8-2013

Essays on the relationship between investor sentiment and Real Estate Investment Trusts

Daniel Huerta
University of Texas-Pan American

ESSAYS ON THE RELATIONSHIP BETWEEN INVESTOR SENTIMENT AND REAL ESTATE INVESTMENT TRUSTS

A Dissertation
by
DANIEL HUERTA

Submitted to the Graduate School of
The University of Texas-Pan American
In partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2013

Major Subject: Business Administration

ESSAYS ON THE RELATIONSHIP BETWEEN INVESTOR SENTIMENT AND REAL ESTATE INVESTMENT TRUSTS

A Dissertation
by
DANIEL HUERTA

COMMITTEE MEMBERS

Dr. Dave O. Jackson
Chair of Committee

Dr. Cynthia Brown
Committee Member

Dr. Thanh Ngo
Committee Member

Dr. Diego Escobari
Committee Member

Dr. Jose Pagan
Committee Member

August 2013

ABSTRACT

Huerta, Daniel, Essays on the Relationship Between Investor Sentiment and Real Estate Investment Trusts. Doctor of Philosophy (Ph.D.), August, 2013, 155 pp., 30 tables, 13 figures, 78 references.

Real Estate Investment Trusts (REITs) are federal tax-exempt firms originated in 1960 to allow investors participation in professionally managed real estate to attain greater portfolio diversification. Although REITs are often considered transparent and informationally efficient, extant literature suggests that investor behavioral biases impact their prices and returns. This dissertation examines the relationship between investor sentiment and REITs, contributing to the literature in the following distinct ways. First, I examine the contemporaneous and intertemporal impact of changes in sentiment on REIT returns making a distinction between sentiment derived from large institutional investors and small individual investors. Results suggest that sentiment from both groups of investors positively affect REIT industry returns contemporaneously; however, no intertemporal effect is observed. Closer examination reveals that institutional investor sentiment has a larger impact on REIT returns than does individual sentiment, consistent with significant increases in institutional ownership after 1992.

Second, I study the impact of the 2008-2009 REIT liquidity crisis on REIT industry returns and volatility and the role of investor sentiment during this period of market turmoil. Results indicate that the liquidity crisis negatively impacted REIT industry returns and significantly increased volatility. Findings suggest that sentiment is a significant factor in

explaining REIT returns and volatility during the crisis, however, consistently larger coefficients for institutional sentiment imply dominance over individual investor sentiment. Liquidity constraints severely affected REIT industry outlooks during the crisis which pushed investors to adjust their portfolios, affecting returns negatively and pushing volatility upward.

Third, I investigate the asymmetric effect of changes in investor sentiment on REIT industry returns and volatility. Results suggest an asymmetric impact between positive and negative changes in institutional investor sentiment on REIT returns and volatility; however, no asymmetric impact is observed for individual investor sentiment. After the REIT liquidity crisis, the sentiment-REIT relationship appears to change. Post-crisis, institutional investor sentiment does impact REIT returns significantly, whereas positive changes in individual investor sentiment positively affect returns. Post-crisis volatility appears to be positively influenced only by bullish changes in institutional sentiment while significantly affected by both negative and positive shifts in individual investor sentiment.

DEDICATION

To my lovely wife Andreina, you always believed in me and sacrificed much to help achieve this goal; your love and understanding got me through this journey. To my children Julian and Ivanna, you are the fuel of my life. To my parents Nelson and Ysis, this would not have been possible without your support in every step of the way; you motivated and inspired me, and I know I will not have a long enough life to pay back all that you have given to me. To the greatest man that ever lived Luis Alfonso Huerta, I hope someday I become at least half of the man you were. To my siblings Diana and Damian, you always know how to put a smile on my face even during difficult times. To my brother-in-law Gabriel, you have seen and shared many ups and downs in my life. To my favorite Tia Nilda, you are my second mother. I dedicate this achievement to you all.

ACKNOWLEDGMENTS

I am grateful to Dr. Dave Jackson, chair of my dissertation committee, for always being there; for his mentoring, patience, and advice. Dr. Jackson, you have been a fundamental pillar in my development as a doctoral student, and I will always appreciate your support. My deepest gratitude goes toward Dr. Cynthia Brown; thank you for always making sure I was on the right path, it has been an honor working with you. My thanks go to my dissertation committee members: Dr. Diego Escobari, Dr. Thanh Ngo and Dr. Jose Pagan. Their advice, input, and comments on my dissertation helped to ensure the quality of my intellectual work.

I would also like to thank my colleagues and friends, Daniel Perez, Peter Egly, Miguel Baeza, Kevin Hurt, Javeria Farooqi, and Klaus Beckmann, who supported and stood beside me every step of the way. Many thanks to Dr. Damian Damianov for his friendship and wise words every time I needed them. Lastly, I thank Dr. Teofilo Ozuna for his guidance and support all these years; you provided an opportunity that will shape the rest of my life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION AND BACKGROUND LITERATURE

1.1. The Real Estate Investment Trust industry

Real Estate Investment Trusts (REITs) are a unique type of firms dedicated exclusively to investments in the real estate industry. REITs have traditionally been classified as a hybrid between real estate and equity that create a distinct investment opportunity in an important industry. The U.S. Congress originated REITs as a particular business class in 1960 to provide the average investor with the opportunity to invest in commercial real estate as a vehicle for portfolio diversification. The creation of REITs allows small investors to hold ownership in professionally-managed real estate portfolios that most investors, with financial constraints, could not have owned otherwise (Chan et al., 2003). The REIT industry has undergone significant legislation-related changes since its inception in the 1960s. The most notable changes that have impacted REITs include the 1992 Umbrella Partnership REIT (UPREIT) structure change, the Revenue Reconciliation Act of 1993, the REIT Tax Simplification Act of 1997, the REIT Modernization Act of 1999, the REIT Improvement Act of 2003, and the REIT Investment Diversification and Empowerment Act of 2007. Each of these changes in legislation has had an influence on the structure of REITs, which have shaped the rules and regulations that govern this industry.

The 1992 UPREIT structure change shaped the modern REIT and opened the path to what real estate academics and industry professionals refer to as the "new REIT era" (e.g.

Pagliari et al., 2005; Oikarinen et al., 2011). UPREIT enabled REITs to own controlling interests in a limited partnership with a real estate operating company. This opened opportunities for existing REITs to increase their real estate holdings by creating these partnerships without the need to incur large investments. Firms can convert to REIT status through an UPREIT structure without triggering capital gain tax liabilities; otherwise any transfer or sale of real estate among non-REIT entities would create a tax liability on capital gains accrued by a real estate property. A REIT may enter into an operating partnership (OP) with the owner of existing real properties and transfer any properties to the REIT, since the transfer of properties among operating partners does not create a tax liability (Capozza and Seguin, 2003).

A similar modality known as DownREIT emerged for those transactions that could not avoid tax liabilities through an UPREIT. As explained by Chae, et al. (2011), a DownREIT is a joint venture between the OP of a REIT and investors who own an existing real estate firm. In the case that an UPREIT agreement triggers a tax liability, the parties may adopt a structure in which the OP becomes the general partner of the existing real estate company under provisions that would provide the real estate company with liquidity and distribution rights equivalent to those provided by owning shares of the OP unit or the existing REIT.

The “new REIT era” fueled growth in the REIT industry resulting in a notable increase in the number of REITs and the market capitalization of the industry. As a result, institutional investors rushed to take part in the REIT boom, institutional holding increased, and analyst coverage on REITs rose. Oikarinen et al. (2011) argue that this added attention to REITs brought more transparency to the industry and prices better reflected market fundamentals and fewer deviations from their net asset value were observed, implying that the REIT industry became more informationally efficient.

The 1993 Revenue Reconciliation Act relaxed the "five or fewer" rule for REIT ownership which regulated the ownership concentration for REITs. This rule explicitly prohibited 50% or more of a REIT to be owned by "five or fewer" distinct investors (Glasscock et al., 2000). This rule especially restricted investment funds from acquiring significant shares of any given REIT since a fund is considered an individual investor. The 1993 reform allowed each institutional beneficiary such as a pension fund beneficiary to be considered an individual investor toward the "five or fewer rule". This change also favored increases in REIT institutional holdings (Lee and Lee, 2003).

The REIT Tax Simplification Act of 1997 primarily modified the Internal Revenue Code to impose monetary penalties to REITs that failed to comply with REIT ownership regulations, revised the definition of "rents from real property" that refer to impermissible tenant service income, and modified the requirements for a company to be considered a REIT subsidiary. Impermissible tenant service income refers to any amount received or accrued directly or indirectly by the REIT for services provided to the tenants of their properties, for example, income from short-term loans for property modifications or renovations, or income from managing or operating third-party properties. The 1997 REIT Tax Simplification Act also lowered the 95% income distribution requirement to the current 90% distribution requirement in the form of dividends to shareholders, allowing a marginal increment in retained earnings in the industry.[1]

The REIT Modernization Act of 1999 introduced further legislative changes to the REIT industry. According to Howe and Jain (2004), the REIT Modernization Act of 1999 was tagged as the most significant legislation affecting REITs since their inception in 1960. This act was

[1] Information from the U.S. Government Printing Office, H.R. 1150 (ih) - Real Estate Investment Trust Tax Simplification Act of 1997. http://www.gpo.gov/fdsys/search/pagedetails.action?packageId=BILLS-105hr1150ih, accessed on December 5, 2012.

expected to have a significant impact on the growth, profitability and risk of the REIT industry in the following years. The major change introduced with this act included the provision to allow REITs to own up to 100% of a Taxable REIT Subsidiary (TRS). A REIT was now allowed to create a TRS to provide services to tenants and other parties that were previously prohibited, increasing their possible spectrum of business activities. The REIT Modernization Act also emphasized the reduction of the mandatory payout level (as introduced in the 1993 Revenue Reconciliation Act) which provided the opportunity for REITs to reinvest more earnings in profitable projects instead of paying out that portion of earnings as dividends. This Act also benefited the healthcare and lodging REIT sub-industries, changed the calculation of personal property rents from an adjusted tax basis to fair market value, and brought about technical changes in the distribution requirement of pre-REIT earnings and profits of real estate companies after becoming or merging with a REIT. All these changes in REIT rules were expected to positively impact the industry. Howe and Jain (2004) document a positive wealth effect on REIT owners resulting from passage of the REIT Modernization Act of 1999. There were positive REIT stock price reactions to events surrounding the passage of the Act. Howe and Jain (2004) also document a significant decline in REIT systematic risk as measured by the Betas of the REIT industry and sub-industries in the period following the passage of the Act.

The Revenue Reconciliation Act of 2003, also known as the REIT Improvement Act of 2003, had three main goals to reduce uncertainties in the application of REIT rules.[2] First, the Improvement Act corrected minor issues in the REIT tax rules not addressed by the REIT Modernization Act of 1999 which could jeopardize a REIT's tax status for holding commercially ordinary debt such as a small loan to finance tenant improvements. Second, the act allowed

[2] Information from NAREIT, the 2007 REIT Investment Diversification and Empowerment Act. http://www.reit.com/portals/0/files/nareit/htdocs/policy/government/S._1568_One-Pager.pdf, accessed on December 5, 2012.

foreign investors to participate in the REIT market fairly by standardizing the tax treatment of foreign institutional investors of publicly traded REITs to that of similar investments in other publicly traded firms. Third, the Act provided the Internal Revenue Service with the ability to levy monetary penalties in the case of a breach of a REIT rule rather than a removal of REIT status to regulation violators. Hence, the REIT Improvement Act of 2003 provided REITs with means to better safeguard their tax-exempt REIT status and to become more an attractive investment to foreign institutional investors.

The REIT Investment Diversification and Empowerment Act of 2007 allowed for some amendments in the Internal Revenue Code of 1986 to simplify certain provisions applicable to REITs. These amendments included five key changes: (1) to treat REIT passive foreign exchange gains attributable to overseas real estate investment as qualifying REIT income, (2) increased from 20 to 25% the amount of REIT's assets that may be represented by securities of one or more taxable subsidiaries (3) modified rules for the excise tax penalty on certain REIT sales activities, (4) treated rental payments from a healthcare facility to a REIT as qualifying REIT income, and (5) treated income from foreign-qualified REITs as domestic qualifying REIT income.[3]

1.1.1. Impact of legislation changes on the REIT industry performance

Overall, REIT legislation changes benefited the industry in one way or another depending on the purpose of the change. Each REIT legislation amendment had particular objectives that impacted both the REIT and investors allocating capital into this market. Evidently, some legislation changes are perceived as more important than others depending on how much impact

[3] Information from the U.S. Government Printing Office, S. 2002 (is) - REIT Investment Diversification and Empowerment Act of 2007. http://www.gpo.gov/fdsys/search/pagedetails.action?packageId=BILLS-110s2002is, accessed on December 6, 2012.

the new legislation has on REITs management and on which particular aspect of REIT rules are being affected.

Prior research investigates different market reactions to REIT legislation changes that occurred in recent years. As aforementioned, the 1992 UPREIT structure change revolutionized the REIT industry and ushered in the new REIT era. Institutional investor ownership sharply rose in REITs and more attention and capital was drawn to the industry. Shortly afterward, the Revenue Reconciliation Act of 1993 introduced new tax changes that impacted REIT unsystematic risk. Crain et al. (2000) explain that the 1993 Act's removal of tax barriers made REITs a more desirable investment for institutional investors. They find that unsystematic risk in the REIT industry diminished between 1993 and 1995 as institutional ownership rose from 17% in 1993 to 30% in 1995. The largest drop in unsystematic risk was observed during the period immediately following announcement of passage of the legislation. Crain et al. (2000) argue that the 1993 REIT legislation change resulted in a more liquid REIT market and a less risky investment to the well-diversified investor.

The legislation change that followed was the REIT Tax Simplification Act of 1997. Xu and Yiu (2010) find that REIT market returns were insignificantly impacted by the 1997 Act using an event study methodology and document a decrease in the REIT industry systematic risk in their cross-sectional analysis results. Soon after, the REIT Modernization Act of 1999, referred to as a key legislation change to REIT industry (Howe and Jain, 2004; Xu and Yiu, 2010), resulted in positive wealth effects associated with the legislative events leading to its enactment along with a reduction in REIT industry systematic risk. Howe and Jain (2004) report an increase in the NAREIT Composite Index and the Morgan Stanley REIT index of almost 4 percent, the largest increase in these indexes at the time. Xu and Yiu (2010) report similar results. The positive wealth effect of the REIT Modernization Act of 1999 is mainly attributed to the relaxation of operational constraints that potentially generated higher REIT revenues, to the ability to retain a larger portion of earnings for reinvestment in profitable projects, and to the added flexibility in healthcare and lodging REITs operations (Howe and Jain, 2004).

The REIT Improvement Act of 2003 significantly reduced the threat of losing the tax-exempt status for REITs as a consequence of "inappropriate" operations. Xu and Yiu (2010) report an insignificant impact of the 2003 Act on REIT returns but a significant increase in REIT systematic risk. Nonetheless, a significant increase in REIT dividends is documented after the enactment of the 2003 Act which positively impacted the industry. The REIT Improvement Act of 2003 coincides with cuts in dividend tax rates in the United States during this same year (Edgerton, 2012). Interestingly, REITs did not qualify for reduced taxation with the 2003 tax cut, yet, dividends in the REIT industry sharply increased. Edgerton (2012) argues "that there is no conclusive evidence that the 2003 dividend tax cut caused large increases in aggregate dividend payouts in the years immediately following the cut (p. 3)" since important non-tax-related changes occurred concurrently with the tax cuts. These non-tax-related events include the recovery of the U.S. economy from the 2001 recession and a coinciding large increase in corporate earnings. In sum, there are confounding reasons that possibly explain increases in dividend payments in the REIT industry in 2003. Hence, given the evidence, these increases cannot be attributed entirely to the REIT Improvement Act of 2003.

Finally, Xu and Yiu (2010) find a positive and significant reaction in REIT returns and increased systematic risk as a consequence of the Diversification and Empowerment Act of 2007. The 2007 Act enabled REITs to engage in more business endeavors through their taxable

REIT subsidiaries by relaxing rules on permitted REIT income and activities, and by reducing the property holding period that constrained property sales.

1.1.2. REIT rules and classifications

One principal characteristic of REITs is their federal tax exemption benefit, which alleviates the double taxation issue (corporate and personal taxation) observed for other firms. In order to receive such classification and to enjoy the tax exemption status, REITs must conform to a set of rules established by the U.S. Congress. The rules that constrain REITs under the U.S. tax law include: (1) REITs must have a minimum of 100 distinct shareholders, (2) five or fewer individuals cannot hold 50% or more of the shares in a REIT, commonly referred to as the "five or fewer" rule, (3) 75% or more of REIT assets must consist of real estate, cash, and government securities, (4) 95% or more of REIT gross income must proceed from real estate in the form of dividends, interest, rents, or capital gains, and (5) a minimum of 90% of income must be distributed in the form of dividends to REIT shareholders every year (Goddard and Marcum, 2012). Additional requirements imposed by the Internal Revenue Tax Code on REITs are that the REIT must be managed by a board of trustees or directors and be an entity that could be taxable as a corporation if it were not classified as a REIT. Additionally, in the case of publicly-traded REITs, shares must be fully transferable between investors (NAREIT, 2012). These regulations obligate REIT management to take alternative approaches in capital structure, dividend policy, capital reinvestment, and other aspects of conducting business which render REITs fundamentally distinct from other firms in the market.

REITs are classified based on their investment-type and purpose. There is a large proportion of REITs that are privately held and nearly 200 that are publicly traded in different

U.S. stock markets. As explained by Goddard and Marcum (2012), whether public or private, REITs are generally classified as equity, mortgage, or a hybrid of both classes. Figure 1.1 illustrates the breakdown of REITs by investment purpose from 1992 to 2011. The largest group is Equity REITs (EREITs), which own and operate income producing real estate. EREITs must have 75% or more of their assets invested in real property and must hold properties for income producing purposes rather than building and selling or buying and selling properties for capital gains (Goddard and Marcum, 2012; NAREIT, 2012). According to the National Association of Real Estate Investment Trusts (NAREIT), EREITs account for roughly 90% of all REITs. The second largest REIT group (about 10% of REITs) is composed of Mortgage REITs (MREITs). MREITs mostly lend money for the purpose of investments in real property or transact with mortgages or securitized pools of mortgages. Mortgage REITs generally extend mortgage credit only on existing properties (NAREIT, 2012) and rarely venture into new developments. Finally, the smallest group is the Hybrid REITs, which tap both business activities of operating and managing commercial real estate and mortgage transactions.[4]

The securitized real estate industry is also divided into a number of sub-industries. NAREIT's classification of subsectors or property types include: shopping centers, malls, healthcare facilities, apartments, warehouses, office buildings, lodging, self-storage, and others. REITs can also be classified as mixed or diversified if they hold real estate from more than one sub-industry. A graphical breakdown of REIT subsectors is shown in Figure 1.2. The largest subsectors within the REIT industry are regional malls (14.43%), apartments (12.30%), healthcare facilities (11.46%), and office buildings (9.18%).

[4] As of 2010 NAREIT excludes Hybrid REITs as a separate group since most REITs are specialized as either Equity or Mortgage REITs.

1.2. REITs as tradable securities

The REIT industry has experienced an enormous increase in both number of firms and market capitalization since its inception in 1960. Particularly after the important reforms introduced in the mid-1980s and especially in1992, the industry experienced a boom that only slowed with the financial crisis that negatively affected the U.S. economy during 2007-2009. However, market capitalization for the REIT industry is rapidly growing again; the total market capitalization reached over $450 billion in 2011, more than twice the value observed in the height of the crisis in 2008. As of January 1, 2012, 166 publicly-traded REITs were registered with the Securities and Exchange Commission (SEC) which amount to a collective market capitalization of $579 billion (NAREIT, 2012). Figure 1.3 graphically illustrates the growth in market capitalization and the number of firms in the REIT industry from 1971 to 2012.

REITs are often referred to as diversification vehicles because of their historically low correlation with the general stock market and because they offer small investors the opportunity to participate in the commercial real estate market (NAREIT, 2012). Few investors are able to obtain a significant ownership or financing stake in the real estate market because of limited resources, knowledge, or both. The fact that an investor can diversify geographically and through different property types provides an opportunity to reduce portfolio unsystematic risk while bearing only the systematic risk that modern portfolio theory suggest should be the goal of every investor. Investment in real estate through REITs further benefit investors with short investment horizons who are not willing to commit to long term ownership often associated with real property investments (Han and Liang, 1995).

There is mixed empirical evidence on the degree of diversification benefits that REITs provide, however, the overall inference is that the determinants and characteristics of REIT returns fluctuate over time, thus, the diversification advantage of REITs is time varying. Ghosh et al. (1996) argue that from the perspective of diversification and liquidity, REITs are observed to behave differently from stocks. The authors analyze correlations among REIT and stock bid-ask spreads, trading volumes, and institutional ownership and suggest strong differences between REITs and stock that are mainly attributable to real estate fundamentals impacting the underlying real assets in REITs. In the same manner, Giliberto and Mengden (1996) explain that REITs behave similar to real estate investments after controlling for various market factors. Giliberto (1990) finds that there is a high correlation between residuals from regressions of direct real estate and REIT returns on financial asset returns, suggesting a strong link between direct and securitized real estate and highlighting the existence of a common real estate factor. Mei and Lee (1994) also suggest a real estate factor that is common to both direct real estate and REITs. On the contrary, Oppenheimer and Grissom (1998) provide evidence of strong Equity REIT co-movements with stock indices, particularly small capitalized firms, using spectral analysis rather than the traditional time domain based methods (e.g. time series regressions and correlations). These authors additionally find that REITs returns co-move less with Treasury securities than with stocks. Ling and Naranjo (1999) also suggest that REITs are integrated with stocks and segmented from direct real estate. Similarly, Glasscock et al. (2000) explain that REITs behaved more like fixed-income instruments before 1992 and displayed little commonalities with stocks. However, REITs and stocks were observed to be co-integrated in the period post-1992, suggesting that stocks and REITs share common factors such as asset pricing structures. In the same manner, Glasscock et al. (2000) argue that portfolio diversification benefits from REITs may be diminishing.

Research by Clayton and MacKinnon (2001) suggests that the relationship between REIT returns and returns to bonds, small and large capitalization stocks, and commercial real estate changes over time and is cyclical in nature. They explain that the previously documented relationship between REITs and small capitalization stocks is stronger during market downturns. Similarly, Hoesli and Serrano (2007) provide evidence of a diminishing correlation between securitized real estate and the general equity markets. A more recent study by Hoesli and Oikarinen (2012) suggests that contemporaneously, REITs behave like stocks but that the long-run REIT market performance is substantially more closely related to direct real estate performance than to general stock market returns. These authors emphasize that the similitude between REITs and direct real estate is significantly greater than that between REITs and the general stock market particularly in the 'long-horizon' of three to four years. Hoesli and Oikarinen (2012) explain that REITs and commercial real estate can be considered as substitutes and provide similar diversification benefits to investors' portfolios. Although there is no conclusive evidence of the degree of diversification advantages of REITs or the time horizon of these benefits, the extant literature implies that the basic return and composition characteristics of REITs renders them an attractive investment to enhance well-diversified portfolios.

1.3. REIT pricing

The above described characteristics of REITs often categorize them as a special type of security that although share characteristics with equity of non-REITs, are sometimes compared to fixed-income securities due to dividend payout regulations. Such characteristics have led researchers to investigate which factors may explain REIT prices and returns. Liu and Mei (1992) use a multifactor model with time varying risk premiums to analyze the predictability of expected returns on equity REITs and their results suggest that REIT risk premiums vary substantially over time and that REIT returns closely resemble small capitalization stocks more than large capitalization stocks and bonds. They emphasize that despite the cash flows resemblance between bonds and REITs, REITs are actually less similar to bonds while more similar to small capitalization stocks. Similarly, Li and Wang (1995) use a multifactor asset-pricing model to evaluate the predictability of REIT and non-REIT stock returns. Their findings suggest that REIT stocks are highly integrated with the general stock market; however, risk premiums for both stocks and bonds explain REIT returns. More specifically, in the case of bond factors, they document that the term spread and the default spread are determinants of REIT returns along with factors that drive equity returns such as dividend yields.

Hsieh and Peterson (1997) later pioneer examining REIT pricing and performance using the Fama and French (1992) common stock factors and the bond market factors in a multivariate setting. Frequently cited in the finance literature, Fama and French (1992) empirically developed factors that explain returns for common stocks. These factors are commonly known as the market risk premium, the firm size, and the book-to-market factors that are included in numerous studies and that capture a large proportion of the variance of stock returns. In addition to the common stock factors, Hsieh and Peterson (1997) include the term spread and default spread factors as in Fama and French (1993) to proxy for unexpected changes in interest rates and shifts in the probability of default. Hsieh and Peterson (1997) show that the Fama-French framework explains REIT returns, more specifically, equity REIT returns are significantly related to the common stock factors, whereas mortgage REITs are related to the three stock market factors and the two bond factors.

Alternatively, Kallberg et al. (2003) argue for a dividend pricing model to determine REIT prices. The finance literature generally contends that future dividend streams are not successful in adequately pricing stocks because of excess volatility in prices that create large transitory price fluctuations. However, because of their stringent dividend policy and few share repurchases, REITs display a stronger link between current dividends and future cash flows. The authors suggest that REIT dividend payouts are a credible signal of the future prospects of the firm, thus, the dividend pricing model cannot be rejected. Nevertheless, the dividend pricing model is not popular in the REIT literature.

Recent empirical studies on REITs rely heavily on the use of the Fama-French asset pricing model since it consistently explains a large proportion of the variance in REIT returns. This framework is commonly used in REIT literature (e.g. Buttimer et al., 2005; Lee et al., 2008; Lin et al., 2009; Ro and Ziobrowski, 2011) to test the impact of newly proposed variables or other empirical issues such as influence of behavioral biases on REIT returns.

1.4. Behavioral biases in REITs

Similar to other financial securities, REITs are observed to be impacted by anomalies that are commonly attributed to behavioral biases influencing financial markets which challenge the conventional view of efficient markets. A recent wave in finance literature argues that investor behavior and sentiment influence their rationale for trading and perception of risk thus impacting prices and returns significantly. Some of the market anomalies that remain on the scope and are frequently tagged as behavioral are the calendar anomalies, initial public offering (IPO) underpricing, and the closed-end fund puzzle. In the case of REITs, these anomalies are explored to determine if they exist for this particular type of security. REITs are often excluded from general stock market empirical studies for their unique “hybrid” (debt and equity) characteristics and regulations, therefore, researchers interested in this industry make the effort to determine commonalities and differences between REITs and other securities.

1.4.1. REIT calendar anomalies

The January effect is a market seasonality documented for common stocks and closed-end funds in the U.S. (Ritter, 1988; Haugen and Jorion, 1996; Brauer and Chang, 1990). It is observed that returns in January are significantly higher than in any other month of the year. This seasonality is attributed to tax-loss-selling pressures from individual investors at the end of the year. Investors sell securities that have lost value to offset tax liabilities from capital gains from winning securities at the end of year. These sales result in a decline in prices given the increase in the supply of these securities to the market. Prices rise again after arbitrageurs buy the same securities resulting in abnormally high returns in January. This theory is commonly known as the tax-loss-selling hypothesis. The January effect reflects the wealth-maximizing behavior of individual investors at the turn of the year (Lee and Lee, 2003). An alternative theory to the January effect is the window-dressing hypothesis that suggests that the January effect is driven by institutional investors that rebalance their portfolios by selling losing stocks and buying winning stocks to appear to be holding a “proper” portfolio at the closing of the fiscal year. This year-end selling pressure by institutional investors results in higher returns in January and is believed to reflect agency problems related to institutional portfolio disclosures (Musto, 1997).

Lee and Lee (2003) examine the January effect in REITs after the Revenue Reconciliation Act of 2003 which facilitated the increase of REIT institutional ownership. The authors support the tax-loss-selling hypothesis and argue that end-of-the-year sales by individual investors lead to abnormally high January returns. Specifically, Lee and Lee (2003) find that the difference between January and non-January returns decreased after a higher institutional investor involvement in the REIT industry and that January premiums deceased significantly for REITs that exhibit higher institutional investor holdings.

Another well-established calendar anomaly in the stock market is the Monday effect. Monday stock returns are observed to be significantly lower than the average Tuesday to Friday return. Some of the explanations of this anomaly are the irregular trading patterns of individual investors during the week (Lakonishok and Maberly, 1990) and the lack of institutional ownership in a given firm or market (Chan et al., 2004). In the case of REITs, Chan et al. (2005) provide evidence that REITs with higher institutional holdings are less affected by the Monday anomaly. These authors document the Monday anomaly in REITs, which is observed to be greater before the structural changes in REITs in the 1990s and show that as institutional ownership in REITs has increased during the "new REIT" era, the Monday effect was progressively eroded. Chan et al. (2005) additionally suggest that REIT returns resemble non-REIT equity returns more after the 1990s structural changes.

1.4.2. REIT IPO underpricing evidence

IPO underpricing is an equity market anomaly that has been observed for decades. The various theories that attempt to explain this phenomenon typically fall back to behavioral biases as a plausible explanation. Loughran and Ritter (2002), for example, relate IPO underpricing to Prospect theory. This theory posits that IPO underpricing occurs because entrepreneurs are more interested in their sudden change in wealth rather than in the level of wealth reached after an IPO and are thus content to leave money on the table by underpricing their newly issued stocks. Other theories that attempt to explain the underpricing of IPOs are the underwriter reputation theory and the winner's curse theory. The underwriter reputation theory posits that investment bankers will underprice IPOs sufficiently to sell the entire issue and maintain a reputation of an underwriter that is successful in allocating shares to investors in the primary market. By underpricing IPOs, underwriters send a positive signal to the market about the future expected performance of the firms and leaves a "door open" for subsequent seasoned equity offerings. The winner's curse theory suggests that IPOs are underpriced to keep the IPO market attractive to investors and liquid to new issuers. Uninformed investors are rewarded by the underpricing according to the winner's curse theory (Joel-Carbonell and Rottke, 2009). Joel-Carbonell and Rottke (2009) document the IPO underpricing irregularity in the REIT industry. The authors find that for a sample of REIT IPOs from 1991 to 2008 there is significant underpricing and consequently display negative long-run performance compared to existing REITs. Joel-Carbonell and Rottke (2009) attribute this anomaly to both the underwriter reputation theory and winner's curse theory.

1.5. Research Objectives

In general, extant REIT literature suggests that although REITs are transparent, more price informationally efficient, and less difficult to value than other stocks (Blau et al., 2011), investor behavioral biases impact their prices and return generating process. Under this notion, Lin et al. (2009) test for the impact of investor sentiment on contemporaneous REIT returns using the closed-end fund discount as a proxy for sentiment. Their findings show that sentiment significantly impacts REIT returns and that institutional ownership is not a factor that affects REIT returns. However, with a significant increase in institutional holdings in REITs in recent years (Below, et al., 2000; Chan et al. 2005) and empirical evidence that shows that after the relaxation of the five-or-fewer rule, the increase in institutional ownership resulted in an increase in REIT prices (Downs, 1998), the findings by Lin et al. (2009) are subject to further scrutiny. Intuitively, it is difficult to discard the effect that institutional investor sentiment has on REITs. In addition, I acknowledge that there are two distinct types of investors: sophisticated investors (institutional) and less sophisticated (individuals), that potentially behave and trade differently and that have different perceptions of the market at given times. Both types of investors should have a different impact on returns. Moreover, Lin et al. (2009) use a proxy of sentiment (closed-end fund discount) that is disputed in the financial literature (Chen et al., 1993). Although the closed-end fund discount is observed to reflect sentiment (Brown and Cliff, 2004), it is not possible to make a distinction between sentiment inflicted by institutional investors and that by individual investors. The use of direct measures of sentiment (survey based) can alleviate the issue of selecting a more suitable proxy for sentiment. Brown and Cliff (2004) show that survey-based measures of sentiment are significantly related to commonly used proxies of sentiment (e.g. the ratio of specialists' short sales to total short sales, the ratio of odd-lot sales to purchases, the equity put to call trading volume, the closed-end fund discount, the net purchases of mutual funds, the proportion of fund assets held in cash and others) and conclude that survey-based sentiment is an appropriate representation of investor sentiment in empirical studies.

This dissertation contributes to the REIT and behavioral finance literature in several distinct ways. In Chapter II, I build on the findings of Lin et al. (2009) and investigate the contemporaneous effect of investor sentiment on REIT returns by using survey-based proxies of institutional and individual investor sentiment. I find a significant impact of both institutional and individual investor sentiment on REIT returns after controlling for commonly used factors that drive returns. More specifically and motivated by the high level of REIT institutional ownership, I find an impact of greater magnitude of institutional sentiment on REIT returns. This diverges from the findings of Lin et al. (2009) which suggest that since REIT literature often relates REITs with small capitalization stocks, the sentiment that impact REIT returns is derived from individuals or small investors. However, since the closed-end fund discount proxy used by Lin et al. (2009) does not make a distinction between sentiment induced by individual and institutional investors, their conclusion can be contested. My findings suggest that institutional investor sentiment has a stronger impact on REIT returns than individual investor sentiment.

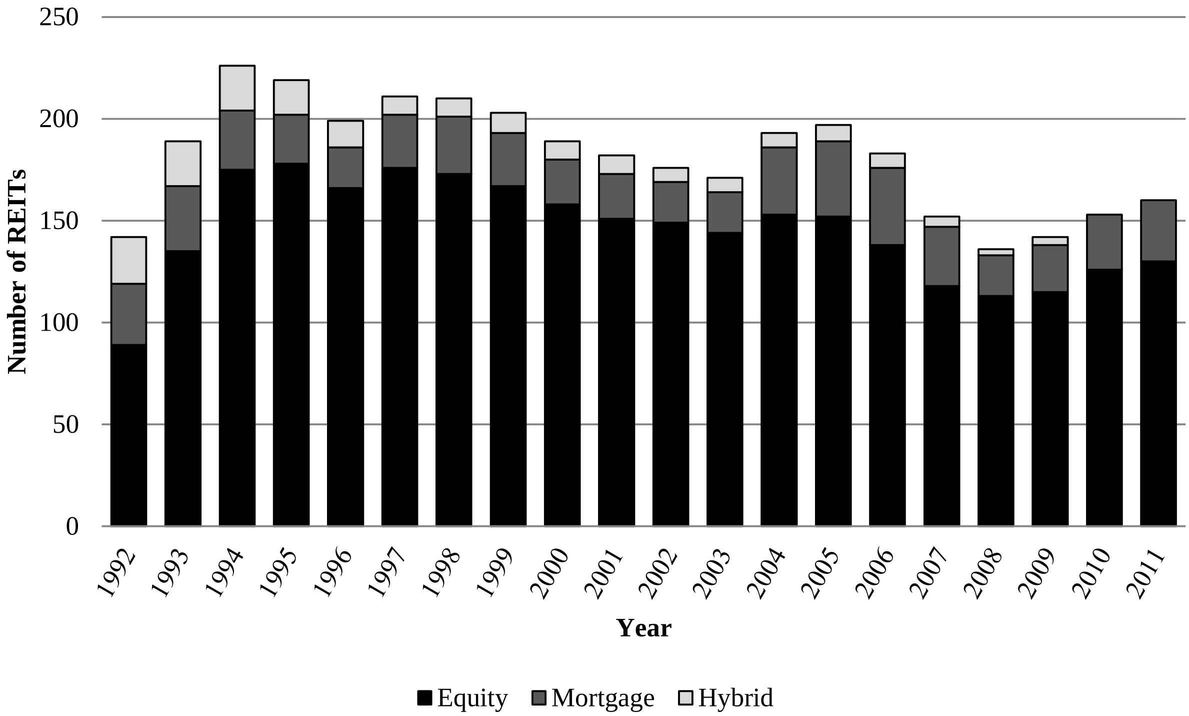
The second contribution of Chapter II is to test the hypotheses of Fisher and Statman (2000) and Brown and Cliff (2005) that posit that high levels of sentiment lead to significantly lower returns in subsequent periods and vice versa. To test this relationship, I employ a vector auto regression (VAR) framework that considers past realizations of each variable. This contributes to the literature by establishing an intertemporal effect of investor sentiment on REIT returns that has not been addressed for this particular industry. Fisher and Statman (2000) and Brown and Cliff (2005) both find intertemporal relationships between sentiment and returns, however the time frame for this relationship varies widely from three months to three years. By studying this intertemporal relationship on the REIT industry I seek to define the time-frame in which to expect this effect for REITs. This would be of benefit to investors since it would aid in their portfolio rebalancing and investment decisions over time using investor sentiment as a signal for potentially profitable fund allocations in REITs. Results suggest no intertemporal relationship between investor sentiment a REIT returns.

