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REITs in Volatile Times: Stabilizing or Not?

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Abstract

Over the last decade, academic research has consistently suggested that adding REITs to a mixed asset portfolio will expand the efficient frontier, thus providing superior risk-adjusted returns. However, during the recent financial crisis, an emerging literature has evolved which questions the efficacy of holding REITs, under certain scenarios, as they can potentially increase volatility, value at risk, and expected shortfalls of a portfolio, especially during times of market volatility. In this paper, we employ the first direct test of the impact of the financial crisis on REIT performance relative to the general equities markets. To do so, we consider both the returns and the conditional volatilities of nine classes of REITs and two general stock indices, utilizing daily data over crisis window that encompasses the Lehman bankruptcy. Utilizing the bankruptcy as an event that dramatically changed the volatility of the market; we find that the volatility of REITs increases much more than that of the general equities markets. The findings provide direct evidence that REITs can be quite volatile and portfolio destabilizing during economic crisis events. We also obtain interesting findings with respect to differences in relative REIT property type performance.

Keywords: Financial Crisis, REITs, and Mixed Assets Portfolios

JEL Codes: G01, G21, G33, L85

REITs in Volatile Times: Stabilizing or Not?

1. Introduction

Real estate investing through REITs has received significant attention in recent years from academics and practitioners. Part of this interest has been driven by the rapid increase in market capitalization of REITs. In fact, by at the end of 2010, the US REIT market had a capitalization of \$390 billion, which is up nearly 10 fold from 1994. Moreover, REITs now trade on all of the major stock exchanges. Investors have and continue to be attracted to REITs because they have had high absolute returns, pay a relatively high dividend yield, and are generally considered to have a low correlation with stocks and bonds and hence have portfolio stabilizing features. Numerous studies have shown that these characteristics suggest that adding REITs to a mixed asset portfolio expands the efficient frontier, thus proving higher risk-adjusted return opportunities. Adding to this, in September of this year, Morningstar released a study that compared the performance of real estate investment trusts (REITs) to private real estate investments. The study suggested that REITs outperform their private investment counterparts significantly, while having other favorable characteristics including superior liquidity, transparency, and capital access. At the conclusion of the study, the authors stated that investors should allocate a larger portion of their real estate holdings to REITs than they are currently doing. As such, it has started to become “a given” that adding REITs to a mixed asset portfolio is always and for everyone - optimal. .

However, a literature has emerged that challenges conventional thinking and suggests that under certain circumstances, REITs might actually have a destabilizing impact on a mixed asset portfolio. In fact, the suggestion of this line of research is that under volatile conditions or when

the market experiences a shock, the efficacy of REIT investing is questionable. First, Anderson, Boney, and Guirguis (2010) show that in high-variance regimes, an unexpected monetary shock impacts REITs about twice as much as the general equities market. Next, Jian and Anderson (2011a) examine value at risk and expected short-falls of REITs across countries and relative to their respective stock indices. The results show that REITs have a higher VAR and ES than general equities and the timing of extreme market movements between REITs and general stock indices are almost perfectly in-sync. As such, the portfolio diversification benefits are not present, exactly when they are needed. In other words, when the market takes a large and extreme move down in the general equities market, it does so at the same time in the REIT markets but to an even greater magnitude. Finally, Jian and Anderson (2011b) show that REITs exhibit strong herding behavior, especially during market downturns. In all, these studies do not question or try to refute the long-run portfolio benefits of REITs, but certainly suggest that REITs do not help, and in fact hinder, mixed asset portfolios during periods of market stress. As such, for many institutions or individuals with short term liquidity needs or perhaps those that have unpredictable cash flows may need to reconsider their allocation to REITs.

