

THE DISTRIBUTION OF REIT LIQUIDITY

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Abstract

In this study, we examine the distribution of market liquidity for a broad sample of real estate investment trusts (REITs). While prior research has focused on the average liquidity of REITs, we extend our analysis to include both the variability and skewness of liquidity, both of which have important implications. Excess variability in liquidity could present future uncertainty about the level of liquidity for REIT investors, which could impact returns as well as the efficacy of investment management. Increased skewness of liquidity is indicative of increased competition among market makers, which can result in better functioning financial markets. Our multivariate tests show that, consistent with the literature, average bid-ask spreads are higher for REITs than for non-REITs. We also find that the variability of bid-ask spreads is larger for REITs than for non-REITs and that the skewness of REIT bid-ask spreads has not only increased across time, but has also increased at a greater rate than the skewness of non-REIT spreads.

One of the primary functions of a real estate investment trust (REIT) is to provide liquidity for real estate assets, which are generally considered to be illiquid. The securitization of claims on real estate has improved market quality (Jain, Sunderman, and Westby-Gibson, 2012), enabled a broader group of investors' access to real estate investments, and enhanced the value of the underlying properties (Benveniste, Capozza, and Seguin, 2001). While the innovation of REITs provides investors more liquid exposure to an illiquid asset class, researchers have begun to examine the liquidity of REITs. For instance, Clayton and MacKinnon (2000) and Cannon and Cole (2011) have shown that the liquidity of REITs has increased over the last 20 years.

These studies, and others that similarly examine REIT liquidity, focus on the average levels of market liquidity. In practice, however, liquidity has many dimensions. For instance, the quantity or depth of the market and the speed of trading also play a role in determining the liquidity of financial securities. While prior research has focused on the average liquidity of REITs, we extend our analysis to include some additional dimensions of liquidity. In particular, we examine the variability and skewness of liquidity, both of which have important implications. Using bid-ask spreads as a measure of liquidity, we compare the liquidity of REITs to the liquidity of non-REITs. Consistent with prior work, we find that while average bid-ask spreads have decreased across time, spreads still remain higher for REITs than for non-REITs. However,

Persaud, and central bankers) that the principal concern about liquidity in financial markets is not the average level of liquidity, which has improved over time, but the variability and uncertainty of liquidity. Consistent with this idea, Chordia, Subrahmanyam, and Anshuman (2001) and Pereira and Zhang (2010) examine the risks associated with liquidity volatility. Given the propensity of real estate to follow very specific economic cycles, and the recent boom and bust period, the examination of how the variation in liquidity of REITs has changed through time and is impacted by these cycles could be insightful.

Following this line of research, we extend our analysis by examining the variability of liquidity for REITs and find that the standard deviation of bid-ask spreads is greater in REITs than in non-REITs, and similar to average spreads, it has decreased through time. Higher volatility of liquidity is consistent with the notion that REITs are more likely than non-REITs to experience liquidity droughts, which has broad implications given the illiquidity of underlying real estate assets during the recent financial crisis.

In addition, Roll and Subrahmanyam (2010) find that the skewness of liquidity is indicative of competition among market makers. In particular, they argue that greater competition among market makers will reduce the ability of market makers to cross-subsidize periods of higher asymmetric information with periods of lower asymmetric information. Consistent with this argument, the authors show that bid-ask spreads have become increasingly right-skewed and that the skewness of liquidity is related to information proxies such as institutional holdings and analyst following. Even though mean bid-ask spreads and the volatility of spreads have decreased for REITs across time, we still find that these moments of the liquidity distribution are greater than similar non-REITs. We examine the skewness of spreads in REITs and find that the skewness of bid-ask spreads has not only increased across time, but it has also increased at a greater rate for REITs than for non-REITs. It appears that although average spreads and spread volatility are higher for REITs compared to non-REITs, the increase in spread skewness has been greater for REITs than for non-REITs, suggesting that REITs have experienced greater competition in the provision of liquidity.

The remainder of the paper proceeds as follows. We first provide a brief review of the related literature. We next describe the sample and data and report the results of our multivariate analyses. We close with concluding remarks 5.

RELATED LITERATURE

While researchers have used many proxies for liquidity, many have focused on the average liquidity of a security (e.g., Amihud and Mendelson, 1986; Datar, Naik, and Radcliffe, 1998; Chordia, Roll, and Subrahmanyam, 2000; Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005; Sadka, 2006; and Han and Lesmond, 2011). Others have focused on the higher moments of the liquidity distribution. For example, Chordia, Subrahmanyam, and Anshuman (2001) posit that stocks with greater liquidity volatility will command a return premium; however, their evidence is inconsistent with their hypothesis. Johnson (2008) examines the variance of liquidity to reconcile

the empirical result that volume and liquidity have been unrelated historically. He finds that volume is positively related to the variance of liquidity, although volume and liquidity remain unrelated. Further, Roll and Subrahmanyam (2010) report that the skewness of bid-ask spreads has increased across time. They argue that this observation is likely because competition among liquidity providers has reduced the ability of market makers to widen spreads during periods of low asymmetric information to subsidize periods of high asymmetric information.

Several researchers have studied the liquidity of REITs; however, the REIT liquidity literature has primarily focused on average liquidity. For example, Nelling, Mahoney, Hildebrand, and Goldstein (1995) examine the bid-ask spreads of REITs from 1986 to 1990 and find that spreads are inversely related to market capitalization but do not vary by asset type. Bhasin, Cole, and Kiely (1997) study how the dramatic growth of REITs in the early 1990s affected liquidity. They find that REIT spreads narrowed dramatically and that REIT spreads are similar to non-REIT spreads in that REIT spreads are determined by return variability, share price, exchange listing, and asset type. However, in contrast to Mahoney, Hildebrand, and Goldstein, they do not find any relation between REIT spreads and market capitalization. Clayton and MacKinnon (2000) also examine REIT liquidity in the early 1990s and find that substantial increases in liquidity are related to organizational structure, which is consistent with a decline in asymmetric information faced by market makers. Other papers have studied the relationship between REIT liquidity and market value (e.g., Benveniste, Capozza, and Seguin, 2001), REIT liquidity and order flow spillovers (e.g., Subrahmanyam, 2007), or compared REIT liquidity and that of common stocks (e.g., Bertin, Kofman, Michayluk, and Prather, 2005). Danielsen and Harrison (2000) examine how the potential for private information affects the liquidity of REITs. They find that REITs with more focused portfolios are easier to value and are thus more liquid. Brounen and Koning (2012) look at the performance of REITs internationally. Additionally, Danielsen and Harrison (2007) find that REIT investments in financial instruments instead of hard assets are correlated with higher spreads and volume.