Chapter III of this dissertation contributes to the literature on the impact of the 2007-2009 U.S. financial crisis on the REIT industry along with the role of investor sentiment during periods of important financial constraints. The REIT industry was particularly impacted during recent financial crisis because of REIT dependency on bank credit line commitments for liquidity and growth. Given regulatory constraints, REITs are obligated to distribute 90% of their income in the form of dividends which leave them with virtually no retained earnings to reinvest and grow. This forces REITs to finance new property developments and major property acquisitions with funds raised through new share and debt issuances, or through bank borrowings. The latter represents close to 74% of total REIT liquidity compared to 45% registered by other types of firms (Ooi et al., 2012). The financial crisis constrained bank lending to a point that a vast majority of REIT credit lines could not be honored, pushing the REIT industry into a liquidity crisis from 2008Q4 to 2009Q2 (Case et al., 2012). Chapter III investigates the impact of the REIT liquidity crisis on REIT returns and volatility acknowledging the importance of investor sentiment on the REIT return generating process. I use a generalized autoregressive conditional heteroscedasticity in mean (GARCH-M) framework to model returns and volatility simultaneously to study this relationship which has not been addressed in the REIT literature. Results suggest that the liquidity crisis had significant negative effects on REIT returns along with significant increases in volatility. Results additionally indicate that investor sentiment is a significant factor in explaining REIT returns and volatility during the sample period from December 2001 to February 2013. Moreover, results suggest that institutional investor sentiment is a significant factor in the returns generating process during the liquidity crisis whereas individual investor sentiment was not significant. Chapter III fills a gap in the behavioral finance literature by providing evidence on the impact of investor sentiment on a highly regulated industry during times of market crisis.

In Chapter IV, I test for the asymmetric impact of changes in sentiment on REIT returns and volatility. I test whether REIT returns and volatility react differently to positive and negative shifts in institutional and individual investor sentiment. For returns, this asymmetric effect is tested by including interactions between the magnitude of the change in sentiment and a dummy variable that identifies positive or negative shifts that are included in a linear regression model. Similar to Lee et al. (2002), volatility is modeled using a generalized autoregressive conditional heteroscedasticity (GARCH) in mean framework in which I include similar interactions between the magnitude and positive/negative shift in sentiment dummy variables. By observing the coefficients in the conditional variance equation, one can observe any asymmetric impacts of changes in sentiment on REIT volatility. Based on the overreaction to negative news and underreaction to positive news premise proposed by DeBondt and Thaler (1985), I generally observe a greater impact for negative sentiment changes than to positive changes in sentiment on both REIT returns and volatility. It is important to determine an existence of an asymmetric effect of sentiment to further establish a relationship between investor sentiment, both institutional and individual, and the return generating process of REITs. Evidence from the field of behavioral finance suggests that sentiment is a significant factor to security price formation. I contribute to the literature by exploring the impact of investor sentiment on a strongly regulated REIT industry and by separating the effect of sentiment from two markedly different classes of investors: large institutions versus individuals. Understanding the relationship between sentiment and returns in an industry with many operational constraints provides the investor with additional knowledge on how to allocate funds more efficiently using sentiment as a potential signal.

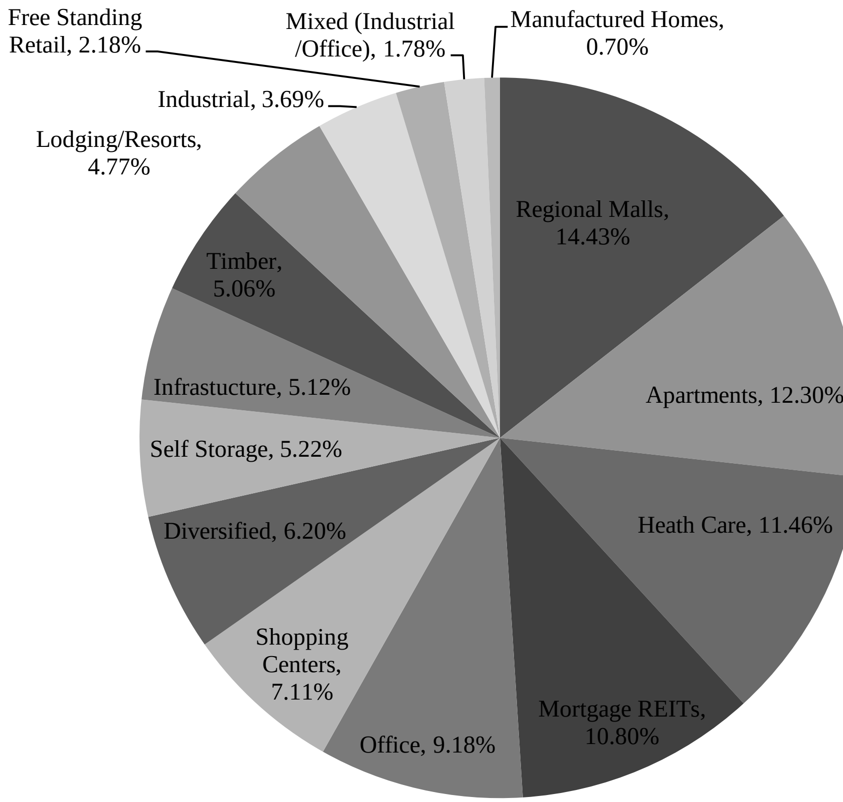
Lastly, Chapter V provides a summary of the empirical findings of this dissertation and a general conclusion of implications from this comprehensive study.

Figure 1.1. Number of REITs by investment purpose (Equity, Mortgage or Hybrid).



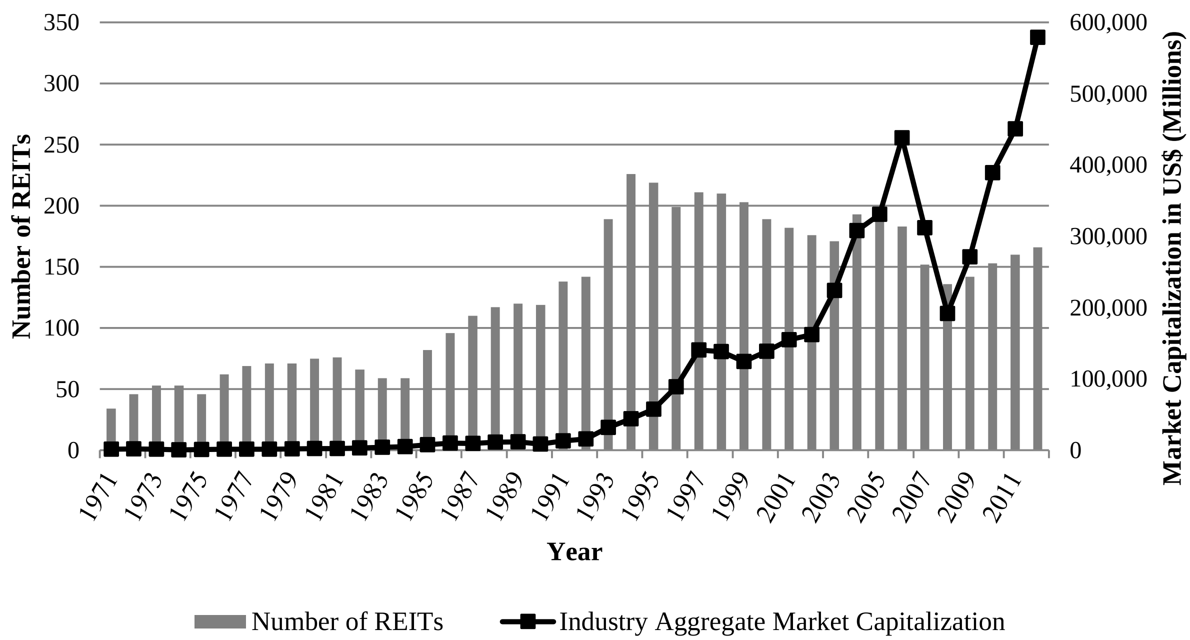
Notes: This figure graphically displays the number of Equity, Mortgage and Hybrid REITs per year from 1992 to 2011. Data is from NAREIT (www.reit.com), accessed on December 12, 2012.

Figure 1.2. REIT classification by sub-industries as of October 2012.



Notes: This graph shows the distribution of REITs by industry subsectors (regional malls, apartments, healthcare facilities, mortgage REITs, office buildings, shopping centers, diversified, self-storage, infrastructure, timber, lodging/resorts, industrial facilities, free standing retail buildings, mixed industrial/office, and manufactured homes.) as reported by the National Association of Real Estate Investment Trusts on November 2012. Data is from the NAREIT November 2012 REIT Watch, a monthly statistical report on the Real Estate Investment Trust Industry (http://returns.reit.com/reitwatch/rw1211.pdf). Accessed on December 17, 2012.

Figure 1.3. Aggregate market capitalization of the REIT industry and number of REITs.



Notes: This graphs graphically shows the aggregate market capitalization in US$ (Millions) of the REIT industry and number of REITs as reported by the National Association of Real Estate Investment trusts from 1971 to 2012. Data is from NAREIT (www.reit.com). Accessed on December 12, 2012.

CHAPTER II

CONTEMPORANEOUS AND INTERTEMPORAL RELATIONSHIP OF INVESTOR SENTIMENT AND REIT RETURNS

2.1. Introduction

Classical financial theory is formed under the assumption that investors are rational wealth maximizers who make investment decisions based on economic and market fundamentals in which sentiment does not play a role in their allocation strategies. The long-standing notion in classical finance is that irrational investors who trade on erroneous beliefs cannot profit consistently over the long-run and will be driven out of the market by rational arbitrageurs; as a result, the long-run impact on prices by irrational traders is trivial. Fama (1965) explains that irrational traders, or noise traders as tagged by Black (1986), will consistently misprice assets and arbitrageurs who trade against them will eventually push prices toward their fundamental values.

However, a wave of literature puts forth the notion that investor sentiment does play a role in the return generating process of financial assets. The concept of investor sentiment is defined as an individual's belief in future cash flows and risk that is not supported by available facts (Baker and Wurgler, 2007), a behavior that impacts asset pricing significantly as revealed in theoretical and empirical work in the field of behavioral finance. The impact of noise traders had been disregarded in the finance literature until recent theoretical models arose in the face of new issues being pointed out by academics such as the limit to the power of arbitrage for sophisticated investors. De Long et al. (1990) put forth a theoretical framework in which they posit that the impact of noise trading can lead to a divergence between market prices and fundamental values. Other researchers, such as Campbell and Kyle (1993) and Barberis et al. (1998) provide further theoretical evidence that investor behavior impacts the price dynamics of financial assets.

Empirical research documents that a relationship exists between sentiment and returns. For example, Neil and Wheatly (1998) find a positive relation between their proxies for sentiment and small capitalization firm expected returns. Similarly, Fisher and Statman (2000) find a statistically significant relationship between sentiment and returns, although their findings show that an intertemporal inverse relationship exists, that is, positive (negative) changes in sentiment lead to decreases (increase) in returns the following month. Fisher and Statman (2000) use measures of investor sentiment for individual, semiprofessional, and institutional investors. They define as semiprofessional investors a group that is midway between amateur individual investors and professional Wall Street strategists (institutional), mainly composed of financial newsletter writers. Fisher and Statman (2000) report that individual investor sentiment and newsletter writer sentiment are unrelated to Wall Street (sophisticated) investor sentiment, marking a difference in the sentiment of different investor types. Brown and Cliff (2005) also report a positive relationship between sentiment and changes in market valuation and a negative intertemporal effect of sentiment on returns, high levels of sentiment lead to significantly lower returns over the following 2 or 3 years. They explain that optimistic (pessimistic) investors drive prices upward (negatively) in the short-run which revert in subsequent periods.

Real Estate Investment Trusts are a unique form of equity that has been studied extensively. Their marked differences from other stocks and strict government imposed controls make them an attractive testing ground for innovative theories in the financial literature. For instance, Howton et al. (2000) argue that REITs can be catalogued as closed-end investment funds that allow investors to indirectly invest in commercial real estate. REITs must derive 75% or more of their gross income from property rentals and it cannot derive 30% or more of its income from the sale of real property that is held for less than 4 years. Moreover, unlike other firms in the market, REITs are tax exempt given that they distribute 90% or more of their income in the form of dividends which restricts them from building retained earnings and hence exhibit unique capital structures.

However, after the REIT legislation change in 1992, which resulted in REITs becoming more liquid, larger, and more focused by property types, REITs switched from their fund-like configuration and adopted characteristics that made them more like other firms in the stock market (Chan et al., 2005). Glasscock et al. (2000) explain that REITs after 1992 began behaving more like small-cap stocks and less like fixed-income bonds. Glasscock et al. (2000) show that before 1992, REITs were cointegrated with the bond market and segmented from the common stock market but document a structural break in the early 1990s which altered the behavior of REITs to mimic stocks.

2.1.1. REITs and investor sentiment

The relationship between investor sentiment and REITs has been addressed to some extent in previous literature; however, it is evident that more research is required to establish a pattern of findings that will bring an enhanced understanding of the impact that investor expectations of future market conditions have on the return generating process of these securities. Chan et al. (1990) pioneered the analysis of the relationship of REIT returns and closed-end fund discounts, a commonly used proxy for investor sentiment. They find that the closed-end fund discounts significantly affect REIT returns using a multifactor Arbitrage Pricing model. Lin et al. (2009) builds on Chan et al. (1990) and formally investigates the investor sentiment-REIT return relationship. Lin et al. (2009) use as a proxy for individual investor sentiment the change in closed-end discounts and control for sophisticated investor influence with the change of REIT institutional ownership. Their use of the individual investor sentiment proxy is motivated by De Long et al. (1990) who find a negative relationship between closed-end fund discounts and stock returns, which complement the results of Lee et al. (1991) that find that changes in irrational investor sentiment is negatively related to closed-end fund discounts and positively related to stock returns. Findings from Lin et al. (2009) suggest that there is a significant relationship between investor sentiment and REIT returns. Results of their analysis show that when their proxy of investor sentiment depicts optimism, REIT returns are higher. These findings are consistent with related research that also suggests a positive relationship between sentiment and stock returns (e.g. Neal and Wheatly, 1998; Lee et al., 2002, Baker and Wurgler, 2007).

Specific results from Lin et al. (2009) suggest that individual investor sentiment impacts REIT returns and that institutional investor ownership does not have a significant impact on REIT prices or mitigates the effect of sentiment on REIT returns. However, these authors ignore the potential effect that institutional investor sentiment may have on REIT returns. There is empirical evidence that since the 1992 boom, REIT institutional ownership has dramatically increased in REITs from 15.81% institutional ownership to 40.60% in 1996 (Below et al., 2000). Devos et al. (2012) reports aggregate REIT institutional ownership at approximately 40% in the third quarter of 2004, peaking at 58% at the beginning of 2008, and falling to 50% at the end of

2009. Research additionally shows that after the relaxation of the five-or-fewer rule with the Revenue Reconciliation Act of 1993, the substantial increase in institutional ownership resulted in an increase in REIT prices (Downs, 1998). Chan et al. (2005) explain that the increase in institutional participation in the REIT market after the structural changes occurred in the 1990s influence REITs to behave more like other equity in the market for which institutional ownership is significant. This tendency points to the belief that the increase in institutional ownership in REITs should enhance the influence of institutional investors' perception of future market conditions on REIT returns.

The use of the closed-end fund discount as a sentiment proxy is disputed in the finance literature. Noticeably, Chen et al. (1993) suggest that findings from Lee et al. (1991) are not sufficiently robust to claim that the closed-end fund discount can be ultimately a reflection of small (individual) investor sentiment. In fact, there are some indications in Chen et al. (1993) that institutional holdings may be a contributing factor to the closed-end fund discount. Results by Chen et al. (1993) and Elton et al. (1998) contest the investor sentiment proxy used in Lin et al. (2009). This allows for a reexamination of the impact of investor sentiment on REIT returns using alternative sentiment measures.

Brown and Cliff (2004) investigate different investor sentiment measures and their feedback on returns. One of the primary findings that they present is that survey-based sentiments are significantly related to commonly used indirect measures (proxies) of sentiment such as: the number of advancing issues to declining issues, the percent change in margin borrowing, the percent change in short interest, the ratio of specialists' short sales to total short sales, the ratio of odd-lot sales to purchases, the equity put-to-call trading volume, the closed-end fund discount, the net purchases of mutual funds, the proportion of fund assets held in cash, and the initial public offerings first day returns. This indicates that survey measures do a proper job in depicting sentiment. Brown and Cliff (2004) suggest that sentiment does not necessarily impact individual investors and small stock exclusively as has been commonly presented in the literature; their analysis shows that institutional investor sentiment is also a factor that impacts returns and that large stocks are also affected by sentiment.

This study builds on the understanding of the impact of investor sentiment and REIT returns. I employ proxies for investor sentiment that are survey-based and are considered direct measures of sentiment in previous literature (Brown and Cliff, 2004) and perform several econometric analyses to investigate the sentiment-REIT- return relationship. I additionally include a real estate specific measure of sentiment that captures the perception of investment conditions of institutional investors in the commercial real estate market by the Real Estate Research Corporation (RERC).

The purpose of this study is twofold. First, I aim to investigate the influence of both institutional and individual investor sentiment on REIT returns and, second, I test the hypothesis of Fisher and Statman (2000) and Brown and Cliff (2005) that suggests that high levels of sentiment lead to significantly lower returns in the following periods and vice versa. Given the regulatory nature of REITs, sentiment from distinct groups of investors may have an impact on the REIT returns that is different from the effect documented for other firms in the market. It is important to establish a relationship between the sentiment of both individual and institutional investors on REIT returns since REIT institutional ownership is on the rise since the 1992 legislation reforms. This essay fills a gap in the REIT literature by recognizing the influence on the REIT industry that two markedly different groups of investors may have. Institutions and individuals are often shown to react differently to information about the market and form expectations that are frequently dissimilar at given points in time. It is important to recognize that large institutional investors have sizeable capital and frequently trade in blocks that are hefty enough to influence the REIT industry, an industry that is relatively smaller compared to others in the stock market. It is also relevant to assess the influence that the expectations of these large investors may have on REITs. Further, this essay contributes to the literature of portfolio management by providing investors that use REITs as their main avenue for investment or use them as portfolio diversification vehicles with more knowledge on the influence of investor sentiment on REIT returns. This may allow REIT market participants to better determine their allocations using changes in sentiment as signals for portfolio rebalancing.

2.2. Data

As a proxy for REIT returns, I employ the FTSE NAREIT U.S. Real Estate Index returns from Thomson's DataStream. The FTSE NAREIT Real Estate Index is a free-float adjusted, market capitalization-weighted index of U.S. Equity REITs. The FTSE NAREIT is a proper sample of the REIT industry since it includes all REITs recognized by the National Association of Real Estate Investment Trusts. Constituents of the Index include all tax-qualified REITs with more than 50 percent of total assets in qualifying real estate assets other than mortgages secured by real property.[5] Additionally, I include the FTSE NAREIT U.S. Total Return index that takes into account dividend payments that constitutes a significant source of income for REIT investors to check for the robustness of the results. It is important to examine total returns in the REIT industry given that investors, especially institutions, often hold REITs in their portfolios

[5] A detailed description of the FTSE NAREIT U.S. Real Estate Index can be found at the National Association of Real Estate Investment Trusts (NAREIT) website: http://www.reit.com/DataAndResearch/IndexData/RealTimeIndexReturns/US/Equity-REITs.aspx, accessed on December 6, 2012.

for their dividends and the steady income that they produce rather than for the appreciation in stock prices. The sample covers the period from January 1992 to February 2013. The sample begins in 1992 since the REIT industry experienced significant changes in rules and regulations then, in fact, academics refer to the period after 1992 as the "new REIT era" (Pagliari et al., 2005; Oikarinen et al., 2011). After the changes in the REIT market in the early 1990s, it is believed that a notable increase in institutional ownership and analyst coverage led to a better dispersion of information about these firms. These changes resulted in REIT prices more accurately reflecting market fundamentals and display less deviation from their net asset value, making the REIT market more efficient (Oikarinen et al., 2011).

As control variables, I use the Fama and French (1992) factors and the default risk (*DEF*) and term structure premiums (*PREM*). Although some academics debate whether the use of the Fama-French factors adequately explain REIT returns, Peterson and Hsieh (1997) address this issue and conclude that equity REIT returns are affected by the market-to-book and size factors as suggested by Fama and French (1992) and by the bond market factors *DEF* and *PREM* (Fama and French, 1993). The Fama-French and bond market risk factors are commonly used in REIT literature as control variables (e.g., Buttimer et al., 2005; Lee et al., 2008; Lin et al., 2009; Ro and Ziobrowski, 2011). The Fama-French factors are obtained from Dr. Kenneth French's website[6]. *DEF* is the default risk premium defined by the difference between Moody's Seasoned Aaa Corporate Bond Yield and the Baa Corporate Bond Yield. *PREM* is the term risk premium constructed as the difference between the 20-year Treasury bond rate and the one-month Treasury bill rate. The *DEF* and *PREM* factors are constructed from data from Thomson's DataStream.

[6] Accessed on November 29, 2012. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

2.2.1. Sentiment indices

The sentiment indices used in this study are all direct, survey-based measures following Brown and Cliff (2004). As a proxy for institutional investor sentiment, this study employs the Investors Intelligence (*II*) survey. Investors Intelligence is an organization based in New Rochelle, NY that is dedicated to financial research and technical analysis.[7] The Investors Intelligence survey is built on a compilation of investment advisory newsletters' perception of the market. These perceptions are labeled bullish, bearish, or hold depending on the recommendations from the advisors for which three measures are constructed: the percentage of bullish advisors, bearish advisors, and neutral advisors. The institutional sentiment index in this analysis is constructed by calculating the spread between the percentage of bullish investors and bearish investors, commonly referred to as the bull-bear spread (Brown and Cliff, 2004).

To proxy for individual investor sentiment, this study employs data from the American Association of Individual Investors (*AAII*) market condition survey. The AAII is a nonprofit organization that focuses on education to individual investors about wealth management and investing.[8] This survey is conducted by the AAII selecting a random sample of its members and asking about their perception of market outlooks for the following 6 months. Depending on the responses, the AAII labels each survey as bullish, bearish, or neutral. The individual sentiment index is constructed by calculating the difference between the percentage of bullish responses and bearish responses of the surveys. The AAII index is the bull-bear spread variable that captures individual investor sentiment (Brown and Cliff, 2004).

---

[7] More information on Investors Intelligence is found at: http://www.investorsintelligence.com/x/about_us.html. Accessed on December 12, 2012.

[8] Additional information on the American Association of Individual Investors at: http://www.aaii.com/. Accessed on December 12, 2012.

This study additionally includes a sentiment variable that captures the perception of market conditions for the commercial real estate sector by the Real Estate Research Corporation (RERC). This variable captures the perceived investment conditions for ten commercial property types from institutional real estate investors which include REITs, pension funds, insurance companies, banks, private firms, opportunity funds, financial companies, and union funds. The limitation of this data is that it is only available in quarterly frequency thus cannot be included in all analyses. However, the inclusion of this variable provides a more extensive assessment of the influence of sentiment on REIT returns. Figure 2.1 graphically shows the percentage of bullish survey respondents from 1992Q1 to 2012Q3 for the II, AAII, and RERC. The graphs in Figure 2.1 depict more volatility in the sentiment for individual investors than both institutional measures of sentiment (II and RERC). It is generally expected that individuals or "small" investors show more frequent and larger corrections in sentiment than do institutional investors.

2.2.2. Descriptive statistics

2.2.2.1. Quarterly data. Table 2.1 presents the correlation among the variables employed in the quarterly frequency analysis. The highest correlation observed in the quarterly variables is between the excess returns of the market (*Rm-Rf*) and the *SMB* factor with a correlation coefficient of 0.443 and between the two measures of changes in sentiment AAII and II with a correlation coefficient of 0.428. Hence, correlation values among variables show no potential problem of multicollinearity in the regression models proposed in section 2.3.

Descriptive statistics for quarterly observations are presented in Table 2.2. As expected, mean NAREIT Total excess returns (0.607%) are noticeably larger than NAREIT Price excess returns (-0.904%). Interestingly, as measured in quarterly frequency, the excess returns of the market (*Rm-Rf*) is, on average, larger than the returns for the REIT industry, this is possibly driven by periods of extremely small or negative returns experienced in the real estate market during the crisis of 2007-2009. Among the sentiment variables, changes in individual investor sentiment ($\Delta AAII$) have the largest standard deviation (20.929%) and greater magnitude in minimum and maximum values in comparison to the II and RERC measures of institutional investor sentiment. This supports the graphical representation of the sentiment measures in Figure 2.1 that shows more volatility and larger corrections in individual investor sentiment compared to institutional investor sentiments.

Figure 2.2 presents the histograms for the three measures of sentiment $\Delta AAII$, ΔII and $\Delta RERC$ and for the two measures of REIT industry returns. The histograms depict a relative normal distribution for all variables, which are a necessary condition for unbiased results in the regression analysis explained in the methodological section 2.3.

2.2.2.2. Monthly data. Table 2.3 presents the correlation table for monthly frequency data. The highest correlation is observed between the excess return in the market (*Rm-Rf*) and the NAREIT industry returns with a correlation coefficient of 0.591. Similar to the quarterly data, the sentiment indices $\Delta AAII$ and ΔII have a correlation coefficient of 0.432. Again, no potential problems of multicollinearity are expected in this frequency.

Summary statistics for monthly observations are presented in Table 2.4. Excess NAREIT total returns show average returns of 0.989% which are higher than the mean NAREIT price excess returns (0.494%). For monthly frequency data, the mean excess return for the NAREIT total index is significantly higher than the mean excess return in the market. This is consistent with NAREIT publications that claim REIT over-performance with respect to the overall stock market when dividends are taken into consideration (NAREIT, 2012).

Consistent with Figure 2.1, individual investor sentiment appears more volatile than institutional investor sentiment. Changes in individual investor sentiment ($\Delta AAII$) have a larger standard deviation of 18.896% compared to the standard deviation of changes in institutional investor sentiment (ΔII) of 10.287% as well as larger magnitudes in minimum and maximum values.

Histograms for the institutional and individual investor sentiment variables along with the two measures of REIT returns are presented in Figure 2.3. The variables appear normally distributed.

2.2.2.3. Weekly data. The correlation table for weekly data is presented in Table 2.5. For this frequency and similar to monthly frequency data, the highest correlation is between the excess return in the market (*Rm-Rf*) and between the two measures of excess REIT returns. The correlation coefficients are 0.561 and 0.562 between the excess NAREIT price returns and excess NAREIT total returns and *Rm-Rf* respectively. The sentiment indices $\Delta AAII$ and ΔII in weekly frequency show a lower correlation (0.162) in comparison to the quarterly (0.428) and monthly frequencies (0.432) which suggests that in observations with higher frequencies there is a larger discrepancy between individuals' and institutions' market expectations.

Summary statistics for weekly frequency data are presented in Table 2.6. Consistent with the monthly data, mean excess NAREIT total returns (0.231%) are on average larger than mean excess NAREIT price returns (0.118%). Correspondingly, mean excess NAREIT total returns are higher than the excess return in the market (0.134%). The inconsistency in mean returns between the quarterly frequency observations and monthly and weekly observations can be attributed to a loss of information in quarterly data due to the large time spacing between observations.

Figure 2.4 shows the histograms for the $\Delta AAII$ and ΔII sentiment variables and the excess NAREIT price and total returns. The variables appear to follow a normal distribution.

2.3. Methodology

2.3.1. Contemporaneous impact of investor sentiment on REIT returns

The purpose of this study is twofold. First, I investigate the contemporaneous impact of investor sentiment on REIT returns while controlling for commonly used factors in the literature. I use quarterly, monthly, and weekly data frequencies for a thorough analysis. Following the methodological framework of Lin et al. (2009), I present univariate regressions of each measure of sentiment on REIT returns; the univariate equation is of the following form:

$$(REIT - Rf)_t = \alpha + \varphi \, \Delta Sent_t + \varepsilon_t \tag{2.1}$$

Where $REIT_t$ are the FTSE NAREIT U.S. Real Estate Index returns at time *t* and $\Delta Sent_t$ is the change in sentiment for each of the three measures of institutional, individual, and real estate sentiments at time *t*. The RERC sentiment is only included in the quarterly frequency regressions due to frequency limitation of this variable.

Next, I include all sentiment variables in a multivariate setting to observe the relationship among them when regressed against the NAREIT index returns. Similar to Fisher and Statman (2000), I find low correlations among the sentiment indices for the different categories of investors (institutional and individual); this allows including the various investor sentiment proxies previously described without encountering problems of multicollinearity in the model specification. The sentiment multivariate equation is of the following form:

$$(REIT - Rf)_t = \alpha + \sum_{i=1}^{n} \varphi_i \, \Delta Sent_{it} + \varepsilon_t \tag{2.2}$$

Where all sentiment variables: II, AAII, and RERC are included in the quarterly frequency regression and only II and AAII are included in the monthly and weekly frequency regressions. I next include the previously described control variables to the equation:

$$\begin{aligned}(REIT - Rf)_t = \alpha + \sum_{i=1}^{n} \varphi_i \, \Delta Sent_{it} \\ + \beta_1 \, Def_t + \beta_2 \, Prem_t + \beta_3 \, (Rm - Rf)_t + \beta_4 \, SMB_t + \beta_5 \, HML_t + \varepsilon_t\end{aligned} \tag{2.3}$$

Where the included control variables are defined as follows: DEF_t is the default risk premium defined by the difference between Moody's Seasoned Aaa Corporate Bond Yield and the Baa Corporate Bond Yield. $PREM_t$ is the term risk premium constructed as the difference between the 20-year Treasury bond rate and the one-month Treasury bill rate. $(Rm\text{-}Rf)_t$ is the excess return on the market portfolio constructed as the value-weighted returns on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate. SMB_t (small minus big) is the average return on the three small portfolios minus the average on the three big portfolios for all stocks based on market capitalization. HML_t (high minus low) is the average return on the two value portfolios minus the average return on the two growth portfolios for all stocks based on the book-to-market ratio and ε_t is the stochastic error term.

2.3.2. Intertemporal relationship of investor sentiment and REIT returns

To test for the intertemporal relationship of investor sentiment and returns, I employ a standard form vector autoregressive model (VAR). The VAR model considers current and past realizations of two or more stationary series and it is able to capture both contemporaneous and long-run relationships among variables. The VAR does not impose a direction of causation among variables which makes it appropriate for assessing temporal relationships (Huth et al., 1994).

To assist in fitting the VAR of the correct order, i.e., to select the appropriate number of lags of each variable to include in the model, I compute four selection-order statistics: the final prediction error (FPE), the Akaike's information criterion (AIC), the Hannan and Quinn information criterion (HQIC), and the Schwarz's Bayesian information criterion (SBIC). The number of lags selected for the VAR model is selected based on the significance of the selection-order criteria.

The vector autoregressive model employed is of the following form:

$$(REIT - Rf)_t = \alpha_{10} + \sum_{n=1}^{N} \alpha_{1_1 n}(REIT - Rf)_{t-n} + \sum_{n=1}^{N} \alpha_{1_2 n} Sent_{t-n} + e_{1t} \tag{2.4}$$

$$Sent_t = \alpha_{20} + \sum_{n=1}^{N} \alpha_{2_1 n}(REIT - Rf)_{t-n} + \sum_{n=1}^{N} \alpha_{2_2 n} Sent_{t-n} + e_{2t} \tag{2.5}$$

Where $(REIT\text{-}Rf)_t$ are the excess returns for the FTSE NAREIT U.S. Real Estate Index returns at time t, $Sent_t$ is the sentiment variable at time t and $(REIT\text{-}Rf)_{t-n}$ and $Sent_{t-n}$ are lags of the REIT excess returns and sentiment variables at time t-n.

A graphical representation of the impact of REIT returns on investor sentiment and vice versa is obtained through impulse response functions (IRFs). The IRFs will depict any contemporaneous and intertemporal long-run relationships among the two relevant variables. The IRFs show the average dynamic response of REIT returns to changes in sentiment (Blanchard and Perotti, 2002). In order to generate valid VAR results, the system of equations must prove to be stationary and the stability condition must hold. If these assumptions are not met, the IRF will not dissipate over time and shocks will be shown to have a permanent effect on the series leading to uninterpretable VAR results. A test of the stability condition is provided in the results section 2.4.2.

2.4. Results

2.4.1. Contemporaneous impact of investor sentiment on REIT returns regression results

2.4.1.1. Quarterly data. Regression results for quarterly frequency data are presented in Tables 2.7 and 2.8. Table 2.7 shows the results in which the dependent variable is the excess NAREIT price returns and Table 2.8 presents results for excess NAREIT total returns. Columns 1, 2, and 3 provide results for the univariate regression analyses in which each measure of investor sentiment $\Delta AAII$, ΔII, and $\Delta RERC$ is included independently. All investor sentiment variables have positive and statistically significant impacts on REIT returns. Results are similar for the alternative measures of REIT returns.

Model 4 in Tables 2.7 and 2.8 show the results for equation 2.2, in which all measures of investor sentiment are included simultaneously. The results in model 4 show that when all three measures are included concurrently, the individual investor sentiment loses statistical significance while the ΔII remains positive and statistically significant at the 1% level and $\Delta RERC$ remains positive and significant at the 5% statistical significance level, i.e., the impact of individual investor sentiment dissipates once included with the two measures of institutional investor sentiment. This provides preliminary evidence of the dominance of institutional investor sentiment over expectations of small individual investors.

Models 5, 6, 7, and 8 provide equations with different combinations of control variables to test for the robustness of the investor sentiment coefficients when variables that have been empirically found to explain returns in the REIT industry are included. Model 5 includes all three measures of investor sentiment along with the Fama-French three-factor model. Neither measure of institutional investor sentiment ΔII and $\Delta RERC$ lose statistical significance although the coefficient for $\Delta RERC$ considerably reduces in magnitude. Interestingly, however, only the high minus low book-to-market (*HML*) factor is statistically significant while the excess return in the market (*Rm-Rf*) and the small minus big (*SMB*) are not statistically significant.

Model 6 shows the results for the equation that only includes as control variables the Fama-French (1993) bond factors. In this model I observe that both bond factors *DEF* and *PREM* are statistically significant at the 1% level and the $\Delta RERC$ is no longer significant while the change in institutional investor sentiment ΔII remains robust with a positive and statistically significant coefficient (5% level). These results support the work of others in the REIT sector that argue that because of the stringent dividend policies in REITs, these firms display similar performance to fixed income generating assets such as bonds.[9]

Columns 8 in Tables 2.7 and 2.8 show the results for the comprehensive model presented in equation 2.3. In this model only the change in institutional investor sentiment (ΔII) remains positive and statistically significant at the 1% level, proving to be robust in all model specifications. The control variables *SMB*, *DEF*, and *PREM* also remain highly significant, noticeably contributing to explaining the variation in both measures of REIT excess returns. This compressive model 7 presents the highest R^2 (48.6 % for the excess NAREIT price returns and 50.2% for the excess NAREIT total returns) among all models presented in tables 2.7 and 2.8.

[9] Model 7 is included in the results table for completeness of the analysis to include all statistically significant factors, SMB, Def, and Prem, along with the three measures of investor sentiment ΔAII, ΔII, and ΔRERC.

Columns 9, 10, and 11 show results for the comprehensive model in equation 2.3 including each measure of changes in investor sentiment independently. Results remain materially unchanged under these specifications. In model 9, $\Delta AAII$ appears statistically significant at the 10% level, however as previously mentioned, this coefficient is not robust in other model specifications.

Results suggest that for quarterly frequency data, changes in future market expectations of individual investors and real estate dedicated institutional investors do not impact REIT industry returns significantly. However, changes on future market expectations in large institutional investors do have a significant impact in the returns of this industry. This implies that the increase in institutional ownership in REIT is shown to have influenced the dynamics in the returns of the REIT sector.

2.4.1.2. Monthly data. Tables 2.9 and 2.10 show regression results for monthly frequency data for excess NAREIT price returns and excess total returns respectively. Results for both measures of REIT industry returns are essentially similar. In columns 1 and 2, I present results for the univariate regressions presented in equation 2.1. Results in monthly frequency indicate a weak impact of changes in sentiment on NAREIT excess returns; $\Delta AAII$ appears to have an insignificant effect on REIT returns while ΔII shows a positive effect on REIT returns but with a statistical significance at only 10%. Column 3 shows the results from equation 2.2, in which both measures of sentiment are included simultaneously in the model. Results indicate that $\Delta AAII$ is insignificant and, consistent with model 2, ΔII is positive and significant at the 10% level.

Models 4 in Tables 2.9 and 2.10 present the results when both measures of sentiment along with the Fama-French three-factor model are included as control variables. All three Fama-

French factors appear highly significant at the 1% statistical significance level, supporting results from prior literature, all with the expected positive sign. In this model with control variables, however, $\Delta AAII$ and ΔII appear with insignificant coefficients. Column 5 show the results for the model that includes both measures of investor sentiment and the Fama and French (1993) bond factors as control variables. Results of this model suggest that the bond factors contribute weakly to the formation of REIT market excess returns with 10% significance levels for both factors *DEF* and *PREM*. $\Delta AAII$ appears insignificant and ΔII is positive and significant at the 10% significance level.

