The Impact of Option Introduction on Real Estate Investment Trusts

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I. Introduction

The impact of option introduction on the returns and volatility of the underlying asset has been an issue examined in depth in the finance literature since Ross (1976) first suggested that the introduction of options expands the information set available to investors. Subsequent research has resulted in mixed findings as to the direction of the price reaction at the time of introduction as well as the resultant volatility of returns, size of spreads, and depth of the market for the underlying asset. Sorescu (2000) and Faff and Hillier (2005) among others suggest that differences in results may be due to variation in sample periods and fundamental differences in the underlying firms.

Although the relationship between option listing and the risk/return characteristics of the underlying equities has been widely examined in broad cross-sectional samples, real estate investment trusts (REITs) have been ignored in these studies. All previous evidence on option listings either specifically exclude this segment or was completed before options on REITs became widely available. The REIT sector only recently became large enough to support significant options activity so early research on option introduction would have few, if any, candidates to include in a sample. Subsequent research specifically removes these firms from consideration as REITs are often viewed as hybrid investments that have some characteristics that are similar to fixed income securities and others that are commonly seen in equities. As such, the REIT segment is often removed from consideration, but we believe that this industry warrants additional examination.

Lee and Stevenson (2005) determine that REITs deserve recognition as a separate asset class in mixed asset portfolios and serve as a hybrid investment falling between equities and fixed income securities on the risk/return continuum. Cotter and Stevenson (2006) note that the

lack of evidence on REIT risk characteristics stems from the relative youth of REITs as an asset class. They argue that studying REITs as an asset class has become increasingly important considering the growth, performance, and underlying risk and return characteristics of the sector. REIT market capitalizations passed the $200 billion mark in the middle of the current decade, and representatives from the REIT sector are increasingly included in benchmark indices. Inclusion in these large indices has increased fund flows into the industry, and Cotter and Stevenson suggest that this increases the need for money managers to understand the nature of the daily volatility of REITs to help them better hedge their investments. The authors also note the lack of traded hedging instruments for REITs and suggest that this increases the complexity of risk management for this asset class. As recently as 1995, only 5% of REITs had listed equity options resulting in little interest in the nature of these securities.

We agree with these researchers that REITs are an increasingly important segment in financial markets, and it is extremely important for portfolio managers and other institutional investors to have an in depth understanding of the risk/return characteristics of REITs and the available derivative securities associated with REITs. In this paper we provide a foundation for that understanding as it relates to the introduction of options on REITs as well as the continued impact that the presence of these options have on the underlying securities. Specifically, we determine how the market reacts when an option is first introduced, and then we examine how the introduction of the option affects the volatility of the returns in addition to the trading volume and spreads for the underlying asset. We compare our findings for REITs with those results from prior research on option introduction for other equities to determine if specific characteristics of REITs lead to differences in the impact that the introduction has on initial returns, volatility, volume, and spreads of the underlying equities.

The following section reviews the related literature and more completely develops the testable hypotheses. The third section provides descriptive statistics for our sample and describes the data to be used in the empirical analysis. The next section describes and presents the results of the empirical analysis and in the final section we offer conclusions from the study and provide suggestions for future research.

II. Literature Review and Testable Hypotheses

Although no previous study examines the introduction of options on REITs, a number of studies look at the impact option listing has on the risk and return characteristics of non-REITs. In their seminal paper on option pricing, Black and Scholes (1973) prove that in a complete and frictionless market, options are redundant securities that can be synthesized in the riskless borrowing underlying equity markets. In this environment, option introduction would have no impact on risk or returns. Ross (1976) suggests however that in markets that are incomplete, option introduction does affect stock prices as the introduction expands the information set available to investors attempting to determine the intrinsic value of the asset. Grossman (1988) also suggests that options can have an impact on the underlying asset in a world where there are transaction costs and incomplete markets. Detemple and Selden (1991) are in agreement with Ross and Grossman and suggest that the introduction of options increases investor demand as it encourages new investors to enter the market. The increased demand should eventually lead to an increase in price for the underlying equity.