In this study, we provide the first direct test of what market uncertainty does to the investment characteristics of REITs relative to the general equities markets. To do this, we utilize daily data from 2007-2009 which encompasses the most dramatic swings in the equities market and includes September of 2008, when the US financial markets were under attack by a series of failures of commercial and investment banks. Perhaps the most serious and market destabilizing event was the bankruptcy of the 140 year-old investment bank, Lehman Brothers. A good indicator of just how serious this event was is the fact that the Dow Jones index experienced its steepest drop since the terrorist attack of September 11, 2001, on the day of the

Lehman bankruptcy. It is generally accepted that the Lehman bankruptcy filing and its aftermath seriously eroded investor confidence and had a ripple effect across the whole financial market, even extending to investment classes, such as REITs. In the middle of September 2008, other firms, such as Merrill Lynch, either went bankrupt or were sold at fire sale prices to other banks. These events were directly linked to massive losses suffered from investments in mortgage-backed securities. Although the events of 9/15 (the Lehman bankruptcy) had their origin in the real estate sector, their effects went far beyond this sector. They generated losses in money market funds, institutional cash funds, hedge funds as well as banks and insurers that had significant exposure to New York investment banks, such as Lehman, or relied on them for financing, either directly or indirectly. In a sense, the Lehman bankruptcy can be regarded as a turning point, one that switched a subprime mortgage crisis into a general financial and economic crisis.

While the impact of negative shocks, such as the 9/11 terrorist attacks, has been analyzed in the literature (e.g., Drakos, 2004; Homan, 2009), few academic studies appear to have focused so far on the effects of the 2007-2009 subprime mortgage crisis. An exception is Pichardo and Bacon (2009), who employ a traditional event study with a 30 day event window to examine the impact of the Lehman bankruptcy (henceforth also called 9/15 event) on the stock prices of 15 firms before and after the 9/15 event. The authors identify a negative shock to the stock prices following the announcement of the Lehman bankruptcy. Here, we focus on the effects on several kinds of REITs of the series of negative shocks encapsulated by the Lehman bankruptcy in the middle of September of 2008. We employ a two-regime GARCH model to statistically test for changes in their returns and conditional volatilities. Our results are consistent with the emerging literature, suggesting a reassessment of the role that REITs can play as part of a conservative

investment strategy.

The following section describes the hypothesis and the methodology employed. Section 3 discusses the empirical analysis and results, while the final section concludes.

2. Hypothesis and Methodology

Since 2007, when the subprime mortgage crisis became apparent, we hypothesize that Lehman's bankruptcy magnified the relative performance and riskiness between REITs and general market stocks. Furthermore, we assume that the bankruptcy event made it clear to investors that the mortgage crisis would not be contained within the residential and mortgage segments of the real estate sector but would affect real estate and financial markets in general. That implies that we should see a "ripple effect" toward those REITs that were relatively far from the center of the subprime mortgage crisis, such as office REITs.

To identify the impact of the Lehman event, which proxies for an increase in overall market volatility and uncertainty, we test for a structural change in a general autoregressive conditional heteroskedasticity (GARCH) framework. The fact that GARCH models can capture the behavior of both the first and conditional second moments of a stock return has made it very attractive for studying the joint behavior of return and volatility (e.g., Schwert 1990; Homan 2006). Rather than estimating a GARCH model separately for the time periods before and after the event, we estimate a regime switching version of the model. This has the advantage that it provides simultaneously estimates of the before and after model coefficients and a statistical test of whether they are statistically different. The two-regime GARCH model employs a 0/1 indicator variable for the Lehman bankruptcy and a number of interaction terms between this intervention variable and the terms that identify the return and conditional volatility parts of the

GARCH model.

The two-regime GARCH model can be written as:

$$\begin{aligned} r_t &= \mu + \alpha r_{t-1} + \beta DJ_t + L(\mu_L + \alpha_L r_{t-1} + \beta_L DJ_t) + e_t \\ \sigma_t^2 &= \eta + \phi e_{t-1}^2 + \varphi \sigma_{t-1}^2 + L(\eta_L + \phi_L e_{t-1}^2 + \varphi_L \sigma_{t-1}^2), \end{aligned} \quad (1)$$

