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Changes in REIT Liquidity 1990–1994: Evidence from Intra-day Transactions

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This study uses data on intra-day transactions to analyze whether real estate investment (REIT) liquidity as measured by the bid-ask spread changed from 1990 to 1994, a period during which the industry's market capitalization increased from $8.7 billion to $45 billion. REIT percentage spreads (spread as percentage of share price) narrowed significantly, primarily attributable to higher share prices rather than narrower dollar-value spreads. An empirical model is used to analyze the determinants of percentage spreads. Return variance and share price, not market capitalization are found to be the primary determinants of percentage spreads in both periods. This suggests that the liquidity of REIT securities is similar to that of non-REIT securities with similar prices and return variance. In addition, percentage spreads are wider for REITs trading on the NASDAQ.

This article examines bid-ask spreads for evidence whether real estate investment trust (REIT) liquidity increased from 1990 to 1994. This was an important period for the REIT industry, during which the market capitalization of all tax-qualified REITs grew from $8.7 billion to $45 billion. The industry effectively doubled in size from 1990–1992 (from $8.7 billion to $15.7 billion), and redoubled during 1993 (to $32.1 billion).[1] Much of this explosive growth is attributable to the switch from private to public ownership of commercial real estate following the industry bust in the late 1980s. The switch from private to public ownership has been fueled in large part by the growing involvement of institutional investors seeking a more liquid vehicle for diversifying into commercial real estate. These investors, who were unable to liquidate their holdings in commingled real estate funds in a timely manner when the commercial real estate market tanked in the late 1980s, perceive REITs as offering a more liquid vehicle for investing in commercial real estate.

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[1] These figures are authors' calculations based upon data from CRSP and various editions of the *REIT Handbook*.

The claim that REITs offer greater liquidity than other real estate investment vehicles has not gone unchallenged. Many respected players in the institutional market argue that REITs are less liquid than proponents claim, pointing out that the market capitalization of most REITs is small enough that the typical-sized trade of an institutional investor could significantly affect transaction prices. Indeed, if multiple large investors were to attempt to sell their shares in response to a cyclical downswing or other event, they would only be able to do so at firesale prices. Because newly organized markets are often illiquid, the maturation of the REIT market, as evidenced by its explosive growth, begs a reexamination of market liquidity. This study addresses this issue by examining the changes in REIT liquidity from 1990 to 1994. The measure of liquidity adopted here is the difference between a security's bid and ask prices, or the bid-ask spread, expressed as a percentage of share price. Amihud and Mendelson (1986) state that, "Illiquidity can be measured by the cost of immediate execution." They argue that "a natural measure of illiquidity is the spread between the bid and ask prices." Ceteris paribus, larger bid-ask spreads are widely regarded as evidence of more illiquid securities. Hence, the spread expressed as a percentage of share price is a natural measure of the cost of immediate execution per dollar of investment. Demsetz (1968) was the first to analyze bid-ask spreads empirically, and numerous researchers have followed his pathbreaking work.[2]

Nelling, Mahoney, Hildebrand and Goldstein (1995) provide some evidence on the liquidity of REITs as measured by the bid-ask spread. They show that, for 1990, REIT bid-ask spreads are similar to the spreads on equities of similar size.[3] Somewhat disconcertingly (for the REIT industry), they also document *reductions* in REIT liquidity as measured by bid-ask spreads over the 1986–1990 period. However, that period predates the explosive growth in the REIT market during 1990–1994. The hypothesis examined is that this growth was accompanied by *increases* in REIT liquidity in part because of the entry into the market of large institutional investors. Consequently, this study examines changes in REIT liquidity as measured by the bid-ask spreads of all publicly traded REITs from 1990 to 1994.

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[2] Note that bid-ask spreads are only one measure of liquidity. In particular, bid-ask spreads can be a poor measure of liquidity if one desires immediate execution of a large trade.