A separate theory on the impact of option listing on the underlying equity is developed from Miller's (1977) work that suggests that the presence of short sale constraints on securities results in an artificial imbalance in the supply-demand relationship. This imbalance caused by

pessimistic investors being unable to invest and profit from an expected decline in price eventually disappears upon the introduction of options. Consistent with this theory, one would expect a decline in stock price on announcement of the introduction of an option for an asset.

The empirical findings upon introduction of option trading have been mixed. Branch and Finnerty (1981), Conrad (1989), and Detemple and Jorion (1990) find evidence of positive abnormal returns to the underlying on announcement of option trading. A more recent study by Sorescu (2000) finds evidence that the positive price reaction at the introduction of options that was found in early studies changed to a significantly negative reaction in 1981. He suggests that this temporal change in the direction of the price reaction may be due to the introduction of index options in 1982, the implementation of regulatory changes in 1981, and/or the likelihood that options allow for a quicker spread of negative information in the market. Sorescu does not determine which, if any, of the above possibilities is the cause of the switch.

> **H1a:** There is a significant positive price reaction for the underlying REIT on announcement of the introduction of traded options.

Faff and Hillier (2005) examine the relation between option introduction and price impact on the underlying equity from a different perspective than that taken by earlier researchers and suggest that the lack of agreement of size or direction of changes in the price of the underlying is consistent with a new hypothesis. They discuss a subset of literature that suggests that when options are traded, informed traders leave the equity market and move to the derivative market to take advantage of the leverage properties of options. Faff and Hillier suggest that this exodus of informed traders to the options market may cause the price reaction of the equity. Their sample includes only UK option introductions, and they find that option introduction has a positive impact on price for their sample. They do suggest however that their hypothesis can be consistent

with expected increases and declines in price around option introduction. The authors claim that the direction of the price impact should be strongly related to the expected future returns of the firm and that an influx of informed traders into the options market with an expectation of poor future performance would result in a decline in price at option introduction.

> **H1b:** There is a significant negative price reaction for the underlying REIT on announcement of the introduction of traded options.

A number of researchers also examine the impact of option introduction on the volatility of the returns of the underlying equity, and again the evidence as to the significance and sign of the impact is mixed. Skinner (1989) and Conrad (1989) both document a decline in volatility of equity returns after the introduction of options, and Kumar, Sarin, and Shastri (1998) also find evidence that option listing reduces return volatility. Bollen (1998) examines the impact of options on the return volatility of the underlying equity using a longer sample period than the ones used in the earlier studies and by comparing changes in volatility after option introduction to volatility changes for a control group. He finds that option introduction does not significantly change the volatility of the returns of the underlying equity. As with the initial price reaction, there is some disagreement in results that may in part be due to a difference in sample period or in the method of calculation of volatility changes. For their sample of UK option introductions, Faff and Hillier (2005) find evidence of a significant increase in volatility of returns for the underlying equities which contrasts with the results of the studies on option introduction for US equities.

> **H2:** There is a significant change in the volatility of returns of the underlying REIT at the introduction of option trading.

Although the issue of the possibility of an endogenous relation between changes in stock trading characteristics and option exchange listing decisions was addressed by all of the above

mentioned authors, many researchers still concluded that the option listing event produced the decline in the volatility of returns of the equity. Mayhew and Mihov (2004) examine the endogeneity of this relationship and conclude that the reduced volatility is endogenous to the selection process and is not the result of the introduction of the option. They conclude that the decline in volatility is, in fact, a determinant of the decision to list options.

This result led to a more extensive examination by Danielsen, Van Ness, and Warr (2007) of some of the other characteristics that had become recognized in prior research as being affected by option listing. These authors suggest the importance of examining characteristics like trading volume, volatility, and the bid-ask spread to determine whether the introduction of options cause changes in these characteristics or whether option exchanges identify potential listings using changes in these characteristics as flags. Danielsen, Van Ness, and Warr conclude that these characteristics are a determinant rather than a result of the option listing.