where r_t is the log differenced daily price index of the underlying stock at time t and σ_t^2 denotes the time-varying conditional variance. The term e_t identifies the error term of the return part of the GARCH model. DJ_t is the log differenced Dow Jones daily price index, which controls for economy-wide effects (Chiang and Wang, 2002). L represents a 0/1 indicator variable that splits the sample into two regimes, one before Lehman ($L = 0$) and one after ($L = 1$). All coefficients without subscript apply to the complete sample. The coefficients subscripted with L denote the change in the corresponding base coefficient that occurs in the second regime. Therefore, the model for regime 1 can be written as:

$$\begin{aligned} r_t &= \mu + \alpha r_{t-1} + \beta DJ_t + e_t \\ \sigma_t^2 &= \eta + \phi e_{t-1}^2 + \varphi \sigma_{t-1}^2 \end{aligned} \quad (2)$$

while the model for regime 2 would be given as:

$$\begin{aligned} r_t &= (\mu + \mu_L) + (\alpha + \alpha_L)r_{t-1} + (\beta + \beta_L)DJ_t + e_t \\ \sigma_t^2 &= (\eta + \eta_L) + (\phi + \phi_L)e_{t-1}^2 + (\varphi + \varphi_L)\sigma_{t-1}^2. \end{aligned} \quad (3)$$

To make the model as general as possible, every coefficient of the base model is allowed to be changed by the Lehman event. The return part of the base model (equation 2) allows for a constant term (parameter μ), a first-order autoregressive component (r_{t-1}), a first-order moving average component (e_{t-1}), and for the impact of economy-wide effects (DJ_t). The conditional variance of the base model contains the elements of a standard GARCH (1,1) model. The model is estimated by standard maximum likelihood.

3. Estimation and Results

We estimate the model for different kinds of REITs: equity REITs, mortgage REITs and seven property-categorized REITs: residential, multi-family, office, industrial, retail, shopping centers, and hotel REITs. The performance of the REIT indices is compared to those of standard stock indices (NASDAQ, S&P 500). We measure REIT performance with market and value weighted SNL REIT indices on a daily basis over the time period from May 1, 2007, to May 11, 2009. Table 1 presents descriptive statistics for all indices employed in this study. Measured over the whole sample, average returns are negative. This captures the depressed market environment in the wake of the subprime lending problems that become apparent in 2007. Average daily returns are lower and standard deviations are higher after the Lehman event. Comparing the REIT indices to the ones of the non-REITs, it is apparent that REITs suffer a more significant decline in returns. The standard deviations of the nine REIT indices also increase more than those of the non-REIT indices after the Lehman bankruptcy. This result is completely aligned with the findings of Jian and Anderson (2011a) in that volatility increases at the same time for both REITs and the general equities markets and the REITs are impacted to a much greater degree.

To provide additional perspective on the adverse impact of the Lehman event, we estimate autoregressive OLS regressions on the logs of the price indices as opposed to the returns. The regressions contain two lags of the dependent variable and the 0/1 indicator variable L . The coefficient of L is reported in the last column of Table 1. It can be interpreted as the short-run percentage impact of the Lehman event on the associated price index. The regression results reveal that the general market indices decline by about two percent on average, while the impact

on the REIT indices is more severe, at three percent in the short run, representing a 50% impact difference.

<Table 1 about here>

Table 2 reports the two-regime GARCH(1,1) regression results.¹ For the two general stock indices, there are significant changes; in the return structure (α_L) for the NASDAQ, in the sensitivity to macroeconomic conditions (β_L) for the S&P500. All of the REITs indices have significant changes in both α_L and β_L , which suggests a stronger impact of the Lehman event on REITs. As for the conditional variance, the moving average part of the GARCH effect (ϕ) stays the same or decreases following the Lehman event, but the autoregressive part (φ) increases dramatically. Thus, the volatility becomes much more persistent for all indices.

