%	7.30%
STD	13.08%	7.34%	6.87%	14.17%	2.67%
Sharpe Ratio	61.71%	61.51%	28.42%	61.77%	

**Source: Federal Reserve Bank St. Louis 1 yr T-Bill Avg. Dec.

*Average return less annualized return risk free divided by standard dev.

Table 5

[19] The quoted total returns for the private market are before payment of asset management fees; Source: NCREIF

The next series of comparisons eliminated diversified public firms, and the uncommon property types, from the Thesis index. This comparison provided a reasonably homogeneous measure of the returns of the public and private real estate equity markets.[20] Under this scenario, the un-weighted de-levered core property Thesis index outperformed the unadjusted NCREIF index by 245 basis points on an annualized basis and outperformed the Adjusted NCREIF by 257 bps on an annualized basis. This public market outperformance is again accompanied by a superior Sharpe ratio result.

Comparative Thesis Index - NCREIF Comparison Firms 4 Property Types (Unweighted)
With 50 BPS Net Bias Adjustment
Summary Table of Results **1978 - 1997**

	Thesis Rate Equity	Thesis De-levered Rate Assets	NCREIF Compounded	Adjusted WT NCREIF Compounded	NCREIF with 50 bps Adj. Wt.	NAREIT Equity	Risk Free **
Compounded	1458.78%	775.79%	461.86%	448.78%	400.43%	1567.14%	307.10%
Annualized Return	14.72%	11.46%	9.01%	8.89%	8.38%	15.11%	7.27%
Average Return	15.40%	11.65%	9.23%	9.09%	8.59%	16.02%	7.30%
STD	12.58%	6.58%	6.87%	6.66%	6.66%	14.17%	2.67%
Sharpe Ratio*	64.57%	66.63%	28.42%	27.24%	19.73%	61.77%	

**Source: Federal Reserve Bank St. Louis 1 yr T-Bill Avg. Dec.

*Average return less annualized return risk free divided by standard dev.

Table 6

The final comparison performed focussed upon the adjustment of the core property type analysis by the calculated net bias adjustment. The net bias adjustment resulted in a reduction of the annual NCREIF returns by 50 basis points. This final adjusted comparison results in the public real estate market, as proxied by the de-levered Thesis index, outperforming the private (NCREIF) real estate market by 307 basis points per annum. The computation of this public market risk premium was the goal of this thesis and the resulting 307 basis point spread is deemed to be statistically significant given the underlying data.

[20] These results are not weighted by NCREIF proportions for reasons more fully discussed in the main body of the thesis.

Summary and Implications:

In conclusion, on a risk-adjusted basis, the public real estate market, as represented by Real Estate Investment Trusts, significantly outperformed the private real estate market, as represented by NCREIF. This outperformance was achieved over a twenty-year time series beginning with the first year of NCREIF data (1978) and continuing through 1997, the last year in which comprehensive public market data was available.

These results have potentially far reaching implications, especially for institutional investors seeking real estate investment as part of a diversified portfolio. Should these results be replicated by additional research, and remain consistent over a longer time series, then the current method of institutional investment in privately held real estate asset would be deemed an inferior risk-adjusted investment strategy. Our results clearly indicate that the public real estate equity market is a more efficient vehicle for investing in stabilized real estate assets than existing private market structures.

These findings do not imply that a place in the investment universe does not exist for private equity real estate investment in the future. On the contrary, these findings simply imply that, with regard to the long term operation and management of institutional real estate, the economies of scale, liquidity and lower cost of capital available to the public market provide superior risk adjusted returns for investors. The future role of private equity will likely evolve into a vehicle for making investments at a higher point on the risk spectrum and subsequently offer significantly higher expected returns than the public market. This role will not be unlike the role of venture capital in the industrial sector. Higher risk real estate will be purchased by the private equity market, nurtured and stabilized until the public markets, with their superior efficiency, provide an exit strategy for these private equity investments.

These potentially far reaching implications merit additional research and analysis. Subsequent research should include measurement of both flow of funds and investment timing. This analysis should focus upon what entities bought and sold real estate assets at varying times in historic market cycles. Additionally, an even more detailed breakdown of public market holdings both by asset and property type is recommended in order to provide an even more homogeneous comparison to the NCREIF Index.

