The Liquidity Crisis, Investor Sentiment, and REIT Returns and Volatility

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Abstract

The real estate investment trust (REIT) industry experienced a liquidity crisis resulting from reduced access to credit commitments as banks were restoring their balance sheets during the 2007-2009 financial crisis. Employing generalized autoregressive conditional heteroscedasticity (GARCH) models we examine the impact of the liquidity crisis and investor sentiment on REIT returns and volatility over the sample period from December 2001 to February 2013. We find that the liquidity crisis negatively impacts REIT returns and helps explain increases in volatility; this finding is robust to multiple specifications. We show that investor sentiment is a significant factor in explaining the REIT return generating process with institutional sentiment playing a dominating role over individual sentiment; furthermore, institutional sentiment was the only relevant sentiment variable during liquidity crisis.

Keywords: Investor Sentiment, Liquidity Crisis, REIT returns, REIT volatility, GARCH-M
JEL Classification Codes: G11, G14, G23

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 prompted the crisis remain under debate; however, a large consensus points to lenient mortgage loan underwriting, aggressive lending practices by financial institutions, financial innovation through the creation of new funding products, historically low interest rates, and lax credit markets. The aggressive lending behavior led to the origination of subprime loans, which together with the real estate mortgage-backed securities market, contributed to the boom and subsequent bust 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 financial crisis quickly spilled over to other industries further weakening the U.S. economy.

The real estate investment trust (REIT) industry did not stand unaffected from this economic disaster. REITs experienced a liquidity crisis as a consequence of the credit crunch that loomed in the financial industry during the period from 2008Q4 to 2009Q2 (Case et al., 2012). Since government regulations constrain REITs' ability to retain their net income through minimum dividend payment requirements, they must have access to funds either through capital markets, debt markets, or banks in order to grow. The REIT industry experienced significant erosion in its equity and debt capital raising abilities during this period. At the same time, bank lending came to a near halt making liquid funds a scarce resource for borrowers including those linked to the REIT industry. Bank funding primarily through credit line facilities is important since it provides REIT managers with leeway in their capital structure decisions and with the flexibility to utilize this source rather than the capital markets during unfavorable times. With REIT retained earnings representing a marginal funding source of new investments in the industry, it is plausible that a fall out in liquidity from traditional sources would place significant pressure on REITs' ability to operate effectively. The changes in market conditions and REITs mandatory minimum dividend payment structure serve to motive this paper.

As market conditions deteriorated during the crisis, investors were pressed to take financial decisions under uncertainty and pressure. The events in the midst of the financial crisis and the market turmoil led to increased volatility in measures of institutional and individual investor sentiment. The increase in volatility is important since a body of literature has documented a relationship between investor sentiment and the formation and volatility of asset prices including REIT prices. Our research is further motivated by the noise trader risk theory which posits that security prices suffer deviations from intrinsic values due to noise introduced by the herding trading behavior of investors trading on non-fundamental information (De Long et al., 1990). Interestingly, 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. For the period from December 2001 to February 2013, sentiment volatility is markedly higher after the second quarter of 2007. Exhibit 1 shows the changes in both individual and institutional investor sentiment for the sample period from December 2001 to February 2013. In Exhibit 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 not to significantly react to the crisis period.

In this paper, we assess whether REIT market returns and volatility were significantly affected by the 2008-2009 REIT liquidity crisis and test the role of investor sentiment on the REIT return generating process. This paper adds to the literature on the impact of the liquidity crisis on REIT sector returns and volatility and to the literature that examines the impact of investor sentiment on REIT returns. The pressure of the liquidity crunch on REIT prices and the influence that investor expectations had during the crisis has not been addressed. We provide evidence on the influence of sentiment on the REIT return generating process, especially during times of scarce financial liquidity and market turmoil.

Overall, results from generalized autoregressive conditional heteroscedasticity in mean models show that REIT returns decreased significantly while volatility increased significantly during the 2008Q4-2009Q2 liquidity crisis. Our results support behavioral hypotheses on the impact of sentiment on security prices (De Long et al., 1990; Barkham and Ward, 1999). In our results, investor sentiment is observed to play a significant role in both the formation and volatility of REIT prices. Furthermore, we analyze the impact of expectations from the heterogeneous REIT investor base by classifying sentiment from institutional and individual investors independently. Institutional investor sentiment is observed to have a larger impact on REIT returns and volatility than individual investor sentiment. Previous research on the sentiment-return relationship in REITs undermines the influence that institutional ownership has on the REIT prices and uses the debatable closed-end fund discount as a proxy of investor sentiment (Lin et al., 2009).[1] This paper 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. Our findings imply that investors may use bullish or bearish shifts in sentiment as a signal for capital allocations in the REIT market, especially from institutional investors who play a significant role in REIT price formation.

