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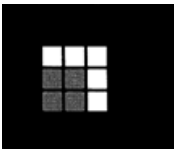

The Liquidity of Property Shares: An International Comparison

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This article investigates the magnitude and determinates of share liquidity over the 1990–2007 period in the world's four largest securitized real estate markets: the United States, the United Kingdom, Continental Europe and Australia. We document a significant and consistent role for market capitalization, nonretail share ownership and dividend yield as drivers of liquidity across markets. We also document significant differences in liquidity across countries and between property and nonproperty companies. Also striking is the lack of correlation among our three measures of liquidity across property firms and time. This supports the notion that share price liquidity is multifaceted and therefore reliance on any one measure of liquidity in empirical work may produce misleading conclusions. Although we find some evidence of a connection between liquidity and firm value, it is less conclusive than prior studies.

A global real estate securities market has steadily developed over the past two decades. At year-end 2007, the market value of publicly traded property companies exceeded one trillion in U.S. dollars.[1] The growth in the global commercial real estate securities market has been driven, in part, by opportunistic domestic and foreign investors in search of positive, risk-adjusted returns. Indeed, investment capital has increasingly become an international commodity. The increasing international popularity of real estate as an asset class also reflects the perceived diversification benefits of property in a mixed-asset portfolio. Although high-net-worth investors may undertake direct investments in foreign property through opportunistic private funds, the public real estate securities market provides a vehicle for investors to construct international property portfolios without the burden of acquiring, managing and disposing of direct

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[1] Source: Global Property Research (www.propertyshares.com).

property investments in faraway countries with unfamiliar legal, political and market structures.[2]

To sustain and increase the flow of investment capital into the international property shares market, performance benchmarks and relative performance measurement are vital (Ling and Naranjo 2002). However, in addition to relative return performance and real estate's value as a diversifier in a mixed-asset portfolio, investors in international property shares are concerned with liquidity. In fact, a recent survey of U.S. institutional investors reveals that liquidity risk is deemed to be the most important risk factor in real estate investment (Dhar and Goetzmann 2005). Moreover, the importance of liquidity has been emphasized by several recent U.S.-based studies that have found a link between liquidity and property share values.[3] This article examines the liquidity of property shares, and its relation to stock market values, in the world's four largest securitized real estate markets: the United States, the United Kingdom, Continental Europe and Australia.

Despite its importance, liquidity is a rather vague and relative concept. In theory, it refers to the ability to sell an asset at market value—quickly and inexpensively. Thus, there are two components to liquidity: speed of sale and price impact (Clayton and MacKinnon 2000). Nevertheless, according to Boulding (1955), "liquidity is a quality of assets which is not a very clear or easily measurable concept." In fact, no unique definition or measure of financial asset liquidity has emerged in the 50 years since Boulding's book was published. In this article, we employ three measures of liquidity: (1) dollar trading volume; (2) turnover, defined as the ratio between the firm's daily trading volume and number of shares outstanding; and (3) a version of Amihud's (2002) "illiquidity" ratio, defined as the ratio of the absolute value of the firm's daily stock return to dollar trading volume. A significant advantage of these three liquidity measures is that their construction requires only daily data on firm market capitalizations, number of shares outstanding, share and dollar trading volume and total returns. These daily data are more readily available across international markets and over time than the microstructure data needed to construct measures of liquidity based on bid-ask spreads.

Using annual cross-sections from 1990 to 2007, we first calculate and discuss our three measures of liquidity over time and across international markets.

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[2] See Eichholtz and Koedijk (1995) for an early discussion of the evolution and importance of international real estate securities markets.

[3] See, for example, Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996) and Datar, Naik and Radcliffe (1998). For a discussion of liquidity and asset pricing in a real estate context, see Benveniste, Capozza and Sequin (2001) and the references contained therein.

Second, using a panel data set and standard regression techniques, we find that a number of factors help to explain firm-level variation in liquidity, including share price level, market capitalization and ownership structure. We also compare our summary statistics and panel regression results for publicly traded property companies to a control sample of nonproperty firms. Finally, although we find some evidence of an empirical link between liquidity and firm value, our evidence is less conclusive than several prior studies.

As revealed by the literature review in the following section, our study is by no means the first to examine liquidity in the context of securitized real estate markets. However, this study extends the existing literature in several important ways. First, we examine the period 1990–2007. During the last decade of this sample period, significant growth and interest in international real estate stocks have occurred. This growth has likely impacted share price liquidity and, with the exception of Marcato and Ward (2007), these later years have not been examined in the existing literature. Second, we compare our results to control samples of nonproperty stocks, matched on the basis of market capitalization. This control sample permits us to examine the liquidity of property shares relative to common stocks—a comparison of significant interest to potential property investors. Finally, our use of three separate proxies for liquidity permits an examination of the robustness of our results not possible in earlier studies.[4]

The remainder of the article proceeds as follows. We next present a brief overview of the most relevant literature on liquidity, followed by a discussion of the variables that have been linked to liquidity. In the fourth section, we discuss our data and present key summary statistics. In the fifth section, we discuss the panel regression methodology selected for our empirical analysis of the determinates of liquidity and present our results. The sixth section contains our analysis of the influence of liquidity on firm value and excess return performance. We conclude with a brief summary.

Some Relevant Literature

Kyle (1985) argues that the liquidity of a financial asset includes three transactional characteristics: (1) *tightness*, the cost of liquidating a position over a short period of time; (2) *depth*, the ability to buy or sell large quantities of shares with minimal price impact; and (3) *resiliency*, the propensity of prices to recover quickly from a random shock to the market. Given the multidimensional

[4] The lack of liquidity studies in an international setting extends beyond real estate. In the finance literature, we know of only two papers that examine a time series of liquidity across different countries, and these two papers only look at emerging markets (Bekaert, Harvey and Lundblad 2005, Lesmond 2005).

nature of liquidity, Bernstein (1987) argues "that no single measure tells the whole story about liquidity." And, in fact, a multitude of liquidity proxies can be found in the literature.[5] However, beginning with Nelling *et al.* (1995), real estate researchers have focused their attention on quoted bid-ask spreads—a common proxy for the cost of liquidating a position in a typical trade (tightness). More specifically, the narrower a firm's quoted bid-ask spread, the less expensive it is for investors to quickly buy and sell shares at a price close to true market value.[6]

Despite its widespread use, Clayton and MacKinnon (2000) argue that, for several reasons, the quoted bid-ask spread is an imperfect measure of liquidity. First, many trades actually occur at prices inside the quoted bid-ask spread, providing improved pricing for both the buyer and seller.[7] Second, quoted bid-ask prices are guaranteed only up to a maximum number of shares. An investor who places an order to buy (sell) a number of shares in excess of the maximum may have the difference filled against orders in the limit book at prices higher (lower) than the quoted price. Finally, as noted by Bhasin, Cole and Kiely (1997), bid-ask spreads may not be an adequate measure of liquidity for institutional investors wishing to quickly execute large trades. Such investors, Clayton and MacKinnon (2000) argue, are more concerned with the impact of their trades on market prices than with the quoted bid-ask spread. Following Kyle (1985) and Glosten and Milgrom (1985), Clayton and MacKinnon (2000) examine the depth of the market by quantifying the impact of trading volume on REIT share price movements.

Amihud (2002) suggests an alternative proxy for liquidity that captures market depth. More specifically, Amihud (2002) measures the illiquidity of stock i in year t as:

$$ILLIQ_t^i = \frac{1}{Days_t^i} \sum_{d=1}^{Days_t^i} \frac{\left|R_{t,d}^i\right|}{V_{t,d}^i}, \tag{1}$$

where $R_{t,d}^i$ and $V_{t,d}^i$ are, respectively, the stock's total return and dollar trading volume on day d in year t, and $Days_t^i$ is the number of trading days

[5] The appendix of Barkley, Naranjo and Nimalendran (2006) contains a detailed summary of the principal liquidity measures used in the financial economics literature.

[6] Other real estate investment trust (REIT) studies that analyze REIT bid-ask spreads as a measure of liquidity include Below, Kiely and McIntosh (1995, 1996), Bhasin, Cole and Kiely (1997), Cole (1998) and Clayton and MacKinnon (1999, 2000).

[7] Clayton and MacKinnon (1999) argue that a better measure of round-trip transaction costs is the relative effective bid-ask spread. The effective spread is calculated as two times the difference between the trade price and the midpoint of the quoted bid-ask price. The relative effective spread is the effective spread divided by the quoted midpoint.

in year *t* for stock *i*. *ILLIQ* is based on the notion that returns for illiquid stocks are more sensitive to trading volumes. Comparing Amihud's illiquidity ratio to an estimate of Kyle's lambda using microstructure data, Hasbrouck (2004) finds a correlation of 0.74 and concludes that "within the class of daily-based estimates, the illiquidity ratio appears to have the most reliable proxy relationship." Brennan and Subrahmanyam (1996) also provide evidence that *ILLIQ* is positively and strongly related to microstructure estimates of illiquidity.

In addition to bid-ask spreads and the price impact of trades, numerous authors have argued that liquidity can be proxied for by trading activity. That is, more actively traded securities are easier to buy and sell—especially when large positions must be disposed in a short period of time. Measures of trading activity used in the literature include the number of shares traded, the dollar volume of shares traded and turnover, generally defined as the number of shares traded divided by number of shares outstanding (*e.g.*, Below, Kiely and McIntosh 1995, Wang, Erickson and Chan 1995, Brennan, Chordia and Subrahmanyam 1998, Clayton and MacKinnon 1999, Chordia, Roll and Subrahmanyan 2001, Hasbrouck and Seppi 2001). In addition to a variant of Amihud's (2002) illiquidity ratio, we employ both dollar trading volume and turnover in our empirical analysis.

