Liquidity in global real estate securities markets

A cyclical and regional analysis pre, during and post GFC

Nicole Lux
Department of Finance and Accounting, De Montfort University, Leicester, UK, and
Alex Moss
Consilia Capital, London, UK and
Cass Business School, London, UK

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Abstract

Purpose – The purpose of this paper is to test the relationship between liquidity in listed real estate markets, company size and geography during different market cycles, specifically pre-crisis (2002-2006) and post-crisis (2010-2014). Further, the study analyses the impact of stock liquidity on stock performance. In a previous study the authors examined the impact of liquidity on the valuation of European real estate shares. The result showed that there is a strong relationship between liquidity, valuation and market capitalisation post the Global Financial Crisis.

Design/methodology/approach – The paper studies the linkages between regional market liquidity and company size for 60 listed real estate companies globally and determines the key drivers of company stock market liquidity pre- and post-crisis as well as the impact on stock performance. Analysis of variance is used to test cross-sectional independence in market liquidity combined with the Tukey's *post hoc* test. The selected test indicators of liquidity to capture market depth and market tightness are daily stock turnover as percentage of market capitalisation and daily bid-ask spreads.

Findings – Findings confirm previous studies that market liquidity factors are correlated globally over time indicating markets interdependence. However, sample groups by company size and geography form independent samples with different sample means, thus specific liquidity levels in each market may be different. First, stock turnover levels have not recovered post-crisis to pre-crisis levels in the majority of markets while spreads have continued moving downward to nearly insignificant levels in line with the rest of the equity market. Second, with regards to stock performance, the European bias previously detected is not apparent in the USA, and there is no evidence of the small cap vs large cap effect of small companies achieving superior returns, although smaller companies have outperformed in Europe and Asia in each of the last three years (2012-2014).

Practical implications – The key implication is that although spread levels for smaller companies are higher, implying a slight risk premium when investing in small companies, this did not manifest into consistent superior stock market returns in the periods studied. In a mature market such as the USA or UK, liquidity levels in terms of stock turnover are higher and spreads are lower thus reducing trading costs, making them more attractive for investors.

Originality/value – This research brings together previous analysis on stock market liquidity and stock performance on a global market level. It further tests the dependence of market liquidity on two key indicators, namely, geography and company size and analyses market changes with respect to liquidity pre- and post-crisis.

Keywords REITs, Bid-ask spread, Listed real estate, Market liquidity, Regional correlation, Stock turnover

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Introduction

The correlation of global equity markets has been a long-term research topic for investors seeking the optimum combination of risk diversification and maximum return. The quantitative analysis of international diversification dates back at least to Henry Lowenfeld's (1909) study of equal-weighted, industry-neutral, risk-adjusted, international diversification strategies, using price data from the global securities trading on the London Exchange around the turn of the century. He illustrates the imperfect co-movement of securities from various countries. In general, global equity markets and regional markets are often correlated with one another, especially in times of economic recession with prominent contagion and spillover effects. Listed real estate companies are considered attractive because of their liquidity, and exposure to underlying real estate returns. Since the evolution of the modern-REIT era in 1992 in the USA, there has been a significant increase in market capitalisation, both in absolute terms and relative to the general equity market, as well as improvements in liquidity. But, with respect to previous findings about the correlation and co-movement in equity markets during times of stress, how have listed real estate markets been affected by the Global Financial Crisis (GFC) 2007/2008 in terms of market liquidity and performance? This research aims to explore dependence in global markets focusing on factors of liquidity over three different time intervals, pre, during and post-GFC. We will analyse:

(1) how liquidity in global listed real estate markets has changed pre (2002-2006), during (2007-2009) and post-crisis (2010-2014);

(2) whether liquidity is primarily influenced by company size and geography; and

(3) the impact of liquidity and company characteristics on performance.

Even in relatively stable periods, co-moving trending behaviour can be found across equity markets for stock returns, volatility and trading volumes. Singha *et al.* (2010) examine the stock returns volatility spillover effects across 15 stock markets of North America, Europe and Asia employing a vector auto regression model, which is used to capture the linear interdependencies among multiple time-series data.

This paper uses liquidity measures which do not require microstructure data that might not be available on a comparative level for international markets. While most other studies have focused on risk and return, this research explores co-movements in market liquidity in different securities markets. The first section starts by analysing the dependence of liquidity on key variables, namely, geography and company size and explores the differences in market liquidity during three time intervals between 2002-2014. The next section of the research links liquidity drivers and performance.