In more recent years, other researchers have continued to study REIT liquidity in a variety of settings. For instance, Huang, Liano, and Pan (2011) study the motives and impact of stock splits made by REITs. They find a short-term increase in REIT liquidity after the split but the liquidity reverts back to normal after the ex-date. They conclude that REITs split their shares to attract attention rather than to improve long run liquidity. Jain, Sunderman, and Westby-Gibson (2012) analyze the market quality differences between REITs and common stocks and find that the 2008 financial crisis significantly influenced the market quality for REITs with increased liquidity, volume, number of trades, and number of quotes post-crisis. Cannon and Cole (2011) examine changes in the average REIT liquidity from 1988 to 2007 using bid-ask spreads, dollar volume, and Amihud's (2002) measure of price impact. They report that the average liquidity of a REIT is a positive function of the volatility of stock returns and a negative function of dollar volume turnover, share price, and market capitalization. Given the liquidity provision of short selling, Blau, Hill, and Wang (2011) show that short selling in REITs is less than short selling in non-REITs, which could be one of the reasons why REITs appear to have a different distribution of liquidity.

With the growing emphasis on other dimensions of stock liquidity (e.g., Persuad, 2003; Roll and Subrahmanyam, 2010) and the increased interest in REIT liquidity, a natural extension of the literature is to examine the distribution of liquidity for REITs by focusing on higher moments of liquidity. To the best of our knowledge, our paper is the first to consider these other dimensions of liquidity in REITs.

DATA DESCRIPTION

The data used in this analysis come from several sources. We start with the universe of REITs obtained from the Ziman REIT database on the Center for Research on Security Prices (CRSP) for the modern REIT era (1993–2011). Given the stark differences between equity REITs and mortgage REITs, we focus our analysis on equity REITs, which we identify following Feng, Price, and Sirmans (2011). We then create a non-REIT sample that consists of securities available on CRSP that (1) are not part of the REIT universe and (2) are matched to a corresponding REIT using a propensity score that focuses on the size of the firm, as well as the book-to-market ratio.

From CRSP, we gather closing bid prices and closing ask prices at the daily level. Recently, Roll and Subrahmanyam (2010) and Chung and Zhang (2014) show that using closing bid and ask prices to calculate the bid-ask spreads provides a very close approximation of the more traditional measures of bid-ask spread that are calculated using high-frequency data.¹ From CRSP, we also gather market capitalization (*Mkt Cap*), prices (*Prices*), and trading volume (*Volume*) at the monthly level. Using CRSP daily returns, we estimate monthly *Beta* from a daily three-factor Fama-French model (FF3). Further, we take the standard deviation of residuals from the FF3 as our estimate of idiosyncratic volatility (*Idiovolt*).

In order to examine the distribution of liquidity for REITs versus non-REITs, we calculate the mean bid-ask spread (*Mean Spread*) as the average of the relative spread (dollar spread divided by the spread midpoint) at the monthly level. Using the daily bid-ask spreads, we also calculate the standard deviation of bid-ask spreads (*Std. Dev. Spread*) at the monthly level. Finally, we follow Roll and Subrahmanyam (2010) and estimate the skewness of daily closing bid-ask spreads (*Skew Spread*) for a particular month.

After excluding observations with missing data, our final sample includes 8,420 monthly REIT observations (203 unique equity REITs) and 8,420 monthly non-REIT observations from 1993 to 2011. Exhibit 1 reports the summary statistics.

While the mean spread for REITs is 0.0147, the mean spread for a matched sample of non-REITs is 0.0132, which is statistically different at the 1% level. The average REIT in our sample has a standard deviation of 0.0061 or just over 0.5%, and a liquidity skewness of 1.4881. In comparison, non-REITs spreads have a lower skewness (significant at the 1% level) while there is no real difference in spread volatility between REITs and non-REITs. The average REIT has a market cap of \$1.48 billion, which is not statistically different from that of the matched sample. This

Exhibit 1
Summary Statistics

Variable	REIT		Non-REIT		Difference Tests	
	Mean	Median	Mean	Median	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Mean Spread</i>	0.0147	0.0081	0.0132	0.0088	0.0015** (4.85)	-0.0008 (1.45)
<i>Std. Dev. Spread</i>	0.0061	0.0038	0.0062	0.0037	0.00 (-0.76)	0.0001 (0.34)
<i>Skew Spread</i>	1.4881	1.0458	1.1992	0.8522	0.2889** (10.74)	0.1936** (-9.65)
<i>Mkt Cap</i> (\$M)	1,487.6090	631.4172	1,334.6168	411.1257	152.992** (3.30)	220.291** (-13.99)
<i>Price</i>	26.0397	21.8600	28.3646	23.0713	-2.3249** (-5.49)	-1.2113** (7.24)
<i>Volume</i> (1,000s)	24,753.3373	6,242.1000	19,606.4502	3,114.4000	5,146.89** (4.63)	3,127.70** (-23.13)
<i>Beta</i>	0.6624	0.5117	0.6077	0.5064	0.0547** (5.82)	0.0053** (-5.49)
<i>Idiovolt</i>	0.0167	0.0130	0.0168	0.0133	0.00 (-0.54)	-0.0003* (2.38)

Notes: The table reports the summary statistics. *Mean Spread* is the average relative bid-ask spreads (bid-ask/midpoint) that is calculated using the daily closing bid and ask prices, during a particular month. Using these daily bid-ask spreads, we also calculate the standard deviation of bid-ask spreads (*Std. Dev. Spread*) at the monthly level. *Skew Spread* is an estimate of the skewness of daily closing bid-ask spreads during a particular month. *Mkt Cap* is the monthly market capitalization. *Price* is the closing monthly price according to CRSP. *Volume* is the monthly volume that is obtained from CRSP. Using daily returns, we estimate a daily three-factor Fama-French model (FF3) in order to obtain monthly estimates of *Beta*. Further, we take the standard deviation of residuals from the FF3 as our estimate of idiosyncratic volatility (*Idiovolt*). Non-REITs are CRSP firms that are not included in the Ziman database and are matched by size and book-to-market ratios. The number of observations is 8,420. *t*-statistics are in parentheses in column (5) and Wilcoxon results are in parentheses in column (6).

* Significant at the 5% level.

** Significant at the 1% level.

is not unexpected given that one of the matching criteria is size. In addition, an average REIT has a *Price* of \$26.04, *Volume* of 24.75 million shares traded per year, a *Beta* of 0.6624, and an *Idiosyncratic Volatility* of 0.0167. While *Price* is significantly lower in the non-REIT sample, *Volume*, *Beta*, and *Idiosyncratic Volatility* are all significantly higher. Given the differences in key variables that have been shown to be related to liquidity, it is important that we properly control for the additional variables in the tests that follow.