< Table 2 about here>

Table 3 gives economic meaning to the changes to the various indices induced by the Lehman event. We first check the impact on stock returns. We calculate the long run impact on stock returns before and after 9/15. The term $r_t|_{L=0}$ represents the long-run return before the event, and $r_t|_{L=1}$ the long-run return after the event,

$$\begin{aligned} r_t|_{L=0} &= \frac{1}{1-\alpha}(\mu + \beta DJ_t) \\ r_t|_{L=1} &= \frac{1}{1-\alpha-\alpha_L}[\mu + \mu_L + (\beta + \beta_L)DJ_t]. \end{aligned} \quad (4)$$

We also show the impact of the Lehman event on the sensitivity (β_L) of the various returns to changes in economy-wide returns (DJ). The last two columns of Table 3 compare the idiosyncratic risks before and after the Lehman event; the risks are represented by the average

¹ The Ljung-Box tests for the standardized residuals and the squared standardized residuals show that no autocorrelation or GARCH effects remain in any of the models.

conditional variances $\bar{\sigma}_t^2|_{L=0}$ and $\bar{\sigma}_t^2|_{L=1}$.

After Lehman, the long-run returns of all indices decline and the macroeconomic sensitivity and the idiosyncratic risk are more pronounced, indicating a negative effect across the whole market. Compared with the two general stock indices, REITs have lower long-run returns, are more sensitive to changes in the Dow Jones index and have larger average volatilities over the whole observation period, indicating a higher risk of loss to investors. More importantly, the differences between REITs and general stocks in terms of return, sensitivity and idiosyncratic risk are much more pronounced after Lehman. This suggests that the 9/15 event has magnified the relative riskiness of REITs, all consistent with the findings of Anderson, Boney, and Guirguis (2010) and Jian and Anderson (2011,a,b).

Among the different categories of REITs, the industrial and office groups have lower long-run returns, while residential and multifamily REITs have relatively higher returns. Similar conclusions can be drawn for the sensitivity and for the idiosyncratic risk of these REIT groups. Therefore, it appears that residential or multifamily REITs are relatively safe in terms of portfolio and investment uncertainty even though they are closest to the subprime mortgage problem that triggered the subsequent financial and economic crisis. REITs focused on the other commercial property sectors tended to suffer a stronger adverse impact from the Lehman event. At first glance, this may seem contrary to intuition, but when examining the underlying operating characteristics and historical performance of each of the major real estate categories, the results are completely in-line with a market characterized by increased uncertainty. Both office and industrial are driven by the same demand drivers, namely GDP growth and employment growth. Both of these factors were and are still at question in the shaky economy. Additionally, for office, in down times, the costs associated with operating an office property tend to dramatically

increase. And, for both property types, the loss of a single tenant can have a dramatic impact on the NOI of the firm, certainly more than that in multi-family. Also, the lease structures, leasing commissions, etc. all present greater potential problems for office and industrial properties than they do for forms of residential real estate.

In comparing the performance of equity and mortgage REITs, we find that mortgage REITs perform worse than equity REITs before 9/15, with lower long-run returns, higher sensitivity and volatility, but better than equity REITs after 9/15. This is simply a timing issue. The market, while not expecting the Lehman event, certainly was concerned that firms like Lehman and Bear Stearns would suffer and that the capital in the real estate market would slow and firms that were capital providers would be in trouble. As such, more of the “event” was priced in the Mortgage REITs than in the Equity REITs. Once the Lehman event occurred, the equity REITs felt the pain as well.

<Table 3 about here>

A volatility plot analysis confirms the previous findings. Figure 1 plots the volatility of industrial REITs, office REITs, residential REITs and the NASDAQ index. It shows that the risk of residential REITs went up before the 9/15 event, relative to office REITs and industry REITs and, particularly relative to the NASDAQ index. The 9/15 event increases the risk of all REITs dramatically, and also relative to the NASDAQ. However, the impact of the 9/15 event on office and industrial REITs is much more significant than on residential REITs.

<Figure 1 about here>

A comparison of the volatility of mortgage and equity REITs is also consistent with the previous analysis (Figure 2). Mortgage REITs have already very strong peaks before the 9/15 event. After 9/15, the average level of risk increases, but by much less than that of other REITs.

However, there still are numerous extreme peaks for several months right after the 9/15 event. By contrast, the risk of equity REITs is negligible before 9/15, supposedly because the investments of equity REITs are relatively removed from the center of attention at that time, the private mortgage market. However, with the Lehman bankruptcy, the risk of equity REITs increases dramatically.