[3] In contrast, Below, Kiely and McIntosh (1995) find that during 1991 spreads on equity REITs were significantly wider than those on similar non-REIT stocks. Using 1985–1986 for a sample of 42 REITs, Wei, Hsieh and Sirmans (1995) find that REIT spreads do not differ by asset type, but are related to whether or not the REIT is a captive firm.

One reason for an increased participation in the REIT market by institutional investors is that larger market capitalization REITs became available, thereby offering institutional investors the opportunity to purchase meaningful chunks of commercial real estate. Another reason is that the "five or fewer" restriction which states that no more than 50% of a REIT's stock could be held by five or fewer investors has essentially been relaxed. New legislation in 1993 directed the IRS to "look through" a large pension investor to the number of individual pension fund participants when applying the rule, thereby opening the door to increased institutional investment in REITs.

As the interest of institutional investors in REITs has increased, so has the interest of investment firms covering the REIT industry. With more investment firms covering each REIT, informational asymmetries between uninformed and informed traders should be reduced. Since informational asymmetries impose adverse selection costs on the market makers and are recovered through the bid-ask spreads, a reduction in informational asymmetries, should cause the bid-ask spreads to decrease.[4]

Data

Initial samples of REITs for 1990 and 1994 were identified using the 1992 and 1995 editions of the *REIT Handbook*, which provides detailed information on all tax-qualified REITs.[5] From this information, all REITs that traded on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX) or the NASDAQ market were identified.[6] This produced samples of 117 and 223 REITs for 1990 and 1994, respectively. The information in the *REIT Handbook* was used to identify the exchange on

[4] See, for example, Glosten and Milgrom (1985), Kyle (1985) and Easley and O'Hara (1987).

[5] The 1992 edition was used to identify REITs in existence as of year-end 1990, and the 1995 edition was used to identify REITs in existence as of year-end 1994. The 1992 edition was used because there was no 1991 edition. The 1992 edition identifies REITs that began trading after year-end 1990 and provides year-end 1990 data on invested assets and market capitalization.

[6] The *REIT Handbook* also identifies "other over-the-counter stocks," but the analysis in this article is limited to stocks trading on the NYSE, the AMEX or NASDAQ exchanges.

Table 1 ■ Number and market capitalization of REITs by exchange listing, asset type and market capitalization quartile, 1990 and 1994. Percentages of yearly totals appear in parentheses.

	1990		1994	
	Number of REITs	Market Capitalization ($ billions)	Number of REITs	Market Capitalization ($ billions)
All REITs	117	8.7	223	44.6
	(100)	(100)	(100)	(100)
Panel A: REITs by exchange listing				
NYSE	52	6.4	138	40.5
	(44)	(74)	(62)	(91)
AMEX	40	1.5	61	2.7
	(34)	(17)	(27)	(6)
NASDAQ	25	0.8	24	1.4
	(22)	(9)	(11)	(3)
Panel B: REITs by asset type				
Equity	58	5.6	178	39.3
	(49)	(64)	(80)	(88)
Mortgage	43	2.5	27	2.4
	(37)	(29)	(12)	(5)
Hybrid	16	0.6	18	2.9
	(14)	(7)	(8)	(7)
Panel C: REITs by market capitalization quartile				
First Quartile	30	0.2	56	0.8
	(25)	(2)	(25)	(2)
Second Quartile	29	0.6	56	3.5
	(25)	(7)	(25)	(8)
Third Quartile	29	1.4	56	11.0
	(25)	(16)	(25)	(25)
Fourth Quartile	29	6.5	55	29.3
	(25)	(75)	(25)	(66)

which each REIT traded and whether a REIT was classified as an equity, mortgage or hybrid REIT. The market capitalization of each firm was then derived from CRSP data.[7]

[7] NAREIT classifies REITs by asset type based upon the distribution of its invested assets. REITs holding at least 75% of invested assets in the form of equity is classified as an equity REIT, whereas a REIT holding at least 75% of invested assets in the form of mortgages is classified as a mortgage REIT. All other REITs are classified as hybrid REITs.