The remainder of this paper is organized as follows. Section 2 provides a review of relevant literature and puts forth our hypotheses. Section 3 describes the data employed in this study. Section 4 explains the methodology. Section 5 discusses the empirical results, and Section 6 concludes.

2. Literature Review

2.1 Investor Sentiment

A body of literature finds a significant relationship between investor sentiment and returns on diverse financial assets (i.e. Shiller, 1981; De Bondt and Thaler, 1985; Lee et al., 1991; Lee et al., 2002). Specifically, research in the REIT industry finds evidence that investor sentiment has a significant impact on REIT returns (Chan et al., 1990; Lin et al., 2009). The behaviorist approach to asset pricing suggests that although market prices are generally observed in equilibrium, noise trading can cause pronounced price deviations that arbitrage forces are unable to correct. This effect on prices intensifies in times of market turmoil and uncertainty when sentiment dominates the market given generalized negative expectations about performance. Despite the evidence, no preceding research explores the sentiment-return relationship in the REIT industry during times of financial turmoil nor do they directly test the noise trader hypothesis by considering institutional (sophisticated investor) and individual (noise trader) sentiment simultaneously in a pricing model as proposed by DeLong et al. (1990).

Using the index of industrial confidence produced by the Confederation of British Industry, the index of consumer confidence produced by the Gallup Polling Organization and the index of inflation expectations produced by Money Market International as proxies for investor sentiment, Barkham and Ward (1999) test the noise trader hypothesis on listed property companies in the United Kingdom (U.K.). These authors explain that there are two fundamental types of market participants: "rational participants" that trade on assumptions formed by unbiased estimates of economic and financial fundamentals and "noise traders" that trade on pseudo-signals and sentiment. They find that U.K. property companies often trade at a discount with respect to their net asset value (NAV) and argue that that this deviation in price can be attributed to unpredictable changes in noise trader sentiment. This evidence suggests that pricing errors can be driven by noise traders although underlying assets in real estate companies are tangible and arguably easier to value compared to other types of assets. The noise trader risk hypothesis has been widely tested in the finance literature and findings show strong support for the theory. Lee et al. (2002) posit that noise trader risk is a systematic risk factor that should not be dismissed when modelling returns and volatility of financial securities. However, research has widely overlooked how the noise trader hypothesis could play a role in REIT price formation.

Based on evidence of increased institutional ownership in REITs in recent years, we hypothesize that institutional investor sentiment has a significant impact on the REIT return generating process while changes in individual investor sentiment should not be a significant determinant of REIT returns and volatility during the REIT liquidity crisis. Devos et al. (2012) point out that aggregate institutional holdings peaked at the beginning of 2008 at 58% ownership and declined to 50% ownership in the second quarter of 2009. Correspondingly, Striewe et al. (2013) explain that the general trend of REIT institutional ownership is positive with a significant decline only observed in 2008 and 2009. They report that, on average, 56.8% of REIT shares are held by institutions in the period from 1998 to 2010. This evidence of significant institutional ownership 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 responded less to the crisis compared to changes in institutional investor sentiment, providing more support to our hypothesis that institutional investor sentiment may influence REIT prices more than individual sentiment. Given that large institutional investors have sizeable capital and frequently trade in blocks that are large enough to influence REIT industry returns, it is expected that institutions will influence prices in the REIT market more than individuals.

2.2 The REIT liquidity crisis

REITs are a unique type of firm that are constrained by government regulation to payout 90 percent or more their net income. This characteristic limits their ability to fund new property development or major property acquisitions using internally-generated funds (Hardin and Hill, 2011). Ott et al. (2005) explain that retained earnings are the identified funding source for only 7% of new REIT investments. Thus, REITs must tap the capital markets or obtain financing from financial institutions in order to grow and operate. During the 2007-2009 financial crisis, capital markets behaved erratically and created shocks to firms dependent on external capital flows to fund operations (Case et al., 2012). The National Association of Real Estate Investment Trusts (NAREIT) reports that during the REIT liquidity crisis (2008Q4 to 2009Q2) equity REITs raised $960.12 million via seasoned equity offerings compared to $7,580.71 million raised in the preceding three quarters. Similarly, equity REITs raised $2,393.30 million via debt offerings during the crisis compared to $5,172.50 million during the preceding three quarters before the liquidity crisis.[2] These figures illustrate the erosion in capital raising abilities by REITs during the liquidity crunch.