Factors Driving Liquidity

Numerous explanatory variables and factors have been linked, either theoretically or empirically, to the multiple definitions of liquidity defined above. For example, Bolton and von Thadden (1998) and Loughran and Schultz (2004) argue the liquidity of a common stock is positively related to its market capitalization. Furthermore, Bolton and von Thadden (1998) posit that this positive relation may result from potential information asymmetries. Pritsker (2002, p. 129) states that, in the presence of asymmetric information, "prices change in response to trades because of the information that the trades might convey about asset fundamentals." However, asymmetric information problems may be mitigated by a larger stock market capitalization. Specifically, Bolton and von Thadden (1998, pp. 2–3) posit that "the number of investors willing to invest in information acquisition in a particular stock will be increasing with the anticipated gains from trade and, hence, in the stock's market capitalization." In short, stocks with larger market capitalizations should have tighter bid-ask spreads and greater trading volume and turnover. Nelling *et al.* (1995) provide empirical support for this hypothesis in a U.S. REIT context. Marcato and Ward (2007) also find that larger REITs are more liquid, but once a REIT is listed on the NYSE, this size effect becomes less important.

A stock's liquidity is also likely to be affected by its price level and the number of shares outstanding. All else equal, it might be expected that fewer trades will be observed for stocks with relatively high stock prices because investors are able to acquire or dispose of a given dollar amount of the firm's equity with fewer trades. Consistent with this hypothesis, Bhasin, Cole and Kiely (1997) document that percentage bid-ask spreads are a decreasing function of share price. Controlling for stock price levels, liquidity is expected to be positively related to the number of shares outstanding.

Numerous studies of liquidity have also found evidence that variables that describe the shareholder base are associated with liquidity. For example, Bolton and von Thadden (1998) argue that blockholdings effectively decrease the number of shareholders and, thus, the liquidity of a stock. Benston and Hagerman (1974), Holmström and Tirole (1993) and Amihud, Mendelson and Uno (1999) also conclude that ownership concentration inhibits liquidity.

In addition to blockholdings, employees (*i.e.*, "insiders") who hold both equity and managerial positions in the firm are expected to have longer investment horizons than outsiders (Benveniste, Capozza and Seguin 2001); thus liquidity is also expected to be negatively related to insider ownership. Helfin and Shaw (2000) also argue that a high level of insider ownership may lead to greater asymmetric information problems and wider bid-ask spreads; this hypothesis is supported by the empirical findings of Sarin, Shastri and Shastri (2000).

Prior studies of stock market liquidity have also shown that institutional investors have shorter investment horizons than noninstitutional investors, suggesting share liquidity is positively related to the level of institutional ownership.[8] Nelling *et al.* (1995) argue that the presence of institutional investors reduces information asymmetries and thus increases liquidity. Using REIT data, Nelling *et al.* (1995), Below, Kiely and McIntosh (1995) and Bhasin, Cole and Kiely (1997) find that bid-ask spreads are inversely related to institutional ownership levels, a result consistent with a positive link between institutional ownership and liquidity. However, Cole (1998) and Chiang and Venkatesh (1988) do not find a significant relation between levels of institutional ownership and REIT bid-ask spreads. In a related study, Sarin, Shastri and Shastri (2000) discover that higher institutional ownership levels are associated with larger average transaction sizes.

Finally, according to the dividend policy literature, firms that consistently distribute a high percentage of earnings in the form of dividends often attract a

[8] See, for example, Jennings, Schnatterly and Seguin (2002) and the references contained therein.

clientele of investors attracted to high dividend yields (*e.g.*, Breen, Hodrick and Korajczyk 2002). We posit that some yield-seeking investors may become loyal to these firms and therefore trade less frequently.

The research reviewed above focuses on the cross-sectional determinates of liquidity. Several authors, however, have examined the liquidity of U.S. REIT shares over time. For example, Clayton and MacKinnon (1999) find that the severe downturn in the REIT market in 1998 was associated with a subsequent decrease in trading volume and an increase in price volatility and relative effective bid-ask spreads. Furthermore, they document that the decrease in liquidity was more pronounced among small-capitalization REIT stocks. In contrast, large-capitalization REIT stocks demonstrated relatively stable liquidity throughout the downturn. Examining a general market decline on the NYSE on October 27, 1997, Glascock, Michayluk and Neuhauser (2004) document that the REIT price declines were one and one-half times larger than the price declines of non-REIT stocks. Furthermore, they document that the closing percentage bid-ask spreads of all stocks significantly increased on the event day and that only the spreads of non-REIT stocks continued to widen on the following day of partial market reversion, while those on REIT stocks declined.

It is important to note that, with the exception of Below, Kiely and McIntosh (1995, 1996), the liquidity studies of property shares discussed above restrict their analyses of liquidity to comparisons of average liquidity measures and factors impacting liquidity. More specifically, these studies do not control for the influence of other factors on liquidity, nor do they examine comparable nonproperty stocks.

Data

The data collection process consisted of four steps. First, all Australian, Continental European, U.K. and U.S. companies included in the GPR General Property Share Index between January 1990 and December 2007 were identified and selected. This GPR index comprises publicly traded property companies with market capitalizations in excess of $50 million. The constituent companies must derive at least 75% of their operational revenues from investment activities (property investment companies) or a combination of investment and development activities (hybrid property companies). Companies may focus their investment and development activities in a particular property type (*i.e.*, office, residential, retail or industrial) or they may diversify across property types. The selection process resulted in 203 property companies for which all necessary data could be obtained. The distribution of these firms across our

four international markets is as follows: 20 in Australia, 61 in Europe,[9] 26 in the United Kingdom and 96 in the United States.

We next obtained daily trading volumes, share prices, total returns, number of shares outstanding and total market capitalizations from Thompson's Datastream Advance. To create a control sample of nonproperty firms, identical information was also collected for all non–real estate firms that traded in our sample countries between January 1990 and December 2007. This information was used to match each property company with a maximum of four nonproperty companies. A nonproperty company needed to have a 1990 market capitalization in a range of +/–10% of the market capitalization of the property company with which it was matched. In addition, the nonproperty companies had to be traded on the same exchange or board as the property company. Overall, the matching procedure resulted in a control sample of 808 nonproperty companies (80 Australian, 244 Continental European, 104 U.K. and 380 U.S. firms).

We construct and examine three measures of liquidity for all property and nonproperty firms. Daily data are used to construct annual averages. Our first liquidity proxy is daily trading volume measured in U.S. dollars. Second, we calculate the mean daily turnover rate, defined as the average percentage of shares outstanding exchanged per trading day. Finally, we construct firm-level daily liquidity ratios, defined as the inverse of Amihud's (2002) illiquidity defined in Equation (1).

Summary Statistics—Liquidity Proxies

Table 1 contains mean values of our three liquidity measures over time, for both our property company (Panel A) and control (Panel B) samples. Property company trading volumes, in millions of U.S. dollars, have grown at an increasing rate in all four markets. For example, the average daily trading volume in Australia was $10.48 billion in 2007, which represents a 75-fold increase over 1990. The U.S. market witnessed a 104-fold increase in trading volume over the sample period. In contrast, the trading volume of U.K. property companies was less than five times greater in 2007 than in 1990. Interestingly, in all but the United Kingdom the trading volume increases among property companies over the sample period far exceeded the corresponding increases among nonproperty firms.

[9] These 61 companies are distributed across Europe's national property share markets as follows: Austria, 4; Belgium, 2; Switzerland, 5; Denmark, 1; Germany, 3; Finland, 2; France, 13; Italy, 4; Netherlands, 7; Sweden, 15; and Spain, 5.

The average daily trading volumes for each market are displayed in Figure 1. In 1990, trading volume was highest in the United Kingdom, but that leading position has been assumed by the United States, at much higher levels. Panel A of Figure 1 clearly reveals the significant growth that has occurred in the trading volumes of U.S. property shares, especially since 1999. With the exception of a slight downturn between 2000 and 2002, Australia has also experienced significant growth in dollar trading volumes, whereas such growth has been more modest in Europe and the United Kingdom. Panel A of Figure 1 also shows that the general increase in trading volume over the sample period has not been continuous. Comparing Panel B of Figure 1 with Panel A, it is clear that dollar trading volumes for U.S. property companies since 2000 have far exceeded the volume of trading observed in the control sample. However, trading volumes in the property company and control samples are more similar in magnitude in the remaining three markets.

Table 1 ■ Mean values of liquidity measures: Selected years.

Panel A: Listed Real Estate	1990	1994	1998	2002	2007
Dollar Volume (in millions $U.S.)					
Australia	0.14	0.24	0.48	1.22	10.48
Continental Europe	0.34	0.80	0.61	0.96	5.93
United Kingdom	1.03	1.23	1.55	0.64	4.73
United States	0.24	0.79	1.94	8.09	24.85
Turnover Rate					
Australia	0.03%	0.05%	0.11%	0.12%	0.33%
Continental Europe	0.11%	0.18%	0.10%	0.19%	0.23%
United Kingdom	0.03%	0.07%	0.03%	0.08%	0.17%
United States	0.22%	0.27%	0.27%	0.53%	0.87%
Liquidity Ratio					
Australia	2.85	4.77	10.28	24.72	163.06
Continental Europe	2.30	3.18	2.54	3.07	7.21
United Kingdom	15.65	21.78	18.42	3.89	11.60
United States	0.10	1.90	3.08	2.85	13.93
Panel B: Control Sample	1990	1994	1998	2002	2007
Dollar Volume (in millions $U.S.)					
Australia	1.32	0.87	0.97	1.40	8.77
Continental Europe	0.58	0.94	0.91	0.67	4.81
United Kingdom	0.27	0.47	1.48	0.76	8.65
United States	0.33	0.82	1.16	1.10	5.53
Turnover Rate					
Australia	0.05%	0.10%	0.07%	0.15%	0.41%
Continental Europe	0.11%	0.15%	0.20%	0.30%	0.86%
United Kingdom	0.08%	0.29%	0.16%	0.45%	0.99%
United States	0.12%	0.24%	0.22%	0.35%	1.31%