Table 1 shows the numbers and market capitalization of the two sample years by exchange listing, asset type and size (as measured by market capitalization quartile). During 1990, 44% of the 117 tax-qualified REITs traded on the NYSE, while 34% traded on the AMEX. The remaining 22% traded on the NASDAQ. Market capitalization was clearly skewed toward the NYSE, which accounted for 74% of the $8.7 billion industry total, while the NASDAQ accounted for only 9%. By asset type, almost half of the 117 REITs were classified as equity specialists, just over a third as mortgage specialists and the remainder as hybrids. Market capitalization was similarly distributed by type. By size, market capitalization was extremely skewed toward the largest firms, with the largest quartile accounting for 75% of the industry's 1990 market value.

During 1994, more than 60% of the 223 tax-qualified REITs traded on the NYSE, and these REITs accounted for more than 90% of the industry capitalization. Only 11% of REITs traded on the NASDAQ, and these 24 firms accounted for only 3% of the industry's $44.6 billion market capitalization. By asset type, four of five REITs were classified as equity specialists. These 178 firms also accounted for 88% of the industry's market capitalization. Thus, the bulk of the growth in the REIT industry was accounted for by equity REITs trading on the NYSE. By size, the market share of the largest quartile of REITs declined from 75% in 1990 to 66% in 1994. Over this same period, the second largest quartile's market share increased from 16% to 25%.

Next, the initial 1990 and 1994 samples of firms were cross-referenced with lists of firms from the Institute for the Study of Securities Market (ISSM) 1990 transaction file and from the New York Stock Exchange's Trading and Quotes (TAQ) 1994 transaction file. Data necessary to calculate bid-ask spreads were obtained for all but three of the firms in the initial samples.[8] The 1990 and 1994 transaction files were also used to obtain the data necessary to calculate daily averages for price and volume.

Two alternative measures of the bid-ask spread were calculated: a dollar spread and a percentage spread. For each quote, the dollar spread is the difference in the ask and bid prices, whereas the percentage spread is the difference in the ask and bid prices *divided* by the average of the ask and

[8] The 1990 ISSM tapes contained no transaction price data for three sample securities: CEDR, CMRT and PDLA. Consequently, these three firms were excluded from the remainder of the analysis. Since in aggregate these three firms accounted for only $23 million in market capitalization, their exclusion should have a negligible effect on the results.

bid prices.[9] The dollar and percentage spreads are then averaged by trading day. Closing spreads are not used because Harris (1989) has shown that the last transaction of the day tends to occur at the asking price, which can bias the results. Finally, the daily spread measurements for each security were averaged over all trading days in each year.

REIT Bid-Ask Spreads in 1990 and 1994

Table 2 presents 1990 and 1994 yearly average REIT bid-ask spreads as a percentage of share price for the industry and broken down by exchange listing, asset type and market capitalization quartile. Overall, the percentage

Table 2 ■ REIT bid-ask spreads as a percentage of share price, by exchange listing, asset type and market capitalization quartile, 1990 and 1994.

	1990		1994	
	Mean	Standard Error	Mean	Standard Error
All REITs	5.6	0.6	4.3	0.4
Panel A: REITs by exchange listing				
NYSE	3.9	0.6	3.4	0.5
AMEX	4.4	0.6	4.9	0.6
NASDAQ	11.6	2.0	7.7	1.5
Panel B: REITs by asset type				
Equity	4.5	0.7	3.5	0.3
Mortgage	6.0	0.9	7.0	1.3
Hybrid	8.6	2.5	8.6	2.3
Panel C: REITs by market capitalization quartile				
First quartile	10.0	1.5	9.5	1.1
Second quartile	5.3	0.6	3.6	0.4
Third quartile	4.4	0.7	2.0	0.1
Fourth quartile	2.1	0.2	1.8	0.1