Ott et al. (2005) highlight the importance of lines of credit to finance growth and to serve as backup liquidity to fund any cash shortages given the stringent REIT dividend payout policy. Lines of credit (credit commitments) are contracts that allow REITs to access funds regardless of the prevailing state of the market at the time of the request and serve as financial slack for REITs (Ooi et al., 2012). [3] To illustrate the importance of credit commitments to the REIT industry, unused credit line balances in proportion to credit lines plus cash for REITs represents close to 74% of total liquidity compared to 45% for firms in other industries (Ooi et al., 2012). Credit line facilities allow borrowing only when and as needed and provide REITs important support to survive adverse economic conditions without committing to long-term financing. For these reasons, credit lines are believed to reduce REIT cost of capital and to increase firm value (Hardin and Hill, 2011). Unfortunately, the financial crisis severely constrained bank lending; bank balance sheet erosion (and the liquidity hoarding response) hindered banks’ capacity to fulfill credit line 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).

3. Data

The sample period includes the latest business cycle as indicated by the National Bureau of Economic Research (NBER) which spans from December 2001 to February 2013.[4] Our sample covers a periods of expansion that includes the buildup of the housing bubble, subsequent bust, a full time span of the latest U.S financial crisis along with the REIT liquidity crisis, and the subsequent mild recovery period. 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 which reflects the returns of all U.S. tax-qualified equity REITs recognized by the National Association of Real Estate Investment Trusts. We additionally test for robustness of the results employing the FTSE NAREIT U.S. Total Return index which takes into account dividend payments.

To proxy for investor sentiment, we employ survey-based weekly 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 six 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). Institutional investor sentiment is built on a compilation of market performance expectations from investment advisory newsletters. 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. REIT index and investor sentiment data are retrieved from Thomson's DataStream.

We use the Fama and French (1992) factors and the default risk (*DEF*) and term structure premiums (*PREM*) as control variables. The Fama-French factors are obtained from Dr. Kenneth French's website.[5] *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 also constructed with data from Thomson's DataStream. All data is in weekly frequency.

3.1. Descriptive statistics

Exhibit 2 presents the contemporaneous bivariate unconditional correlations for the variables employed in the empirical analysis. Besides the strong correlation between the two measures of REIT excess return, the highest correlation coefficients observed are between the excess return in the market (*Rm-Rf*) and the two measures of REIT excess returns. Due to the high correlation between excess NAREIT total and price returns, their corresponding pair-wise correlations with (*Rm-Rf)* are both 0.645. The sentiment indices Δ*II* and Δ*AAII* display a correlation of 0.195 which declines slightly to 0.144 during the REIT liquidity crisis. With the exception of the strong correlation between excess market returns (a control variable) and our two measures of REIT excess returns (our dependent variables), the low-to-moderate correlations help mitigate any potential multicollinearity issues that could impact our empirical specifications.

Summary statistics are presented in Exhibit 3. As expected, weekly excess NAREIT total returns (mean of 0.251%) are on average larger than excess NAREIT price returns (mean of 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. Moreover, it is worth mentioning that both measures of NAREIT excess returns (price and total) are on average larger than the excess market returns (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, our $\Delta AAII$ variable, have a noticeably larger standard deviation of 15.042 when compared to changes in institutional investor sentiment, our ΔII variable, which reflects a standard deviation of 4.908; furthermore, our individual investor sentiment variable also reflects larger magnitudes in minimum and maximum values during the entire sample period. During the liquidity crisis, the standard deviation of 1.678 for ΔII and 4.654 for $\Delta AAII$ are considerably smaller with respect to the whole sample period; nonetheless, the standard deviation for ΔII is smaller compared to $\Delta AAII$.

