

INTEREST RATE RISK OF REAL ESTATE INVESTMENT TRUSTS

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May 2015

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1. Executive Summary

This report provides an analysis of the sensitivity of equity Real Estate Investment Trust (“REIT”) returns to interest rate changes. It explores the relationship between equity REITs and interest rates, various equity REIT sectors and interest rates, and then goes further to determine the sensitivity of individual equity REIT returns to various characteristics commonly associated with interest rate sensitivity.

In this study we implement a three step approach that builds and refines the Fama French factor model to generate both constant and time varying betas to the bond market. We analyze these bond betas for equity REIT sector indices over time to explore the evolving sensitivity of various sector REITs to interest rates. Individual equity REIT bond betas are also examined to determine the best model to describe their sensitivity to selected interest rate related characteristics.

Over the period analyzed, results show that our equity factor model was a better fit to the data as compared to our bond factor model, indicating the performance of the equity markets better explains the performance of equity REITs. Industrial, Storage, and Healthcare REIT sectors have the highest bond betas, indicating the most interest rate risk, while the Industrial and Lodging sectors display greater equity market risk.

The introduction of an equity sector specific factor, in order to refine the market factor in our model, yields minimal improvement. However, results support that sector specific influences tested in these regressions have had an increasing impact on the Lodging, Healthcare, Apartment, and Retail sectors.

The next step was to construct cross-sectional regressions to model the sensitivity of individual equity REITs across various interest rate related characteristics including but not limited to:

weighted average lease term, S&P credit ratings, leverage ratios, effective interest rate on debt and sensitivity.

Univariate regressions uncover:

- Statistically similar interest rate sensitivity exhibited amongst equity REITs in 3 sectors: Residential, Healthcare and Industrials
- No positive relationship between weighted average lease term and interest rate sensitivity is established as the coefficient is not directionally intuitive or statistically significant
- The use of derivatives, although not statistically significant, corresponds with a lower bond beta and therefore lower interest rate sensitivity
- Higher S&P credit ratings coincide with greater interest rate sensitivity even amongst investment grade rated REITs
- No statistically significant relationship can be found between equity REIT bond betas and their use of financial leverage

Lastly, the results from the multivariate regressions that combined equity REIT characteristics did not reveal a statistically significant model to better represent the data set, but indicated:

- Combining weighted average lease term and the use of derivatives provides no new insight from evaluating these variables individually
- Weighted average lease term and S&P credit ratings in concert exhibit similar behavior to their univariate models and the relationship between these characteristics and interest rate sensitivity remains counterintuitive
- Resulting coefficients from combining weighted average lease term and leverage also remain directionally consistent with univariate models, implying the inverse of the relationship we would have expected with interest rate changes

- Incorporating all four independent variables in one regression results in a multivariate model that was not statistically significant but reverted the previously observed inverse relationship between leverage and interest rate sensitivity

In conclusion, our results identify a general trend indicating increasing interest rate risk in REIT returns over time whilst finding heterogeneity of interest rate risk amongst individual REITs. Despite utilizing multiple approaches to refine our models we were unable to explain this heterogeneity by differences in debt profiles, use of derivatives, weighted average lease duration, among other characteristics we considered.

Our study was subject to limitations including the selected time period for our individual REIT analysis, of 2008 to 2013. This encompassed a period during which interest rates were essentially zero, which may have distorted the relationship between various characteristics we investigated and interest rate sensitivity. Furthermore, our sample REIT data presents a static profile and does not model how these characteristics have changed over time.

Additionally, the extent of derivative use and occupancy rates of real estate owned was not considered. Further research could be carried out to determine how these factors may impact the results.

We present this report in seven sections. Following this Executive Summary, section two provides a brief history and overview of key trends that shape the REIT industry and describes the relationship between REITs and interest rates. Section three lays out previous literary work that relates to our hypothesis and informs our methodology. Section four outlines our hypothesis and describes the data gathered and methodology applied for this study. Section five presents the results of univariate and multivariate regressions of a sample of individual equity REITS to interest rate related characteristics. Section six presents the results of univariate and multivariate

regressions of a sample of individual equity REITS to interest rate related characteristics.

Finally, section seven delivers the conclusive findings from all of the research and analysis.

2. Introduction

A Real Estate Investment Trust (“REIT”) is an investment firm that has elected to qualify for certain tax exemptions by focusing its activities on distributing income from “owning, operating, acquiring, developing, and managing real estate investments”.ⁱ It is essentially a “pass-through” vehicle that holds and manages real estate assets and distributes nearly all¹ earned income directly to investors.ⁱⁱ It may be public or private, and may hold debt or equity instruments related to real estate.

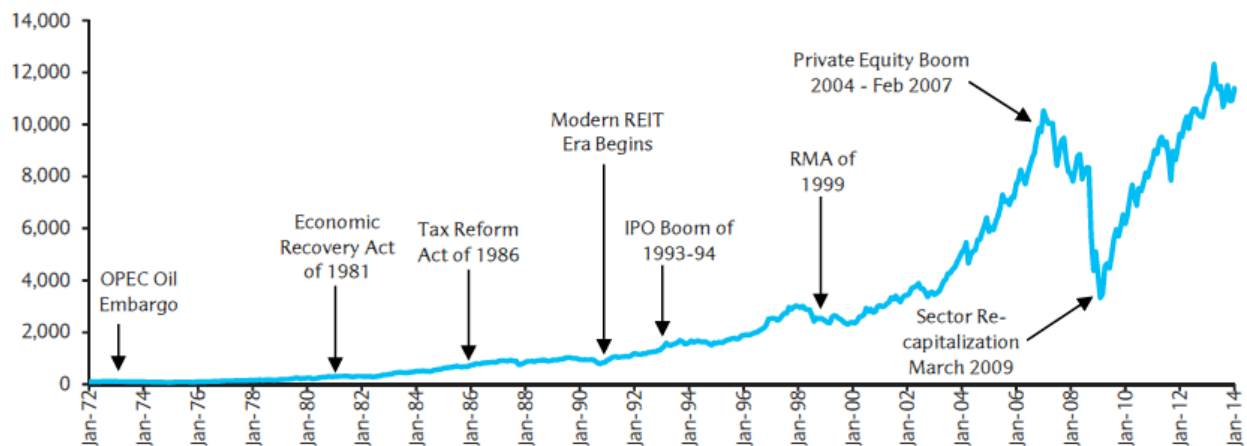
There are three types of REITs including equity, mortgage, and hybrid REITs. An equity REIT is a REIT that owns or has an equity interest in real estate leased to corporations or individuals, and is often specialized by geography or property type.ⁱⁱⁱ A mortgage REIT makes or owns loans or other obligations that are secured by real estate collateral.^{iv} Finally, hybrid REITs combine the investment strategies of both equity REITs and mortgage REITs. Hybrid REITs were popular in the 1970s and 1980s. However, the National Association of Real Estate Investment Trusts (“NAREIT”) discontinued the hybrid index in 2010. The focus of our study is the equity REIT sector, the most common type that accounts for approximately 90% of the REIT industry.

¹ The REIT Modernization Act of 1999 that went into effect in 2001 reduced the dividend payout ratio from 95% to 90% of taxable income.

2.1 History of the Real Estate Investment Trust Industry^v

Legislative and tax amendments over the past 50 years are responsible for developing the environment in which REITs operate today. Prior to 1960, real estate was primarily held by wealthy individuals and corporations. With changes to the Internal Revenue Service (“IRS”) tax laws in 1960 came the ability for wealthy individuals to pool capital into a corporate structure that was exempted from corporate income tax. This is when the REIT industry was born. However, due to many restrictions REITs were not popular during the 1960s. In order to comply with the Real Estate Investment Trust Act of 1960, REITs operated as passive investment vehicles that were not allowed to operate or manage the property they owned.

Figure 1: Timeline of REIT History vs. Sector Stock Performance, January 1972 – January 2014



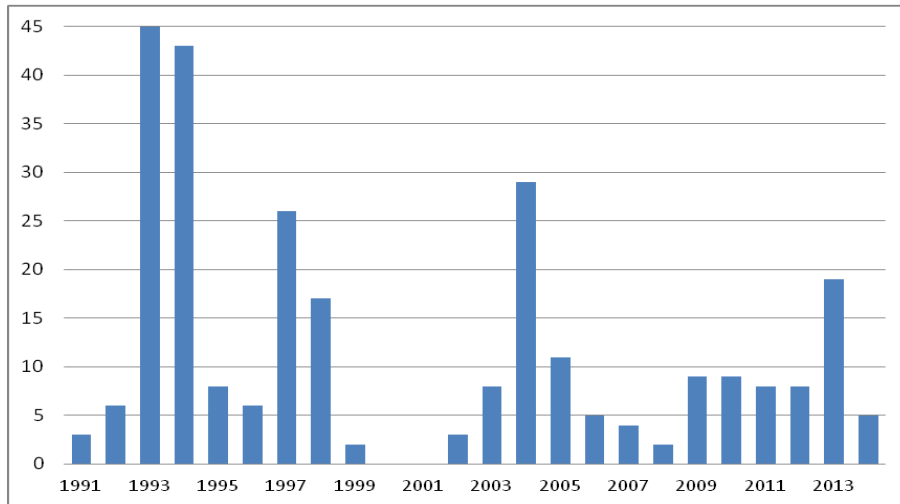
Source: NAREIT, Thompson and Barclays Research

The period from 1969 to 1974 was the era of the mortgage REIT. The primary reasons for forming mortgage REITs were to gain a share of the construction loan market without using costly balance sheet capacity and to earn management fees. However, many of the mortgage REITs went bankrupt in the 1970s when the OPEC Oil Embargo triggered a rise in oil prices and subsequently an inflation spike. Rising inflation led to an increase in floating rates, which

impacted the liability side of REITs, whereas the fixed rate mortgage rates used to provide mortgage loans to builders, remained stable.

In the 1980s, the passage of the Economic Recovery Act of 1981 initiated the flow of capital from REITs to the private real estate investment sector, which offered a preferential accelerated depreciation tax shield. Overbuilding created excess supply in the market that subsequently led to soft rental rates and ultimately the real estate crash. Furthermore, the passage of the Tax Reform Act of 1986 eliminated preferential tax treatment of private real estate investors and also allowed REITs to be actively managed. Apart from private real estate investors becoming unprofitable and widespread foreclosures, the Tax Reform Act of 1986 encouraged a shift away from mortgage REITs towards equity REITs and led to the REIT Initial Public Offering (the “IPO”) boom in the early 1990s.

Figure 2: Number of completed Initial Public Offerings (“IPO”), 1991 - 2014



Source: NYU MSRM 2015 Capstone Team and NAREIT

The 1990s can be categorized as the REIT return era. The Revenue Reconciliation Act of 1993 modified the “five or fewer” rule to make it easier for institutional investors to invest in REITs.² As outlined in Figure 2, in 1993 and 1994, almost 100 REITs went public.

Passed in 2001, the REIT Modernization Act of 1999 reduced the minimum dividend payout requirements and provided more flexibility in managing REITs. Another REIT era began with the largest leveraged buyout ever, Equity Office Properties. The REIT market peaked in February 2007 and subsequently crashed in 2008. In the fourth quarter of 2008, the market capitalization of REITs fell by 38% and triggered many bankruptcies.

In 2009, REIT performance mirrored the real estate market as it began to slowly recover. However, the strong performance was driven by strong demand in thriving real estate markets and prime properties. REITs continued to perform well until May 2013, when then Chairman of the Federal Reserve, Ben Bernanke, announced the initiation of Quantitative Easing (“QE”). Immediately following this announcement, and only for a short while, investors became bearish on REITs and REIT returns fell significantly. This spurred the awakening of the controversy over interest rates’ impact on REIT returns.

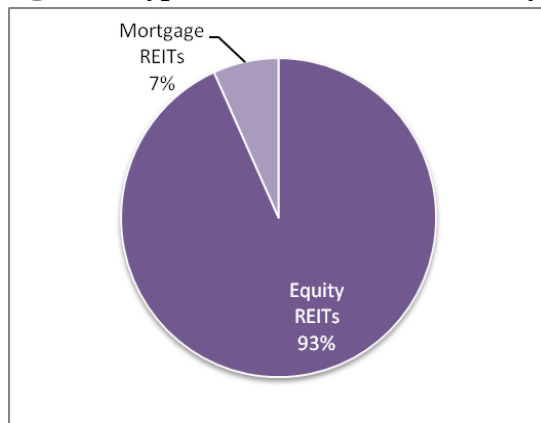
² (Prof. Stijn Van Nieuwerburgh) In accordance with the Real Estate Investment Trust Act 1960 (the “REIT Act”) there are number of tests a qualifying REIT must satisfy to be exempted from the corporate income tax, as following:

- a. Diffusion of ownership which requires at least 100 shareholders and does not allow five or fewer individuals and/or trusts to own more than 50% of a REIT stock.
- b. Concentration of asset in real estate requiring that 75% of assets is in real estate, mortgages, cash or federal government securities; and that 75% of income is derived from the underlying property.
- c. Buy and hold requiring REITs to have their income derived from passive sources such as rents and/or mortgages, and, among other things prohibiting REITs to hold property with a primary purpose of sale.
- d. Dividend distribution requiring 90% of taxable income to be distributed to the shareholders each year.
- e. Taxes on the corporate level are paid on the difference between the taxable income and the dividends leading to very small corporate income tax amount, which is one of the key tax benefit of this investment vehicles.