Table 1 ■ continued

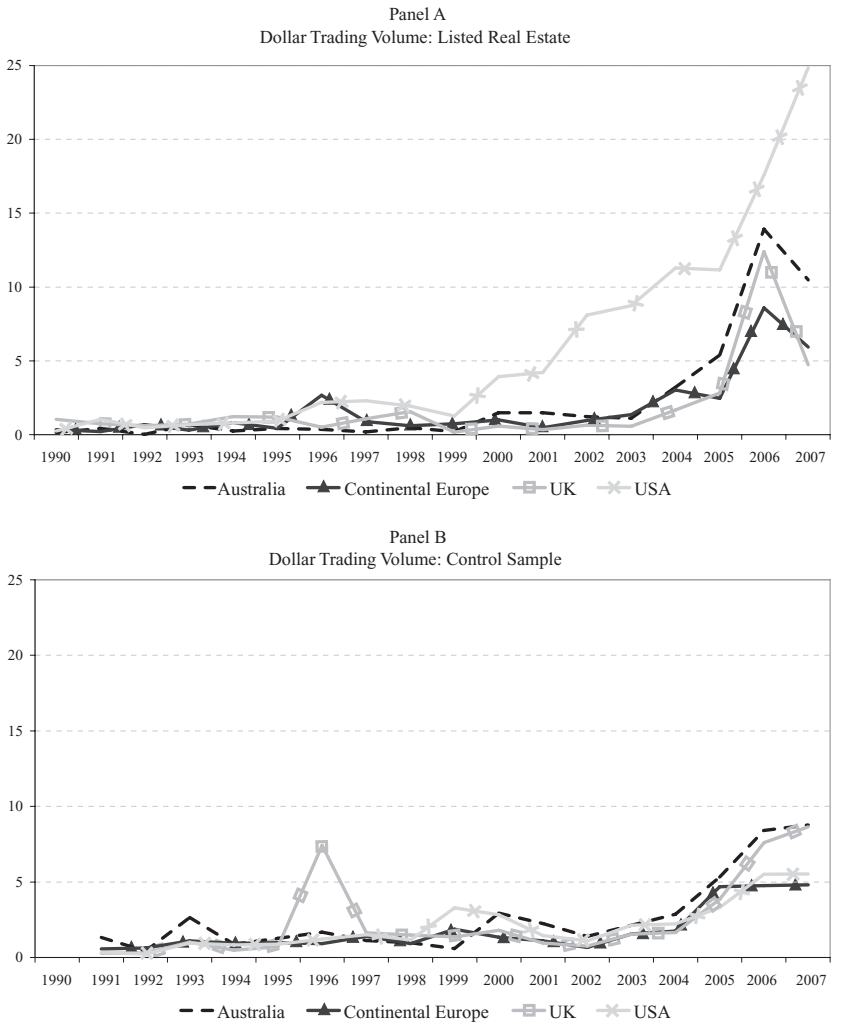
Panel B: Control Sample	1990	1994	1998	2002	2007
Liquidity Ratio					
Australia	1.85	2.77	3.73	15.53	45.18
Continental Europe	0.77	0.84	1.96	1.42	7.44
United Kingdom	5.10	10.05	7.58	5.96	30.99
United States	0.65	2.63	4.77	7.11	36.21

Notes: Dollar Volume: dollar trading volume in millions of U.S. dollars; *Turnover Rate*: the ratio between the firm's daily trading volume and number of shares outstanding; *Liquidity Ratio*: the inverse of Amihud's (2002) illiquidity ratio (see Equation (1)). All property companies included in the GPR General Property Share Index between January 1990 and December 2007 were identified and selected, which resulted in 202 property companies for which all necessary data could be obtained. The distribution of these firms is as follows: 20 in Australia, 61 in Continental Europe, 26 in the United Kingdom and 96 in the United States. Share prices, number of shares outstanding, total market capitalizations, the percentage of nonretail investors and dividend yields for our sample of property companies were obtained from Thomson's Datastream Advance. Identical information was also collected for all non–real estate firms that traded in our sample countries between January 1990 and December 2007. This information was used to match each property company with a maximum of four nonproperty companies. A nonproperty company needed to have a market capitalization in a range of +/–10% of the market capitalization of the property company with which it was matched. In addition, nonproperty companies had to be traded on the same exchange or board as the property company. The matching procedure resulted in a control sample of 808 nonproperty companies, including 80 Australian, 244 European, 104 U.K. and 380 U.S. firms. All figures are annual averages of daily data.

Examination of our second liquidity proxy, the mean daily share turnover rate, illustrates the importance of considering more than one liquidity proxy. Although both trading volume and the turnover rate display strong overall growth over the sample period, the growth paths as well as the relative positions of the four property share markets differ markedly. For example, the turnover rate among our sample of Australian property companies has increased 11-fold from 0.03% in 1990 to 0.33% in 2007. The turnover rate of property shares in the United Kingdom has also increased significantly. However, relative to the other three markets, turnover rates remain low. In fact, in 2007 the turnover rate among U.S. property companies (0.87%) was five times greater than the comparable U.K. rate (0.17%). Turnover rates of property companies in Europe have not displayed the increases observed in Australia, the United Kingdom and the United States over the 1990–2007 sample period.

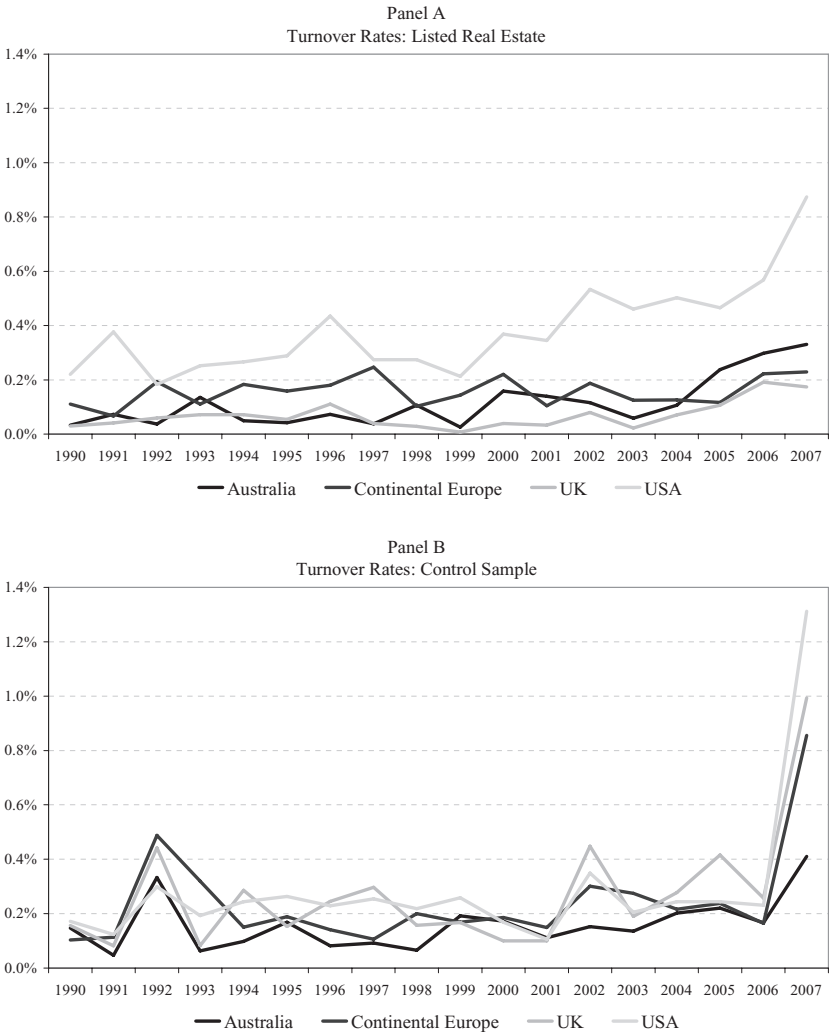
Average daily turnover rates for each market from 1990 to 2007 are displayed in Figure 2. It is clear from Panel A that shares of U.S. property companies turn over much more quickly, on average, than property shares in the other three

Figure 1 ■ Daily dollar trading volumes over time across markets.



markets, with a notable spike in U.S. share turnover in 2007. Moreover, the United States has witnessed the most rapid increase in property share turnover over the sample period. Figure 2 also makes clear that property share turnover in Continental Europe has not experienced the same increases that have occurred in the U.S. market. In fact, the average European turnover rate in 2007 was only slightly greater than in the 1990s. Based on both turnover and dollar trading volume, property company shares in the United States have exhibited substantially more liquidity than their Australian, European and U.K. counterparts.

Figure 2 ■ Turnover rates over time across markets.



Panel B of Figure 2 displays mean turnover rates for our nonproperty companies. It is interesting to note that, from 1994 through 2004, turnover rates for U.S. property companies exceeded rates observed in the U.S. control sample. However, although turnover among U.S. property companies increased significantly from 2004 to 2007, nonproperty U.S. companies displayed an even larger average increase in share turnover. This significant spike in turnover rates among the control sample also occurred in Europe and the United Kingdom. Since 1994, turnover rates for property and nonproperty companies in

Australia have been roughly similar. In Europe, however, turnover rates for property companies have been lower than nonproperty companies since 2000. The relative liquidity of U.K. property shares has also decreased substantially since 2000.

