Changes in REIT liquidity 1988 - 2007: Evidence from daily data

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Abstract In this study, we present panel-data evidence on REIT liquidity and its determinants over the 1988 – 2007 period. We focus upon liquidity measures that do not require micro-structure data (1) to facilitate use of our results as benchmarks for comparisons with results from international markets for which micro-structure data may be unavailable, (2) to provide benchmarks that do not require access to costly (and voluminous) micro-structure data. We find that REIT liquidity improved during the early and mid-1990s, deteriorated during the late 1990s, and then improved dramatically during 2000 – 2006, with the notable exception of 2007. Liquidity improved the most for REITs traded on the NYSE, and was an order of magnitude better than liquidity of REITs traded on the AMEX or NASDAQ. We link the deterioration in liquidity observed in 2007 to the investment portfolio of a REIT. We find that the percentage bid-ask spread is highly correlated with the measure of price impact proposed by Amihud (2002). We provide panel-data evidence on the key determinants of the percentage bid-ask spread that largely confirms the results reported by Bhasin, Cole and Kiely (1997) for 1990 and 1994: the percentage spread is a positive function of the volatility of stock returns, and a negative function of dollar volume turnover, share price and market capitalization. Finally, we provide evidence that these results obtained using daily closing bid- and ask-prices are not qualitatively different from those obtained using market micro-structure data. This suggests that we can use liquidity measures based upon readily available daily return data rather than being forced to rely upon market micro-structure data.

Keywords: Bid-Ask, Spread, Depth, Liquidity, Price Impact, REIT, Tightness

JEL Classification: G12, G21, G23, G29

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1. Introduction

When U.S. Real Estate Investment Trusts ("REITs") were first created during the 1970s, they were viewed as a tax-preferred mechanism enabling retail investors to own shares in diversified real-estate portfolios. Following the U.S. commercial real estate debacle of the late 1980s, REITs were "re-discovered" as a mechanism enabling institutional investors to hold real estate in their portfolios and obtain relatively high dividend yields while maintaining the able to exit their investments at will without requiring a sale of the underlying real estate assets. The liquidity of REIT investments relative to alternatives, such as separate accounts and commingled real estate funds, had great appeal to these investors, and led to tremendous change in the REIT industry during the past two decades. Market capitalization grew from $11 billion in 1987 to $141 billion in $1997 and $312 billion in 2007. However, the 2007 figure was down by more than 25% from its high of $438 billion in 2006. Institutional investors played a pivotal role in this growth, with institutional ownership of equity REITs accounting for 76 percent of all outstanding shares as of year-end 2008 (Source: SNL Securities).

The number of REITs grew from 110 in 1987 to a high of 226 in 1994 and then fell to 152 as of year-end 2007. Most REITs acquire and manage real estate ("equity REITs"), but REITs that either issue their own loans or purchase secondary market securities ("mortgage REITs") exist, as well. Equity REITs have come to dominate the industry. In 1987, equity REITs accounted for slightly less than half of both the number and market cap of the industry. By 1997, equity REITs accounted for more than 90 percent of the industry market cap, and that percentage has remained relatively stable through 2007. By 1997, equity REITs accounted for three out of every four REITs; this percentage also has remained around this level through today.

Mortgage REITs saw their fortunes rise and fall during the past two decades. The market cap of mortgage REITs reached what was then a high of $3.6B in 1987, declined in the early 1990s to a low of $2.5B in 1994 before rising again during the late 1990s to a high of $7.4B in 1997. Their market cap fell to a low of $1.6B in 2000 and then rose to an all-time high of $29B in 2006 before dropping to $19B in 2007.

In view of these seismic changes in the industry, it is time to revisit the issue of REIT liquidity. If REITs were attractive because of their liquidity, have the improvements in REIT liquidity documented by researchers for the early 1990s continued into the late 1990s and on into the 21st century, paralleling the increase in the industry's market capitalization? How has REIT liquidity changed in response to the housing bubble and financial crisis of 2008-2009, when credit in general all but dried up?

In this study, we shed new light on these important issues by presenting evidence on REIT liquidity and its determinants over the 1988 – 2007 period. Our panel data, covering 337 REITs over 20 years, enable us to be the first to employ panel-data techniques in exploring the determinants of REIT liquidity.

We focus upon liquidity measures that do not require micro-structure data (1) to facilitate use of our results as benchmarks for comparisons with results from international markets for which micro-structure data may be unavailable, (2) to provide benchmarks that do not require access to costly (and voluminous) micro-structure data.

We find that REIT liquidity deteriorated during the late 1990s, rebounded dramatically during 2000 – 2006, and then declined again during 2007. Liquidity improved most for REITs traded on the NYSE, and was an order of magnitude better than the liquidity of REITs traded on

the AMEX or NASDAQ. We link the deterioration in liquidity observed in 2007 to the investment portfolio of a REIT.

We also find that the percentage bid-ask spread is highly correlated with the measure of price impact proposed by Amihud (2002). The percentage spread has been criticized by some academics as only a measure of inventory costs; our finding refutes this criticism, at least for REITs.

We provide panel-data evidence on the key determinants of the percentage bid-ask spread that largely confirms the results reported by Bhasin, Cole and Kiely (1997) for 1990 and 1994— the percentage spread is a positive function of the volatility of stock returns, and a negative function of dollar-volume turnover, share price and market capitalization.

Finally, we provide evidence that these results obtained using daily closing bid- and ask-prices are not qualitatively different from those obtained using market micro-structure data. This finding suggests that, at least for U.S. REITs, we can use liquidity measures based upon readily available daily-return data rather than being forced to rely upon difficult-to-obtain market micro-structure data.

2. Literature Review

The literature on stock market liquidity dates back at least to Demsetz (1968), but we focus only on studies that examine the liquidity of REITs. For good survey articles of stock market liquidity, see O'Hara (1995), Madhavan (2000), and Biais, Glosten and Spatt (2005).

Nelling *et al*. (1995) were the first to examine REIT liquidity. They analyze daily closing bid-ask spreads primarily for NASDAQ firms over the late 1980s. They find that REIT liquidity as measured by the percentage spread declined during the 1980s, i.e., percentage spreads widened, making REIT shares relatively expensive.

Below, Kiely and McIntosh (1996) use market-microstructure data from 1991 to examine the intraday-trading behavior of REITs. They find that REITs have lower volume and fewer trades than non-REITs, and that mortgage REITs trade at narrower spreads than equity REITs. They also find that REITs with higher institutional ownership trade at narrower spreads that are closer to those observed for non-REITS.

Bhasin, Cole and Kiely (1997) also use market micro-structure data to examine REIT liquidity. They analyze TAQ data from 1990 and 1994 and find that percentage bid-ask spreads declined significantly over that period—a time when there was significant growth in the number and market capitalization of REITs. They also use an empirical model of the spread developed by Stoll (1978) to provide evidence on the determinants of the spread. They confirm, for REITS, the basic results reported by Stoll—that liquidity is a positive function of the price and dollar volume, and a negative function of the volatility of stock returns.

Cole (1998) reexamines the 1990 and 1994 data used by Bhasin, Cole and Kiely (1997). He finds that the improvements in liquidity reported by Bhasin, Cole and Kiely are attributable to the "new REITs" that went public during 1991 – 1993 and were larger, higher priced, and traded with more volume than REITs existing in 1990. When he looks only at REITs that existed during both periods, he finds that REIT liquidity for these firms actually declined.

Clayton and MacKinnon (2000) use intraday data from 1993 and 1996 to decompose the percentage spread into three components, as suggested by the model developed by Kyle (1985)—the cost of liquidating a position quickly ("tightness"), the ability to liquidate a large position without materially affecting price ("depth"), and the ability of a stock's price to recover quickly from a random market shock ("resiliency") . Like Bhasin, Cole and Kiely (1997), they find strong evidence that liquidity increased during the early 1990s, even when using a matched

sample. This finding contrasts with those of Cole (1998), but most of the "new REITs" in Cole's study only began to trade during 1992. Clayton and MacKinnon's decomposition of the spread suggests that most of the improvement in liquidity was attributable to improvements in depth rather than tightness.

Benveniste, Capozza and Seguin (2001) use data on REITS from 1985 – 1992 to analyze the relation between liquidity and market value. Comparing the replacement value of assets held by a REIT to the value of the REIT itself, they find that securitization through the REIT structure increases the value of the underlying real estate assets by 10 – 20 percent. They also analyze cross-sectional determinants of liquidity as measured by dollar volume, and find that the market value of equity explains almost half the variation in dollar volume, but that the statistical significance of this relation disappears when they include control variables for institutional ownership and property focus.