> **H3a:** An introduction of traded options leads to changes in trading volume, volatility, and the bid-ask spread of the underlying REIT shares.
>
> **H3b:** Changes in volume, volatility, and the bid-ask spreads of the underlying REIT are the drivers in the exchange's decision to include listed options.

Although the theories, results, and conclusions of the reactions of prices and other related characteristics differ across many of the above described studies, there is one constant in all of them – REITs are not included in the samples. Whether this is a result of the scarcity of options on REITs during the sample periods for these studies, or due to the hybrid nature of REITs as a security and a decision to remove them from the sample so as to not complicate results, is not necessarily important. This constant does however give us an opportunity to provide a more complete foundation for understanding how the introduction of options on REITs impacts the underlying security. This is especially timely given the growing importance of REITs as an asset

class. Strong precedence exists in studies that compare stock price behavior for REITs and industrial equities that lead us to believe that there is the potential for the impact of options on REITs to differ from the impact of options on non-REIT equities. Even if REITs behave in a similar fashion to other equities when options are listed, researchers and portfolio managers that focus on this asset class will be interested in the impact option introduction has on REITs since this has not yet been documented for these assets.

A number of studies that examine the volatility of REIT returns suggest that an investigation into the impact of option introduction for REITs may produce results that differ from those for option listing for non-REITs and highlight the unique nature of REITs as compared to broader samples of equities. Chaudhry, Maheshwari, and Webb (2004) examine the cross-sectional determinants of the idiosyncratic portion of REIT volatility and find that the determinants of this risk in REITs differ from those of their industrial counterparts. Stevenson (2002) finds that monthly REIT volatility is influenced strongly by small cap stocks and value stocks and that equity REIT volatility impacts the volatility of other REIT types. Cotter and Stevenson (2006) model daily volatility and find that REIT volatility is time-varying and due to spillover effects from other equity indices. Cotter and Stevenson (2007) find that when volatility is modeled using daily data as opposed to monthly, the volatility is influenced more by large cap stocks. Ooi, Wang, and Webb (2009) further examine volatility in REITs by separating market and firm-specific volatility. They find that contrary to the relationship for many equities, firm-specific risk matters in REIT pricing and in fact is the most important type of risk for REITs. Although there is some disagreement as to what impacts the volatility of REIT returns, the studies do show that REIT volatility is unique to the sector and so we should expect that the introduction of options may have a different impact on REITs than on other equities.

In this paper, we examine the impact of option listing on the underlying REIT. As in the previous studies on option introduction for equities of industrial firms, we look at the initial price impact on the underlying and then the subsequent changes in return volatility, volume, and spread. We expect the price of REITs to change due to option listing but are unsure of the direction of change as the listing may expand the information set available to investors as Ross (1976) suggests or reduce short sale constraints as hypothesized by Miller (1977) or some combination of these theories. As with equity option introduction, we also expect to see changes in volatility of returns, volume, and spread. We compare initial reactions and changes in these characteristics for REITs with those found in earlier studies of non-REIT equities to see whether the effects of option listing hold across equity type.

Similar to Danielsen, Van Ness, and Warr (2007), we look at all of these data points prior to option listing to determine whether the option listing causes changes in these characteristics or whether the characteristics are a determinant of the listing as these authors claim is the case for non-REIT equities. To provide more information on the differences between option introduction for equities and for REITs, we compare our optionable REIT sample to REITs without options. In response to the findings of Sorescu (2000), we also look at various time periods in our sample to ensure that our results are not time period specific.

IV. Sample and Methods

We employ individual REIT daily implied return volatility data, from January 1996 through December 2006, made available from OptionMetrics.[1] We obtain REIT monthly and daily returns, prices, shares outstanding, and volume data from the Center for Research in

[1] OptionMetrics is a financial research and consulting firm specializing in econometric analysis of the options markets.

Security Prices database (CRSP) and book value of equity from the Compustat database. The CRSP and Compustat data is not restricted solely to REITs with options or to the period 1996-2006.