Our third proxy for liquidity, the liquidity ratio, tells a somewhat different story about the development of property share liquidity than trading volume and turnover. Most strikingly, when measured by the liquidity ratio, Australia, not the United States, is the most liquid property market, and the difference is quite large. The average daily liquidity ratio in our sample of Australian property companies averages 2.85 in 1990, increasing to 163.06 in 2007. This 57-fold increase reveals a significant reduction in the sensitivity of stock prices to dollar trading volume. In the United States, the liquidity ratio among property companies was only 0.10 in 1990, by far the lowest of all four property share markets at the time. It increased 139-fold over the following 17 years. Interestingly, the liquidity ratio in Europe has displayed only a modest three-fold increase. This relatively stagnant growth in Europe's liquidity ratio is consistent with the lack of growth in liquidly measured by trading volume and share turnover. Moreover, the liquidity ratio has actually declined somewhat in recent years in the United Kingdom, indicating more stock price sensitivity to trading volumes. Based on the liquidity ratio, the market for public property companies in the United Kingdom is, and has been, more liquid than the nonproperty company market. Until 2007, this was also true in Continental Europe. In contrast, property markets in the United Kingdom and the United States are significantly less liquid than their nonproperty counterparts.

Despite these differences, the overall picture is one of increasing liquidity in all three property share markets. This finding is in line with Marcato and Ward (2007), who analyze bid-ask spreads for U.S. REITs and British-listed property companies between 1991 and 2005, and who report decreasing spreads in both markets. However, they attribute the increase in liquidity for U.S. REITs to the introduction of new REITs in 1993 and 1994, because most of the narrowing in the bid-ask spread is in these years. Our liquidity measures do not specifically point to these years, so we cannot confirm that conclusion.

Table 2 provides correlations among our three measures of liquidity. The reported correlations are averages of the annualized cross-firm correlations across the 18-year sample period. Dollar trading volumes and share turnover display significant correlation, ranging from an average of 0.39 in the United Kingdom to 0.77 in Europe. The liquidity ratio and dollar trading volume are also positively correlated, ranging from an average of 0.29 in the United States to 0.63 in Australia. More striking is the lack of correlation between the liquidity ratio and share turnover. In fact, this correlation is negative, although not significant,

Table 2 ■ Averages of annual cross-firm correlations of liquidity variables: 1990–2007.

		Dollar Volume	Share Turnover
Australia	Share turnover	0.42	
	Liquidity ratio	0.63	0.26
Continental Europe	Share turnover	0.77	
	Liquidity ratio	0.32	0.16
United Kingdom	Share turnover	0.39	
	Liquidity ratio	0.55	−0.11
United States	Share turnover	0.73	
	Liquidity ratio	0.29	−0.08

Notes: Dollar volume is the annualized daily average of dollar trading volume in millions of U.S. dollars. Share turnover is defined as the annual average of the ratio between the firm's daily trading volume and the number of shares outstanding. The liquidity ratio is defined as the inverse of Amihiud's (2002) illiquidity ratio (see Equation (1)). The reported correlations are averages of the annual cross-firm correlations across the 18-year sample. The number of firms in each sample is as follows: 20 in Australia, 61 in Continental Europe, 26 in the United Kingdom and 96 in the United States. To construct the sample, all Australian, Continental European, U.S. and U.K. companies included in the GPR General Property Share Index between January 1990 and December 2007 were identified and selected, which resulted in 203 property companies for which all necessary data could be obtained. Dollar trading volumes, number of shares traded, number of shares outstanding and daily share prices changes were obtained from Thomson's Datastream Advance.

in both the United Kingdom and the United States. Clearly, our liquidity proxies are capturing different information over the 1990–2007 time period. This, in turn, supports the notion that share price liquidity is multifaceted and that reliance on any one measure of liquidity in empirical work may not produce robust conclusions.

Summary Statistics—Explanatory Variables

Table 3 contains average values for the explanatory variables used in our regression analysis of the determinants of liquidity. The first three columns display mean values for our sample of property companies for the years 1990, 1998 and 2007; the remaining three columns contain the corresponding data for our control sample of nonproperty firms. Overall, Table 3 reveals that, on average, property companies vary significantly from nonproperty companies of comparable size in characteristics found to impact stock market liquidity in previous studies.

Table 3 ■ Summary statistics—explanatory variables.

	Property Shares			Control Sample		
	1990	1998	2007	1990	1998	2007
Average Market Cap (in millions $U.S.)						
Australia	351	841	5,697	757	987	4,768
Continental Europe	439	607	3,067	418	939	2,899
United Kingdom	645	931	2,202	388	939	2,120
United States	176	853	2,916	477	1,317	2,544
Average Daily Share Price (in $U.S.)						
Australia	$0.92	$1.48	$3.45	$2.78	$2.87	$11.50
Continental Europe	$54.76	$40.46	$70.03	$107.89	$100.28	$319.36
United Kingdom	$5.06	$4.26	$12.80	$4.49	$7.90	$19.39
United States	$8.90	$20.45	$40.38	$8.56	$20.56	$41.21
Percentage of Shares Held by Non-Retail Investors and Employees						
Australia	52.2%	21.3%	22.5%	32.8%	34.2%	21.1%
Continental Europe	52.8%	46.5%	38.2%	53.1%	46.5%	45.7%
United Kingdom	34.3%	32.3%	21.8%	18.5%	23.5%	18.1%
United States	21.6%	23.2%	19.4%	21.0%	22.5%	19.6%
Average Daily Dividend Yield						
Australia	10.5%	7.2%	6.0%	5.7%	4.5%	3.7%
Continental Europe	3.8%	3.3%	3.9%	2.8%	3.1%	2.9%
United Kingdom	3.2%	2.7%	2.2%	4.4%	3.3%	2.4%
United States	9.3%	6.9%	5.2%	3.2%	1.7%	1.7%

Notes: All Australian, Continental European, U.K. and U.S. companies included in the GPR General Property Share Index between January 1990 and December 2007 were identified and selected, which resulted in 203 property companies for which all necessary data could be obtained. The distribution of these firms across our four international markets is as follows: 20 in Australia, 61 in Continental Europe, 26 in the United Kingdom and 96 in the United States. Average market capitalizations are reported in millions of U.S. dollars. Daily share prices are also in U.S. dollars. Share prices, number of shares outstanding, total market capitalizations, the percentage of nonretail investors and dividend yields for our sample of property companies were obtained from Thomson's Datastream Advance. We define nonretail investors as large blockholders, employee owners and institutional investors. Identical information was also collected for all non–real estate firms that traded in our sample countries between January 1990 and December 2007. This information was used to match each property company with a maximum of four nonproperty companies. A nonproperty company needed to have a market capitalization in a range of +/–10% of the market capitalization of the property company with which it was matched. In addition, nonproperty companies had to be traded on the same exchange or board as the property company. The matching procedure resulted in a control sample of 808 nonproperty companies, including 80 Australian, 244 Continental European, 104 U.K. and 380 U.S. firms. All figures are annual averages of daily data.

Inspection of mean equity market capitalizations clearly reveals that property companies in all four markets increased significantly in size over the 1990–2007 sample period. For example, the average market capitalization of U.S. property companies increased from $176 million in 1990 to $2.9 billion in 2007. However, it was not until 2003 that the average market capitalization (in U.S. dollars) in all four countries exceeded $1 billion. The growth in average firm size accelerated after 2002; for example, by 2007 the average market capitalization of our Australian property companies was $5.7 billion. The corresponding 2007 averages for our U.K. and European property firms are $2.2 and $3.1 billion, respectively. By construction, the average market capitalizations of our control samples are similar to the market capitalization of our property companies. However, it is worth noting that, with the exception of the United Kingdom, average market capitalizations have grown more quickly among property companies than in our control samples.

The average daily share price of property firms in Europe (measured in U.S. dollars) far exceeds share prices in our three other markets. For example, in 2007 the average share price of a property company in Europe was $70.03. The corresponding average share price in Australia, the United Kingdom and the United States were $3.45, $12.80 and $40.38, respectively. These share price differences are substantial, but they seem to be decreasing, as property share prices in Europe have grown at a slower pace compared to share prices in the other three markets. In both Europe and Australia, the average share price of property firms is significantly less than the price of nonproperty firms in the control samples. In contrast, the share prices of property firms in the United Kingdom and the United States are only slightly less than the corresponding prices of firms in the control samples. It is worth noting that the higher average share prices in Continental Europe are offset to some degree by a lower average number of shares outstanding.

As discussed above, prior studies have provided evidence that liquidity is negatively related to blockholdings and the holdings of insiders. In contrast, the empirical link between institutional ownership and property share liquidity is less clear. Unfortunately, we are unable to distinguish among blockholders, insiders and institutional investors in our data set. We therefore refer to the sum of these three investor groups as "nonretail" investors.

In all four property share markets, the percentage of shares held by nonretail investors has decreased between 1990 and 2007, and especially so in Australia. By 2007, the average percentage of shares held by nonretail investors varied remarkably little in Australia, the United Kingdom and the United States,

ranging from 19.4% in the United States to 22.5% in Australia.[10] However, at 38.2%, the corresponding 2007 percentage in Europe is noticeably higher. In three of four property share markets, the degree to which shares are held by nonretail investors is similar to that in nonproperty firms. In the United States, for example, nonretail investors in U.S. property firms owned 19.4% of outstanding shares in 2007. The corresponding figure for our U.S. control sample is 19.6%. Only in Europe is this percentage substantially higher in nonproperty than in property firms.

Property company dividend yields vary significantly across countries. As expected, dividend yields are highest in Australia and the United States—countries in which most publicly traded real estate firms are structured to avoid entity-level taxation. Despite the fact that yields have come down substantially in both countries, the average 2007 dividend yield for our U.S. sample of property companies was 5.2%; the corresponding yield in Australia was 6.00%. In contrast, property companies in the United Kingdom during the 1990–2007 time period were taxed as regular corporations.[11] Thus, to mitigate the adverse effects of double taxation on shareholders, U.K. companies tended to retain a larger percentage of firm earnings with the intent to produce increased capital gains for investors that are taxed on a deferred basis and at lower rates than dividend income. This reinvestment strategy is reflected in an average 2007 U.K. dividend yield of just 2.2%. Our European sample contains both firms able to avoid entity-level taxation and firms that cannot. This mixture of pass-through and fully taxable companies explains the 3.9% average dividend yield in 2007. Note also that dividend yields in the United Kingdom are broadly consistent with those of nonproperty firms, reflecting their similar taxation. In Australia and, in particular, the United States, average dividend yields for our sample of property firms are significantly higher than the yields of comparable-size nonproperty companies.