Exhibit 2 details how the different measures of liquidity have evolved through time. Columns (1) and (4) detail the mean spread, columns (2) and (5) detail the standard

Exhibit 2
Distribution of Liquidity by Year

Year	N	REIT			Non-REIT		
		Mean Spread (1)	Std. Dev. Spread (2)	Skew Spread (3)	Mean Spread (4)	Std. Dev. Spread (5)	Skew Spread (6)
1993	240	0.0281	0.0093	0.6878	0.0255	0.0075	0.2967
1994	371	0.0224	0.0079	0.6577	0.0232	0.0063	0.3092
1995	403	0.0259	0.0076	0.3551	0.0209	0.0056	0.1314
1996	427	0.0240	0.0061	0.3432	0.0201	0.0053	0.2303
1997	467	0.0231	0.0060	0.2780	0.0194	0.0054	0.3918
1998	498	0.0262	0.0066	0.6346	0.0217	0.0073	0.7627
1999	504	0.0347	0.0094	0.3894	0.0233	0.0086	0.6111
2000	504	0.0319	0.0097	0.4995	0.0233	0.0095	0.7495
2001	497	0.0184	0.0102	0.7014	0.0159	0.0085	0.8716
2002	493	0.0124	0.0091	0.6757	0.0121	0.0079	0.9332
2003	491	0.0074	0.0058	1.5377	0.0064	0.0052	1.2630
2004	504	0.0043	0.0033	2.4288	0.0054	0.0039	1.5346

Exhibit 2 (continued)
Distribution of Liquidity by Year

Year	N	REIT			Non-REIT		
		Mean Spread (1)	Std. Dev. Spread (2)	Skew Spread (3)	Mean Spread (4)	Std. Dev. Spread (5)	Skew Spread (6)
2005	535	0.0038	0.0034	3.2550	0.0048	0.0037	1.8408
2006	522	0.0034	0.0028	2.9429	0.0042	0.0030	1.8240
2007	485	0.0039	0.0034	3.3819	0.0049	0.0039	1.9542
2008	469	0.0073	0.0084	3.3015	0.0113	0.0111	3.0528
2009	464	0.0065	0.0047	1.9893	0.0126	0.0096	1.8200
2010	473	0.0037	0.0018	1.2509	0.0042	0.0032	1.6661
2011	473	0.0035	0.0018	1.8843	0.0035	0.0024	1.5965

Notes: This table shows the distribution of liquidity through time. Measures are reported by year for both REIT and non-REIT firms. *Mean Spread* is the average relative bid-ask spreads (bid-ask/midpoint) that is calculated using the daily closing bid and ask prices, during a particular month. Using these daily bid-ask spreads, we also calculate the standard deviation of bid-ask spreads (*Std. Dev. Spread*) at the monthly level. *Skew Spread* is an estimate of the skewness of daily closing bid-ask spreads during a particular month). Non-REITs are CRSP firms that are not included in the Ziman database and are matched by size and book-to-market ratios.

deviation of spread, and columns (3) and (6) detail the skewness of spread. Although the mean spread has been steadily decreasing for both REIT and non-REIT firms alike, the impact of the recent financial crisis on liquidity is quite evident with a large increase occurring in 2009. The standard deviation of spreads for REITs follows a similar pattern and is in contrast to the non-REIT sample. While the mean and standard deviation for spread increased around the financial crisis, the skewness of the spread decreased. This could indicate that market makers were less willing to participate and compete during this time period.

RESULTS

In this section, we continue to examine how the distribution of REIT liquidity compares to non-REIT liquidity. First, we compare the distributional characteristics (including the mean, the standard deviation, and the skewness) of bid-ask spreads for our sample of REITs to those of non-REITs over different time horizons. Second, we shift our focus to a multivariate setting where we can better control for other factors that might influence liquidity. Finally, we explore the distribution of REIT liquidity across various property types.

TIME PERIOD ANALYSIS

Since Exhibit 2 shows that not only has the liquidity of REITs and non-REITs changed through time, but that specific events can also greatly impact the prevailing trends, we next examine subsamples that are divided by significant events. Exhibit 3 provides the results of a univariate analysis of REITs versus non-REITs by time period. Panel A provides the results for 1993–2000, which is prior to the decimalization of stock prices. Panel B provides the results for the post decimalization period, 2001–2011. Panel C provides the results for the REIT bubble period, which we define as 2003–2007.

Consistent with our previous results for the entire time period, we find that the mean spread of REITs is lower than the mean spread of non-REITs during the decimalization period (1993–2000). In addition, the standard deviation of spreads is higher for non-REITs in the pre-decimalization period while there is no real difference between the skewness of REIT spreads and that of non-REIT spreads. However, these findings are reversed in the post decimalization period (2001–2011) and during the REIT bubble period (2003–2007). While the standard deviation of spreads is never smaller for non-REITs compared to REITs during the later time periods, the skewness of spreads is significantly smaller for non-REITs. This higher skewness for REITs could be the result of the increased attention that real estate has received as an asset class. The increased attention could have attracted more market makers, which through competition increased the skewness of spreads. However, care needs to be taken when interpreting these results because of the known factors that influence liquidity that are not controlled for in this univariate setting.

Exhibit 3
Univariate Analysis of REITs vs. Non-REITs by Time Period

	REIT Sample		Non-REIT Sample		Difference	
	Mean	Mean	Mean	Mean	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 1993–2000 (<i>N</i> = 6,829)						
<i>Mean Spread</i>	0.0273	0.0192	0.0220	0.0168	0.0053** (9.06)	0.0023** (-10.26)
<i>Std. Dev. Spread</i>	0.0078	0.0055	0.0070	0.0052	0.0007** (3.97)	0.0002** (-4.44)
<i>Skew Spread</i>	0.4665	0.3678	0.4645	0.3319	0.002 (0.07)	0.0359 (-0.76)
Panel B: 2001–2011 (<i>N</i> = 10,812)						
<i>Mean Spread</i>	0.0068	0.0021	0.0077	0.0029	-0.0009** (-3.67)	-0.0007** (-7.59)
<i>Std. Dev. Spread</i>	0.0050	0.0023	0.0056	0.0024	-0.0007** (-3.26)	-0.0001** (-3.07)
<i>Skew Spread</i>	2.1334	1.7631	1.6631	1.2456	0.4702** (13.03)	0.5175** (13.86)
Panel C: 2003–2007 REIT Bubble (<i>N</i> = 5,074)						
<i>Mean Spread</i>	0.0045	0.0019	0.0051	0.0024	-0.0006* (-2.57)	-0.0005** (-5.44)
<i>Std. Dev. Spread</i>	0.0037	0.0022	0.0039	0.0022	-0.0002 (-1.02)	0 (0.22)
<i>Skew Spread</i>	2.7186	2.4504	1.6864	1.2213	1.0322** (20.17)	1.2291** (21.45)