Column 6 presents results for the comprehensive model presented in equation 2.3. In this model, both measures of individual and institutional investor sentiment are included along with all control variables. Results show that $\Delta AAII$ and ΔII are statistically insignificant while the three Fama-French stock market factors are positive and statistically significant at the 1% level. The bond factors *DEF* and *PREM* lose significance once included along with the Fama-French three stock factors. Columns 7 and 8 show the results of the full model using the two measures of investor sentiment alternatively, however, results are similar to those observed in model 6.

2.4.1.3. Weekly data. Weekly frequency data results are particularly relevant because they capture the short-run dynamics between changes in investor sentiment and REIT industry excess returns as well as the short-run relationships between the Fama-French stock market factors and bond factors and REIT returns. Figure 2.5 graphically shows the dynamics of the changes in sentiment for individual and institutional investors. Clearly, investor reactions to new information occur rapidly and corrections to future market expectations are prompt. These dynamic shifts are expected to have nearly immediate impacts on returns.

Tables 2.11 and 2.12 present the regression results for weekly frequency data for dependent variables excess NAREIT price returns and total returns respectively. Results for both measures of returns yield, in essence, similar coefficients. Columns 1 and 2 show the results for equation 2.1 univariate regressions. The two measures of changes in investor sentiment $\Delta AAII$ and ΔII positively and significantly (1% level) impact REIT excess returns when included in the model independently. Column 3 presents the results for equation 2.2 where $\Delta AAII$ and ΔII are included simultaneously in the model. Results of this model specification show that both measures of sentiment remain significant (1% level) and positive. However, an F-test of the null hypothesis $\Delta AAII = \Delta II$ indicates that the coefficient for ΔII (0.165) is statistically lager than the coefficient for $\Delta AAII$ (0.023) at the 1% significance level ($F = 43.19$, $p = 0.000$). This supports the hypothesis that changes in institutional investor sentiment have a larger impact on returns than do changes in individual investor sentiment.

Column 4 shows the results for the model that includes both sentiment variables $\Delta AAII$ and ΔII and the Fama-French three-factor model. In this model specification, investor sentiment coefficients $\Delta AAII$ (0.010) and ΔII (0.038) remain positive and statistically significant (5% level). All three Fama-French factors are positive and statistically significant at the 1% level. Column 5 presents the results for the model specification which includes $\Delta AAII$ and ΔII and the Fama and French (1993) bond factors. Results for this model show that $\Delta AAII$ and ΔII continue to be positive and significant and the bond factors, although of the expected sign, are not statistically different from zero.

Column 6 presents the results for the comprehensive model in equation 2.3. Results for this specification show that changes in individual and institutional investor sentiment remain positive and statistically significant at the 5% level. Based on an F-test of the null $\Delta AAII = \Delta II$

indicates that the coefficient for Δ*II* (0.041) is statistically larger than the coefficient for Δ*AAII* (0.012) (F = 2.80, p = 0.094), supporting the conjecture that changes in institutional investor sentiment have a larger impact on returns than do changes in individual investor sentiment. Control variables *Rm-Rf*, *SMB* and *HML* are all positive and statistically significant at the 1% level while the Fama and French (1993) bond factors remain statistically indistinguishable from zero. Comprehensive model 6 explains roughly 48% of the variation in REIT market returns (R^2 = 0.479). Models 7 and 8 show results for equation 2.3 using the two measures of investor sentiment alternatively, with results remaining unchanged.

2.4.2. Intertemporal relationship between investor sentiment and REIT returns VAR results

Table 2.13 presents the selection-order statistics for the VAR analysis for the excess NAREIT price and total returns to establish the suitable number of lags to be included in the system of equations. For both measures of excess NAREIT returns, 4 lags are appropriate according to the FPE, AIC, and HQIC.[10] All VAR results in this analysis meet the necessary stability conditions in which the calculated eigenvalues lie inside the unit circle, that is, the system is rendered stationary and the IRFs will show shocks that dissipate over time. The results for the stability condition tests are presented in Appendix B.

The results for the VAR analysis for the impact that innovations (shocks) of changes in individual investor sentiment (Δ*AAII*) have on excess REIT price and total returns are presented in Tables 2.14 and 2.15 respectively. Graphical representations of these results are shown in the

[10] The SBIC selection order criterion suggests a model with 2 lags. VAR analysis using 2 lags yield similar results.

impulse response functions in Figure 2.6.[11] Results show that a shock in $\Delta AAII$ has a significant and positive impact on contemporaneous excess REIT price and total returns. However, neither IRF depicts significant reversal or long-run effect.

The VAR results for the impact of shocks of changes in institutional investor sentiment (ΔII) on excess REIT price and total returns are reported in Tables 2.16 and 2.17 respectively. Impulse response functions are presented in Figure 2.7. Similar to $\Delta AAII$, results show that an innovation in ΔII has a significant and positive impact on contemporaneous excess REIT price and total returns with no significant reversal or long-run effect. Results show that the magnitudes of the impact of shocks in ΔII have a lager magnitude than shocks in $\Delta AAII$ on REIT excess returns with no perceptible difference between price and total returns.

Results suggest that although both measures of sentiment $\Delta AAII$ and ΔII have positive and significant contemporaneous impacts on REIT excess returns, while changes in institutional investor sentiment (ΔII) have a larger effect on returns. These results support the hypothesis that institutional investor sentiment has a larger impact than individual investor sentiment in the REIT industry given the large increase in institutional holdings in this sector. The results in this analysis, however, do not support the findings of Fisher and Statman (2000) and Brown and Cliff (2005) who observes high levels of sentiment being followed by low returns in subsequent periods. The findings I present for the REIT industry may suggest that although sentiment affects REIT returns contemporaneously, this effect is not persistent in the long-run given the transparency and relative ease of valuation of underlying assets of these firms and the rapid adjustment in REIT equity prices.

---

[11] All combinations of impulse response functions from the statistical software output are presented in Appendix A, relevant IRFs are presented in figures 2.6 and 2.7.

2.5. Summary and conclusions

The relationship between investor sentiment and REIT industry returns has been widely overlooked in the finance and real estate literature. Advances in the field of behavioral finance show evidence that markets are not necessarily efficient at all times and that investors' future market expectations play a role in the return generating process of securities. Although REITs are regarded to be highly efficient in their pricing given their higher levels of transparency and ease of valuation of underlying assets with respect to other firms, prices do contain a significant portion of noise, which is in part constituted by sentiment.

This essay contributes to the REIT literature by examining the contemporaneous and intertemporal impact of changes in investor sentiment and REIT industry excess returns. One of the key contributions is the distinction made between two markedly different types of investors: large institutional investors with very sophisticated and efficient teams of analysts that carefully scrutinize their investments and have substantial amounts of capital, and smaller individual investors that neither have the same capacity of analysis nor the large magnitude of capital. Recent work by Lin et al. (2009) on the relationship between sentiment and REIT returns shows that individual investor sentiment, proxied by the closed-end fund discount, significantly affects REIT returns. However, their proxy for investor sentiment fails to make the distinction of whether this sentiment actually reflects future expectations by individuals or by institutional investors (Chen et al., 1993) which opens an avenue for research to revisit this sentiment-return relationship in REITs.

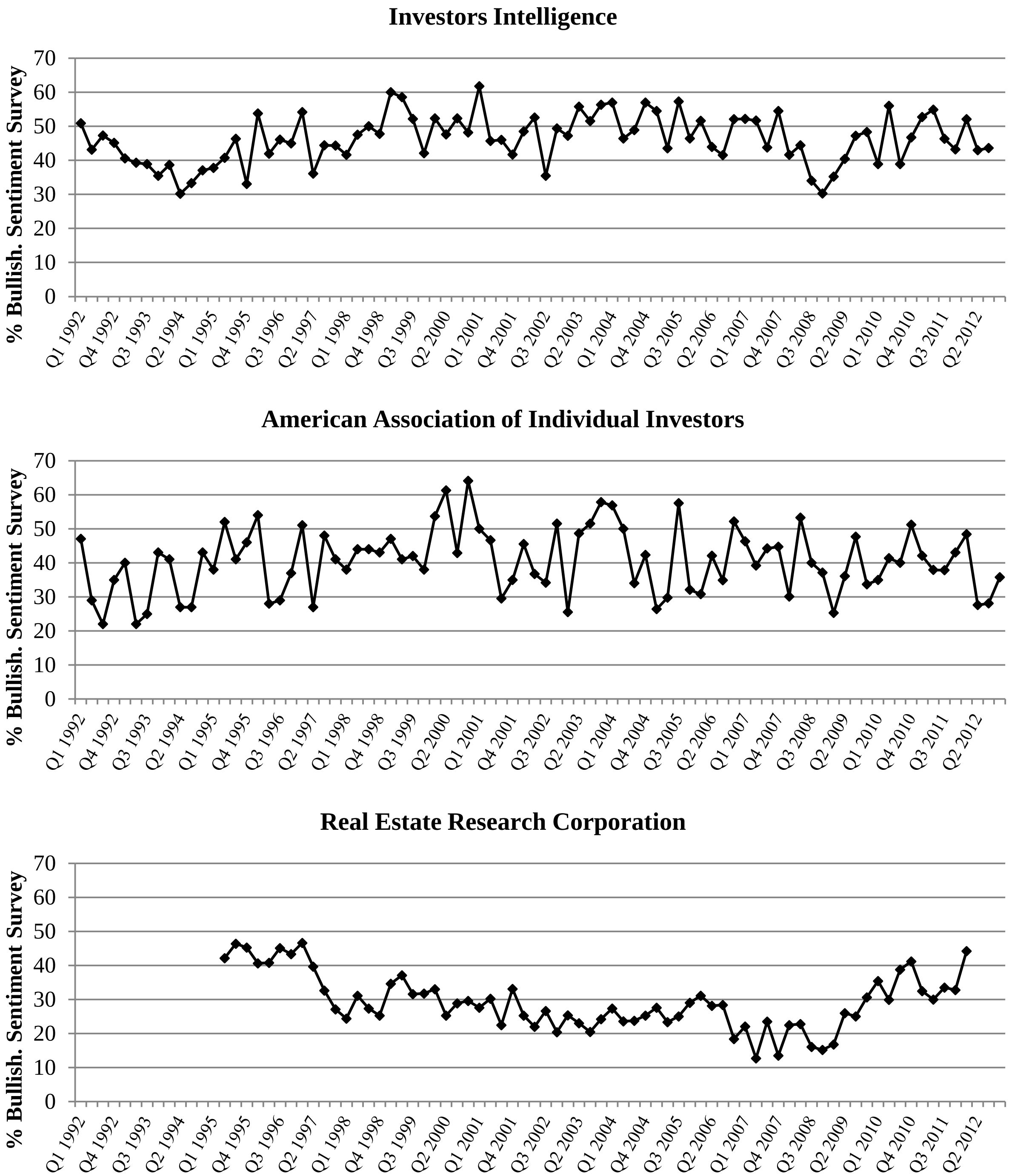
Given the large increase in institutional ownership that the REIT industry has experienced since the important legislative changes occurred early in the 1990s, I expect REIT returns to be impacted more by changes in institutional investors' future market expectations than by changes in individual investors' expectations. Moreover, to consider the capital capacity and block trading capability of institutional investors offers a stronger basis to expect that changes in institutional investor sentiment may impact REIT industry returns more than changes in individual investor sentiment.

I offer a methodological framework that uses regression analysis and VAR estimations to test for the impact that changes in investor sentiment may have on REIT industry returns. In sum, regression results suggest that both changes in individual and institutional investor sentiment significantly impact contemporaneous REIT sector returns. Closer examination of the regression coefficients indicate that changes in institutional investor sentiment have a larger impact on REIT returns than changes in individual investor sentiment, supporting my initial conjecture. Regression results also support previous research that find that the Fama-French market and bond factors are useful in explaining the variation in REIT returns (e.g. Buttimer et al., 2005; Lee et al., 2008; Lin et al., 2009; Ro and Ziobrowski, 2011), although results diverge depending on the frequency of the data employed.

VAR results are consistent with the regression results; impulse response functions suggest a positive and significant impact of shocks in changes in individual investor sentiment on REIT returns as well as a significant impact of shocks in changes in institutional investor sentiment on REIT returns contemporaneously. Results, however, do not support the hypothesis of a long-run relationship of sentiment and returns (Fisher and Statman, 2000; Brown and Cliff, 2005) for the REIT industry, that is, shocks have an insignificant effect on returns after the first week. Concurrent with regression results, shocks in institutional investor sentiment have a larger effect than do shocks in individual investor sentiment.

The findings presented in this essay have implications for portfolio management, capital allocation strategies, and behavioral finance. Market participants can use changes in investor sentiment as signals for portfolio rebalancing and capital allocations. Investor sentiment measures are readily found as public information which is accessible to all investors providing data that may be used to structure investment strategies. In addition, these findings provide more evidence on the influence of investor sentiment on security pricing even for highly regulated sectors such as the REIT industry. Although REIT prices are believed by many to reflect all firm assets and efficiently discount future cash flows, the influence of corrections in investor perception of market conditions significantly affects returns.

Figure 2.1. Quarterly investor sentiment surveys from Investors Intelligence, American Association of Individual Investors and Real Estate Research Corporation.



Notes: These graphs show quarterly percentage of bullish investor sentiment surveys from Investors Intelligence, American Association of Individual Investors and Real Estate Research Corporation from 1992Q1 to 2012Q3.

Figure 2.2. Histograms quarterly frequency data

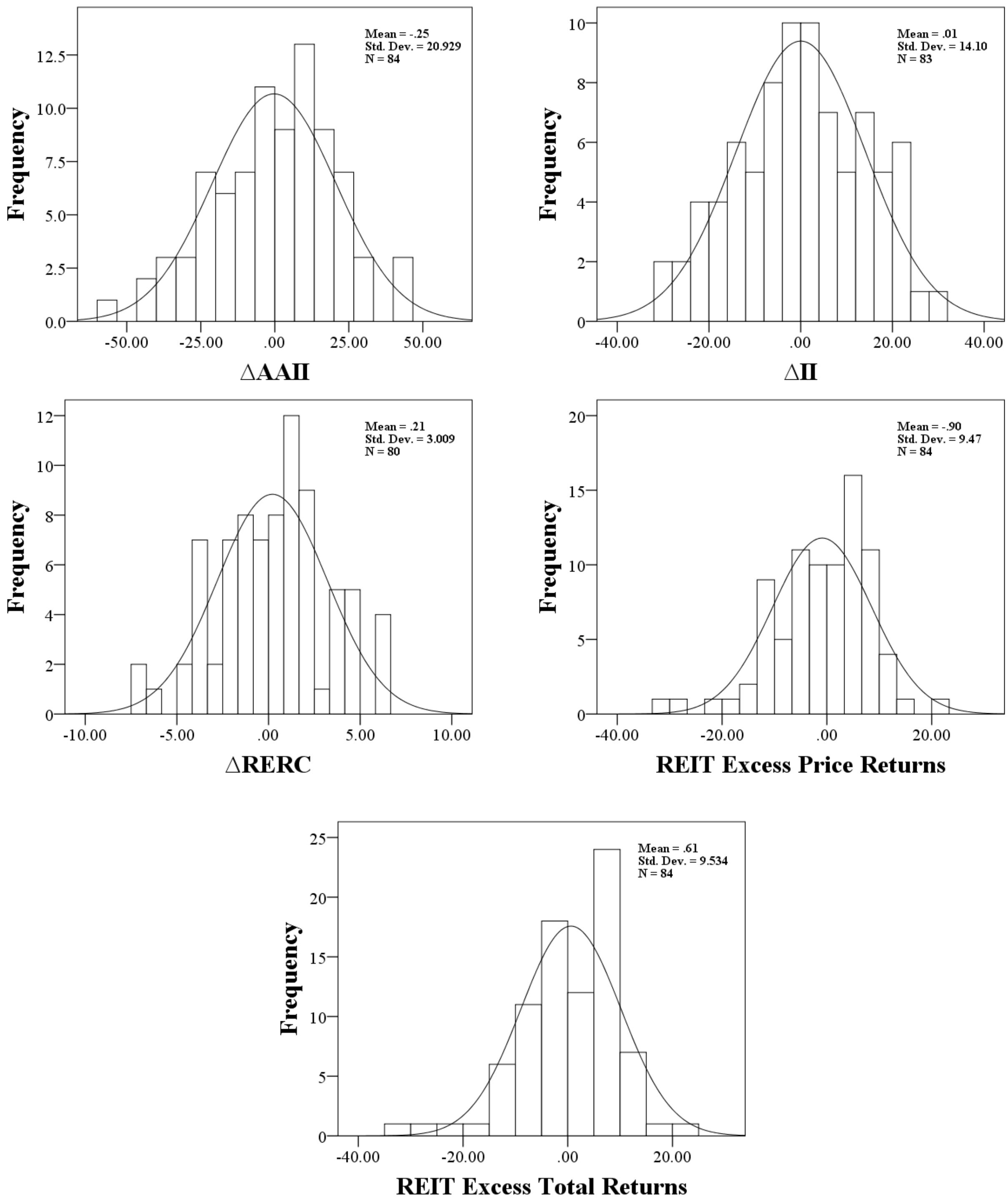


Figure 2.3. Histograms monthly frequency data

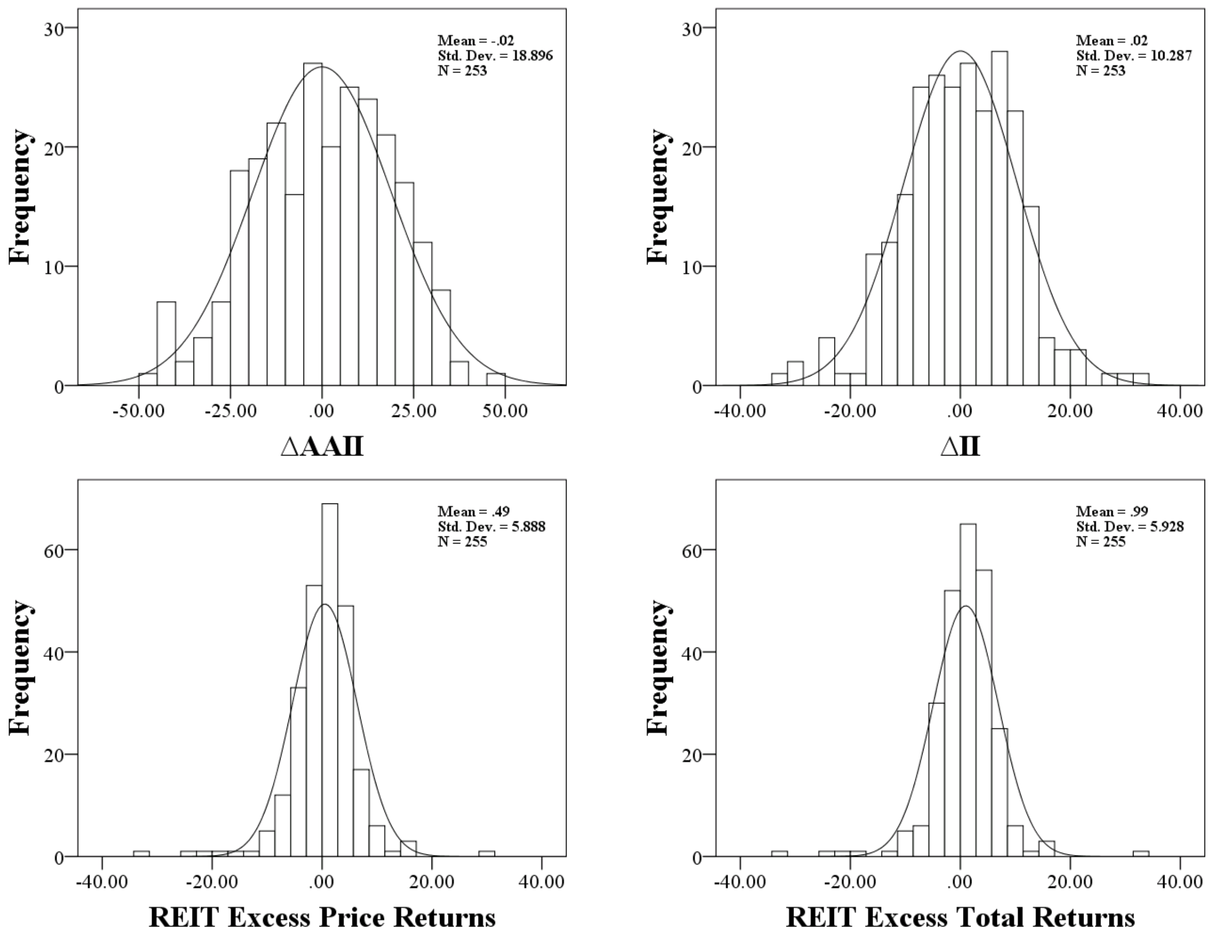


Figure 2.4. Histograms weekly frequency data

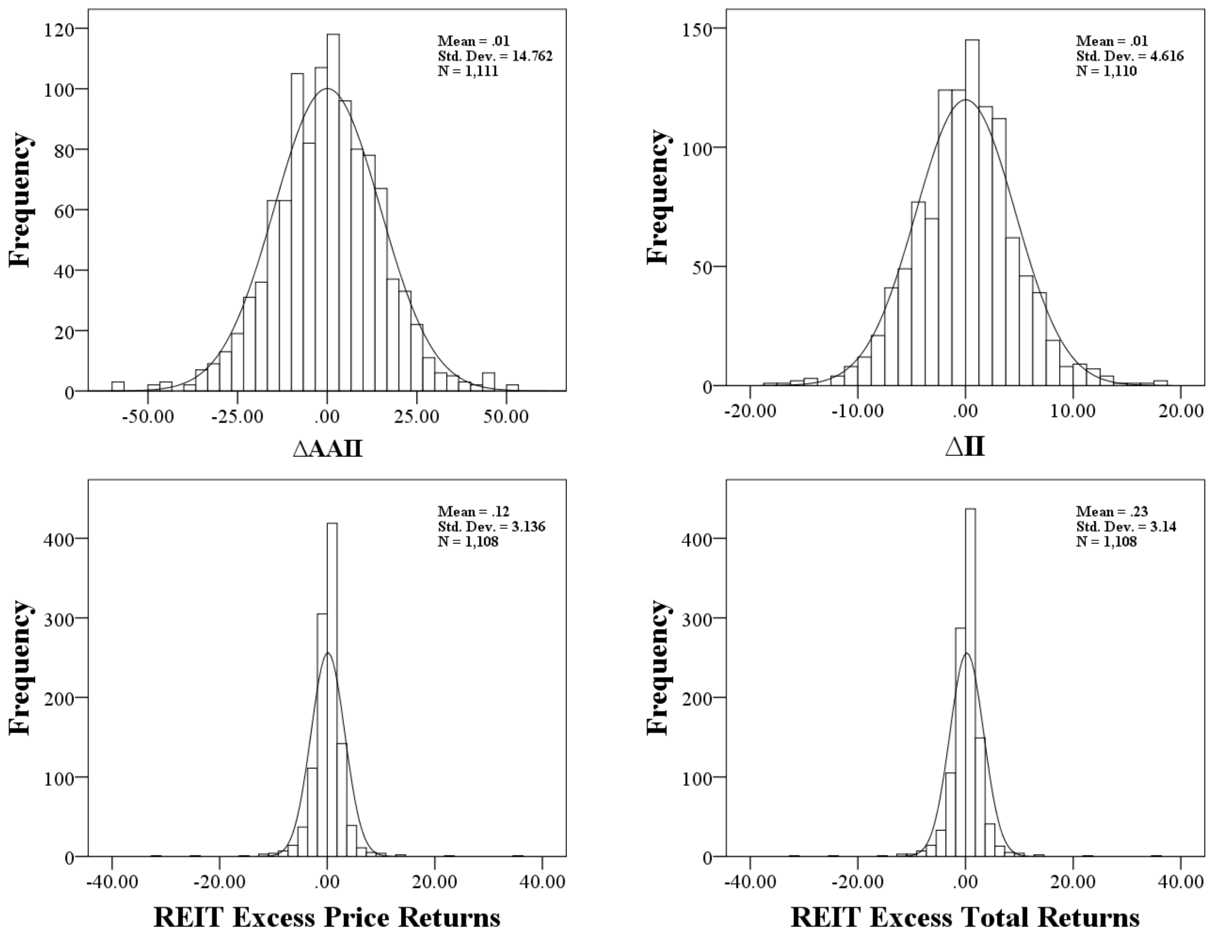
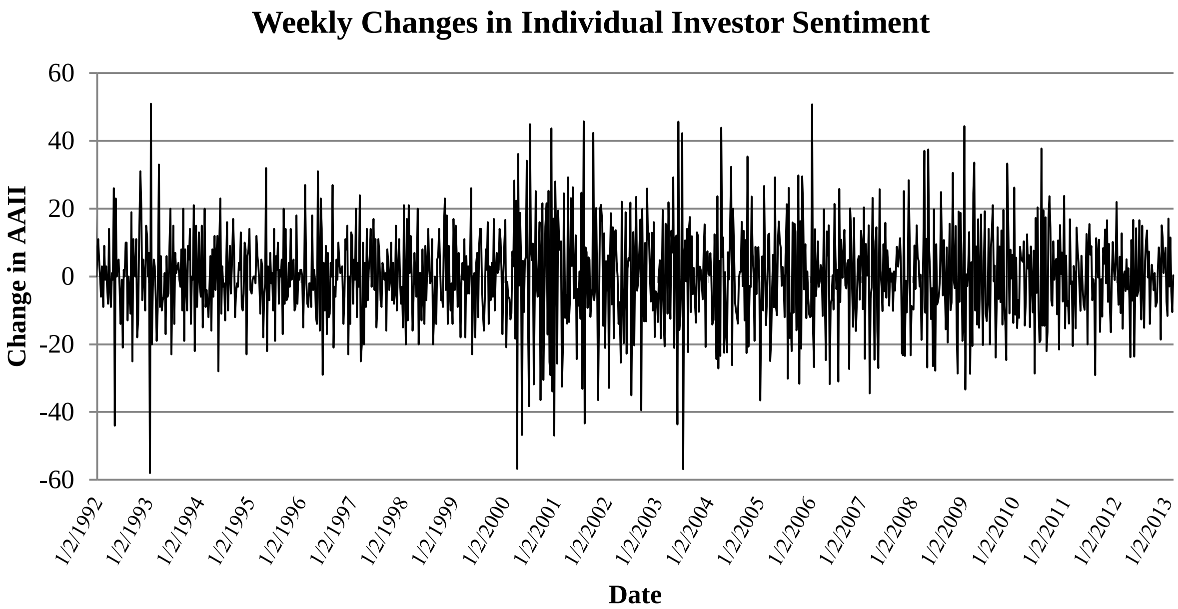
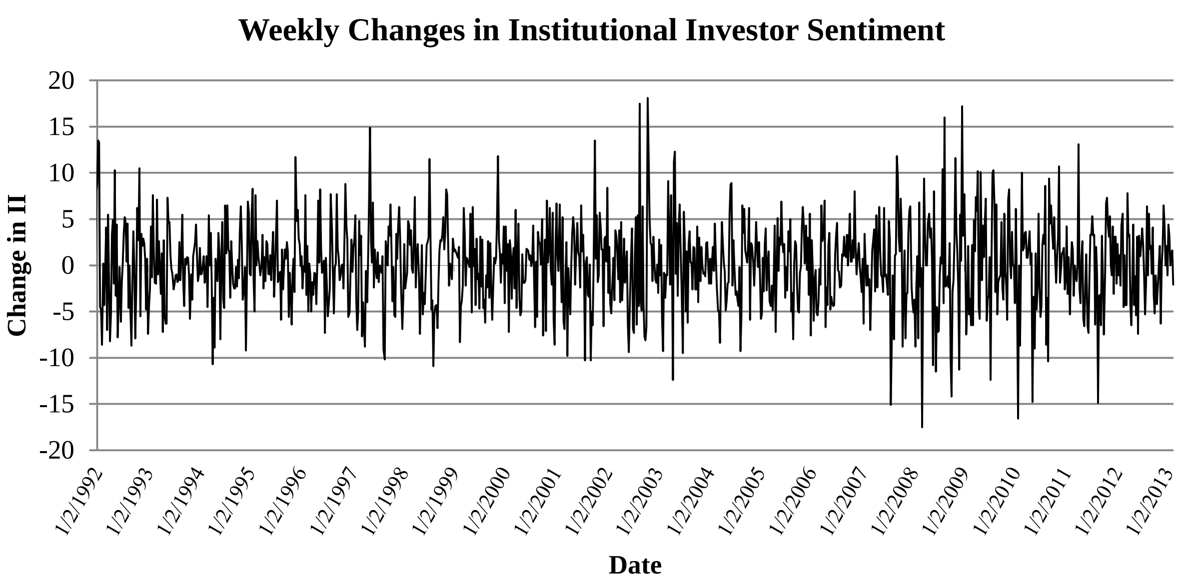


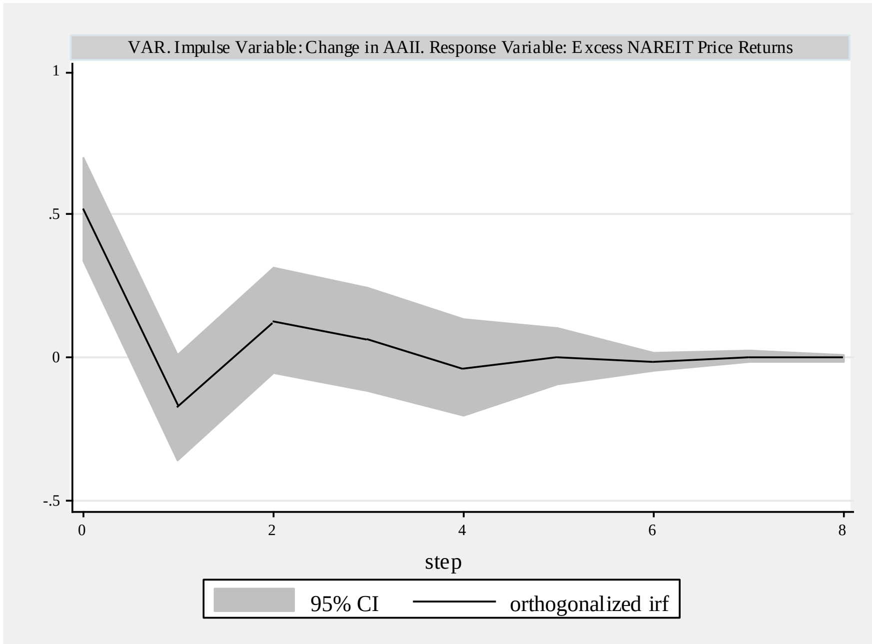
Figure 2.5. Weekly changes in individual ($\Delta AAII$) and institutional (ΔII) investor sentiment





Notes: These graphs show changes in institutional and individual investor sentiment from Investor's Intelligence (II) and the American Association of Individual Investors (AAII), respectively. The sample covers the period from January 1992 to February 2013.

Figure 2.6. Impulse response functions. Change in individual investor sentiment on excess NAREIT price and total returns.



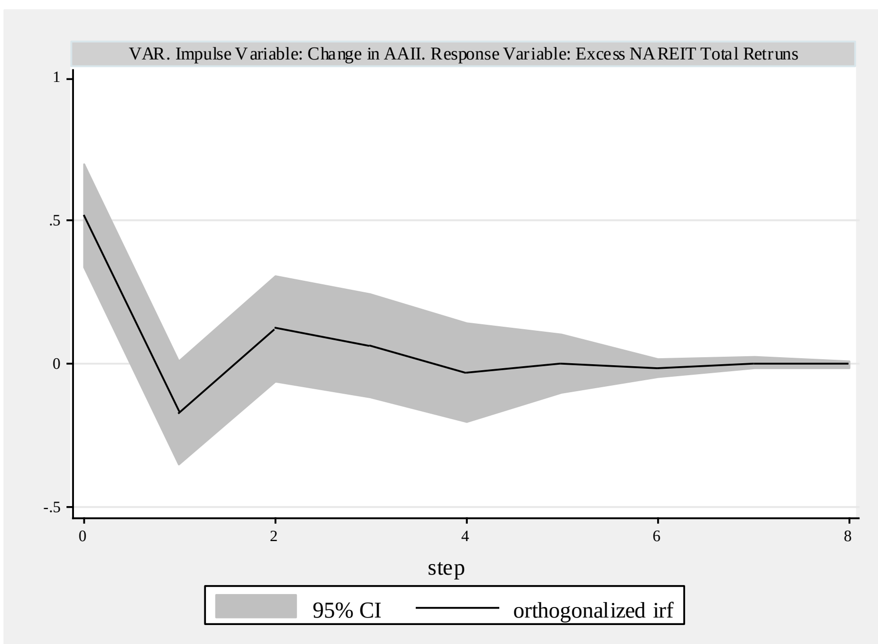
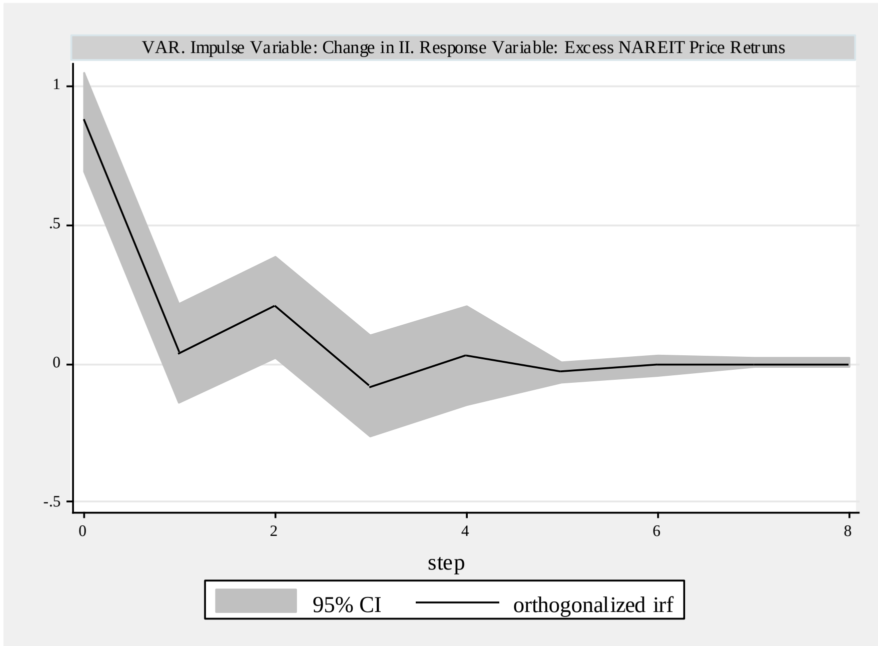


Figure 2.7. Impulse response functions. Change in institutional investor sentiment on excess NAREIT price and total returns.