[10] According to Thompson Financial, the data provider, closely held shares include: (1) shares held by officers, directors and their immediate families; (2) shares held in trust; (3) shares of the company held by any other corporation (except shares held in a fiduciary capacity by banks or other financial institutions); (4) shares held by pension/benefit plans; and (5) shares held by individuals who hold 5% or more of the outstanding shares. It excludes: (1) shares under option exercisable within 60 days, (2) shares held in a fiduciary capacity, (3) shares held by insurance companies and (4) preferred stock or debentures that are convertible into common shares.

[11] Although the REIT system had been introduced in the United Kingdom by 2007, this does not impact our results, because the introduction was gradual and has only involved a minority of the firms in our sample during 2007.

Explaining Cross-Sectional Variation in Liquidity

To investigate the determinants of international property share liquidity, we separately estimate the following weighted panel regression for both property and nonproperty companies:

$$\begin{aligned} Volume_t^i = {} & \alpha + \beta_1\, Australia + \beta_2\, Europe + \beta_3\, UnitedKingdom \\ & + \beta_4\, MarketCap_t^i + \beta_5\, Non\,\mathrm{Re}\, tail_t^i + \beta_6\, DividendYield_t^i \\ & + \beta_7\, \mathrm{Pri}ce * Australia_t^i + \beta_8\, \mathrm{Pri}ce * Europe_t^i + \beta_9\, \mathrm{Pri}ce * UK_t^i \\ & + \beta_{10}\, \mathrm{Pri}ce * US_t^i + \varepsilon_t, \end{aligned} \tag{2}$$

where:

$Volume_t^i$ = the average daily trading volume, in U.S. dollars, for firm i in year t;
α = constant;
$Australia$ = binary variable set equal to one if firm i is located in Australia;
$Europe$ = binary variable set equal to one if firm i is located in Continental Europe;
UK = binary variable set equal to one if firm i is located in the United Kingdom;
$MarketCap_t^i$ = average daily market capitalization, in millions of U.S. dollars, of firm i in year t;
$Nonretail_t^i$ = average percentage of shares of firm i held by nonretail investors in year t;
$DividendYield_t^i$ = average daily dividend yield of firm i in year t;
$\mathrm{Pri}ce * Australia_t^i$ = average daily stock price of firm i in year t; times Australian indicator variable;
$\mathrm{Pri}ce * Europe_t^i$ = average daily stock price of firm i in year t; times Europe indicator variable;
$\mathrm{Pri}ce * UK_t^i$ = average daily stock price of firm i in year t; times U.K. indicator variable;
$\mathrm{Pri}ce * US_t^i$ = average daily stock price of firm i in year t; times U.S. indicator variable;
ε_t = an error term.

We base the regression model on a U.S. perspective; therefore, the estimated intercept of the regression can be interpreted as the country effect for the United States. The *Nonretail* variable is the percentage of a firm's shares held by nonretail investors, here defined to include institutional investors, employees and blockholders. In prior studies, institutional ownership is generally

associated with increased liquidity. In contrast, employees and blockholders usually have a negative impact on liquidity. Unfortunately, our data set does not allow us to distinguish among these three types of nonretail shareholders.

We estimate an unbalanced panel regression that includes all cross-sectional observations from 1990 to 2007 (*i.e.*, 18 years). Although not reported, yearly fixed effects are also included. Because we do not have complete information on each variable for each firm and year, we weigh regression coefficients based on time. More recent years with larger sample sizes are therefore more heavily weighted. We use White (1980) diagonal standard errors and covariances. An identical panel regression is also estimated for the control sample. *t* statistics are reported in parentheses. The property company results are estimated with 1,665 observations; the control sample contains 7,553 observations.[12]

The regression results for dollar trading volume are reported in Columns 1 and 2 of Table 4. The dollar trading volume of Australian and European property companies is not distinguishable from the trading volume of U.S. property firms. In contrast, U.K. property company shares have significantly less trading volume than the shares of U.S. property firms, all else equal. In the control sample, the estimated coefficients on *Australia*, *Europe* and *UK* are all negative and highly significant, indicating that U.S. nonproperty companies of similar market capitalization experience significantly more trading volume than their European, Australian and U.K. counterparts.

As expected, property companies with larger market capitalizations have significantly greater trading volume, all else equal. This result is consistent with the findings of Nelling *et al.* (1995), Benveniste, Capozza and Seguin (2001) and Marcato and Ward (2007). Moreover, the estimated coefficient on *Market Cap.* is of similar magnitude in the control sample regression. A significant and positive relation between *Volume* and market capitalization is consistent with the results of Bolton and von Thadden (1998) and Loughran and Schultz (2004) for the general U.S. stock market.

Among property firms, the estimated coefficient on *Nonretail* is negative and significant. Similar, but somewhat stronger, results are found for our control sample. Thus, the negative impact of large blockholdings and insider ownership

[12] One referee raised a concern about the potential endogeneity of share price levels and our liquidity proxies. To examine this issue, we also ran two-stage-least-squared cross-sectional regressions on annual subsets of our data with both stock price and trading volume (as well as our other liquidity proxies) as dependent variables. Although not reported, the estimated coefficients on stock price are nearly identical to the ordinary least squares (OLS) estimates presented here. Given the panel setting of our data set, we prefer to estimate the regressions using OLS.

Table 4 ■ Panel regressions explaining firm-level variation in liquidity.

	Dollar Volume		Turnover Rate		Liquidity Ratio	
	Property Shares	Control Sample	Property Shares	Control Sample	Property Shares	Control Sample
Intercept	1.07	12.79***	4.44***	9.36***	40.10***	48.02***
	(0.8)	(13.5)	(7.4)	(22.6)	(6.7)	(3.9)
Australia	1.21	−5.21***	−2.76***	−4.74***	113.93***	68.43***
	(0.7)	(−4.8)	(−3.5)	(−10.1)	(19.7)	(5.7)
Europe	−0.91	−3.54***	−1.29**	−4.03***	1.14	−10.68
	(−0.7)	(−4.3)	(−2.3)	(−11.4)	(0.2)	(−0.9)
UK	−3.21**	−5.63***	−3.01***	−5.02***	1.01	39.55***
	(−2.5)	(−6.6)	(−5.4)	(−13.3)	(0.2)	(3.3)
Market Cap.	0.00***	0.00***	0.00	−0.00***	0.01***	0.01***
	(21.5)	(12.4)	(−0.1)	(−8.3)	(22.1)	(7.2)
Nonretail Investors	−0.03**	−0.05***	−0.02***	−0.02***	−0.15**	0.37***
	(−2.4)	(−4.3)	(−3.9)	(−4.0)	(−2.4)	(2.6)
Dividend Yield	0.15	−0.26***	0.09**	−0.13***	0.67*	−0.67
	(1.5)	(−3.9)	(2.3)	(−4.1)	(1.7)	(−0.6)
Price ∗ Australia Interaction	−3.38***	−0.24**	−0.03	−0.02	2.11	−4.27***
	(−6.5)	(−1.9)	(−0.2)	(−0.4)	(1.3)	(−4.1)
Price ∗ Europe Interaction	−0.09***	0.00	−0.02	0.01***	−0.26**	0.75***
	(−4.3)	(0.1)	(−1.6)	(3.8)	(−2.1)	(3.9)
Price ∗ UK Interaction	−0.17**	0.04	−0.01	0.04*	0.79*	−1.65***
	(−2.1)	(0.7)	(−0.3)	(1.9)	(1.7)	(−2.9)
Price ∗ US Interaction	0.06***	0.00	0.00	−0.01***	−0.86***	−0.76***
	(3.2)	(0.1)	(0.6)	(−3.9)	(−9.4)	(−3.9)

Table 4 ■ continued

	Dollar Volume		Turnover Rate		Liquidity Ratio	
	Property Shares	Control Sample	Property Shares	Control Sample	Property Shares	Control Sample
Adjusted R^2	0.30	0.12	0.07	0.11	0.65	0.05
F statistic	33.37	37.92	6.97	35.76	103.40	9.05

Notes: t statistics are reported in parentheses. *, ** and *** denote statistical significance at the .01 level, .05 level and .10 level, respectively. The dependent variables are the annualized daily average of dollar trading volume in millions of U.S. dollars (Columns 1 and 2), the share turnover rate (Columns 3 and 4) defined as the ratio between the firm's daily trading volume multiplied by 1,000 and the number of shares outstanding and the liquidity ratio (Columns 5 and 6) defined as the inverse of Amihud's (2002) illiquidity ratio (see Equation (1)). *Australia*, *Europe* and *UK* are binary variables set equal to one if the firm is located in one of these respective countries. We base the regression model on a U.S. perspective; therefore, the estimated intercept of the regression can be interpreted as the country effect for the United States. *Market Cap.* is the firm's average annual average market capitalization, based on daily data, in millions of U.S. dollars; *Nonretail Investors* is the percentage of shares of stock held by nonretail investors, defined to include institutional investors, employees and blockholders; *Dividend Yield* is the annual average dividend yield; *Price ∗ Australia, Price ∗ Europe, Price ∗ UK and Price ∗ US* are interaction variables constructed by multiplying the firms' stock prices by the Australia, Europe, U.K. and U.S. indicator variables, respectively. We estimate an unbalanced panel regression that includes all cross-sectional observations from 1990 to 2007 (*i.e.*, 18 years). Regression coefficients are weighted based on time. More recent years with larger sample sizes are therefore more heavily weighted. Although not reported, yearly fixed effects are also included. We use White (1980) diagonal standard errors and covariances. The property company results are estimated with 1,665 observations; the control sample contains 7,553 observations.

on liquidity appears to dominate any positive effect associated with institutional ownership.