4. Methodology

4.1. REIT industry returns and volatility

Our first specification involves the estimation of the following generalized autoregressive conditional heteroscedasticity-in-mean (GARCH-M) to examine the impact of the liquidity crisis on REIT industry returns and conditional variance:

$$(REIT - Rf)_t = \alpha_0 + \beta_1 Crisis_t + \beta_2 h_t + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t, \quad (1)$$

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

The dependent variable $(REIT\text{-}Rf)_t$ in the mean equation corresponds to the FTSE NAREIT U.S. Real Estate Index excess returns. $Crisis_t$, which appears in the mean and the variance equations, 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. Notice that the conditional variance h_t modeled in equation 2, which captures contemporaneous realizations of volatility that is often observed to influence excess returns, enters the mean equation and its effect is captured by β_2. X_{it} is a vector of *N* control variables that are expected to explain REIT industry excess returns and ε_t is the remainder stochastic term, assumed to follow a normal distribution.

The vector X_{it} includes the Fama-French three-factor model 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 in X_{it} 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. Peterson and Hsieh (1997) address the appropriateness of the Fama-French variables for REIT return models 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 French, 1993).

In the conditional variance modeled by equation 2, we have that ε_{t-1}^2 captures the lagged squared innovations from equation 1. With persistent volatility we expect φ_2 to be statistically significant (i.e. the current value of the variance of the errors depends on the realized ε_{t-1}^2). I_{t-1} is an indicator variable equal to 1 if lagged shocks are positive (i.e. $\varepsilon_{t-1} \geq 0$) and 0 if lagged shocks are negative. Hence, the $\varepsilon_{t-1}^2 I_{t-1}$ term captures the Glosten et al. (1993) threshold ARCH (TARCH) asymmetric effect of shocks on volatility. We expect the TARCH coefficient φ_3 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 additional volatility persistence. Lastly, we include $Crisis_t$ in the variance equation as well to model not only its mean effects on excess returns but also its potential role on volatility.

Equations 1 and 2 are estimated jointly as a system of equations using maximum likelihood. The estimation follows the methods proposed in Engle (1982) who introduced the autoregressive conditional heteroscedasticity (ARCH) to simultaneously model the mean and the conditional variance of a series. A more restrictive homoscedasticity assumption when modeling the returns of most financial assets is, more often than not, violated. The violation means that ordinary least squares is not efficient and usual inference procedures are not appropriate. Bollerslev (1986) extended the (ARCH) modeling process of Engle (1982) to a Generalized ARCH (GARCH) to allow the conditional variance to be dependent upon previous own lags. GARCH is typically preferred to ARCH as it is more parsimonious and less likely to breach non-negativity constraints. We expect that this flexible modeling strategy captures the periods of unusual large volatility in REITs that come as a response to continuously fluctuating market conditions. We additionally include two extensions to the methods proposed by Bollerslev. First, in keeping with basic theory of asset markets we employ a GARCH-M to assess if the return's conditional variance affects excess returns. The basic premise is that risk-averse agents will require compensation for holding risky assets. Second, we model a differentiated effect of positive and negative innovations on conditional volatility.

Similar specifications to model first and second moments of REIT returns have been used in empirical research. Papers that examine the relationship between the volatility of different assets classes and REITs make a strong argument on the appropriateness of GARCH-M to model REIT returns given the concern of heteroscedasticity (Cotter and Stevenson, 2006; and Stevenson, 2002).

4.2. The roles of the liquidity crisis and investor sentiment

The analysis of the role of investor sentiment on 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). We propose the following augmented GARCH-M model:

$$(REIT - Rf)_t = \alpha_0 + \beta_1 h_t + \beta_2 \Delta II_t + \beta_3 \Delta AAII_t + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \tag{3}$$

$$h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 \Delta II_t + \varphi_6 \Delta AAII_t \tag{4}$$

in which *(REIT-Rf)$_t$* in the mean equation 3 are the FTSE NAREIT U.S. Real Estate Index excess returns, h_t are contemporaneous realizations of the 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 excess returns. The conditional variance equation includes ARCH, TARCH, and GARCH terms consistent with equation 2 along with changes in institutional and individual investor sentiment ΔII and $\Delta AAII$.

To test whether changes in sentiment have a differentiated effect on REIT returns and volatility during crisis and non-crisis periods, we augment the GARCH-M model with an interaction between the change in sentiment for institutional and individual investors and the dummy variable $Crisis_t$. The resulting model takes the following form:

$$(REIT - Rf)_t = \alpha_0 + \beta_1 h_t + \beta_2 Crisis_t * \Delta II_t + \beta_3 Crisis_t * \Delta AAII_t + \sum_{i=1}^{N} \gamma_i X_{it} + \varepsilon_t \qquad (5)$$

$$h_t = \varphi_1 + \varphi_2 \varepsilon_{t-1}^2 + \varphi_3 \varepsilon_{t-1}^2 I_{t-1} + \varphi_4 h_{t-1} + \varphi_5 Crisis * \Delta II_t + \varphi_6 Crisis * \Delta AAII_t \qquad (6)$$

in which the mean 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 described previously. $(REIT\text{-}Rf)_t$ are the FTSE NAREIT U.S. Real Estate Index excess returns. Consistent with the previous models, the conditional variance includes 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.