2.2 Overview of the REIT Industry Today

REITs have gone through many changes and incurred their fair share of growing pains, but are now a significant part of the overall economy. As of December 31, 2014 there were 216 publicly listed REITs³ registered with the SEC with a combined market capitalization of \$907 billion and owning around \$1.8 trillion in gross assets.^{vi}

Figure 3: Type of the U.S. Listed REITs by market capitalization, December 31, 2014



Source: NYU MSRM 2015 Capstone Team and NAREIT

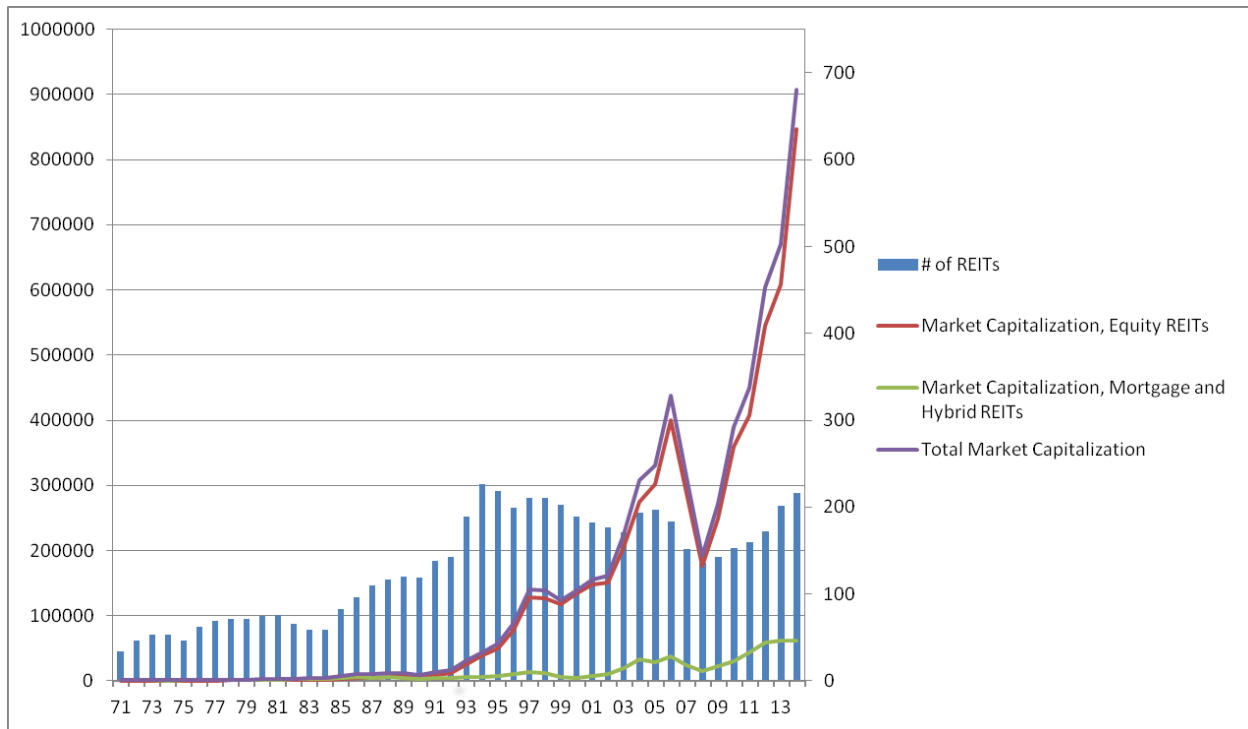
As outlined in Figure 3 and Figure 4, equity REITs account for over 90% of the REIT market, i.e. out of 216 REITs, 177 are equity REITs with a market capitalization of \$846 billion accounting for 93% of the combined market capitalization.

There are a number of REITs that are included in Standards & Poor's ("S&P") indices, including the S&P 500, S&P 400 and S&P 600. They are expected to be designated as a separate S&P "sector" in mid-2016.^{vii,4}

³ According to the NAREIT, there are more than 1,000 REITs that have filed the tax return with the IRS.

⁴ The change relates to the Equity REITs only. As outlined in the Forbes article, mortgage REITs will remain in the financial sector under the newly created industry devoted to mortgage REITs.

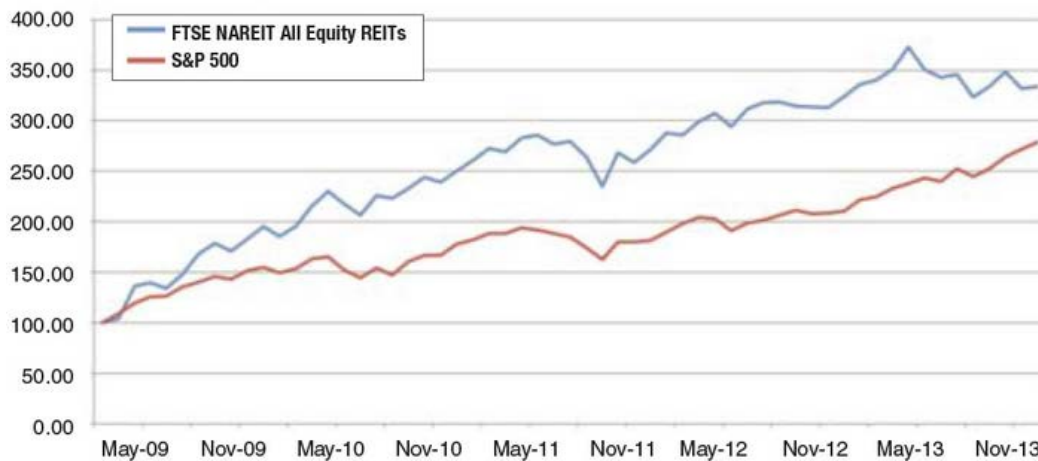
Figure 4: Historical U.S. Listed REIT Industry Market Capitalization (\$millions at year end) and Number of REITs, 1972 – 2014



Source: NYU MSRM 2015 Capstone Team and NAREIT

Investors choose to invest in REITs for numerous reasons. By investing in REITs, investors also get access to the more liquid real estate market as they can buy and sell REIT shares more frequently than they would be able to buy and sell the actual underlying real estate property. They can also be used to diversify portfolios and as outlined in Figure 5, they have historically shown only modest correlation to the broader stock market. One of the key benefits for smaller investors is that REITs allow them to have a “fractional ownership in large scale assets” in an investment vehicle that is professionally managed and provides consistent income in terms of dividends and potential capital appreciation.^{viii}

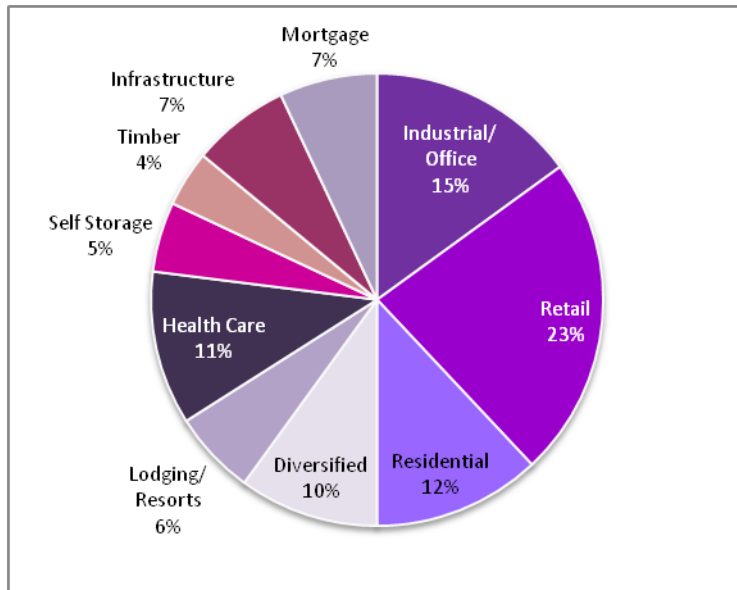
Figure 5: Return of the U.S. Listed Equity REITs vs. S&P 500 Stock, May 2009 – Nov 2013



Source: NAREIT

There are more than 30 countries that have REITs with laws that are fairly similar to REIT regulations of the U.S. They own and manage various properties including shopping centers, apartments, hospitals, hotels, office buildings, timber and others. Most of them specialize in one property type, sometimes even geographical region and/or city. Depending on the underlying property type, the return of the various REIT sectors will vary. As outlined in the Figure 6 distinction is made between several REIT sectors according to the underlying property type they own and/or invest in. 61% of the total market capitalization relates to the five REIT sectors including the Retail, Industrial/Office, Residential, Healthcare and Diversified. The largest component relates to the Retail REIT sector, which accounts for 23% of the total market capitalization. Retail REITs mainly invest in shopping centers, regional malls, outlet malls and other freestanding retail properties. The second largest component relates to the Industrial-Office REIT sector, which accounts for 15% of the total market capitalization. Their property portfolio significantly varies but mainly relates to investments in office buildings, distribution centers, bulk warehouse space, light manufacturing facilities, and R&D facilities^{ix}.

Figure 6: Market Capitalization of the listed U.S. REITs by Property Type, December 31, 2014



Source: NYU MSRM 2015 Capstone Team and NAREIT

The Residential REIT sector accounts for 12% of the total market capitalization. It owns and operates residential rental buildings as well as manufactured housing properties. The Healthcare REIT sector mainly invests in hospitals, nursing and retirement homes and the Diversified REIT sector invest in various properties^x.

2.3 REITs and Interest Rates

Since the recent global financial crisis the Federal Reserve (“Fed”) has utilized additional tools to influence interest rates as a vehicle to stimulate the economy. Through the QE program, the Fed engaged in additional bond buying intended to lead to a pickup in economic growth. The Fed began to taper QE in December 2013 with the last purchase in October 2014^{xi}. The Fed Funds rate is currently at historical lows of 0 to 0.25%,^{xii} and majority of economists^{xiii} are forecasting the first rate hike by the fourth quarter of 2015. Against this backdrop, investors are increasingly asking what the impact of interest rates will be on different asset classes. As shown in the Figure 7 and Figure 7.a., interest rates are at historically low levels, both on a longer-term and a more recent basis.

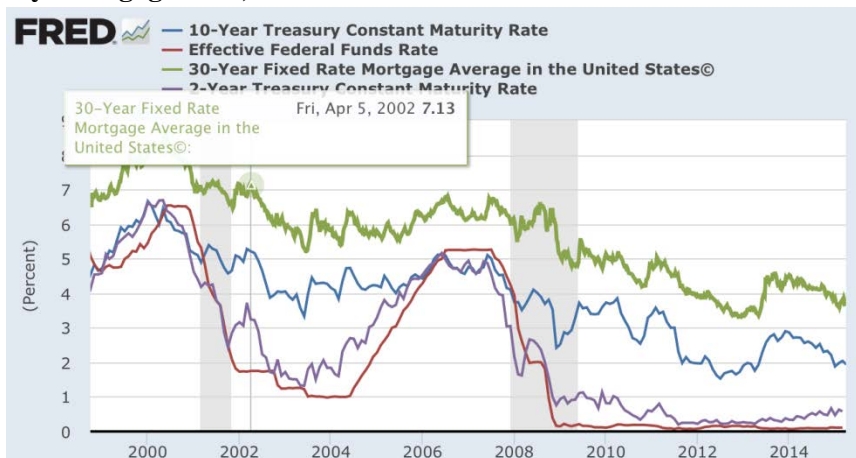
There are different types of interest rates that affect REITs; mortgage rates affect REIT lease terms, treasury yields combined with credit spreads affect the REIT cost of capital, and finally, the forward yield curve affects the dividends discounted in valuation models. It is important to note that interest rates tend to move in tandem with each other, and mortgage rates historically move in tandem with treasury rates making them a good proxy for interest rates.^{xiv}

Figure 7: Historical Evolution of Interest Rates: 10y UST, 2y UST, Effective Fed Funds Rate, and 30y Mortgage Rate, 1970 – 2015



Source: Federal Reserve Economic Data (“FRED”), Federal Reserve Bank of St. Louis

Figure 7.a.: Historical Evolution of Interest Rates: 10y UST, 2y UST, Effective Fed Funds Rate, and 30y Mortgage Rate, 2000 – 2015

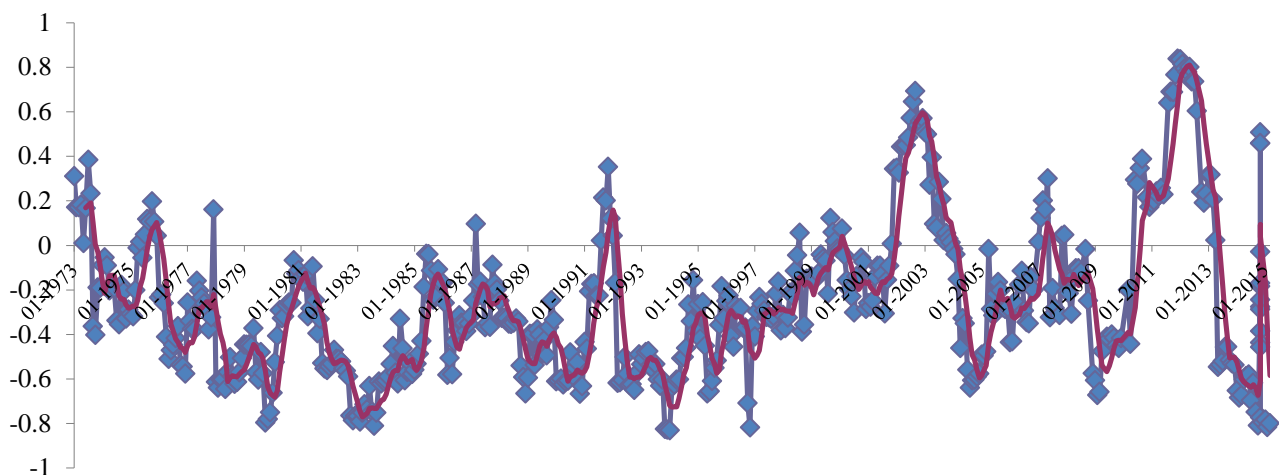


Source: Federal Reserve Economic Data (“FRED”), Federal Reserve Bank of St. Louis

It is difficult to confirm long-term direct correlation patterns between the movements in interest rates and REIT performance. Mueller and Pauley (1995)^{xv} find that interest rate movements cannot adequately explain REIT price movements. They also find that REIT prices and interest rates have low and negative correlations during both rising and falling interest-rate periods, and that the correlations were stronger in falling periods than rising periods.

Using monthly NAREIT All Equity REIT total returns and 10-year US CMT total returns, we ran monthly 12-month rolling correlations for the period from March 1973 to March 2014. We also find weak rolling correlations with a mean of -0.25 and a standard deviation of 0.35. Although we did not specifically isolate periods of rising rates, on a long term basis we did not find strong evidence to suggest a high correlation between interest rates and REIT returns. While many institutional investors assert that REITs perform well in rising rate environments^{xvi}, some academics like Mueller and Pauley (1995) find that there is not enough evidence to support this.

Figure 8: 12-month rolling Correlation of 10-year US CMT Total Returns and All Equity REIT Total Returns, March 1973 to March 2015



Source: NAREIT and Federal Reserve Economic Data (“FRED”), Federal Reserve Bank of St. Louis

REITs may be impacted by interest rate fluctuations because real estate greatly relies on investment from borrowed finances. The overall real estate value is affected by the cost of financing, consequently impacting demand and affordability. Therefore, if interest rates increase; a reduction in the aggregate demand for real estate, lower real estate values, and increased cost of debt financing may ensue. Furthermore, real estate investors may require a greater rate of return if interest rates increase, resulting in lower real estate values. Additionally, during periods of heightened interest rates, real estate development is more costly due to the associated carried interest. However, the hypothesized inverse relationship of real estate valuation and interest rate fluctuations may be disproved because of the underlying forces that cause interest rate movements which are self-hedging. While a weak economy and low inflationary prospects result in decreased interest rates, high interest rates implicate a strong economy, high inflationary prospects, and forces on increasing real estate values by increasing net operating income and lowering risk premia.^{xvii}

From a liability portfolio perspective, interest rates affect REITs through their cost of debt. REITs rely on debt to finance their operations and acquisitions and typically fund themselves through bank capital loans, private placements, or capital market transactions. The structure of the business is also such that, some projects tend to be financed with short-term roll-over debt and only upon permanent completion are bridged to long-term fixed debt. REITs can therefore gain on their liability portfolios if the debt is locked in prior to major interest rate increase, and adversely if they have locked in debt and rates come down they end up with higher cost of capital that could otherwise be obtained.^{xviii}

Depending on the sector and property type, lease agreements can vary from one night to many years with locked in lease terms. Theoretically, REITs with longer-term leases should be

amongst the most sensitive to movements in interest rates since they may have less flexibility in obtaining higher on-market rates. In the current macroeconomic environment of impending interest rate increases, this theory of REIT interest rate sensitivity affected by varying lease durations, which may differ by sector, is the primary motivation for our study.^{xix}

3. Literature Review

3.1 Interest Rate Sensitivity of various REIT characteristics

The riskiness and performance of REITs have been studied in many publications. Of relevance to our study are those relating to REIT beta movement over time, REIT return volatility relating to REIT characteristics, and in particular, REIT sensitivity to the different durations of various REIT sector leases and their use of derivatives to hedge this exposure.