Notes: This table shows the distribution of liquidity for different time periods. Measures are reported for both REIT and matched non-REIT firms. *Mean Spread* is the average relative bid-ask spread (bid-ask/midpoint) that is calculated using the daily closing bid and ask prices, during a particular month. Using these daily bid-ask spreads, we also calculate the standard deviation of bid-ask spreads (*Std. Dev. Spread*) at the monthly level. *Skew Spread* is an estimate of the skewness of daily closing bid-ask spreads during a particular month. Non-REITs are CRSP firms that are not included in the Ziman database and are matched by size and book-to-market ratios. *t*-statistics are in parentheses in column (5) and Wilcoxon results are in parentheses in column (6).

*Significant at the 5% level.

**Significant at the 1% level.

THE DISTRIBUTION OF LIQUIDITY: MULTIVARIATE ANALYSIS

Because of the many factors that influence liquidity, it is important to examine the differences between REIT and non-REIT liquidity in a multivariate setting. To do so, we estimate the following equation using pooled stock-month observations.

$$\begin{aligned}
\text{Liquidity Distribution}_{i,t} = & \beta_0 + \beta_1 \ln(\text{Volume}_{i,t}) + \beta_2 \ln(\text{Size}_{i,t}) + \beta_3 \text{Idiovolt}_{i,t} \\
& + \beta_4 \text{Beta}_{i,t} + \beta_5 \ln(\text{Price}_{i,t}) + \beta_6 D93-00_t + \beta_7 \text{REIT}_i \\
& + \beta_8 D93-00_t \times \text{REIT}_i + \varepsilon_{i,t}.
\end{aligned} \tag{1}$$

The dependent variable is either *Mean Spread*, *Std. Dev. Spread*, or *Skew Spread* for stock i in month t . The independent variables include the natural log of monthly volume for stock i ($\ln(\text{Volume}_{i,t})$), the natural log of market capitalization ($\ln(\text{Size}_{i,t})$), idiosyncratic volatility ($\text{Idiovolt}_{i,t}$), the estimate for beta ($\text{Beta}_{i,t}$) that is obtained from a daily FF3, and the closing price each month ($\text{Price}_{i,t}$). In addition, we include an indicator variable that captures the period when stocks traded on fractions of dollar.² Specifically, the indicator variable $D93-00_t$ is equal to one during the pre-decimalization period, or the period (1993–2000) before the minimum tick size was \$0.01, and is zero otherwise. We also include an indicator variable REIT_i , which equals unity if security i is classified as a REIT, and is zero otherwise. Further, we interact these two indicator variables ($D93-00_t \times \text{REIT}_i$) in order to determine whether the difference between the distribution of REIT/non-REIT bid-ask spreads is related to the pre-decimalization period.

Exhibit 4 reports the results from estimating equation (1) using pooled OLS regressions. Standard errors are clustered by firm and month (Peterson, 2009).³ Columns (1) and (2) report the results when the dependent variable is *Mean Spread*, columns (3)–(6) show the results when the dependent variable is *Std. Dev. Spread* and *Skew Spread*, respectively. Further, columns (1), (3), and (5) report the results when we do not include the interaction term ($D93-00_t \times \text{REIT}_i$) while columns (2), (4), and (6) show the results when the interaction variable is included.

The results in column (1) in Exhibit 4 show that, for the combined samples of REITs and non-REITs, average bid-ask spreads are inversely related to both $\ln(\text{Volume}_{i,t})$ and $\ln(\text{Size}_{i,t})$. These findings suggest that, on average, stocks that have higher trading volume and higher market capitalization have lower bid-ask spreads or higher liquidity. These results are consistent with the literature (e.g., McInish and Wood, 1992; Chan, Christie, and Schultz, 1995; Nelling, Mahoney, Hildebrand, and Goldstein, 1995; Bhasin, Cole, and Kiely, 1997). We also find that average bid-ask spreads are negatively associated with beta but positively associated with idiosyncratic volatility. These findings suggest that higher exposure to unsystematic risk results in higher bid-ask spreads, which is consistent with McInish and Wood (1992). Again, similar to prior studies, we find that average bid-ask spreads are inversely related to share prices. This result might be due to the construction of the relative spread. The spread is determined relative to the midpoint of closing bid and ask prices. Therefore, stocks with lower prices will have higher spreads as a percentage of closing stock prices. Consistent with the idea that bid-ask spreads have been decreasing over time, we find that the estimate for $D93-00$ is positive and significant, suggesting that spreads were larger during the pre-decimalization period (Bessembinder, 2003). Further, we are able to confirm that, after controlling for a variety of independent variables, the estimate for REIT is both positive and significant, suggesting that REITs are less liquid than non-REIT stocks. In economic terms, the estimate for REIT suggests that REITs have a bid-ask spread that is 48 bps higher than non-REITs.

Exhibit 4
Regressions Results

	<i>Mean Spread</i>		<i>Std. Dev. Spread</i>		<i>Skew Spread</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0309** (26.13)	0.0313** (26.51)	0.0131** (17.05)	0.0131** (16.86)	0.1601* (2.45)	0.1182 (1.83)
<i>Ln(volume)</i>	-0.0029** (-11.59)	-0.0029** (-11.94)	-0.0012** (-6.75)	-0.0012** (-6.72)	0.1681** (11.41)	0.1716** (11.93)
<i>Ln(size)</i>	-0.0014** (-5.75)	-0.0013** (-5.56)	-0.0004* (-2.54)	-0.0004* (-2.51)	-0.0192 (-1.08)	-0.0252 (-1.43)
<i>Beta</i>	-0.0023* (-1.98)	-0.0022* (-1.96)	-0.0016 (-1.84)	-0.0016 (-1.83)	0.0953* (2.15)	0.0852* (2.11)
<i>Idiovolt</i>	0.5617** (17.19)	0.5641** (17.34)	0.3317** (15.22)	0.3318** (15.22)	4.7842** (3.81)	4.5387** (3.64)
<i>Price</i>	-0.0000** (-4.91)	-0.0000** (-4.67)	-0.0000* (-2.46)	-0.0000* (-2.46)	0.0038** (5.76)	0.0036** (5.53)
<i>D93-00</i>	0.0121** (30.41)	0.0104** (28.31)	-0.0001 (-0.30)	-0.0001 (-0.62)	-1.1152** (-44.75)	-0.9440** (-30.18)
<i>REIT</i>	0.0048** (19.41)	0.0035** (16.72)	0.0014** (11.30)	0.0013** (8.35)	0.1867** (7.38)	0.3225** (8.93)
<i>D93-00</i> × <i>REIT</i>		0.0034** (6.53)		0.0001 (0.55)		-0.3534** (-7.70)
Adj. R ²	0.5013	0.503	0.3605	0.3605	0.1982	0.2005