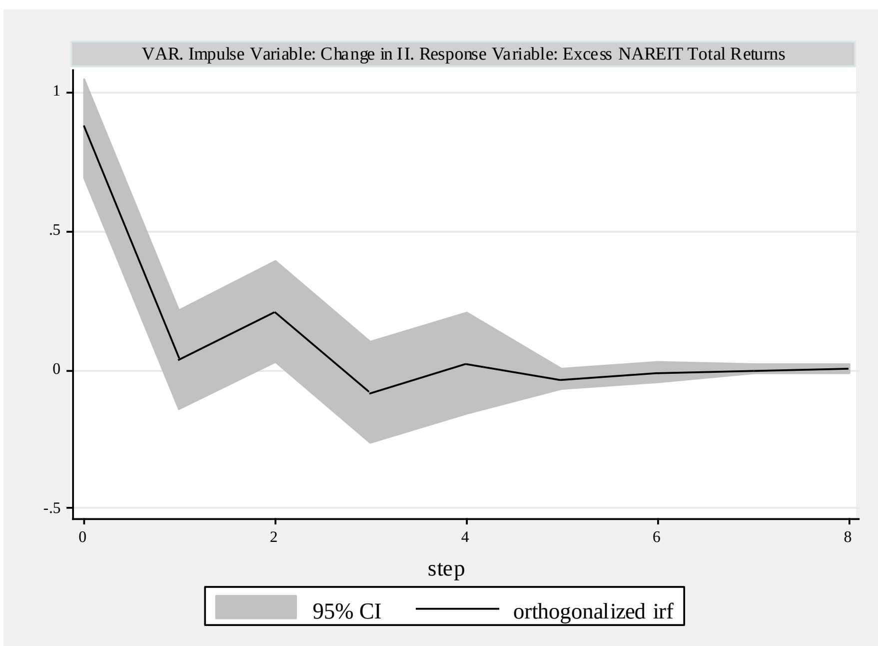


Table 2.1. Correlation table quarterly observations

	Excess NAREIT Price Returns	*Excess NAREIT Total Returns*	*ΔAAII*	*ΔII*	*ΔRERC*	*Rm-Rf*	*SMB*	*HML*	*PREM*	*DEF*
Excess NAREIT Price Returns	1.000									
Excess NAREIT Total Returns	0.999	1.000								
ΔAAII	0.247	0.249	1.000							
ΔII	0.420	0.426	0.428	1.000						
ΔRERC	0.266	0.273	-0.100	0.063	1.000					
Rm-Rf	0.191	0.196	0.206	0.064	0.181	1.000				
SMB	0.210	0.212	0.179	0.053	0.066	0.443	1.000			
HML	0.346	0.350	0.083	0.143	0.096	-0.027	0.044	1.000		
PREM	0.149	0.144	-0.050	-0.053	0.244	-0.028	0.264	0.104	1.000	
DEF	-0.294	-0.305	0.019	0.051	-0.109	-0.144	0.151	0.015	0.397	1.000

Table 2.2. Summary statistics quarterly observations

Variable	Obs	Mean	Std. Dev.	Min	Max
NAREIT Price Returns	85	2.153	9.308	-31.839	23.060
NAREIT Total Returns	85	3.660	9.423	-30.997	24.275
Excess NAREIT Price Returns	84	-0.904	9.470	-31.949	22.880
Excess NAREIT Total Returns	84	0.607	9.533	-31.107	24.095
Δ*AAII*	84	-0.253	20.929	-53.970	45.760
Δ*II*	83	0.011	14.100	-31.700	30.700
Δ*RERC*	80	0.209	3.009	-7.300	6.111
Rm-Rf	85	1.809	8.572	-22.280	20.640
SMB	85	0.912	5.244	-10.830	19.100
HML	85	0.684	7.804	-32.010	23.850
PREM	85	2.404	1.331	-0.110	4.330
DEF	86	0.958	0.442	0.570	3.000
Rf	85	3.020	2.046	0.020	6.210

This table provides summary statistics for all variables employed in quarterly frequency. NAREIT price returns are calculated based on the FTSE NAREIT U.S. Real Estate Index returns from Thomson's DataStream. NAREIT total returns account for dividend payments. Excess NAREIT price returns are the REIT industry price returns minus the risk-free rate. Excess NAREIT total returns are the REIT industry total returns minus the risk-free rate. Δ*II* and Δ*AAII* are changes in institutional and individual investor sentiment, respectively. Δ*RERC* are changes in the Real Estate Research Corporation Sentiment index. *Rm-Rf, SMB* and *HML* are the Fama-French equity factors and *DEF* and *PREM* are the Fama-French bond factors. *Rf* is risk-free rate of return.

Table 2.3. Correlation table monthly observations

	Excess NAREIT Price Returns	*Excess NAREIT Total Returns*	$\Delta AAII$	ΔII	*Rm-Rf*	*SMB*	*HML*	*PREM*	*DEF*
Excess NAREIT Price Returns	1.000								
Excess NAREIT Total Returns	0.999	1.000							
$\Delta AAII$	0.018	0.021	1.000						
ΔII	0.112	0.109	0.432	1.000					
Rm-Rf	0.591	0.591	-0.034	0.064	1.000				
SMB	0.267	0.266	0.133	0.150	0.182	1.000			
HML	0.235	0.236	0.056	0.094	-0.213	-0.334	1.000		
PREM	0.0416	0.040	0.010	-0.022	-0.010	0.211	-0.093	1.000	
DEF	-0.160	-0.163	0.012	0.016	-.148	0.076	-0.140	0.363	1.000

Table 2.4. Summary statistics monthly observations

Variable	Obs	Mean	Std. Dev.	Min	Max
NAREIT Price Returns	255	0.743	5.883	-32.443	31.186
NAREIT Total Returns	255	1.237	5.925	-32.199	31.723
Excess NAREIT Price Returns	255	0.494	5.888	-32.523	31.176
Excess NAREIT Total Returns	255	0.989	5.928	-32.279	31.713
$\Delta AAII$	253	-0.021	18.896	-50.000	47.600
ΔII	253	0.016	10.287	-31.700	33.200
Rm-Rf	256	0.568	4.436	-17.230	11.340
SMB	256	-0.061	3.428	-22.000	8.470
HML	256	0.523	3.272	-9.780	13.840
PREM	256	2.362	1.340	-0.330	4.430
DEF	256	0.963	0.444	0.530	3.430
Rf	256	0.249	0.168	0.000	0.560

This table provides summary statistics for all variables employed in monthly frequency. NAREIT price returns are calculated based on the FTSE NAREIT U.S. Real Estate Index returns from Thomson's DataStream. NAREIT total returns account for dividend payments. Excess NAREIT price returns are the REIT industry price returns minus the risk-free rate. Excess NAREIT total returns are the REIT industry total returns minus the risk-free rate. ΔII and $\Delta AAII$ are changes in institutional and individual investor sentiment, respectively. *Rm-Rf, SMB* and *HML* are the Fama-French equity factors and *DEF* and *PREM* are the Fama-French bond factors. *Rf* is risk-free rate of return.

Table 2.5. Correlation table weekly observations

	Excess NAREIT Price Returns	*Excess NAREIT Total Returns*	$\Delta AAII$	ΔII	*Rm-Rf*	*SMB*	*HML*	*PREM*	*DEF*
Excess NAREIT Price Returns	1.000								
Excess NAREIT Total Returns	0.999	1.000							
$\Delta AAII$	0.152	0.152	1.000						
ΔII	0.262	0.261	0.162	1.000					
Rm-Rf	0.561	0.562	0.142	0.319	1.000				
SMB	0.157	0.158	0.083	0.138	0.139	1.000			
HML	0.289	0.289	0.009	-0.012	-0.132	-0.223	1.000		
PREM	0.023	0.022	0.009	0.006	0.006	0.073	-0.026	1.000	
DEF	-0.017	-0.018	0.008	0.046	-0.017	0.026	-0.037	0.382	1.000

Table 2.6. Summary statistics weekly observations

Variable	Obs	Mean	Std. Dev.	Min	Max
NAREIT Price Returns	1111	0.180	3.131	-32.454	35.113
NAREIT Total Returns	1111	0.293	3.136	-32.417	35.166
Excess NAREIT Price Returns	1108	0.118	3.136	-32.461	35.106
Excess NAREIT Total Returns	1108	0.231	3.140	-32.424	35.159
Δ*AAII*	1111	0.014	14.762	-58.000	51.000
Δ*II*	1110	0.013	4.616	-17.500	18.100
Rm-Rf	1109	0.134	2.437	-18.000	12.610
SMB	1109	0.036	1.327	-9.370	6.440
HML	1109	0.081	1.399	-7.000	9.790
PREM	1011	2.326	1.342	-0.270	4.540
DEF	1112	0.963	0.440	0.500	3.460
Rf	1109	0.062	0.041	0.000	0.140

This table provides summary statistics for all variables employed in weekly frequency. NAREIT price returns are calculated based on the FTSE NAREIT U.S. Real Estate Index returns from Thomson's DataStream. NAREIT total returns account for dividend payments. Excess NAREIT price returns are the REIT industry price returns minus the risk-free rate. Excess NAREIT total returns are the REIT industry total returns minus the risk-free rate. Δ*II* and Δ*AAII* are changes in institutional and individual investor sentiment, respectively. *Rm-Rf, SMB* and *HML* are the Fama-French equity factors and *DEF* and *PREM* are the Fama-French bond factors. *Rf* is risk-free rate of return.

Table 2.7. Regression results quarterly frequency. FTSE NAREIT price excess returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Intercept	-0.879	-0.877	-1.338	-1.314	-1.834*	2.071	2.181	2.632	2.304	2.381	2.506
	(-0.87)	(-0.92)	(-1.29)	(-1.39)	(-1.98)	(0.96)	(1.06)	(1.22)	(0.96)	(1.11)	(1.03)
Δ*AAII*	0.100**			0.056	0.031	0.051	0.046	0.030	0.078*		
	(2.06)			(1.10)	(0.62)	(1.11)	(1.06)	(0.67)	(1.77)		
Δ*II*		0.288***		0.235***	0.219***	0.269***	0.247***	0.251***		0.272***	
		(4.24)		(3.16)	(3.08)	(3.99)	(3.82)	(3.90)		(4.69)	
Δ*RERC*			0.845**	0.814**	0.652**	0.411	0.361	0.331			0.405
			(2.44)	(2.55)	(2.08)	(1.34)	(1.23)	(1.11)			(1.23)
Rm-Rf					0.078			0.023	0.047	0.058	0.055
					(0.65)			(0.27)	(0.39)	(0.55)	(0.45)
SMB					0.221			0.268	0.253	0.251	0.308
					(1.16)			(1.47)	(1.27)	(1.41)	(1.51)
HML					0.331***		0.307***	0.308***	0.380***	0.319***	0.384***
					(2.80)		(2.87)	(2.89)	(3.30)	(3.05)	(3.24)
DEF						-8.984***	-8.831***	-8.958***	-8.282***	-8.830***	-7.981***
						(-4.22)	(-4.35)	(-4.39)	(-3.79)	(-4.49)	(-3.49)
PREM						2.192***	2.001***	1.751**	1.738**	1.926***	1.338*
						(3.02)	(2.88)	(2.46)	(2.31)	(2.85)	(1.68)
N	84	83	80	80	80	80	80	80	83	83	80
R^2	0.049	0.182	0.071	0.246	0.342	0.403	0.463	0.486	0.337	0.465	0.328
Adj. R^2	0.038	0.171	0.059	0.216	0.289	0.363	0.419	0.428	0.285	0.422	0.273
F-Statistic	4.23	17.96	5.96	8.26	6.33	9.99	10.51	8.40	6.45	10.99	5.95

This table presents the results for quarterly frequency data for the following equations:

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \boldsymbol{\varphi}\, \Delta \boldsymbol{Sent_t} + \boldsymbol{\varepsilon_t}$, models 1, 2 and 3.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi_i}\, \Delta \boldsymbol{Sent_{it}} + \boldsymbol{\varepsilon_t}$, model 4.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi_i}\, \Delta \boldsymbol{Sent_{it}} + \boldsymbol{\beta_1}\, \boldsymbol{Def_t} + \boldsymbol{\beta_2}\, \boldsymbol{Prem_t} + \boldsymbol{\beta_3}\, (\boldsymbol{Rm - Rf})_t + \boldsymbol{\beta_4}\, \boldsymbol{SMB_t} + \boldsymbol{\beta_5}\, \boldsymbol{HML_t} + \boldsymbol{\varepsilon_t}$, models 6, 7, and 8.

Models 9, 10 and 11 show results for models that include each measure of sentiment independently along with the complete set of control variables. The independent variable is FTSE NAREIT Price excess returns. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 2.8. Regression results quarterly frequency. FTSE NAREIT total excess returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Intercept	0.634	0.643	0.184	0.209	-0.324	3.844*	3.956*	4.409**	4.092*	4.171*	4.281
	(0.62)	(0.67)	(0.18)	(0.22)	(-0.35)	(1.79)	(1.93)	(2.06)	(1.71)	(1.96)	(1.76)
$\Delta AAII$	0.102**			0.056	0.031	0.051	0.046	0.029	0.079*		
	(2.09)			(1.11)	(0.61)	(1.12)	(1.07)	(0.66)	(1.81)		
ΔII		0.294***		0.240***	0.224***	0.275***	0.253***	0.257***		0.278***	
		(4.32)		(3.23)	(3.15)	(4.10)	(3.93)	(4.02)		(4.84)	
$\Delta RERC$			0.869***	0.837***	0.670**	0.429	0.379	0.346			0.424
			(2.50)	(2.62)	(2.14)	(1.41)	(1.30)	(1.18)			(1.29)
Rm-Rf					0.084			0.025	0.049	0.060	0.058
					(0.70)			(0.23)	(0.41)	(0.58)	(0.47)
SMB					0.220			0.274	0.261	0.259	0.314
					(1.16)			(1.52)	(1.32)	(1.47)	(1.54)
HML					0.336***		0.312***	0.313***	0.389***	0.325***	0.390***
					(2.85)		(2.93)	(2.97)	(3.39)	(3.15)	(3.30)
DEF						-9.250***	-9.095***	-9.220***	-8.590***	-9.151***	-8.224***
						(-4.37)	(-4.51)	(-4.56)	(-3.94)	(-4.70)	(-3.60)
PREM						2.193***	1.999***	1.743**	1.742**	1.935*	1.323*
						(3.04)	(2.90)	(2.47)	(2.33)	(1.96)	(1.66)
N	84	83	80	80	80	80	80	80	83	83	80
R^2	0.050	0.187	0.074	0.254	0.352	0.416	0.478	0.502	0.350	0.482	0.340
Adj. R^2	0.039	0.177	0.062	0.224	0.299	0.377	0.435	0.446	0.299	0.441	0.286
F-Statistic	4.35	18.68	6.26	8.61	6.61	10.56	11.14	8.94	6.83	11.79	6.27

This table presents the results for quarterly frequency data for the following equations:

$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha} + \boldsymbol{\varphi}\ \Delta \boldsymbol{Sent}_t + \boldsymbol{\varepsilon}_t$, models 1, 2 and 3.

$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\ \Delta \boldsymbol{Sent}_{it} + \boldsymbol{\varepsilon}_t$, model 4.

$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\ \Delta \boldsymbol{Sent}_{it} + \boldsymbol{\beta}_1\ \boldsymbol{Def}_t + \boldsymbol{\beta}_2\ \boldsymbol{Prem}_t + \boldsymbol{\beta}_3\ (\boldsymbol{Rm-Rf})_t + \boldsymbol{\beta}_4\ \boldsymbol{SMB}_t + \boldsymbol{\beta}_5\ \boldsymbol{HML}_t + \boldsymbol{\varepsilon}_t$, models 6, 7, and 8.

Models 9, 10 and 11 show results for models that include each measure of sentiment independently along with the complete set of control variables. The independent variable is FTSE NAREIT Total excess returns. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 2.9. Regression results monthly frequency. FTSE NAREIT price excess returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.472	0.470	0.470	-0.0387	1.847*	-0.305	-0.304	-0.307
	(1.27)	(1.27)	(1.27)	(-1.53)	(1.95)	(-0.46)	(-0.45)	(-0.46)
ΔAAII	0.006		-0.012	-0.008	-0.012	-0.008	-0.009	
	(0.28)		(-0.54)	(-0.54)	(-0.57)	(-0.55)	(-0.67)	
ΔII		0.064*	0.073*	-0.006	0.77*	-0.004		-0.010
		(1.78)	(1.84)	(-0.23)	(1.96)	(-0.15)		(-0.41)
Rm-Rf				0.842***		0.835***	0.834***	0.838***
				(14.69)		(14.27)	(14.35)	(14.37)
SMB				0.543***		0.531***	0.529***	0.527***
				(6.95)		(6.64)	(6.70)	(6.63)
HML				0.860***		0.851***	0.849***	0.849***
				(10.52)		(10.25)	(10.35)	(10.26)
DEF					-2.712**	-0.516	-0.521	-0.512
					(-3.09)	(-0.85)	(-0.86)	(-0.84)
PREM					0.523*	0.179	0.181	0.179
					(1.80)	(0.89)	(0.91)	(0.89)
N	253	253	253	253	253	253	253	253
R^2	0.000	0.012	0.014	0.571	0.052	0.572	0.572	0.572
Adj. R^2	-0.004	0.009	0.006	0.562	0.037	0.560	0.562	0.562
F-Statistic	0.08	3.17	1.73	65.61	3.41	46.86	54.88	54.78

This table presents the results for monthly frequency data for the following equations:

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \boldsymbol{\varphi}\, \Delta \boldsymbol{Sent}_t + \boldsymbol{\varepsilon}_t$, models 1 and 2.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\, \Delta \boldsymbol{Sent}_{it} + \boldsymbol{\varepsilon}_t$, model 3.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\, \Delta \boldsymbol{Sent}_{it} + \boldsymbol{\beta}_1\, \boldsymbol{Def}_t + \boldsymbol{\beta}_2\, \boldsymbol{Prem}_t + \boldsymbol{\beta}_3\, (\boldsymbol{Rm - Rf})_t + \boldsymbol{\beta}_4\, \boldsymbol{SMB}_t + \boldsymbol{\beta}_5\, \boldsymbol{HML}_t + \boldsymbol{\varepsilon}_t$, models 4, 5, and 6.

Models 7 and 8 show results for models that include each measure of sentiment independently along with the complete set of control variables. The independent variable is FTSE NAREIT Price excess returns. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 2.10. Regression results monthly frequency. FTSE NAREIT total excess returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.967***	0.966***	0.966***	0.349	2.393***	0.221	0.224	0.219
	(2.58)		(2.59)	(1.38)	(2.51)	(0.33)	(0.33)	(0.33)
$\Delta AAII$	0.007		-0.010	-0.006	-0.012	-0.006	-0.007	
	(0.33)		(-0.46)	(-0.41)	(-0.49)	(-0.43)	(-0.59)	
ΔII		0.063*	0.071*	-0.009	0.075*	-0.007		-0.012
		(1.73)	(1.76)	(-0.35)	(1.88)	(-0.26)		(-0.48)
Rm-Rf				0.851***		0.841***	0.840***	0.843***
				(14.75)		(14.28)	(14.35)	(14.38)
SMB				0.537***		0.533***	0.530***	0.530***
				(6.83)		(6.63)	(6.67)	(6.63)
HML				0.872***		0.858***	0.855***	0.857***
				(10.60)		(10.28)	(10.36)	(10.79)
DEF					-2.77***	-0.553	-0.561	-0.550
					(-3.13)	(-0.90)	(-0.92)	(-0.90)
PREM					0.524*	0.179	0.182	0.178
					(1.79)	(0.88)	(0.90)	(0.88)
N	253	253	253	253	253	253	253	253
R^2	0.000	0.012	0.013	0.571	0.052	0.573	0.573	0.573
Adj. R^2	-0.004	0.008	0.005	0.562	0.037	0.561	0.562	0.562
F-Statistic	0.11	3.00	1.60	65.70	3.40	46.93	54.95	54.90

This table presents the results for monthly frequency data for the following equations:

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \boldsymbol{\varphi}\, \Delta \boldsymbol{Sent}_t + \boldsymbol{\varepsilon}_t$, models 1 and 2.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\, \Delta \boldsymbol{Sent}_{it} + \boldsymbol{\varepsilon}_t$, model 3.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\, \Delta \boldsymbol{Sent}_{it} + \boldsymbol{\beta}_1\, \boldsymbol{Def}_t + \boldsymbol{\beta}_2\, \boldsymbol{Prem}_t + \boldsymbol{\beta}_3\, (\boldsymbol{Rm - Rf})_t + \boldsymbol{\beta}_4\, \boldsymbol{SMB}_t + \boldsymbol{\beta}_5\, \boldsymbol{HML}_t + \boldsymbol{\varepsilon}_t$, models 4, 5, and 6.

Models 7 and 8 show results for models that include each measure of sentiment independently along with the complete set of control variables. The independent variable is FTSE NAREIT Total excess returns. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 2.11. Regression results weekly frequency. FTSE NAREIT price excess returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.117	0.115	0.115	-0.064	0.175	-0.136	-0.154	-0.138
	(1.25)	(1.27)	(1.27)	(-0.92)	(0.70)	(-0.71)	(-0.80)	(-0.72)
ΔAAII	0.031***		0.023***	0.010**	0.025***	0.010**	0.012**	
	(4.91)		(3.79)	(2.09)	(3.67)	(1.97)	(2.25)	
ΔII		0.176***	0.165***	0.038**	0.175***	0.041**		0.045***
		(8.94)	(8.35)	(2.41)	(8.01)	(2.38)		(2.62)
Rm-Rf				0.727***		0.731***	0.753***	0.737***
				(24.09)		(23.13)	(24.90)	(23.38)
SMB				0.374***		0.368***	0.382***	0.375***
				(6.93)		(6.47)	(6.72)	(6.58)
HML				0.868***		0.914***	0.921***	0.918***
				(17.06)		(16.86)	(16.97)	(16.92)
DEF					-0.306	-0.051	-0.026	-0.050
					(-1.31)	(-0.29)	(-0.15)	(-0.28)
PREM					0.090	0.049	0.045	0.049
					(1.13)	(0.82)	(0.76)	(0.82)
N	1108	1108	1108	1108	1009	1009	1009	1009
R^2	0.021	0.067	0.079	0.469	0.083	0.479	0.476	0.477
Adj. R^2	0.020	0.067	0.078	0.467	0.079	0.477	0.473	0.474
F-Statistic	24.07	79.92	47.64	195.00	22.74	131.57	151.85	152.42

This table presents the results for weekly frequency data for the following equations:

$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha} + \boldsymbol{\varphi}\, \Delta\boldsymbol{Sent}_t + \boldsymbol{\varepsilon}_t$, models 1 and 2.

$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\, \Delta\boldsymbol{Sent}_{it} + \boldsymbol{\varepsilon}_t$, model 3.

$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\, \Delta\boldsymbol{Sent}_{it} + \boldsymbol{\beta}_1\, \boldsymbol{Def}_t + \boldsymbol{\beta}_2\, \boldsymbol{Prem}_t + \boldsymbol{\beta}_3\, (\boldsymbol{Rm-Rf})_t + \boldsymbol{\beta}_4\, \boldsymbol{SMB}_t + \boldsymbol{\beta}_5\, \boldsymbol{HML}_t + \boldsymbol{\varepsilon}_t$, models 4, 5, and 6.

Models 7 and 8 show results for models that include each measure of sentiment independently along with the complete set of control variables. The independent variable is FTSE NAREIT Price excess returns. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 2.12. Regression results weekly frequency. FTSE NAREIT total excess returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.230**	0.228**	0.228**	0.048	0.296	-0.016	-0.034	-0.019
	(2.46)	(2.50)	(2.51)	(0.70)	(1.17)	(-0.08)	(-0.18)	(-0.10)
ΔAAII	0.031***		0.023***	0.010**	0.025***	0.010**	0.011**	
	(4.89)		(3.77)	(2.06)	(3.65)	(1.94)	(2.22)	
ΔII		0.176***	0.165***	0.038**	0.175***	0.041**		0.045***
		(8.92)	(8.34)	(2.37)	(7.99)	(2.33)		(2.57)
Rm-Rf				0.730***		0.734***	0.756***	0.740***
				(24.19)		(23.22)	(24.98)	(23.48)
SMB				0.378***		0.372***	0.385***	0.379***
				(7.00)		(6.54)	(6.79)	(6.65)
HML				0.870***		0.917***	0.923***	0.921***
				(17.10)		(16.91)	(17.01)	(16.97)
DEF					-0.314	-0.058	-0.034	-0.057
					(-1.35)	(-0.33)	(-0.19)	(-0.32)
PREM					0.089	0.048	0.044	0.048
					(1.12)	(0.79)	(0.73)	(0.80)
N	1108	1108	1108	1108	1009	1009	1009	1009
R^2	0.021	0.067	0.079	0.471	0.083	0.481	0.478	0.479
Adj. R^2	0.020	0.066	0.077	0.469	0.079	0.477	0.475	0.476
F-Statistic	23.87	79.66	47.43	196.32	22.60	132.38	152.86	153.40

This table presents the results for weekly frequency data for the following equations:

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \boldsymbol{\varphi}\,\Delta \boldsymbol{Sent}_t + \boldsymbol{\varepsilon}_t$, models 1 and 2.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\,\Delta \boldsymbol{Sent}_{it} + \boldsymbol{\varepsilon}_t$, model 3.

$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha} + \sum_{i=1}^{n} \boldsymbol{\varphi}_i\,\Delta \boldsymbol{Sent}_{it} + \boldsymbol{\beta}_1\,\boldsymbol{Def}_t + \boldsymbol{\beta}_2\,\boldsymbol{Prem}_t + \boldsymbol{\beta}_3\,(\boldsymbol{Rm - Rf})_t + \boldsymbol{\beta}_4\,\boldsymbol{SMB}_t + \boldsymbol{\beta}_5\,\boldsymbol{HML}_t + \boldsymbol{\varepsilon}_t$, models 4, 5, and 6.

Models 7 and 8 show results for models that include each measure of sentiment independently along with the complete set of control variables. The independent variable is FTSE NAREIT Total excess returns. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 2.13. VAR selection-order criteria

Panel A: Excess NAREIT Price Returns, ΔAAII, ΔII

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-10562.1	-	-	-	41191.3	19.1396	19.1448	19.1532
1	-10412.9	298.31	9	0.000	31954.8	18.8857	18.9063	18.9401
2	-10377.9	69.968	9	0.000	30485.5	18.8386	18.8747	18.9339*
3	-10354.5	46.756	9	0.000	29701.7	18.8126	18.8640	18.9486
4	-10328.3	52.508*	9	0.000	28787.7*	18.7813*	18.8482*	18.9582
Endogenous: Excess NAREIT Price Returns, ΔAAII, ΔII							Obs = 1104	

Panel B: Excess NAREIT Total Returns, ΔAAII, ΔII

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-10563.9	-	-	-	41326.7	19.1429	19.1480	19.1565
1	-10413.9	300.05	9	0.000	32009.2	18.8874	18.9080	18.9418
2	-10378.7	70.393	9	0.000	30525.7	18.8400	18.8760	18.9352*
3	-10355.3	46.633	9	0.000	29744.1	18.8140	18.8655	18.9501
4	-10329.5	51.600*	9	0.000	28852.6*	18.7836*	18.8505*	18.9604
Endogenous: Excess NAREIT Total Returns, ΔAAII, ΔII							Obs = 1104	

This table presents the selection-order statistics for the Vector Auto-regression analysis to select the appropriate number of lag to be included in model for Excess NAREIT Price returns, ΔAAII, and ΔII in Panel A and Excess NAREIT Total returns, ΔAAII, and ΔII in Panel B. The four selection-order statistics are the following: the final prediction error (FPE), the Akaike's information criterion (AIC), the Hannan and Quinn information criterion (HQIC), and the Schwarz's Bayesian information criterion (SBIC). * indicates the number of lags according to each selection order criteria.

Table 2.14. Vector auto regression. Excess NAREIT price returns and ΔAAII

		Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ΔAAII							
	ΔAAII						
	L1.	-0.467	0.030	-15.460	0.000	-0.526	-0.408
	L2.	-0.237	0.033	-7.220	0.000	-0.301	-0.173
	L3.	-0.156	0.033	-4.770	0.000	-0.220	-0.092
	L4.	-0.085	0.030	-2.850	0.004	-0.144	-0.027
	Excess NAREIT Price Returns						
	L1.	0.691	0.131	5.270	0.000	0.434	0.947
	L2.	0.277	0.134	2.080	0.038	0.016	0.539
	L3.	-0.086	0.133	-0.650	0.518	-0.348	0.175
	L4.	-0.456	0.132	-3.450	0.001	-0.714	-0.197
	Constant	-0.013	0.400	-0.030	0.974	-0.798	0.772
Excess NAREIT Price Returns							
	ΔAAII						
	L1.	-0.008	0.007	-1.160	0.246	-0.022	0.006
	L2.	0.001	0.008	0.110	0.916	-0.014	0.016
	L3.	0.008	0.008	1.010	0.313	-0.007	0.023
	L4.	0.000	0.007	-0.030	0.974	-0.014	0.013
	Excess NAREIT Price Returns						
	L1.	-0.120	0.031	-3.950	0.000	-0.180	-0.061
	L2.	0.099	0.031	3.190	0.001	0.038	0.160
	L3.	-0.006	0.031	-0.190	0.849	-0.067	0.055
	L4.	0.010	0.031	0.320	0.747	-0.050	0.070
	Constant	0.122	0.093	1.300	0.192	-0.061	0.304

		Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
Log Likelihood	-7215.57						
FPE	1683.91	*ΔAAII*	9	13.314	0.194	265.9	0.000
Det(Sigma_ml)	1629.89	*Excess NAREIT Price Returns*	9	3.101	0.038	36.1	0.000
Number of Obs.	1104						

This table presents the results for the vector auto-regression model:

$$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\alpha}_{10} + \sum_{n=1}^{N} \boldsymbol{\alpha}_{1_1 n}(\boldsymbol{REIT - Rf})_{t-n} + \sum_{n=1}^{N} \boldsymbol{\alpha}_{1_2 n}\boldsymbol{Sent}_{t-n} + \boldsymbol{e}_{1t} \quad \textbf{(2.4)}$$

$$\boldsymbol{Sent}_t = \boldsymbol{\alpha}_{20} + \sum_{n=1}^{N} \boldsymbol{\alpha}_{2_1 n}(\boldsymbol{REIT - Rf})_{t-n} + \sum_{n=1}^{N} \boldsymbol{\alpha}_{2_2 n}\boldsymbol{Sent}_{t-n} + \boldsymbol{e}_{2t} \quad \textbf{(2.5)}$$

in which $(REIT\text{-}Rf)_t$ are excess NAREIT price returns and $Sent_t$ are changes in individual investor sentiment Δ*AAII*. $(REIT\text{-}Rf)_{t-n}$ and $Sent_{t-n}$ are lags of the REIT returns and sentiment variables at time *t-n*.

Table 2.15. Vector auto regression. Excess NAREIT total returns and ΔAAII

	Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ΔAAII						
ΔAAII						
L1.	-0.466	0.030	-15.450	0.000	-0.526	-0.407
L2.	-0.237	0.033	-7.230	0.000	-0.301	-0.173
L3.	-0.157	0.033	-4.780	0.000	-0.221	-0.092
L4.	-0.086	0.030	-2.850	0.004	-0.144	-0.027
Excess NAREIT Total Returns						
L1.	0.682	0.131	5.210	0.000	0.425	0.938
L2.	0.280	0.134	2.100	0.036	0.018	0.542
L3.	-0.083	0.133	-0.620	0.534	-0.345	0.179
L4.	-0.448	0.132	-3.390	0.001	-0.706	-0.189
Constant	-0.062	0.404	-0.150	0.878	-0.855	0.730
Excess NAREIT Total Returns						
ΔAAII						
L1.	-0.008	0.007	-1.110	0.265	-0.022	0.006
L2.	0.000	0.008	0.070	0.948	-0.014	0.015
L3.	0.008	0.008	0.980	0.325	-0.007	0.023
L4.	0.000	0.007	0.030	0.976	-0.014	0.014
Excess NAREIT Total Returns						
L1.	-0.123	0.031	-4.040	0.000	-0.183	-0.064
L2.	0.101	0.031	3.240	0.001	0.040	0.162
L3.	-0.005	0.031	-0.160	0.871	-0.066	0.056
L4.	0.009	0.031	0.280	0.778	-0.052	0.069
Constant	0.237	0.094	2.510	0.012	0.052	0.422

		Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
Log Likelihood	-7217.33	Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
FPE	1688.71	*ΔAAII*	9	13.320	0.193	264.6	0.000
Det(Sigma_ml)	1634.53	*Excess NAREIT Price Returns*	9	3.104	0.033	37.2	0.000
Number of Obs.	1104						

This table presents the results for the vector auto-regression model:

$$(REIT - Rf)_t = \alpha_{10} + \sum_{n=1}^{N} \alpha_{1_1 n}(REIT - Rf)_{t-n} + \sum_{n=1}^{N} \alpha_{1_2 n} Sent_{t-n} + e_{1t} \qquad \textbf{(2.4)}$$

$$Sent_t = \alpha_{20} + \sum_{n=1}^{N} \alpha_{2_1 n}(REIT - Rf)_{t-n} + \sum_{n=1}^{N} \alpha_{2_2 n} Sent_{t-n} + e_{2t} \qquad \textbf{(2.5)}$$

in which $(REIT\text{-}Rf)_t$ are excess NAREIT total returns and $Sent_t$ are changes in individual investor sentiment Δ*AAII*. $(REIT\text{-}Rf)_{t\text{-}n}$ and $Sent_{t\text{-}n}$ are lags of the REIT returns and sentiment variables at time *t-n*.

Table 2.16. Vector auto regression. Excess NAREIT price returns and ΔII

		Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ΔII							
	ΔII						
	L1.	0.092	0.031	2.990	0.003	0.032	0.153
	L2.	0.024	0.031	0.760	0.447	-0.037	0.084
	L3.	-0.015	0.031	-0.470	0.639	-0.075	0.046
	L4.	-0.079	0.030	-2.600	0.009	-0.138	-0.020
	Excess NAREIT Price Returns						
	L1.	0.211	0.045	4.650	0.000	0.122	0.299
	L2.	0.118	0.046	2.550	0.011	0.027	0.209
	L3.	0.010	0.047	0.220	0.823	-0.081	0.102
	L4.	-0.123	0.046	-2.700	0.007	-0.213	-0.034
	Constant	0.005	0.135	0.040	0.972	-0.259	0.269
Excess NAREIT Price Returns							
	ΔII						
	L1.	0.036	0.021	1.690	0.091	-0.006	0.078
	L2.	0.027	0.021	1.270	0.204	-0.015	0.069
	L3.	-0.018	0.021	-0.850	0.397	-0.060	0.024
	L4.	-0.002	0.021	-0.100	0.916	-0.043	0.039
	Excess NAREIT Price Returns						
	L1.	-0.143	0.031	-4.560	0.000	-0.204	-0.081
	L2.	0.073	0.032	2.280	0.022	0.010	0.136
	L3.	-0.002	0.032	-0.060	0.951	-0.065	0.061
	L4.	0.017	0.032	0.540	0.589	-0.045	0.079
	Constant	0.125	0.093	1.340	0.180	-0.058	0.308

		Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
Log Likelihood	-5981.52						
FPE	179.90	*ΔAAII*	9	4.477	0.060	70.8	0.000
Det(Sigma_ml)	174.12	*Excess NAREIT Price Returns*	9	3.098	0.034	38.5	0.000
Number of Obs.	1104						

This table presents the results for the vector Auto-regression model:

$$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\alpha_{10}} + \sum_{n=1}^{N} \boldsymbol{\alpha_{1_1 n}}(\boldsymbol{REIT-Rf})_{t-n} + \sum_{n=1}^{N} \boldsymbol{\alpha_{1_2 n}}\boldsymbol{Sent}_{t-n} + \boldsymbol{e_{1t}} \qquad \textbf{(2.4)}$$

$$\boldsymbol{Sent_t} = \boldsymbol{\alpha_{20}} + \sum_{n=1}^{N} \boldsymbol{\alpha_{2_1 n}}(\boldsymbol{REIT-Rf})_{t-n} + \sum_{n=1}^{N} \boldsymbol{\alpha_{2_2 n}}\boldsymbol{Sent}_{t-n} + \boldsymbol{e_{2t}} \qquad \textbf{(2.5)}$$

in which $(REIT\text{-}Rf)_t$ are excess NAREIT price returns and $Sent_t$ are changes in institutional investor sentiment Δ*II*. $(REIT\text{-}Rf)_{t-n}$ and $Sent_{t-n}$ are lags of the REIT returns and sentiment variables at time *t-n*.

Table 2.17. Vector auto regression. Excess NAREIT total returns and ΔII

		Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ΔII							
	ΔII						
	L1.	0.092	0.031	2.980	0.003	0.031	0.153
	L2.	0.024	0.031	0.760	0.448	-0.037	0.084
	L3.	-0.015	0.031	-0.480	0.628	-0.076	0.046
	L4.	-0.079	0.030	-2.620	0.009	-0.139	-0.020
	Excess NAREIT Total Returns						
	L1.	0.213	0.045	4.710	0.000	0.124	0.302
	L2.	0.117	0.046	2.510	0.012	0.025	0.208
	L3.	0.011	0.047	0.230	0.815	-0.080	0.102
	L4.	-0.122	0.046	-2.660	0.008	-0.211	-0.032
	Constant	-0.020	0.136	-0.150	0.882	-0.287	0.247
Excess NAREIT Total Returns							
	ΔII						
	L1.	0.037	0.021	1.710	0.087	-0.005	0.079
	L2.	0.029	0.021	1.330	0.184	-0.014	0.071
	L3.	-0.018	0.021	-0.830	0.409	-0.060	0.024
	L4.	-0.004	0.021	-0.190	0.848	-0.045	0.037
	Excess NAREIT Total Returns						
	L1.	-0.146	0.031	-4.660	0.000	-0.207	-0.084
	L2.	0.075	0.032	2.320	0.020	0.012	0.138
	L3.	-0.002	0.032	-0.060	0.951	-0.065	0.061
	L4.	0.017	0.032	0.530	0.599	-0.045	0.079
	Constant	0.245	0.094	2.590	0.009	0.060	0.429

		Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
Log Likelihood	-5981.95	Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
FPE	180.14	*ΔAAII*	9	4.477	0.060	70.9	0.000
Det(Sigma_ml)	174.36	*Excess NAREIT Price Returns*	9	3.100	0.035	40.1	0.000
Number of Obs.	1104						

This table presents the results for the vector auto-regression model:

$$(REIT - Rf)_t = \alpha_{10} + \sum_{n=1}^{N} \alpha_{1_1 n}(REIT - Rf)_{t-n} + \sum_{n=1}^{N} \alpha_{1_2 n} Sent_{t-n} + e_{1t} \qquad \textbf{(2.4)}$$

$$Sent_t = \alpha_{20} + \sum_{n=1}^{N} \alpha_{2_1 n}(REIT - Rf)_{t-n} + \sum_{n=1}^{N} \alpha_{2_2 n} Sent_{t-n} + e_{2t} \qquad \textbf{(2.5)}$$

in which $(REIT\text{-}Rf)_t$ are excess NAREIT total returns and $Sent_t$ are changes in institutional investor sentiment Δ*II*. $(REIT\text{-}Rf)_{t-n}$ and $Sent_{t-n}$ are lags of the REIT returns and sentiment variables at time *t-n*.