For the option sample, we use all REITs that have options traded on them with the condition that there is a least five years of prior stock return data. This is necessary for the calculation of the beta and the calculation of idiosyncratic realized volatility. To calculate the beta for REIT *j*, monthly REIT returns, *r*, are regressed on market returns over the prior 60 months:

$$r_{j,t} = \alpha_j + \beta_j MRET_t + \varepsilon_{j,t} \qquad (1)$$

where MRET is the return on the CRSP value-weighted index. Each subsequent month, the sample is updated to use only the prior 60 months, resulting in a rolling beta estimate for each REIT.

To determine whether there is a price reaction on the announcement of the option introduction, we use a standard event study methodology (Brown and Warner, 1985). Day 0 is the day when it is announced that the REIT will have traded options. We look for a price reaction around day 0 to see how the market interprets the news of option introduction. A significant positive stock price reaction is consistent with Ross's (1976) theory that option introduction expands the information set available to investors trying to determine the intrinsic value of the REIT. A significant negative reaction is consistent with Miller's (1977) short sale theory.

We also test whether volatility changes around introduction of traded options. Annual REIT volatility is presented as a percentage of S&P500 volatility each year after dividing the sample according to whether or not the REITs have traded options. Volatility is calculated as the mean of all monthly volatilities in the year where monthly volatilities are calculated as the

standard deviation of daily returns in the month. For each year in the sample period, we run a t-test for a difference in the means between the annual volatility for optionable REITs as compared to that for non-optionable REITs.

To further investigate this impact of options on price volatility, we also compare REIT characteristics prior to the introduction of the option to REIT characteristics following the introduction. Month 0 for a REIT in the sample is the first month that the option is traded. We look at volatility for REITs with options over several different windows of time. We use a baseline period from month -60 to month -1 and characterize this time period as pre-option. We examine volatility post-option for two different windows: month 1 to month 12 and month 1 to month 24.

We calculate two different volatility measures to use to examine volatility changes. To find the ADJVOL variable, we find individual monthly REIT volatility and subtract the volatility of the CRSP value-weighted index for the corresponding month. For the RELVOL variable, we find the ratio of the individual monthly REIT volatility to the volatility of the CRSP value-weighted index for the corresponding month. We average the ADJVOL and RELVOL variables for each firm across all months in a window. All variables are calculated for each REIT for each time frame examined. We estimate the volatility variables for each REIT over a window prior to the option introduction from month -60 to month -1 and compare these variables with corresponding ones calculated over the two periods following the introduction, from month 1 to 12 and month 1 to 24.

To test for differences in volatility pre- and post-option introduction, we subtract the average ADJVOL for each REIT in the baseline period [-60, -1] from the average ADJVOL for each REIT in periods [1, 12] and [1, 24]. We follow the same process for the RELVOL variable

over each of the windows. We find the average difference in each time period for each variable across all firms in the sample and then divide by the standard deviation to find a t-statistic for the difference in means between pre-option and post-option. Following a similar methodology, we also compare bid-ask spread and volume of the underlying REIT around option introduction.

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TABLE 1

REIT Volatility, Returns, and Volume Event Study

This table presents REIT volatility, return, and volume changes in event time, before and after introduction of traded REIT options. For each REIT, volatility, returns, and volume are calculated over the periods [-60, -1], [-60, -49], [-48, -37], [-36, -25], [-24, -13], [-12, -1], [1, 12], and [1, 24] where month 0 is the first month the REIT had traded options. Volatility for each period is calculated as the mean of all monthly volatilities in the period where monthly volatilities are calculated as the standard deviation of daily returns in the month. Adj Volatility is the difference between option specific REIT volatilities and CRSP value-weighted index volatilities. Rel Volatility is calculated as ratio of option specific REIT volatilities with CRSP value-weighted index volatilities. Panel A displays levels for each measure in each period. Panel B displays differences for the Adj Volatility, Rel Volatility, Excess Returns, and Rel Volume measures for the pre-option period ([-60,-1]) and post-option period ([1,12] and [1,24]). Differences in means t-statistics are shown in parentheses.