[9] An alternative procedure calculates percentage bid-ask spreads for each trade by dividing the prevailing spread by the trade price. This procedure can lead to incorrect estimates because of the bid-ask bounce in trade prices. The bid-ask bounce is caused by buyer- and seller-initiated trades, where buyer-initiated trades transact at the asking price and seller-initiated trades transact at the bid price. The "correct" percentage spread would have the true price of the stock in the denominator, which lies close to the mid-point of the spread.

bid-ask spread declined from 5.6% in 1990 to 4.3% in 1994. The results of a *t*-test for difference in means indicates that this 1.33% difference is statistically significant at the 0.05 level.

Panel A shows that the overall decline in percentage spreads does not hold across exchange listings. While the spreads of NYSE REITs declined 0.5 percentage points from 3.9% to 3.4%, the spreads of AMEX REITs increased by 0.5 percentage points from 4.4% to 4.9%. The spreads of NASDAQ REITs declined 3.9 percentage points from 11.6% to 7.7%, but the number of NASDAQ REITs is very small (only 11% of the firms in 1994). None of these differences by exchange are statistically significant.

Panel B shows that the overall decline in percentage spreads has not been uniform across asset types. Indeed, it is attributable almost entirely to the decline in the spreads of equity REITs, whose numbers tripled over the sample period and accounted for 80% of the firms in 1994. Equity REIT spreads fell 1.0 percentage points from 4.5% to 3.5%. Spreads on mortgage REITs actually increased over this time period from 6.0% to 7.0%, while spreads of hybrid REITs remained unchanged at 8.6%. None of these differences by asset type are statistically significant.

Panel C shows that percentage spreads declined for each of the four market value quartiles, but that the two middle quartiles register the greatest declines. Spreads of the smallest firms declined from 10.0% to 9.5% and spreads of the largest firms declined from 2.1% to 1.8%. Hence, the percentage spreads of firms in the smallest quartile remained approximately five times those of firms in the largest quartile. Spreads of firms in the third quartile, however, fell by more than half from 4.4% to 2.0%, which was not significantly different from the 1994 spreads of firms in the largest quartile.

To investigate whether the declines in percentage spreads over the 1990–1994 period were driven by declines in the dollar-value spread, share price, or both, Table 3 presents average dollar-value spreads instead of percentage spreads. As shown at the top of Table 3, the average dollar spread actually widened from 30 cents to 35 cents during the 1990-1994 period, a 5 cent difference that is statistically significant at the 0.10 level. Panel A shows that dollar spreads increased for both NYSE and AMEX REITs, but declined for NASDAQ REITs. Only the NYSE increase (from 24 cents to 35 cents), however, is statistically significant. Panel B shows that dollar spreads increased for all three asset types, but only the increase for mortgage REITs (from 23 cents to 31 cents) is statistically significant. Panel C shows that dollar spreads increased for all firms except those in the smallest size quartile. The increases for the second and fourth quartiles are

Table 3 ■ REIT bid-ask spreads in dollars, by exchange listing, asset type and market capitalization quartile, 1990 and 1994.

	1990		1994	
	Mean	Standard Error	Mean	Standard Error
All REITs	0.30	0.02	0.35	0.01
Panel A: REITs by exchange listing				
NYSE	0.24	0.01	0.35	0.01
AMEX	0.22	0.01	0.28	0.02
NASDAQ	0.58	0.09	0.51	0.07
Panel B: REITs by asset type				
Equity	0.34	0.04	0.36	0.01
Mortgage	0.23	0.02	0.31	0.04
Hybrid	0.33	0.06	0.36	0.04
Panel C: REITs by market capitalization quartile				
First Quartile	0.35	0.07	0.32	0.02
Second Quartile	0.26	0.02	0.34	0.02
Third Quartile	0.28	0.04	0.33	0.01
Fourth Quartile	0.29	0.03	0.39	0.02

statistically significant. As a whole, the results in Table 4 show that REIT dollar spreads were constant or increasing during the 1990–1994 period. Therefore, the declines in the percentage spreads observed in Table 2 should be attributed to increases in share prices rather than to declines in dollar spreads. The increase in dollar spreads could be due in part to increases in the fixed costs of order processing. Regardless of what caused the increase in dollar spreads, investors saw a decline in liquidity costs per dollar of investment.