CHAPTER III

THE LIQUIDITY CRISIS, INVESTOR SENTIMENT AND REIT RETURNS AND VOLATILITY

3.1. Introduction

The financial crisis of 2007-2009 and the recession that accompanied it are catalogued as the worst economic downturn in U.S. history since the Great Depression of the 1930s. The causes that led to the crisis are still under debate; however, a large consensus points to lenient loan underwriting and poor lending practices by financial institutions together with historically low interest rates and lax credit markets. The consequence of this inadequate lending behavior was the origination of subprime loans which contributed to the boom and subsequent burst of the housing bubble and the crash of the financial system. The U.S. Treasury Office of Financial Stability recognizes that for the first time in 80 years, the U.S. financial system stood on the verge of collapse. This crisis quickly spilled over to other industries further weakening the U.S. economy.

Real estate investment trusts (REITs) certainly did not stand immune from this economic disaster. The REIT sector experienced a liquidity crisis as a consequence of the credit crunch by-product of the debacle of the financial sector. REITs must have access to funds through the capital markets or bank borrowings in order to grow. During the 2007-2009 financial crisis, capital markets behaved erratically and created shocks to firms dependent on external capital flows to fund growth and operations (Case et al., 2012). Equity offerings during these troubled times were difficult, new corporate debt was extremely costly and banks halted their lending activities almost completely making liquid funds a scarce resource. Given the many regulations imposed by the government, REITs are constrained to retain a very small fraction (maximum 10%) of its net income, which limits their ability to fund new property development or major property acquisitions using internally-generated funds (Hardin and Hill, 2011). In fact, Ott et al. (2005) show that REIT retained earnings only account for 7% of new investments in this industry and highlight the importance of credit lines to finance growth and to serve as backup liquidity in the face of any cash shortages. Credit commitments (lines) are contracts that allow REITs to access funds up to a prespecified amount over a given time period regardless of the market conditions at the time of the request for funds.[12] A loan commitment legally binds a lender to extend credit upon request, functioning as cash reserves or financial slack for REITs (Ooi et al., 2012). To illustrate the importance of credit commitments to the REIT industry, unused credit line balances in proportion to unused credit lines and cash for REITs represents close to 74% of total liquidity compared to 45% registered by firms in general (Ooi et al., 2012).

The availability of credit lines provide REIT managers with leeway in their capital structure decisions and with the flexibility to make use of this readily available liquidity rather than to tap the capital market at unfavorable times. This allows REITs to borrow only when needed and survive adverse economic conditions without committing to long-term financing. For these reasons, credit lines are believed to reduce capital costs and to increase REIT firm value (Hardin and Hill, 2011). Unfortunately, the financial crisis constrained bank lending so severely

[12] The credit commitment insurance hypothesis argues that the aggregate level of loan commitments are less susceptible to changes in the credit market conditions compared to a term or spot loans that are arranged as and when a firm needs funding from the bank (Sofianos et al., 1990; Morgan, 1998). Only under a materially adverse change of condition (e.g. a breach of financial covenants) established in the loan commitment contract may the lender reduce or refuse to fulfill a request for funds (Ooi et al., 2012).

that eroded their capacity to fulfill these commitments and harshly deteriorated the flow of cash to the REIT industry leading to a liquidity crisis from 2008Q4 to 2009Q2 (Case et al., 2012).

As market conditions deteriorated during the crisis, investors were pressed to take financial decisions under uncertain conditions and on very short notice. The events in the midst of the financial crisis and the turmoil in future expectations lead to erratic investor behavior which is reflected in increased volatility as seen in measures of institutional and individual investor sentiment. This increase in sentiment volatility is more evidently portrayed by changes in institutional investor sentiment which are usually less volatile compared to changes in individual investor sentiment. During the period from December 2001 to February 2013, sentiment volatility is markedly larger after the second quarter of 2007. Figure 3.1 graphically shows the changes in both individual and institutional investor sentiment for the sample period from December 2001 to February 2013. In Figure 3.1, institutional investor sentiment realizes its lowest values after the beginning of the crisis denoting negative expectations during the crisis period. In contrast, changes in individual investor sentiment appear to not significantly react to the crisis period.

A body of literature finds a significant relationship between investor sentiment and returns on numerous financial assets. Moreover, research in the REIT industry finds evidence that changes in investor sentiment has a significant impact on REIT returns and volatility. This essay explores this relationship during times of financial commotion in the REIT industry. Specifically, I assess whether returns and volatility for the REIT industry were significantly affected by the 2008-2009 REIT liquidity crisis. I employ GARCH-M models to test whether investor sentiment contributed to REIT market returns and volatility during the crisis.

Based on evidence of increased institutional ownership in REITs in recent years, I hypothesize that institutional investor sentiment has a significant impact on the return generating process of REITs while changes in individual investor sentiment should not be a determinant of REIT returns and volatility during the REIT liquidity crisis. Devos et al. (2012) points out that aggregate institutional holding peaked at the beginning of 2008 at 58% ownership and declined to 50% ownership in the second quarter of 2009, which potentially diminishes the impact of individual investor sentiment on REIT returns. Moreover, as previously pointed out, changes in individual investor sentiment seem more erratic and responding less to the crisis compared to changes in institutional investor sentiment providing more support to the hypothesis that institutional investor sentiment will influence REIT returns and volatility more than individual sentiment. Additionally, institutions and individual are often shown to react differently to market information and form non-congruent expectations, which points to a larger impact from institutions than from individuals. Furthermore, the fact that large institutional investors have sizeable capital and frequently trade in blocks that are large enough to influence REIT industry returns supports the notion that these investors will influence the market more than individuals.

This essay adds to the literature on the impact of the liquidity crisis on the REIT sector returns and volatility as well as on the literature that refers to the impact of investor sentiment on REIT returns in the following distinct ways. Previous research on the sentiment-return relationship in REITs undermines the influence that institutional ownership has on the REIT industry and employed a widely criticized proxy of investor sentiment (closed-end fund discount) that fails to make a proper distinction between sentiment derived from individuals and institutional investors (Lin et al., 2009)[13]. Moreover, the impact of the liquidity crisis on REIT returns and volatility and the influence that investor sentiment had during the crisis has not been addressed. This essay fills a gap in the behavioral finance literature by providing evidence on the impact of investor sentiment on a highly regulated industry during times of market crisis.

3.2. Data

The sample period includes the latest business cycle as indicated by the National Bureau of Economic Research[14] (NBER) which spans from the end of the 2001 recession in December 2001 to February 2013. The REIT liquidity crisis extends from October 2, 2008 to July 2, 2009 (Case et al., 2012). REIT returns are proxied by the FTSE NAREIT U.S. Real Estate Index returns from Thomson's DataStream which reflects the returns of all U.S. tax-qualified equity REITs recognized by the National Association of Real Estate Investment Trusts. I additionally employ the FTSE NAREIT U.S. Total Return index which takes into account dividend payments to test for robustness in the results.

To proxy for investor sentiment, I employ survey-based measures of sentiment compiled by the American Association of Individual Investors (AAII) and Investor's Intelligence (II) following Brown and Cliff (2004). Individual investor sentiment is captured by a survey that is conducted by the AAII on a random sample of its members inquiring on their perception of market expectations for the following 6 months. The AAII labels each survey as bullish, bearish, or neutral. The individual sentiment index is constructed by calculating the difference between the percentage of bullish responses and bearish responses of the surveys (bull-bear spread).

---

[13] Chen et al. (1993) and Elton et al. (1998) contest the closed-end fund discount as a proxy of investor sentiment that solely reflects individual investor sentiment arguing that there is empirical evidence that institutional holdings may be a factor that contributes to these discounts.

[14] Accessed at http://www.nber.org/cycles/cyclesmain.html on April 24, 2013.

Institutional investor sentiment is built on a compilation of investment advisory newsletter expectations of the market. These perceptions are labeled bullish, bearish, or hold depending on the recommendations from the advisors. The institutional sentiment index in this analysis is constructed by calculating the bull-bear spread from the percentage of bullish newsletters with respect to the percentage of bearish newsletters.

As control variables, I use the Fama and French (1992) factors and the default risk (*DEF*) and term structure premiums (*PREM*). Peterson and Hsieh (1997) address the appropriateness of these variables for REIT and find that equity REIT returns are affected by the market-to-book and size factors as suggested by Fama and French (1992) and by the bond market factors *DEF* and *PREM* (Fama and Fench, 1993). The Fama-French factors are obtained from Dr. Kenneth French's website[15]. *DEF* is the default risk premium defined by the difference between Moody's Seasoned Aaa Corporate Bond Yield and the Baa Corporate Bond Yield. *PREM* is the term risk premium constructed as difference between the 20-year Treasury bond rate and the one-month Treasury bill rate. The DEF and PREM factors are constructed from data from Thomson's DataStream. All data is in weekly frequency.

3.2.1. Descriptive statistics

Table 3.1 presents the correlation among the variables employed in the empirical analysis. The highest correlation observed is between the excess return in the market (*Rm-Rf*) and between the two measures of excess REIT returns. Coincidently, the correlation coefficients are both 0.645 between the excess NAREIT price returns and (*Rm-Rf)* and between excess NAREIT total returns and (*Rm-Rf)*. The sentiment indices ΔII and $\Delta AAII$ display a correlation of

---

[15] Accessed on November 29, 2012. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

merely 0.195 and 0.144 during the REIT liquidity crisis. There is no hint of possible multicollinearity issues among the variables utilized in the analysis.

Summary statistics are presented in Table 3.2. As expected, weekly excess NAREIT total returns (0.251%) are on average larger than excess NAREIT price returns (0.160%). It is central to recall that the total NAREIT index takes into account dividends which are an important source of income for investors making allocations in the REIT industry. It is worth mentioning that both measures of NAREIT excess returns (price and total) are on average larger than the excess return in the market (0.103%). This is consistent with claims from NAREIT of REIT over-performance with respect to the overall stock market and especially when dividends are accounted for (NAREIT, 2012).

Changes in individual investor sentiment have a noticeably larger standard deviation (15.042) when compared to changes in institutional investor sentiment (4.908) as well as larger magnitudes in minimum and maximum values during the entire sample period. During the crisis, standard deviation for ΔII (1.678) and $\Delta AAII$ (4.654) are considerably smaller with respect to the whole sample period, nonetheless, the standard deviation for ΔII is smaller compared to $\Delta AAII$.

3.3. Methodology

3.3.1. The REIT liquidity crisis

The goal in this essay is to assess the impact of the liquidity crisis on REIT industry returns and conditional variance given than volatility is accepted to be a measure of risk and is of great interest to investors. I propose the following GARCH-M model:

$$(REIT - Rf)_t = \propto_0 + \beta_1 Crisis_t + \beta_2 h_t + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \qquad (3.1)$$

$$h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 Crisis_t + \omega_t \quad (3.2)$$

in the mean equation 3.1, $(REIT\text{-}Rf)_t$ are the FTSE NAREIT U.S. Real Estate Index excess returns, $Crisis_t$ is a dummy variable that takes the value of 1 during the REIT liquidity crisis from October 2, 2008 to July 2, 2009 and the value of 0 outside the crisis period, h_t are contemporaneous realizations of volatility which are often observed to influence returns and X_{it} is a vector of control variables that are observed to explain REIT industry excess returns. The Fama-French three-factor model variables are included as control variables that consist of the excess returns of the market constructed as the value-weighted returns on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate; SMB_t (small minus big) as the average return on the three small portfolios minus the average return on the three big portfolios for all stocks based on market capitalization.; and HML_t (high minus low) as the average return on the two value portfolios minus the average return on the two growth portfolios for all stocks based on the book-to-market ratio. Control variables also include the Fama-French bond factors *DEF* and *PREM*. DEF_t is the default risk premium defined as the difference between Moody's Seasoned Aaa Corporate Bond Yield and the Baa Corporate Bond Yield. $PREM_t$ is the term risk premium constructed as the difference between the 20-year Treasury bond rate and the one-month Treasury bill rate and ε_t is the stochastic error term at time *t*.

In the conditional variance equation 3.2, ε_{t-1}^2 are t-1 squared innovations from equation 3.1, expected to be significant since conditional variance of ε_t^2 depends on the realized ε_{t-1}^2. $\varepsilon_{t-1}^2 I_{t-1}$ is the Glosten et al. (1993) threshold ARCH (TARCH) asymmetric effect of shocks on volatility term. I_{t-1} takes the value of 1 if $\varepsilon_{t-1} \geq 0$ and 0 if the shocks are negative. The TARCH coefficient is expected to be negative since positive shocks are observed to cause a downward revision in conditional variance (Lee et al., 2002). h_{t-1} are t-1 realizations of conditional variance to account for volatility persistence. Lastly, $Crisis_t$ is a dummy that takes the value of 1 during the REIT liquidity crisis and 0 otherwise.

The assumption of homoscedasticity when modeling the returns of most financial assets is more often than not violated. This problem tends to provide questionable coefficients with widely used econometric techniques such as ordinary least squares linear regressions using time series data. Financial asset prices usually exhibit certain periods of unusually large volatility given fluctuations in market conditions over time. To account for this fluctuation in volatility, Engle (1982) provides the autoregressive conditional heteroscedasticity model to simultaneously model the mean and the conditional variance of a series. Bollerslev (1986) later extended this technique to account for the impact that conditional variance has on returns, modeling returns and conditional variance (volatility) simultaneously and underlining the effect that lagged realizations of conditional variance (t-1) have on volatility at time t.

The results for the model made up of equations 3.1 and 3.2 will show whether the REIT liquidity crisis impacted REIT industry returns and volatility significantly. According to prior research, credit availability and the existence of dependable credit lines represent a significant portion of REIT liquidity which is fundamental for REIT financial health (Ooi et al., 2012).

3.3.2. The liquidity crisis, investor sentiment and REIT industry returns and volatility

The analysis of the role of investor sentiment of REIT returns and volatility during the REIT liquidity crisis begins by examining whether investor sentiment is a significant factor in modeling REIT returns and volatility during the sample period investigated (December 2001 to February 2013); I propose the following GARCH-M model:

$$(REIT - Rf)_t = \propto_0 + \beta_1 h_t + \beta_2 \Delta II_t + \beta_3 \Delta AAII_t + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \tag{3.3}$$

$$h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 \Delta II_t + \varphi_6 \Delta AAII_t + \omega_t \tag{3.4}$$

in which, in the mean equation 3.3, $(REIT\text{-}Rf)_t$ are the FTSE NAREIT U.S. Real Estate Index excess returns, h_t are concurrent realizations of conditional variance and X_{it} is a vector of control variables as described in the previous section. ΔII and $\Delta AAII$ are changes in institutional and individual investor sentiment respectively to test for the impact of changes in sentiment on REIT returns. The conditional variance equation 3.4 includes ARCH, TARCH, and GARCH terms consistent with equation 3.2 along with changes in institutional and individual investor sentiment ΔII and $\Delta AAII$.

To test whether changes in sentiment impact REIT returns and volatility differently during crisis and non-crisis periods, I modify the GARCH-M model by using an interaction between the change in sentiments for institutional and individual investors and a dummy variable $Crisis_t$ which take the value of 1 during the liquidity crisis period and 0 otherwise, the model takes the following form:

$$(REIT - Rf)_t = \propto_0 + \beta_1 h_t + \beta_2 Crisis_t * \Delta II_t + \beta_3 Crisis_t * \Delta AAII_t + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \tag{3.5}$$

$$h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 Crisis * \Delta II_t + \varphi_6 Crisis * \Delta AAII_t + \omega_t \tag{3.6}$$

in which the mean equation 3.5 includes contemporaneous realizations of conditional variance h_t, changes in institutional and individual investor sentiment during the crisis $Crisis_t * \Delta II_t$ and

$Crisis_t * \Delta AAII_t$ respectively and a vector of control variable X_{it} as previously described. $(REIT\text{-}Rf)_t$ are the FTSE NAREIT U.S. Real Estate Index excess returns.

Consistent with the previously described models, the conditional variance equation 3.6 is modeled with ARCH, TARCH, and GARCH terms and the two interactions of the dummy $Crisis_t$ and changes in institutional and individual investor sentiment: $Crisis_t * \Delta II_t$ and $Crisis_t * \Delta AAII_t$ respectively.

3.4. Results

3.4.1. The liquidity crisis and REIT returns and volatility

Results for the model related to equations 3.1 and 3.2 are presented in Table 3.3. Model 1 in Table 3.3 shows that contemporaneous volatility (h_t) positively and significantly impact REIT excess returns for both the price and total REIT return index. These results are consistent with the concept that higher risk, proxied by volatility in this case, is associated with higher returns satisfying the orthodox risk-return relationship.

The significant negative coefficients (-8.080 for excess NAREIT price returns and -7.829 for excess total returns) for the liquidity crisis dummy ($Crisis_t$) provides evidence that returns significantly deteriorated during the REIT crisis of 2008-2009. Moreover, the positive and significant coefficient for the REIT liquidity crisis in the conditional variance equation in Model 1 suggests that volatility significantly rose during the liquidity crisis period. As uncertainty increased and REIT experienced liquidity constraints, REIT industry returns experienced higher volatility as a reflection of negative expectation in future market performance. As expected, ε_{t-1}^2shows positive and significant coefficients (0.201 for REIT price returns and 0.202 for REIT total returns) implying than conditional variance heavily depends on prior shock in in the mean equation. Negative coefficients for the TARCH term $\varepsilon_{t-1}^{2} I_{t-1}$ show that negative shocks have a larger impact on volatility than do positive ones, portraying the asymmetric effect of shocks on conditional variance suggested by Glosten et al. (1994). Additionally, consistent with Bollerslev (1986), h_{t-1} shows positive and significant coefficients (0.754 for REIT price returns and 0.750 for REIT total returns) suggesting a significant persistence of volatility over time.

Model 2 in Table 3.3 show the results for the same model (equations 3.1 and 3.2) together with the Fama-French three-factor model as the vector of control variables in the mean equation. Coefficients for all three Fama-French equity factors are positive and significant as anticipated and $Crisis_t$ remains negative and significant (-7.433 for REIT price returns and -7.458 for REIT total returns) in the mean equation and positive and significant (2.492 for REIT price returns and 2.490 for REIT total returns) in the conditional variance equation.

Model 3 in Table 3.3 modifies the model (equations 3.1 and 3.2) by including the Fama-French bond factors DEF_t and $PREM_t$ as control variables. Results in Model 3 show that bond factors are not significant in explaining the variation in REIT excess returns. The $Crisis_t$ coefficients remain unaffected for excess returns and volatility.

Model 4 in Table 3.3 shows the results for the comprehensive model that includes the entire set of control variables. Results robustly show that $Crisis_t$ coefficients remain of the expected sign and statistical significance regardless of the model specification in both the mean and variance equations. Excess REIT returns are significantly lower during the liquidity crisis confirming deterioration in market conditions during this period. This substantial decrease in returns is accompanied by augmented volatility in the REIT market during the liquidity crisis providing evidence of higher risk and uncertainty for REITs during a period of harsh liquidity constraints between 2008Q4 and 2009Q2. All residuals follow a white noise process as suggested by significant Portmanteau *Q*-statistics reported in the last line of Table 3.3.

3.4.2. Investor sentiment and the liquidity crisis

I begin by exploring the impact of changes in investor sentiment on REIT returns for the sample period that spans from December 2001 to February 2013. The sample period selected begins after the 2001 recession to capture only the effect of the 2008-2009 REIT liquidity crisis, this encompasses the latest business cycle as determined by NBER. Results for the model composed of equations 3.3 and 3.4 are presented in Model 1 and 2 of Table 3.4. Overall, results show that changes in institutional and individual investor sentiment significantly impact REIT excess returns. Specifically, as portrayed in Model 1, changes in sentiment are positive and significant factors in modeling REIT excess returns although changes in institutional investor sentiment (ΔII) appear to have a larger effect than changes in individual investor sentiment ($\Delta AAII$). Changes in both institutional and individual investor sentiment show a negative relationship to volatility, this effect is larger in magnitude for changes in institutional investor sentiment in comparison to changes in individual investor sentiment. Result for REIT excess price and total returns are similar.

Model 2 shows that the effect of sentiment on returns remains significantly positive with the inclusion of the vector of control variables in the model. ΔII displays a coefficient of 0.065 significant at the 1% significance level while $\Delta AAII$ has a smaller coefficient of 0.011 significant at the 5% level. The dominance of ΔII is not surprising given the increased levels of institutional ownership in the REIT industry and predominant institutional investor market power. In the conditional variance equation in Model 2, it is worthy to point out that after including the ARCH, TARCH and GARCH terms, the impact of $\Delta AAII$ becomes insignificant. Yet, ΔII are robust to this specification suggesting that changes in institutional investor sentiment have a negative and significant impact on REIT volatility. That is, positive changes in institutional investor sentiment are associated with reductions in volatility. As institutional investors turn bullish, they tend to hold REITs especially since REIT investors not only purchase this type of equity for its price appreciation but for the steady stream of dividends; however, as sentiment turns bearish, probably as a consequence of negative market outlooks, investors will actively rebalance their portfolios leading to increased volatility. Results in Table 3.4 suggest that investor sentiment is a significant factor in explaining REIT returns during the sample period from December 2001 to February 2013.

I next examine the impact of changes in sentiment during the 2008-2009 liquidity crisis. Results for the model composed of equations 3.5 and 3.6 are presented in Table 3.5. Model 1 in Table 3.5 shows results that include the Fama-French framework as control variables along with the interactions $Crisis_t*\Delta II_t$ and $Crisis_t*\Delta AAII_t$ in the mean equation. The conditional variance equation includes $Crisis_t*\Delta II_t$ and $Crisis_t*\Delta AAII_t$ in conjunction with ARCH, TARCH, and GARCH terms. Results for REIT excess price and total returns are congruent. Findings indicate that during the crisis period ΔII_t significantly impact REIT excess returns whereas $\Delta AAII_t$ are not significant. These results differ from the previous analysis for the entire sample period which indicates that both individual and institutional investor sentiment influence returns. Results suggest that sentiment from individual investors were either too erratic, meaning that sentiment from bullish and bearish individuals cancelled each other and thus no impact was observed or that institutional investors were the only ones with sufficient market power to influence returns during the liquidity crisis. As expected, all three Fama-French equity factors are positive and statistically significant. In the conditional variance equation, results show that institutional investor sentiment (ΔII_t) is negatively and significantly related to volatility whereas individual investor sentiment ($\Delta AAII_t$) was not a significant factor in explaining volatility during the liquidity crisis. The TARCH term in the conditional variance equation is not significant suggesting that there is no asymmetric effect in lagged ε_t^2. That is, negative and positive shocks in the mean equation contributed symmetrically to volatility.

Model 2 in Table 3.5 expands the model by including the complete vector of control variables. Results remain materially unchanged. The Fama-French bond factors are not significant whereas equity factors are all positive and statistically significant. Institutional investor sentiment appears to influence positively to REIT returns and negatively to volatility as in the prior model. Overall, these results suggest that although investor sentiment plays a significant role in the REIT return and volatility generation process, institutional investors exhibit a greater influence in the REIT industry.

3.4.2.1. Robustness check. To check for robustness, I augment the GARCH-M model to simultaneously include ΔII_t and $\Delta AAII_t$ for the complete sample period along with the interactions $Crisis_t*\Delta II_t$ and $Crisis_t*\Delta AAII_t$ in both the mean and conditional variance equations. The idea is to test whether the sentiment coefficients during the crisis remain robust with the inclusion of sentiment for the entire sample period. Results are presented in Model 3 in Table 3.5 and are consistent with the findings presented in the preceding sections. Results imply dominance of changes in institutional investor sentiment over individual investor sentiment; moreover, changes in institutional investor sentiment display a coefficient of significantly greater magnitude during the REIT liquidity crisis compared to the rest of the sample period, implying that although institutional investor sentiment significantly impacts returns during the entire sample period, changes in institutional investor sentiment played a larger and more important role during the crisis. On the other hand, changes in individual investor sentiment appear only marginally significant for excess NAREIT price returns in Model 3 though this significance dissipates in the model for excess NAREIT total returns.

In the case of the conditional variance equation in Model 3 of Table 3.5, both ΔII_t and $\Delta AAII_t$ exhibit a negative relationship with volatility, however, the magnitude of the coefficients for ΔII_t are larger in magnitude (-0.215 for excess price returns and -0.215 for excess total returns) in comparison to $\Delta AAII_t$ (-0.031 for excess price returns and -0.0374 for excess total returns). Nevertheless, only ΔII_t appear significant in explaining REIT volatility during the crisis.

Model 4 in Table 3.5 shows results for an additional specification of the model with consistent results. I report Portmanteau *Q*-statistics in the last line of tables presented, residual follow a white noise process as suggested by significant Portmanteau *Q*-statistics in every specification.

3.5. Conclusion

The unique dividend policy restrictions of the REIT industry obligate these firms to hold a diminutive portion of retained earnings. This obligates REITs to fund new investments either by raising cash through new debt or equity, which is very costly, or by relying on credit commitments from banks and other financial institutions. Research finds that the latter option is preferable since credit lines also serve as financial slack for REITs (Ooi et al., 2012). Credit commitments function as cash reserves for REITs which accounts for close to 64% of total liquidity in this industry in comparison to 45% registered by firms in general. In summary, credit commitments represent a vital component of REIT operations and may serve as an indication of REIT financial health.

The subprime crisis of 2007-2009 triggered market turmoil that had devastating consequences on the U.S. economy. The financial sector was specially affected by this crisis, banks went out of business and market conditions did not begin to normalize until the government intervened. The REIT industry was not immune from this financial disaster. The financial crisis constrained banks and other financial institutions so severely that eroded their capacity to fulfill their credit commitments with REITs. This deteriorated the flow of cash to this industry and resulted in a severe REIT liquidity crisis from 2008Q4 to 2009Q2.

Results in this study indicate that the liquidity crisis had significant negative effects on REIT returns along with significant increases in volatility. As liquid funds became scarce, growth and expansion opportunities diminished and REIT overall financial heath was affected. REIT industry outlooks were not promising and uncertainty flooded the market. Investors in an attempt to rebalance their portfolios in response to the crisis created increased volatility during these troubled times.

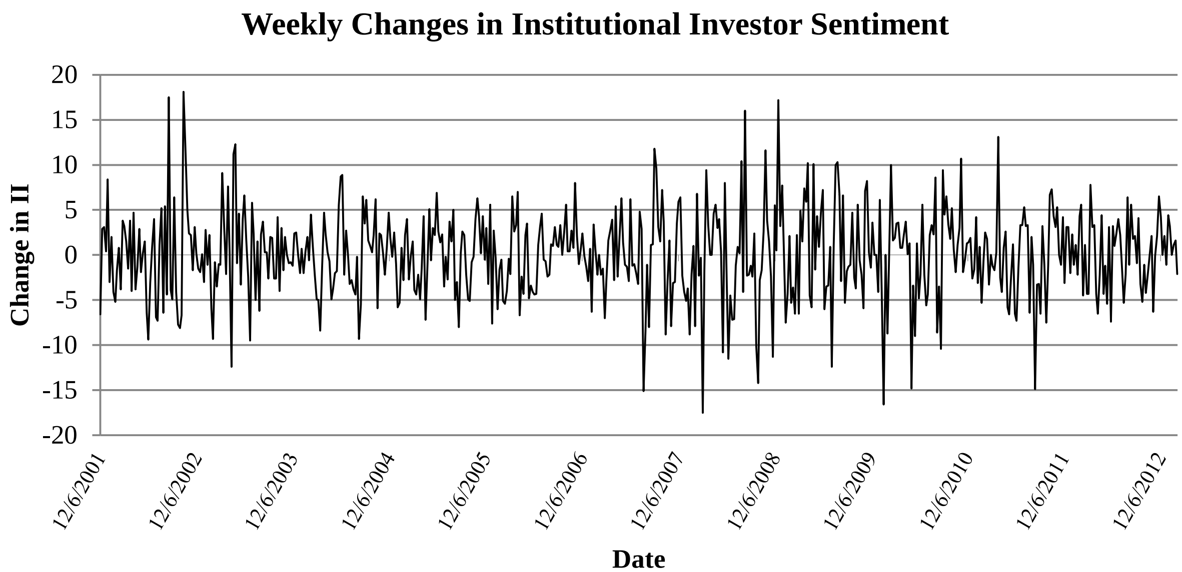
According to the behavioral finance viewpoint, asset pricing is affected not only by economic fundamentals but also by investor sentiment. Bullish investors who have positive market expectations will affect security prices given their trading patterns, as well bearish investor trading will pressure prices in their particular way. Research in the REIT industry finds that investor sentiment is a significant factor in explaining REIT returns and volatility; this essay explores this relationship between investor sentiment and REIT returns and volatility during the period spanning from the 2001 recession to February 2013 and specifically during the REIT liquidity crisis of 2008-2009.

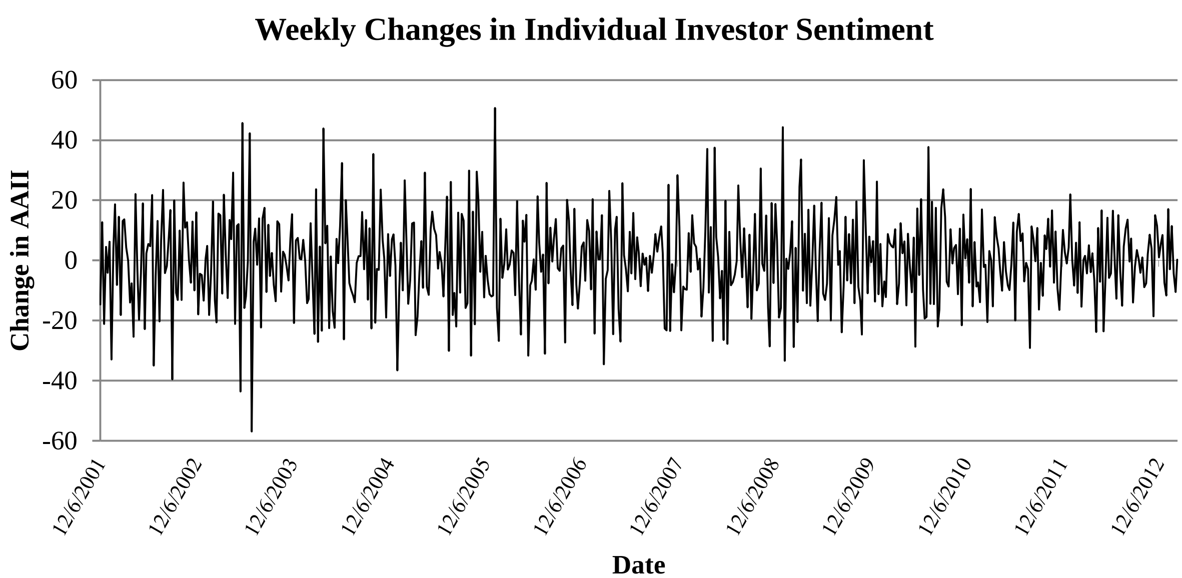
Results indicate that investor sentiment is a significant factor in explaining REIT returns and volatility during the relevant sample period. Specifically, both institutional and individual investor sentiment appear to have a positive and significant effect on returns; however the coefficient for institutional investor sentiment was consistently larger in magnitude than for individual investor sentiment. Similarly, the effect on volatility from institutional and individual investor sentiment is significant denoting a negative relationship between sentiment and volatility. These findings suggest that although sentiment from these two markedly different group of investors are relevant in explaining REIT returns and volatility, sentiment for institutional investors dominates this effect.

Sentiment also plays an important role during the REIT liquidity crisis. However, results consistently indicate that institutional investor sentiment is a significant factor in the return generating process during the crisis whereas individual investor sentiment was no longer significant. A plausible explanation can be derived from the large increase in institutional holding in the REIT industry. Aggregate institutional ownership is recorded at a notable 50% in 2009Q2. Furthermore, institutional investors with sizeable capital have the market power sufficient to influence industry returns which is clearly not the case for individual investors.

This essay provides evidence on the relevance of investor sentiment in the REIT industry. Particularly, investors should pay close attention to changes in institutional investor sentiment especially during times of market turmoil. Overall, results suggest that positive (negative) changes in aggregate sentiment will affect REIT returns positively (negatively) and volatility negatively (positively). Investors may use sentiment as a signal for capital allocation. These findings offer support to the field of behavioral finance by highlighting the influence that investor perception and mood can have on the market.

Figure 3.1. Changes in institutional and individual investor sentiment





Notes: These graphs show changes in institutional and individual investor sentiment from Investor's Intelligence (II) and the American Association of Individual Investors (AAII), respectively, for the time period from the end of the 2001 recession in December 2001 to February 2013. The REIT liquidity crisis extends from October 2, 2008 to July 2, 2009.

Table 3.1. Correlation table

	Exss REIT Price Ret	*Exss REIT Total Ret*	*Crisis* ΔAAII*	*Crisis*ΔII*	*Crisis*	*ΔAAII*	*ΔII*	*Rm-Rf*	*SMB*	*HML*	*DEF*	*PREM*
Exss REIT Price Ret	1.000											
Exss REIT Total Ret	0.999	1.000										
Crisis ΔAAII*	0.289	0.289	1.000									
*Crisis*ΔII*	0.208	0.209	0.144	1.000								
Crisis	-0.091	-0.088	0.007	0.098	1.000							
ΔAAII	0.186	0.184	0.310	0.045	0.003	1.000						
ΔII	0.284	0.284	0.049	0.342	0.035	0.195	1.000					
Rm-Rf	0.645	0.645	0.215	0.181	-0.061	0.172	0.382	1.000				
SMB	0.208	0.208	-0.020	0.067	-0.005	0.054	0.170	0.224	1.000			
HML	0.481	0.481	0.295	0.100	-0.108	0.067	0.077	0.309	0.004	1.000		
DEF	-0.036	-0.033	0.012	0.159	0.860	0.015	0.066	-0.014	0.014	-0.061	1.000	
PREM	0.024	0.026	0.006	0.009	0.179	0.009	0.016	0.009	0.064	0.023	0.266	1.000

Table 3.2. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Excess NAREIT Price Returns	582	0.160	3.986	-32.461	35.106
Excess NAREIT Total Returns	582	0.251	3.990	-32.424	35.159
Crisis (dummy)	585	0.068	0.253	0.000	1.000
Crisis$*\Delta$*AAII*	585	0.009	4.654	-33.380	44.310
Crisis$*\Delta$*II*	584	0.044	1.678	-14.200	17.200
Δ*AAII*	585	-0.061	15.042	-56.900	50.750
Δ*II*	584	0.017	4.908	-17.500	18.100
Rm-Rf	582	0.103	2.626	-18.000	12.610
SMB	582	0.074	1.182	-3.870	3.660
HML	582	0.062	1.267	-7.000	7.600
DEF	585	1.180	0.506	0.599	3.460
PREM	584	2.791	1.405	-0.230	4.540

This table provides summary statistics for all variables employed in the econometric analysis in this essay. Excess NAREIT price returns are the REIT industry price returns minus the risk-free rate. Excess NAREIT total returns are the REIT industry total returns minus the risk-free rate, total returns account for dividend payments. The *Crisis* dummy variable takes the value of 1 during the REIT liquidity crisis (October 2, 2008 to July2, 2009) and 0 otherwise. The interactions *Crisis*$*\Delta$*II* and *Crisis*$*\Delta$*AAII* represent changes in institutional and individual investor sentiment during the crisis, respectively. Δ*II* and Δ*AAII* are changes in institutional and individual investor sentiment, respectively. *Rm-Rf*, *SMB* and *HML* are the Fama-French equity factors and *DEF* and *PREM* are the Fama-French bond factors.