There have been various studies on the impact of interest rate changes on REITs. First, Chen and Tzang (1988) use the period between 1973 and 1985 and establish that equity REITs are sensitive to fluctuations in interest rates.^{xx} However, they assert that changes in inflationary expectations were the reasons behind equity REIT interest rate sensitivity, not the actual interest rate movements. In 1995, Mueller and Pauley (1995) discover that equity REITs tend to be less sensitive to interest rate movements than stocks, concluding that equity REIT valuation variations are not meaningfully related to interest rate fluctuations.^{xxi}

Chaney and Hoesli (2010) expanded upon past studies on the REIT interest rate sensitivity based on individual REIT characteristics, by modeling empirically, using Discounted Cash Flow (“DCF”) models and Monte Carlo simulations, both the rental dynamics and the properties’ macro-economic environment of a typical office investment property’s entire life.^{xxii} They observed that an interest rate increase leads to an increase of the current rent. As a result, the future cash flows of an income-producing property are projected to also increase. This movement partly counterbalances the negative impact that the increasing interest rate has on the property value. Even though both assets are expected to have identical cash flows, their results portray that the bond’s interest rate sensitivity is more significant than that of the office property.^{xxiii}

This is due to the fact that a typical office property’s free cash flows usually moves in the same

direction as interest rates, partially offsetting the impact of the interest rate movement on the property's present value.^{xxiv} They conclude that the key determinants of the interest rate sensitivity are the risk premium, the condition of the macro-economic environment, and the remaining duration of the property.^{xxv} They found that due to the positive relationship between the bond's maturity and its duration, a decrease in the property's remaining lifespan reduced the interest rate sensitivity significantly.^{xxvi} Fluctuations in the lease term, the time period between rent evaluations, and the vacancy rate have a much less significant impact on interest rate sensitivity. Investors do have some ability to manage duration via selecting appropriate properties as opposed to through manipulating the lease contracting process, such as changing lease terms. In summary, Chaney and Hoesli determine that due to the self-hedge of real estate it is actually less sensitive to interest rate fluctuations than other assets with the same average cash flow growth rate.^{xxvii}

Finally, Madura, Allen, and Springer (2000) expanded on prior similar research by studying the sensitivity of REIT returns to stock market and interest rate fluctuations during a more recent time period, between 1992 and 1996. This was an interesting period to study because the REIT industry significantly matured during the early 1990's and REITs began resembling normal operating companies more than in prior periods.^{xxviii} As a result of increasing demand for securitized real estate, demand for REIT stock considerably increased.

Their research goes further to determine whether the sensitivity of REIT returns to stock market and interest rate fluctuations is impacted by different REIT characteristics. Specifically, they analyze how sensitivity to interest rate and market variations may differ amongst REITs because of their management strategy, financial leverage, asset structure, and the level of investment portfolio specialization.^{xxix} They conclude that by minimizing financial leverage and by self-managing their portfolios, REITs are able to decrease the level of sensitivity of their returns to

stock market fluctuations. They found substantive evidence that both long-term and short-term interest rate changes influence REIT returns. However, they could not prove that REITs have the ability to impact their exposure to interest rate changes through financial leverage, management strategy, degree of specialization, or asset structure.^{xxx}

Furthermore, since prior studies established that there is interest rate sensitivity variation by individual REIT characteristics, it is worth noting the research done on how REITs have hedged this exposure. Horng and Wei (1999) broke ground when they investigated the use of derivatives in the REIT industry with observed data from a sample of 186 REITs obtained from the EDGAR database prior to 1995. They found that 41% of REITs utilize interest rate derivatives.^{xxxi} REITs that have larger market cap tend to engage in more derivatives, but REITs that are smaller and are more leveraged utilize more derivatives. They attribute this behavior to the high costs of entering the hedging market and financial distress. Additionally, equity REITs tend to decrease their hedging engagement as interest rates rise, which they believe is attributed to trying to control funding costs.^{xxxii}

The overall conclusion from the literature reviewed, and others not referenced, is that empirical studies involving the dynamics of REIT risk vary over time and change based on various REIT characteristics. Individual risk factors will vary with the different evaluation and approximation methodologies, the period of time over which the study is carried out, and the composition of the sample.^{xxxiii} However, it can be concluded that REIT returns are more sensitive to the stock market environment than they are to interest rate fluctuations and there is evidence that individual REIT characteristics influence the riskiness of REITs.

3.2 CAPM, Fama French, Real Estate, and Interest Rates

Our methodology for investigating the interest rate sensitivity of REITs was derived from sources including Sharpe and Lintner (1964, 1965) and Fama and French (1993). Sharpe and Lintner developed the capital asset pricing model (“CAPM”) to speculate that systematic risk is related to a stock's excess return above the risk-free rate.^{xxxiv} Subsequently, several related studies continued to develop the theory of asset pricing. One of the broader studies of capital asset pricing endeavors to utilize pricing models to conclude whether the cross-sectional variations in company returns can be clarified by company specific exposures to systematic risk factors. The second broader category of capital asset pricing research tries to explain the time series of continuous company or portfolio returns.^{xxxv}

More specifically, in 1993 Fama and French developed a three-factor model that expanded on the first broader category of asset pricing research on cross-sectional return variations. This model conjectured that a stock portfolio's excess return is a function of the sensitivity to the excess return on the market portfolio, a market to book value factor, and a firm size factor.^{xxxvi} Additional significant research that concentrated on identifying factors that are systematically linked to a company's stock returns include those by Fama et al. in 1993, Lakonishok et al. in 1994, and Fama and French in 1995 and 1996.^{xxxvii} However, these studies focus more on companies with ordinary common stock instead of REITs and thus the results of these studies are limited in their application to REITs.^{xxxviii}

In regards to the second category of asset pricing studies, in 1974 Stone went beyond the basic single-factor model from the CAPM and developed a two-factor pricing model for explaining stock returns that had an interest rate proxy to compliment the market proxy.^{xxxix} The interest rate proxy was included for the purpose of implying that the interest rate effect on the returns of some

companies is not completely captured by the indirect effect that the interest rate may have on the market's returns. Therefore, some companies may be more directly impacted by interest rate fluctuations. They found that the most effective method of capturing the direct results is to separate the interest rate effects from the market. Research that documents an inverse relationship between stock returns and inflationary expectations created the need for a two-factor model that individually captures interest rate variations.^{xl}

The two-factor model is the most applicable for evaluating market value of companies that have operating characteristics that may increase their exposure to interest rate fluctuations. Flannery and James (1984) assert that companies with financial assets are more sensitive to interest rate variations, particularly when the liability and financial asset maturities do not match.^{xli} The long-term interest rate acts as an extra-market proxy as it has implied market expectations of future interest rates, possibly also implying a variation in inflationary levels.^{xlii} Therefore, if a company's assets are affected by these factors then a change in the long-term interest rate could induce a firm re-valuation.

The findings and methodologies discussed above influenced our approach in testing our hypotheses, which are outlined in the next section.

4. Hypothesis, Data and Methodology

4.1 Hypothesis

Our study extends the body of research of REIT performance to a more recent period with data extracted from various sources up to 2014. We evaluate whether REITs exposure to interest rate changes is influenced by selected asset and debt structure characteristics including but not limited to the amount of financial leverage, weighted average lease term, use of derivatives, S&P credit rating, and other characteristics as summarized in Appendix 11. We then take it one step further and investigate the dependence of individual REITs on the same characteristics. No other research we have found to date has incorporated all these factors in a comprehensive study of REIT sensitivity to interest rate movements.

As REITs have behaved increasingly more like stocks over time, we expect that when isolating REIT bond sensitivities from equity related market factors we would find that REIT sensitivities to interest rates have been increasing.^{xliii} We believe this could be the result of REITs taking on more debt and increasing competition amongst REITS as more entities become listed as REITs over time. We also suspect that due to similarities in lease terms and liability portfolios within a sector, individual REITs display similar interest rate sensitivity.

Asset Structure Characteristics: Weighted Average Lease Term

The weighted average lease term measures the asset weighted lease term across the equity REIT portfolio. We believe this characteristic can be used to indicate asset duration of equity REITs as outlined in Table 1 on the following page, and hypothesize that equity REITs with longer lease terms should exhibit greater interest rate sensitivity. Intuitively, longer contractual underlying property leases potentially reduce the flexibility REITs have in re-negotiating rates. This inflexibility could result in a widening duration gap between assets and liabilities, leading to

increased cash flow volatility^{xliv}.

Table 1: Lease Duration per Sector and Other Characteristics of Commercial Real Estate Sectors

Property Sector	Economic Drivers	Lease Duration	Relative Cyclicity
Hotel	Business and consumer sentiment; corporate profits; fuel prices (higher costs for air travel) <i>Hotels are highly cyclical due to their nightly leases, as room rates and occupancies can change swiftly with economic conditions. Low relative operating margins and significant recurring capital expenditures add volatility to the cash flow profile.</i>	1 day	Very high
Self-Storage	Population; employment growth (particularly in urban areas, where space is more limited) <i>Lease terms are relatively short, but self-storage companies have strong pricing power, since small businesses and apartment dwellers will typically agree to higher rents rather than discard belongings or move into a larger space.</i>	1 month	High
Apartment	Household formation; job growth; home affordability; single-family housing sentiment <i>Apartment REITs are largely cyclical, as profitability is tied to employment rates. However, they tend to be inversely (negatively) correlated to residential housing (tighter mortgage requirements and uncertainty on home prices tend to benefit apartment demand).</i>	1 year	High to medium
Shopping Center	Consumer spending; disposable income; employment <i>Tenants are generally geared toward non-discretionary (grocery, discount retail, pharmacy), offering some defensive qualities. Big box centers generally have stronger-credit tenants, but are also at greater risk from e-commerce penetration. Neighborhood centers typically include more local businesses (nail salons, pizza parlors), which are more dependent on the local economy.</i>	3–5 years	Low to medium
Industrial	Exports; manufacturing activity; inventories; shipping volumes; business sentiment <i>Despite long lease durations, industrial properties have short construction times due to less-complex building requirements, so supply tends to closely track demand. A shorter property cycle results in greater sensitivity to domestic and global economic growth.</i>	3–6 years	Medium
Regional Mall	Discretionary spending; consumer sentiment; employment <i>Tenants tend to be discretionary-focused (department stores, boutique retail). Leases typically include rent step-ups, providing some support in the event of a downturn in the economy.</i>	5–10+ years	Low
Office	Corporate profits; employment growth; business outlook <i>Lengthy lease durations (10 years or more for urban offices) provide long-term cash flow visibility. Offices in central business districts often see near-constant low supply conditions.</i>	5–10+ years	Low to medium
Health Care	Government reimbursement rates (i.e., Medicare and Medicaid); population aging; home sales <i>Long-term tenants such as hospitals and medical office buildings provide generally stable, bond-like income payments, resulting in a defensive investment profile.</i>	8–10 years	Very low to medium

Source: NAREIT, Cohen & Steers, “What history tells us about REITS and Rising Rates”, Viewpoint, July 2014, by

Tom Bohjalian

Creditworthiness: Credit Rating

We propose that REITs with higher credit ratings should have lower interest rate sensitivities. We believe that higher credit rated REITs have an advantage over lower credit rated REITs. REITs with higher credit ratings can benefit more from refinancing in times of changing interest rates levels, while REITs with lower credit ratings have a higher risk of investors negatively reassessing their cost of financing in increasing rate environments.

Liability Portfolio Characteristics: Effective average interest rate of debt, fixed to floating ratio, leverage, and derivatives

We propose that REITs with higher leverage could be more severely impacted by the interest rate changes. In a 2014 REIT Valuation Report by Green Street Advisors, research on balance sheet risk implied that markets favor REITs with lower leverage. Green Street Advisors were able to show that over the ten year period ending September 2012, a 10% variance in the leverage ratio had been associated with a 5% gap in total returns. Given that investors shun more highly levered REITs, we were interested in testing if this may be due an assumption of higher interest rate sensitivity for these REITs. The more levered a REIT is, the potentially greater their interest expense which could negatively impact their net operating income. We further propose that REITs that are already exposed to higher effective interest rates could have higher interest rate sensitivities as a result of higher cost of debt. Lastly we assert that REITs that use derivatives should have lower interest rate sensitivity when compared to REITs that do not, as employing interest rate related derivatives is an indication of an attempt to manage exposure to interest rates.

4.2 Data Gathering and Data Analysis

The data set we utilized to investigate the sector trends and sensitivities and in running the univariate and multivariate sector return regressions consists of NAREIT indices total return data collected from NAREIT and FactSet Research Systems Inc. (“FactSet”). We use the NAREIT All Equity Total Return Index and each NAREIT sector index returns, while monthly returns covering the period from January 1994 through December 2014 are collected from the FactSet.

In order to calculate the individual REIT bond betas, we employ a data set that consists of monthly return data collected from FactSet for 70 selected publicly traded REITs over a five year period ending as of December 31, 2013. The REIT selection is based on the largest market capitalization for each of the sectors within the NAREIT All Equity REIT index, and the end date of December 31, 2013 is chosen to ensure the consistency of the publicly available data for each REIT.

Finally, the data set we use to explore specific drivers of REIT interest rate sensitivity is sourced from SEC filings and other data providers, including Bloomberg and FactSet. We identify and collect numerous balance sheet, asset/investment, and qualitative interest rate related variables for each individual REIT as of December 31, 2013.

4.3 Methodology and Process Overview

The methodology applied in this study is based on constant beta models and time-varying beta models. We implement a three step approach that builds and refines the factor models to explore the sensitivity of sector REITs to interest rates and determine the best model to describe the sensitivity of REITs to numerous interest rate related characteristics.

We first evaluate the relationship between the two variables on a simple statistical basis by way of single factor regression, prior to modeling the relationship between interest rates and equity REIT excess returns on a multi-factor regression basis. The constant beta model results are presented and discussed in section 5.1.

Our second step is to build a time-varying beta model and investigate the All Equity REIT excess returns to four factors, three of which are commonly known as the “Fama French” factors. The Fama French three-factor model builds on the traditional Capital Asset Pricing Model (“CAPM”). It pertains to the findings of Fama and French (1992) that “value” and “size” are significant factors in explaining the realized returns of publicly traded stocks. These factors are referred to as SMB (Small Minus Big) and HML (High Minus Low). SMB addresses “size” and measures the additional return to investors from investing in relatively small market capitalization assets. HML addresses the “value premium” to investors for holding assets with high book-to-market values.^{xlv} These two factors are combined with the equity market excess returns and risk free rate, also known as the CAPM model, to construct part of the three-factor model. These factors have been found to explain much of the risk of returns.