5. Results

5.1. The liquidity crisis and REIT returns and volatility

The estimation results for the models in equations 1 and 2 are presented in Exhibit 4. Model 1 shows that the contemporaneous volatility h_t has a positive and statistically significant impact on REIT excess returns; this statistical relationship holds for both REIT return indices (i.e. the price and total REIT return index). These results are consistent with the orthodox risk-return investment relationship which posits that higher risk, proxied by volatility in this case, commands higher returns.

The statistically significant negative coefficients on the liquidity crisis (*Crisis*$_t$) dummy variable in the mean equation (-8.080 on the model based on excess NAREIT price returns and -7.829 on the model examining excess total returns) provide evidence that excess returns significantly deteriorated during the REIT liquidity crisis period. The results would suggest that investors may have rebalanced their portfolios towards lower risk investments and away from riskier type asset classes thus sacrificing potential return for safety and liquidity. These results support evidence of REIT investors displaying a "flight to quality" during the economic crisis (Devos et al., 2012). The positive and statistically significant coefficient on the liquidity crisis dummy variable in the conditional variance equation in Model 1 suggests that volatility significantly rose during the liquidity crisis period. As uncertainty increased and the REIT industry experienced liquidity constraints, REIT industry returns experienced higher volatility as a reflection of negative expectations regarding future market performance. This finding supports the view of the importance of REITs access to liquidity either through capital markets or bank facilities to operate effectively. The results also suggest that the absence of these liquidity sources is viewed unfavorably by investors. As expected, ε_{t-1}^2shows positive and statistically significant coefficients (0.201 for REIT price returns and 0.202 for REIT total returns) implying that conditional variance heavily depends on prior squared shocks in the mean equation. Negative and statistically significant 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. (1993).

Additionally, consistent with Bollerslev (1986), h_{t-1} shows positive and statistically significant coefficients (0.754 for the model based on REIT price returns and 0.750 for the model that examines REIT total returns) suggesting a relatively high volatility persistence.

Model 2 in Exhibit 4 expands Model 1 by incorporating the Fama-French three-factor model as a vector of control variables in the mean equation. The coefficients for all three Fama-French equity factors are positive and significant. Moreover, the $Crisis_t$ variable continues to explain REIT returns and volatility based on the negative and statistically significant coefficients in the mean equation (-7.433 for REIT price returns model and -7.458 for REIT total returns model) and the positive and statistically significant coefficients in the conditional variance equation (2.492 for REIT price returns model and 2.490 for REIT total returns model).

Model 3 in Exhibit 4 modifies our benchmark model of equations 1 and 2 by including the Fama-French bond factors DEF_t and $PREM_t$ in the vector of controls X_{it}. The results in Model 3 suggest that bond factors do not significantly explain the observed time series variation in REIT excess returns suggesting that REITs behave more like equity securities rather than fixed-income securities during our sample period. These findings are consistent with Boudry et al. (2012) that observe REITs behaving more like equity rather than fixed-income securities and unsecuritized real estate in the short-run. The $Crisis_t$ coefficients remain statistically significant implying that the crisis plays an important role in modeling REIT excess returns and volatility even after controlling for the Fama-French bond factors.

Model 4 in Exhibit 4 shows the results for the comprehensive model that includes the entire set of control variables in addition to the REIT liquidity crisis dummy variable. The results robustly show that the coefficients on $Crisis_t$ have the expected signs and are statistically significant under various model specifications in both the mean and conditional variance equations. Moreover, REIT excess returns are significantly lower during the liquidity crisis period confirming deterioration in market conditions. The substantial decrease in returns is accompanied by increased volatility in the REIT market during the liquidity crisis providing evidence of higher risk and uncertainty for REITs. Evidence suggests that REIT impaired access to liquid funds led to uncertainty regarding the true market value of REIT assets and their capacity to produce cash flows.