Appendix 1

Spreadsheet Results for All Property Type Thesis Index

Comparative Thesis Index - All Firms

Summary Table of Results 1978 - 1997

Year	Thesis Rate Equity	Thesis De-levered Rate Assets	NCREIF Compounded	NCREIF Adjusted Weights	NAREIT Equity	0.005 NCREIF w/50bps	Rate Debt	Rate Preferred	Risk Free **
1977									
1978	16.415%	11.893%	16.11%	15.39%	10.34%	15.61%	9.02%	8.92%	9.44%
1979	33.09%	17.09%	20.46%	17.20%	35.86%	19.96%	8.13%	10.96%	10.92%
1980	24.01%	15.84%	18.09%	18.45%	24.37%	17.59%	9.06%	11.50%	13.23%
1981	11.10%	10.83%	16.62%	17.07%	6.00%	16.12%	10.52%	14.72%	11.57%
1982	16.47%	13.25%	9.43%	9.24%	21.60%	8.93%	10.29%	7.22%	8.23%
1983	26.77%	18.07%	13.13%	13.10%	30.64%	12.63%	8.94%	7.14%	9.24%
1984	20.86%	16.20%	13.84%	13.98%	20.93%	13.34%	9.27%	9.06%	8.60%
1985	15.67%	16.20%	11.24%	11.45%	19.10%	10.74%	9.97%	9.06%	7.16%
1986	16.26%	13.81%	8.30%	8.52%	16.41%	7.80%	8.79%	3.78%	5.55%
1987	-7.33%	-2.04%	8.00%	8.08%	-4.48%	7.50%	8.92%	6.79%	6.69%
1988	13.73%	11.76%	9.62%	9.84%	15.75%	9.12%	8.51%	0.00%	8.32%
1989	4.45%	6.27%	7.77%	7.99%	4.64%	7.27%	9.40%	0.00%	7.21%
1990	-21.12%	-9.85%	2.30%	2.29%	-23.62%	1.80%	9.21%	0.00%	6.61%
1991	29.23%	19.52%	-5.59%	-5.73%	29.42%	-6.09%	8.64%	3.89%	4.17%
1992	20.93%	15.72%	-4.26%	-4.25%	20.66%	-4.76%	7.64%	4.38%	3.55%
1993	19.13%	14.53%	1.38%	1.36%	18.70%	0.88%	9.33%	5.99%	3.45%
1994	3.27%	4.60%	6.30%	6.44%	2.99%	5.80%	6.63%	6.33%	6.67%
1995	12.65%	9.96%	7.54%	7.42%	14.21%	7.04%	7.26%	5.91%	5.03%
1996	33.10%	19.84%	10.31%	10.05%	36.40%	9.81%	6.50%	7.41%	5.18%
1997	18.24%	12.19%	13.91%	13.81%	20.52%	13.41%	5.70%	6.77%	5.24%
			16.17%	16.22%					

Summary Table of Results 1978 - 1997

	Thesis Rate Equity	Thesis De-levered Rate Assets	NCREIF Compounded	NAREIT Equity	Risk Free **
Compounded	1416.01%	788.02%	461.86%	1567.14%	307.10%
Annualized Return	14.56%	11.54%	9.01%	15.11%	7.27%
Average Return	15.35%	11.78%	9.23%	16.02%	7.30%
STD	13.08%	7.34%	6.87%	14.17%	2.67%
Sharpe Ratio	61.71%	61.51%	28.42%	61.77%	

**Source: Federal Reserve Bank St. Louis 1 yr T-Bill Avg. Dec.

*Average return less annualized return risk free divided by standard dev.

Appendix 2

Spreadsheet Results for Thesis Index by Adjusted NCREIF Weights Four Property Types

Comparative Thesis Index - NCREIF Comparison Firms 4 Property Types
Adjusted NCREIF Weighted - 10 Year Series
Summary Table of Results **1988 - 1997**