Panel A: Levels

Window	Adj Volatility	Rel Volatility	Excess Returns	Rel Volume
[-60, -1]	0.120	2.34	0.45%	0.067
[-60, -49]	0.167	2.90	-0.76%	0.067
[-48, -37]	0.158	2.77	0.11%	0.059
[-36, -25]	0.125	2.45	0.44%	0.064
[-24, -13]	0.090	2.00	1.39%	0.062
[-12, -1]	0.069	1.63	0.66%	0.077
[1, 12]	0.070	1.52	-0.69%	0.091
[1, 24]	0.087	1.66	-0.67%	0.092

Panel B: Differences

Window	Adj Volatility	Rel Volatility	Excess Returns	Rel Volume
[-60, -1]-[1,12]	0.050	0.813	1.14%	-0.024
	(2.18)	(4.01)	(2.77)	(2.50)
[-60, -1]-[1, 24]	0.033	0.675	1.12%	-0.025
	(1.32)	(3.15)	(3.17)	(2.48)

Figure 1 – Number of REITS Through Time

This figure presents the number of REITs listed on CRSP each year. To be included in the sample the REIT must have at least one monthly return observation in the year.

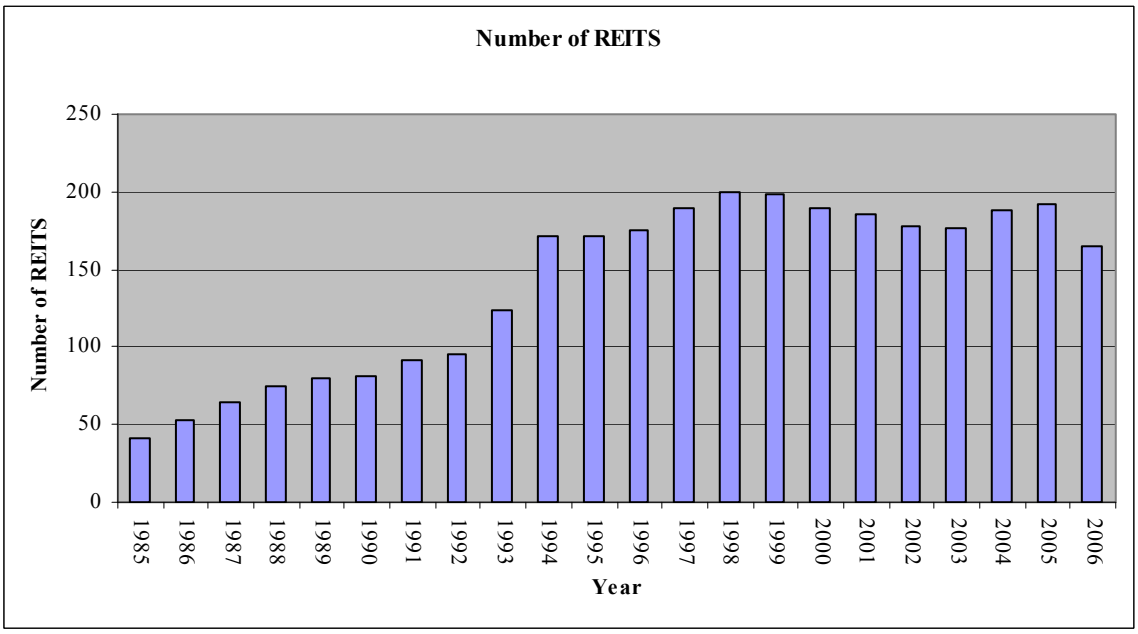

Figure 2 – Percentage of REITs with Traded Options

This figure presents the percentage of REITS listed on CRSP with OptionMetrics option data each year. To be included in the sample the REIT must have at least one monthly return observation in the year. To be considered an optionable REIT, at least one option observation must be listed in OptionMetrics in the year.