Notes: The table reports the results from estimating the following equation using pooled security-month data.

$$\begin{aligned}
 \text{Liquidity Distribution}_{i,t} = & \beta_0 + \beta_1 \ln(\text{Volume}_{i,t}) + \beta_2 \ln(\text{Size}_{i,t}) + \beta_3 \text{Idiovolt}_{i,t} + \beta_4 \text{Beta}_{i,t} \\
 & + \beta_5 \ln(\text{Price}_{i,t}) + \beta_6 \text{D93-00}_t + \beta_7 \text{REIT}_i + \beta_8 \text{D93-00}_t \times \text{REIT}_i + \varepsilon_{i,t}.
 \end{aligned}$$

The dependent variable is either *Mean Spread* (columns (1) and (2)), *Std. Dev. Spread* (columns (3) and (4)), or *Skew Spread* (columns (5) and (6)) for stock *i* in month *t*. The independent variables include the natural log of monthly volume for stock *i* ($\ln(\text{Volume}_{i,t})$), the natural log of market capitalization ($\ln(\text{Size}_{i,t})$), idiosyncratic volatility ($\text{Idiovolt}_{i,t}$), the estimate for beta ($\text{Beta}_{i,t}$) that is obtained from a daily FF3, and the natural log of the closing monthly price ($\ln(\text{Price}_{i,t})$). We also include an indicator variable *D93-00*, which is equal to one during the pre-decimalization period, or the period before the minimum tick size was \$0.01 – zero otherwise. In addition, we include an indicator variable *REIT*, which equals unity if security *i* is classified as the REIT and zero otherwise. We also interact these two indicator variables ($\text{D93-00}_t \times \text{REIT}_i$) in order to determine whether the REIT/non-REIT difference between the distribution of bid-ask spreads is related to the pre-decimalization period. The number of observations is 17,640. *t*-statistics are reported in parentheses and are obtained after controlling for two-dimensional clustering.

*Significant at the 5% level.

**Significant at the 1% level.

Column (2) of Exhibit 4 reports the results when we include the interaction between $D93-00_i$ and $REIT_i$. Because the coefficients on the other variables are similar in sign and magnitude to those in column (1), we only discuss our findings for the interaction variable. We find that $D93-00_i \times REIT_i$ produces a positive estimate that is significantly different from zero at the 1% level. This finding is consistent with Bertin, Michayluk, Prather, and Kofman (2005), who show that friction-based measures of liquidity are higher for REITs than for non-REITs during the decimalization period. Our findings also support those in Cannon and Cole (2011) by showing that REIT spreads decreased over time. Further, the results in columns (1) and (2) provide support for the idea that while average spreads are lower during the post-decimalization period, REIT spreads have decreased at a greater rate than non-REIT spreads.

Next, we examine the variability of the bid-ask spread in columns (3) and (4) of Exhibit 4. The results in column (3) are qualitatively similar to those in column (4). Therefore, for brevity, we only discuss the regression results in column (4). First, we find that stocks with lower trading volume and higher market cap have higher spread volatility. Recall that the standard deviation of bid-ask spreads is an inverse proxy for liquidity (Chordia, Subrahmanyam, and Anshuman, 2001). Thus, these findings suggest that low trading volume and large stocks have low liquidity and are consistent with the results from columns (1) and (2) where liquidity is measured by mean spreads. We also find that spread volatility is positively associated with idiosyncratic volatility but is negatively associated with price while there is not a significant association between beta and spread volatility. Again, these results are generally consistent with those from columns (1) and (2). However, the coefficients on the indicator variable capturing the pre-decimalization period, $D93-00_i$, or on the interaction term, $D93-00_i \times REIT_i$, are not statistically different from zero, which stands in contrast to the results from columns (1) and (2). This result suggests that, unlike mean spreads, there is no evidence that spread volatility decreased during the post-decimalization period. As before, we find that the indicator variable $REIT$ produces a coefficient that is both positive and significant, suggesting that, on average, REITs are less liquid (in spread volatility terms) than non-REITs. Specifically, REITs have a spread volatility that is 13 bps higher than non-REITs (column (4)).

Columns (5) and (6) in Exhibit 4 report the results when we include the skewness of bid-ask spreads as the dependent variable. Roll and Subrahmanyam (2010) argue that greater (positive) skewness in bid-ask spreads can be due to increased competition among market makers. This increase in market making competition reduces the ability of market makers to cross subsidize higher spreads across periods of low asymmetric information. In the case of a single monopolist market maker, when asymmetric information between the trader and the market maker is low, the monopolist can charge a higher spread to subsidize the periods when asymmetric information is high. Greater competition forces the market maker to charge lower spreads generally and no longer allows for cross-subsidization across periods with different information asymmetry.

As before, we are able to draw similar conclusions whether or not we include the interaction between $D93-00_i \times REIT_i$. Therefore, for brevity, we focus our discussion on the results presented in column (6) in Exhibit 4 where the interaction term is

included. We find evidence that spread skewness is directly related to volume. These results are fairly intuitive and suggest that securities with more trading activity have greater market making competition and subsequently more positive skewness in bid-ask spreads. Consistent with findings in Roll and Subrahmanyam (2010), the indicator variable $D93-00$ produces a negative estimate, suggesting that spread skewness is higher in the more recent period than during the period prior to decimalization. In other words, these results suggest that spread skewness has increased over time. Interestingly, we also find that the indicator variable $REIT$ produces a positive and significant estimate, indicating that spread skewness is larger for REITs than for non-REITs. The coefficient on the interaction term, $D93-00_i \times REIT_i$ is both negative and significant. This negative estimate suggests that the larger spread skewness that is observed in REITs is more prevalent during the decimalization period. To the extent that spread skewness represents greater market making competition, as argued by Roll and Subrahmanyam (2010), a possible explanation for our findings is that the growth of REITs has attracted more market makers (whether in the form of dealers, specialists, or high-frequency traders). The REIT structure might also provide some insights as to why REIT spread skewness has increased at a rate greater than non-REIT spread skewness. Hardin and Hill (2008) argue that because REITs take more frequent trips to the capital markets, increased monitoring might mitigate asymmetric information. Less asymmetric information might suggest that REIT market makers do not need to cross-subsidize periods of asymmetric information, thus leading to higher levels of spread skewness. Further, the regulatory structure of REITs might also result in less asymmetric information relative to non-REITs. For instance, the majority of shares outstanding in REITs cannot be held by fewer than six shareholders. Also, REITs must pay out a minimum of 90% of taxable income in the form of dividends.⁴ These unusual regulatory structures might also reduce the level of asymmetric information, which causes less cross-subsidization across periods by REIT market makers.