Year	De-levered Rate Apts.	Adj NCREIF WT Apts	De-levered Rate Industrial	Adj NCREIF WT. Ind.	De-levered Rate Office	Adj NCREIF WT. Office	De-levered Rate Retail	Adj NCREIF WT Retail	De-levered Total Rate	NCREIF Compound	Adj NCREIF Compound	NCREIF RETAIL	Risk Free **
1977													
1978	0.00%	0.00%	0.00%	48.99%	0.00%	28.11%	14.01%	22.90%	3.21%	16.11%	15.39%	10.93%	9.44%
1979	0.00%	0.00%	0.00%	44.81%	0.00%	27.66%	40.38%	27.53%	11.12%	20.46%	17.20%	11.24%	10.92%
1980	0.00%	0.00%	0.00%	42.42%	0.00%	33.32%	9.08%	24.26%	2.20%	18.09%	18.45%	12.78%	13.23%
1981	26.69%	0.00%	0.00%	32.96%	0.00%	44.74%	8.21%	22.30%	1.83%	16.62%	17.07%	11.02%	11.57%
1982	15.55%	0.00%	0.00%	29.57%	0.00%	50.61%	15.17%	19.82%	3.01%	9.43%	9.24%	7.02%	8.23%
1983	17.25%	0.00%	0.00%	21.85%	0.00%	44.74%	18.35%	33.41%	6.13%	13.13%	13.10%	13.84%	9.24%
1984	9.05%	2.40%	0.00%	21.36%	0.00%	45.67%	17.50%	30.56%	5.57%	13.84%	13.98%	16.89%	8.60%
1985	3.78%	2.65%	0.00%	19.66%	0.00%	46.02%	16.42%	31.67%	5.30%	11.24%	11.45%	14.40%	7.16%
1986	12.24%	2.89%	8.99%	21.00%	-12.30%	43.82%	17.24%	32.28%	2.42%	8.30%	8.52%	12.53%	5.55%
1987	2.39%	4.14%	-21.57%	22.83%	-20.33%	40.60%	5.07%	32.43%	-11.44%	8.00%	8.08%	12.37%	6.69%
1988	18.23%	5.45%	10.43%	21.77%	12.59%	41.46%	12.82%	31.32%	12.50%	9.62%	9.84%	14.94%	8.32%
1989	1.28%	7.35%	-2.76%	21.76%	-6.25%	40.31%	10.93%	30.59%	0.32%	7.77%	7.99%	12.52%	7.21%
1990	-1.01%	9.20%	-3.05%	20.90%	-28.44%	38.94%	-9.29%	30.96%	-14.68%	2.30%	2.29%	5.96%	6.61%
1991	25.88%	10.32%	-0.68%	21.71%	-11.57%	34.95%	22.60%	33.02%	5.94%	-5.59%	-5.73%	-1.85%	4.17%
1992	20.08%	11.62%	10.49%	19.72%	8.78%	33.60%	15.58%	35.06%	12.81%	-4.26%	-4.25%	-2.25%	3.55%
1993	16.99%	11.89%	12.93%	17.20%	13.37%	32.61%	8.86%	38.31%	12.00%	1.38%	1.36%	4.84%	3.45%
1994	3.68%	13.19%	5.56%	16.87%	-0.05%	28.69%	4.45%	41.26%	3.24%	6.30%	6.44%	6.01%	6.67%
1995	9.06%	14.20%	0.72%	16.95%	19.69%	31.60%	6.84%	37.26%	10.17%	7.54%	7.42%	3.98%	5.03%
1996	15.75%	14.65%	20.67%	16.05%	26.47%	33.24%	17.20%	36.07%	20.62%	10.31%	10.05%	4.85%	5.18%
1997	8.43%	14.86%	11.08%	17.69%	19.50%	37.74%	8.99%	29.71%	13.24%	13.91%	13.81%	8.54%	5.24%

~~Summary Table of Results~~													
	1988 - 1997												
Compounded	197.48%		83.85%		48.92%		149.57%		100.25%	59.08%	58.97%	419.79%	71.33%
Ann. Returns	11.52%		6.28%		4.06%		9.58%		7.53%	6.33%	6.25%	8.60%	6.49%
Avg. Returns	11.84%		6.54%		5.41%		13.02%		7.62%	4.93%	4.92%	9.03%	5.54%
STD	8.88%		7.87%		16.90%		9.45%		9.72%	6.35%	6.37%	5.33%	1.62%
Sharpe Ratio	60.21%		0.63%		-6.39%		69.11%		11.61%	-24.57%	-24.60%	47.65%	

**Source: Federal Reserve Bank St. Louis 1 yr T-Bill Avg. Dec.

*Average return less annualized return risk free divided by standard dev.