Dollar trading volume is not associated with the firm's dividend yield in the property company regression. However, the estimated coefficient on *Dividend Yield* is negative and significant in our control sample. The lack of significance in our property company regressions may reflect the fact that the majority of these firms must consistently pay a high percentage of their earning as dividends in order to retain their tax-exempt status. Thus, there is significantly less variation in dividend yields in our sample of property firms than in the control sample.[13]

As previously discussed, the literature generally suggests a negative relationship between liquidity and share price. By including a stock price–country dummy interaction variable for all four markets, we are able to test for a country effect in the relation between trading volume and share price. The regression results reported in Table 4 reveal significant variation in the sign and significance of the four price–country interaction variables. In particular, higher share prices have a negative and significant effect on property share trading volume in Australia, Europe and the United Kingdom. In contrast, the estimated coefficient on *Price* $*$ *US* is positive and significant. However, when using our nonproperty company sample, only the estimated coefficient on *Price* $*$ *Australia* is statistically significant.

The panel regression model is able to explain 30% of the variation in dollar trading volume among property companies. However, at 0.12, the adjusted R^2 for our control sample regression is significantly lower. This suggests that the trading volume of property shares may be driven by different fundamentals than the trading volume of common stocks.[14]

We next estimate a revised version of Equation (2) in which we substitute share turnover rates for dollar trading volume as the dependent variable. To help interpretation of the economic significance of the explanatory variables, we multiply the turnover rate by 1,000. The results for the turnover rate specification are reported in Columns 3 and 4 of Table 4. In our property company regression, the estimated coefficients on *Australia*, *Europe* and *UK* are

[13] For example, the standard deviation of average dividend yields in our U.S. property company sample is 4.68%; the corresponding standard deviation for our U.S. control sample is 2.48%.

[14] Despite the matching of our property companies with our control sample based on market capitalization, it is likely the control sample is more heterogeneous than our sample of property companies. This may partially account for the reduced explanatory power of the control sample regressions.

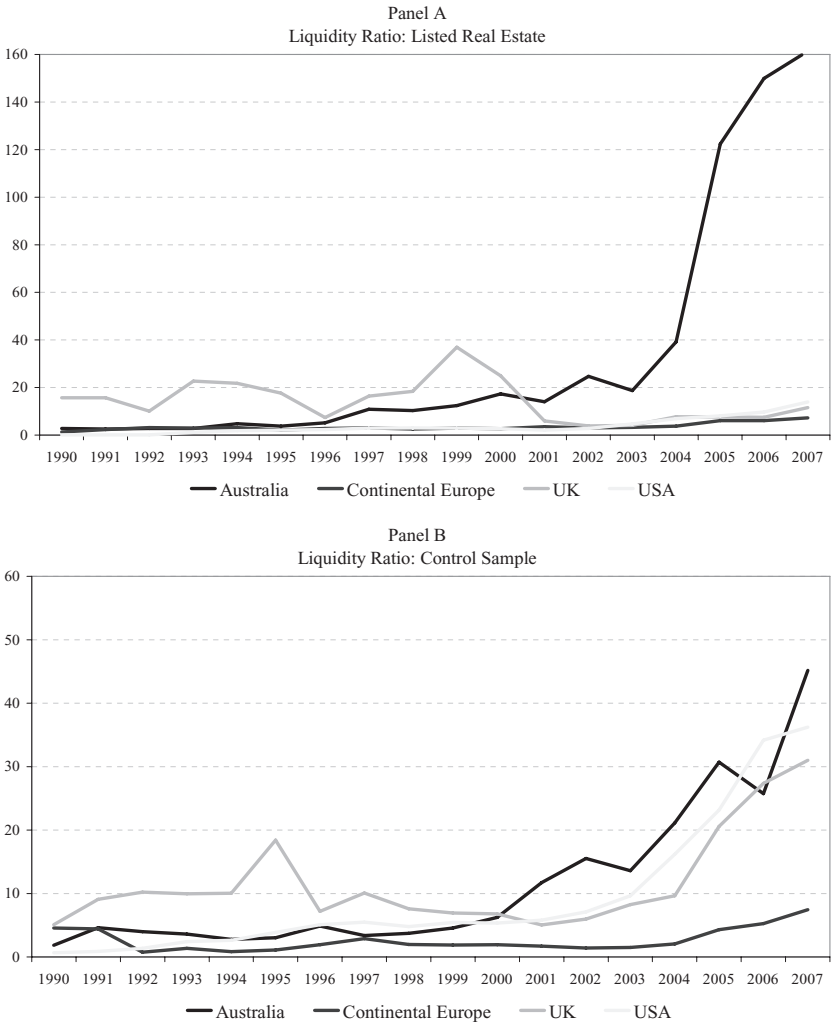
negative and significant, providing additional evidence that U.S. property shares are significantly more liquid than property shares in Australia, Europe and the United Kingdom. The negative coefficient estimates on the country dummies are even more pronounced in the control sample regression. Overall, turnover rates are significantly greater in the United States than in our other markets.

Interestingly, the estimated coefficient on *Market Cap.* in our property company turnover regression cannot be distinguished from zero. In sharp contrast, the estimated coefficient on *Market Cap.* is negative and highly significant in our control sample regression. Turnover rates for both property and nonproperty firms are negatively related to the concentration of nonretail ownership. In fact, the estimated coefficients on *Nonretail* are nearly identical in the two samples. The estimated coefficient on *Dividend Yield* is actually positive and significant in the property company regression but negative and significant in the control sample regressions. Although the trading volume of property companies in Australia, Europe and the United Kingdom are significantly more negatively affected by price than in the United States, the sensitivity of turnover rates to stock price levels does not vary across markets in our sample of property companies. However, in our control sample, turnover rates in the United States and Europe are significantly more adversely affected by high share prices than in Australia and the United Kingdom.

Finally, we estimate a version of Equation (2) using the liquidity ratio as the dependent variable. The estimated coefficient is significant and positive on *Australia*, but it is not statistically significant for *Europe* and the *UK*. Consistent with Figure 3, the magnitude of the coefficient on *Australia* suggests that, when measured by the liquidity ratio, Australia has the most liquid property share market. The results for the control sample tell a similar story, with *Australia* having the largest regression coefficient.

The estimated coefficient for *Market Cap.* is strongly positive and significant for property shares (t statistic $= 22.1$). This coefficient estimate is nearly identical to the corresponding estimate in the control sample regression. The estimated coefficient on *Nonretail* is negative and significant in our property shares regression but positive and significant in the control sample regression. The estimated coefficient on *Dividend Yield* is weakly significant and positive in our property shares regression but insignificant in the control sample regression. Regarding share price, we do find the negative relation with liquidity the literature suggests for the United States and for Continental Europe. However, for the United Kingdom we find a weakly significant positive effect, and for Australia we find no significant effect at all. The results for our sample of property firms contrast sharply with those for the control sample, where we find negative and significant regression coefficients on the price–country interaction

Figure 3 ■ Liquidity ratios over time across markets.



variables for all markets except Europe. The adjusted R^2 for the liquidity ratio regression is 0.65, which is quite high compared to the previous two regression specifications. The adjusted R^2 for the control sample regression is much lower (0.05). This again suggests the liquidity of property shares may be driven by a different set of fundamentals than the liquidity of common stocks.

Liquidity and Firm Value

We next address a question of fundamental importance: Does liquidity matter? That is, do cross-country differences in liquidity influence firm value and return performance? Since Amihud and Mendelson (1986), researchers have attempted to document a link between the value of a firm's equity and its underlying liquidity. A common approach is to search for the expected negative relation between liquidity and required returns. However, required rates of return are not directly observable; thus, researchers are forced to use observed rates of returns as proxies for required rates of return. Unfortunately, the statistical power of such tests is low, especially in smaller samples, because the variance of the unexpected component of observed returns dominates the variance of the expected component (see Benveniste, Capozza and Seguin 2001, p. 634).

To avoid the problem of low statistical power associated with the use of realized returns as proxies for required returns, we follow Benveniste, Capozza and Seguin (2001) and examine directly the relation between liquidity and firm value. More specifically, we quantify the relation between firm liquidity and Tobin's q, defined as the ratio of each firm's equity market value to the book value of total assets.[15] We accomplish this by estimating the following cross-sectional regression, using the combined data set of 203 listed property companies, of firm-level Tobin's q on one of our liquidity measures and a vector of control variables:

$$\begin{aligned} q_t^i = {} & \alpha + \beta_1 \, Age_{t-1}^i + \beta_2 \, Assets_{t-1}^i + \beta_3 \, DividendYield_{t-1}^i \\ & + \beta_4 \, DebtAssets_{t-1}^i + \beta_5 \, Volality^i + \beta_6 \, Nonretail_t^i \\ & + \beta_7 \, Liquidity_{t-1}^i + \varepsilon^i, \end{aligned} \tag{3}$$

where:

q_t^i = Tobin's q for firm i at the end of year t, measured as the ratio of the firm's market value to the book value of total assets;
α = a constant;
Age_{t-1}^i = the log of firm i's age at the end of year $t-1$;
$Assets_{t-1}^i$ = the log of firm i's assets at the end of year $t-1$;
$DividendYield_{t-1}^i$ = average daily dividend yield of firm i in year $t-1$;
$DebtAssets_{t-1}^i$ = total debt over total assets for firm i at the end of year $t-1$;

[15] For additional justification of the use of Tobin's q in this context, see Lang and Stulz (1994). Benveniste, Capozza and Seguin (2001) use estimates of the current market values of the firm's assets (NAVs) in the denominator of their q ratios instead of depreciated book values, as is standard in the literature. We cannot replicate this approach because we do not have NAV estimates.