Danielson and Harrison (2002) examine how private information affects the liquidity of REITs. They find that NYSE and AMEX REITs are significantly more liquid than NASDAQ REITs and that REITs holding more transparent portfolios trade at narrower spreads.

Marcato and Ward (2007) develop a model for decomposing REIT liquidity into the three components suggested by the model of Kyle (1985), but, unlike Clayton and MacKinnon (2000), they use data on daily stock returns rather than market microstructure data. Marcato and Ward seek to establish that the results reported by Clayton and MacKinnon intraday data can be approximated by their model using daily data. Marcato and Ward find that many of the results reported by Clayton and MacKinnon can, indeed, be approximated by their model using daily data.

In a study very similar in spirit to our own, Brounen, Eichholtz and Ling (2009) employ three liquidity measures based upon daily data to explore liquidity across four international markets (Australia, Europe, the U.K. and the U.S.). They find that both property and non-property shares trading in the U.S. market are more liquid than shares trading in the other three markets analyzed.

3. Data and Methodology

3.1 Data

Our data come primarily from two sources: CRSP and Compustat. From CRSP, we obtain daily data from 1988 – 2007 on exchange listing, price, volume, returns and shares outstanding for all firms with standard industrial classification 6798. We also obtain closing bid and ask prices from 1993 – 2007 as NYSE and AMEX data on bids and asks became available in late December of 2002. To mitigate the influences of IPOs and mergers, we require that a REIT trade on at least 245 days in a year for that firm-year data to be included in our analysis.

From Compustat, we obtain annual data from 1988 – 2007 on total assets, total debt, total liabilities, and equity investments in real estate. We then merge our data from CRSP and Compustat by CUSIP and YEAR to obtain our final sample of 3,209 firm-year observations on 337 REITs over 20 years.

Table 1 shows the number of REITs in our sample by year and exchange. The total number of REITs ranges from a low of 99 in 1988 to a high of 206 in 1995. The number of NYSE REITs ranges from a low of 36 in 1988 to a high of 155 in 2005, while the number of AMEX (NASDAQ) REITs ranges from a low of 18 (7) in 2007 (2007) to a high of 53 (36) in 1992 (1988).

3.2 Methodology

3.2.1. Measuring Liquidity

We calculate three alternative measures of liquidity based upon daily stock-price data—
the percentage bid-ask spread, the dollar volume, and the price impact as proposed by Amihud
(2002).

The *Percentage Bid-Ask Spread* is calculated as:

$$\text{Percentage Spread}_{i,t} = (\text{Bid}_{i,t} - \text{Ask}_{i,t}) / [(\text{Bid}_{i,t} + \text{Ask}_{i,t}) / 2] \qquad (1)$$

The percentage spread is the most widely used measure of liquidity, but has been criticized by
some academics as measuring only the "tightness" component of liquidity. Lower values indicate
greater liquidity.

The *Dollar Volume* is calculated as:

$$\text{Dollar Volume}_{i,t} = \text{Volume}_{i,t} \times \text{Price}_{i,t} \qquad (2)$$

The dollar volume has been used by Benveniste, Capozza, Seguin (2001) and others to capture
the "depth" component of liquidity. Higher values of dollar volume indicate greater market depth
and greater liquidity.

The *Price Impact* measure of liquidity was originally proposed by Amihud (2002), and is
closely related to another measure of liquidity known as the *Amivest Measure*, which is the ratio
of the sum of daily volume to the sum of the absolute return, and was used by Berkman and

Eleswarapu (1998) and Amihud *et al*. (1997). The *Price Impact* for stock *i* on day *t* is calculated as:

$$\text{Price Impact}_{i,t} = \text{ABS} (\text{Return}_{i,t}) / \text{Dollar Volume}_{i,t} \qquad (3)$$

Where *ABS* indicates the absolute value, *Return* $_{i,t}$ is the daily return on stock *i* for day *t*; and *Dollar Volume* $_{i,t}$ is as defined above. The advantage of the *Price Impact* over the *Amivest* measure is the ease of its interpretation—the price impact is simply the change in share price per dollar of volume. Like the *Dollar Volume*, the *Price Impact* is primarily a measure of the "depth" component of liquidity. Lower values of *Price Impact* indicate more depth and liquidity.

For each measure of liquidity, we first calculate its value on a daily basis for each REIT. Next, we calculate annual averages for each REIT. We then use these annual averages by REIT to calculate annual measures of liquidity for the industry so that we can track changes in liquidity over time.

3.2.2. *Explaining the Percentage Spread*

We use an empirical model of the percentage spread developed by Stoll (1978) and used by Chiang and Venkatesh (1988) and Bhasin, Cole and Kiely (1997). Market makers incur three types of costs: *fixed costs*, *inventory costs*, and *adverse-information costs*. In Stoll's model, fixed costs are proxied by share price; inventory costs are proxied by volatility as measured by the standard deviation of returns; and adverse information costs are proxied by turnover, as measured by dollar volume divided by market cap.

We also include size (as measured by market capitalization) because Chiang and Venkatesh (1988) and Nelling *et al*. (1995) find this variable to be a significant determinant of spreads. We include exchange dummies because Kadlec and McConnell (1994) find that changing from an AMEX or NASDAQ listing to a NYSE listing reduces a stock's spread. Our model is as follows:

Percentage Bid-Ask Spread $_{i, t}$ =

F (Price, Standard Deviation of Returns, Turnover, Market Cap, AMEX, NASDAQ)   (4)

We transform all continuous variables into natural logarithms. We summarize our expectations regarding the relation between liquidity and our explanatory variables below:

Variable	Expected Sign
ln (Share Price)	-
ln (Std. Dev of Returns)	+
ln (Turnover)	-
ln (Market Cap)	-
AMEX, NASD	+

4. Results

4.1. Percentage Bid-Ask Spreads By Year and Exchange

In column 2 of Table 2, we present median daily REIT percentage bid-ask spreads over the period 1993 – 2007.[1] For all REITs, the average annual percentage spread rose from 2.33% in 1993 to 2.45% in 1995, fell to 1.82% in 1997, and peaked at a high of 2.80% 1999. From 1999 through 2004, we find dramatic declines in the percentage spread—from 2.80% to 0.19%. During 2005 – 2007, the percentage spread dropped to a low of 0.16% in 2006 before rising to 0.20% in 2007.

In columns 3 – 5 of Table 2, we present median annual REIT percentage bid-ask spreads by exchange listing: NYSE, AMEX or NASDAQ. The spreads of NYSE firms are lower than those of firms on either the AMEX or NASDAQ in each year except for 2000. In most years, these differences are massive; in 2006, for example, the 0.13 percentage spread is less than one fourth that of AMEX REITs and one-third that of NASDAQ REITs. For 2003 – 2007, the percentage spreads of NYSE REITs are less than half the spreads of AMEX and NASDAQ REITs in each year.

Overall, the statistics in Table 2, which we present graphically in Figure 1, show fluctuating percentage spreads during the 1990s, followed by dramatic declines during the 2000 – 2004 period, and a leveling off during 2005 – 2007.

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[1] CRSP does not report closing bid- and ask-prices prior to December 2002. We do obtain data from NASDAQ firms from 1988 – 2002 and those results are available from the authors upon request.

4.2. Dollar Volume by Year and Exchange

In column 2 of Table 3, we present the median daily dollar volume (in millions) over the period 1988 – 2008. Median dollar volume fluctuated between 0.025 million and 0.071 million 1988 – 1993, then more than doubled to 0.17 million in 1993, and doubled again in 1994 to 0.36 million and in 1995 to 0.68 million . Dollar volume hit its 1990s peak at 1.16 million in 1997, before declining to 0.67 million in 2000. Over the subsequent eight years from 2000 through 2007, dollar volume spiked upward in each year to a peak of 8.82 million in 2007, a more than twelve-fold increase in this measure of liquidity.

In columns 3 – 5 of Table 3, we explore the changes in dollar volume by exchange listing. In this table, we see that the huge increases in dollar volume were limited to NYSE firms, which rose from 0.96 million in 1999 to 15.1 million in 2007. In contrast, the dollar volume of NASDAQ REITs over the same period did not even double, from 0.12 million to a high of 0.23 million in 2007. The dollar volume of AMEX REITs rose from 0.05 million in 2000 to a high of 0.17 million in 2005 before declining to 0.10 million in 2007.