By classifying the data of 60 global companies into different groups to distinguish samples by country of origin and size, the paper analyses the impact of the so-called small cap effect on listed real estate companies' liquidity globally. The idea of a small cap premium is more than two decades old. Rolf Banz (1981) found, however, that this relationship is not linear and that this effect only affected the smallest firms in the market (~20 per cent of the smallest firms).

From a practical standpoint, this study is relevant because a number of practitioners have been attracted to small cap stocks owing to academic research (e.g. Keim, 1983; Fama and French, 1992), which provides evidence that expected returns of small cap stocks are systematically different from those of large cap stocks. This research expands previous studies focusing on small vs large cap effect in terms of market liquidity, which ultimately impacts overall stock performance. Hence, this study

differs from previous studies and adds value to existing literature in a number of important ways:

(1) Previous studies (Cannon and Cole, 2011; Clayton and MacKinnon, 2000) have focused on US REITs. This study concentrates on global listed real estate securities (i.e. REITs and REOCs) and correlations in global market liquidity pre, during and post-GFC.

(2) The research analyses the impact of the small cap vs large cap effect on global market liquidity and ultimately the impact on stock performance, using actual annualised returns rather than expected or required returns, assuming that corporate stock market valuations capture a consensus of current forecasts.

For the analysis, 60 listed real estate companies in the UK, Continental Europe, Japan, Asia and the USA have been selected. This research allows for both time-series and cross-sectional variations in market liquidity. For the analysis the sample has been grouped into two sets of data that distinguishes the sample by company size and country of origin.

Review of relevant literature

Historical trend in liquidity

The existing literature has acknowledged that liquidity of listed real estate securities deteriorated during the late 1990s, rebounded dramatically during 2000-2006, and then declined again during 2007. This is demonstrated by a study on US REITs by Cannon and Cole (2011). They confirmed the results of Bhasin *et al.* (1997) that 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 capitalisation. They suggest that daily return data are not qualitatively different from market microstructure data. The same relationship between volume turnover, market capitalisation, volatility and market spreads is presented in a detailed study by Moss and Lux (2014) for the UK and European listed real estate sector.

Very early on, Clayton and MacKinnon (2003) investigated changes in REIT liquidity since the dramatic growth of the market in 1993. They used trade-by-trade data to estimate and compare Kyle's (1985) measure of inverse liquidity for the 1993 and 1996. They found a significant increase in REIT liquidity, in median price impact of trades with the increase in adverse-selection costs due to more informed traders, more than offset by the increase in market thickness as a result of an increase in the number of uninformed (liquidity) traders. More recently, Scholz and Schaefers (2014) found in a study on European listed real estate securities that liquidity is a significant pricing factor in real estate stock returns, even after controlling for market, size and book-to-market factors. In addition, they detected that real estate stock returns load predominantly positively on the liquidity risk factor, suggesting that real estate equities tend to behave like illiquid common equities.

Measures of liquidity

Liquidity measures not using microstructure data are typically bid-ask spread and stock turnover, which are also used in this research. As Brounen *et al.* (2009) found, stock liquidity is a multifaceted component. The literature identifies and tests the usefulness of various proxy measures of trading costs as a factor of illiquidity, including dealing spreads, measures of individual trade impact and activity, asset size

and asset volatility. All of these are useful in quantifying real-world liquidity premia. It should be noted that there are different concepts of asset liquidity, with different measures of liquidity focus on alternative aspects of the measurement problem. There are multiple liquidity studies on equity markets using the so-called microstructure approach. The microstructure of a market is reflected in three main characteristics of market liquidity as identified by Kyle (1985):

(1) Tightness: measured by the size of bid-ask spreads.

(2) Depth/breadth: measured by the volume of trades possible without affecting current prices; a market is deep when there are orders both above and below the trading price of an asset.

(3) Resilience: measured by the speed at which the price impact of trade dissipates. A market is resilient if there are many orders in response to price changes. There is a lack of resiliency when the order flow does not adjust quickly in response to price swings.