$Volatility^i$ = return volatility, measured by the standard deviation of monthly share price returns for the prior 60 months;
$Nonretail_t^i$ = average percentage of shares of firm i's shares held by nonretail investors in year t.
$Liquidity_{t-1}^i$ = the average value of one of our three liquidity measures—*Dollar Trading Volume*, *Turnover Rate* or *Liquidity Ratio*—for firm i in year $t-1$.
ε_t = an error term.

Our selection of control variables is motivated by Amihud (2002) and Amihud, Mendelson and Pedersen (2005). This cross-sectional regression is repeated for each year from 1991 to 2007 (we lose 1990 due to the lag structure). We first estimate the annual cross-sectional regressions using only the control variables; subsequently we test the effect of individually adding each of the liquidity proxies. Average coefficient estimates and t statistics from the 18 cross-sectional regressions are reported in Table 5.

We find no evidence that Tobin's q is associated with firm age. The estimated coefficient on the log of total firm assets is negative and statistically significant in all four regression specifications. This negative relation between firm size and market value is surprising given that the observed consolidation that occurred in the REIT industry during this period suggests larger firms were more, not less, valuable.

When using the liquidity ratio as our proxy for liquidity, we find a negative and statistically significant relation between the firm's *Dividend Yield* and Tobin's q. Although negative, the estimated coefficient on *Dividend Yield* is not significant in the other three specifications. When employing only the control variables, we also find a negative and statistically significant relation between *Debt Asset* and Tobin's q. However, none of the other control variables, including *Nonretail Investors*, has a significant relation with firm value.

Adding measures of liquidity to the cross-sectional regressions does not markedly affect the magnitude or significance of the control variables. Moreover, although the estimated coefficients on dollar trading volume and share turnover carry the expected positive signs, neither is statistically significant. Thus, trading volume and turnover do not appear to be important determinants of firm value in our sample of property companies. However, the estimated coefficient on the liquidity ratio (Column 4) is positive and significant at the 10% level. In summary, although we find some limited evidence of an empirical link between liquidity and firm value, our evidence is less conclusive than the findings of Benveniste, Capozza and Seguin (2001) in the U.S. REIT market.

Table 5 ■ Cross-sectional regressions explaining the impact of firm liquidity on Tobin's *q*.

Intercept	2.77***	3.08**	2.61**	5.65***
	(2.0)	(2.3)	(2.0)	(3.8)
Age	0.11	0.14	0.15	−0.05
	(0.6)	(0.6)	(0.6)	(0.1)
Assets	−0.24**	−0.34***	−0.22***	−0.64***
	(−2.1)	(−2.6)	(−2.4)	(−3.6)
Dividend Yield	−0.06	−0.06	−0.09	−0.09**
	(−1.4)	(−1.4)	(−1.5)	(−2.0)
Debt/Assets	−1.03*	−0.82	−0.79	−1.00
	(−1.7)	(−1.4)	(−1.4)	(−1.6)
Volatility	0.02	0.01	0.00	0.03
	(0.4)	(0.2)	(0.1)	(0.6)
Nonretail Investors	−0.01	−0.01	−0.01	−0.01
	(−1.4)	(−1.2)	(−1.3)	(−1.0)
Dollar Trading Volume		0.16		
		(1.3)		
Share Turnover			116.46	
			(0.9)	
Liquidity Ratio				0.04*
				(1.7)
R^2	0.35	0.39	0.40	0.56
F statistic	5.28	5.01	6.42	8.70

Notes: This table contains results of annual cross-sectional regressions of firm-level Tobin's *q* on several firm characteristics and three measures of stock liquidity for our set of 203 listed real estate companies. Tobin's *q* is defined as the value of the firm's equity at year end divided by the book value of total assets. The reported coefficients and *t* statistics (in parentheses) are averages of the 18 annual cross-sections from 1990 through 2007. *, ** and *** denote statistical significance at the .01 level, .05 level and .10 level, respectively. Tobin's *q* is calculated as the ratio of the firm's market value to total assets. *Age* is the firm's age in years; *Assets* is the value of the firm's assets; and *Debt/Assets* is the ratio of total debt over total assets, all measured at the end of the prior year. *Dividend Yield* is the average daily dividend yield in the prior year; *Volatility* is return volatility, measured as the standard deviation of share price returns for the prior 60 months; and *Nonretail Investors* is the percentage of shares of stock held by nonretail investors, defined to include institutional investors, employees or blockholders. *Dollar Trading Volume*, *Share Turnover* and *Liquidity Ratio* are the average values of our three liquidity proxies in year $t-1$. A lack of firms in Australia and the United Kingdom, especially in the early years of our sample period, precludes the inclusion of country fixed effects.

Overall, our cross-sectional regressions are able to explain an average of 35% to 56% of firm-level variation in Tobin's *q*.

Finally, we examine the time-series effects of market-wide changes in stock liquidity on property company returns. Amihud (2002) posits that required risk

premiums in the current period are a decreasing function of current liquidity, as expected in the prior period. That is, expected liquidity increases equity values and, therefore, decreases excess returns. In contrast, excess returns are an increasing function of contemporaneous unexpected liquidity.

To test these two hypotheses, we first compute averages of our firm-level liquidity ratios for each quarter of the sample period. We refer to this country-specific aggregate measure of the liquidity ratio as *ALIQRATIO*. Expected liquidity for each country in the current quarter is defined as *ALIQRATIO* in the previous quarter (similar to an AR(1) model). Unexpected liquidity in the current quarter is therefore the difference between this quarter's aggregate liquidity and the previous quarter's.

To compute market-wide measures of excess returns (risk premiums) as the dependent variable, we obtained quarterly total returns on the aggregate real estate indexes in Australia, Europe, the United Kingdom and the United States from the GPR General National index for 1990–2007. To obtain country-level betas, we regressed these quarterly returns on the MSCI National Stock index for each country. Each country's excess return (alpha) is computed by

Table 6 ■ Time-series effects of market-wide changes in property share liquidity.

	Australia	Continental Europe	United Kingdom	United States
Intercept	0.03	0.01	0.02	0.02
	(5.1)	(0.2)	(1.5)	(2.6)
Expected liquidity	−0.01	−0.01	−0.01	−0.08
	−(0.2)	−(0.9)	(−0.3)	−(1.8)
Unexpected liquidity	0.01	0.01	0.01	0.02
	(0.6)	(0.5)	(0.5)	(0.5)
R^2	0.01	0.01	0.01	0.07

Notes: We first compute an average of firm-level liquidity ratios for each quarter of the sample period. Expected liquidity in each quarter is defined as liquidity in the previous year. Unexpected liquidity is the difference between this quarter's aggregate liquidity and the previous quarter's. To compute market-wide measures of excess returns (risk premiums), we obtained quarterly returns on the listed real estate indexes in Australia, Europe, the United Kingdom and the United States from the GPR General National index for 1990–2007. To estimate market-level betas, we regressed these quarterly returns on the MSCI National Stock index for each country. Each market's excess return (alpha) is computed by subtracting the product of each market's beta and stock market return from the GPR General return of each quarter. This procedure produces a data set that contains 71 quarterly observations of excess return, expected liquidity and unexpected liquidity for each market (we lose one quarterly observation in the calculation of expected liquidity). We then regress each market's excess quarterly return on an intercept, expected liquidity and unexpected liquidity.

subtracting the product of each country's beta and stock market return from the GPR General return in each quarter. This procedure produces a data set that contains 71 observations of excess returns, expected liquidity and unexpected liquidity for each country (we lose one observation in the calculation of expected liquidity). Finally, we regressed each country's time series of excess returns on an intercept, expected liquidity and unexpected liquidity.

The results of this estimation are reported in Table 6. The coefficients on expected liquidity carry the expected negative sign, and the estimated coefficients on unexpected liquidly carry the expected positive signs. However, none of the estimated liquidity coefficients are statistically significant. Thus, at a quarterly frequency, the liquidity effects on share performance posited by Amihud (2002) are not present in our global data set of property shares.

Conclusion

At year-end 2007, the market value of property companies traded on public exchanges around the world exceeded one trillion in U.S. dollars. In addition to return performance and real estate's value as a diversifier in a mixed-asset portfolio, recent surveys indicate that many investors in international property shares deem liquidity to be an important risk factor in the real estate investment decision-making process. Moreover, several recent studies using U.S. data have found a link between liquidity and share prices. However, despite a large literature on the co-movement of asset prices, returns and volatilities across international markets, the role of liquidity in international stock markets has been underresearched. This article examines the liquidity of property company shares and a control sample of nonproperty companies in the world's four largest securitized real estate markets: the United States, the United Kingdom, Continental Europe and Australia.

We employ three measures of liquidity: (1) dollar trading volume; (2) turnover, defined as the ratio between the firm's daily trading volume and number of shares outstanding; and (3) the inverse of Amihud's (2002) illiquidity ratio, defined as the ratio of the absolute value of the firm's daily stock return to dollar trading volume. A significant advantage of these liquidity measures is that their construction requires only daily data on firm market capitalizations, number of shares outstanding, trading volume and total returns. These data are more readily available across international markets and over time than the microstructure data needed to construct measures of liquidity based on bid-ask spreads.

We extend the existing literature along several important dimensions. First, during the later years of our 1990–2007 sample period, significant growth and

interest in international real estate have occurred, and many publicly traded property companies have evolved from small-cap stocks into mid-cap and, in some cases, large-cap stocks. Prior research strongly suggests that liquidity is positively related to a firm's market capitalization. However, with the exception of Marcato and Ward (2007), existing studies of U.S. property share liquidity have relied on pre-2000 data. Second, we analyze property share liquidity internationally in order to determine the extent to which U.S. property share is comparable to liquidity in the largest non-U.S. securitized real estate markets. Third, by comparing our property company results to a control sample of nonproperty stocks we are able to compare the liquidity of property companies to common stocks, a comparison of significant interest to international investors. Finally, our use of three separate proxies for liquidity permits an examination of the robustness of our results not possible in earlier studies.