We apply the Fama French model and add corresponding interest rate risk factors throughout our analysis using the following equation:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \beta_i^{SMB} + \beta_i^{HML} + \varepsilon^i$$

Where:

- (i) $(R_i - R_f)$ is the monthly excess returns of dependent variables (All Equity REIT index, Sector Index, or REIT Returns, depending on the regression)
- (ii) $(R_m - R_f)$ is the excess return series on the equity market index
- (iii) SMB is the difference between small stock portfolio return and large stock portfolio return
- (iv) HML is the difference between the high book-to-market portfolio and low book-to-market portfolio

We apply this Fama French three-factor model and add an additional factor to account for the interest rate risk as estimated by the excess returns of the 10-year US CMT. The time-varying beta models are calculated from monthly excess returns and depending on the regression, based on the previous 5 and/or 20 years of returns data.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \beta_i^{SMB} + \beta_i^{HML} + \beta_i(R_b - R_f) + \varepsilon^i$$

Where:

- (i) $(R_b - R_f)$ is the monthly excess returns of the 10-year US Treasury Constant Maturity bond (“CMT”)

We then added an additional fifth factor, designed to capture sector specific attributes, to see whether we could obtain stronger results.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \beta_i^{SMB} + \beta_i^{HML} + \beta_i(R_b - R_f) + \beta_i(R_s - R_f) + \varepsilon^i$$

Where:

- (i) $(R_s - R_f)$ represents the monthly excess returns for the selected S&P equity sector index

All time-varying analyses are done using regressions with Newey-West standard errors, and run with a tailored code we built in the software program Matlab. Compared to the standard regression analysis, the Newey-West estimator allows us to overcome issues related to autocorrelation in the time series data and therefore provides more accurate standard errors.^{xlvi}

In our third and final step outlined in section 6, we investigate our specific sample of 70 REITs with a constant beta model. The individual REIT excess returns are regressed against the same three factors, plus the bond factor, over a five year period. The result is a vector of bond betas for each of our sample REITs that are regressed as the dependent variables against specific characteristics of the individual REITs gathered from the public sources outlined in section 4.1.

5. Analysis of Results

5.1 Univariate Sector Analysis

In this section we take sector analysis to a level beyond basic statistics and investigate the drivers of excess returns of the different REIT sectors. The first sample univariate regression applies the equity market factor, traditionally known as the CAPM model and the second applies the bond market factor, i.e. excess returns of 10-year CMT, for the time period from 1994 to 2014.

Table 2: Full Sample Univariate Regression, Risk Factor Analysis to Equity (CAPM), December 1994 - December 2014

	Alpha (t-Stat)	β Market (t-Stat)	R-Squared %
All Equity	0.36 (1.15)	0.73 (5.90)	32.2
Office	0.40 (1.19)	0.79 (6.28)	31.6
Industrial	0.30 (0.60)	1.00 (4.59)	24.7
Retail	0.48 (1.26)	0.73 (4.73)	25.0
Apartments	0.50 (1.50)	0.65 (5.71)	25.1
Lodging	(0.08) (0.17)	1.20 (6.66)	35.2
Self-Storage	0.90 (2.76)	0.52 (5.08)	16.5
Healthcare	0.67 (1.85)	0.54 (4.82)	16.1

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

As outlined in Table 2, the market betas for each of the sectors are positive and with significant t-Stats, indicating a positive correlation with the broader equity market. Lodging has the highest market beta at 1.20, followed by Industrial with a market beta of 1.00. These two sectors are

therefore the most cyclical. The sectors with the lowest market beta are Healthcare and Self-Storage, at 0.54 and 0.52 respectively.

The equity model assumes that market risk is the only source of risk. When compared to the bond model presented in Table 3 we find that the bond factor model does not fit our data as well as the equity factor model as indicated by lower R-Squareds for all regressions. Lodging is the only sector that is statistically significantly negative. Several others, including the Office, Apartment and Retail are negative though not statistically different from zero as represented by t-Stats. These results however, do not indicate a clear enough picture as to the relationship between interest rates and equity REITs.

Table 3: Full Sample Univariate Regression – Risk Factor Analysis to Bond, December 1994 – December 2014

	Alpha (t-stat)	β Bond (t-stat)	R-Squared %
All Equity	0.85 (2.17)	-0.07 <i>(-0.26)</i>	0.06
Office	0.95 (2.27)	-0.15 <i>(-0.55)</i>	0.25
Industrial	0.89 (1.64)	0.18 (0.39)	0.17
Retail	0.95 (2.10)	-0.02 <i>(-0.05)</i>	0.00
Apartments	0.96 (2.52)	-0.17 <i>(-0.76)</i>	0.34
Lodging	0.89 (1.38)	-0.77 <i>(-1.97)</i>	3.01
Self-Storage	1.16 (3.18)	0.24 (0.97)	0.75
Healthcare	0.94 (2.50)	0.24 (0.87)	0.64

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

5.2 Refining the Factor Model

5.2.1 Three-factor Model plus an Additional Bond Factor

In order to refine our models to a higher degree, and incorporate the notion that REITs are interest rate sensitive, we apply the three-factor model plus an additional bond factor. We investigate these coefficients on a constant beta basis as well as a monthly time-varying basis.

Compared to our one-factor results on a full sample basis, the R-Squared overall significantly increases indicating a better explanation of the variation in monthly equity REIT returns. In addition, the alphas decrease compared to the univariate model although they are not statistically different from zero. In all scenarios, the sensitivity to interest rates is captured to a much higher degree when incorporating these additional risk factors.

As outlined in Table 4, the sector with the highest model fit is Lodging, which coincides with a bond beta of -0.16, implying that Lodging REIT returns are negatively correlated with excess bond returns. As interest rates rise, bond prices decrease and excess bond returns are negative. This is the only sector that represents a hedge against interest rate increases, displaying this inverse relationship to interest rates although not statistically significant with a t-Stat of -0.77.

The bond betas for Industrial, Self-Storage, and Healthcare are the highest standing at 0.71, 0.57, and 0.53 respectively with t-Stats of significance. These sectors display the most overall interest rate risk. Conversely, the lowest positive bond betas resulted in the sectors Office and Apartment. As for equity market risk, the Lodging and Industrial sectors exhibit the highest equity market betas of 1.27 and 1.12 respectively. Controlling for these risk factors provides a much clearer picture as to the interest rate sensitivity of REITs.

Table 4: Full Sample Risk Factor Analysis by Sector Comparison, December 1994 – December 31, 2014

	Alpha (t-stat)	β Market (t-stat)	β SMB (t-stat)	β HML (t-stat)	β Bond (t-stat)	R Squared %
All Equity	-0.06 (-0.25)	0.81 (9.76)	0.51 (6.75)	0.93 (8.55)	0.32 (2.23)	57.6
Office	-0.01 (-0.04)	0.88 (9.83)	0.49 (5.45)	0.96 (8.36)	0.25 (1.56)	53.7
Industrial	-0.31 (-0.70)	1.12 (6.32)	0.60 (3.37)	1.11 (5.57)	0.71 (1.96)	41.0
Retail	0.00 (0.00)	0.82 (7.28)	0.57 (5.58)	1.01 (6.66)	0.39 (1.97)	48.7
Apartment	0.13 (0.48)	0.73 (9.42)	0.44 (6.12)	0.91 (8.92)	0.18 (1.28)	47.7
Lodging	-0.52 (-1.50)	1.27 (10.72)	0.78 (6.30)	1.42 (7.54)	-0.16 (-0.77)	59.5
Storage	0.46 (1.63)	0.58 (7.30)	0.52 (6.14)	0.70 (6.22)	0.57 (3.30)	35.5
Healthcare	0.22 (0.72)	0.65 (8.05)	0.36 (3.51)	0.80 (6.05)	0.53 (2.67)	34.4

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

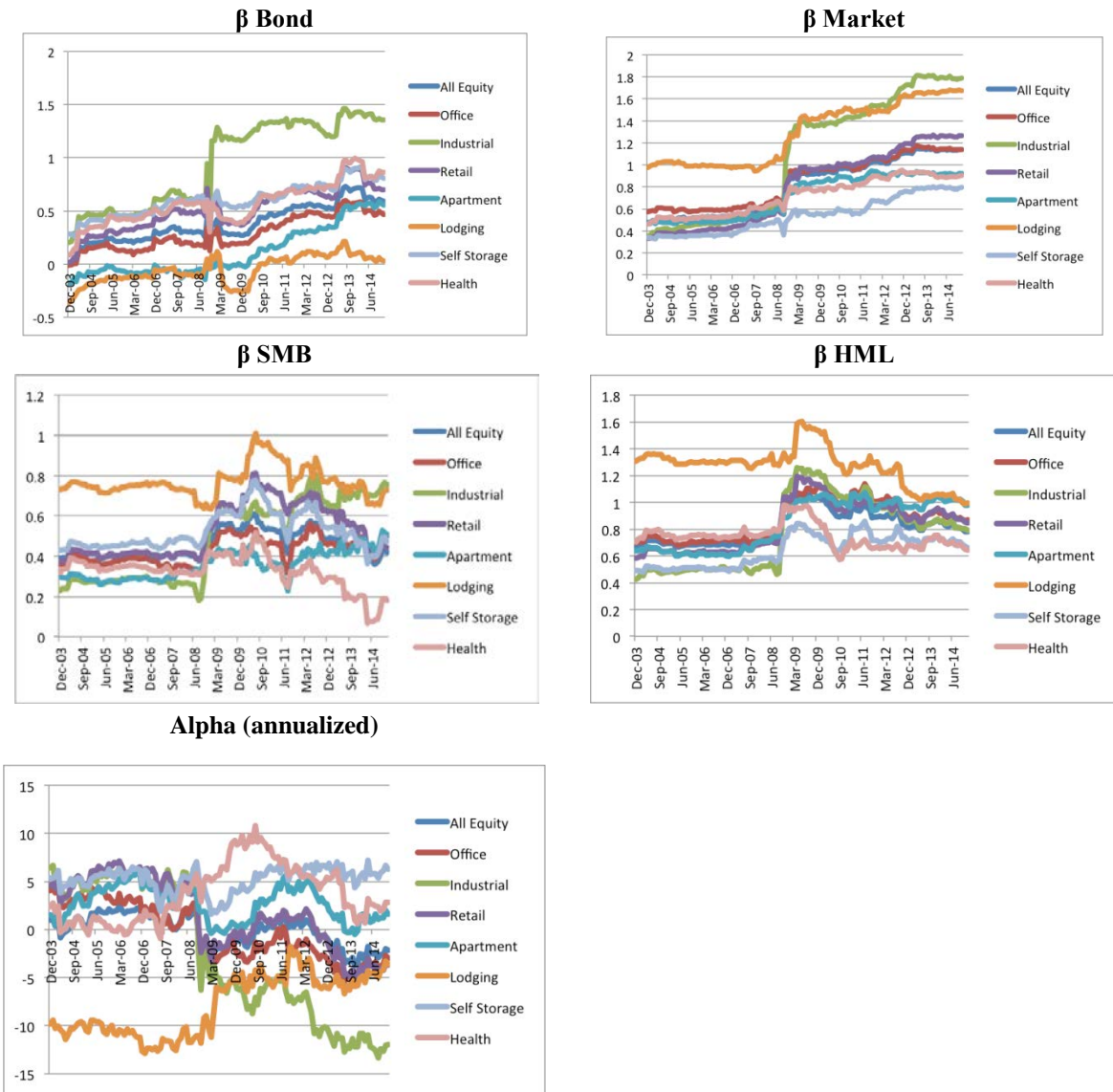
Revisiting the concept of lease duration in the context of bond betas

Compared to the industry average lease durations outlined in Table 1, we do not find a direct ranking correlation between our resulting bond betas and the industry estimates of lease durations. For example, industry participants estimate Lodging and Self Storage to have the lowest lease durations amongst all sectors, while our findings for the lowest bond betas were for Office and Apartments. As for the highest lease durations, these sectors are estimated to be Regional Mall, Office and Healthcare while our findings identified Industrial, Storage, and Health to have the highest bond betas. This finding contrasts with the conventional hypothesis by market participants that higher lease duration sectors display higher interest rate sensitivities.

The charts in Figure 7 display the results from running the time-varying rolling regressions of monthly rolling 120-month windows from 1994 to 2014, for each sector as well as the All Equity REIT index. As the charts indicate, both bond market and equity market betas have been increasing over time, pointing towards increasing interest rate risk inherent in REIT returns. In particular, in the 10 years period ending in September 2008 to January 2009, the bond beta's experienced big changes and have since steadily increased over time. That increase has been led by the Industrial sector. In line with our previous results, the Lodging sector has been the only sector exhibiting stronger decreases compared to other sectors (e.g. since July 2013). The analysis further displays that bond betas are not constant over time.

Amongst the most notable alpha results is the Industrial sector's alpha which has decreased substantially, and the Lodging sector's alpha which has increased steadily. Both however, have been negative whereas Self-storage has consistently remained amongst the highest displaying an average monthly rolling alpha of 0.44% over the full period.

Figure 9: Time Varying Beta Estimations, 10 Year Monthly Rolling Alpha and Bond, Market, SMB, and HML Betas, December 1994 – December 2014



Source: NYU MSR 2015 Capstone Team, NAREIT and FactSet

5.2.2 Refining bond betas by adding an Equity Sector Factor into the Four Factor Model

Another unique contribution of our analysis is an attempt to de-sensitize equity REIT betas from equity sector influence. We wanted to evaluate if we could refine the market factor by introducing a specific equity sector factor. We hypothesize that this sector specific factor would pick up sector specific attributes that were not being captured by the overall market factor and thereby enhance the regression model to produce “purer” bond betas. To accomplish this we regressed the seven different NAREIT REIT sector indices against the same Fama French model with an added bond market factor represented (four-factor model) but this time incorporating a fifth factor. This fifth factor was the corresponding equity sector index. To run this regression we used monthly return data for the period from December 1994 to December 2014⁵. We regressed monthly 10-year rolling returns over a 20 year period for each REIT sector index incorporating a varying fifth factor dependent on the sector as presented in the Table 5 on the following page.

⁵ With the exception of the Office sector where our data start data is 3/1/1994, as that is the inception date of the corresponding equity sector index; S&P 500 Sub/Office Svcs&Supplies TR Index

Table 5: NAREIT REIT Sector Index and Corresponding Equity Sector Index

NAREIT REIT Sector Index	Corresponding Equity Sector Index (5 th Factor)
FTSE NAREIT Equity Lodging/Resorts Index	S&P 500 Ind/Hotels Restaurants & Leisure TR Index
FTSE NAREIT Retail Index	S&P 500 Ind/Multiline Retail TR Index
FTSE NAREIT Equity Health Care Index	S&P 500 Sec/Health Care TR Index
FTSE NAREIT Equity Office Index	S&P 500 Sub/Office Svcs&Supplies TR Index
FTSE NAREIT Equity Industrial Index	S&P 500 Sec/Industrials TR Index
FTSE NAREIT Equity Self Storage Index	S&P 500 Sec/Industrials TR Index
FTSE NAREIT Equity Apartments Index	S&P 500 Ind/Hotels Restaurants & Leisure TR Index

Source: NYU MSRM 2015 Capstone Team, NAREIT, S&P and FactSet

As there was no corresponding sector index representing Apartments, we decided to use index that represent Lodging, the S&P 500 Industry; Hotels, Restaurants and Leisure index as a proxy. Similarly for Self-Storage, we used the S&P 500 Sector Industrials Index to represent the equity sector effect.