In summary, the statistics in Table 3, which we present graphically in Figure 2, show that REIT liquidity as measured by median daily dollar volume increased by more than tenfold during the 1990s, and then increased by another tenfold during the 2000s. However, most of this increased liquidity was realized only by NYSE REITs; REITs listed on AMEX and NASDAQ enjoyed increased liquidity on a much more modest scale, finishing in 2007 at an order of magnitude smaller than NYSE REITs.

4.3. Price Impact by Year and Exchange

In column 2 of Table 4, we present the median daily price impact over the 1988 – 2007 period. After jumping from around 0.5 in 1988 and 1989 to 1.11 in 1990 and to a peak of 1.19 in 1991, the price impact declined to 0.68 in 1993 and then plummeted to 0.15 in 1994. During 1995 – 1997, the price impact continued to decline to a low of 0.01 before rising to 0.03 in 2000. From 2001 – 2007, the price impact resumed its decline, signaling greater market depth, from 0.017 in 2001 to a low of 0.002 in 2007.

In columns 3 – 5 of Table 4, we explore changes in the price impact by exchange listing. Most striking in these columns are the wide differences across exchanges. In 1988, the Price Impact is 1.69 for NASDAQ REITs, 0.82 for AMEX REITs, but only 0.139 for NYSE REITs. AMEX REITs do not reach the 1988 level of Price Impact for NYSE REITs until 2005; NASDAQ REITs until 2004. However, the Price Impact of NYSE REITs had dropped to a miniscule 0.004 in 2004 and 2005. By 2004, the Price Impact of NYSE REITs had fallen to only 0.002. Thus, liquidity as measured by the Price Impact remained roughly five times greater for AMEX and NASDAQ REITs than for NYSE REITs pretty much throughout the last two decades.

In summary, the statistics in Table 4, which we present graphically in Figure 3, show that REIT liquidity as measured by Amihud Price Impact declined by an order of magnitude during the 1990s, and then declined by another order of magnitude during the 2000s. However, this improvement in depth was limited to NYSE REITs; AMEX and NASDAQ REITs realized much more modest improvements in depth.

4.4. Correlations of Liquidity Measures

In Table 5, we present the Pearson product-moment correlation coefficients calculated over the 1993 – 2007 period for each of our three annual measures of liquidity: the *Percentage Spread*, the *Dollar Volume* and the *Price Impact*. We find statistically significant and numerically large correlations between the *Percentage Spread* and both the *Price Impact* (+0.69) and the *Dollar Volume* (−0.20)—each of which is a measure of market depth. The percentage spread has been criticized by some academics, such as Brennan and Subrahmanyam (1996), as measuring only the "tightness" of the market. Our results strongly refute this criticism—at least for REITs. Clearly, the percentage spread is also measuring the depth of the market, as well. We also find a negative and significant correlation between the *Price Impact* and *Dollar Volume*. (−0.16). What is surprising is that the *Price Impact* is far more highly correlated with the *Percentage Spread* than with the *Dollar Volume*.

4.5. Descriptive Statistics and Correlations of the Explanatory Variables

In Table 6, we present descriptive statistics for the variables that, after logarithmic transformations, we use in Stoll's empirical model of the percentage spread. The mean percentage spread is 2.7 percent, the mean dollar volume is $3.68 million and the mean price impact is 0.76. The average share price is $19.41, and ranges from $0.30 to $397.51. The average dollar turnover is $3.14 million, with a range of $0.18 million to $174 million. The average market cap is $764 million and ranges from a low of $28 million to a high of $23 billion. The average standard deviation of returns (volatility) is 0.020.

The explanatory variables are likely to be highly correlated, so we present pair-wise Pearson product-moment correlations in Table 7. Indeed, each pair-wise correlation of the six

explanatory variables are statistically significant at better than the 0.0001 level, with correlation coefficients ranging from 0.08 between the AMEX dummy and the log of the standard deviation of returns to 0.77 between the log of share price and the log of market cap. These statistics indicate the potential for multicollinearity in our regression results, which we will explore in more detail below.

4.6. Determinants of Percentage Bid-Ask Spread

In Tables 8 – 12, we present results from estimating eq. (4), where we use Stoll's empirical model of the percentage bid-ask spread to explore determinants of REIT spreads. In Table 8, we estimate the model for several different sub-periods. In Table 9, we add controls for year fixed-effects by including a set of year dummy variables to explore the incremental explanatory power of this panel estimation technique; we also estimate the basic model separately for NYSE REITs and for AMEX and NASDAQ REITs. In Table 10, we repeat the analysis in Table 9 while limiting the sample to a balanced panel of 46 REITs for which annual data are available throughout the 1993-2007 period. In Table 11, we limit our analysis to 1994 in order to compare our findings with those ob Bhasin, Cole and Kiely (1998). Finally, in Table 12, we explore the impact of portfolio composition on the percentage spread.

4.7. Explaining the Percentage Bid-Ask Spread 1993 – 2007

In Table 8, we present the results from estimating eq. (4) without time fixed effects for various time periods within 1993 - 2007. In specification (1), we include our six explanatory variables and examine data from 1993 – 2007. Our results show that these six variables account for more than 65% of the variability in our dependent variable (adjusted R-square = 0.655). Each

of the explanatory variables has the expected sign, except for the two exchange dummies. Both AMEX and NASD are negative and statistically significant, indicating that percentage spreads are lower for AMEX and NASD REITs than for NYSE REITs, but only after controlling for the other four explanatory variables. The results for those four variables indicate that percentage spreads are narrower when share prices are higher, when turnover is higher and when market capitalization is higher; and when return volatility is lower. The coefficients indicate that the influence on the percentage spread is largest for Dollar Turnover, followed by Volatility of Returns, Market Cap and Share Price.

One concern about Stoll's model is the possibility for endogeneity caused by the inclusion of Share Price as the denominator of the dependent variables and as an explanatory variable. Share Price also is a component of market cap (share price times shares outstanding). To address these concerns, we replace the log of share price and the log of market cap observed for year t with the same variables observed for year $t-1$, i.e., with lagged values of those two variables. Inclusion of these lagged variables causes us to lose 289 firm-year observations. As shown in specification (2), the results are virtually unchanged, except that the log of share price is no longer statistically significant. Its coefficient drops from -0.168 (t-statistic = -5.23) in specification (1) to only -0.18 (t-statistic=-0.51) in specification (2). In this specification, the coefficients indicate that the influence on the percentage spread is largest for Volatility of Return, followed by Dollar Turnover and (lagged) Market Cap, with Share Price being statistically insignificant. In the remainder of our tests, we will use the two lagged variables in place of their contemporaneous counterparts.

Another concern about our model is the potential for multicollinearity, which can lead to inflated standard errors and unstable parameter estimates. As noted in our discussion of Table 6,

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the explanatory variables are highly correlated. Consequently, we run collinearity diagnostics to assess whether collinearity is a problem in our model. We examine the condition indices for each variable, as suggested by Besley, Kuhn and Welsch (1980), who caution about values greater than 10, and, especially, about values greater than 100. The highest condition index in our model is only 4.1, indicating that multicollinearity is not a problem. We also check the variance inflation factor for each variable, and also find that our model does not appear to be materially affected by multicollinearity.

Another concern about our model are the vast changes that occurred in the REIT industry during the 15 years we study. To address this concern, we split our sample roughly in half and analyze the seven-year sub-periods 1993 – 2000 and 2001 – 2007 separately. Another reason for examining the two periods separately is the decimalization of the three stock exchanges that occurred during late 2000 through early 2001. Decimalization of the NYSE and AMEX was completed in January 2001, with the NASDAQ following in April 2001. The results for the first half and last half of our sample period appear in Table 8 as specifications (3) and (4), respectively. In each specification, each of the six explanatory variables are statistically significant with the same signs as in specification (2). However, the coefficients for Share Price, Market Cap and Dollar Turnover are significantly larger in magnitude during the later period. These results indicate that controls for year fixed effects are likely to be appropriate.

For the 1993 – 2000 period, the model explains 74 percent of the variability in the percentage spread; for the 2001 – 2007 period, the model explains 66 percent of the variation in the percentage spread.