To investigate the determinants of international property share liquidity, we estimate weighted panel regressions for both property companies and our control sample of nonproperty firms. Our primary results can be summarized as follows. First, with respect to liquidity differences across countries and continents, we find evidence that shares of U.S. property companies are significantly more liquid than European, Australian and U.K. property company shares. Moreover, U.S. nonproperty companies of similar market capitalization are also significantly more liquid than their European, Australian and U.K. counterparts.

Second, both property and nonproperty companies with larger market capitalizations are substantially more liquid, all else equal. These findings are consistent with the results of Bolton and von Thadden (1998) and Loughran and Schultz (2004) for the general U.S. stock market and with Benveniste, Capozza and Seguin (2001) for U.S. real estate markets. Third, consistent with prior theoretical and empirical work on U.S. stock market liquidity, we find that liquidity is negatively and significantly related to the percentage of shares closely held by nonretail investors, defined as large blockholders, company insiders and institutional investors. This result was found in both our property and nonproperty samples. Fourth, liquidity is negatively related to the firm's dividend yield in our control sample regressions, which is consistent with our hypothesis that firms with high dividend yields develop clienteles who prefer to trade less frequently, all else equal. However, this result does not hold for the firms in our sample of property companies. The lack of significance in our property company regressions may reflect the fact that the majority of these firms must consistently pay a high percentage of their earnings as dividends in order to retain their tax-exempt status, resulting in less variation in dividend yields.

Finally, the existing U.S.-based literature suggests a negative relation between liquidity and share price levels. To avoid the problem of low statistical power associated with the use of realized returns as proxies for required returns, we follow Benveniste, Capozza and Seguin (2001) and examine directly the relation between firm-level liquidity and Tobin's q, defined as the ratio each firm's equity market value to the book value of total assets. This is accomplished by estimating annual cross-sectional regressions of Tobin's q on our three measures of liquidity and a set of control variables, using the combined data set of 203 listed property companies. We find that trading volume and share turnover do not appear to be important determinants of firm value. However, the estimated coefficient on the liquidity ratio is positive and significant. In summary, although we find some evidence of an empirical link between liquidity and firm value, our evidence is less conclusive than the findings of Benveniste, Capozza and Seguin (2001) in the U.S. REIT market.

This article provides the first international analysis of the liquidity of publicly traded property companies and a control sample of nonproperty companies. Future research should seek to include an even broader sample of countries and to examine whether the findings presented here are robust to alternative observation frequencies and liquidity measures. Also, we would like to suggest further investigation of the effect of (il)liquidity on firm value and expected property share returns.

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References

Amihud, Y. 2002. Illiquidity and Stock Returns: Cross-Section and Time-Series Effects. *Journal of Financial Markets* 5: 31–56.

Amihud, Y. and H. Mendelson. 1986. Asset Pricing and the Bid-Ask Spread. *Journal of Financial Economics* 17: 223–249.

Amihud, Y., H. Mendelson and J. Uno. 1999. Number of Shareholders and Stock Prices: Evidence from Japan. *Journal of Finance* 54: 1169–1184.

Amihud, Y., H. Mendelson and L.H. Pedersen. 2005. Liquidity and Asset Prices. *Foundations and Trends in Finance* 1: 269–364.

Barkley, T., A. Naranjo and M. Nimalendran. 2006. Where's the Liquidity? Information and Trading Costs in Asset Pricing. Working Paper. University of Florida.

Bekaert, G., C.R. Harvey and C. Lundblad. 2005. Liquidity and Expected Returns: Lessons from Emerging Markets. Working Paper. Columbia University.

Below, S., J. Kiely and W. McIntosh. 1995. An Examination of Informed Traders and the Market Microstructure of Real Estate Investment Trusts. *Journal of Real Estate Research* 10: 335–361.

——. 1996. REIT Pricing Efficiency: Should Investors Still Be Concerned? *Journal of Real Estate Research* 12: 397–412.

Benston, G.J. and R.L. Hagerman. 1974. Determinants of Bid-Ask Spreads in the Over-the-Counter Market. *Journal of Financial Economics* 1: 353–364.

Benveniste, L., D.R. Capozza and P.J. Seguin. 2001. The Value of Liquidity. *Real Estate Economics* 29: 633–660.

Bernstein, L.P. 1987. Liquidity, Stock Markets, and Market Makers. *Financial Management* 16: 54–62.

Bhasin, V., R. Cole and J. Kiely. 1997. Changes in REIT Liquidity 1990–1994: Evidence from Intraday Transactions. *Real Estate Economics* 25: 615–630.

Bolton, P. and E.L. von Thadden. 1998. Blocks, Liquidity, and Corporate Control. *The Journal of Finance* 53: 1–25.

Boulding, K.E. 1955. *Economic Analysis*. 3rd ed. Harper and Brothers: New York.

Breen, W.J., L.S. Hodrick and R.A. Korajczyk. 2002. Predicting Equity Liquidity. *Management Science* 47: 470–483.

Brennan, M.J. and A. Subrahmanyam. 1996. Market Microstructure and Asset Pricing: On the Compensation for Illiquidity in Stock Returns. *Journal of Financial Economics* 41: 441–464.

Brennan, M.J., T. Chordia and A. Subrahmanyam. 1998. Alternative Factor Specifications, Security Characteristics, and the Cross-Section of Expected Stock Returns. *Journal of Financial Economics* 49: 345–373.

Chiang, R. and P. Venkatesh. 1988. Insider Holdings and Perceptions of Information Asymmetry: A Note. *The Journal of Finance* 43: 1041–1048.

Chordia, T., R. Roll and A. Subrahmanyam. 2001. Market Liquidity and Trading Activity. *The Journal of Finance* 56: 501–530.

Clayton, J. and G. MacKinnon. 1999. REIT Market Maturation and Pricing Dynamics. *Real Estate Finance* 17: 51–62.

——. 2000. Measuring and Explaining Changes in REIT Liquidity: Moving Beyond the Bid-Ask Spread. *Real Estate Economics* 28: 89–115.

Cole, R. 1998. *Changes in REIT Liquidity 1990–94: The Role of "New REITs"*. Paper presented at the American Real Estate and Urban Economics Association Meeting: Chicago.

Datar, V.D., N.Y. Naik and R. Radcliffe. 1998. Liquidity and Stock Returns: An Alternative Test. *Journal of Financial Markets* 1: 203–219.

Dhar, R. and W.N. Goetzmann. 2005. Institutinal Perspectives on Real Estate Investing: The Role of Risk and Uncertainty. Yale ICF Working Paper No. 05-20.

Eichholtz, P. and Koedijk. 1995. The Global Real Estate Securities Market. *Real Estate Finance* 13: 23–31.

Glascock J., D. Michayluk and K. Neuhauser. 2004. The Riskiness of REITs Surrounding the October 1997 Stock Market Decline. *The Journal of Real Estate Finance and Economics* 28: 339–354.

Glosten, L. and P. Milgrom. 1985. Bid, Ask and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders. *Journal of Financial Economics* 14: 71–100.

Hasbrouck, J. 2004. Liquidity in the Futures Pits: Inferring Market Dynamics from Incomplete Data. *Journal of Financial and Quantitative Analysis* 39: 305–326.

Hasbrouck, J. and D.J. Seppi. 2001. Common Factors in Prices, Order Flows and Liquidity. *Journal of Financial Economics* 59: 383–411.

Helfin, F. and K.W. Shaw. 2000. Blockholder Ownership and Market Liquidity. *The Journal of Financial and Quantitative Analysis* 35: 621–633.

Holmström, B. and J. Tirole. 1993. Market Liquidity and Performance Monitoring. *Journal of Political Economy* 101: 678–709.

Jennings, W.W., K. Schnatterly and P.J. Seguin. 2002. Institutional Ownership, Information and Liquidity. *Innovations in Investments and Corporate Finance* 7: 41–71.

Kyle, A.P. 1985. Continuous Auctions and Insider Trading. *Econometrica* 53: 1315–1336.

Lang, L. and R. Stulz. 1994. Tobin's q, Corporate Diversification, and Firm Performance. *Journal of Political Economy* 102: 1248–1280.

Lesmond, D. 2005. Liquidity of Emerging Markets. *Journal of Financial Economics* 77: 411–452.

Ling, D.C. and A. Naranjo. 2002. Commercial Real Estate Return Performance: A Cross-Country Analysis. *The Journal of Real Estate Finance and Economics* 24: 119–142.

Loughran, T. and P. Schultz. 2004. Liquidity: Urban Versus Rural Firms. Working Paper. University of Notre Dame.

Marcato, G. and C. Ward. 2007. Back from Beyond the Bid-Ask Spread: Estimating Liquidity in International Markets. *Real Estate Economics* 35: 599–622.

Nelling, E.F., J.M. Mahoney, T.L. Hildebrand and M.A. Goldstein. 1995. Real Estate Investment Trusts, Small Stocks and Bid-Ask Spreads. *Real Estate Economics* 23: 45–63.

Pritsker, M. 2002. Large Investors and Liquidity: A Review of the Literature. Committee on the Global Financial System, editor. *Risk Measurement and Systematic Risk—Proceedings of the Third Joint Central Bank Research Conference*. Bank for International Settlements: Basel, Switzerland. 126–139.

Sarin, A., K.A. Shastri and K. Shastri. 2000. Ownership Structure and Stock Market Liquidity. Working Paper. University of Pittsburgh.

Wang, K., J. Erickson and S.H. Chan. 1995. Does the REIT Stock Market Resemble the General Stock Market? *Journal of Real Estate Research* 10: 445–460.

White, H. 1980. A Heteroscedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity. *Econometrica* 44: 817–838.