Regression Methodology

Table 2 provided evidence based upon univariate analysis that percentage bid-ask spreads narrowed from 1990 to 1994. That analysis, however, provides no insights into what factors might be responsible for the narrowing of spreads. One obvious candidate is market capitalization, which, as noted previously, quadrupled during the analysis period. However, previous researchers have developed theoretical models of the percentage spread that suggest factors other than market capitalization should be considered. In the remainder of this article, the percentage spread is analyzed using multivariate

Table 4 ■ Descriptive statistics for variables used to explain REIT bid-ask spreads as a percentage of share price, 1990 and 1994.

	1990		1994	
Variable	Mean	Standard Error	Mean	Standard Error
Std. Dev. of returns (%)	17.6	3.1	6.7	1.0
Volume (000's)	10.9	1.0	30.5	2.2
Turnover (percentage of market capitalization)	1.3	0.1	2.5	0.2
Share price (dollars)	9.0	0.6	14.8	0.6
Market value ($ millions)	74.1	10.8	200.0	16.0

Descriptive statistics for 1990 are based upon 114 REITs.
Descriptive statistics for 1994 are based upon 223 REITs.

regression in an effort determine whether market capitalization, or some other factors, explain the narrowing of REIT spreads from 1990 to 1994. Like Chiang and Venkatesh (1988), this analysis uses the work of Stoll (1978) as the basis for a model of the spread.

Bid-ask spreads compensate market makers for the costs incurred while providing inter-temporal liquidity to prospective buyers and sellers. Market makers incur fixed, inventory and adverse information costs during trading. Fixed costs include back office and paper work costs. Inventory costs are incurred when market makers buy or sell from personal inventory and bear the risk of random price changes. Adverse selection costs exist because market makers are unable to distinguish between informed and uninformed investors. Positive spreads allow the market makers to recover losses due to trading with informed traders from uninformed traders.

In Stoll's empirical model, the holding cost component is proxied by return variability and volume variables. Holding or inventory costs incurred by a dealer depend upon the risks assumed by the dealer, which increase with the variability of a stock's return and the holding period.[10] In turn, holding

[10] Note that due to their role as providers of liquidity, dealers are limited in their ability to diversify their positions.

periods are likely to be functions of trading volume since the dealer can more easily reverse a position when the stock is actively traded. Consequently, the percentage spread is expected to be an increasing function of the variance of returns and a decreasing function of trading volume. Stoll includes turnover (defined as dollar volume divided by market capitalization) as a proxy for adverse information costs. If investors trade stocks about which they have no private information in amounts proportional to shares outstanding, then they should trade stocks about which they do have private information more frequently, leading to higher levels of turnover in those stocks. The variability of a stock's return might also proxy for adverse information.

Percentage spreads are expected to be positively associated with turnover and return variability.[11] Stoll includes price per share as a proxy for unobservable minimum order cost, expecting a negative relationship with the percentage spread as the minimum cost is distributed across more dollars for higher priced stocks. Spreads are expected to show a decreasing relationship with price.[12]