Comparing the results of our four-factor regression to our five-factor regression over the entire period we find that our R-Squared improves marginally in all cases but our bond betas remain consistent. Similar to the four-factor model results, we found statistically significant t-Stats for the Industrial, Retail, Self-Storage and Healthcare sectors. As outlined in the Table 6, the most significant improvements occurs in the Office sector where t-Stats results increased from 1.56 to 1.70 and Self-Storage sector which increased from 3.30 to 3.41. The t-Stat declined from 2.67 to 2.51 for the Healthcare sector, but the result remains statistically significant. In all the equity REIT sectors our bond betas are positive except for Lodging in which we find a bond beta of -0.16.

Table 6: 4-Factor and 5-Factor Regression Results, December 1994 to December 2013

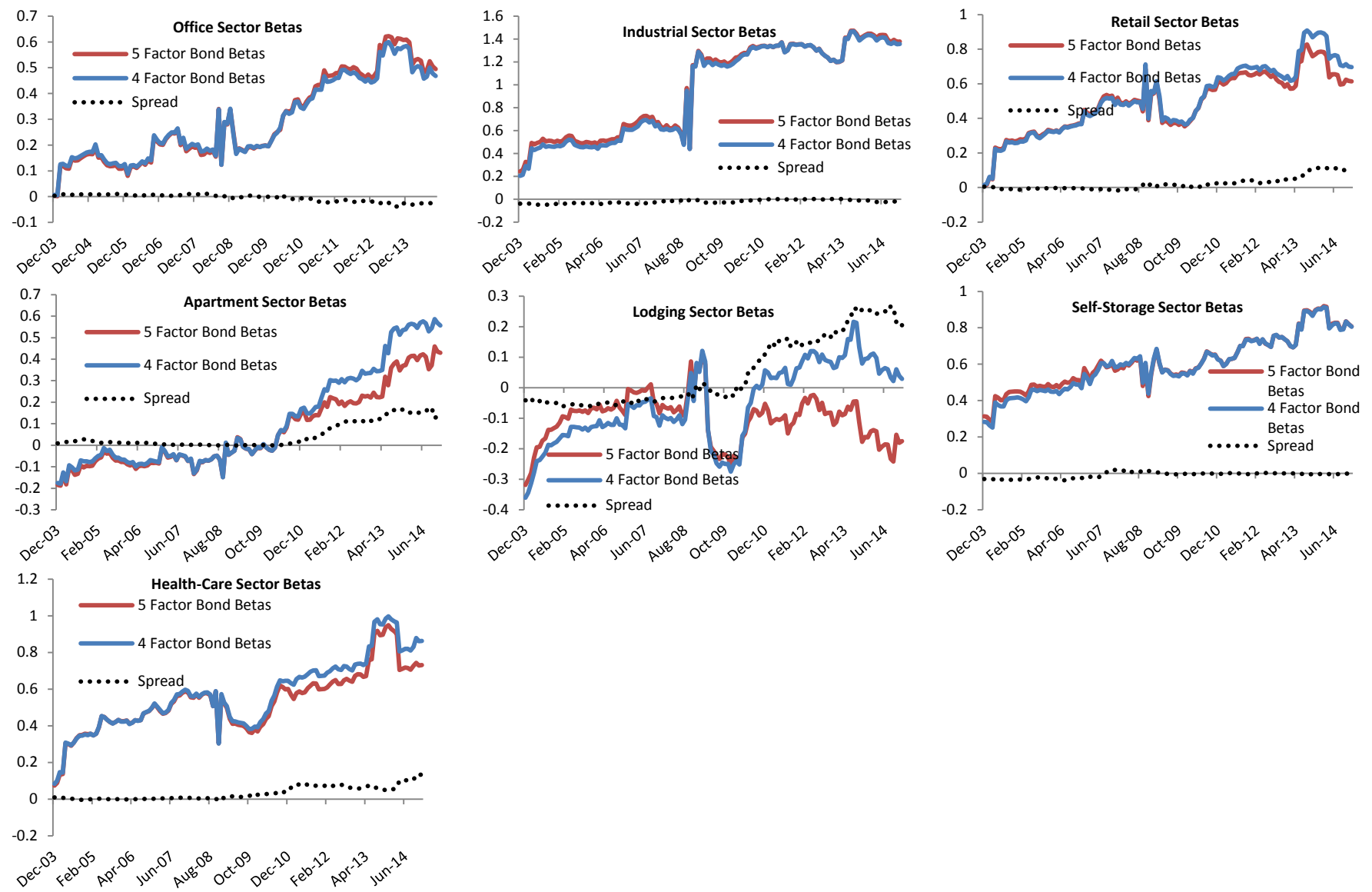
	Bond Beta	t-Stat	R-Squared
<i>5 Factor to Office⁶</i>	0.28	1.70	54.0
<i>4 Factor to Office⁶</i>	0.25	1.56	53.7
<i>5 Factor to Industrial</i>	0.72	2.0	41.1
<i>4 Factor to Industrial</i>	0.71	1.96	41.0
<i>5 Factor to Retail</i>	0.40	2.05	50.0
<i>4 Factor to Retail</i>	0.39	1.97	48.7
<i>5 Factor to Apartment</i>	0.17	1.27	48.0
<i>4 Factor to Apartment</i>	0.18	1.28	47.7
<i>5 Factor to Lodging</i>	(0.16)	(0.85)	61.0
<i>4 Factor to Lodging</i>	(0.16)	(0.77)	59.5
<i>5 Factor to Self-Storage</i>	0.58	3.41	35.7
<i>4 Factor to Self-Storage</i>	0.57	3.30	35.5
<i>5 Factor to Health</i>	0.50	2.51	35.1
<i>4 Factor to Health</i>	0.53	2.67	34.4

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

The next stage considered the influence of the equity sector on REIT sector bond betas over time by running the five-factor regression model over monthly 10-year rolling windows from December 1994 to December 2014. As outlined in the Figure 8, the four-factor and five-factor bond betas are compared over rolling periods. Our results indicate that in the Office, Industrial and Self-Storage sectors both four-factor and five-factor betas track closely, indicating that the inclusion of the equity sector in the model had minimal influence on the measurement of interest rate sensitivity.

The Retail, Apartments, Lodging and Healthcare sectors show an interesting divergence in four-factor and five-factor bond betas that seems to occur around the same time in 2010, and remain divergent up to December 2014. While the divergence in the Retail and Healthcare sectors appears muted, the difference for Lodging and Apartments is greater. Finally, in all four cases the five-factor bond betas are lower than the four factor betas.

Figure 10: Monthly Rolling 10-Year 4-Factor and 5-Factor Equity REIT Bond Betas from December 1994 to December 2014



Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

6. Individual REITs Analysis

In the next phase of our analysis we constructed cross sectional regressions for individual equity REITs representing all sectors. The regressions were run across various characteristics that in our opinion have an impact on the equity REITs interest rate sensitivity. For each equity REIT subsector defined by NAREIT in the NAREIT All Equity REIT Index, we selected the six largest REITs by market capitalization as of December 31, 2014. As outlined in Appendix 11, our data set represents 78% of the total market capitalization of the NAREIT All Equity REITs index as of December 31, 2014⁶. To ensure we had an adequate history to analyze, we eliminated any equity REITs with inception dates after January 1, 2009⁷.

Using the four-factor model, we conducted regressions this time using five years of monthly returns for each equity REIT. This resulted in the output of 70 five-year four-factor bond betas that were later regressed across various equity REIT characteristics.

To assess whether our sample bond betas were representative of their sector, in Table 7 we grouped the four-factor bond betas for each individual REIT by sector and compared them to the corresponding sector index four-factor bond betas. We further apply period context by comparing the bond betas over the last five years to sector index bond betas calculated over the last twenty years ending in December 2013.

⁶ Where there were less than six equity REITs in a subsector, we selected all available.

⁷ We expanded our data set to include four additional Residential Equity REITs for robustness. We excluded the mortgage REITs index because unlike equity REITs where the underlying is real estate property, mortgage REITs underlyings are loans and other obligations that are secured by real estate collateral.

Table 7: Five-Year Individual REIT Bond Betas by Sector and Corresponding 5-Year and 20-Year NAREIT Sector Index Bond Betas ending at December 31, 2013

NAREIT Equity REIT Sectors	Last 20 Years			Last 5 Years														
	NAREIT Index 4 Factor Bond Beta	NAREIT Index 4 Factor Bond Beta	Market Cap Weighted Average 4 Factor Bond Beta	Individual REIT Bond Betas by NAREIT Sector														
Office	0.25	0.38	0.37	0.70	0.35	(0.14)	0.53	(0.46)	0.91									
Industrial ⁸	0.71	0.56	0.68	0.55	0.99	(0.03)	1.05	0.64	0.47	0.35	0.56	(0.79)	0.53					
Retail	0.39	0.52	0.11	1.36	1.29	(0.70)	(2.11)	0.58	1.28	(0.31)	0.60	1.02	(1.07)	0.65	0.21	2.17	(1.28)	0.07
Apartment	0.18	0.81	0.85	0.07	0.53	1.10	0.70	0.95	1.14	0.82	0.82	0.85	0.90	0.40	1.56	(0.24)		
Lodging	-0.16	-0.23	-0.31	0.51	0.26	(0.57)	(0.39)	(0.33)										
Self-Storage	0.57	0.82	0.76	0.04	0.57	0.86	1.01											
Healthcare	0.53	0.75	0.73	0.67	0.65	1.27	0.61	0.74	0.84									
Timber ⁹	N/A	N/A	-0.41	-0.12	-0.69	0.37	-0.16											
Diversified ¹⁰	N/A	N/A	0.46	0.39	0.75	0.6	0.16											

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

We find for all sectors available the five-year sector index bond betas differ from their twenty-year counterparts. In all cases except for the Industrial and Lodging sectors, the five-year bond betas are higher implying that the interest rate sensitivity of each of these sectors has increased over the last five-years as compared to their longer term historical sensitivity. The five-year industrial sector bond beta is 0.56, while the twenty year value is 0.71. The most notable differences over time are in the Apartment REIT sector where the five-year bond

⁸ The Industrial Sector includes equity REITs from designated in sub-sectors; Industrial and Industrial Mixed. Equity REITS in the sub-sector Industrial Office have been classified as Office

⁹ There is no NAREIT Sector Index representing Timber REIT.

¹⁰ The Diversified Sector encompasses a wide range of equity REIT types and therefore cannot be compared to any equity REIT sector index.

beta was 0.81 while the twenty year bond beta was 0.18, and in Healthcare in which the five-year bond beta was 0.75 but the longer term beta to the bond market was 0.5.

When we calculated market cap weighted four-factor bond betas for the individual REITs by sector¹¹ our results mostly line up with the sector index with the exception of the Retail sector. There are 38 retail equity REITs in the NAREIT All Equity REIT index, this is the largest number of constituents of all the REIT sectors and comprises 23% of the market capitalization of the All Equity REIT index as of December 31, 2014. With fifteen individual REITs participating in the regression, we had the largest number of individual REITs in this sector. However, four of the top fifteen largest retail sector equity REITs by market capitalization had to be excluded from our regression analysis as they did not have five years of return data. This may have affected the market cap weighted average betas for this sector.

When examining our results for the individual REIT bond betas, we find they vary significantly even within a sector. We see the greatest differences in the Retail sector which encompasses three sub-sectors; regional malls, free-standing retail and shopping centers. When separated by sub-sector in Table 8, we find that all free-standing retail equity REITs appear to have positive and mostly larger bond betas implying this sub-sector has on average greater interest rate sensitivity than the rest of the retail sector. Regional malls have mostly lower or negative bond betas, implying lower interest rate sensitivity within the Retail sector, while shopping centers

¹¹ Apartment Sector REITs BRE Properties and Essex merged in April 2014. As our bond betas were calculated to December 31, 2013 when computing the market cap weighted bond beta for the Apartment Sector we applied a 63% weighting to ESS and a 37% weighting to BRE to represent the distribution of company's combined common stock across ESS and BRE stock holders. <http://www.marketwatch.com/story/essex-property-trust-inc-and-bre-properties-complete-162-billion-merger-2014-04-01>

show a range of bond betas, positive and negative, indicating the interest rate sensitivity differs by individual equity REIT.

Table 8: Equity REIT Retail Sector Bond Betas by Sub-Sector, December 2008 to December 2013

Retail Sub-Sectors	Individual REIT 5 year 4-Factor Bond Betas					
Free Standing	1.4	1.3	0.6	2.2		
Regional Malls	(0.7)	(2.1)	0.6	1.0	(1.3)	0.1
Shopping Centers	1.3	-0.3	(1.1)	0.7	0.2	

Source: NYU MSRM 2015 Capstone Team, NAREIT, and FactSet

As outlined in Table 7, all the individual equity REITs in the Healthcare and Self-Storage sectors are positive. The Industrial and Apartment REIT sectors also mostly display positive five-year bond betas. The office sector is a sub-sector of the Industrial sector but has its own NAREIT Sector Index. This sector also showed varying bond betas, both positive and negative, while the weighted average is positive 0.37, and in line with the bond beta for the office sector index. Finally, the individual equity REITs in the Lodging sector displayed mostly negative bond betas and a weighted average bond beta of -0.3. This is lower than the long-term average and the five-year bond beta for the Lodging sector index.

6.1 Impact Assessment of the selected characteristics to the Interest Rate Sensitivities of Individual REITs

Having determined that the interest rate sensitivities for the individual equity REITs in our sample were reasonably representative of their respective sector, we regressed these bond betas across various characteristics we believed would influence their interest rate sensitivity.

To gather these characteristics we used various sources including data providers Bloomberg and FactSet, but we also retrieved data directly from the REITs Annual Reports in our sample. Informed by academic literature, we expanded on variables considered by Madura, Allen, and Springer (2000), who investigated the impact of asset structure, financial leverage, management strategy and the degree of portfolio specialization on interest rate risk exposure of REITs. In addition to measures of leverage, we selected the following characteristics to investigate: S&P credit ratings, leverage ratios, weighted average lease term, effective (or weighted average) interest rate on debt and sensitivity, each of which are explained in further detail below.