5.2. Investor sentiment and the liquidity crisis

We initially explore 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 evaluate only the effect of the 2008-2009 REIT liquidity crisis. The estimation results for the specifications in equations 3 and 4 are presented in Models 1 and 2 of Exhibit 5. 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 in modeling REIT excess returns although changes in institutional investor sentiment (ΔII) appear to have a larger effect than changes in individual investor sentiment ($\Delta AAII$), even after factoring that the standard deviation of $\Delta AAII$ is much larger than of ΔII. Changes in both institutional and individual investor sentiment show a negative relationship with volatility. This effect is larger in magnitude for changes in institutional investor sentiment in comparison to changes in individual investor sentiment. These findings remain qualitatively unchanged whether we are modeling REIT excess price returns or REIT excess total returns.

Model 2 shows that the effect of sentiment on returns remains positive and statistically significant when we include the vector of control variables in the model. ΔII displays a coefficient of 0.065 significant at the 1% 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 statistically insignificant. On the other hand, the estimates on ΔII are robust to this specification suggesting that changes in institutional investor sentiment have a negative and statistically significant impact on REIT volatility. Positive changes in institutional investor sentiment are associated with reductions in volatility. An interpretation to our findings is that as institutional investors turn bullish, they tend to hold REITs especially since REIT investors not only purchase this type of equity for the 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. Overall, the results in Exhibit 5 suggest that investor sentiment is a significant factor in explaining REIT returns during the sample period from December 2001 to February 2013.

We next examine the impact of changes in sentiment during the 2008-2009 liquidity crisis. The estimation results for the model in equations 5 and 6 are presented in Exhibit 6. Model 1 shows the estimates that include the Fama-French framework as controls 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. The results for REIT excess price and total returns are congruent. The findings indicate that during the liquidity crisis ΔII significantly impacts REIT excess returns whereas $\Delta AAII$ does not. These results differ from the previous analysis that included the entire sample period which indicates that both individual and institutional investor sentiment influence returns. Our results suggest that sentiment from individual investors were either too erratic, meaning that sentiment from bullish and bearish individuals cancelled each other out 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 ($\Delta AAII_t$) is not a significant factor in explaining volatility during the liquidity crisis. The TARCH term in the conditional variance equation is not statistically significant suggesting that there is no asymmetric effect in lagged ε_t^2 (i.e. lagged squared shocks have the same effect whether there are positive or negative shocks to excess returns in the mean equation).

Model 2 in Exhibit 6 expands the model by including the complete vector of control variables. Our previous 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 positively influence REIT returns and negatively impact volatility as in the prior model during the liquidity crisis. 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 compared to individual investors during the liquidity crisis. This may suggest that during the crisis period, noise traders' role in REIT asset price formation is dampened by institutional investor sentiment and that REIT price formation may be driven more by fundamentals if we accept that institutional sentiment is driven by rational expectations as suggested by Barkham and Ward (1999).

5.3. Augmented Model

We 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 liquidity crisis remain robust with the inclusion of sentiment for the entire sample period. The results are reported in Model 3, Exhibit 6, which are consistent with the findings presented in the preceding sections. The maximum likelihood estimates 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. This implies 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 Exhibit 6, 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). Model 4 provides additional robustness checks showing estimates that are consistent in signs and magnitude with the previously reported specifications.

6. Conclusion

The unique dividend policy restrictions of the REIT industry constrain these firms to hold a diminutive portion of income in retained earnings. This dividend policy restriction forces REITs to fund new investments by raising cash through costly debt or equity issuance or by relying on credit commitments from banks and other financial institutions. Research finds that the latter option is preferable since credit lines serve as financial slack for REITs and do not impact their capital structure (Ooi et al., 2012). Credit commitments function as cash reserves for REITs which accounts for close to 74% 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 2007-2009 financial crisis triggered market turmoil that had major negative consequences on the U.S. economy. The financial sector was especially affected by this crisis, some banks failed and market conditions did not begin to settle until the federal government intervened. The REIT industry was not immune from this financial disaster. The financial crisis severely constrained banks, and other financial institutions, eroding their capacity to fulfill credit commitments to REITs. The diminished flow of cash to the REIT industry led to a severe liquidity crisis that spanned from 2008Q4 to 2009Q2.

In this paper we estimated various GARCH specifications to find strong empirical evidence that the liquidity crisis had a statistically significant negative effect on REIT excess returns. Moreover we also find that the liquidity crisis helped explain the significant increase in market volatility. We argue that as liquid funds became scarce, growth and expansion opportunities diminished and REIT overall financial heath was adversely affected. The REIT industry outlook was negative 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; on the other hand, bearish investor trading will also pressure prices. Research in the REIT industry finds that investor sentiment is a significant factor in explaining REIT returns and volatility; this paper explores the relationship between investor sentiment and REIT returns and volatility during the period spanning from the 2001 recession to February 2013 with a focus on the REIT liquidity crisis of 2008-2009.