Next, we estimate a variant of equation (1) by focusing on the period when the prices of REITs were highest. In particular, we estimate the following equation using both the REIT sample and the non-REIT sample.

$$\begin{aligned}
 \text{Liquidity Distribution}_{i,t} = & \beta_0 + \beta_1 \ln(\text{Volume}_{i,t}) + \beta_2 \ln(\text{Size}_{i,t}) + \beta_3 \text{Idiovolt}_{i,t} \\
 & + \beta_4 \text{Beta}_{i,t} + \beta_5 \ln(\text{Price}_{i,t}) + \beta_6 D93-00_i + \beta_7 D03-07_i \\
 & + \beta_8 REIT_i + \beta_9 D03-07_i \times REIT_i + \varepsilon_{i,t}.
 \end{aligned} \tag{2}$$

The dependent and independent variables are the same as in equation (1) with two exceptions. First, we include an additional indicator variable $D03-07$ that represents the period when both real estate prices and REIT prices were highest. Second, we include the interaction term $D03-07 \times REIT$ in place of $D93-00 \times REIT$. We report the results from estimating equation (2) using pooled OLS with controls for clustering in the error term in Exhibit 5.

As before, columns (1) and (2) in Exhibit 5 report the results when *Mean Spread* is used as the dependent variable. The estimates in these columns are similar in sign

Exhibit 5
REIT Bubble Period

	<i>Mean Spread</i>		<i>Std. Dev. Spread</i>		<i>Skew Spread</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0313** (24.25)	0.0309** (23.79)	0.0134** (16.27)	0.0134** (16.29)	-0.3512** (-5.22)	-0.1721* (-2.50)
<i>Ln(volume)</i>	-0.0029** (-11.62)	-0.0029** (-11.68)	-0.0012** (-6.80)	-0.0012** (-6.80)	0.1893** (13.23)	0.1975** (13.78)
<i>Ln(size)</i>	-0.0013** (-5.72)	-0.0013** (-5.62)	-0.0004* (-2.49)	-0.0004* (-2.51)	-0.0332 (-1.87)	-0.0465** (-2.66)
<i>Beta</i>	-0.0023* (-1.98)	-0.0023* (-1.98)	-0.0016 (-1.84)	-0.0016 (-1.84)	0.0815* (2.15)	0.0848* (2.08)
<i>Idiovolt</i>	0.5581** (16.45)	0.5594** (16.46)	0.3290** (14.76)	0.3289** (14.76)	9.7831** (7.44)	9.1394** (7.00)
<i>Price</i>	-0.0000** (-4.92)	-0.0000** (-4.78)	-0.0000* (-2.47)	-0.0000* (-2.47)	0.0038** (5.92)	0.0034** (5.51)
<i>D93-00</i>	0.0118** (27.39)	0.0118** (27.32)	-0.0003 (-1.02)	-0.0003 (-1.02)	-0.7555** (-26.40)	-0.7526** (-26.35)
<i>D03-07</i>	-0.0005 (-1.89)	0.0005 (1.60)	-0.0004* (-2.24)	-0.0005* (-2.20)	0.7078** (20.16)	0.1961** (4.34)
<i>REIT</i>	0.0048** (19.44)	0.0054** (17.27)	0.0014** (11.32)	0.0013** (8.87)	0.1836** (7.34)	-0.1158** (-4.23)
<i>D03-07</i> × <i>REIT</i>	-0.0021** (-6.22)	0.0002 (0.90)	1.0283** (18.32)			
Adj. R ²	0.5014	0.502	0.3607	0.3607	0.2203	0.237

Notes: The table reports the results from estimating the following equation using pooled security-month data.

$$\begin{aligned}
 \text{Liquidity Distribution}_{i,t} = & \beta_0 + \beta_1 \ln(\text{Volume}_{i,t}) + \beta_2 \ln(\text{Size}_{i,t}) + \beta_3 \text{Idiovolt}_{i,t} + \beta_4 \text{Beta}_{i,t} \\
 & + \beta_5 \ln(\text{Price}_{i,t}) + \beta_6 \text{D93-00}_t + \beta_7 \text{D03-07}_t + \beta_8 \text{REIT}_i + \beta_9 \text{D93-00}_t \times \text{REIT}_i \\
 & + \beta_{10} \text{D03-07}_t \times \text{REIT}_i + \varepsilon_{i,t}.
 \end{aligned}$$

The dependent variable is either *Mean Spread* (columns (1) and (2)), *Std. Dev. Spread* (columns (3) and (4)), or *Skew Spread* (columns (5) and (6)) for stock *i* in month *t*. The independent variables include the natural log of monthly volume for stock *i* ($\ln(\text{Volume}_{i,t})$), the natural log of market capitalization ($\ln(\text{Size}_{i,t})$), idiosyncratic volatility ($\text{Idiovolt}_{i,t}$), the estimate for beta ($\text{Beta}_{i,t}$) that is obtained from a daily FF3, and the natural log of the closing monthly price ($\ln(\text{Price}_{i,t})$). We also include an indicator variable D93-00_t , which is equal to one during the pre-decimalization period, or the period before the minimum tick size was \$0.01 – zero otherwise. And an indicator variable for the REIT bubble period D03-07_t . In addition, we include an indicator variable REIT_i , which equals unity if security *i* is classified as the REIT and zero otherwise. We also interact these two indicator variables ($\text{D03-07}_t \times \text{REIT}_i$) in order to determine whether the REIT/non-REIT difference between the distribution of bid-ask spreads is related to the bubble period. The number of observations is 17,640. *t*-statistics are reported in parentheses and are obtained after controlling for two-dimensional clustering.

* Significant at the 5% level.