Table 3.3. Effect of REIT liquidity crisis on excess REIT returns and volatility

	Model 1		Model 2		Model 3		Model 4	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
α_0	-0.032	0.071	-0.582**	-0.506**	0.301	0.355	-0.287	-0.252
h_t	0.048**	0.046**	0.145***	0.147***	0.056**	0.053**	0.153***	0.156***
$Crisis_t$	-8.080***	-7.829***	-7.433***	-7.458***	-8.281***	-8.028***	-7.038***	-7.116***
$Rm\text{-}Rf_t$			0.629***	0.630***			0.629***	0.631***
SMB_t			0.352***	0.357***			0.355***	0.359***
HML_t			0.557***	0.556***			0.556***	0.556***
DEF_t					-0.507	-0.467	-0.433	-0.409
$PREM_t$					0.051	0.055	0.047	0.052
φ_1	-0.328	-0.327	-0.091	-0.081	-0.322	-0.315	-0.123	-0.103
ε_{t-1}^2	0.201***	0.202***	0.166***	0.161***	0.197***	0.198***	0.168***	0.163***
$\varepsilon_{t-1}^2 I_{t-1}$	-0.132**	-0.125**	-0.162***	-0.157***	-0.142***	-0.135**	-0.167***	-0.161***
h_{t-1}	0.754***	0.750***	0.712***	0.711***	0.760***	0.756***	0.718***	0.716***
$Crisis_t$	3.370***	3.386***	2.492***	2.490***	3.360***	3.370***	2.491***	2.483***
Log-likelihood	-1428.11	-1429.05	-1307.76	-1308.14	-1427.37	-1428.36	-1306.84	-1307.25
Wald χ^2	10.44***	9.65***	477.58***	475.96***	13.30***	12.34***	485.79***	483.45***
N	582	582	582	582	582	582	582	582
Portmanteau Q-stat	131.73***	135.30***	132.80***	137.58***	129.74***	133.50***	131.72***	136.46***

This table reports the results for the GARCH-M model described by eqs. 3.1 and 3.2:

$(\boldsymbol{REIT-Rf})_{\boldsymbol{t}} = \propto_{\boldsymbol{0}} + \boldsymbol{\beta_1 Crisis_t} + \boldsymbol{\beta_2 h_t} + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t}$ (3.1)

$\boldsymbol{h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 Crisis_t + \omega_t}$ (3.2)

Each model has two columns that show results for excess NAREIT price returns and excess NAREIT total returns, respectively. The REIT liquidity crisis spans from October 2, 2008 to July 2, 2009. The Portmanteau *Q*-statistic tests for white noise in the residuals. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 3.4. GARCH-M results. Changes in institutional and individual investor sentiment.

	Model 1		Model 2	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
α_0	0.157	0.247	0.286	-0.067
h_t			0.048*	0.024
$Rm\text{-}Rf_t$			0.564**	0.557***
SMB_t			0.358***	0.345***
HML_t			0.504***	0.481***
DEF_t			-0.500	
$PREM_t$			0.021	
ΔII_t	0.218***	0.218***	0.065***	0.064***
$\Delta AAII_t$	0.026***	0.026**	0.011**	0.011**
φ_1	2.612***	2.616***	-1.429***	-1.436***
ε_{t-1}^2			0.179***	0.176***
$\varepsilon_{t-1}^2 I_{t-1}$			-0.182***	-0.170***
h_{t-1}			0.825***	0.819***
ΔII_t	-0.048***	-0.048***	-0.243***	-0.250***
$\Delta AAII_t$	-0.003**	-0.002**	-0.007	-0.010
Log-likelihood	-1585.82	-1586.99	-1304.63	-1305.80
Wald χ^2	60.69***	60.09***	375.85***	346.09***
N	582	582	582	582
Portmanteau Q-stat	145.87***	148.27***	129.41***	133.92***

This table reports the results for the GARCH-M model described by eqs. 3.3 and 3.4.

$$(\boldsymbol{REIT - Rf})_{\boldsymbol{t}} = \propto_{\boldsymbol{0}} + \boldsymbol{\beta_1 h_t} + \boldsymbol{\beta_2} \Delta \boldsymbol{II_t} + \boldsymbol{\beta_3} \Delta \boldsymbol{AAII_t} + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t} \quad (3.3)$$

$$\boldsymbol{h_t} = \boldsymbol{\varphi_1} + \boldsymbol{\varphi_2 \varepsilon_{t-1}^2} + \boldsymbol{\varphi_3 \varepsilon_{t-1}^2 I_{t-1}} + \boldsymbol{\varphi_4 h_{t-1}} + \boldsymbol{\varphi_5} \Delta \boldsymbol{II_t} + \boldsymbol{\varphi_6} \Delta \boldsymbol{AAII_t} + \boldsymbol{\omega_t} \quad (3.4)$$

Results are for the sample period from December 2001 to February 2013. Each model has two columns that show results for excess NAREIT price returns and excess NAREIT total returns, respectively. The Portmanteau Q-statistic tests for white noise in the residuals. Sample period from December 2001 to February 2013. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 3.5. GARCH-M Results. Changes in institutional and individual investor sentiment during the REIT liquidity crisis.

	Model 1		Model 2		Model 3		Model 4	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
α_0	0.101	0.190	0.336	0.365	0.411	0.452	0.321	0.288
h_t	-0.006	-0.005	0.006	0.004	-0.002	-0.003	-0.002	0.005
$Rm\text{-}Rf_t$	0.596***	0.597***	0.598***	0.599***	0.535***	0.538***	0.546***	0.537***
SMB_t	0.347***	0.350***	0.354***	0.355***	0.350***	00353***	0.314***	0.333***
HML_t	0.513***	0.519**	0.513***	0.513***	0.425***	0.422***	0.496***	0.497***
DEF_t			-0.386	-0.327	-0.375	-0.336	-0.308	-0.220
$PREM_t$			0.044	0.047	0.031	0.036	0.041	0.040
$Crisis_t*\Delta II_t$	0.519**	0.519**	0.538***	0.535**	0.497**	0.499**		
$Crisis_t*\Delta AAII_t$	0.037	0.039	0.036	0.038	0.023	0.026		
ΔII_t					0.047**	0.043**	0.066***	0.066***
$\Delta AAII_t$					0.010*	0.009	0.017***	0.015***
φ_1	-0.677**	-0.686*	-0.630*	-0.647*	-1.362***	-1.384***	-0.336	-0.719**
ε_{t-1}^2	0.137***	0.127***	0.155***	0.139***	0.086***	0.075**	0.217***	0.160***
$\varepsilon_{t-1}^2 I_{t-1}$	-0.069	-0.055	-0.094	-0.074	-0.079*	-0.068	-0.107	-0.072
h_{t-1}	0.786***	0.790***	0.777***	0.783***	0.835***	-0.034**	0.681***	0.768***
$Crisis_t*\Delta II_t$	-0.422***	-0.424***	-0.412***	-0.417***	-0.247***	-0.250***	-0.205***	-0.421***
$Crisis_t*\Delta AAII_t$	-0.006	-0.005	-0.009	-0.006	0.010	0.014	-0.132***	0.036
ΔII_t					-0.215***	-0.215***		
$\Delta AAII_t$					-0.031**	-0.034**		
Log-likelihood	-1305.47	-1305.40	-1304.86	-1304.88	-1289.00	-1289.09	-1300.99	-1302.11
Wald χ^2	357.74***	355.25***	360.21***	353.78***	322.59***	321.97***	419.23***	365.85***
N	582	582	582	582	582	582	582	582
Portmanteau Q-stat	143.75***	147.26***	138.01***	142.97***	151.04***	156.15***	142.02***	141.79***

This table reports the results for the GARCH-M model described by eqs. 3.5 and 3.6.

$$(\boldsymbol{REIT - Rf})_t = \propto_0 + \boldsymbol{\beta_1 h_t} + \boldsymbol{\beta_2 Crisis_t} * \Delta \boldsymbol{II_t} + \boldsymbol{\beta_3 Crisis_t} * \Delta \boldsymbol{AAII_t} + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t} \quad (3.5)$$

$$\boldsymbol{h_t} = \boldsymbol{\varphi_1} + \boldsymbol{\varphi_2 \varepsilon_{t-1}^2} + \boldsymbol{\varphi_3 \varepsilon_{t-1}^2 I_{t-1}} + \boldsymbol{\varphi_4 h_{t-1}} + \boldsymbol{\varphi_5 Crisis} * \Delta \boldsymbol{II_t} + \boldsymbol{\varphi_6 Crisis} * \Delta \boldsymbol{AAII_t} + \boldsymbol{\omega_t} \quad (3.6)$$

Model 1 and 2 include the interactions *Crisis**Δ*II* and *Crisis**Δ*AAII* which represent changes in institutional and individual investor sentiment during the REIT liquidity crisis, respectively. The REIT liquidity crisis spans from October 2, 2008 to July 2, 2009. Augmented models 3 and 4 additionally include Δ*II* and Δ*AAII* for the entire sample period. Each model has two columns that show results for excess NAREIT price returns and excess NAREIT total returns, respectively. The Portmanteau *Q*-statistic tests for white noise in the residuals. *, ** and *** represent 1%, 5% and 10% significance level respectively.

CHAPTER IV

THE ASYMMETRIC EFFECT OF CHANGES IN SENTIMENT ON REIT RETURNS AND VOLATILITY

4.1. Introduction

After years of debate, sentiment is now recognized by many to be a significant factor influencing the return generating process of financial securities. Orthodox financial theory assumes that investors are all rational profit maximizers that make trades based on fundamental information and their allocations are not biased by sentiment. However, the behavioral finance approach to modeling returns has proposed and provided evidence that sentiment does affect prices. An example of a theoretical framework that incorporates sentiment is DeLong, et al. (1990), who model the effect of investor sentiment on equity prices. Their theoretical model suggests that although arbitrageurs bet against noise trader mispricing, they cannot always drive prices to their fundamental values. This is because noise traders, who trade on noise as if it were information, can drive prices so far away from fundamentals that sophisticated investors will not be willing to bear the risk of betting against them.

Going as far as Black (1986), who acknowledged that prices are not always fully reflective of fundamentals and that “noise” cannot be excluded from models that attempt to grasp the return and volatility behavior of securities. He refers to noise as factors that cause this deviation which, among other components, largely includes irrational trader sentiment. Empirical evidence on the impact of sentiment on security prices is now common in the financial literature.

For instance, widely cited papers, such as Baker and Wurgler (2006, 2007) and Brown and Cliff (2004, 2005), show that sentiment is a factor that significantly impacts stock returns. In the case of REITs, Chan et al. (1990) and Lin et al. (2009) find that proxies for investor sentiment significantly impact REIT returns even after controlling for other factors that affect REIT prices.

Based on the DeLong, et al. (1990) theoretical model, empirical research has emerged to show the effect of investor sentiment not only on returns but on higher moments of return such as volatility, a view supported by Brown (1999). Glosten et al. (1993) provide evidence that market volatility is, in fact, impacted by shocks to the market and that there is an asymmetric impact on volatility depending on the nature of the shock. These shocks, as suggested by Black (1986), carry information not reflected by fundamentals and that investor sentiment in a key component of these shocks. Lee et al. (2002) use a generalized autoregressive conditional heteroscedasticity (GARCH) framework to test for the impact of sentiment on returns and its conditional variance (volatility). They find that volatility is asymmetrically impacted by changes in sentiment, specifically finding that negative sentiment has a greater impact than positive sentiment, and that higher (lower) volatility in prior periods lead to lower (higher) future returns. This linkage between sentiment, stock returns, and volatility offer an avenue of research on securities with unique characteristics such as REITs which are often considered a hybrid between equity and fixed-income securities (Lee and Stevenson, 2005). Moreover, REITs offer characteristics of both stocks and direct private real estate investments, bringing diversification benefits to investor portfolios which categorize them as a unique asset class for many investors.

REITs serve as a testing ground for many theories that hold true for other industries. The underlying assets and strict rules that REITs must conform to clearly differentiate them from other stocks. REIT qualifying rules dictate that these firms must derive 75% or more of their gross income from property rentals and it cannot derive 30% or more of its income from the sale of real property held for less than 4 years. Moreover, unlike other firms in the market, REITs are tax exempt as long as they distribute 90% or more of their income in the form of dividends, restricting REITs from building up retained earnings (Howton et al., 2000) and making them attractive securities for investors seeking income in addition to capital gains on their investments.

Other characteristics observed in REITs that highlight their distinctiveness is the increased levels of institutional ownership recorded in recent years for this industry.[16] REIT aggregate institutional ownership has fluctuated between 50% and 58% between 2008 and 2009 (Devos et al., 2012) and currently maintaining historically high levels of institutional ownership, suggesting that institutions are attracted to REITs probably because of their income producing and portfolio diversification capabilities. A well-known fact is that increased levels of institutional ownership in firms act as an influencing factor in management behavior and, consequently, in the formation of stock prices. Institutions can add pressure to prices and price volatility because their trading patterns may serve as signals to other investors that hold the same stock (e.g. herding) or because their large stock holdings and their potential to trade in blocks can substantially affect prices. Little research has addressed the influence that investor sentiment has on REIT returns, Lin et al. (2009) is one of the few that investigates this relationship. Their results suggest that sentiment does impact returns of the REIT industry; however, they claim that this impact is generated by individual investor sentiment and that institutional ownership is not a significant factor in their empirical framework. A primary concern with findings from Lin et al. (2009) comes from their choice of proxy for sentiment, although closed-end fund discounts serve as a widely accepted reflection of investor sentiment, Chen et al. (1993) argues that this proxy is

[16] Institutions that invest in REITs include bank trusts, insurance companies, mutual funds/investment advisers, and others (Devos et al., 2012). The group with largest REIT holdings is the mutual funds/investment advisers (38% of ownership on average).

not necessarily a strict reflection of individual investor sentiment, rather, it reflects the sentiment of the overall market which includes both small and institutional investors. By using direct (survey-based) measures of sentiment that differentiate individual and institutional investors' expectations in Chapter II, I contest the findings from Lin et al. (2009), I find that REIT returns are influenced by both individual and institutional investor sentiment, however, institutional sentiment impacts REIT returns more than individual sentiment denoting a difference between these two groups of investors.

The purpose of this essay is to analyze the impact that asymmetric changes in sentiment have on REIT returns and volatility. DeLong, et al. (1990) and Lee et al. (2002) propose that the direction and magnitude of changes in sentiment are relevant in asset pricing, more specifically, negative corrections in sentiment affect security returns and volatility differently than do positive shifts in sentiment. This essay adds to the REIT literature by testing contesting theories about the effect that shifts in sentiment may have on returns and volatility. These theories are based on behavioral biases observed for different types of investors: those who overreact to new information, usually reacting more to negative than to positive innovations, those optimistic investors who "ride the bandwagon", follow others in a herding behavior and are overly optimistic, and those contrarian strategists who believe that by reacting opposite to overall market movements can reap the benefits of arbitrage.

An additional contribution of this essay is investigating the impact of changes in sentiment on REIT returns and volatility for two markedly different types of investors: institutional investors and individual investors. These two groups of investors are observed to create distinct expectations of the market based on the same set of information, which will probably impact returns and volatility differently. Moreover, institutional investor sentiment appears to be less volatile than individual investor sentiment, further denoting differences between institutional and individual corrections in future market expectations. The high concentration of institutional ownership in the REIT industry points to a larger influence of institutional investor sentiment than individual investor sentiment on REIT returns and conditional variance. This contributes to the behavioral finance and REIT literature by further exploring the sentiment-return relationship and by examining the effect that sentiment has on volatility for this peculiar and highly regulated industry.

4.1.1. Theories on the asymmetric impact of changes in sentiment on returns and volatility

The overreaction to information premise argues that investors tend to overreact to new information with negative changes in investor perception usually having a stronger impact on returns than do positive ones. DeBondt and Thaler (1985) innovated this overreaction theory based on Bayes' rule which posits that most people overreact to unexpected and dramatic news events, particularly when the news is negative. Their findings suggest that the overreaction to news contemporaneously impact prices which reverse in subsequent periods. Under the DeBondt and Thaler (1985) conjecture, negative changes in sentiment should have a negative impact on returns and could lead to an increase in volatility, whereas positive changes in sentiment should positively influence returns and volatility with a lower magnitude. Hence, given the nature of investor overreaction, volatility is expected to significantly increase if the change in sentiment is either positive or negative. Investors will tend to impulsively trade responding to the abrupt change in sentiment putting upward pressure on volatility.

The "bandwagon effect" theory suggests that investors follow trends and exhibit herding behavior. Since bandwagon investors are particularly optimistic, prices should rise as they will create more demand for securities when sentiment is bullish. These optimistic investors tend to react under the pressure of positive sentiment; however, negative changes in sentiment lead investors to hold their investments to not realize losses which are believed to be transitory. This may be particularly true in the REIT industry since many investors not only purchase REIT shares in the pursuit of capital gains but for the important dividend income that these generate, providing a reasonable argument as to why investors continue to hold a stock even while the price is decreasing. Optimistic investors will tend to increase portfolio rebalancing and trading activities with positive changes in sentiment, contributing to an increase in volatility. However, negative changes in sentiment for bandwagon riders should not contribute to increased volatility since their trading volume should diminish.

Finally, an alternative theory is the contrarian investor reaction theory. A contrarian becomes bullish when the overall reaction of investors is negative, seeking arbitrage opportunities provided by noise traders who are trading on biased expectations and not on fundamental information. The contrarian investor theory suggests that stock purchases will be triggered by negative shifts in sentiment that should lead to positive returns. Under the contrarian investor reaction theory, volatility should increase with negative changes in sentiment since these should cue investors to acquire. On the other hand, positive changes in sentiment should impact volatility much less than negative ones; however, extremely bullish sentiment should signal contrarians to sell which will potentially result in increased volatility.

A graphical representation of the effect anticipated by the different theories on the asymmetric impact of changes in sentiment on returns and volatility is provided in Figure 4.1. There can be a separation of predicted effects by the different theories on returns and volatility;

for example, one can observe no effect of changes in sentiment on returns despite a significant overreaction effect observed on volatility.

4.2. Data

The sample consists of 1108 weekly observations that spans from January 1992 to January 2013 covering the "new REIT" era.[17] The "new REIT" era began in 1992 after significant legislative changes to REIT rules and regulations. Some of these fundamental changes included changes in the structure of REITs as tax-exempt business entities which led to an increase in REIT institutional ownership, analyst coverage, and pricing efficiency (Oikarinen et al., 2011). As a proxy for REIT industry returns, I employ the FTSE NAREIT U.S. Real Estate Index returns from Thomson's DataStream. The FTSE NAREIT is a free-float adjusted, market capitalization-weighted index of all U.S. Equity REITs, which account for about 90% of all REITs in the U.S. (NAREIT, 2012). Additionally, I include the FTSE NAREIT U.S. Total Return index that takes into account dividend payments that constitutes a significant source of income for REIT investors. The average three-month T-Bill yield is used as the risk-free rate to calculate weekly excess returns.

Following Lee et al. (2002) and Brown and Cliff (2004) I employ survey-based, direct measures of investor sentiment for this analysis. Survey-based sentiment measures are significantly related to commonly used sentiment proxies (Brown and Cliff, 2004) and have the advantage of reflecting individual and institutional sentiment independently. For institutional

[17] Other sample periods were also explored, specifically, I use the sample periods that end on December 2006 in order to isolate the effect of the financial crisis and the REIT liquidity crisis on returns and on volatility, results are similar.

investor sentiment I employ the Investors Intelligence survey. [18] This survey is compiled for a sample of investment advisory newsletters from which they extract bullish, bearish, or neutral outlooks of the financial markets every week. The institutional investor sentiment (*II*) variable is constructed by calculating the spread between bullish and bearish sentiments, also known as the bull-bear spread (Brown and Cliff, 2004).

Individual investor sentiment is obtained from the American Association of Individual Investors (*AAII*) market condition survey.[19] The individual sentiment variable is constructed by calculating the bull-bear spread for every week in the sample period. Figure 4.1 graphically portrays the weekly percentage of bullish respondents for both the II and AAII surveys. This figure depicts a higher volatility in individual investor sentiment compared to institutional sentiment, which seems more stable over time.

The Fama-French (1993) equity and bond factors are included in the analysis as control variables. Although some academics debate as to whether the Fama-French factors are suitable for REIT empirical studies, Peterson and Hsieh (1997) find that the market risk premium, the firm asset size, the book-to-market factor, the term spread, and the default spread capture a significant proportion of REIT returns which renders these variables apt to model REIT returns.

4.2.1. Descriptive statistics

Table 4.1 presents the correlation table for the variables employed in this study. The correlation between changes in individual investor sentiment ($\Delta AAII$) and changes in institutional

[18] Based in New Rochelle, NY, Investors Intelligence is an organization dedicated to technical analysis and financial research that collects data on institutional investors' perception of the market. Further information on Investors Intelligence is found at: http://www.investorsintelligence.com/x/about_us.html. Accessed on December 12, 2012.
[19] The AAII survey is administered to a random sample of its members each week in which AAII inquires about the investor's perception of market outlooks, bullish, bearish or neutral, in the next 6 months. Additional information on the American Association of Individual Investors at: http://www.aaii.com/. Accessed on December 12, 2012.

investor sentiment (ΔII) is roughly 0.162, which shows that these two distinct classes of investors react differently to innovations and new information in the market. Such a low correlation between these two measures of sentiment suggests that these should impact returns and volatility differently. The largest correlations observed among the variables are between the NAREIT excess returns and the FF excess return of the market (0.561) and the HML factor (0.289), which is reasonable given that REITs, despite regulations and rules are, in fact, equity and are expected to highly correlate to equity market factors. Overall, Table 4.1 shows no correlation large enough to suggest a multicollinearity problem in the empirical models presented in section 4.3.

Summary statistics are presented in Table 4.2. Weekly mean NAREIT excess total returns (0.118%) are larger than excess price returns (0.231%) as expected. Excess total returns reflect not only REIT stock returns but also incorporate dividends which are a substantial source of income for REIT investors. Mean excess REIT total weekly returns are larger than market excess returns (0.134%) for the sample period, supporting claims of REIT over performance with respect to stock market from the National Association of Real Estate Investment Trusts.

Changes in institutional investor sentiment (ΔII) appear less volatile than do changes in individual investor sentiment ($\Delta AAII$) as graphically observed in Figure 4.2. The standard deviation for $\Delta AAII$ (14.762%) is substantially larger than for ΔII (4.616%), moreover, the minimum (-58.000) and maximum (51.000) values for $\Delta AAII$ are considerably larger in magnitude than for ΔII (min: -17.500, max: 18.100) denoting a significant difference in volatility of sentiment for these two group of investors. The low average weekly changes in sentiment indicate that negative and positive shifts in sentiment are offsetting over time.

To test for the asymmetric impact of changes in sentiment on returns, I employ an interaction between a dummy variable D_t that takes the value of 1 if changes in sentiment are positive and 0 if changes in sentiment are negative and the magnitude of the change in sentiment at time *t*. This dummy variable is multiplied by the magnitude of the change in sentiment since previous research find that in addition to the direction of the correction in sentiment, the magnitude of shifts in sentiment has a significant impact on the formation of conditional volatility of returns and expected returns (Lee et al., 2002). Mean [D_t* $|\Delta AAII|_t$](5.713) and [$(1-D_t)$* $|\Delta AAII|_t$](5.699) are observed to be considerably larger than mean [D_t* $|\Delta II|_t$](1.777) and [$(1- D_t)$* $|\Delta II|_t$](1.765) respectively again suggesting greater volatility in individual investor sentiment with respect to institutional sentiment. Table 4.3 presents the frequency table for changes in both individual and institutional investor sentiment. Overall there are more positive ΔII and $\Delta AAII$ than negative changes; however, the difference is minor.

4.3. Methodology

4.3.1. Testing for OLS heteroscedastic errors

The appropriateness of an ordinary least squares (OLS) methodology depends heavily on the characteristics of the residuals. OLS is unbiased and consistent if the error term is homoscedastic and normally distributed. Otherwise, OLS coefficients are biased and inferences based on results can be erroneous.

The asymmetric impact of changes in investor sentiment can be tested by isolating negative changes in sentiment from positive ones. In addition, it is important to account for the magnitude of these changes since the size of the fluctuation in investor sentiment is observed to influence returns (Lee et al., 2002). To test the asymmetric effect of changes in sentiment on REIT returns, I employ the following linear model:

$$(REIT - Rf)_t = \beta_0 + \beta_1 D_t|\Delta Sent_t| + \beta_2 (1 - D_t) |\Delta Sent_t| + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \qquad (4.1)$$

Where $(REIT\text{-}Rf)_t$ are the FTSE NAREIT U.S. Real Estate Index excess returns at time t and $\Delta Sent_t$ is the change in sentiment for the measures of institutional and individual sentiment at time t. D_t is a dummy variable that takes the value of 1 if the change in sentiment is positive and 0 if the change in sentiment is negative. The interaction between the dummy D_t and $\Delta Sent_t$ provides the asymmetric impact of changes in sentiment on REIT returns, β_1 reflects the impact that positive changes in sentiment have on REIT industry returns whereas β_2 reflects the impact of negative changes in sentiment. The changes in sentiment for individual and institutional investors are included in the model separately and simultaneously to assess whether there are any overriding effects among the sentiments of these two types of investors.

X_t is a vector of control variables that are observed to explain the variability in REIT returns (Buttimer et al., 2005; Lee et al., 2008; Lin et al., 2009; Ro and Ziobrowski, 2011). As control variables, I employ the Fama and French (1992) three stock market factors and the default risk (DEF_t) and term structure variables ($TERM_t$) as proposed by Peterson and Hsieh (1997). $(Rm\text{-}Rf)_t$ is the excess return on the market portfolio constructed as the value-weighted returns on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate. SMB_t (small minus big) is the average return on the three small portfolios minus the average on the three big portfolios for all stocks based on market capitalization. HML_t (high minus low) is the average return on the two value portfolios minus the average return on the two growth portfolios for all stocks based on the book-to-market ratio. Def_t is the default risk premium defined by the difference between Moody's Seasoned Aaa Corporate Bond Yield and the Baa Corporate Bond Yield. $Prem_t$ is the term risk premium constructed as difference between the 20-

year Treasury bond rate and the one-month Treasury bill rate and ε_t is the stochastic error term at time *t*.

As previously mentioned, to obtain unbiased OLS coefficients the disturbance term ε_t is required to be homoscedastic and normally distributed. I test for heteroscedasticity using a variation of the Breusch-Pagan test which consists in predicting and testing ε_t after running equation 4.1 using OLS. Because it is assumed that ε_t has zero conditional expectation, variance of ε_t must be equivalent to ε^2_t. Therefore, predicted ε_t are squared and regressed against the independent variables from the original OLS regression model as shown in the following equation:

$$\varepsilon_t^2 = \beta_0 + \beta_1 D_t|\Delta Sent_t| + \beta_2 (1 - D_t) |\Delta Sent_t| + \sum_{i=1}^{N} \gamma_i X_{it} + \varphi_t \tag{4.2}$$

To test for the violation of the homocedasticity assumption, I test whether ε^2_t is significantly associated to one or more independent variables. The null hypothesis in the Breusch-Pagan test is that coefficients from equation 4.2 are conjunctively equal to zero ($H_0: \beta_1 = \beta_2 = \sum_{i=1}^{N} \gamma_i = 0$). I compute the F-statistic for the joint significance of all variables and LM (Lagrange Multiplier) statistic based on the R^2 obtained from equation 4.2. Rejection of the null hypothesis indicates heteroscedastic errors and the inappropriateness of OLS to obtain BLUE[20] coefficients.

Tables 4.4, 4.5, and 4.6 present the OLS regression results from equation 4.1. The Breusch-Pagan test implies heteroscedastic residuals indicating an autoregressive conditional heteroscedasticity (ARCH) process in the residuals for every specification of the model.[21] Thus, the least-squares estimators for these models are not efficient and the application of an ARCH

[20] Best linear unbiased estimator
[21] Only excluding Model 2 from Table 4.5.

model calculated via maximum-likelihood is appropriate (Escobari and Lee, 2013). Significant Portmanteau *Q*-statistics suggest that residuals are all white noise.

4.3.2. GARCH-M model: Asymmetric impact of changes in sentiment on REIT returns and volatility

To model the impact of changes in sentiment on REIT returns and volatility, I employ a Generalized Autoregressive Conditional Heteroscedasticity in mean (GRACH-M) model of the following form:

$$(REIT - Rf)_t = \beta_0 + \beta_1 D_t|\Delta Sent_t| + \beta_2 (1 - D_t) |\Delta Sent_t| + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \qquad (4.3)$$

$$h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 D_t |\Delta Sent_t| + \varphi_6 (1 - D_t) |\Delta Sent_t| + \omega_t \qquad (4.4)$$

Where, in the mean equation 4.3, $(REIT\text{-}Rf)_t$ are the FTSE NAREIT U.S. Real Estate Index excess returns and $\Delta Sent_t$ is the change in sentiment for the measures of institutional and individual sentiment alternatively. D_t is a dummy variable that takes the value of 1 if the change in sentiment is positive and 0 if the change in sentiment is negative at time *t*. The interaction between D_t and the absolute value of the change in investor sentiment at time *t* ($|\Delta Sent_t|$) provides the opportunity to measure whether positive changes in sentiment impact REIT industry returns differently than negative changes in sentiment. To determine an asymmetric impact of changes in sentiment on returns, I perform an F-test on the null hypothesis: $\beta_1 = \beta_2$. A statistically significant difference between coefficients β_1 and β_2 will suggest asymmetry in the impact of positive and negative changes of sentiment on REIT excess returns.

h_t is the conditional volatility of REIT excess returns which is included in the model to test whether concurrent volatility is impacting REIT returns. X_t are a set of control variables that are observed to explain REIT returns similar to those employed in equation 4.1. ε_t is the stochastic error term that is distributed $\varepsilon_t \sim N(0, h_t)$.

In the conditional variance equation 4.4, ε_{t-1}^2 are *t-1* shocks in equation 4.3 and I_{t-1} is a dummy variable that take the value of 1 if $\varepsilon_{t-1} \geq 0$ and 0 if the shocks are negative. h_{t-1} are *t-1* realizations of the conditional variance to account for autocorrelation in volatility and ω_t is the error term.

Through the dummy variable I_{t-1}, I expect to capture that conditional volatility is impacted differently by negative and positive shocks (Nelson, 1991; Glosten et al., 1993). If $\varepsilon_{t-1} \geq 0$ the magnitude of the impact will be captured by φ_3. Glosten et al. (1993) find that the magnitude of the impact of bad news is greater than for good news on market volatility therefore φ_3 is expected to be of negative sign since positive shocks have been observed to cause a downward revision in conditional variance.

Identical to the mean equation 4.3, D_t is a dummy variable that is equal to 1 if the change in sentiment is positive and 0 if the change in sentiment is negative The interaction between the dummy variables D_t and $(1- D_t)$ and $|\Delta Sent_t|$ will reflect the impact that the magnitude of the changes in sentiment along with the direction of the changes in investor sentiment have on REIT return volatility. It is expected that investors will react differently to the magnitudes of the shifts in bullish and bearish sentiment (Lee et al., 2002); in fact, DeLong et al. (1990) predict that the direction and magnitude of changes in sentiment are relevant in asset pricing. Specifically, if $\Delta Sent_t > 0$ the impact on volatility will be captured by the coefficient φ_5, and if $\Delta Sent_t < 0$ the impact on volatility will be captured by φ_6. Individual and institutional investor sentiments are included in the model independently and simultaneously for a thorough analysis. The asymmetric impact of changes in sentiment on the formation of conditional variance is tested through an F-test of the null hypothesis $H_0: \varphi_5 = \varphi_6$.

4.4. Empirical Results

4.4.1. REIT returns and volatility and changes in institutional investor sentiment (ΔII)

Table 4.7 presents the empirical results for the GARCH-M model in equations 4.3 and 4.4. Model 1 includes the results for the equation that only includes positive and negative changes in institutional investor sentiment (ΔII) in the mean and conditional variance equations. There are no relevant differences between results for REIT price returns and total returns. Results show that both positive and negative changes in institutional investor sentiment have a significant impact on REIT returns and that there is a significant difference between the coefficients for positive and negative changes in institutional investor sentiment (χ^2 = 17.29 significant at the 1% level for REIT price returns and χ^2 =16.47 significant at the 1% level for REIT total returns). The signs of the coefficients are as expected, positive changes in institutional investor sentiment are associated positively with REIT industry returns whereas negative changes in investor sentiment have a negative impact on REIT returns. In support of the DeBondt and Thaler (1985) overreaction conjecture, the magnitude of the negative changes in institutional investor sentiment coefficient is larger in magnitude than that for the coefficient for positive changes.

The insignificant h_t coefficient indicates that contemporaneous conditional variance is not a significant factor in explaining the variation in REIT industry returns. Lee et al. (2002) mention that by including h_t in the mean equation of a GARCH model accounts for volatility feedback on returns, however, for this particular industry I observe that conditional variance does not help explain REIT returns.

Control variables *Rm-Rf*, *SMB* and *HML* are all positive and statistically significant at the 1% level, indicating that REIT returns are highly associated with the Fama-French equity factors. REITs tend to respond to the same factors that explain the variation in returns of other stocks in the market. On the other hand, the *Def* and *Prem* bond factors appear statistically insignificant in the results; previous research argues that because of the unique dividend policy in the REIT industry, these resemble to some extent the behavior of fixed-income securities (Lee and Stevenson, 2005). However, my results do not support this conjecture.

The conditional variance equations in Model 1 (Table 4.7) shows that all estimated GARCH coefficients are significant. Innovations have an asymmetric effect on conditional volatility. Negative shocks cause higher upward revisions in volatility than do positive shocks as found in previous research (Lee et al, 1992). Also, volatility at $t-1$ significantly impacts concurrent conditional volatility indicating serial correlation in h. Explicitly, volatility is persistent. Both positive and negative shifts in sentiment appear to positively contribute to volatility, however, the difference between the magnitudes of the coefficients for positive and negative changes in institutional investor sentiment are not statistically significant. Yet, it is essential to point out that negative shifts in institutional investor sentiment impact conditional variance significantly whereas positive changes in sentiment have an insignificant effect. These results are again consistent with the overreaction hypothesis which posits that negative sentiment contributes to volatility more than positive sentiment. All residual follow a white noise process as suggested by significant Portmanteau Q-statistics reported in the last line of Table 4.7.

4.4.2. REIT returns and volatility and changes in individual investor sentiment (Δ*AAII*)

Model 2 in Table 4.7 shows the results for equations 4.3 and 4.4 that includes changes in individual investor sentiment (Δ*AAII*). In the first column of Model 2, I have excess REIT price returns as the dependent variable. Under this specification, positive changes in individual investor sentiment are observed to impact returns positively and significantly (10% significance level), whereas, negative shifts in individual investor sentiment impact returns negatively, although their effect is insignificant. These results are consistent with a bandwagon effect even though the impact on returns is weak. There is a significant difference between the coefficient for positive and negative Δ*AAII* (χ^2 =6.62, significant at the %5 level), indicative that returns are impacted asymmetrically by bullish and bearish changes in sentiment. As observed in Model 1 (Table 4.7), control variables *Rm-Rf*, *SMB*, and *HML* are all positive and statistically significant, yet, coefficients for bond factors *Def* and *Prem* are not statistically different from zero.

The conditional variance equation in Model 2 (Table 4.7) for REIT price returns show that GARCH terms are significant and consistent with results from Model 1. Negative changes in individual investor sentiment appear to contribute positively to volatility, yet, positive Δ*AAII* do not have a significant effect on conditional variance. These findings are consistent with the overreaction hypothesis in which negative shifts in sentiment are associated with greater increased volatility than for positive changes in sentiment.

When I examine the results for REIT total returns, I can observe slight differences compared to REIT price returns. For instance, in the mean equation, although there is a significant difference between the coefficient for positive and negative Δ*AAII* (χ^2 =5.00, significant at the 5% level), neither coefficient is significant. These results imply that changes in sentiment from individual (small) investors are not relevant to REIT returns. Nevertheless, both positive and negative $\Delta AAII$ positively contribute to REIT total return volatility significantly. This signals that although small investors do not have a significant impact on returns, their trading introduces increased risk this market. More than likely, risk derived from irrational trading contributes to REIT return over-performance with respect to the overall stock market. The coefficient for negative $\Delta AAII$ is larger in magnitude than for positive $\Delta AAII$ giving support to the overreaction conjecture in the conditional variance equation of Model 2 (Table 4.7).

4.4.3. Comprehensive GARCH-M model: Modeling REIT returns and volatility jointly including ΔII and $\Delta AAII$

Model 3 in Table 4.7 presents the results for the compressive model that includes ΔII and $\Delta AAII$ simultaneously. This model is useful to test whether results are robust when sentiments from these two markedly different types of investors are jointly included in the model specification. The results for REIT price returns and for total returns are almost identical. The results for the mean variance equation in both specifications show that ΔII is significant while $\Delta AAII$ does not contribute significantly to changes in REIT returns. These findings are consistent with results from Chapter II. Significant increases in institutional ownership in REITs in recent years may explain these results; levels of institutional holdings have reached levels up to 58% and have steadily declined to 50% after 2009 (Devos et al., 2012) which indicates the importance of institutional investor sentiment to the REIT industry. Moreover, institutions generally have larger capital than individuals and often have the capacity to trade in blocks large enough to influence REIT prices.

By examining the asymmetric impact of changes in sentiments on REIT returns, I observe that the coefficients for positive ΔII are statistically different from negative ΔII (χ^2

=16.11, significant at the 1% level) denoting an asymmetric impact between positive and negative shifts in institutional investor sentiment. Moreover, the magnitude for negative ΔII is larger than for positive changes, providing further support for the overreaction hypothesis. In the case of $\Delta AAII$, no asymmetry is observed.