A basic model specification is defined to include four variables—standard deviation of stock returns, volume, price and turnover. This specification is then augmented with five additional variables. The first augmenting variable is a measure of size (market value of equity) because Chiang and Venkatesh (1988) find this variable important in explaining spreads. In addition, Nelling *et al.* (1995) report that market capitalization is the primary determinant of REIT bid-ask spreads. Both studies report a negative relationship between market value and spreads so a negative relationship also is expected here. Second, two dummy variables are included indicating whether a stock trades on the AMEX or NASDAQ exchanges as opposed to the NYSE. Kadlec and McConnell (1994) have documented that changing a stock's listing to the NYSE reduces spreads. Each of these variables is expected to be positive. Finally, two dummy variables are included for REIT asset type (mortgage and hybrid) to test whether spreads on these types of REITs are different from spreads on equity REITs. Nelling *et al.* report significantly lower spreads for equity REITs, so the dummies for mortgage and hybrid REITs are expected to be positive. The final, full model specification is:

[11] The predicted sign on return variability due to adverse information is the same as that due to the holding cost component—if there exists an investor with an informational advantage, the advantage would increase with the variability of the asset for which he has the information (*e.g.*, Kyle 1985).

[12] Stoll's model also includes variables that proxy for competition among dealers and dealer wealth.

$$Spread_{i,t} = \beta_0 + \beta_1\, Return\ Variability_{i,t} + \beta_2\, Volume_{i,t} + \beta_3\, Turnover_{i,t} + \beta_4\, Share\ Price_{i,t} + \beta_5\, Market\ Value_{i,t} + \beta_6\, AMEX_{i,t} + \beta_7\, NASDAQ_{i,t} + \beta_8\, Mortgage_{i,t} + \beta_9\, Hybrid_{i,t} + \epsilon_{i,t}$$

where $Spread_{i,t}$ is the average percentage bid-ask spread for firm i in year t; $Return\ Variability_{i,t}$ is the standard deviation of the daily return on stock i in year t; $Volume_{i,t}$ is the average daily volume for stock i in year t; $Turnover_{i,t}$ is the average daily dollar volume of stock i as a percentage of its market capitalization in year t; $Share\ Price_{i,t}$ is the average daily share price for stock i in year t; $Market\ Value_{i,t}$ is the market capitalization for stock i in year t; $AMEX_{i,t}$ is a dummy variable indicating that stock i trades on the AMEX in year t; $NASDAQ_{i,t}$ is a dummy variable indicating that stock i trades on the NASDAQ exchange in year t; $Mortgage_{i,t}$ is a dummy variable indicating that stock i was a mortgage REIT in year t; $Hybrid_{i,t}$ is a dummy variable indicating that stock i was a hybrid REIT in year t; and $\epsilon_{i,t}$ is an error term for stock i in year t. Given this specification, dummy variables measure spread differences relative to an equity REIT trading on the NYSE. The 1990 and 1994 samples are pooled by interacting each explanatory variable with dummy variables indicating observations from each year. This permits a test of whether each variable's coefficients for 1990 and 1994 are different, and also increases the efficiency of the estimates.[13]

This methodology allows for testing whether the differences in 1990 and 1994 spreads reported in Table 2 are due to: (1) values of the independent variables over the same period; (2) values of the underlying relationship between spreads and the independent variable; or (3) other unexplained factors. If spread differences are attributable to changes in the variables, then one should observe differences across years in the variable means but not in the parameter estimates of those variables. Changes in the underlying relationship between spreads and the explanatory variables would show up as differences across years in the parameter estimates for a given variable. Finally, differences in spreads due to unexplained factors would show up as differences in the intercepts for the two years. The results of this analysis provide insights into the factors to which the observed differences in 1990 and 1994 spreads can be attributed. This has important implications for institutional investors seeking a more liquid vehicle for including commercial real estate assets in their portfolios.

[13] Results obtained from performing separate regressions for 1990 and 1994 are not qualitatively different from the pooled results, although significance levels of some variables are slightly lower because of the loss of efficiency.