4.8. Explaining the Percentage Bid-Ask Spread 1993 – 2007 Including Time Fixed Effects

In Table 9, we explore the effects of controlling for time fixed effects by including a series of dummy variables for each year in our sample. We exclude 2007 so that these variables measure the difference in the percentage spread relative to the 2007 percentage spread. In specification (1), we include the six explanatory variables appearing in Table 8 along with a set of 14 year dummies, indicating observations from 1993 – 2006. In specification (2), we include only the six explanatory variables from Table 8, whereas, in specification (3), we include only the 14 year dummies. By comparing the adjusted-Rsquares of these three alternative specification, we can estimate the incremental explanatory power of the two sets of variables. In specification (1), we find that 19 of our 20 explanatory variables are statistically significant, with the sole exception being the dummy variable indicating REITs that trade on the NASDAQ exchange. All 14 of the year dummies are statistically significant, and indicate the differences in percentage spreads across years relative to 2007. For 1993 – 2002, the coefficients on the year dummies are positive, indicating that spreads were wider in those years relative to 2007. For 2003 – 2006, the coefficients on the year dummies are negative, indicating that spreads were narrower in those years relative to 2007. In other words, liquidity declined in 2007 as the financial crisis hit the REIT industry, by 92 basis points from 2006, after controlling for price, volatility, turnover, market cap and exchange. Overall, the variables in specification (1) explain 88 percent of the variation in the percentage spread over the 1993 – 2007 period.

To evaluate the incremental explanatory power of the two sets of variables, we compare the adjusted Rsquares of specifications (2) and (3) relative to specification (1). Price, volatility, turnover, market cap and exchange explain 64 percent of the variability in the percentage spread over the 1993 – 2007 period, so that the adding the year dummies improves the ability of our

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model to explain the percentage spread by an incremental 24 percentage points. Alternatively, the 14 year dummies explain 52 percent of the variation in the percentage spread over the 1993 – 2007 period so that the six variables in specification (2) improve our ability to explain the percentage spread by 36 percentage points.

4.9. Explaining the Percentage Bid-Ask Spread 1993 – 2007: NYSE vs. AMEX/NASDAQ

Another potential concern about our results is the vast differences in liquidity documented in Table 2 for NYSE REITs relative to AMEX and NASDAQ REITs. A logical question is whether our empirical model is valid for this latter group of firms or just for NYSE firms. To address this concern, we estimate our basic model (without exchange dummies and year dummies) separately for NYSE REITs in specification (4) of Table 9 and for AMEX and NASDAQ REITs in specification (5) of Table 9. The primary difference in the two specifications is that Share Price is negative and insignificant for NYSE REITs but positive and significant for AMEX/NASDAQ REITs. Volatility is positive and significant in both specifications and both turnover and market cap are negative and significant in both specifications. These four variables explain only 55 percent of the variability in the percentage spread of NYSE REITs but 74 percent of the variability of AMEX/NASDAQ REITs during 1993 – 2007. Not shown in Table 9 are results from estimating the same two specifications but also including the 14 year dummy variables. The results for price, volatility, turnover and market cap are qualitatively unchanged by adding the time fixed effects, but the explanatory power of the model improves to 91 percent for NYSE REITs and to 85 percent for AMEX/NASDAQ REITs.

4.10. Explaining the Percentage Bid-Ask Spread 1993 – 2007 for a Balance Panel of REITs

Thus far, we have conducted our analysis using an unbalanced panel of REITs. In other words, the composition of the sample changes each year, depending upon IPOs and mergers & acquisitions. As Cole (1998) documents, increases in REIT liquidity reported by Bhasin, Cole and Kiely (1998) from 1990 to 1994 were driven by changes in the sample across the two years. The large REITs that went public during 1993 exhibited much greater liquidity than the smaller REITs that existed during both 1990 and 1994. In fact, the liquidity of these latter REITs actually declined over the 1990 to 1994 period.

Similar concerns arise about our results. Does liquidity improve for the average REIT or are the observed improvements in liquidity driven by differences in the annual cross-sections over time? To address this concern, we construct a balanced panel of the 46 REITs in our sample for which data are available for all 15 years from 1993 – 2007. For this balanced panel, the percentage spread ranges from 2.0% to 2.5% during 1993 – 2000, but from 2001 – 2004, percentage spreads dropped from 1.6% to 0.2%, where they remained for 2005 – 2007. The dollar volume increased from 0.10 million during the 1988 – 1992 period to 0.71 million in 2000, and then increased to 6.60 million in 2007. The price impact dropped from 0.20 in 1988 – 1992 to 0.03 in 2000 and then to 0.003 in 2005 – 2007. In general, these results (which are available from the author upon request) are consistent with those reported in Tables 2 – 4, which leads us to conclude that improvements in liquidity were not driven by changes in the annual cross-sections within our unbalanced panel.

We explore this issue further in Table 10, where we replicate the analysis in Table 9 but using our balanced panel. In specification (1), price, volatility, turnover and market cap are statistically significant with the expected signs. The dummy for AMEX REITs remains negative

and significant, but the dummy for NASDAQ REITs is positive and insignificant. Each of the year dummies is significant, with 1993 – 2002 coefficients being positive and 2003 – 2006 coefficients being negative. This specification explains 88 percent of the variability in the percentage spreads of these 46 REITs over 1993 – 2007. In specification (2), we exclude the year dummies while, in specification (3), we include only the year dummies. Specification (2) explains 66 percent of the variability in the percentage spread while specification (3) explains only 46 percent of the variability in the percentage spread. Hence, the incremental explanatory power of the year dummies is 22 percentage points whereas the incremental explanatory power of the remaining variables is 42 percentage points.

Finally, specifications (4) and (5) present results from estimating our model without time fixed effects estimated separately for NYSE REITs and for AMEX and NASDAQ REITs, respectively. As in Table 9, the key difference is that the sign of Share Price flips to positive for AMEX/NASDAQ REITs; however, this coefficient is not significantly different from zero in Table 10. In general, all of the results in Table 10 based upon the balanced panel are not qualitatively different than those appearing in Table 9 for the unbalanced panel.

4.11. Comparison with Bhasin Cole and Kiely (1997)

In Table 11, we estimate eq. (4) for 1994 only in order to compare our results with those reported by Bhasin, Cole and Kiely (1997) ("BCK") using intraday market microstructure data from 1994. We are unable to make comparisons with the BCK results for 1990 because daily bid- and ask-prices are not available for NYSE or AMEX firms prior to 1993. Our sample is significantly smaller than that of BCK (169 versus 337), but the explanatory power of the two models is very similar (adjusted Rsquares of 0.93 versus 0.89). Each of the four variables that is

statistically significant in BCK's model also is statistically significant in our model and each has the same sign across the two models. This suggests that percentage bid-ask spread measured using daily closing spreads make reasonable proxies for percentage bid-ask spreads measured using intra-day market micro-structure data.

4.12. Equity Real-Estate Investments and REIT Liquidity

In Table 12, we present the coefficients from re-estimating eq. (4) on a year-by-year basis from 2001 – 2007 with one additional variable—the percentage of equity investments in real estate as a percentage of total assets. Unfortunately, this variable is not available for earlier years. For brevity, we only present the coefficient on the equity real-estate variable. The equity real-estate variable is positive throughout the 2002-2004 period, indicating that percentage spreads are wider when firms held more equity investments in real estate, but that this relation switched signs in 2006-2007. These results are consistent with the story that, in the early part of the decade, investors viewed equity real estate investments as more opaque than the primary alternative REIT asset—mortgage-backed securities; but, as the subprime mortgage crisis emerged, investors changed their perceptions in favor of equity real estate investments and against MBS investments.

5. Summary and Conclusions

In this study, we present evidence on REIT liquidity and its determinants over the 1988-2007 period. We focus upon three liquidity measures that do not require micro-structure data: the percentage bid-ask spread, the dollar volume and the price impact measure proposed by Amihud (2002).

We find that REIT liquidity deteriorated during the late 1990s but improved dramatically during 2000 – 2006, with the notable exception of 2007. Liquidity improved the most for REITs traded on the NYSE, and was an order of magnitude better than liquidity of REITs traded on the AMEX or NASDAQ. We link the deterioration in liquidity observed in 2007 to the investment portfolio of a REIT. Greater portfolio allocations to equity real estate rather than to mortgage investments were associated with greater liquidity in 2007.

We provide panel-data evidence on the key determinants of the percentage bid-ask spread that largely confirms the results reported by Bhasin, Cole and Kiely (1997) for 1990 and 1994: the percentage spread is positively related to the volatility of stock returns and negatively related to dollar volume turnover, share price and market capitalization.

Finally, we provide evidence that these results obtained using daily closing bid- and ask-prices are not qualitatively different from those obtained using market micro-structure data. This suggests that we can use liquidity measures based upon readily available daily return data rather than being forced to rely upon market micro-structure data.