S&P Credit Ratings

Credit ratings for U.S. REITs or Real Estate Operating Companies (REOC) represent S&P's current opinion of the company's overall ability to repay its debt obligations. Standard & Poor's describes their credit rating methodology for REITs as a combination of a comprehensive assessment of business strategy and financial statement analysis, along with an equally thorough structured finance review and evaluation of the property portfolio.^{xlvii}

Amongst the criteria considered by S&P in their ratings methodology are market position, asset quality, capital structure, profitability and financial profile. Given the consideration to profitability and financial profile, we hypothesized that equity REITs with higher credit ratings would have lower interest rate sensitivities and therefore lower bond betas. As of the third

quarter of 2014, 62 Equity REITs were rated investment grade, making up 67% by equity market capitalization^{xlviii}. As outlined in Table 9, within our data sample we found that 51 or 73% of the 70 sample equity REITs had current S&P credit ratings. Of those 51, 33 or 65% had an investment grade rating.

Table 9: REIT Sample Investment Grade vs. Non-Investment Grade by Sector

	Investment Grade	Non-Investment Grade	Not Available	Investment Grade out of Total Rated
All REITs	47%	26%	27%	65%
Diversified	50%	17%	33%	75%
Healthcare	50%	17%	33%	75%
Industrial	50%	50%	0%	50%
Infrastructure	25%	75%	0%	25%
Lodging	20%	40%	40%	33%
Residential	46%	31%	23%	60%
Retail	40%	20%	40%	67%
Self-Storage	75%	0%	25%	100%
Timber	83%	17%	0%	83%

Source: NYU MSRM 2015 Capstone Team, Bloomberg and S&P

Leverage Ratios

For our analysis we selected three leverage ratios available through FactSet fundamentals. These included total debt to total capital, short term debt to total debt and long term debt to total debt.^{xlix} From equity REIT publicly available 10-K filings and/or Annual Reports we also gathered the percent of actual fixed rate debt to floating rate debt. We expected to find that equity REITs with higher debt, specifically those with higher floating rate debt, would exhibit higher interest rate sensitivity and display higher bond betas.

Table 10 summarizes our findings for total debt to total capital across our sample. We find differences in the market cap weighted average of total debt to total capital by sector. The

Infrastructure sector appears to have the highest debt to capital ratio at 73.03, this seems intuitive as we would expect Infrastructure REITs to require significant leverage to own and maintain large scale infrastructure. The sector with the lowest debt to capital was Self-Storage. This might be indicative of lower capital and maintenance requirements of self-storage units and the ability to generate regular cash flow from short term lease arrangements.

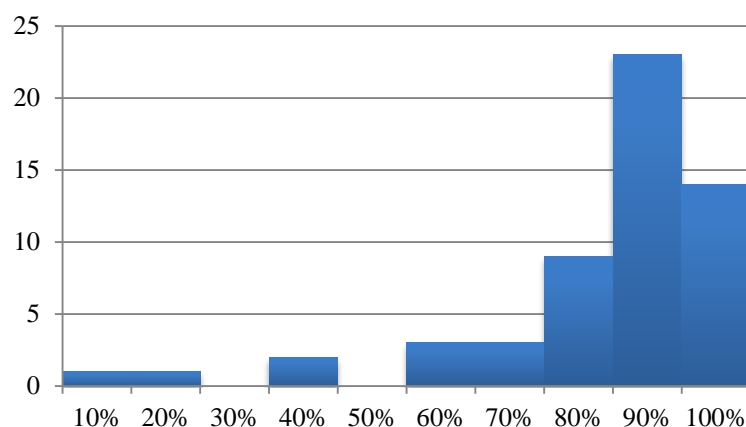
Table 10: Market Capitalization Weighted Average Total Debt to Total Capital by REIT Sector as of December 31, 2014

REIT Sample Total Debt: Total Capital	Market Cap Weighted Average Total Debt/ Total Capital
All REITS	54.72
Diversified	61.97
Healthcare	48.65
Industrial	48.34
Infrastructure	73.03
Lodging	40.67
Residential	53.83
Retail	66.27
Self-Storage	20.81
Timber	51.66

Source: NAREIT and FactSet

As outlined in Figure 11, we also found that a majority of equity REITs had a higher proportion of fixed debt to floating debt possibly indicating lower interest rate sensitivity.

Figure 11: Histogram of Fixed to Floating Debt across REIT sample as of Dec 31, 2014



Source: NYU MSRM 2015 Capstone Team, NAREIT and Annual Reports

Weighted Average Lease Term

The weighted average lease term measures the asset weighted lease term across the equity REIT portfolio. We believed this characteristic could be used to indicate asset duration for equity REITs, and hypothesized that equity REITs with longer lease terms would exhibit greater interest rate sensitivity, and exhibit higher bond betas. We also research if lease durations cluster by sector, and if so results in differing interest rate sensitivity by sector¹².

Table 11 present the market cap weighted average lease terms for the equity REITs in our sample set by sector.

¹² In collecting this data, where average full lease term was not provided, average remaining lease terms were used. Across the sample set, weighted average lease terms were not available for any timber sector REITs.

Table 11: REIT Sample - Overview of Market Capitalization Weighted Average Lease Term in Years

	Minimum	Maximum	Average
All REITS	0.1	25.0	7.3
Diversified	7.0	8.1	7.5
Healthcare	5.0	15.0	13.5
Industrial	3.3	11.9	7.2
Infrastructure	10.0	25.0	10.0
Lodging	1.0	20.0	14.8
Residential	N/A	14.0	2.1
Retail	3.0	15.0	6.25
Self-Storage	0.1	5.2	0.41
Timber	0.0	0.0	NA

Source: NYU MSRM 2015 Capstone Team, NAREIT and Equity REIT Annual Reports

These results are broadly consistent with industry average characteristics summarized in Table 4 as reported by Cohen & Steers in their July 2014 Viewpoints¹, with the notable exception of Lodging. Federal income tax laws restrict REITs and their subsidiaries from operating or managing hotels. Most REITs lease all of their hotels to taxable REIT subsidiaries (“TRS”) which pay rent that can be treated as “rents from real property.” The TRSs retain third-party managers, who are deemed to be “eligible independent contractors”, to operate the hotels pursuant to management agreementsⁱⁱ. The weighted average lease terms we collected from SEC filings and Annual Reports capture the lease durations from agreements between REITs and their taxable subsidiaries, not room rental lease durations. Therefore we may not be able to treat the weighted average lease terms for these equity REITs in the same way as equity REITs of other sectors. For this reason, we analyzed the impact of weighted average lease term both including and excluding the Lodging sector.

The Use of Derivatives

Horng and Wei (1999) examined the use of derivatives in REITs and reported that from their observations of Annual Reports, REITs use interest rate derivatives primarily to hedge financing costs and interest rate sensitive assets. They found that, at the time, 41% of REITs used interest rate derivatives. Assuming our samples are comparable the use of derivatives amongst REITs is increasing. As outlined in Table 12 and derived from data in Appendix 11, we found 83% of the REITs in our sample use some form of derivatives. We also found the use of derivatives is dispersed across sectors. The most commonly used derivatives amongst our sample set were interest rate swaps, followed by interest rate caps. This would be consistent with their finding that most REITs are using derivatives to manage their interest rate exposure. We found a number of REITs with global exposure in our data set that were using currency swaps to hedge currency exposure. We would expect to find higher bond betas for those equity REITs that were not employing derivatives to manage interest rate risk. As our analysis did not take into account the notional amount of derivatives used and collateral agreements in place, we were unable to draw any conclusions on how effectively the equity REITs in our sample used derivatives to hedge their interest rate risk. This would be an interesting area of further study.

Table 12: REIT Sample Derivative Use by Sector

	Use Derivatives	Do Not Use Derivatives
All REITs	83%	17%
Diversified	100%	0%
Healthcare	50%	50%
Industrial	69%	31%
Infrastructure	100%	0%
Lodging	60%	40%
Residential	85%	15%
Retail	100%	0%
Self-Storage	75%	25%
Timber	100%	0%

Source: NYU MSRM 2015 Capstone Team, NAREIT and Equity REIT Annual Reports

Effective (or Weighted Average) Interest Rate on Debt

From equity REIT 10-K filings and Annual Reports we were able to obtain the effective or weighted average interest rate on debt. This was often reported for both fixed and variable debt, but was more consistently presented on total debt. The weighted average interest rate on debt would certainly be influenced by the proportion of long term and short term debt, and in conjunction with the total amount of debt may inform a REITs ability to handle increases in interest rates. We would expect to see REITs with higher effective interest rates exhibit higher interest rate sensitivity, and therefore correspond with higher bond betas.

Sensitivity

Measures of sensitivity were also obtained from REIT 10-K filings and normalized across all REITs as the resulting dollar amount increase in interest expense due to a 1% increase in interest rates. To allow for comparability across REITs we divided sensitivity by total debt. We would expect this characteristic to have the most profound relationship with our bond betas as this is a direct measure of interest rate sensitivity of each equity REIT.

6.2 Univariate and Multivariate Regression Analysis

6.2.1 Univariate Regressions to Annual Report Characteristics

We began by running a univariate regression of five-year bond betas of the 70 individual REITs against their sector assignments and using a constant of 0. Seven out of the nine sectors displayed positive coefficients indicating that those REIT sectors are positively correlated with bond betas, or interest rate sensitivity. The Lodging and Timber sectors displayed negative coefficients. As outlined in Table 12 and in Appendix 2, three sector results were statistically significant; Healthcare, Residential and Industrial. The Healthcare sector coefficient was 0.80, with a t-Stat of 2.85. Based on our lease duration hypothesis and relatively longer average lease durations of Healthcare REITs standing at 13.5 years, we would have expected the Healthcare sector to show a strong positive coefficient. Contrary to our expectations, we found a positive coefficient of 0.74 for Residential REITs and a t-Stat of 3.89 while our sample set's market cap weighted average lease duration was only 2.1 years. Finally the Industrial sector also displayed a statistically significant t-Stat of 2.14, and a positive coefficient of 0.34, a result that appears in line with the sample's calculated weighted average lease duration of 7.2 years.

Although not statistically significant, the Lodging sector coefficient of -0.10 appears to disconnect with the cap weighted average lease duration for the sector which was 14.8 years. This might indicate that the lease terms of the underlying property to the TRS were not as determinant of interest rate sensitivity as room lease durations. The Self-Storage REITs in our sample had an average weighted average lease duration of 0.41 but resulted in a higher than anticipated coefficient of 0.6. Again, this result was not statistically significant with a t-Stat of 1.81. Finally, Retail and Diversified REIT sectors were in line with our expectation, but again did not indicate statistical significance. The overall regression had an adjusted R-Squared of 0.3.

Our second regression, the results of which are outlined in Table 13 and Appendix 3, of the individual REIT bond betas and their corresponding weighted average lease terms yielded an R-Squared of 0.0. The coefficient for weighted average lease term was not directionally intuitive at -0.02. We would have expected a positive coefficient where higher weighted average lease terms correspond with higher bond betas, or higher interest rate sensitivity. Longer term leases can cause rental income to be locked in for longer periods, and thus decreasing a REITs ability to manage income to offset increases in interest expenses. With a t-Stat of -1.31, this result was also not statistically significant.

Taking into account the possibly erroneous interpretation of weighted average lease term for the Lodging sector we reran this regression excluding all the sample equity REITs in the Lodging sector. However, as shown in Appendix 3.a this regression also yielded a negative coefficient for weighted average lease term of -0.01 and was also not statistically significant with a t-Stat of -0.73. Further, the adjusted R-Squared was 0.0.

Although these results were not what we expected, we know there are many other factors that could offset the interest rate risk associated with long-term leases, such as the use of derivatives and the amount of leverage. In the multivariate regressions in section 6.2.2 we present the results for these characteristics both individually and in concert.

Our third regression, which can be referenced in Table 13 and Appendix 4, looked at the use of derivatives across the sample set. The use of derivatives is indicated with a binary independent variable in which a value of 2 indicated a REIT uses derivatives and a value of 1 if it did not. This regression had an adjusted R-squared of 0.0. Though not statistically significant with a t-Stat of -1.5, the co-efficient for the use of derivatives was -0.32. The negative coefficient is in line with what we would have expected given that a higher value (indicating the use of

derivatives) corresponds with a lower bond beta and lower interest rate sensitivity. As mentioned earlier, the most common type of derivative used by the REITs in our sample set were interest rate swaps.

Our fourth regression explored the interaction of individual REIT bond betas and the amount of leverage, represented by total debt to total capital. Referring to the results in Table 13, we would have expected to see a positive relationship between the amount of leverage and interest rate sensitivity. However, this regression resulted in a co-efficient of 0.00. This result was not statistically significant with a t-Stat of -0.22 and the overall regression yielded a negative R-squared of 0.0, indicating no real relationship between the REIT bond betas and their use of leverage. The use of derivatives may be offsetting the interest rate risk of highly levered REITs. This may be exacerbated by the fact that our sample set was comprised of the largest REITs by market capitalization while Horng and Wei (1999) found that REITs that were smaller and had a larger amount of debt tended to use more derivatives. The full set of results for this regression is available in Appendix 5.

We then went a step further to explore the ratio of fixed debt to floating debt. The positive coefficient for this variable, as shown in Table 13, was not in line with our expectation and was not statistically significant. We expected to see equity REITs with a higher portion of fixed rate debt to be less interest rate sensitive than those with higher variable rate debt. The positive coefficient for this variable was 0.24 and was associated with a t-Stat 0.54. The full regression results are available in Appendix 5.a.

Our next regression considered the current S&P credit rating of the individual REITs as the dependent variable. S&P credit ratings are issued as letter grades. Therefore, in order to run this regression we converted each of the 22 different S&P ratings to a numerical value where the

highest rated (AAA) REIT received a value of 23 and the lowest rated REIT (D) received a value of 2. REITS that were non-rated (NR) received a score of 1 and REITs that did not have a rating were excluded from the regression. In our data set we had 51 REITs that were covered by S&P and had received a rating. This regression resulted in an adjusted R-squared of 0.0 as shown in Table 13 and in Appendix 6. The coefficient for the S&P credit rating was 0.03 with a t-Stat of 1.80, although not a very strong positive coefficient we were surprised to see this result as it indicates the higher (or better) the S&P credit rating the greater the interest rate sensitivity. We would have expected a negative coefficient for this regression and hypothesized that there may be a bifurcation in the behavior of investment grade versus non-investment grade REITs. We tested by running an additional regression on the bond betas of just the investment grade REITs. Our data set contained 33 REITs. This accounted for 65% of all REITs with ratings and 47% of the entire data set. This regression, summarized in Table 13 and Appendix 6.a, resulted in a stronger positive coefficient of 0.17, with an almost statistically significant t-Stat of 1.96. However, this relationship again is the inverse of what we would expect. This possibly indicates that with regard to REITs, the market does not view credit ratings to be indicative of interest rate risk and instead is being interpreted as an indicator of default risk, and therefore displaying a different behavior. We did not have sufficient data to run a regression for the non-investment grade rated REITs.

There were a number of other univariate regressions that we considered where our chosen model did not follow the trend of our data. We generated a negative adjusted R-squared for the following univariate regressions to sensitivity, long-term debt as a percentage of total debt and the S&P Outlook. All of these characteristics would intuitively impact interest rate sensitivity

however our results indicated no relationship for these independent variables to our sample REIT bond betas. These results are also summarized in Table 13.