Distinguishing between market depth and breadth is often difficult. Mostly market depth is perceived as a sufficiently large number of orders priced below and above the market closing price and breadth characterises the condition of the market facilitating large-volume trades at existing prices. Joint indicators of liquidity and volume are also often employed in the pricing of infrequently traded stocks (e.g. Blume *et al.*, 1994). Market liquidity has several dimensions and there is no current consensus about an optimal liquidity measure. The choice of the liquidity measure rather depends on the objective of the study and the analysed asset class.

While some measures are equally useful for listed real estate data, such as bid-ask spread, others cannot be applied as easily, such as measures of market resilience, which requires order flow data. Overall, the connection between liquidity and the magnitude of the bid-ask spread is well established as an indicator of market tightness; the current research uses it as one indicator of (il)liquidity. Bid-ask spreads can also be analysed in conjunction with other variables. For instance, Jegadeesh and Subrahmanyam (1993) finds that spreads as a percentage of the price are correlated negatively with the price level, volume and the number of market makers, and positively with volatility. Each of these findings is consistent with the theory on the bid-ask spread. Some studies demonstrate that the larger the spread the more highly valued the security. This has been successfully demonstrated by Boothe (1988) and Gwilyma *et al.* (1998). For the purpose of this study, we have selected bid-ask spread and stock turnover as the most relevant liquidity measures.

Listed real estate liquidity relative to other asset classes

Bond and Chang (2012) investigated cross-asset liquidity between equity markets and REITs and between REITs and private real estate markets. They found lower levels of liquidity for REITs compared to a set of control firms matched on size and book-to-market ratios. Commonality in liquidity was also lower for REITs than the controls and the overall market. However, they did find an important difference in share turnover for REITs, which appears to have a higher level of commonality than found in other studies that may be due to the financial crisis. Additionally, they found evidence of similar time-series variation in liquidity for public and private real estate markets.

When considering global comparison studies, Brounen *et al.* (2009) investigated the magnitude and determinants of share liquidity during 1990-2007 in the world's four

largest securitized real estate markets: the USA, UK, Continental Europe and Australia. They found a significant and consistent role for market capitalisation, non-retail share ownership and dividend yield as drivers of liquidity across markets that share price liquidity is multifaceted and that reliance on one measure may be misleading. Although some evidence of a connection between liquidity and firm value was found, it was less conclusive than previous studies. In a study very similar to the current one, Brounen *et al.* (2009) employ three liquidity measures based upon daily data to explore liquidity across four international markets (Australia, Europe, the UK and the USA). They find that both property and non-property shares trading in the USA market are more liquid than shares trading in the other three markets analysed, which is also confirmed by the results of this research in the next sections.

Liquidity as a style factor

The literature about the price effect of liquidity has been growing during the last decade. Brunnermeier and Pedersen (2009) identified a positive relationship between an asset's market liquidity (i.e. the ease with which it is traded) and the traders' (of that asset) funding liquidity (i.e. the ease with which they can obtain funding). Hill *et al.* (2012) identified a positive relationship between a company's valuation and its liquidity as measured by cash and unused credit lines, i.e. corporate liquidity. Anson (2010) provided a framework for measuring liquidity risk and calculating a premium for that risk. Ibbotson *et al.* (2013) provided evidence that liquidity can be classified as a separate investment style, since market liquidity is an economically significant indicator of long-term returns, it is not a substitute for size, value and/or momentum, it has been stable historically and changes in liquidity are associated with changes in valuation.

The small cap effect

The liquidity premium is the difference in price between assets identical except for their liquidity. One true driver of higher returns for small stock is their illiquidity. Much of this so-called small-cap effect (the out performance of small companies over long horizons) is attributed to their relative illiquidity compared to larger companies. Amihud and Mendelson (2002) shows that over time expected market illiquidity positively affects *ex ante* stock excess return, i.e. there is an illiquidity premium. According to Hibbert *et al.* (2009), these equity market liquidity premia have been estimated at 3-8 per cent p.a. across different equity markets. The study examines if the same is true for listed real estate companies or if there are characteristics other than size that determine illiquidity of specific companies.

This current research argues that REIT market liquidity has followed the general improvement in liquidity of global securities markets and will continue to vary over time with the economic cycle and market maturity. The same is true for the so-called "small firm effect". The effect is known to translate into a discount on value for smaller companies since they are expected to earn those excess returns. However, whether or not small capitalisation stocks always offer superior returns relative to the market and outperform mid and large capitalisation stocks depends on economic cycles and market maturity or transparency.