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Table 1:
Number of REITs 1988 - 2007
By Year and Exchange Listing

Year	Total	NYSE	AMEX	NASD
1988	99	36	27	36
1989	104	39	33	32
1990	105	42	34	29
1991	108	45	34	29
1992	125	48	53	24
1993	129	57	52	20
1994	169	95	52	22
1995	206	128	51	27
1996	193	130	37	26
1997	182	137	25	20
1998	190	148	23	19
1999	197	151	27	19
2000	191	148	24	19
2001	180	139	25	16
2002	176	135	29	12
2003	171	132	27	12
2004	169	136	21	12
2005	186	155	20	11
2006	177	147	21	9
2007	152	127	18	7

NYSE indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.

Table 2:
Median Daily Percentage Bid-Ask Spread 1988 - 2007
By Year and Exchange Listing

Year	All		NYSE		AMEX		NASD	
	Obs.	Spread	Obs.	Spread	Obs.	Spread	Obs.	Spread
1988	99	n/a	36	n/a	27	n/a	36	4.99%
1989	104	n/a	39	n/a	33	n/a	32	5.36%
1990	105	n/a	42	n/a	34	n/a	29	7.18%
1991	108	n/a	45	n/a	34	n/a	29	7.45%
1992	125	n/a	48	n/a	53	n/a	24	7.25%
1993	129	2.33%	57	1.74%	52	2.54%	20	7.07%
1994	169	1.99%	95	1.41%	52	2.25%	22	7.10%
1995	206	2.45%	128	2.32%	51	2.71%	27	4.98%
1996	193	2.16%	130	2.03%	37	2.16%	26	3.91%
1997	182	1.82%	137	1.58%	25	3.04%	20	5.76%
1998	190	2.08%	148	1.86%	23	3.72%	19	3.41%
1999	197	2.80%	151	2.50%	27	5.07%	19	2.26%
2000	191	2.48%	148	2.20%	24	5.47%	19	2.20%
2001	180	1.31%	139	1.22%	25	2.07%	16	1.98%
2002	176	0.93%	135	0.85%	29	1.35%	12	2.42%
2003	171	0.40%	132	0.37%	27	1.31%	12	1.58%
2004	169	0.19%	136	0.17%	21	0.81%	12	0.79%
2005	186	0.21%	155	0.17%	20	0.76%	11	0.44%
2006	177	0.16%	147	0.13%	21	0.64%	9	0.45%
2007	152	0.20%	127	0.18%	18	1.05%	7	0.54%

Spread is the median of the annual averages of the daily percentage bid-ask spread for REITs that traded for at least 245 days during the year. *NYSE* indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.

Figure 1:
REIT Percentage Spreads 1993-2007
By Exchange Listing

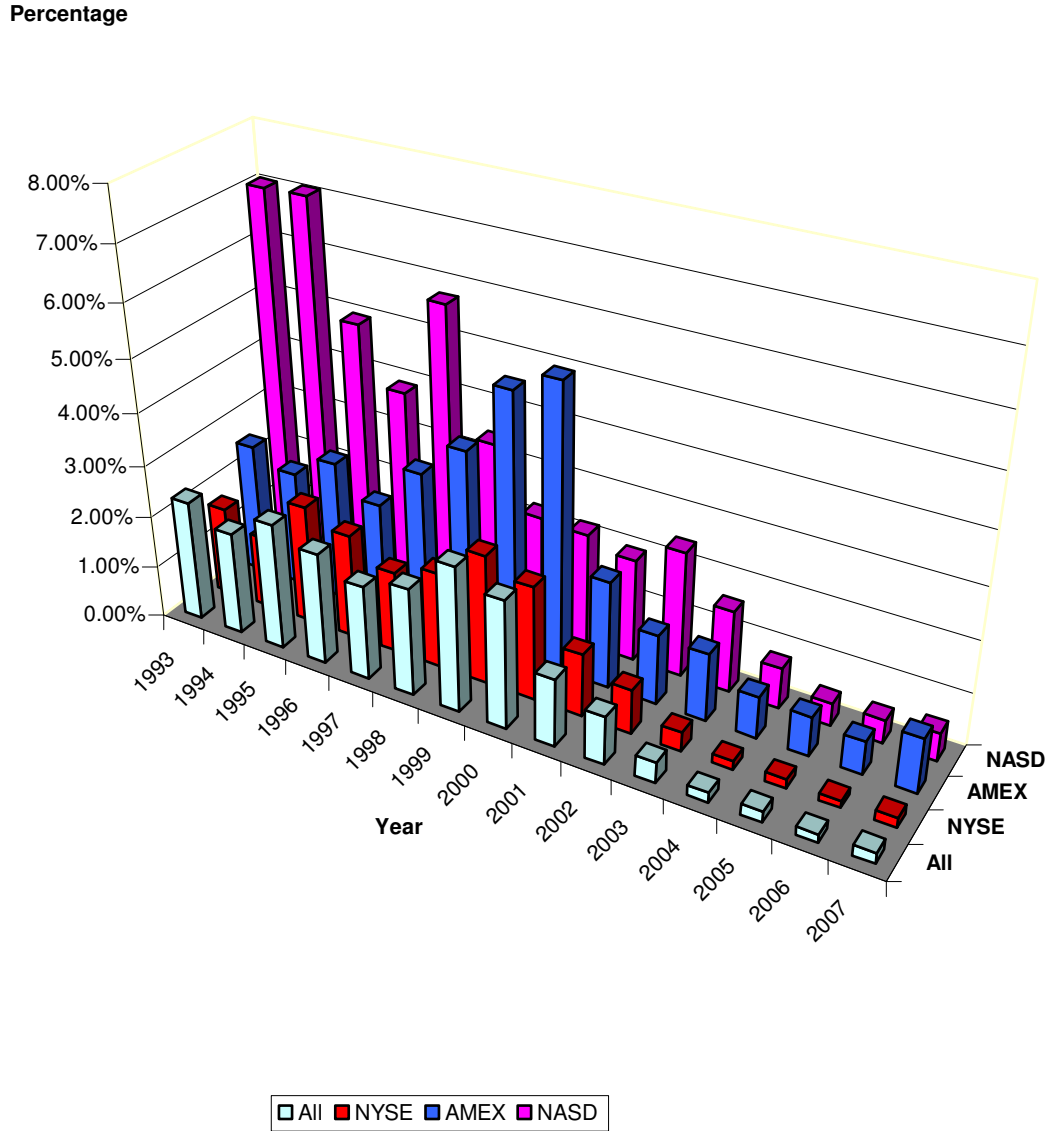*Spread* is the median of the annual averages of the daily percentage bid-ask spread for REITs that traded for at least 245 days during the year. *NYSE* indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.

Table 3:
Median Daily Dollar Volume 1988 - 2007
By Year and Exchange Listing

Year	All		NYSE		AMEX		NASD	
	Obs.	Volume	Obs.	Volume	Obs.	Volume	Obs.	Volume
1988	99	0.064	36	0.130	27	0.033	36	0.023
1989	104	0.071	39	0.133	33	0.030	32	0.018
1990	105	0.038	42	0.102	34	0.019	29	0.012
1991	108	0.025	45	0.125	34	0.016	29	0.012
1992	125	0.026	48	0.180	53	0.019	24	0.011
1993	129	0.047	57	0.379	52	0.022	20	0.022
1994	169	0.171	95	0.591	52	0.020	22	0.026
1995	206	0.363	128	0.594	51	0.018	27	0.073
1996	193	0.679	130	0.925	37	0.036	26	0.088
1997	182	1.162	137	1.365	25	0.096	20	0.033
1998	190	1.097	148	1.488	23	0.161	19	0.084
1999	197	0.775	151	1.030	27	0.092	19	0.166
2000	191	0.673	148	0.965	24	0.051	19	0.123
2001	180	0.979	139	1.811	25	0.080	16	0.160
2002	176	1.748	135	2.841	29	0.085	12	0.056
2003	171	2.379	132	3.315	27	0.095	12	0.111
2004	169	3.609	136	5.209	21	0.117	12	0.222
2005	186	3.688	155	4.761	20	0.166	11	0.194
2006	177	4.924	147	7.223	21	0.126	9	0.237
2007	152	8.819	127	15.091	18	0.096	7	0.231

Volume is the median of the annual averages of the daily dollar trading volume for REITs that traded for at least 245 days during the year. *NYSE* indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.