<Figure 2 about here>

4. Conclusion

In this paper, we performed the first direct tests of how REITs perform in periods of crisis relative to the general equities market. We utilize the Lehman event as the critical point that turned a subprime mortgage crisis into a full-fledged financial crisis. Using a two-regime GARCH model, we estimate the reaction of both return and conditional volatility. The empirical analysis is based on the performance of two general stock indices (NASDAQ and S&P 500) and several types of REIT indices. The paper uses daily returns for the time period from May 1, 2007, to May 11, 2009.

The results confirm that the negative shock of the financial crisis, as encapsulated by the 9/15 event, increased the risk of REITs as well as general stocks, as represented by the NASDAQ and S&P500 indices. More importantly, it magnified the relative performance and risks between REITs and general stocks, and also among different REIT categories. Compared with general stock indices, REITs display a lower long-run return, a higher macroeconomic sensitivity and a much more pronounced and persistent volatility since the beginning of the mortgage crisis, but particularly after the 9/15 event. Hence, the idea that REITs are safe investments that allow investors to ride out economic downturns requires a reassessment, at least to the extent that

downturns have their origin in the real estate sector.

Additionally, among different REIT property categories, residential or multifamily REITs turn out to be a better choice than industrial or office REITs in terms of their return and investment uncertainty, particularly after the 9/15 event; this is despite the fact that their investments are much closer to the origin of the financial crisis, the subprime mortgage problem, than the investments of the industrial or office REITs. Nevertheless, their underlying properties' characteristics help explain this result. In all, this study significantly adds to the understanding of how REITs impact portfolios when the markets are volatile.

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Table 1: Descriptive Statistics

Index	Mean of Return Series		Standard Deviation of Return Series		Impact of 9/15 event on the Log of the Stock Price Index
	pre 9/15	post 9/15	pre 9/15	post 9/15	
General Market					
Dow Jones	-0.000404	-0.00185	0.0118	0.0305	-0.017***
NASDAQ	-0.000326	-0.00162	0.0136	0.0336	-0.021***
SP500	-0.000496	-0.00193	0.0125	0.0338	-0.021***
REITs					
Residential	-0.000459	-0.00389	0.0227	0.0705	-0.028***
Multi-Family	-0.000454	-0.00398	0.0229	0.0716	-0.040***
Office	-0.000717	-0.00495	0.0210	0.0754	-0.055***
Industry	-0.000963	-0.00615	0.0236	0.0918	-0.035***
Retail	-0.000885	-0.00472	0.0229	0.0745	-0.033***
Shopping center	-0.000197	-0.00254	0.0239	0.0652	-0.032***
Hotel	-0.00167	-0.00381	0.0234	0.0869	-0.017***
Equity	-0.000633	-0.00402	0.0214	0.0696	-0.069***
Mortgage	-0.000271	-0.00197	0.0279	0.0531	0.001

Notes: The return series are log-differenced daily price indices from 05/01/07 to 05/11/09. The last column reports on the coefficient b of the OLS regression: $P_t = c + a_1 P_{t-1} + a_2 P_{t-2} + bL$, where P denotes the logged daily price index and L is a dummy variable for the Lehman bankruptcy, with $L = 0$ before 9/15 and $L = 1$ after 9/15. *** denotes significance at the 1% levels

Table 2: Regression Results of 2-Regime GARCH Model with Dow Jones Return as Control Variable