Table 4 presents cross-sectional descriptive statistics for the two sample years. This table shows that the average daily return's standard deviation fell from 18% in 1990 to 7% in 1994, a decline of more than 60%. Average daily volume almost tripled from 11,000 shares in 1990 to more than 30,000 shares in 1994. Average daily turnover (dollar volume divided by market capitalization) increased from 1.3% to 2.5%. Average share price increased from $9 to $15 and average market value increased from $74 million to $200 million. Shares outstanding (not shown) increased only slightly from 11 million to 12.6 million, implying that most of the increase in market value was due to increases in share prices. (Differences in the distributions of REITs across exchanges and asset types are shown in Table 1.)

Regression Results

Because an analysis of the raw data suggested that non-linearities were present in the data, Equation (1) was estimated using logarithmic transforms of the continuous variables. Table 5 presents results for 1990 and 1994 based upon the logarithmic transforms of the percentage spread, return variability, volume, turnover, share price and market capitalization. Overall, this specification explains almost 90% of the variability in percentage spreads, which led to the rejection of a non-transformed specification (not shown, but available from the authors on request) that explains only 70% of the variability of percentage spreads. The results for 1990 appear in column 2, and show that only three variables—return variance, share price and the NASDAQ dummy—are statistically significant at least at the 0.01 level. As expected, return variance and the NASDAQ dummy are positive while share price is negative. Interestingly, log market value is negative but lacks statistical significance. Without the log transform, market value is positive but insignificant. This calls into question the conclusion of Nelling *et al.* that "market capitalization is the primary determinant of REIT bid-ask spreads." In fact, market capitalization is a significant determinant of REIT bid-ask spreads *only* when the share price is omitted from the specification. And even when share price is excluded from the model, return variance, rather than market capitalization, is the *primary* determinant of REIT bid-ask spreads. A resolution between these results and those of Nelling *et al.* can be obtained by acknowledging the role played by share price in explaining percentage spreads. Since price dominates market value in explaining percentage spreads and the correlation between these two variables is very high (0.66 in 1990 and 0.65 in 1994), the significance of market value in earlier work can be attributed to model mis-specification (*i.e.*, the omission of share price).

Table 5 ■ Determinants of REIT bid-ask spreads. Pooled multivariate regression results for 1990 and 1994. Dependent variable is the natural logarithm of the bid-ask spread as a percentage of share price. (*t*-Statistics appear in parentheses).

Variable	1990	1994	*t*-test[a]
Intercept	4.15**	4.17**	0.0
	(16.2)	(16.3)	
ln (std. dev. of returns)	0.49**	0.38**	−1.2
	(6.3)	(6.7)	
ln (volume)	−0.10	−0.01	0.7
	(−1.4)	(−0.1)	
ln (turnover)	0.03	−0.17	−1.3
	(0.4)	(−1.3)	
ln (share price)	−0.44**	−0.41**	0.2
	(−5.1)	(−3.3)	
ln (market value)	0.02	−0.08	−0.7
	(0.2)	(−0.7)	
AMEX	−0.07	−0.34**	−3.1**
	(−1.1)	(−5.8)	
NASDAQ	0.42**	0.28**	−1.3
	(5.0)	(4.0)	
Mortgage	−0.01	0.06	0.8
	(−0.1)	(1.0)	
Hybrid	−0.10	0.06	1.5
	(−1.2)	(0.9)	

Number of observations = 337 and adjusted R^2 = 0.89.

[a] Test statistic for a test of whether the variable coefficient for 1994 is significantly different than that for 1990.

* Indicates statistical significance at the 0.05 level.
** Indicates statistical significance at the 0.01 level.