Figure 2:
REIT Dollar Volume 1988-2007
By Exchange Listing
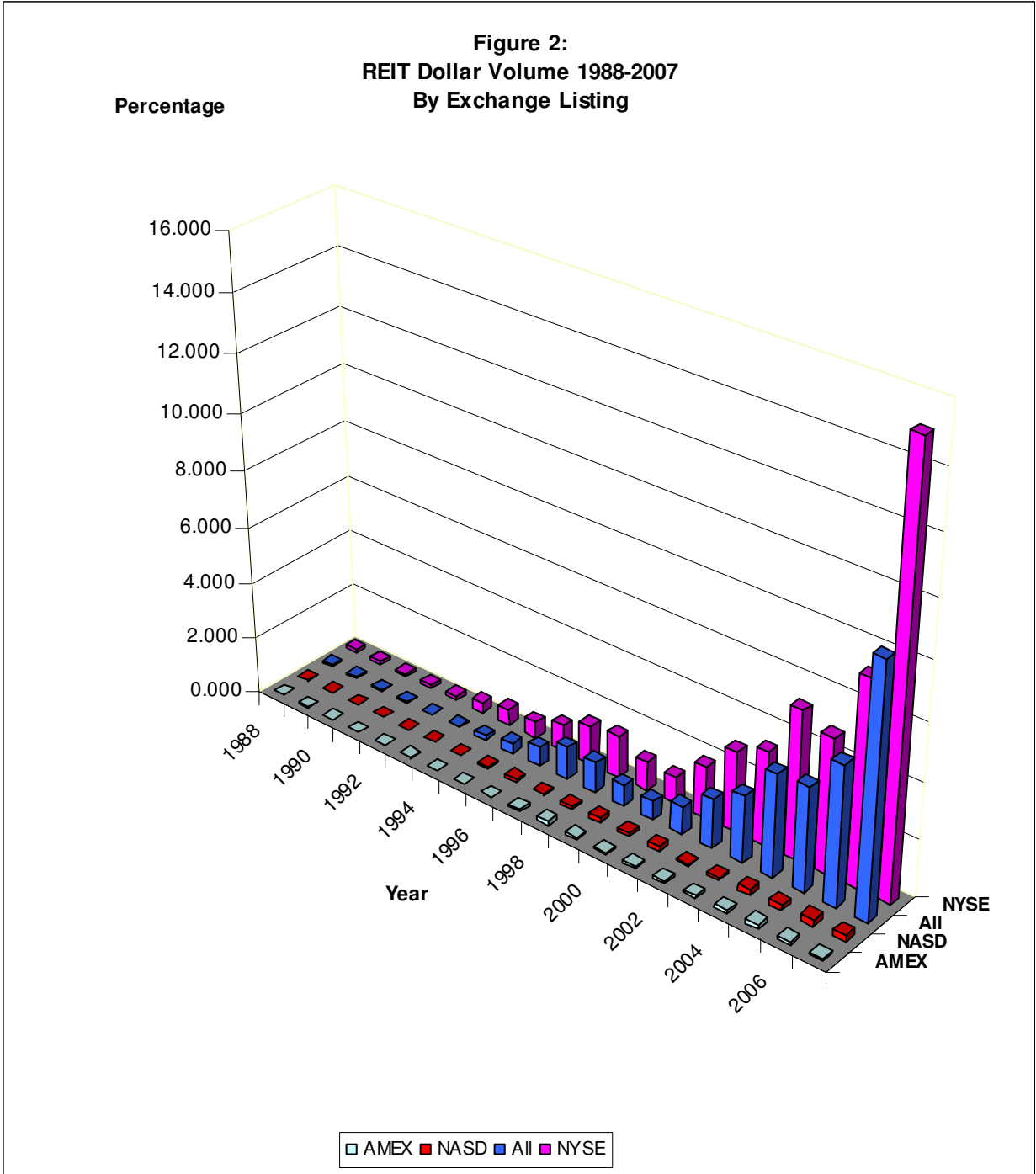
Volume is median of the annual averages of the daily dollar trading volume for REITs that traded for at least 245 days during the year. *NYSE* indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.

Table 4:
Median Price Impact 1988 - 2007
By Year and Exchange Listing

Year	All		NYSE		AMEX		NASD	
	Obs.	Impact	Obs.	Impact	Obs.	Impact	Obs.	Impact
1988	99	0.524	36	0.139	27	0.820	36	1.686
1989	104	0.478	39	0.151	33	0.849	32	1.460
1990	105	1.109	42	0.221	34	2.119	29	3.063
1991	108	1.193	45	0.203	34	2.483	29	2.671
1992	125	0.920	48	0.120	53	1.192	24	2.579
1993	129	0.683	57	0.050	52	0.939	20	3.490
1994	169	0.147	95	0.033	52	0.929	22	2.319
1995	206	0.067	128	0.031	51	0.950	27	0.850
1996	193	0.027	130	0.017	37	0.322	26	0.936
1997	182	0.013	137	0.009	25	0.362	20	1.715
1998	190	0.017	148	0.011	23	0.219	19	0.966
1999	197	0.022	151	0.015	27	0.431	19	0.604
2000	191	0.029	148	0.015	24	0.976	19	0.483
2001	180	0.017	139	0.008	25	0.706	16	0.599
2002	176	0.008	135	0.005	29	0.286	12	1.418
2003	171	0.006	132	0.003	27	0.267	12	0.826
2004	169	0.004	136	0.002	21	0.142	12	0.125
2005	186	0.004	155	0.003	20	0.136	11	0.072
2006	177	0.003	147	0.002	21	0.121	9	0.093
2007	152	0.002	127	0.001	18	0.658	7	0.107

Impact is the price impact as defined by Amihud (2002), which is the absolute value of the daily stock return divided by the daily dollar trading volume, for REITs that traded for at least 245 days during the year. *NYSE* indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.

Figure 3:
**REIT Price Impact 1988-2007**
By Exchange Listing

Impact is the price impact as defined by Amihud (2002), which is the absolute value of the daily stock return divided by the daily dollar trading volume, for REITs that traded for at least 245 days during the year. *NYSE* indicates REITs trading on the New York Stock Exchange. *AMEX* indicates REITs trading on the American Stock Exchange. *NASD* indicates REITs trading on the NASDAQ Stock Exchange.
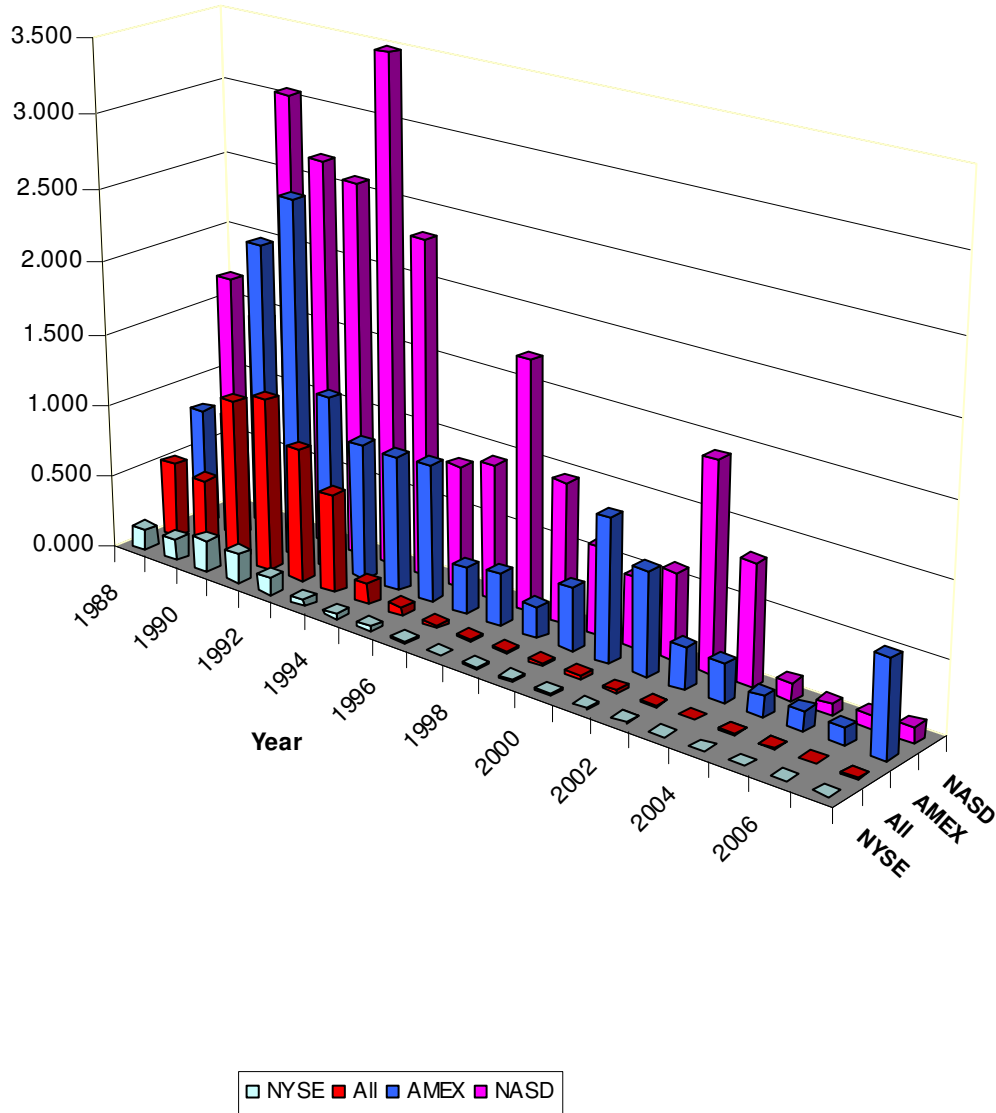
Table 5
Correlations between Liquidity Measures
Prob > |r| under H0: Rho = 0
Number of Observations