In the conditional variance equations, results are consistent with Models 1 and 2. Negative changes in institutional investor sentiment contribute to upward revisions in volatility significantly, whereas positive changes in sentiment are not significant in explaining volatility. In effect, a statistically significant difference among coefficients for positive and negative ΔII suggest an asymmetric impact on conditional variance (χ^2 =3.25, significant at the 10% level for REIT price returns and χ^2 =3.39, significant at the 10% level for REIT total returns). In contrast, there is no significant difference between the coefficients for positive and negative $\Delta AAII$. However, for both price and total returns, the coefficients for negative $\Delta AAII$ are larger in magnitude than for negative changes which support the overreaction hypothesis. Positive $\Delta AAII$, however, appear to only significantly positively (10% significance level) impact volatility in REIT total excess returns. Residuals follow a white noise process as suggested by significant Portmanteau *Q*-statistics reported in the bottom line of Table 4.7.

4.4.4. Analyzing pre and post liquidity crisis periods

The financial crisis of 2007-2009 led the U.S. into the worst economic downturn since the Great Depression. The financial sector stood on the verge of collapse for the first time in 80 years, banks were failing and the economy almost came to a complete halt. In response, the U.S. government quickly intervened by injecting liquidity into banks and other financial institutions to reactivate lending and revitalize the economy. However, recovery was slow and lending practices dramatically changed, considerably constraining business activities in the U.S.

The REIT industry was significantly impacted by this credit crunch. Banks and other financial institutions were not able to fulfill an important portion of REIT credit commitments which are vital for REIT operations, in fact, they account for a significant 74% of total REIT liquidity (Ooi et al., 2012). This deteriorated flow of cash to the REIT industry led to a REIT liquidity crisis from 2008Q2 to 2009Q4. In effect, this liquidity crisis had negative consequences on the REIT industry: prices quickly dropped and trading activity dramatically increased resulting in amplified risk and adverse overall market conditions during the crisis.

I analyze the impact of changes in investor sentiment on REIT returns and volatility for the period leading to the 2008-2009 REIT liquidity crisis and the period after the start of the crisis. The idea is to empirically test whether shifts in sentiment impact returns and volatility differently before and after this abrupt change in liquidity conditions in the REIT industry. The period prior to the crisis includes observations from January 1992 to the last week of September 2009 whereas the post-crisis period begins in October 2008 and ends with our sample period, February 2013.

Results for this analysis are reported in Table 4.8. Column 1 of Table 4.8 includes a crisis dummy which takes the value of 1 during the 2008-2009 REIT liquidity crisis and a value of zero otherwise. Results are similar to those observed in Model 3 of Table 4.7 for both excess REIT price returns and excess total returns. Results indicate that only changes in institutional investor sentiment significantly impact REIT returns: positive ΔII impact REIT excess returns positively and significantly whereas negative ΔII impact REIT excess returns negatively and significantly. This effect of ΔII is asymmetric as indicated by a significant difference in coefficients for positive and negative ΔII (χ^2 =17.08, significant at the 1% level for REIT price excess returns and χ^2 =16.23, significant at the 1% level for REIT excess total returns). Neither positive nor negative $\Delta AAII$ appear to influence REIT excess returns significantly. In this model, the Crisis Dummy appears negatively impacting returns; however, the coefficient is not statistically significant.

In the conditional variance equation, the coefficient for the Crisis Dummy is positive (2.818) and statistically significant at the 1% level, suggesting that the REIT liquidity crisis significantly contributed to increased volatility. Results additionally indicate negative ΔII significantly contribute to positive revisions in volatility whereas positive ΔII is not a significant factor in explaining REIT excess return volatility. This is, again, consistent with the overreaction to negative news conjecture. In the case of $\Delta AAII$, result show that both positive and negative changes in individual investor sentiment significantly contribute to volatility. Although there is not a statistically significant difference between the two coefficients, the negative $\Delta AAII$ coefficient (0.055, 1% significance level, for excess NAREIT price returns and 0.056, 1% significance level, for total returns) is larger in magnitude than the positive $\Delta AAII$ coefficient (0.033, 10% significance level, for excess NAREIT price returns and 0.040, 1% significance level, for total returns), suggesting further support to the overreaction hypothesis.

The second column of Table 4.8 presents the results for the pre-liquidity crisis period. Results indicate that prior to the 2008-2009 REIT liquidity crisis, only negative changes in institutional investor sentiment had a significant effect on REIT excess price and total returns. These results are consistent with the DeBondt and Thaler (1985) overreaction hypothesis and with the hypothesis of institutional investor sentiment dominance on REIT returns. There is a significant asymmetry between positive and negative ΔII (χ^2 =14.54, significant at the 1% level for REIT price excess returns and χ^2 =13.86, significant at the 1% level for REIT total excess returns) during the pre-crisis period. Both positive and negative $\Delta AAII$ appear statistically insignificant in the pre-crisis results and there is no asymmetric effect between the two on returns. For conditional variance, results are consistent with Model 3 of Table 4.7. Negative ΔII are positive and significant whereas positive ΔII are statistically insignificant for both price and total REIT excess returns. For $\Delta AAII$ though there is not a statistically significant difference between the two coefficients, the negative $\Delta AAII$ coefficient (0.053, 1% significance level, for excess NAREIT price returns and 0.055, 1% significance level, for total returns) is larger in magnitude than the positive $\Delta AAII$ coefficient (0.048, 1% significance level, for excess NAREIT price returns and 0.054, 1% significance level, for total returns), backing the overreaction hypothesis. In general, results from the pre-crisis period closely resemble results for the comprehensive model during the entire sample period (Model 3 of Table 4.7).

Results for the post-liquidity crisis period are presented in the third column of Table 4.8. Interestingly, post-crisis results appear different than that for the pre-crisis period and for the whole sample period. In this post-liquidity crisis analysis, results suggest that institutional investor sentiment does not influence REIT excess returns. Further, conversely to pre-crisis results, positive changes in individual investor sentiment positively and significantly impact REIT excess returns whereas negative $\Delta AAII$ are insignificant. Post-crisis results suggest a bandwagon effect for individual investor sentiment; however, the effect from institutional investor sentiment on REIT excess returns is no longer existent. A plausible explanation may be that sentiment among investors became so erratic than there was not a clear bullish or bearish trend among institutional investors resulting in an inappreciable effect of ΔII on REIT excess returns.

The conditional variance equations also display different results compared to pre-liquidity crisis and complete sample period. For the post-crisis period, positive Δ*II* have a positive and significant impact on volatility, whereas negative Δ*II* are insignificant. In this case, positive and negative Δ*II* asymmetrically impact returns (χ^2 =9.47, significant at the 5% level for REIT price excess returns and χ^2 =10.39, significant at the 5% level for REIT total excess returns), meaning that the effect of positive Δ*II* is statistically larger than negative Δ*II* contrary to pre-crisis results. Apparently, bullish shifts in institutional investor sentiment are associated with upward revisions in volatility in the post-crisis period; possibly due to portfolio rebalancing once institutional investors became optimistic. For Δ*AAII*, coefficients remain of larger magnitude for negative Δ*AAII* (0.063, 10% significance level, for excess NAREIT price returns and 0.064, 10% significance level, for total returns) than for positive Δ*AAII* (0.059, 1% significance level, for excess NAREIT price returns and 0.059, 1% significance level, for total returns) although the significance level for negative Δ*AAII* coefficients is weaker.

4.5. Summary and conclusions

REITs are a unique form of equity that allows investors to diversify their portfolios with professionally managed real estate assets without having to invest large amounts of funds in illiquid commercial real estate. The U.S. government strictly regulates the REIT industry by imposing restrictions on their business activities, dividend policies, minimum number of stockholders, among other constraints. These limitations render REITs a distinct type of asset and a great testing ground for financial theories.

Advances in behavioral finance suggest that security prices not only reflect economic fundamentals but are also influenced by investor perception and trading patterns. Theoretical models and empirical research provides evidence that investor sentiment is a significant factor in explaining returns and volatility and that noise traders can deviate prices from fundamental values substantially. The relationship between investor sentiment and REITs has been at large understudied so far. This essay contributes to the REIT literature in the following distinct ways. First, I test whether there is an asymmetric impact between positive and negative changes in investor sentiment on REIT returns and volatility using a GARCH-M framework. I specifically test theories that are based on behavioral biases observed for different types of investors: those who overreact to new information, usually reacting more to negative than to positive innovations, those optimistic investors who "ride the bandwagon", follow others in a herding behavior and are overly optimistic, and those contrarian strategists who believe that by reacting opposite to overall market reactions can reap the benefits of arbitrage. Second, I make a distinction between two markedly different categories of investors: large institutional investors and the small individual investor. These two groups of investors are observed to form distinct expectations of the market based on the same set of information, which may impact returns and volatility differently. Third, I investigate whether the relationship between REIT returns and volatility is affected with the change in markets conditions caused by the 2008-2009 REIT liquidity crisis.

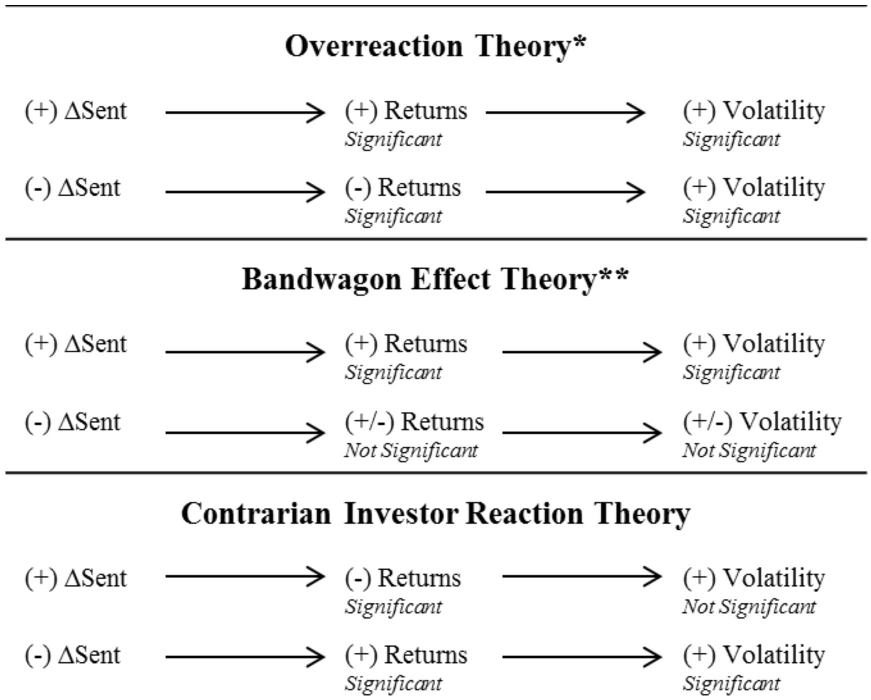
Overall, results indicate that changes in institutional investor sentiment have a larger impact on REIT returns and volatility compared to changes in individual investor sentiment. This is consistent with the significant increase in aggregate institutional ownership in REITs in recent years. According to Devos et al. (20120), the average aggregate ownership for REIT is recorded at merely 50% after 2009. Additionally, results suggest an asymmetric impact between positive and negative changes in institutional investor sentiment on both REIT excess returns and volatility whereas no significant difference is recorded between the effect positive and negative changes in individual investor sentiment on REIT returns and volatility. As institutional investor sentiment turns bearish, institutions will tend to hold less of the risky assets because of pessimistic future expectations. The negative returns are pushed by sentiment-induced sales of REIT stocks. Conversely, bullish shifts in sentiment will pressure price upward since optimistic investors will seek to purchase REITs in the expectation of improvements in future market performance. In general, results favor the DeBondt and Thaler (1985) overreaction to negative news hypothesis; coefficients for negative changes in sentiment are consistently larger in magnitude than for positive shifts in sentiment.

When analyzing the post- liquidity crisis period, results suggest a change in the relationship between investor sentiment and REIT returns and volatility. Post-crisis, institutional investor sentiment does not appear to significantly impact REIT excess returns and, conversely to pre-crisis, individual investor sentiment significantly influences returns. Interestingly, REIT returns appear significantly affected by positive changes in individual investor sentiment after the beginning of the REIT liquidity crisis, indicating a bandwagon effect for individual investors. Individual investors seem to react with optimism to positive news in the market after the start of the crisis and push prices positively. A plausible explanation for the lack of statistical significance of institutional investor sentiment in explaining REIT returns may be that sentiment among institutional investors became so erratic that bullish and bearish sentiments cancelled each other resulting in an inappreciable effect of changes in institutional investor sentiment on REIT excess returns.

Further, post-crisis volatility also displayed differences from general results. Apparently, bullish shifts in institutional investor sentiment are significantly impacting volatility post-crisis possibly due to institutional investor increased trading activity once sentiment turns bullish. The coefficient for negative changes in individual investor sentiment remains larger in magnitude than positive changes in sentiment in the post-crisis conditional variance equation.

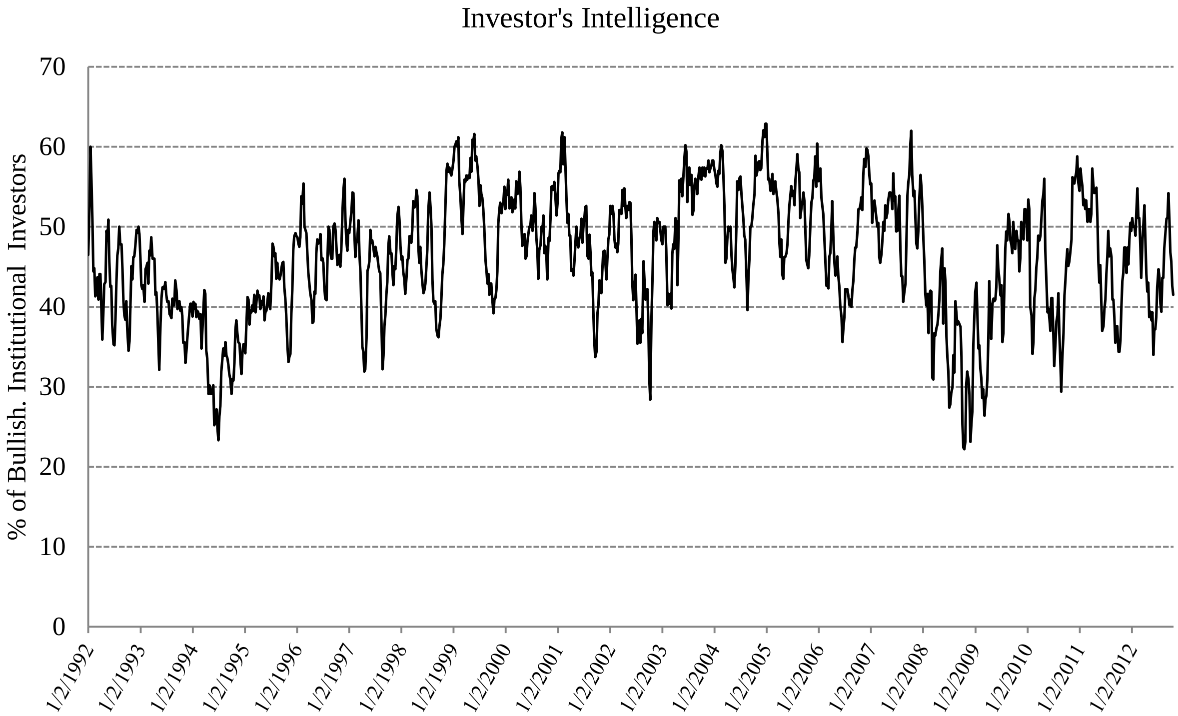
Findings from this essay provide further evidence on the importance of investor sentiment in explaining returns and volatility. Despite REIT significant regulations and relatively easier to value assets, investor sentiment plays an important role in their return generating process and should be considered when valuing these firms. Overall, results provide support to the field of behavioral finance and open an avenue for research on the REIT-sentiment relationship.

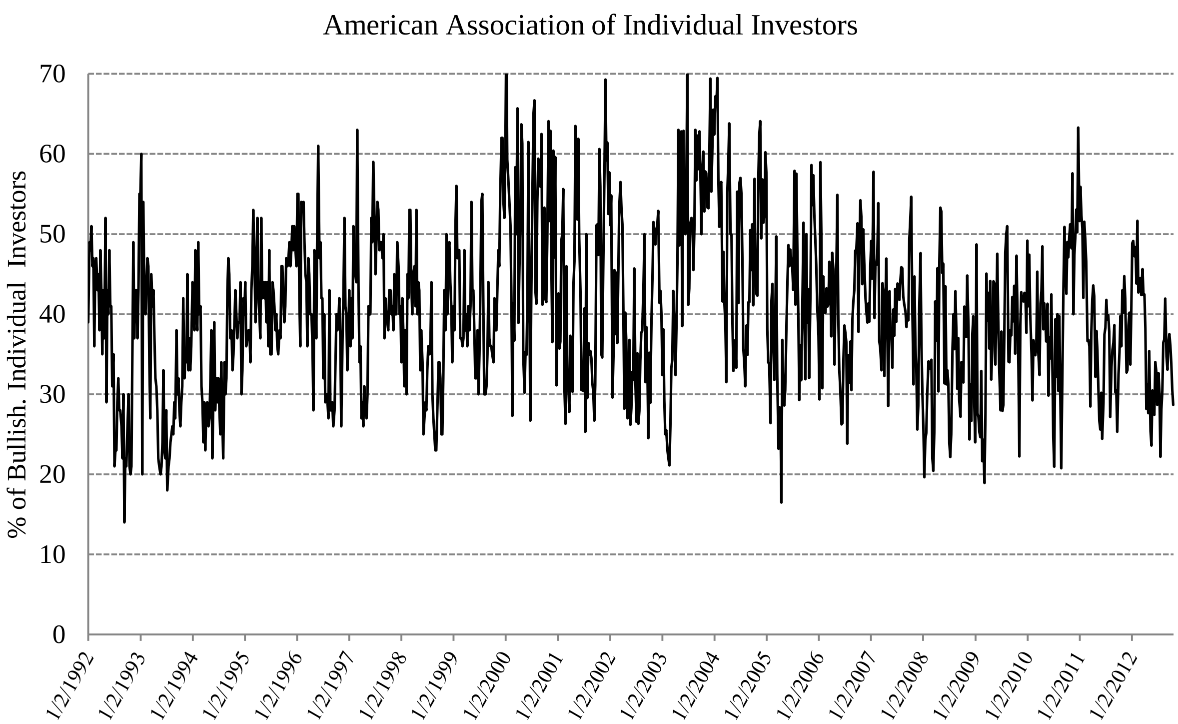
Figure 4.1. Graphical Representation of theories on the asymmetric impact of changes in sentiment on returns and volatility



Notes: *The Overreaction Theory suggests that both positive and negative changes in sentiment must have significant impacts on returns and volatility, however, the impacts from negative changes in sentiment should be greater in magnitude than from positive ones. ** The Bandwagon Effect Theory expects that overoptimistic investors will have a positive effect on returns and volatility if changes in sentiment are positive; however, non-significant effects on returns or volatility if changes are negative There can be a separation of predicted effects by the different theories on returns and volatility; for example, one can observe no effect of changes in sentiment on returns yet a significant overreaction effect observed on volatility.

Figure 4.2. Bullish individual and institutional investor sentiment (1992-2013).





Notes: This figure graphically shows the weekly percentage of bullish surveys for institutional (Investors Intelligence) and individual (American Association of Individual Investors) investors from January 1992 to January 2012.

Table 4.1. Correlation table

	Excess REIT Price Ret	*Excess REIT Total Ret*	ΔII	$\Delta AAII$	*Positive Dummy** $\|\Delta II\|$	*Negative Dummy** $\|\Delta II\|$	*Positive Dummy** $\|\Delta AAII\|$	*Negative Dummy** $\|\Delta AAII\|$	*Rm-Rf*	*SMB*	*HML*	*Def*	*Prem*
Excess REIT Price Ret	1.000												
Excess REIT Total Ret	0.999	1.000											
ΔII	0.262	0.261	1.000										
$\Delta AAII$	0.152	0.152	0.162	1.000									
*Positive Dummy** $\|\Delta II\|$	0.221	0.220	0.842	0.133	1.000								
*Negative Dummy** $\|\Delta II\|$	-0.221	-0.220	-0.840	-0.140	-0.415	1.000							
*Positive Dummy** $\|\Delta AAII\|$	0.132	0.132	0.137	0.846	0.131	-0.099	1.000						
*Negative Dummy** $\|\Delta AAII\|$	-0.126	-0.126	-0.138	-0.850	-0.095	0.138	-0.437	1.000					
Rm-Rf	0.561	0.562	0.319	0.142	0.254	-0.283	0.103	-0.138	1.000				
SMB	0.157	0.158	0.138	0.083	0.081	-0.150	0.085	-0.056	0.139	1.000			
HML	0.289	0.289	-0.012	0.009	-0.023	-0.003	0.045	0.029	-0.132	-0.223	1.000		
Def	-0.017	-0.018	0.046	0.008	0.138	0.060	0.061	0.047	-0.017	0.026	-0.037	1.000	
Prem	0.023	0.022	0.006	0.009	0.049	0.039	0.003	-0.013	0.006	0.073	-0.026	0.382	1.000

Table 4.2. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Excess NAREIT Price Returns	1108	0.118	3.136	-32.461	35.106
Excess NAREIT Total Returns	1108	0.231	3.140	-32.424	35.159
ΔII	1110	0.013	4.616	-17.500	18.100
$\Delta AAII$	1111	0.014	14.762	-58.000	51.000
$D^* \lvert\Delta II\rvert$	1110	1.777	2.753	0.000	18.100
$(1- D)^* \lvert\Delta II\rvert$	1110	1.765	2.729	0.000	17.500
$D^* \lvert\Delta AAII\rvert$	1111	5.713	8.672	0.000	51.000
$(1-D)^* \lvert\Delta AAII\rvert$	1111	5.699	8.806	0.000	58.000
Rm-Rf	1109	0.134	2.437	-18.000	12.610
SMB	1109	0.036	1.327	-9.370	6.440
HML	1109	0.081	1.399	-7.000	9.790
Prem	1011	2.326	1.342	-0.270	4.540
Def	1112	0.963	0.440	0.500	3.460

This table provides summary statistics for all variables employed in the econometric analysis in this essay. Frequency of observations is weekly. Excess NAREIT price returns are the REIT industry price returns minus the risk-free rate. Excess NAREIT total returns are the REIT industry total returns minus the risk-free rate, total returns account for dividend payments. ΔII and $\Delta AAII$ are changes in institutional and individual investor sentiment, respectively. . D_t is a dummy variable that takes the value of 1 if the change in sentiment is positive and 0 if the change in sentiment is negative at time *t*. The interaction between D_t and the absolute value of the change in investor sentiment at time *t* ($\lvert\Delta Sent_t\rvert$) measure whether positive changes in sentiment impact REIT industry returns differently than negative changes in sentiment. *Rm-Rf*, *SMB* and *HML* are the Fama-French equity factors and *Def* and *Prem* are the Fama-French bond factors.

Table 4.3. Frequency table: Changes in institutional and individual investor sentiment

	Frequency	**Percent**
Positive ΔII	573	51.71%
Negative ΔII	537	48.29%
Total $\Delta \boldsymbol{II}$	**1,110**	**100%**
Positive $\Delta AAII$	566	50.99%
Negative $\Delta AAII$	545	49.01%
Total $\Delta \boldsymbol{AAII}$	**1,111**	**100%**

This table reports weekly frequencies for positive and negative changes in institutional investor sentiment (ΔII) and positive and negative changes in individual investor sentiment ($\Delta AAII$) for the sample period from January 1992 to January 2013.

Table 4.4. Regression results. Changes in institutional investor sentiment on FTSE NAREIT price and total excess returns.

	Model 1		Model 2		Model 3		Model 4	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
Intercept	0.092	0.204	-0.189	-0.077	0.160	0.280	-0.230	-0.111
	(0.65)	(1.44)	(-1.75)	(-0.72)	(0.60)	(1.05)	(-1.15)	(-0.56)
$D_t * \lvert\Delta II\rvert_t$	0.183***	0.183***	0.076***	0.076***	0.193***	0.193***	0.085***	0.084***
	(5.03)	(5.01)	(2.73)	(2.71)	(4.75)	(4.75)	(2.74)	(2.73)
$(1- D_t) * \lvert\Delta II\rvert_t$	-0.170***	-0.170***	-0.006	-0.006	-0.183***	-0.182***	-0.006	-0.004
	(-4.62)	(-4.61)	(-0.22)	(-0.19)	(-4.52)	(-4.50)	(-0.18)	(-0.13)
$Rm\text{-}Rf_t$			0.733***	0.736***			0.738***	0.741***
			(24.36)	(24.47)			(23.43)	(23.52)
SMB_t			0.386***	0.389***			0.381***	0.385***
			(7.14)	(7.21)			(6.68)	(6.75)
HML_t			0.875***	0.877***			0.921***	0.924***
			(17.19)	(17.23)			(16.98)	(17.03)
Def_t					-0.315	-0.323	-0.095	-0.102
					(-1.32)	(-1.36)	(-0.53)	(-0.57)
$Prem_t$					0.092	0.091	0.048	0.046
					(1.15)	(1.14)	(0.80)	(0.77)
N	1108	1108	1108	1108	1009	1009	1009	1009
R^2	0.067	0.067	0.468	0.470	0.071	0.071	0.478	0.480
Adj. R^2	0.066	0.066	0.466	0.468	0.067	0.067	0.475	0.476
F-Statistic	39.95	39.82	194.20	195.57	19.13	19.13	131.16	132.02
Portmanteau Q-stat	191.04***	195.18***	160.96***	164.47***	180.68***	184.64***	157.75***	161.54***
Breusch-Pagan (LM)	12.07***	11.97***	14.44**	14.25**	134.21***	134.41***	195.95***	197.14***
B-P p-value	0.002	0.003	0.013	0.014	0.000	0.000	0.000	0.000

This table presents the results for the linear model in equation 4.1 which only includes changes in institutional investor sentiment (ΔII):

$$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, \boldsymbol{D_t} |\Delta \boldsymbol{Sent_t}| + \boldsymbol{\beta_2}\, (\boldsymbol{1 - D_t})\, |\Delta \boldsymbol{Sent_t}| + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t}$$

The Portmanteau *Q*-statistic tests for white noise in the residuals. The Breusch- Pagan test is to test for heteroscedasticity in a linear regression model. The null hypothesis in the Breusch-Pagan test is that coefficients from equation 4.2 are conjunctively equal to zero ($H_0: \beta_1 = \beta_2 = \sum_{i=1}^{N} \gamma_i = 0$). I compute the F-statistic for the joint significance of all variables and LM (Lagrange Multiplier) statistic based on the R^2 obtained from equation 4.2. Rejection of the null hypothesis indicates heteroscedastic errors and the inappropriateness of OLS to obtain Best Linear Unbiased Estimators. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 4.5. Regression results. Changes in individual investor sentiment on FTSE NAREIT price and total excess returns.

	Model 1		Model 2		Model 3		Model 4	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
Intercept	0.069	0.183	-0.066	0.048	0.082	0.200	-0.128	-0.010
	(0.47)	(1.24)	(-0.60)	(0.44)	(0.29)	(0.71)	(-0.62)	(-0.05)
$D_t * \|\Delta AAII\|_t$	0.035***	0.035***	0.011	0.011	0.037***	0.037***	0.009	0.009
	(2.96)	(2.94)	(1.24)	(1.20)	(2.81)	(2.82)	(0.92)	(0.93)
$(1- D_t) * \|\Delta AAII\|_t$	-0.027**	-0.027**	-0.011	-0.011	-0.030**	-0.030**	-0.014	-0.014
	(-2.29)	(-2.29)	(-1.29)	(-1.29)	(-2.35)	(-2.32)	(-1.47)	(-1.43)
$Rm\text{-}Rf_t$			0.748***	0.751***			0.753***	0.755***
			(25.85)	(25.96)			(24.87)	(24.96)
SMB_t			0.388***	0.391***			0.383***	0.386***
			(7.21)	(7.27)			(6.73)	(6.79)
HML_t			0.875***	0.877***			0.922***	0.924***
			(17.14)	(17.19)			(16.93)	(16.98)
Def_t					-0.225	-0.234	-0.020	-0.028
					(-0.93)	(-0.97)	(-0.11)	(-0.16)
$Prem_t$					0.082	0.081	0.044	0.043
					(1.00)	(0.99)	(0.74)	(0.72)
N	1108	1108	1108	1108	1009	1009	1009	1009
R^2	0.022	0.021	0.467	0.468	0.025	0.024	0.476	0.478
Adj. R^2	0.020	0.020	0.464	0.466	0.021	0.021	0.473	0.474
F-Statistic	12.11	12.01	192.82	194.19	6.31	6.26	130.06	130.92
Portmanteau Q-stat	195.82***	199.99***	161.38***	164.17***	187.72***	191.77***	158.47***	161.56***
Breusch-Pagan (LM)	5.76*	5.78*	7.73	7.64	151.72***	151.99***	198.91***	200.18***
B-P p-value	0.056	0.056	0.172	0.177	0.000	0.000	0.000	0.000

This table presents the results for the linear model in equation 4.1 which only includes changes in individual investor sentiment ($\Delta AAII$):

$$(\boldsymbol{REIT} - \boldsymbol{Rf})_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, \boldsymbol{D_t} |\Delta \boldsymbol{Sent_t}| + \boldsymbol{\beta_2}\, (\mathbf{1} - \boldsymbol{D_t})\, |\Delta \boldsymbol{Sent_t}| + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t}$$

The Portmanteau *Q*-statistic tests for white noise in the residuals. The Breusch- Pagan test is to test for heteroscedasticity in a linear regression model. The null hypothesis in the Breusch-Pagan test is that coefficients from equation 4.2 are conjunctively equal to zero ($H_0\colon \beta_1 = \beta_2 = \sum_{i=1}^{N} \gamma_i = 0$). I compute the F-statistic for the joint significance of all variables and LM (Lagrange Multiplier) statistic based on the R^2 obtained from equation 4.2. Rejection of the null hypothesis indicates heteroscedastic errors and the inappropriateness of OLS to obtain Best Linear Unbiased Estimators. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 4.6. Regression results. ΔII and $\Delta AAII$ on REIT returns

	Model 1		Model 2		Model 3		Model 4	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
Intercept	0.045	0.159	-0.180	-0.066	0.126	0.244	-0.197	-0.080
	(0.25)	(0.90)	(-1.34)	(-0.49)	(0.44)	(0.86)	(-0.92)	(-0.37)
D_t* $\lvert\Delta II\rvert_t$	0.172***	0.172***	0.073***	0.073***	0.181***	0.181***	0.081***	0.081***
	(4.75)	(4.74)	(2.62)	(2.60)	(4.45)	(4.45)	(2.62)	(2.61)
$(1-D_t)$* $\lvert\Delta II\rvert_t$	-0.158***	-0.158***	-0.002	-0.002	-0.170***	-0.169***	-0.001	0.000
	(-4.31)	(-4.31)	(-0.08)	(-0.06)	(-4.19)	(-4.17)	(-0.03)	(0.01)
D_t* $\lvert\Delta AAII\rvert_t$	0.028**	0.027**	0.009	0.009	0.028**	0.029**	0.007	0.007
	(2.37)	(2.35)	(1.02	(-1.24)	(2.23)	(2.24)	(0.71)	(0.72)
$(1-D_t)$* $\lvert\Delta AAII\rvert_t$	-0.020*	-0.020*	-0.011	-0.011	-0.021*	-0.021*	-0.013	-0.013
	(-1.72)	(-1.72)	(-1.24)	(-1.24)	(-1.68)	(-1.65)	(-1.38)	(-1.35)
$Rm\text{-}Rf_t$			0.728***	0.731***			0.732***	0.735***
			(24.11)	(24.21)			(23.14)	(23.24)
SMB_t			0.379***	0.382***			0.376***	0.380***
			(7.00)	(7.06)			(6.57)	(6.64)
HML_t			0.871***	0.873***			0.919***	0.921***
			(17.07)	(17.12)			(16.89)	(16.93)
Def_t					-0.321	-0.330	-0.088	-0.097
					(-1.35)	(-1.39)	(-0.49)	(-0.54)
$Prem_t$					0.091	0.090	0.046	0.045
					(1.14)	(1.13)	(0.77)	(0.75)
N	1108	1108	1108	1108	1009	1009	1009	1009
R^2	0.080	0.079	0.471	0.472	0.083	0.083	0.481	0.482
Adj. R^2	0.076	0.076	0.467	0.469	0.078	0.077	0.476	0.477
F-Statistic	23.84	23.73	139.65	140.59	15.16	15.07	102.67	103.30
Portmanteau Q-stat	196.51***	200.99***	156.37***	159.73***	186.65***	190.76***	153.06***	156.62***
Breusch-Pagan (LM)	15.97***	15.89***	17.87**	17.70**	136.59***	136.83***	197.97***	199.17***
B-P p-value	0.003	0.003	0.013	0.013	0.000	0.000	0.000	0.000

This table presents the results for the linear model in equation 4.1 which includes changes in institutional (ΔII) and individual ($\Delta AAII$) investor sentiment simultaneously:

$$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, \boldsymbol{D_t}|\Delta \boldsymbol{Sent_t}| + \boldsymbol{\beta_2}\,(\boldsymbol{1 - D_t})\,|\Delta \boldsymbol{Sent_t}| + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t}$$

The Portmanteau *Q*-statistic tests for white noise in the residuals. The Breusch- Pagan test is to test for heteroscedasticity in a linear regression model. The null hypothesis in the Breusch-Pagan test is that coefficients from equation 4.2 are conjunctively equal to zero ($H_0: \beta_1 = \beta_2 = \sum_{i=1}^{N} \gamma_i = 0$). I compute the F-statistic for the joint significance of all variables and LM (Lagrange Multiplier) statistic based on the R^2 obtained from equation 4.2. Rejection of the null hypothesis indicates heteroscedastic errors and the inappropriateness of OLS to obtain Best Linear Unbiased Estimators. T-statistic in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 4.7. GARCH-M results. ΔII and $\Delta AAII$ on REIT returns and volatility

	Model 1		Model 2		Model 3	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
α_0	-0.172	-0.000	-0.373**	-0.190	-0.229	-0.052
h_t	0.004	0.004	0.011	0.013	0.009	0.009
$D_t \|\Delta II_t\|$	0.055**	0.055**			0.053**	0.053**
$(1-D_t)\|\Delta II_t\|$	-0.060**	-0.057**			-0.061**	-0.059**
$D_t \|\Delta AAII_t\|$			0.012*	0.009	0.008	0.006
$(1-D_t)\|\Delta AAII_t\|$			-0.009	-0.009	-0.002	-0.003
$Rm\text{-}Rf_t$	0.538***	0.542***	0.574***	0.583***	0.533***	0.539***
SMB_t	0.318***	0.330***	0.311***	0.324***	0.304***	0.317***
HML_t	0.539***	0.539***	0.552***	0.566***	0.522***	0.527***
Def_t	0.195	0.122	0.299	0.227	0.180	0.111
$Prem_t$	-0.006	-0.005	0.015	0.018	0.008	0.009
φ_1	-2.505***	-2.569***	-1.905***	-2.298***	-2.583***	-2.674***
ε^2_{t-1}	0.175***	0.177***	0.229***	0.228***	0.192***	0.194***
$\varepsilon^2_{t-1}I_{t-1}$	-0.102***	-0.101***	-0.142***	-0.143***	-0.122***	-0.122***
h_{t-1}	0.819***	0.819***	0.796***	0.797***	0.795***	0.794***
$D_t \|\Delta II_t\|$	0.039	0.051			0.087	0.099
$(1-D_t)\|\Delta II_t\|$	0.312***	0.318***			0.282***	0.286***
$D_t \|\Delta AAII_t\|$			-0.081	0.046***	0.027	0.034*
$(1-D_t)\|\Delta AAII_t\|$			0.066***	0.068***	0.038**	0.040**
Log-likelihood	-2072.49	-2070.31	-2086.85	-2085.03	-2070.33	-2068.15
Wald χ^2	688.87***	701.53***	622.95***	629.48***	621.10***	630.24***
N	1009	1009	1009	1009	1009	1009
χ^2 Diff. +/- ΔII (Mean eq.)	17.29***	16.47***			16.11***	15.36***
χ^2 Diff. +/- ΔAAII (Mean eq.)			6.62**	5.00**	1.61	1.23
χ^2 Diff. +/- ΔII (Cond. Var.)	1.80	1.88			3.25*	3.39*
χ^2 Diff. +/- ΔAAII (Cond. Var.)			0.79	1.12	0.15	0.06
Portmanteau Q-stat	165.40***	171.24***	158.54***	162.38***	162.36***	167.78***

This table reports the results for the GARCH-M model which includes changes in individual ($\Delta AAII$) and institutional investor sentiment (ΔII) simultaneously described by eqs. 4.3 and 4.4:

$$(\boldsymbol{REIT - Rf})_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1} \boldsymbol{D_t}|\Delta \boldsymbol{Sent_t}| + \boldsymbol{\beta_2} (\boldsymbol{1 - D_t}) |\Delta \boldsymbol{Sent_t}| + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t} \quad (4.3)$$

$$\boldsymbol{h_t} = \boldsymbol{\varphi_1} + \boldsymbol{\varphi_2 \varepsilon_{t-1}^2} + \boldsymbol{\varphi_3 \varepsilon_{t-1}^2 I_{t-1}} + \boldsymbol{\varphi_4 h_{t-1}} + \boldsymbol{\varphi_5 D_t} |\Delta \boldsymbol{Sent_t}| + \boldsymbol{\varphi_6}(\boldsymbol{1 - D_t}) |\Delta \boldsymbol{Sent_t}| + \boldsymbol{\omega_t} \quad (4.4)$$

Each model has two columns that show results for excess NAREIT price returns and excess NAREIT total returns, respectively. The Portmanteau *Q*-statistic tests for white noise in the residuals. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Table 4.8. GARCH-M results. The liquidity crisis, changes in sentiment and REIT returns and volatility.