	NASDAQ	SP500	Residential	Multi-Family	Office	Industry	Retail	Shopping Center	Hotel	Equity	Mortgage
	0.001 (0.003)	-0.00001 (0.0001)	-0.0001 (0.0008)	-0.0001 (0.0008)	-0.0002 (-0.0007)	-0.0005 (0.0008)	-0.0004 (0.0008)	-0.0005 (0.0007)	-0.001 (0.001)	-0.00007 (0.0006)	-0.0006 (0.001)
	0.002 (0.008)	0.0002 (0.0003)	-0.0007 (0.003)	-0.0007 (0.003)	-0.002 (0.003)	-0.001 (0.004)	-0.001 (0.003)	-0.001 (0.003)	0.001 (0.003)	-0.0007 (0.003)	-0.0002 (0.003)
α	0.057*** (0.020)	-0.005 (0.009)	0.0003 (0.035)	-0.0007 (0.035)	-0.003 (0.033)	-0.018 (0.037)	-0.017 (0.034)	0.007 (0.034)	-0.003 (0.035)	-0.023 (0.032)	0.058*** (0.020)
α_L	-0.090*** (0.029)	0.014 (0.014)	-0.248*** (0.042)	-0.248*** (0.055)	-0.183*** (0.056)	-0.140*** (0.058)	-0.182*** (0.057)	-0.192*** (0.059)	-0.223*** (0.047)	-0.206*** (0.052)	-0.286*** (0.048)
β	1.059*** (0.026)	1.036*** (0.009)	1.363*** (0.064)	1.379*** (0.066)	1.364*** (0.057)	1.450*** (0.073)	1.475*** (0.064)	1.418*** (0.062)	1.398*** (0.073)	1.405*** (0.057)	1.590*** (0.070)
β_L	-0.002 (0.033)	0.065*** (0.014)	0.391*** (0.115)	0.392*** (0.114)	0.608*** (0.102)	0.953*** (0.144)	0.371*** (0.114)	0.377*** (0.108)	0.876*** (0.108)	0.423*** (0.100)	0.290*** (0.096)
η	0.00003*** (0.000)	0.00001*** (0.000)	0.0002*** (0.000)	0.0002*** (0.000)	0.0002*** (0.000)	0.0002*** (0.000)	0.0002*** (0.000)	0.0002*** (0.000)	0.00007*** (0.000)	0.0001*** (0.000)	0.0002*** (0.000)
ϕ	0.114* (0.064)	0.144*** (0.055)	0.174*** (0.058)	0.172*** (0.059)	0.090** (0.038)	0.139** (0.067)	0.157** (0.067)	0.201*** (0.076)	0.219*** (0.084)	0.166*** (0.069)	0.756*** (0.097)
ϕ_L	0.024 (0.130)	0.004 (0.011)	-0.155*** (0.067)	-0.157** (0.067)		0.002 (0.095)	-0.085 (0.079)	-0.158* (0.083)	-0.150* (0.092)	-0.117* (0.071)	-0.423*** (0.151)
φ									0.464*** (0.111)		
φ_L	0.549*** (0.024)	0.579*** (0.078)	0.867*** (0.029)	0.872*** (0.290)	0.829*** (0.033)	0.795*** (0.059)	0.829*** (0.039)	0.865*** (0.032)	0.436*** (0.107)	0.850*** (0.033)	0.497*** (0.078)
ML	2309.889	2720.225	1722.500	1712.498	1757.658	1664.173	1735.312	1733.582	1706.710	1786.862	1692.564
Q(10)	6.106	8.952	2.684	4.517	2.184	9.611	5.165	1.649	7.734	0.673	0.0313
Q_Sq(10)	1.267	0.132	0.014	0.127	0.0028	0.215	0.012	0.0004	12.060	0.003	0.0090

Notes: ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively; standard errors are in parentheses; ML is the log of the maximum likelihood value; Q(10) denotes the Ljung-Box test for autocorrelation in the standardized residuals for 10 lags; Q_Sq(10) stands for the Ljung-Box test for autocorrelation in the squared standardized residuals for 10 lags; The coefficients refer to those of Equation 1.