Our results are consistent with behavioral finance explanations. We find 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 were found to have a positive and statistically significant effect on returns, however, the point estimates on the institutional investor sentiment were consistently larger than the individual investor sentiment. Similarly, the analysis shows that the institutional and individual investor sentiment both have a negative and statistically significant effect on volatility. Interestingly, while sentiment from these two markedly different groups of investors are relevant in explaining REIT returns and volatility, sentiment for institutional investors dominates the effects.

The results additionally provide strong evidence that sentiment plays an important role during the REIT liquidity crisis. While the results consistently indicate that institutional investor sentiment is a significant factor affecting excess returns during the crisis, individual investor sentiment was no longer significant. A plausible explanation can be derived from the large increase in institutional holdings in the REIT industry. According to Striewe et al. (2013), aggregate institutional ownership is recorded at an average of 56.8% of shares outstanding for the period 1998-2010. Furthermore, institutional investors with sizeable capital have sufficient market power to influence industry returns which is clearly not the case for individual investors.

Finally, this paper additionally contributes by providing evidence on the relevance of investor sentiment in the REIT industry. In particular, investors should pay close attention to changes in institutional investor sentiment especially during times of market turmoil. Overall, the 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 expectations can have on the market.

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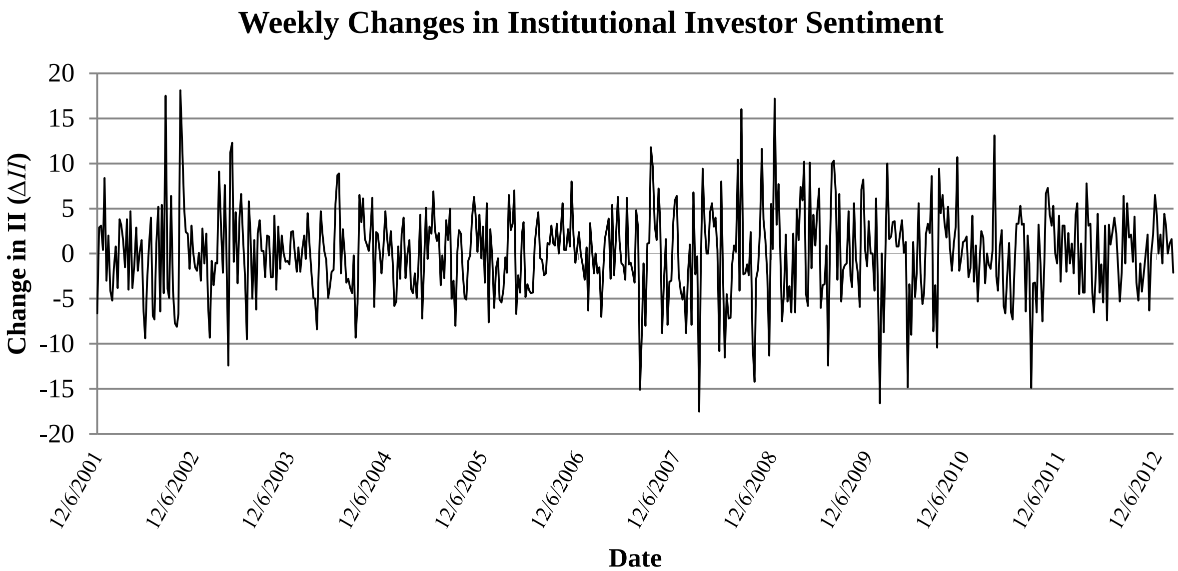
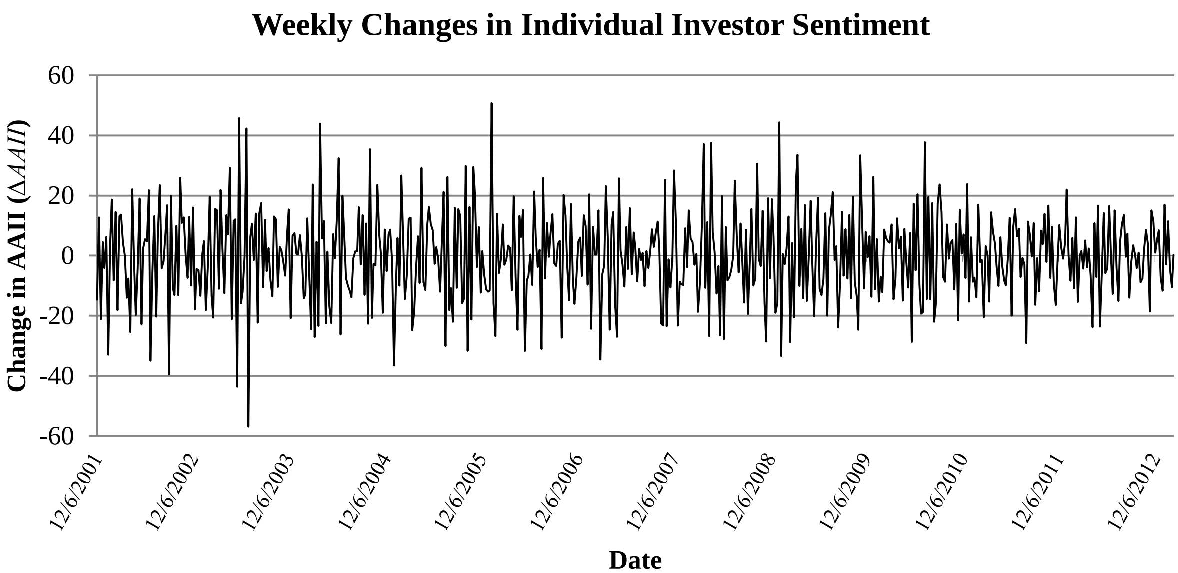
Exhibit 1. Changes in institutional and individual investor sentiment