** Significant at the 1% level.

and magnitude as those in the previous table. However, a few results are noteworthy. First, we find that the indicator variable *D93-00* produces an estimate that is positive and significant. This result is consistent with the idea that spreads, generally, were lower in a more recent time period. Second, the coefficient on the independent variable *REIT* is positive and significant, suggesting again that average bid-ask spreads are higher for our REIT sample than for our non-REIT sample. In economic terms, the coefficient on *REIT* suggests that REITs have bid-ask spreads that are 54 bps higher than the spreads of non-REITs (column (2)). Third, we find that the lower average spreads during the later period are driven by the period when real estate prices and REIT prices were highest as the interaction variable produces a negative and significant estimate in column (2). The interaction estimate indicates that, during the period when REIT prices were highest, REITs are more liquid than non-REITs. Economically, the bid-ask spreads of REITs were 21 bps lower than the spreads of non-REITs.

Columns (3) and (4) in Exhibit 5 show the results with spread volatility as the dependent variable. To the extent that high spread volatility reflects less liquidity, we find results that are qualitatively similar to those in columns (1) and (2). Specifically, we find that the coefficient on *REIT* is positive and significant in both columns (3) and (4), suggesting that REITs are in general less liquid than non-REITs. In economic terms, the estimate for *REIT* suggests that the spread volatility of REITs was 13 bps higher than the spread volatility of non-REITs generally (column (4)). However, in column (4), the coefficient on the interaction variable is positive but not significant. If a real estate/REIT bubble did indeed exist, then our findings suggest that REIT spreads were not unusually volatile (relative to non-REITs) during this bubble period.

Columns (5) and (6) in Exhibit 5 present the results from estimating equation (2) when we include *Skew Spread* as the dependent variable. Similar to before, we find that volume is directly related to the skewness of bid-ask spreads. We also find that the indicator variable *D93-00* produces an estimate that is negative and statistically significant. This negative estimate suggests that the skewness of bid-ask spreads increased during the decimalization period and is consistent with findings in Roll and Subrahmanyam (2010). In column (5), the estimate for the indicator variable *REIT* is positive and significant, suggesting that, in general, REITs have higher skewness in bid-ask spreads than non-REITs. However, when we include the interaction term *D03-07* × *REIT* (column (6)) the coefficient on *REIT* is no longer significant while the coefficient on the interaction variable is positive and significant. These findings indicate that the observed higher level of skewness in our REIT sample is driven by the period when REIT prices were highest. To the extent that positive skewness in bid-ask spreads represents greater market making competition that disallows for the cross-subsidization of higher spreads across periods of asymmetric information (Roll and Subrahmanyam, 2010), then the positive interaction estimate in column (6) suggests that, during the period when REIT prices were highest, market makers had the greatest difficulty cross subsidizing spreads during periods of low information asymmetry with spreads during periods with high information asymmetry.

THE DISTRIBUTION OF REIT LIQUIDITY—BY REIT PROPERTY FOCUS

Danielsen and Harrison (2007) show that the liquidity of REITs varies across property types. Therefore, in our final set of tests, we test whether REIT property types affect the moments of the liquidity distribution. We do so by estimating the following equation using pooled REIT-month data.

$$\begin{aligned}
 \text{Liquidity Distribution}_{i,t} = & \beta_0 + \beta_1 \ln(\text{Volume}_{i,t}) + \beta_2 \ln(\text{Size}_{i,t}) + \beta_3 \text{Idiovolt}_{i,t} \\
 & + \beta_4 \text{Beta}_{i,t} + \beta_5 \ln(\text{Price}_{i,t}) + \beta_6 \text{D93-00}_i + \beta_7 \text{Diverse}_i \\
 & + \beta_8 \text{Retail}_i + \beta_9 \text{Resident}_i + \beta_{10} \text{Office}_i + \beta_{11} \text{Storage}_i \\
 & + \beta_{12} \text{Lodging}_i + \beta_{13} \text{Health}_i + \varepsilon_{i,t}.
 \end{aligned} \tag{3}$$

For the most part, the dependent and independent variables have been defined previously. The only difference is that we include seven new indicator variables that capture the type of property focus of each REIT according to the NAREIT database. For instance, REITs that are classified as having a diverse property focus are given the value of one and are zero otherwise. Similarly, we create six other indicator variables that capture a retail property focus (*Retail_i*), a residential property focus (*Resident_i*), a commercial office building property focus (*Office_i*), a storage facility property focus (*Storage_i*), an additional lodging property focus (*Lodging_i*), and a health care property focus (*Health_i*). If a particular REIT is not classified as one of these seven focuses, they are classified as *Other*. *Other* is the omitted variable.

The results from estimating equation (5) after controlling for two-dimensional clustering are reported in Exhibit 6. Columns (1) and (2) report the results when *Mean Spread* is included as the dependent variable while columns (3) and (4) (columns (5) and (6)) present the results when *Std. Dev. Spread (Skew Spread)* is included as the dependent variable. In columns (1), (3), and (5), we only include the property focus indicator variables. Columns (2), (4), and (6) report the results from estimating the full model.

In column (1) in Exhibit 6, we find that the coefficients on *Retail*, *Resident*, *Office*, *Storage*, and *Health* are each negative and significant. These results suggest that REITs that focus in these property types have smaller bid-ask spreads than REITs that are classified as *Other* or *Diverse*. *Diverse* is the lone property type with a positive and significant estimate. When controlling for the other independent variables in column (2), we find quite different results. *Retail*, *Resident*, *Office*, and *Health* change sign, although some of them are not significantly different from zero. *Storage* has the same sign but loses significance and *Lodging* that was insignificant is now significant. Once again, the need to control for other factors that might influence liquidity is apparent.

The results in columns (3) and (4) in Exhibit 6 are qualitatively similar to the results in columns (1) and (2). Focusing mainly on the estimates in the full model (column (4)), we find that *Diverse*, *Office*, and *Lodging* are the only indicator variables that are positive and significantly different from zero. Columns (5) and (6) show very little