Appendix 3

NCREIF Weights Spreadsheet

NCREIF PROPERTY TYPES
Weight Adjustments - Four Property Types = 100%

	Composite Capitalization	Residential Capitalization	Residential NCREIF Weight	Residential Adjusted Weight	Office Capitalization	Office NCREIF Weight	Office Adjusted Weight	Industrial Capitalization	Industrial NCREIF Weight	Industrial Adjusted Weight	Retail Capitalization	Retail NCREIF Weight	Retail Adjusted Weight	Total NCREIF Weight	Total Adjusted Weight
1978	$729,986,518	-	0.00%	0.00%	$172,787,294	23.67%	28.11%	$301,112,493	41.25%	48.99%	$140,743,331	19.28%	22.90%	84.20%	100.00%
1979	1,231,133,627	-	0.00%	0.00%	295,138,686	23.97%	27.66%	478,101,155	38.83%	44.81%	293,738,683	23.86%	27.53%	86.67%	100.00%
1980	1,976,014,374	-	0.00%	0.00%	591,831,803	29.95%	33.32%	753,477,074	38.13%	42.42%	430,996,997	21.81%	24.26%	89.89%	100.00%
1981	3,668,148,597	-	0.00%	0.00%	1,532,098,545	41.77%	44.74%	1,128,576,717	30.77%	32.96%	763,768,214	20.82%	22.30%	93.36%	100.00%
1982	4,893,870,665	-	0.00%	0.00%	2,322,330,950	47.45%	50.61%	1,356,969,597	27.73%	29.57%	909,528,085	18.59%	19.82%	93.77%	100.00%
1983	9,025,037,692	-	0.00%	0.00%	3,841,194,299	42.56%	44.74%	1,875,994,501	20.79%	21.85%	2,867,884,697	31.78%	33.41%	95.13%	100.00%
1984	11,476,035,737	269,331,692	2.35%	2.40%	5,122,701,096	44.64%	45.67%	2,395,787,836	20.88%	21.36%	3,428,084,444	29.87%	30.56%	97.73%	100.00%
1985	15,407,790,207	398,554,243	2.59%	2.65%	6,921,479,078	44.92%	46.02%	2,957,064,099	19.19%	19.66%	4,763,381,886	30.92%	31.67%	97.62%	100.00%
1986	17,870,897,077	508,290,823	2.84%	2.89%	7,701,431,895	43.09%	43.82%	3,691,067,204	20.65%	21.00%	5,672,498,116	31.74%	32.28%	98.33%	100.00%
1987	22,184,603,366	905,882,755	4.08%	4.14%	8,877,339,833	40.02%	40.60%	4,992,107,102	22.50%	22.83%	7,092,618,835	31.97%	32.43%	98.57%	100.00%
1988	28,470,920,216	1,517,588,594	5.33%	5.45%	11,549,160,426	40.56%	41.46%	6,064,921,828	21.30%	21.77%	8,726,445,535	30.65%	31.32%	97.85%	100.00%
1989	32,656,131,813	2,357,377,196	7.22%	7.35%	12,928,786,086	39.59%	40.31%	6,978,998,047	21.37%	21.76%	9,811,233,689	30.04%	30.59%	98.22%	100.00%
1990	37,970,807,036	3,433,022,832	9.04%	9.20%	14,535,434,763	38.28%	38.94%	7,801,109,942	20.55%	20.90%	11,558,543,631	30.44%	30.96%	98.31%	100.00%
1991	37,009,612,799	3,734,424,061	10.09%	10.32%	12,651,496,549	34.18%	34.95%	7,857,267,953	21.23%	21.71%	11,953,713,419	32.30%	33.02%	97.80%	100.00%
1992	39,499,283,316	4,508,894,647	11.42%	11.62%	13,037,695,180	33.01%	33.60%	7,653,568,455	19.38%	19.72%	13,602,986,345	34.44%	35.06%	98.24%	100.00%
1993	40,949,888,447	4,780,526,982	11.67%	11.89%	13,113,310,098	32.02%	32.61%	6,915,278,120	16.89%	17.20%	15,406,811,821	37.62%	38.31%	98.21%	100.00%
1994	41,010,207,892	5,295,309,166	12.91%	13.19%	11,515,708,165	28.08%	28.69%	6,771,452,306	16.51%	16.87%	16,561,893,484	40.38%	41.26%	97.89%	100.00%
1995	48,278,542,054	6,739,200,147	13.96%	14.20%	14,999,268,513	31.07%	31.60%	8,046,588,122	16.67%	16.95%	17,687,035,586	36.64%	37.26%	98.33%	100.00%
1996	54,324,764,528	7,878,271,882	14.50%	14.65%	17,880,098,004	32.91%	33.24%	8,631,280,715	15.89%	16.05%	19,403,541,948	35.72%	36.07%	99.02%	100.00%
1997	65,126,197,138	9,566,856,764	14.69%	14.86%	24,297,944,171	37.31%	37.74%	11,386,050,682	17.48%	17.69%	19,129,732,521	29.37%	29.71%	98.86%	100.00%