The results for 1994, which appear in column 3, show the same three variables significant in explaining 1990 spreads are statistically significant in explaining 1994 spreads as well, again with the expected signs. In addition, the AMEX dummy is negative and significant, indicating that spreads on AMEX stocks were significantly lower during 1994 than spreads on other stocks. In the last column of Table 5 are test statistics from *t*-tests for differences in the 1990 and 1994 coefficients. These statistics indicate that only the AMEX coefficient is significantly different in 1990 and 1994. This stability of coefficients over the time period is strong evidence that the decline in percentage spreads documented in Table 2 are attributable to changes in the values of the explanatory variables rather than to a fundamental change in the underlying relationship between spreads and the

explanatory variables or than to unexplained factors. Indeed, with an adjusted R^2 of 0.89, there is very little variation in spreads left to explain. A check of Table 4 provides added support for this conclusion. A look at the three variables significant in both periods shows that the average return variability dropped from 18% to 7%, average share price rose from $9 to $15, and the percentage of firms trading on the NASDAQ declined from 20% to 11%.

In summary, this analysis of the determinants of bid-ask spreads shows that a variation of the empirical model proposed by Stoll (1978) explains almost 90% of the variability in spreads, that this model is stable over time, and that the primary determinants are the variance of daily returns, share price and exchange listing. These results are largely consistent with other studies in the finance literature that have analyzed the percentage spreads of non-REIT stocks, and suggest that there is nothing "different" about the determinants of REIT liquidity. Also, these findings contradict the earlier claims of Nelling *et al.* that market capitalization is the primary determinant of 1990 REIT bid-ask spreads, and that 1990 spreads were lower for equity REITs. This may be attributed to the possibility that market value proxies for share price in their model.

Conclusion

This study examines the bid-ask spreads of REITs for evidence whether the liquidity of REITs increased over the 1990–1994 period. This was an important period for the REIT industry, during which the industry's market capitalization quintupled. The analysis shows that REIT liquidity increased significantly from 1990 to 1994. These findings have important implications for institutional and other investors as they seek more liquid vehicles for diversifying into commercial real estate. First, the results show that the costs of acquiring or liquidating commercial real estate holdings in the form of REIT equity securities have fallen as the size of the REIT market has grown. Second, the results show that the primary determinants of REIT spreads are risk (as measured by the variability of daily stock returns), share price and exchange listing. Greater variability gives rise to wider spreads, while higher share prices give rise to lower spreads.

REITs listed on the NASDAQ have wider spreads than those listed on the NYSE and the AMEX. In general, the analysis shows that the determinants of bid-ask spreads were stable from 1990 to 1994, with one notable exception. In the latter period, the spreads of REITs listed on the AMEX were significantly lower than those listed on the NYSE.

While this study provides evidence on changes in REIT liquidity, it leaves much room for future research in this area. First would be to determine why the return variability of REITs declined so precipitously from 1990 to 1994. One potential explanation is the stabilization of the market for commercial real estate assets. During 1990, the commercial real estate market was in free fall with few properties transacting. The Resolution Trust Corporation was just gearing up and had yet to begin disposing of the remnants of the battered thrift industry. These factors created tremendous uncertainty about real estate asset values, which translated into greater variability of returns on those assets. By 1994, commercial real estate markets were well on the road to recovery, with numerous transactions reducing uncertainty about asset values, hence reducing the variance of return on those assets. Another potential explanation for the decline in REIT return variability is the dramatic increase in REITs' market capitalization. Researchers have documented that small stocks have greater return variability.

A second promising area of future research would be to test whether the determinants of REIT spreads and the variability of REIT returns are different from the determinants of spreads or return variability for typical stocks. It may well be true that spreads and the return variability for similar non-REIT stocks also declined from 1990 to 1994. The data processing requirements for testing this hypothesis, however, are formidable.

A third promising area of future research would be to investigate the role of inside and outside block ownership in determining REIT spreads, and how these roles have changed since the relaxation of the "five or fewer" rule. Chiang and Venkatesh (1988) report a positive effect of insider holdings on dealer information costs but no effect for institutional holdings based upon a sample of 63 NYSE firms. It seems likely that an analysis of REITs would provide similar results. These areas are left as promising paths for future research.

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