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.

Exhibit 2. 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

Notes: This table shows the correlation matrix for the variables employed. Excess NAREIT Price Returns are the weekly 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*ΔII* and *Crisis*ΔAAII* represent changes in institutional and individual investor sentiment during the crisis, respectively. *ΔII* and *ΔAAII* are changes in institutional and individual investor sentiment, respectively. *Rm-Rf*, *SMB* and *HML* are the Fama-French equity factors while *DEF* and *PREM* are the Fama-French bond factors.

Exhibit 3. 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**Δ*AAII*	585	0.009	4.654	-33.380	44.310
*Crisis**Δ*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

Notes: Excess NAREIT Price Returns are the weekly 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**Δ*II* and *Crisis**Δ*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.

Exhibit 4. Effect of REIT liquidity crisis on REIT excess 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
Mean Equation Parameters								
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
Volatility Equation Parameters								
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***
Model Diagnostics								
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

Notes: This table reports the results for the GARCH-M model described by equations 1 and 2 in the methodology section. Each model has two columns: one reports the results for excess NAREIT price returns and the other for excess NAREIT total returns. The Wald's test checks for model parameter restrictions under the null that our set of parameters is equal to zero; the Wald's test statistic is Chi-square distributed. Sample period is from December 2001 to February 2013. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Exhibit 5. GARCH-M results. Impact of changes in institutional and individual investor sentiment on REIT excess returns and volatility.

	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

Notes: This table reports the results for the GARCH-M model described by equations 3 and 4 in the methodology section of the paper. Results are for the sample period from December 2001 to February 2013. Each model has two columns: one that reports results based on for excess NAREIT price returns and the other that uses excess NAREIT total returns, respectively The Wald's test checks for model parameter restrictions under the null that our set of parameters is equal to zero; the Wald's test statistic is Chi-square distributed. *, ** and *** represent 1%, 5% and 10% significance level respectively.

Exhibit 6. GARCH-M Results. Impact of changes in institutional and individual investor sentiment during the REIT liquidity crisis on REIT excess 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	0.101	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***	0.353***	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

Notes: This table reports the results for the GARCH-M model described by equations 5 and 6 in the methodology section of the paper. 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. 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. *, ** and *** represent 1%, 5% and 10% significance level respectively.

[1] 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. Thus, closed-end fund discounts fail to make a proper distinction between sentiment derived from individuals and institutional investors

[2] Data on REIT capital offerings is found at the NAREIT website: https://www.reit.com/data-research/data/reit-capital-offerings. Accessed on October 12, 2015.

[3] 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 in condition (e.g. a breach of financial covenants) as established in the loan commitment contract may the lender reduce or refuse to fulfill a request for funds (Ooi et al., 2012).

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

[5] Accessed on November 29, 2013. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html