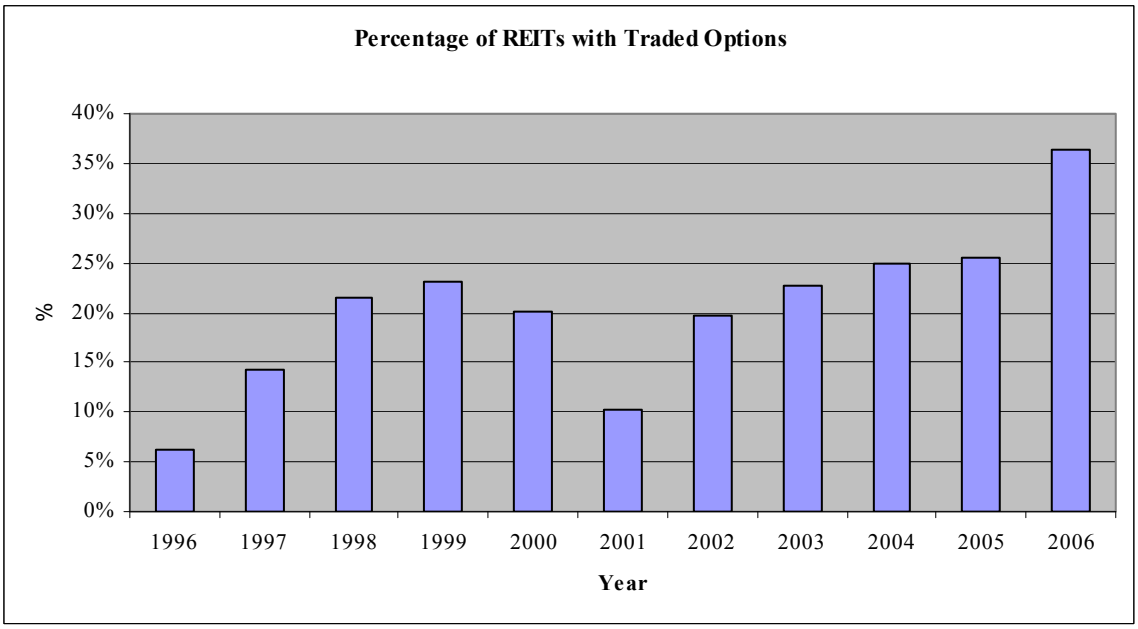

Figure 3 – REIT Volatility Through Time

This figure presents annual REIT volatility as a percentage CRSP VW volatility each year. Volatility is calculated as the mean of all monthly volatilities in the year where monthly volatilities are calculated as the standard deviation of daily returns in the month. To be included in the sample the REIT must have at least one monthly return observation in the year. To be considered an optionable REIT, at least one option observation must be listed in OptionMetrics in the year.