		Percentage Spread	Price Impact	Dollar Volume
Percentage Spread	Correlation	1.000		
	p-value			
	Obs.	2,892		
Price Impact	Correlation	0.693		
	p-value	0.0001	1.000	
	Obs.	2,892	3,209	
Dollar Volume	Correlation	-0.197	-0.156	1.000
	p-value	0.0001	0.0001	
	Obs.	2,892	3,209	3,209

Percentage Spread is the annual average of the daily percentage bid-ask spread. *Price Impact* is the annual average of the daily price impact as defined by Amihud (2002). *Dollar Volume* is the annual average of the daily dollar trading volume. Annual averages are calculated for each year during which a REIT traded for at least 245 days during 1993 – 2007. Correlations are Pearson product-moment correlation coefficients.

Table 6:
Descriptive Statistics

Variable	Obs.	Median	Mean	Std. Error	Minimum	Maximum
Percentage Spread	2,892	0.016	0.027	0.001	0.000	0.701
Price Impact	3,209	0.028	0.762	0.030	0.000	12.003
Dollar Volume	3,209	0.653	3.676	0.187	0.000	174.268
Share Price	3,209	16.12	19.408	0.307	0.097	397.512
Std.Dev. of Return	3,209	0.015	0.020	0.000	0.000	0.139
Dollar Turnover	3,209	2.42	3.142	0.070	0.019	143.911
Market Cap ($M)	3,209	251.7	764.5	28.4	0.3	22,767.9
AMEX	3,209	0	0.195	0.007	0.000	1.000
NASD	3,209	0	0.120	0.006	0.000	1.000

Percentage Spread is the annual average of the daily percentage bid-ask spread. *Price Impact* is the annual average of the daily price impact as defined by Amihud (2002). *Dollar Volume* is the annual average of the daily dollar trading volume. *Share Price* is the annual average of the daily closing share price. *Std. Dev. of Return* is the annual standard deviation of the daily stock return. *Dollar Turnover* is defined as the annual average of the daily dollar trading volume divided by annual average of the market capitalization. *Market Cap* is the annual average of the market capitalization. *AMEX* is an indicator variable for REITs trading on the American Stock Exchange. *NASD* is an indicator variable for REITs trading on the NASDAQ Stock Exchange.

Table 7:
Correlations between Explanatory Variables
Prob > |r| under H0: Rho = 0
Number of Observations = 2,892

	ln (Price)	ln (SD Return)	ln ($ Turnover)	ln (Market Cap)	AMEX	NASD
ln (Price)	1.000					
ln (SD of Return)	-0.681	1.000				
	0.0001					
ln (Dollar Turnover)	0.462	-0.176	1.000			
	0.0001	0.0001				
ln (Market Cap)	0.773	-0.544	0.603	1.000		
	0.0001	0.0001	0.0001			
AMEX	-0.292	0.081	-0.400	-0.468	1.000	
	0.0001	0.0001	0.0001	0.0001		
NASD	-0.315	0.458	-0.203	-0.387	-0.169	1.000
	0.0001	0.0001	0.0001	0.0001	0.0001	

ln (Price) is the natural logarithm of the annual average of the daily closing price. *ln (SD of Return)* is the natural logarithm of the annual standard deviation of the daily stock return. *ln (Dollar Turnover)* is the natural logarithm of the annual average of the dollar turnover, which is defined as the daily dollar trading volume divided by market capitalization. *ln (Market Cap)* is the natural logarithm of the annual average of the market capitalization. *AMEX* is an indicator variable for REITs trading on the American Stock Exchange. *NASD* is an indicator variable for REITs trading on the NASDAQ Stock Exchange.

Table 8:
Determinants of the Percentage Bid-Ask Spread

Variable	(1) All Years		(2) All Years		(3) 1993-2000		(4) 2001-2007		(5) 2004-2007	
Intercept	2.636	13.04 **a**	3.217	14.95 **a**	1.280	8.69 **a**	1.936	6.73 **a**	1.772	9.59 **a**
ln (Share Price t)	-0.168	-5.23 **a**								
ln (Share Price t-1)			-0.018	-0.51	-0.150	-6.10 **a**	-0.222	-5.50 **a**	0.003	0.13
ln (SD of Return)	0.446	10.38 **a**	0.687	16.17 **a**	0.708	24.71 **a**	0.643	10.89 **a**	0.825	22.05 **a**
ln (Dollar Turnover)	-0.525	-25.40 **a**	-0.606	-27.49 **a**	-0.153	-9.92 **a**	-0.544	-17.87 **a**	-0.410	-21.10 **a**
ln (Market Cap t)	-0.334	-20.84 **a**								
ln (Market Cap t-1)			-0.333	-19.06 **a**	-0.125	-10.46 **a**	-0.254	-11.31 **a**	-0.290	-21.93 **a**
AMEX	-0.623	-12.82 **a**	-0.634	-11.98 **a**	-0.236	-7.04 **a**	-0.339	-4.62 **a**	0.146	3.15 **a**
NASD	-0.277	-4.98 **a**	-0.401	-6.37 **a**	-0.141	-3.59 **a**	-0.329	-3.62 **a**	0.158	2.74 **a**
Adjusted R-Square	0.655		0.644		0.738		0.658		0.895	
F-Statistic	915.96	**a**	786.98	**a**	681.62	**a**	365.55	**a**	893.17	**a**
Obs.	2,892		2,603		1,457		1,146		631	

Percentage Bid-Ask Spread is the natural logarithm of the annual average of the daily percentage bid-ask spread. *ln (Share Price t)* is the natural logarithm of the median daily closing price in year t. *ln (Share Price t-1)* is the natural logarithm of the annual average of the daily closing price in year t – 1. *ln (SD of Return)* is the natural logarithm of the annual standard deviation of the daily stock return. *ln (Dollar Turnover)* is the natural logarithm of the annual average of the dollar turnover, which is defined as the daily dollar trading volume divided by market capitalization. *ln (Market Cap t)* is the natural logarithm of annual average of the market capitalization in year t. *ln (Market Cap t-1)* is the natural logarithm of annual average of the market capitalization in year t – 1. *AMEX* is an indicator variable for REITs trading on the American Stock Exchange. *NASD* is an indicator variable for REITs trading on the NASDAQ Stock Exchange. Under each column, the first number is the coefficient and the second number is the standard error.
a indicates statistical significance at the 0.01 level.