Exhibit 6 Property Type Analysis

	Mean Spread		Std. Dev. Spread		Skew Spread	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0165** (22.04)	0.0356** (33.32)	0.0078** (26.04)	0.0135** (27.91)	1.3661** (21.72)	0.2722* (2.45)
<i>Ln(volume)</i>		-0.0019** (-8.04)		-0.0006** (-5.20)		0.0974** (4.01)
<i>Ln(size)</i>		-0.0029** (-9.83)		-0.0010** (-7.37)		0.0343 (1.13)
<i>Idiovolt</i>		-0.0061** (-16.74)		-0.0032** (-19.68)		0.5230** (13.86)
<i>Beta</i>		0.5873** (35.93)		0.3077** (41.44)		2.8995 (1.71)
<i>Price</i>		0.0000 (1.33)		0.0000 (1.28)		0.0038** (4.04)
<i>D93-00</i>		0.0115** (28.29)		-0.0006** (-3.21)		-1.0919** (-25.77)
<i>Diverse_i</i>	0.0092** (8.29)	0.0081** (10.33)	0.0011* (2.46)	0.0016** (4.47)	-0.0946 (-1.02)	0.0972 (1.20)
<i>Retail_i</i>	-0.0039** (-4.42)	0.0012 (1.83)	-0.0029** (-8.12)	0.0000 (-0.11)	0.1785* (2.40)	0.1950** (2.94)
<i>Resident_i</i>	-0.0041** (-4.36)	0.0014* (1.98)	-0.0030** (-7.84)	0.0000 (0.12)	-0.0489 (-0.61)	0.0149 (0.21)
<i>Office_i</i>	-0.0031** (-3.37)	0.0043** (6.51)	-0.0021** (-5.52)	0.0010** (3.31)	0.2852** (3.66)	0.1007 (1.45)
<i>Storage_i</i>	-0.0065** (-3.83)	-0.001 (-0.79)	-0.0039** (-5.70)	-0.0007 (-1.25)	0.3097* (2.16)	0.3431** (2.74)
<i>Lodging_i</i>	0.002 (1.87)	0.0058** (7.32)	0.0005 (1.05)	0.0017** (4.74)	0.1433 (1.57)	-0.1201 (-1.46)
<i>Health_i</i>	-0.0033** (-3.09)	0.0025** (3.20)	-0.0023** (-5.43)	0.0005 (1.53)	0.1790* (1.99)	0.1456 (1.83)
Adj. R ²	0.0284	0.5206	0.0256	0.3897	0.0041	0.2506

Notes: The table reports the results from estimating the following equation using pooled REIT-month data. Only REITs are included in this analysis.

$$\begin{aligned}
 \text{Liquidity Distribution}_{i,t} = & \beta_0 + \beta_1 \ln(\text{Volume}_{i,t}) + \beta_2 \ln(\text{Size}_{i,t}) + \beta_3 \text{Idiovolt}_{i,t} + \beta_4 \text{Beta}_{i,t} \\
 & + \beta_5 \ln(\text{Price}_{i,t}) + \beta_6 \text{D93-00}_t + \beta_7 \text{Diverse}_i + \beta_8 \text{Retail}_i + \beta_9 \text{Resident}_i \\
 & + \beta_{10} \text{Office}_i + \beta_{11} \text{Storage}_i + \beta_{12} \text{Lodging}_i + \beta_{13} \text{Health}_i + \varepsilon_{i,t}.
 \end{aligned}$$

The dependent variable is either *Mean Spread* (columns (1) and (2)), *Std. Dev. Spread* (columns (3) and (4)), or *Skew Spread* (columns (5) and (6)) for stock *i* in month *t*. The independent variables include the natural log of monthly volume for stock *i* ($\ln(\text{Volume}_{i,t})$), the natural log of market capitalization ($\ln(\text{Size}_{i,t})$), idiosyncratic volatility ($\text{Idiovolt}_{i,t}$), the estimate for beta ($\text{Beta}_{i,t}$) that is obtained from a daily FF3, and the natural log of the closing monthly price ($\ln(\text{Price}_{i,t})$). We also

Exhibit 6 (continued)
Property Type Analysis

include an indicator variable *D93-00*, which is equal to one during the pre-decimalization period, or the period before the minimum tick size was \$0.01 and zero otherwise. In addition, we include seven new indicator variables that capture the type of property focus of each REIT according to the NAREIT database. For instance, REITs that are classified as having a diverse property focus are given the value of one – zero otherwise (*Diverse*). Similarly, we create six other indicator variables that capture a Retail property focus (*Retail*), residential property focus (*Resident*), a commercial office building property focus (*Office*), a storage facility property focus (*Storage*), an additional lodging property focus (*Lodging*), and a health care property focus (*Health*). If a particular REIT is not classified as one of these seven focuses, they are classified as *Other*. *Other* is the omitted variable. The number of observations is 8,848. *t*-statistics are reported in parentheses and are obtained after controlling for two-dimensional clustering.

* Significant at the 5% level.

** Significant at the 1% level.

significance across property types. In fact, the only indicator variables in column (6) that produce a coefficient that is reliably different from zero are the variables *Retail* and *Storage*. REITs that are classified as having a *Retail* (*Storage*) property focus have a skewness that is 0.1878 (0.3431) units higher than REITs that are classified as having *Other* property focuses.

The results in Exhibit 6 support prior evidence in the literature that REIT liquidity varies across property-type focus. We find that the moments of the liquidity distribution also vary across property focuses.

CONCLUSION

Many of the researchers who examine REIT liquidity focus on the level of liquidity. While examining the average liquidity of a security is informative, the picture is often incomplete given the many dimensions of liquidity. In this paper, we examine the distribution of liquidity for REITs across some of these other dimensions. Consistent with prior research, we find that average bid-ask spreads are higher for REITs than for non-REITs. We also find that the standard deviation of bid-ask spreads is larger for REITs than for non-REITs. Thus, REIT investors are more likely to experience liquidity uncertainty than investors in common stocks as market conditions change. Further, we find that the skewness of bid-ask spreads has not only increased across time, but has also increased at a greater rate for REITs than for non-REITs. This suggests that competition between REIT market makers has increased more than competition between non-REIT market makers (Roll and Subrahmanyam, 2010).

In addition, we find that after controlling for other factors that influence liquidity REITs that hold diverse, office, lodging, and healthcare properties appear to have lower liquidity as measured by lower bid-ask spreads and spread volatility. Given the increased interest in securitized real estate over the past 20 years, understanding the distribution of liquidity might provide new insights on how the REIT market has evolved when compared to non-REITs. Further, a better understanding of the liquidity

distribution can provide an unusual look at the effect of varying market conditions on illiquidity as new types of securities are designed and brought to market.

ENDNOTES

1. Chung and Zhang (2014) find that the relation is stronger for NASDAQ stocks and is better specified in cross-sectional analysis. In unreported tests, we examine the robustness of our analysis with respect to these issues by including year fixed effects and an exchange indicator variable and find similar results.
2. Prior to 1997, stocks traded on 1/8ths of a dollar. Between 1997 and 2001, stocks traded on 1/16ths of a dollar. At the beginning of 2001, the NYSE lowered the minimum tick-size pricing increment to \$0.01.
3. We do not control for cross-sectional fixed effects because the indicator variable *REIT* does not vary across the time series. Therefore, including these fixed effects estimates would result in bias and inconsistent estimates. Also, the indicator variable *D93-00* does not allow us to control for time series fixed effects. Including time series fixed effects would violate the full rank condition required for asymptotically consistent estimates.
4. Prior to 2001, the minimum dividend requirement was 95% of taxable income.

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