	Crisis Dummy		Pre-Crisis Period		Post-Crisis Period	
	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns	Excess NAREIT Price Returns	Excess NAREIT Total Returns
α_0	-0.265	-0.082	-0.168	-0.001	1.032	1.034
h_t	0.016	0.015	-0.012	-0.016	0.002	0.001
$D_t\ \lvert\Delta II_t\rvert$	0.051**	0.052**	0.042	0.043	0.139	0.140
$(1-D_t)\ \lvert\Delta II_t\rvert$	-0.067**	-0.064**	-0.077**	-0.072**	0.006	0.000
$D_t\ \lvert\Delta AAII_t\rvert$	0.010	0.008	0.007	0.004	0.065**	0.063*
$(1-D_t)\ \lvert\Delta AAII_t\rvert$	-0.002	-0.003	0.002	0.002	-0.002	0.001
Crisis Dummy	-2.275	-2.102				
$Rm\text{-}Rf_t$	0.523***	0.528***	0.483***	0.491***	0.867***	0.852***
SMB_t	0.298***	0.311***	0.272***	0.287***	0.094	0.106
HML_t	0.496***	0.500***	0.467***	0.474***	0.335***	0.355***
Def_t	0.196	0.118	0.299	0.251	-1.123***	-1.089***
$Prem_t$	0.020	0.023	-0.030	-0.026	-0.017	-0.003
φ_1	-2.090***	-2.193***	-1.917***	-2.032***	0.336	0.400
ε_{t-1}^2	0.190***	0.193***	0.249***	0.257***	0.280*	0.285*
$\varepsilon_{t-1}^2 I_{t-1}$	-0.098**	-0.099**	-0.151***	-0.154***	0.898**	0.855**
h_{t-1}	0.742***	0.741***	0.669****	0.670***	0.079	0.066
$D_t\ \lvert\Delta II_t\rvert$	0.074	0.084	0.067	0.077	0.188***	0.183***
$(1-D_t)\ \lvert\Delta II_t\rvert$	0.181***	0.186***	0.179***	0.181***	-0.160	-0.160
$D_t\ \lvert\Delta AAII_t\rvert$	0.033*	0.040***	0.048***	0.054***	0.059***	0.059***
$(1-D_t)\ \lvert\Delta AAII_t\rvert$	0.055***	0.056***	0.053***	0.055***	0.063*	0.064*
Crisis Dummy	2.818***	2.824***				
Log-likelihood	-2056.60	-2054.45	-1504.99	-1502.99	-551.09	-551.05
Wald χ^2	596.31***	598.81***	358.19***	360.72***	1235.71***	1157.45***
N	1009	1009	783	783	226	226
χ^2 Diff. +/- ΔII (Mean eq.)	17.08***	16.23***	14.54***	13.86***	1.78	1.97
χ^2 Diff. +/- ΔAAII (Mean eq.)	2.04	1.62	0.22	0.08	5.40**	4.56**
χ^2 Diff. +/- ΔII (Cond. Var.)	2.20	1.99	2.49	2.14	9.47***	10.39***
χ^2 Diff. +/- ΔAAII (Cond. Var.)	1.14	0.73	0.08	0.00	0.03	0.04
Portmanteau Q-stat	172.24***	176.58***	172.66***	178.43***	122.27***	121.09***

This table reports the results for the GARCH-M model which includes changes in individual ($\Delta AAII$) and institutional investor sentiment (ΔII) simultaneously described by eqs. 4.3 and 4.4:

$$(\boldsymbol{REIT-Rf})_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, \boldsymbol{D_t}|\Delta \boldsymbol{Sent_t}| + \boldsymbol{\beta_2}\,(\boldsymbol{1-D_t})\,|\Delta \boldsymbol{Sent_t}| + \sum_{i=1}^{N} \boldsymbol{\gamma_i X_{it}} + \boldsymbol{\varepsilon_t} \quad (4.3)$$

$$\boldsymbol{h_t} = \boldsymbol{\varphi_1} + \boldsymbol{\varphi_2 \varepsilon^2_{t-1}} + \boldsymbol{\varphi_3 \varepsilon^2_{t-1} I_{t-1}} + \boldsymbol{\varphi_4 h_{t-1}} + \boldsymbol{\varphi_5 D_t}\,|\Delta \boldsymbol{Sent_t}| + \boldsymbol{\varphi_6}(\boldsymbol{1-D_t})\,|\Delta \boldsymbol{Sent_t}| + \boldsymbol{\omega_t} \quad (4.4)$$

The first model presents results that include an additional dummy variable *Crisis* which take the value of 1 during the REIT liquidity crisis between October 2, 2008 to July 2, 2009. The second and third models present the result for pre and post-liquidity crisis periods, respectively. Each model has two columns that show results for excess NAREIT price returns and excess NAREIT total returns, respectively. The Portmanteau *Q*-statistic tests for white noise in the residuals. *, ** and *** represent 1%, 5% and 10% significance level respectively.

CHAPTER V

SUMMARY AND CONCLUSIONS

Real Estate Investment Trusts were created by Congress in 1960 to provide small investors with the opportunity to invest in professionally managed real estate. REITs provide benefits of liquidity compared to direct real estate investments and deliver steady income with less risk than direct real estate ownership. REITs maintain a federal tax-exempt status so long as they conform to a strict set of rules[22]; this relieves investors from the double taxation issue observed for most all other industries. REIT investors enjoy the benefits of diversification by including real estate in their portfolios and are an investment that provides regular dividend payments which caters to a significant group of market participants.

The REIT industry has experienced significant legislation changes since its inception. All these changes have shaped the modern REIT which is now an attractive and feasible investment, not only to individuals, but to large institutional investors. Aggregate institutional holding in the REIT industry is recorded at levels of 50% at the end of 2009 (Devos et al., 2009) which is a significant increase from the 15.81% aggregate institutional ownership in 1992 (Below et al., 2000). REIT industry market capitalization amounts to a considerable $600 billion as of 2012 and is expected to continue to grow, underlining the importance of this sector to the U.S. economy.

[22] Rules include the distribution of 90% of their taxable income in the form of dividends, ownership guidelines, and operational restrictions; refer to Chapter I.

Despite important advances in the field of behavioral finance, the relationship between investor sentiment and REITs has been notably understudied. This dissertation contributes to the literature in the following distinct ways. In Chapter II, I explore the contemporaneous and intertemporal impact of changes in investor sentiment on REIT returns. Specifically, I make a clear distinction between two markedly different types of investors: large institutional investors with very sophisticated and efficient teams of analysts that carefully scrutinize their investments and have substantial amounts of capital, and smaller individual investors that neither have the same capacity of analysis nor the magnitude of capital and who do not have the capacity to significantly influence the industry individually. Findings in Chapter II suggest a significant relationship between investor sentiment and REIT returns. Results show that both changes in institutional and individual investor sentiment positively impact contemporaneous REIT industry returns significantly. Closer examination of the regression coefficients indicates that changes in institutional investor sentiment have a larger impact on REIT returns than changes in individual investor sentiment. Regression results also support previous research that find that the Fama-French market and bond factors are useful in explaining the variation in REIT returns (e.g. Buttimer et al., 2005; Lee et al., 2008; Lin et al., 2009; Ro and Ziobrowski, 2011). No significant intertemporal relationship between investor sentiment and returns is observed.

In Chapter III, I explore the impact of the 2008-2009 REIT liquidity crisis on REIT industry returns and volatility and the role of investor sentiment during this period of market turmoil. The financial crisis of 2007-2009 was the worst economic downturn in the U.S. economy since the Great Depression. Banks and other financial institutions were severely impacted as a result of the crisis. The REIT industry certainly did not stand immune from this economic debacle. In order to grow and make new investments, REITs rely on either capital raised through the issuance of new shares or debt, or on credit commitments from banks and other financial institutions since they obligated to distribute most of their income in the form of dividends to shareholders. The bank borrowing option is preferable since it is less expensive and does not obligate a REIT to tap into the capital market at unfavorable times. Credit commitments function as cash reserves for REITs which accounts for close to 64% of total liquidity in this industry in comparison to 45% registered by general firms (Ooi et al., 2012). The financial crisis constrained banks and other financial institutions so severely that eroded their capacity to fulfill their credit commitments with REITs. This deteriorated the flow of cash to this industry and resulted in a severe REIT liquidity crisis from 2008Q4 to 2009Q2 (Case et al., 2012).

Results from Chapter III indicate that the liquidity crisis had a significantly negatively impact on REIT industry returns as well as a significant increase in volatility. Liquidity constraints severely affected REIT industry performance outlook during the crisis which pushed investors to adjust their portfolios accordingly, affecting returns negatively and pushing volatility upward. Results additionally show that investor sentiment is a significant factor in explaining REIT returns and volatility during the 2008-2009 liquidity crisis. Institutional investor sentiment coefficients were consistently larger than coefficients for individual investor sentiment in the mean and conditional equations of the GARCH-M models. These findings suggest that although sentiment from these two markedly different group of investors are relevant in explaining REIT returns and volatility, sentiment for institutional investors dominates this effect during the crisis.

In Chapter IV, I investigate the asymmetric effect of changes in investor sentiment on REIT industry returns and volatility. Empirical evidence in the financial literature suggests that sentiment impacts both returns and volatility and that this impact is asymmetric depending on the nature of the shock in sentiment (e.g. Glosten et al., 1993; Lee et al., 2002). DeLong, et al.

(1990) and Lee et al. (2002) propose that the direction and magnitude of changes in sentiment are relevant in asset pricing, more specifically, negative corrections in sentiment affect security returns and volatility differently than positive shifts in sentiment. Results in Chapter IV indicate an asymmetric impact between positive and negative changes in institutional investor sentiment on both REIT excess returns and volatility; however, no asymmetric impact is observed between positive and negative changes in individual investor sentiment. Results additionally show that changes in institutional investor sentiment have a greater impact on REIT returns and volatility than changes in individual investor sentiment. Findings in Chapter IV also suggest that after the 2008-2009 REIT liquidity crisis the relationship between sentiment and REIT industry returns and volatility changed. Post-crisis, institutional investor sentiment does not appear to impact REIT returns significantly, whereas, positive changes in individual investor sentiment were positively related to returns. Individual investors seem to react with optimism to positive news in the market after the start of the crisis and push prices positively. Volatility in the post-crisis period appears to be positively affected by bullish changes in institutional investor sentiment but not significantly affected by negative shifts in sentiment. Both negative and positive shifts in individual investor sentiment show to impact REIT industry volatility significantly.

Overall, results in this dissertation provide strong evidence of the impact of investor sentiment on the price formation of REITs. Despite strict REIT regulations and relative transparency with respect to other firms, investor sentiment plays an important role in their return generating process and should be a consideration when valuing these firms. Findings consistently show that although sentiments from both individual and institutional investors influence REIT returns and volatility, there is noticeably larger impact from institutional investors. This should not be surprising given the important increase in aggregate institutional ownership in the REIT industry in the new REIT era.

The findings presented in this dissertation have implications for portfolio management and capital allocation strategies. Investors can use changes in investor sentiment as signals for portfolio rebalancing and capital allocations. Investor sentiment measures are readily found as public information which is accessible to all investors providing data that may be used to structure investment strategies. In addition, these findings provide more evidence on the influence of investor sentiment on security pricing even for highly regulated sectors such as the REIT industry. This dissertation provides support to the field of behavioral finance and opens an avenue for research on the REIT-sentiment relationship.

REFERENCES

Baker, M. and Wurgler, J. (2006). Investor Sentiment and the Cross-Section of Stock Returns. *Journal of Finance,* 61(4), 1645-1680.

Baker, M. and Wurgler, J. (2007). Investor Sentiment in the Stock Market. *Journal of Economic Perspectives*, 21(2), 129-151.

Barberis, N., Shleifer A. and Vishny, R. (1998). A model of Investor Sentiment. *Journal of Financial Economics,* 49(3), 307-343.

Below, S. D., Stansell, S. R. and Coffin, M. (2000). The determinants of REIT institutional ownership: Tests of the CAPM. *Journal of Real Estate Finance and Economics,* 21(3), 263–278.

Black, F. (1986). Noise. *Journal of Finance,* 41, 529– 543.

Blanchard, O. and Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *The Quarterly Journal of Economics*, 117, 1329-1368.

Blau, B.M., Hill, M.D. and Wang, H. (2011). REIT Short Sales and Return Predictability. *Journal of Real Estate Finance and Economics,* 42, 481-503.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of econometrics*, 31(3), 307-327.

Brauer, G.A. and Chang, E.C. (1990). Return Seasonality in Stocks and Their Underlying Assets: Tax-Loss Selling Versus Information Explanations. *Review of Financial Studies,* 3, 255-280.

Brown, G.W. (1999). Volatility, sentiment, and Noise Traders. *Financial Analysts Journal,* 55(2), 82-90.

Brown, G.W. and Cliff, M.T. (2004). Investor Sentiment and the Near-Term Stock Market. *Journal of Empirical Finance,* 11(1), 1-27.

Brown, G.W. and Cliff, M.T. (2005). Investor Sentiment and Asset Valuation. *Journal of Business,* 78(2), 405-440.

Buttimer, R.J., Hyland, D.C. and Sanders, A.B. (2005). REITs, IPO Waves and Long-Run Performance. *Real Estate Economics,* 33(1), 51-87.

Campbell, J.Y. and Kyle, A.S. (1993). Smart Money, Noise Trading and Stock Price Behaviour. *Review of Economic Studies*, 60, 1-34.

Capozza, D.R. and Seguin, P.J. (2003). Special Issue: Real Estate Investment Trusts-Foreword from the Guest Editors. *Real Estate Economics*, 31(3), 305-311.

Case, B., Hardin, W.G. and Wu, Z. (2012). REIT Dividend Policies and Dividend Announcement Effects During the 2008-2009 Liquidity Crisis. *Real Estate Economics,* 40(3), 387-421.

Chae, M., Levy, D. and Fatheree, G. (2011). Workouts Involving UPREIT and DownREIT Properties: A Guide for REIT Executives. *Real Estate Finance Journal*, 27, 44-62.

Chan, K., Hendershott, P. and Sanders, A. (1990). Risk and Return on Real Estate: Evidence from Equity REITs. *Real Estate Economics*, 18(4), 431-452.

Chan, S., Erickson, J. and Wang, K. (2003). *Real estate investment trusts: Structure, performance, and investment opportunities*. Oxford/New York: Oxford University Press.

Chan, S.H., Leung, W.K. and Wang, K. (2004). The Impact of Institutional Investors on the Monday Seasonal. *Journal of Business*, 77(4), 967-986.

Chan, S.H., Leung, W.K. and Wang, K. (2005). Changes in REIT Structure and Stock Performance: Evidence from the Monday Stock Anomaly. *Real Estate Economics*, 33, 89-120.

Chen, N. F., Kan, R., & Miller, M. H. (1993). Are the Discounts on Closed-End Funds a Sentiment Index? *Journal of Finance*, 48(2), 795-800.

Clayton, J. and MacKinnon, G. (2001). The Time-Varying Nature of the Link between REIT, Real Estate and Financial Asset Returns. *Journal of Real Estate Portfolio Management*, 7(1), 43-54.

Crain, J., Cudd, M. and Brown, C. L. (2000). The impact of the Revenue Reconciliation Act of 1993 on the pricing structure of equity REITs. *Journal of Real Estate Research*, 19(3), 275-285.

DeBondt, W. and Thaler, R. (1985). Does the Stock Market Overreact? *Journal of Finance,* 40(3), 793-805.

DeLong, J., Shleifer, A., Summers, L. and Waldmann, R. (1990). Noise Trader Risk in Financial Markets. *Journal of Political Economy*, 98(4), 703-738.

Devos, E., Ong, S.E. and Spieler, A.C. (2012). REIT Institutional Ownership Dynamics and the Financial Crisis. *Journal of Real Estate Finance and Economics,* 1-23.

Downs, D. (1998). The value in targeting institutional investors: Evidence from the five-or-fewer rule change. *Real Estate Economics,* 26(4), 613–649.

Edgerton, J. (2012). Four facts about dividend payouts and the 2003 tax cut. *International Tax and Public Finance*, 1-16.

Elton, E.J., Gruber, M.J. and Busse, J.A. (1998). Do investors care about sentiment? *Journal of Business,* 71, 477–500.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica*, 50(4), 987-1007.

Escobari, D. and Lee, J. (Forthcoming). Demand Uncertainty and Capacity Utilization in Airlines. *Empirical Economics.*

Fama, E. (1965). The Behavior of Stock Market Prices. *Journal of Business,* 38, 34-105.

Fama, E. and French, K. (1992), The Cross-Section of Expected Stock Returns. *Journal of Finance,* 47, 427-465.

Fama, E. and French, K. (1993). Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics,* 33, 3-56.

Fisher, K. and Statman, M. (2000). Investor sentiment and stock returns. *Financial Analyst Journal,* 56(2), 16-23.

Ghosh, C., Miles, M. and Sirmans, C.F. (1996). Are REITs Stocks? *Real Estate Finance,* 13(3), 46-53.

Giliberto, S.M. (1990). Equity Real Estate Investment Trusts and Real Estate Returns. *Journal of Real Estate Research,* 5, 259-263.

Giliberto, S.M. and Mengden, A. (1996). REITs and Real Estate: Two Markets Reexamined. *Real Estate Finance,* 13(1), 56-60.

Glasscock, J.L., Lu, C. and So, R.W. (2000). Further Evidence on the Integration of REIT, Bond and Stock Returns. *Journal of Real Estate Finance and Economics,* 20(2), 177-194.

Glosten, L.R., Jagannathan, R. and Runkle, D.A. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. *Journal of Finance,* 48(5), 1779-1801.

Goddard, J. and Marcum, B. (2012). *Real Estate Investment, A Value Based Approach*. Berlin: Springer Berlin Heidelberg.

Hardin, W.G and Hill, M.D. (2011). Credit Line Availability and Utilization in REITs. *Journal of Real Estate Research,* 33(4), 507-530.

Haugen, R.A. and Jorion, P. (1996). The January Effect: Still There after All These Years. *Financial Analysts Journal,* January-February, 27-31.

Hoesli, M. and Oikarinen, E. (2012). Are REITs real estate? Evidence from International Sector Level Data. *Journal of International Money and Finance,* 31(7), 1823-1850.

Hoesli, M. and Serrano, C. (2007). Securitized Real Estate and its Link with Financial Assets and Real Estate: An International Analysis. *Journal of Real Estate Literature,* 15, 59-84.

Howe, J.S. and Jain, R. (2004). The REIT Modernization Act of 1999. *Journal of Real Estate Finance and Economics*, 28(4), 369-388.

Howton, S.D., Howton, S.W. and Friday, H S. (2000). Long Run Underperformance in REITs Following Seasoned Equity Offerings. *Journal of Real Estate Portfolio Management,* 6(4), 355-363.

Huth, W.L., Eppright, D.R. and Taube, P.M. (1994). The Indexes of Consumer Sentiment and Confidence: Leading or Misleading Guides to Future Buyer Behavior. *Journal of Business Research,* 29, 199-206.

Joel-Carbonell, A. and Rottke, N.B. (2009). Efficient markets versus behavioral anomalies: the case of REITs. *Journal of Property Investment and Finance,* 27(4), 413-424.

Kallberg, J.G., Liu, C.H. and Srinivasan, A. (2003). Dividend Pricing Models and REITs. *Real Estate Economics,* 31(3), 435-450.

Lakonishok, J. and Maberly, E. (1990). The weekend effect: Trading patterns of individual and institutional investors. *Journal of Finance,* 45(1), 231-243.

Lee, Y.W., Jiang, C.X. and Indro, D.C. (2002). Stock market volatility, excess returns, and the role of investor sentiment. *Journal of Banking & Finance,* 26, 2277-2299.

Lee, C., Shleifer, A. and Thaler, R. H. (1991). Investor sentiment and the closed-end fund puzzle. *Journal of Finance,* 46(1), 75–109.

Lee, M.L. and Lee, M.T. (2003). Institutional Involvement and REIT January Effect Over Time. *Journal of Property Investment and Finance,* 21(6), 435-449.

Lee, M.L., Lee, M.Y. and Chiang, K.C.H. (2008). Real Estate Risk Exposure of Equity Real Estate Investment Trusts. *Journal of Real Estate Finance and Economics,* 36, 165-181.

Lee, S. and Stevenson, S. (2005). The Case for REITs in the Mixed-Asset Portfolio in the Short and Long Run. *Journal of Real Estate Portfolio Management,* 11(1), 55-80.

Li, Y. and Wang, K. (1995). The Predictability of REIT Returns and Market Segmentation. *Journal of Real Estate Research,* 10(4), 471-482.

Lin, C.Y., Rahman, H. and Yung, K. (2009). Investor Sentiment and REIT Returns. *Journal of Real Estate Finance and Economics,* 39, 450-471.

Ling, D.C. and Naranjo, A. (1999). The Integration of Commercial Real Estate and Stock Markets. *Real Estate Economics,* 27, 483-516.

Liu, C.H. and Mei, J. (1992). The Predictability of Returns on Equity REITs and Their Co-Movement with Other Assets. *Journal of Real Estate Finance and Economics,* 5, 401-418.

Loughran, T. and Ritter, J.R. (2002). Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies,* 15, 413-443.

Mei, J. and Lee, A. (1994). Is There a Real Estate Factor Premium? *Journal of Real Estate Finance and Economics*, 9, 113-126.

Morgan, P.D. (1998). The Credit Effects of Monetary Policy: Evidence Using Loan Commitment. *Journal of Money, Credit, and Banking*, 30, 102-118.

Musto, D.K. (1997). Portfolio disclosures and year-end price shifts. *Journal of Finance,* 52, 1563-1588.

NAREIT (2012). Frequently Asked Questions About REITs. Accessed on December 6, 2012, http://www.reit.com/portals/0/PDF/REIT-FAQ.pdf.

Neal, R. and Wheatley, S.M. (1998). Do measures of investor sentiment predict returns? *Journal of Financial and Quantitative Analysis*, 33 (4), 523–547.

Nelson, D.B. (1991). Conditional heteroscedasticity in asset returns: A new approach. *Econometrica*, 59(2), 347-370.

Oikarinen, E., Hoesli, M. and Serrano, C. (2011). The Long-Run Dynamics between Direct and Securitized Real Estate. *Journal of Real Estate Research*, 33(1), 73-103.

Ooi, J.T.L., Wong, W.C. and Ong, S.E. (2012). Can Bank Lines of Credit Protect REITs against a Credit Crisis? *Real Estate Economics*, 40(2), 285-316.

Oppenheimer, P. and Grissom, T.V. (1998). Frequency Space Correlation between REITs and Capital Market Indices. *Journal of Real Estate Research*, 16(3), 291-310.

Ott, S., Riddiough, T. and Yi, H.C. (2005). Finance, Investment, and Investment Performance: Evidence from REIT sector. *Real Estate Economics,* 33, 203-235.

Pagliari Jr., J.L., Scherer, K.A. and Monopoli, R.T. (2005). Public versus Private Real Estate Equities: A More Refined, Long-Term Comparison. *Real Estate Economics,* 33, 147–187.

Peterson, J.D. and Hsieh, C.H. (1997). Do Common Risk Factors in the Returns on Stocks and Bonds Explain Returns on REITs? *Real Estate Economics,* 25(2), 321-345.

Ritter, J. (1988). The Buying and Selling Behavior of Individual Investors at the Turn of the Year. *Journal of Finance,* 43, 701-717.

Ro, S.H. and Ziobrowski, A.J. (2011). Does Focus Really Matter? Specialized vs. Diversified REITs. *Journal of Real Estate Finance and Economics,* 42, 68-83.

Sofianos, G., Wachtel, P. and Melnik, A. (1990). Loan Commitment and Monetary Policy. *Journal of Banking and Finance,* 14, 1057-1088.

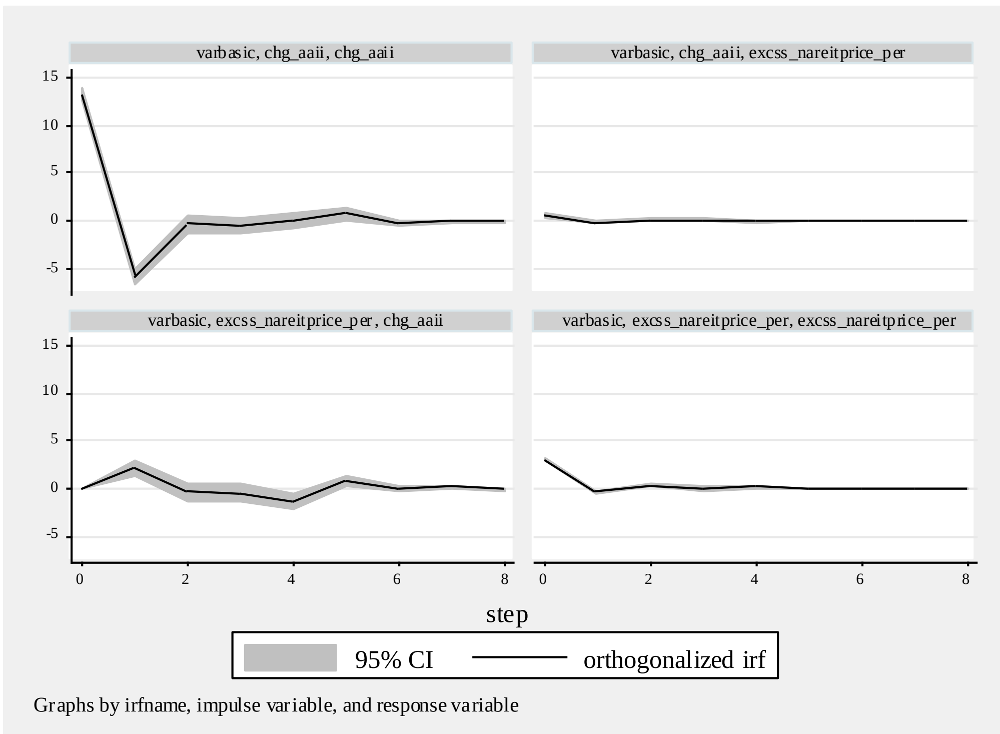
Xu, Y. and Yiu, C. Y. (2010). The effects of tax reforms on REITs: an international empirical study. *Available at SSRN 1878505*.

APPENDIX A

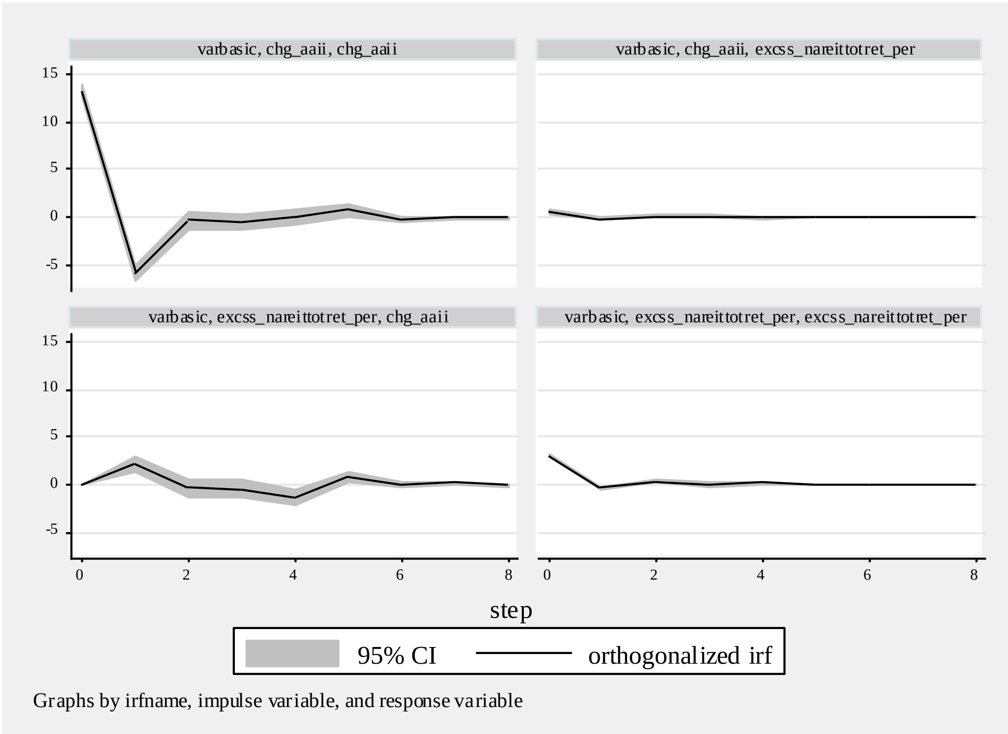
APPENDIX A

VAR RESULTS: IMPULSE RESPONSE FUNCTIONS

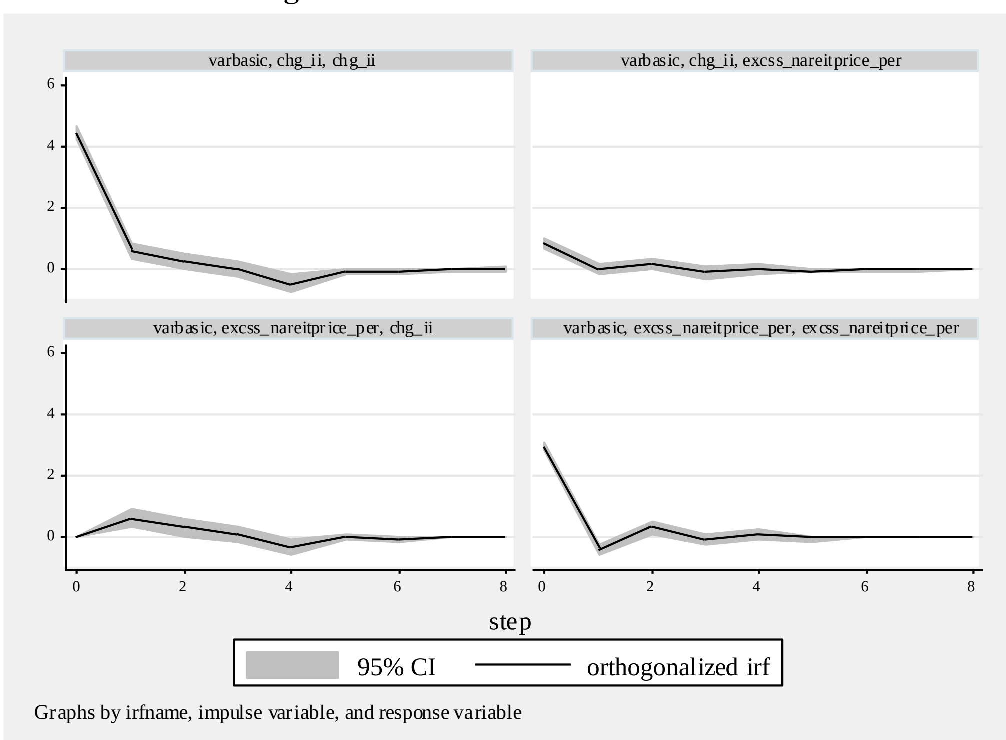
Vector Auto regression. Excess NAREIT Price Returns and ∆AAII



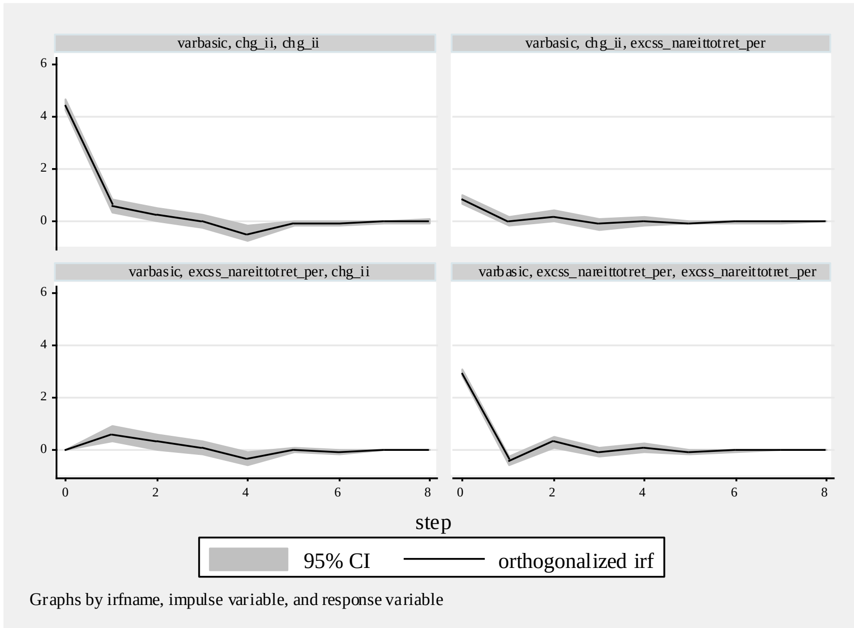
Vector Auto regression. Excess NAREIT Total Returns and ΔAAII



Vector Auto regression. Excess NAREIT Price Returns and ΔII



Vector Auto regression. Excess NAREIT Total Returns and ∆II



APPENDIX B

APPENDIX B

VAR RESULTS: STABILITY CONDITIONS

Vector Auto regression. Excess NAREIT Price Returns and ΔAAII

Eigenvalue stability condition

Eigenvalue	Modulus
-.4462028 + .330786*i*	.555442
-.4462028 - .330786*i*	.555442
.1611945 + .5314713*i*	.555379
.1611945 - .5314713*i*	.555379
-.5200411	.520041
.3095079	.309508
.09672491 + .2297567*i*	.249287
.09672491 - .2297567*i*	.249287

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

Vector Auto regression. Excess NAREIT Total Returns and ΔAAII

Eigenvalue stability condition

Eigenvalue	Modulus
.1658115 + .535009*i*	.560114
.1658115 - .535009*i*	.560114
-.4444841 + .3292875*i*	.553169
-.4444841 - .3292875*i*	.553169
-.5100645	.510065
.2782444	.278244
.09962221 + .1879712*i*	.212739
.09962221 - .1879712*i*	.212739

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

Vector Auto regression. Excess NAREIT Price Returns and ΔII

Eigenvalue stability condition

Eigenvalue	Modulus
.4322792 + .3772798*i*	.573764
.4322792 - .3772798*i*	.573764
-.3567267 + .3174098*i*	.477496
-.3567267 - .3174098*i*	.477496
-.4299761	.429976
.3848792	.384879
-.07822686 + .3528728*i*	.36144
-.07822686 - .3528728*i*	.36144

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

Vector Auto regression. Excess NAREIT Total Returns and ΔII

Eigenvalue stability condition

Eigenvalue	Modulus
.4349181 + .3783261*i*	.576441
.4349181 - .3783261*i*	.576441
-.3623305 + .3226246*i*	.485149
-.3623305 - .3226246*i*	.485149
-.4412055	.441205
.3874425	.387443
-.07261426 + .3605501*i*	.36779
-.07261426 - .3605501*i*	.36779

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

BIOGRAPHICAL SKETCH

Daniel Huerta-Sanchez earned the degree of Doctor of Philosophy in Business Administration with concentration in Finance at the University of Texas-Pan American in 2013. He received his Bachelor's Degree in Computer Engineering from Universidad Dr. Rafael Belloso Chacin in Maracaibo, Venezuela in 2004. His research interests include behavioral finance, securitized real estate, and banking. His publications in peer-reviewed journals include: *Journal of International Financial Markets, Institutions & Money, Banking and Finance Review, Journal of Real Estate Portfolio Management, Global Journal of Finance and Economics, and the Global Business and Finance Review*. Daniel Huerta has been hired as a Visiting Assistant Professor in Finance at the College of Charleston beginning on Fall 2013. Daniel Huerta can be contacted at 3016 Princeton Avenue, McAllen, TX, 78504 or by phone at (956) 607-7166.