Variable	(1) All Years		(2) All Years		(3) All Years		(4) NYSE Only		(5) AMEX & NASD	
Intercept	1.434	11.16 **a**	3.217	14.95 **a**	-4.359	-83.61 **a**	2.981	9.90 **a**	3.249	15.94 **a**
ln (Share Price t-1)	-0.118	-5.83 **a**	-0.018	-0.51			-0.062	-1.35	0.134	3.30 **a**
ln (SD of Return)	0.634	23.45 **a**	0.687	16.17 **a**			0.630	10.14 **a**	0.992	24.24 **a**
ln (Dollar Turnover)	-0.388	-29.10 **a**	-0.606	-27.49 **a**			-0.790	-24.81 **a**	-0.356	-14.85 **a**
ln (Market Cap t-1)	-0.233	-22.53 **a**	-0.333	-19.06 **a**			-0.308	-13.20 **a**	-0.312	-14.89 **a**
AMEX	-0.278	-9.01 **a**	-0.634	-11.98 **a**						
NASD	-0.035	-0.95	-0.401	-6.37 **a**						
D1993	0.387	7.75 **a**			0.894	9.07 **a**				
D1994	0.439	8.68 **a**			0.834	8.43 **a**				
D1995	0.821	17.52 **a**			0.865	9.57 **a**				
D1996	0.971	21.47 **a**			0.724	8.45 **a**				
D1997	0.942	20.76 **a**			0.576	6.58 **a**				
D1998	0.932	20.62 **a**			0.572	6.35 **a**				
D1999	1.197	27.39 **a**			0.798	9.19 **a**				
D2000	1.037	23.83 **a**			0.765	8.89 **a**				
D2001	0.544	12.22 **a**			0.152	1.75				
D2002	0.283	6.34 **a**			-0.234	-2.67 **a**				
D2003	-0.174	-3.73 **a**			-0.927	-10.38 **a**				
D2004	-0.880	-19.18 **a**			-1.646	-18.33 **a**				
D2005	-0.778	-16.80 **a**			-1.705	-18.9 **a**				
D2006	-0.923	-20.06 **a**			-1.922	-21.56 **a**				
Adjusted R-Square	0.884		0.644		0.517		0.553		0.744	
F-Statistic	985.01	**a**	786.98	**a**	198.25	**a**	568.93	**a**	524.47	**a**
Obs.	2,603		2,603		2,603		1,844		721	

Percentage Bid-Ask Spread is the natural logarithm of the annual average of the daily percentage bid-ask spread. *ln (Share Price t-1)* is the natural logarithm of the annual average of the daily closing price in year t – 1. *ln (Std. Dev of Return)* is the natural logarithm of the annual standard deviation of the daily stock return. ln (Dollar Turnover) is the natural logarithm of the annual average of the dollar turnover, which is defined as the daily dollar trading volume divided by market capitalization. *ln (Market Cap t-1)* is the natural logarithm of annual average of the market capitalization in year t – 1. *AMEX* is an indicator variable for REITs trading on the American Stock Exchange. *NASD* is an indicator variable for REITs trading on the NASDAQ Stock Exchange. *DYYYY* is an dummy indicator variable for year YYYY, which ranges from 1993 to 2006. Under each column, the first number is the coefficient and the second number is the standard error. a indicates statistical significance at the 0.01 level.

<p align="center">**Table 10:**</p>
<p align="center">**Determinants of the Percentage Bid-Ask Spread**</p>

Variable	(1) All Years		(2) All Years		(3) All Years		(4) NYSE Only		(5) AMEX & NASD	
Intercept	1.073	4.56 **a**	2.757	7.19 **a**	-4.492	-46.47 **a**	2.382	4.48 **a**	3.216	9.72 **a**
ln (Share Price t-1)	-0.177	-5.04 **a**	-0.165	-2.85 **a**			-0.245	-3.48 **a**	0.142	1.58
ln (Std.Dev. of Return)	0.644	13.32 **a**	0.882	11.59 **a**			0.867	8.20 **a**	0.983	13.08 **a**
ln (Dollar Turnover)	-0.387	-15.13 **a**	-0.579	-13.76 **a**			-0.682	-12.40 **a**	-0.323	-5.82 **a**
ln (Market Cap t-1)	-0.193	-9.86 **a**	-0.213	-6.52 **a**			-0.168	-3.86 **a**	-0.319	-6.91 **a**
AMEX	-0.269	-4.47 **a**	-0.420	-4.14 **a**						
NASD	0.102	1.32	-0.294	-2.28 **b**						
D1993	0.398	4.70 **a**			0.722	4.05 **a**				
D1994	0.499	5.99 **a**			0.689	3.96 **a**				
D1995	0.881	10.46 **a**			0.990	5.69 **a**				
D1996	0.918	10.91 **a**			0.903	5.19 **a**				
D1997	0.956	11.46 **a**			0.775	4.45 **a**				
D1998	1.031	12.55 **a**			0.889	5.11 **a**				
D1999	1.237	15.01 **a**			1.065	6.12 **a**				
D2000	1.017	12.27 **a**			0.978	5.62 **a**				
D2001	0.508	6.07 **a**			0.383	2.20 **b**				
D2002	0.267	3.21 **a**			-0.006	-0.03				
D2003	-0.207	-2.44 **b**			-0.738	-4.24 **a**				
D2004	-0.794	-9.54 **a**			-1.359	-7.81 **a**				
D2005	-0.695	-8.31 **a**			-1.431	-8.22 **a**				
D2006	-0.839	-10.00 **a**			-1.703	-9.79 **a**				
Adjusted R-Square	0.8819		0.658		0.4583		0.534		0.785	
F-Statistic	278.42	**a**	239.26	**a**	45.91	**a**	157.13	**a**	169.75	**a**
Obs.	744		744		744		546		186	

Percentage Bid-Ask Spread is the natural logarithm of the annual average of the daily percentage bid-ask spread. *ln (Share Price t-1)* is the natural logarithm of the annual average of the daily closing price in year t – 1. *ln (Std. Dev of Return)* is the natural logarithm of the annual standard deviation of the daily stock return. ln (Dollar Turnover) is the natural logarithm of the annual average of the dollar turnover, which is defined as the daily dollar trading volume divided by market capitalization. *ln (Market Cap t-1)* is the natural logarithm of the annual average of the market capitalization in year t – 1. *AMEX* is an indicator variable for REITs trading on the American Stock Exchange. *NASD* is an indicator variable for REITs trading on the NASDAQ Stock Exchange. *DYYYY* is an dummy indicator variable for year YYYY, which ranges from 1993 to 2006. Under each column, the first number is the coefficient and the second number is the standard error. a indicates statistical significance at the 0.01 level.

Table 11:
Determinants of the Percentage Bid-Ask Spread 1994
Comparison with Bhasin, Cole and Kiely 1997

Variable	CC 2008 Parameter Estimate	t Value	BCK 1997 Parameter Estimate	t Value
Intercept	2.210	0.5	4.17	16.3 a
ln (Price)	-0.274	-5.5 a	-0.41	-3.3 a
ln (Std.Dev Returns)	0.551	7.2 a	0.38	6.7 a
ln (Dollar Volume)	0.097	0.3	-0.01	-0.1
ln (Turnover)	-0.189	-0.5	-0.17	-1.3
ln (Market Cap)	-0.248	-0.7	-0.08	-0.7
AMEX	-0.123	-2.3 b	-0.34	-5.8 a
NASD	0.477	6.6 a	0.28	4.0 a
Adj. Rsquare	0.93		0.89	
Number of Obs.	169		337	

Percentage Bid-Ask Spread is the natural logarithm of the annual average of the daily percentage bid-ask spread. *ln (Share Price)* is the natural logarithm of the annual average of the daily closing price. *ln (Std. Dev of Return)* is the natural logarithm of the annual standard deviation of the daily stock return. *ln (Dollar Turnover)* is the natural logarithm of the annual average of the dollar turnover, which is defined as the daily dollar trading volume divided by market capitalization. *ln (Market Cap t-1)* is the natural logarithm of annual average of the market capitalization in year t – 1. *AMEX* is an indicator variable for REITs trading on the American Stock Exchange. *NASD* is an indicator variable for REITs trading on the NASDAQ Stock Exchange. *DYYYY* is an dummy indicator variable for year YYYY. Under each column, the first number is the coefficient and the second number is the standard error. a indicates statistical significance at the 0.01 level.

Table 12:
Determinants of the Percentage Bid-Ask Spread
Real Estate Coefficients

Year	Coef.	t-statistic
2001	-0.242	-2.41 **b**
2002	0.056	0.49
2003	0.168	1.91 **c**
2004	0.023	0.30
2005	0.079	1.18
2006	-0.016	-0.24
2007	-0.195	-1.97 **b**

This table presents the coefficients for a real estate variable defined as the natural logarithm of percentage of equity investments in real estate as a percentage of total assets that come from a series of annual regressions covering 2001 – 2007, where the dependent variable is the natural logarithm of the annual average of the percentage bid-ask spread and, in addition to the real estate variable, the explanatory variables include the natural logarithm of the annual average of the share price, the annual standard deviation of daily returns, the annual average of the daily dollar trading volume, the annual average of the dollar turnover, the annual average of the market capitalization, as well as two dummy indicator variables, one for REITs that trade on the American Stock Exchange and one for REITs that trade on the NASDAQ Stock Exchange.