Table 13: Univariate Regression Results Summary

Univariate Regression Characteristics	# of Observations	Co-efficient	T-Stat	Adjusted R-Square	Reference
Weighted Average Lease Term	63	-0.02	-1.31	0.0	Appendix 2
Weighted Average Lease Term (excl. Lodging)	58	-0.01	-0.73	0.0	Appendix 2a
Use of Derivatives	70	-0.32	-1.46	0.0	Appendix 3
Leverage Ratio (Total Debt to Total Capital)	68	0.00	-0.22	0.0	Appendix 4
Leverage Ratio (Long Term Debt to Total Debt)	69	-0.23	-0.52	0.0	
Leverage Ratio (Fixed to Floating Debt)	69	0.24	0.54	0.0	Appendix 4a
Effective Interest Rate	69	-1.41	-0.16	0.0	
Sensitivity to Total Debt	42	0.00	-0.24	0.0	
S&P Credit Rating	51	0.03	1.80	0.0	Appendix 5
Investment Grade Rating	33	0.17	1.96	0.1	Appendix 5a
S&P Outlook	41	0.02	0.08	0.0	

Source: NYU MSRM 2015 Capstone Team, NAREIT and Equity REIT Annual Reports

6.2.2 Multivariate Regressions to Annual Report Characteristics

In this section we explored four multivariate regressions combining various characteristics from our sample of equity REITs. The summarized results for these regressions are available in Table 14. The first multivariate model regressed 63 equity REIT bond betas to weighted average lease term and the use of derivatives. Our results displayed negative coefficients for both dependent variables consistent with the univariate regressions. The negative coefficient for weighted average lease term remains opposed to our hypothesis, while the use of derivatives continues to indicate a negative relationship with interest rate risk as we would expect. The adjusted R-squared was 0.0, indicating the combined model was not a better fit to the data than the univariate models were.

The second multivariate regression considered weighted average lease term and S&P credit ratings for 44 individual equity REITs. Again the directionality of the coefficients was consistent with the univariate models we have previously tested but remained counter intuitive. Similarly this regression resulted in an adjusted R-squared of 0.01, indicating this multivariate model was not a better fit for the data set.

The third multivariate regression combined weighted average lease term with total debt to total capital. Yet again we found that the directionality of the coefficients was consistent with the univariate models but the reverse of our hypothesis. Similarly this regression resulted in an adjusted R-squared of 0.0, indicating this multivariate model did not provide a better explanation of our data set.

The final multivariate regression incorporated all four previously mentioned independent variables; weighted average lease term, S&P credit ratings, total debt to total capital and the use of derivatives across 43 individual equity REITs. The direction of all but one co-efficient

remained unchanged from their univariate regressions. When considered with the three other variables, total debt to total capital displayed a positive co-efficient, where it had previously had a slightly negative co-efficient. The t-Stat did not show statistical significance for this variable at 0.89. Finally, the adjusted R-squared for the regression was 0.0.

Table 14: Multivariate Regression Results Summary

Multivariate Regression Characteristics	# of Observations	Co-efficient	T-Stat	Adjusted R-Square	Reference
Weighted Average Lease Term	63	-0.02	-1.21	0.0	Appendix 6
Use of Derivatives		-0.22	-1.07		
Weighted Average Lease Term	44	-0.02	-1.16	0.0	Appendix 7
S&P Credit Ratings		0.02	1.04		
Weighted Average Lease Term	61	-0.02	-1.31	0.0	Appendix 8
Total Debt to Total Capital		0.00	-0.25		
Weighted Average Lease Term	43	-0.01	-0.81	0.0	Appendix 9
S&P Credit Ratings		0.02	1.08		
Use of Derivatives		-0.08	-0.29		
Total Debt to Total Capital		0.01	0.89		

Source: NYU MSRM 2015 Capstone Team, NAREIT and Equity REIT Annual Reports

7. Conclusion

The results from time-varying rolling regressions by sector and the All Equity REIT index indicate that bond market betas have been increasing over time. This trend implies increasing interest rate risk in REIT returns. In particular, over the last 10 years, bond beta trends show significant fluctuations and have been steadily increasing. Our individual REIT analysis also found that when summarized by sector, in all except for the Industrial and Lodging sectors, five-year bond betas were higher than their historical averages. This again implies that the interest rate sensitivity of each of these sectors has increased.

These results seem concerning in light of the probable increase in interest rates going forward. Post the global financial crisis, and the initiation of the QE program, the Fed Funds rate is at historical lows of close to zero. However, the Fed began to taper QE in December 2013, with the first rate hike forecasted to occur by the fourth quarter of 2015.^{lii} Against this backdrop, our results are particularly poignant given increasing investor concern of the impact of interest rates on different asset classes, especially REITs.

When examining results for individual REIT bond betas, we discovered significant heterogeneity of interest rate risk, even amongst individual equity REITs within the same sector. We observed the greatest divergences in the Retail sector, which is likely due to the fact that it encompasses three sub-sectors which behave differently.

Disturbingly, we were unable to explain this heterogeneity by differences in debt profiles, use of derivatives, weighted average lease duration, among other characteristics that we considered. This is in line with the findings of Allen, Madura and Springer (2000) who also could not prove REITs have the ability to impact their exposure to interest rate changes through individual

characteristics such as financial leverage, management strategy, degree of specialization, or asset structure.^{liii}

The lack of correlation between intuitively related REIT characteristics to interest rates may be explained by the effective use of derivatives, which should markedly reduce interest rate sensitivity. Given the extent of the use of derivatives amongst our sample set, this could significantly impact our analysis.

Another possible explanation for our results could be the selected timeframe. The duration of the return period analyzed was 2008 to 2013, a period during which interest rates were essentially zero. Quantitative Easing and a zero interest rate policy may be distorting the relationship between leverage related factors and interest rate sensitivity. Additionally, our characteristics were a static representation of our individual REIT sample and therefore also only consider a single point in time. Extending the timeframe and gathering time varying characteristics could be a further area of study.

Appendix 1: 5-Factor Regressions Results by Sector for period from December 1994 to December 2014¹³

5 Factor to Office			5 Factor to Industrial			5 Factor to Retail			5 Factor to Health		
	Coefficient	T-Stat		Coefficient	T-Stat		Coefficient	T-Stat		Coefficient	T-Stat
Alpha	-0.0316	-0.1137	Alpha	-0.3089	-0.6849	Alpha	-0.0229	-0.0726	Alpha	0.142	0.4508
Market	0.9138	9.2492	Market	0.9456	2.896	Market	0.6757	7.3046	Market	0.5354	4.6044
SMB	0.4961	5.4398	SMB	0.6245	3.4866	SMB	0.5757	5.9334	SMB	0.43	3.3199
HML	0.9806	8.357	HML	1.0598	4.7315	HML	0.9598	7.1253	HML	0.7922	5.9745
Bond	0.2761	1.7044	Bond	0.7196	2.0013	Bond	0.399	2.0465	Bond	0.5031	2.5143
Sector	-0.0326	-0.5898	Sector	0.1627	0.8056	Sector	0.1487	2.0275	Sector	0.1649	1.1875
R-Squared	54.0236		R-Squared	41.1137		R-Squared	50.0306		R-Squared	35.1439	

5 Factor to Apartment			5 Factor to Lodging			5 Factor to Self Storage		
	Coefficient	T-Stat		Coefficient	T-Stat		Coefficient	T-Stat
Alpha	0.1104	0.409	Alpha	-0.594	-1.7229	Alpha	0.4637	1.6399
Market	0.6592	6.3491	Market	0.9983	9.1473	Market	0.4512	2.0307
SMB	0.4545	5.9651	SMB	0.8437	6.6989	SMB	0.5402	6.1144
HML	0.8746	8.2467	HML	1.3062	7.3	HML	0.658	4.9955
Bond	0.1737	1.2723	Bond	-0.1648	-0.846	Bond	0.5825	3.4061
Sector	0.0843	1.1669	Sector	0.3125	3.0021	Sector	0.1193	0.6702
R-Squared	47.9898		R-Squared	60.9653		R-Squared	35.6523	

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

¹³ With the exception of the Office sector where our data start data is 3/1/1994, as that is the inception date of the corresponding equity sector index; S&P 500

Sub/Office Svcs&Supplies TR Index

Appendix 2: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and Equity REIT Sectors for 70 Individual Equity REITs¹⁴

<i>Regression Statistics</i>	
Multiple R	0.61281
R Square	0.37553
Adjusted R Square	0.27724
Standard Error	0.68386
Observations	70

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	9	17.1554	1.9062	4.0759	0.0004
Residual	61	28.5275	0.4677		
Total	70	45.6829			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-	-	-	-	-	-	-	-
Residential	0.7378	0.1897	3.8899	0.0003	0.3585	1.1171	0.3585	1.1171
Lodging	(0.1016)	0.3058	(0.3321)	0.7409	(0.7131)	0.5100	(0.7131)	0.5100
Retail	0.2508	0.1766	1.4203	0.1606	(0.1023)	0.6039	(0.1023)	0.6039
Infrastructure	0.3862	0.3419	1.1294	0.2632	(0.2976)	1.0699	(0.2976)	1.0699
Industrial/Office	0.3783	0.1766	2.1426	0.0361	0.0252	0.7314	0.0252	0.7314
Healthcare	0.7971	0.2792	2.8549	0.0059	0.2388	1.3553	0.2388	1.3553
Timber	(0.1496)	0.3419	(0.4376)	0.6632	(0.8334)	0.5341	(0.8334)	0.5341
Self-Storage	0.6183	0.3419	1.8084	0.0755	(0.0654)	1.3021	(0.0654)	1.3021
Diversified	0.4770	0.3419	1.3950	0.1681	(0.2067)	1.1607	(0.2067)	1.1607

Source: NAREIT, FactSet and NYU MSRM 2015 Capstone Team

¹⁴ Timber sector saves as the baseline for this regression. This regression was run with a constant set to 0.

Appendix 3: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and Weighted Average Lease Terms of 63 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.1656
R Square	0.0274
Adjusted R Square	0.0115
Standard Error	0.6371
Observations	63

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.6983	0.6983	1.7205	0.1945
Residual	61	24.7574	0.4059		
Total	62	25.4557			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.61200	0.12910	4.74043	0.00001	0.35385	0.87016	0.35385	0.87016
Weighted Average Lease Term	(0.02033)	0.01550	(1.31169)	0.19454	(0.05131)	0.01066	(0.05131)	0.01066

Data Source: NYU MSRM 2015 Capstone Team, NAREIT, FactSet and Individual REIT Annual Reports

Appendix 3.a.: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and Weighted Average Lease Terms of 58 Individual Equity REITs excluding all Equity REITs in the Lodging Sector

<i>Regression Statistics</i>	
Multiple R	0.0976
R Square	0.0095
Adjusted R Square	(0.0082)
Standard Error	0.6346
Observations	58

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.2171	0.2171	0.5390	0.4659
Residual	56	22.5513	0.4027		
Total	57	22.7683			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.6091	0.1368	4.4535	0.0000	0.3351	0.8830	0.3351	0.8830
Weighted Average Lease Term	(0.0128)	0.0174	(0.7342)	0.4659	(0.0476)	0.0221	(0.0476)	0.0221

Source: NYU MSRM 2015 Capstone Team, NAREIT, FactSet and Individual REIT Annual Reports

Appendix 4: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and the Use of Derivatives amongst 70 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.1738
R Square	0.0302
Adjusted R Square	0.0159
Standard Error	0.6961
Observations	70

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.0260	1.0260	2.1175	0.1502
Residual	68	32.9475	0.4845		
Total	69	33.9735			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.9964	0.4121	2.4176	0.0183	0.1740	1.8188	0.1740	1.8188
Use Derivatives Y/N	(0.3212)	0.2208	(1.4552)	0.1502	(0.7617)	0.1193	(0.7617)	0.1193

Source: NYU MSRM 2015 Capstone Team, NAREIT, FactSet and Individual REIT Annual Reports

Appendix 5: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and Leverage Ratios for 68 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.0267
R Square	0.0007
Adjusted R Square	(0.0144)
Standard Error	0.7170
Observations	68

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.0241	0.0241	0.0469	0.8292
Residual	66	33.9260	0.5140		
Total	67	33.9502			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.4721	0.3097	1.5246	0.1321	(0.1461)	1.0903	(0.1461)	1.0903
Total Debt/ Total Capital (FactSet)	(0.0012)	0.0056	(0.2166)	0.8292	(0.0124)	0.0100	(0.0124)	0.0100

Source: NYU MSRM 2015 Capstone Team, NAREIT and FactSet

Appendix 5.a.: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and the Ratio of Fixed Rate Debt to Floating rate Debt for 69 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.0662
R Square	0.0044
Adjusted R Square	(0.0105)
Standard Error	0.7103
Observations	69

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.1490	0.1490	0.2953	0.5886
Residual	67	33.8025	0.5045		
Total	68	33.9515			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.2109	0.3706	0.5692	0.5711	(0.5287)	0.9506	(0.5287)	0.9506
Actual Fixed/Floating	0.2383	0.4385	0.5434	0.5886	(0.6370)	1.1136	(0.6370)	1.1136

Source: NYU MSRM 2015 Capstone Team, NAREIT, FactSet and Individual REIT Annual Reports

Appendix 6: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and 51 Individual Equity REIT S&P Credit Ratings

<i>Regression Statistics</i>	
Multiple R	0.2496
R Square	0.0623
Adjusted R Square	0.0432
Standard Error	0.6765
Observations	51

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.4899	1.4899	3.2555	0.0773
Residual	49	22.4256	0.4577		
Total	50	23.9155			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	(0.0069)	0.2239	(0.0309)	0.9755	(0.4569)	0.4431	(0.4569)	0.4431
S&P Credit Rating	0.0303	0.0168	1.8043	0.0773	(0.0034)	0.0641	(0.0034)	0.0641

Source: NYU MSRM 2015 Capstone Team, NAREIT, Bloomberg, S&P and FactSet

Appendix 6.a.: Univariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) and S&P Ratings for 33 Investment Grade rated Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.3319
R Square	0.1101
Adjusted R Square	0.0814
Standard Error	0.5668
Observations	33

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.2326	1.2326	3.8371	0.0592
Residual	31	9.9578	0.3212		
Total	32	11.1904			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	(2.1779)	1.3586	(1.6030)	0.1191	(4.9488)	0.5930	(4.9488)	0.5930
Investment Grade	0.1734	0.0885	1.9589	0.0592	(0.0071)	0.3540	(0.0071)	0.3540

Source: NYU MSRM 2015 Capstone Team, NAREIT, Bloomberg, S&P and FactSet

Appendix 7: Multivariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) to Weighted Average Lease Term and the Use of Derivatives

<i>Regression Statistics</i>	
Multiple R	0.2134
R Square	0.0456
Adjusted R Square	0.0137
Standard Error	0.6363
Observations	63

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	1.1597	0.5799	1.4320	0.2469
Residual	60	24.2960	0.4049		
Total	62	25.4557			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.9980	0.3839	2.5995	0.0117	0.2300	1.7660	0.2300	1.7660
Weighted Average Lease Term	(0.0188)	0.0155	(1.2086)	0.2316	(0.0499)	0.0123	(0.0499)	0.0123
Use Derivatives Y/N	(0.2189)	0.2051	(1.0675)	0.2900	(0.6290)	0.1913	(0.6290)	0.1913