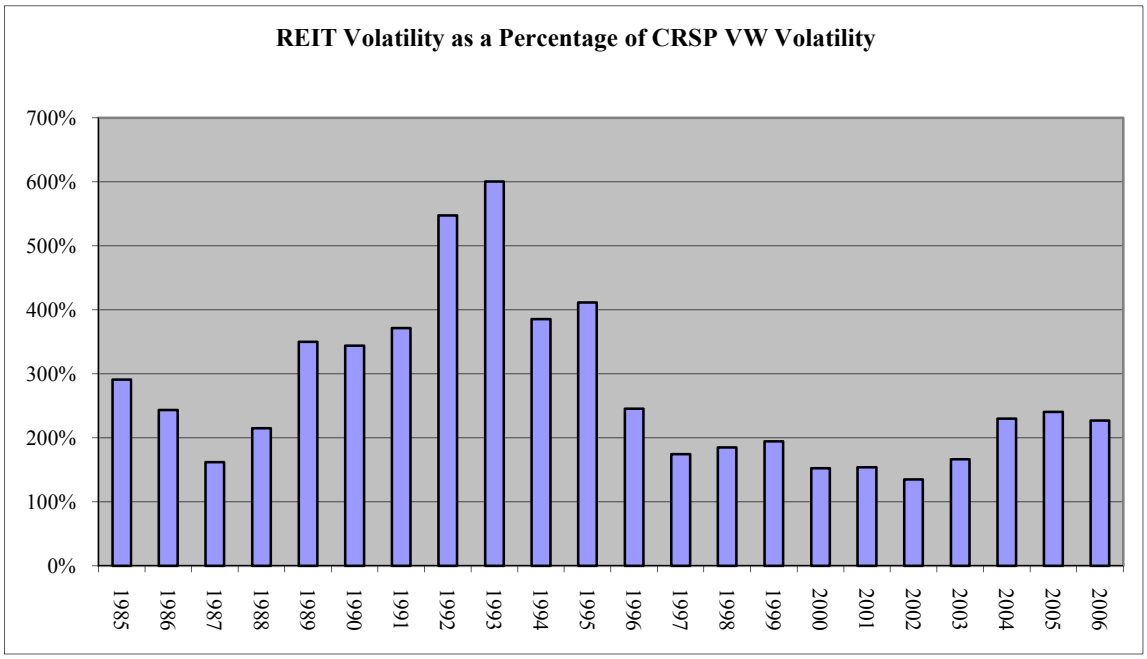

Figure 4 – REIT Volatility by Optionable or Non-Optionable

This figure presents annual REIT volatility as a percentage of CRSP VW volatility each year after dividing the sample according to whether or not they have traded options. Volatility is calculated as the mean of all monthly volatilities in the year where monthly volatilities are calculated as the standard deviation of daily returns in the month. To be included in the sample the REIT must have at least one monthly return observation in the year. To be considered an optionable REIT, at least one option observation must be listed in OptionMetrics in the year. ** and * indicates the difference between volatilities of optionable and non-optionable firms in the year is significant at the 10% and 5% levels respectively.

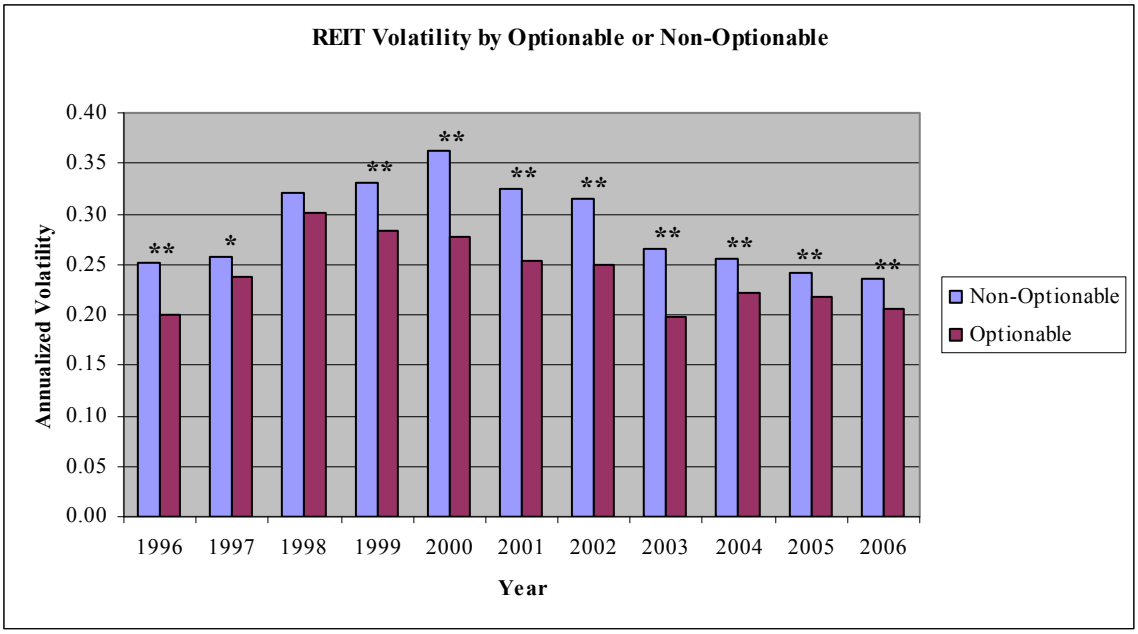

Chart 1 – Event Time Buy-and-Hold Excess Returns

This chart presents the mean buy-and-hold excess return to non-optionable REITs that later become optionable. Returns are presented in event time where each month [0] is the first month where options were traded for the REIT. Excess returns for each REIT are measured monthly as the difference between the REIT return and the CRSP Value-Weighted Index.