Table 3: Implied Statistics of the Impact by Lehman's Bankruptcy

	Long-run Return		Sensitivity		Idiosyncratic Risk	
	Pre 9/15 ($r_t _{L=0}$)	Post 9/15 ($r_t _{L=1}$)	Pre 9/15 (β)	Post 9/15 ($\beta_L + \beta$)	Pre 9/15 ($\bar{\sigma}_t^2 _{L=0}$)	Post 9/15 ($\bar{\sigma}_t^2 _{L=1}$)
General Market						
NASDAQ	0.000607	0.000117	1.059	1.057	0.0000354	0.0000869
SP500	-0.000426	-0.00186	1.036	1.101	0.0000101	0.0000188
REITs						
Residential	-0.000650	-0.00324	1.363	1.754	0.000251	0.00164
Multi-Family	-0.000656	-0.00326	1.379	1.771	0.000258	0.00171
Office	-0.000749	-0.00490	1.364	1.972	0.000195	0.00189
Industry	-0.00107	-0.00513	1.450	2.403	0.000278	0.00310
Retail	-0.000979	-0.00402	1.475	1.846	0.000234	0.00174
Shopping Center	-0.00108	-0.00407	1.418	1.795	0.000228	0.00178
Hotel	-0.00156	-0.00343	1.398	2.274	0.000271	0.00212
Equity	-0.000623	-0.00338	1.405	1.828	0.000189	0.00140
Mortgage	-0.00117	-0.00199	1.590	1.300	0.000541	0.00101

Figure 1: Volatilities of Industry, Office, Residential REITs and NASDAQ indices

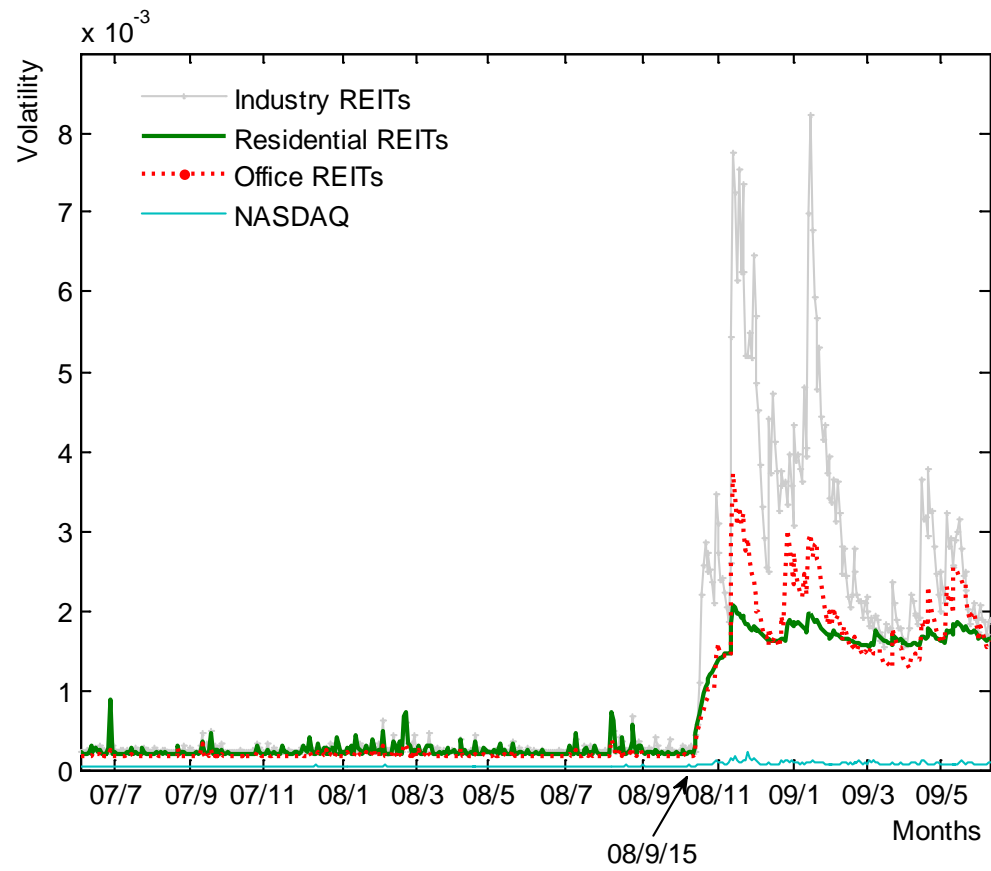


Figure 2: Volatilities of Mortgage and Equity REIT indices