Source: NYU MSRM 2015 Capstone Team, NAREIT, FactSet and Individual REIT Annual Reports

Appendix 8: Multivariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) to Weighted Average Lease Term and the S&P Credit Ratings of 44 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.2439
R Square	0.0595
Adjusted R Square	0.0136
Standard Error	0.6012
Observations	44

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	0.9371	0.4686	1.2965	0.2845
Residual	41	14.8176	0.3614		
Total	43	15.7548			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.3919	0.2476	1.5832	0.1211	(0.1080)	0.8919	(0.1080)	0.8919
Weighted Average Lease Term	(0.0185)	0.0160	(1.1588)	0.2532	(0.0507)	0.0137	(0.0507)	0.0137
S&P Credit Rating	0.0166	0.0159	1.0449	0.3022	(0.0155)	0.0488	(0.0155)	0.0488

Source: NYU MSRM 2015 Capstone Team, NAREIT, Bloomberg, S&P, FactSet and Individual REIT Annual Reports

Appendix 9: Multivariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) to Weighted Average Lease Term and the Total Debt to Total Capital of 61 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.1694
R Square	0.0287
Adjusted R Square	(0.0048)
Standard Error	0.6526
Observations	61

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	0.7299	0.3649	0.8568	0.4298
Residual	58	24.7049	0.4259		
Total	60	25.4348			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.6935	0.3351	2.0694	0.0430	0.0227	1.3644	0.0227	1.3644
Weighted Average Lease Term	(0.0213)	0.0163	(1.3090)	0.1957	(0.0539)	0.0113	(0.0539)	0.0113
Total Debt/ Total Capital	(0.0014)	0.0055	(0.2546)	0.7999	(0.0124)	0.0096	(0.0124)	0.0096

Source: NYU MSRM 2015 Capstone Team, NAREIT, FactSet and Individual REIT Annual Reports

Appendix 10: Multivariate Regression of 5 Year 4 Factor Bond Betas (Jan-2009 to Dec-2013) to Weighted Average Lease Term, S&P Credit Ratings, The Use of Derivatives and Total Debt to Total Capital of 43 Individual Equity REITs

<i>Regression Statistics</i>	
Multiple R	0.2825
R Square	0.0798
Adjusted R Square	(0.0171)
Standard Error	0.6175
Observations	43

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	1.2566	0.3142	0.8240	0.5181
Residual	38	14.4881	0.3813		
Total	42	15.7447			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.2066	0.7159	0.2886	0.7745	(1.2427)	1.6559	(1.2427)	1.6559
Weighted Average Lease Term	(0.0139)	0.0172	(0.8057)	0.4254	(0.0488)	0.0210	(0.0488)	0.0210
S&P Credit Rating	0.0182	0.0170	1.0763	0.2886	(0.0161)	0.0526	(0.0161)	0.0526
Use Derivatives Y/N	(0.0800)	0.2782	(0.2875)	0.7753	(0.6432)	0.4832	(0.6432)	0.4832
Total Debt/ Total Capital	0.0053	0.0059	0.8877	0.3803	(0.0067)	0.0173	(0.0067)	0.0173

Source: NYU MSRM 2015 Capstone Team, NAREIT, S&P, Bloomberg, FactSet and Individual REIT Annual Reports

Appendix 11: Summary of Interest Rate Related Characteristics from REIT Annual Reports

Ticker	Bond Beta	Market Cap	Start Date	Credit Rating			Debt			Actual Fixed/Float ing	Leases Weighted Average Lease Term	Derivatives info		Sensitivity / Total Debt	Sensitivity
				S&P Credit Rating	S&P Outlook	Leverage	Short Term	Long Term	Derivatives Y/N			Effective Interest Rate			
Diversified															
VNO-US	0.39	21,911	11/80	16	2	60.30	190	9,789	10,274	0.90	7.50	2	0.04	2,237	22,984,000
DLR-US	0.75	8,973	10/00	15	2	57.88	170	4,792	4,962	0.65	7.00	2	0.04	222	1,100,000
IRM-US	0.60	8,098	01/92	10	2	79.93			4,172	0.84	7.50	2	0.06	791	3,300,000
WPC-US	0.16	7,249	01/94	15	2	52.05	14	2,053	2,067	0.55	8.10	2	0.04		-
Healthcare															
HCP-US	0.65	20,168	12/80	16	2	44.47	667	7,995	8,587	1.00	15.00	2	0.05	116	1,000,000
VTR-US	0.84	21,096	09/85	16	2	51.52	142	9,365	9,378	0.81	15.00	2	0.04		-
HCN-US	0.67	24,795	08/81	15	2	48.27	330	10,237	10,652	0.89	13.50	2	0.05	1,023	10,893,620
OHI-US	0.61	4,979	08/88	13	2	60.89	5	2,024	2,024	1.00	10.00	1	0.05		-
HR-US	1.27	2,663	05/93	NR	-	52.03	11	1,337	1,348	0.82	5.00	1	0.05	40	54,505
SNH-US	0.74	4,504	10/99	NR	-	40.53	48	1,893	1,893	0.70	8.00	1	0.06	9,403	17,800,000
Industrial, Industrial Mixed and Industrial Office															
PLD-US	0.64	21,469	11/93	16	2	39.66	866	8,145	9,011	0.84	7.00	2	0.04	24	220,000
DCT-US	0.55	3,141	12/02	14	2	-	11	1,441	1,452	0.82	3.30	2	0.05	689	1,000,000
FR-US	(0.03)	2,261	06/90	13	3	53.51	113	1,184	1,297	0.87	6.00	2	0.02	23	30,000
EGP-US	0.99	2,002	11/80	1	-	39.38	49	845	894	0.94	7.00	2	0.01	1,024	915,385
MNR-US	1.05	625	08/86	NR	-	44.77	22	251	272	0.92	6.80	1	0.06		-
FPO-US	0.47	726	10/03	NR	-	47.70	35	639	638	0.34	6.50	2	0.04	1,098	700,000
PSB-US	0.35	2,141	03/91	NR	-	-	-	250	250	1.00	5.00	1	0.05	-	-
LPT-US	0.56	5,558	06/90	15	2	51.73	214	3,040	3,254	-	-	2	0.05	676	2,200,000
DRE-US	(0.79)	6,892	02/82	15	2	58.54	84	4,170	4,254	0.92	4.40	2	0.06		-
KRC-US	0.70	5,808	01/93	14	3	47.25	251	1,954	2,205	0.72	6.20	1	0.05		-
SLG-US	0.35	11,487	08/93	13	3	51.45	167	6,753	6,968	0.82	11.90	2	0.05	1,220	8,500,000
BXP-US	0.53	19,515	06/93	17	2	66.74	833	10,689	11,522	1.00	6.75	1	0.05		-
ARE-US	(0.14)	6,339	05/93	14	3	43.87	229	2,832	3,601	0.84	7.60	2	0.04	512	1,844,000
BMR-US	(0.46)	4,253	08/04	NR	-	35.36	341	2,330	2,671	0.67	10.00	2	0.05		-
DEI-US	0.91	4,100	10/06	NR	-	62.19	20	3,221	3,241	0.35	5.00	2	0.04	432	1,400,000
Infrastructure															
AMT-US	0.80	39,207	02/94	14	1	80.38	70	14,408	14,478	0.72	10.00	2	0.04		-
CCI-US	0.50	26,292	08/94	13	2	62.60			11,595	0.66	10.00	2	0.04		-

Ticker	Bond Beta	Market Cap	Start Date	Credit Rating			Debt			Leases		Derivatives info		Sensitivity / Total Debt	Sensitivity
				S&P Credit Rating	S&P Outlook	Leverage	Short Term	Long Term	Total Debt	Actual Fixed/Float ing	Weighted Average Lease Term	Deriva tives Y/N	Effective Interest Rate		
CORR-US	(0.27)	289	02/03	1	-	28.34	3	67	70	0.00	10.00	2	0.05	-	
PW-US	0.50	14	11/80	1	-	21.65	-	-	2,507	1.00	25.00	2	0.05	-	
Lodging															
HPT-US	0.26	4,638	08/91	14	2	46.69	-	2,704	2,704	1.00	15.60	1	0.05	9	23,135
HST-US	(0.57)	17,973	11/80	13	2	39.70	317	4,759	4,759	0.71	20.00	2	0.05	3,152	15,000,000
LHO-US	(0.39)	4,207	04/94	1	-	37.37	13	1,242	1,255	0.59	12.00	2	0.04	-	
DRH-US	0.51	2,902	05/05	NR	-	39.38	57	1,092	1,092	1.00	1.00	1	0.05	92	100,000
SHO-US	(0.33)	3,392	10/04	NR	-	42.79	23	1,381	1,420	0.71	1.00	2	0.05	-	
Residential Apartments and Residential Manufacturing Homes															
HME-USA	1.10	3,729	07/94	15	2	60.13	64	2,394	2,457	0.89	1.00	2	0.05	1,099	2,700,000
ACC-USA	0.07	4,328	08/04	14	2	51.11	-	2,744	2,744	0.80	0.88	2	0.04	1,458	4,000,000
AIV-USA	0.53	5,407	07/94	13	3	81.94	170	4,218	4,388	0.97	1.00	1	0.05	-	
BRE-USA	0.70	4,853	11/84	NR	-	50.1	54	1,705	1,759	1.00	1.00	1	0.05	8	13,300
CPT-US	0.95	6,380	07/93	NR	-	48.46	35	2,495	2,531	0.92	0.83	2	0.06	830	2,100,000
MAA-US	1.14	5,620	01/94	NR	-	54.05	457	3,015	3,473	0.97	3.00	2	0.04	-	
AVB-US	0.82	21,435	03/90	16	3	41.82	167	5,979	6,179	0.83	1.00	2	0.04	1,570	9,700,000
EQR-US	0.82	25,868	08/89	16	3	50.61	561	10,205	10,766	0.85	1.00	2	0.04	1,327	14,285,714
ESS-US	0.85	8,263	06/90	15	2	61.63	-	3,034	3,034	0.88	0.75	2	0.05	-	
UDR-US	0.90	7,866	11/80	15	3	55.62	360	3,164	3,524	0.75	14.00	2	0.04	482	1,700,000
ELS-US	0.40	4,325	02/89	1	-	71.05	120	2,073	2,192	1.00	1.00	2	0.05	-	
SUI-US	1.56	2,903	12/89	1	-	79.69	46	1,447	1,493	1.00	1.00	2	0.05	1,608	2,400,000
UMH-US	(0.24)	226	09/81	1	-	52.39	15	195	210	0.79	1.00	2	0.05	400	84,000
Retail – Free Standing, Regional Malls and Shopping Centers															
NNN-US	1.36	5,135	01/90	16	2	36.12	150	1,420	1,570	0.97	12.00	2	0.05	-	
O-US	1.29	10,564	10/90	16	2	43.62	50	4,117	4,167	1.00	4.50	2	0.05	312	1,300,000
ADC-US	2.17	546	04/94	NR	-	35.36	13	146	158	0.76	5.50	2	0.04	600	95,000
GTY-US	0.60	608	11/84	NR	-	27.57	-	158	158	0.85	3.00	2	0.03	3,797	600,000
SPG-US	0.58	57,240	12/89	18	2	80.13	2,073	21,516	23,589	0.93	-	2	0.05	-	17,600,000
GGP-US	(0.70)	24,858	04/89	1	-	66.23	393	15,879	15,891	0.89	4.30	2	0.02	1,208	19,200,000
MAC-US	(2.11)	13,174	03/90	1	-	57.71	158	4,425	4,583	0.89	-	2	0.04	-	
TCO-US	1.02	4,866	11/88	1	-	104.09	141	2,917	3,058	0.71	8.00	2	0.05	196	600,000
CBL-US	(1.28)	3,300	10/93	NR	-	77.57	182	4,675	4,858	0.83	5.28	2	0.05	947	4,600,000
PEI-US	0.07	1,599	11/84	NR	-	64.66	69	1,564	1,633	0.91	4.50	2	0.05	1,102	1,800,000
FRT-US	1.28	9,038	12/80	17	2	61.59	21	2,322	2,322	1.00	4.00	2	-	-	

Ticker	Bond Beta	Market Cap	Start Date	Credit Rating		Leverage	Debt			Actual Fixed/Float ing	Leases Weighted Average Lease Term	Derivatives info		Sensitivity / Total Debt	Sensitivity
				S&P Credit Rating	S&P Outlook		Short Term	Long Term	Total Debt			Derivatives Y/N	Effective Interest Rate		
KIM-US	(0.31)	10,334	10/87	16	2	47.68	838	4,221	4,221	0.84	7.00	2	0.06	1,753	7,400,000
DDR-US	(1.07)	6,595	01/89	14	2	48.46	360	4,935	5,294	0.94	15.00	2	0.05	718	3,800,000
REG-US	0.65	5,947	10/93	NR	-	50.15	173	1,682	1,855	0.94	6.50	2	0.06	-	-
WRI-US	0.21	4,269	08/85	NR	-	62.53	369	1,931	2,300	0.93	4.00	2	0.05	1,217	2,800,000
Self-Storage															
PSA-US	0.86	31,913	07/79	18	2	8.71	776	63	839	0.11	0.08	1	0.05	-	-
CUBE-US	0.04	3,595	10/00	15	2	51.04	5	1,114	1,139	0.97	0.08	2	0.04	351	400,000
SSS-US	1.01	2,944	06/91	14	3	41.83	0	626	626	0.87	5.20	2	0.05	798	500,000
EXR-US	0.57	6,791	08/00	NR	-	52.54	29	1,918	1,947	0.83	0.08	2	0.04	2	3,000
Timber															
PCL-US	(0.12)	7,570	06/85	15	2	66.34	467	3,197	3,664	0.83	-	2	0.05	-	-
WY-US	(0.69)	18,787	12/59	15	2	44.32	2	4,891	5,409	0.89	-	2	0.07	-	-
RYN-US	0.37	3,524	02/90	14	2	48.66	113	1,462	1,574	0.58	-	2	0.03	-	-
PCH-US	(0.16)	1,700	11/80	13	3	73.66	3	320	323	1.00	-	2	0.07	-	-
Total Market Capitalization as of Dec 31, 2014 (A)		655,759.50													
Total FTSE NAREIT AE Index (B)		846,410.30													
Sample (A)/(B)		78%													

Source: Annual Reports and SEC 10-K

Key:

S&P Credit Rating	Nominal
AAA	23
AA+	22
AA	21
AA-	20
A+	19
A	18
A-	17
BBB+	16
BBB	15
BBB-	14
BB+	13
BB	12
BB-	11
B+	10
B	9
B-	8
CCC+	7
CCC	6
CCC-	5
CC	4
C+, C, C-	3
D	2
NR	1

Derivatives	Nominal
YES	2
NO	1

S&P Outlook	Nominal
POS	3
STABLE	2
NEG	1

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