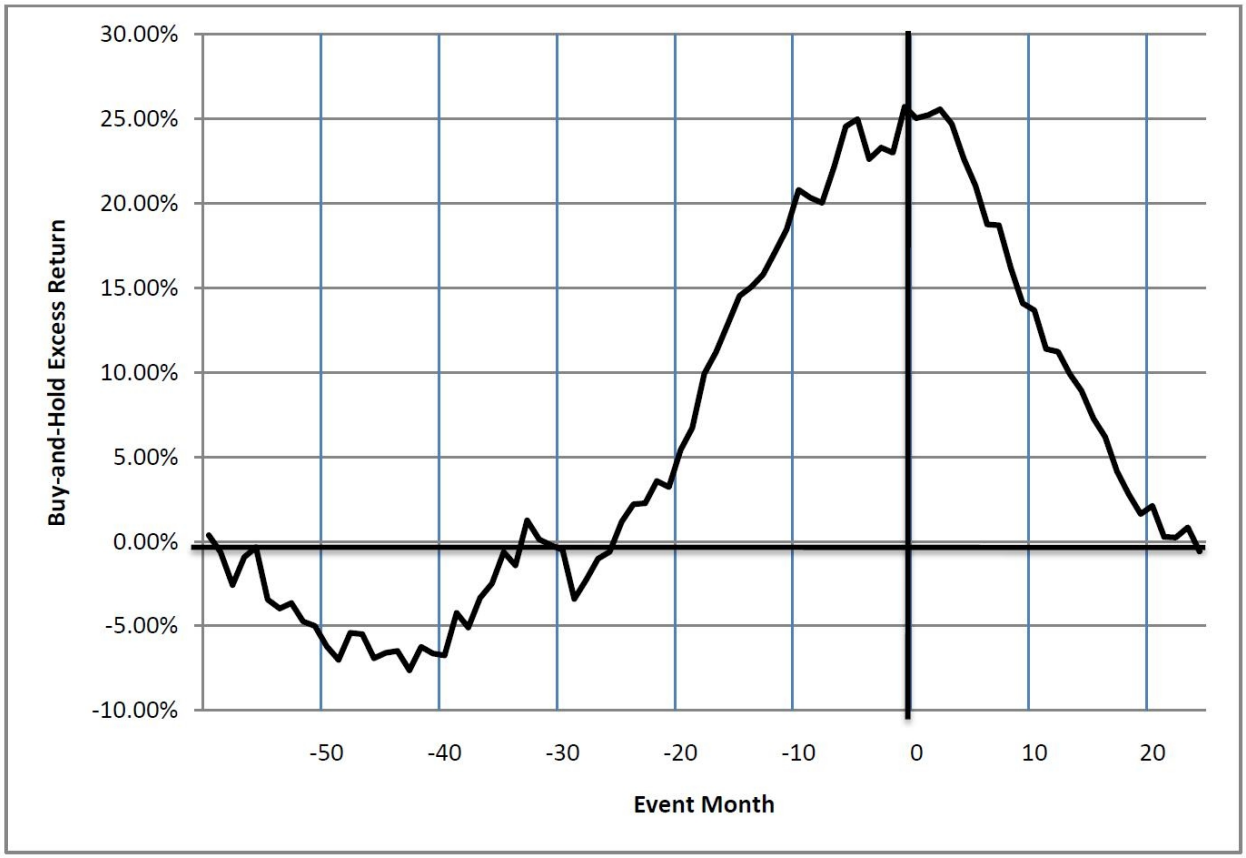

Chart 2 – Portfolio Buy-and-Hold Returns

This chart presents the buy-and-hold returns of portfolios of optionable and non-optionable REITs. Each month firms are classified as optionable or non-optionable based on whether options were traded for the REIT in the previous month.