Appendix 4

Spreadsheet Results Un-weighted NCREIF 4 Property Types

Comparative Thesis Index - NCREIF Comparison Firms 4 Property Types (Unweighted)
Summary Table of Results 1978 - 1997

0.005

Year	Rate Equity	Rate Assets	NCREIF Compounded	NCREIF Adjusted	NCREIF w/ 50 bps adj.	NAREIT Equity	Rate Debt	Rate Pref.	Risk Free
1977									
1978	14.083%	10.176%	16.11%	15.39%	14.89%	10.34%	7.84%	0.00%	9.44%
1979	43.35%	20.22%	20.46%	17.20%	16.70%	35.86%	8.25%	0.00%	10.92%
1980	9.42%	9.78%	18.09%	18.45%	17.95%	24.37%	10.03%	0.00%	13.23%
1981	5.78%	9.06%	16.62%	17.07%	16.57%	6.00%	11.15%	0.00%	11.57%
1982	22.72%	15.20%	9.43%	9.24%	8.74%	21.60%	10.33%	0.00%	8.23%
1983	29.03%	18.28%	13.13%	13.10%	12.60%	30.64%	9.27%	0.00%	9.24%
1984	23.24%	16.68%	13.84%	13.98%	13.48%	20.93%	9.50%	9.05%	8.60%
1985	14.44%	16.68%	11.24%	11.45%	10.95%	19.10%	10.09%	9.05%	7.16%
1986	20.96%	15.98%	8.30%	8.52%	8.02%	16.41%	8.19%	0.00%	5.55%
1987	0.35%	1.44%	8.00%	8.08%	7.58%	-4.48%	8.69%	23.49%	6.69%
1988	16.61%	13.45%	9.62%	9.84%	9.34%	15.75%	8.70%	0.00%	8.32%
1989	8.44%	8.74%	7.77%	7.99%	7.49%	4.64%	9.15%	0.00%	7.21%
1990	-16.01%	-7.11%	2.30%	2.29%	1.79%	-23.62%	8.96%	0.00%	6.61%
1991	20.17%	15.06%	-5.59%	-5.73%	-6.23%	29.42%	7.86%	0.00%	4.17%
1992	21.83%	16.20%	-4.26%	-4.25%	-4.75%	20.66%	7.19%	7.04%	3.55%
1993	15.03%	12.08%	1.38%	1.36%	0.86%	18.70%	9.43%	5.83%	3.45%
1994	1.53%	3.67%	6.30%	6.44%	5.94%	2.99%	6.57%	6.21%	6.67%
1995	10.32%	8.67%	7.54%	7.42%	6.92%	14.21%	7.18%	6.08%	5.03%
1996	30.19%	17.73%	10.31%	10.05%	9.55%	36.40%	6.54%	7.47%	5.18%
1997	16.47%	11.09%	13.91%	13.81%	13.31%	20.52%	5.72%	6.60%	5.24%
				16.22%					

Comparative Thesis Index - NCREIF Comparison Firms 4 Property Types (Unweighted)
Summary Table of Results 1978 - 1997

	Thesis Rate Equity	Thesis De-levered Rate Assets	NCREIF Compounded	Adj. Wt. NCREIF Compounded	NCREIF with 50 bps Adj. Wt.	NAREIT Equity	Risk Free **
Compounded	1458.78%	775.79%	461.86%	448.78%	400.43%	1567.14%	307.10%
Annualized Return	14.72%	11.46%	9.01%	8.89%	8.38%	15.11%	7.27%
Average Return	15.40%	11.65%	9.23%	9.09%	8.59%	16.02%	7.30%
STD	12.58%	6.58%	6.87%	6.66%	6.66%	14.17%	2.67%
Sharpe Ratio*	64.57%	66.63%	28.42%	27.24%	19.73%	61.77%	

**Source: Federal Reserve Bank St. Louis 1 yr T-Bill Avg. Dec.

*Average return less annualized return risk free divided by standard dev.

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