Data and methodology

Data

The sample comprises 60 listed real estate companies from five regions (UK, Europe, Japan, Asia (e.g. Japan), and the USA; our terminology reflects the decision to divide

Europe into the UK and Continental Europe, and the Asia Pacific region into Japan and Asia (which includes Australia, but obviously not Japan). This allows us to compare regional rather than country groupings. We have isolated the UK and Japan as countries because we wanted to see whether the fact that they have independently large real estate markets and listed real estate groups, as well as separate major currencies to their regional neighbours had an impact on our findings. Previous studies have typically concentrated on individual countries, notably USA, UK and Australia. In future studies we would consider adding Australia as a separate grouping in the Asia Pacific region, and Switzerland as a separate grouping in the European region (Table I). The data set consists of daily data on trading volumes, prices and market capitalisation over a period of 12 years (2002-2014); effectively five years pre, two years during and five years after the GFC. Using constituents of the EPRA Global Developed Index as a starting point, the selected sample companies were grouped by size, based on an initial filter of daily liquidity in the shares (as measured by value traded); and by listing region. The companies have been selected based on market capitalisation (size), historic data availability and data consistency. Each regional sample has an equal amount of small, medium and large companies. Daily liquidity measures of bid-ask spread and stock turnover are calculated for each company and aggregated to group averages representing three different time periods. The following analysis answers the question of how homogenous is each sample and how big are the differences between the different samples.

It should be noted that due to the limited sample size, results can be distorted by stock-specific factors. Companies are not homogenous, especially in non-mature markets. Any valuation premium for liquidity may not be linear or graded, and indeed the impact may be binary, i.e. only companies with a minimum level of liquidity are included in portfolios and can easily raise further equity capital. In addition, what is considered a large or small company may differ depending on geographic region. In the USA, a large company has been defined as a company $\geqslant$US$10 bn market capitalisation, a small company $<$ US$5 bn market capitalisation, while in Japan a large company is defined as $>$ US$5 bn market capitalisation (Table I).

The sample shows that what is considered a large company in Europe or the UK is still only a small company in the USA. Ranking the sample by largest to smallest company shows that four of the largest ten companies worldwide are American REITs. The largest company in Europe ranking among the top ten by market capitalisation is Unibail. On the other hand, eight of the smallest ten are European or UK REITs (see also data in Table AI).

Methodology

In order to measure movements of global market liquidity, two measures have been selected, namely, bid-ask spreads and stock turnover ratios. The company data sample

Table I. Company size bands in each geographic market

	USD (bn)		
	Large	Medium	Small
USA	$\geqslant$10	5-10	$<$5
UK	$\geqslant$5	1-5	$<$1
Europe	$\geqslant$2	1-2	$<$1
Asia	$\geqslant$10	5-10	$<$5
Japan	$\geqslant$5	2-10	$<$2

is stratified by regional market and company size to identify sample independence. Regarding company size, previous research has shown that globally small caps can be distinguished from large caps in several aspects. For instance, while previous research has examined differences in performance, turnover and bid-ask spreads can be significantly different. The first section of the paper explores the differences in liquidity on global REIT markets over different time periods. The core point of the concept of liquidity is the possibility to exchange a given asset in the market without dramatic changes in the prevailing market price. Friction arises from order processing, adverse information and inventory costs, these can be measured in bid-ask spread. A high level of competition between intermediaries allows for a reduction of the order processing component and improves the liquidity condition of the market, which we expect to see in a mature market. The informational component of the bid-ask spread sheds light on the degree of efficiency due to the presence of hidden information or insider trading. The bid-ask spread is calculated as shown in the following formula:

$$\text{Spread} = \frac{(P_{ask} - P_{bid})}{(P_{bid} + P_{ask})/2} \tag{1}$$

where P is the daily bid or ask quote. The bid-ask spread is used to understand the daily price liquidity and price efficiency. Another characteristic is the reduction in liquidity during a crisis or market downturn, which links volume or trade indicators to liquidity. For example, a relationship between returns and volume is documented in the literature on seasonal, weekly effects by French and Roll (1986) and in the contributions on intra-day patterns described by McInish and Wood (1992). In order to measure market depth, there are two choices. First, the simple turnover ratio defined as number of shares traded divided by total shares outstanding or second, the turnover rate in terms of total traded value over the market capitalisation of the stock is calculated. Formula (2) calculates the daily traded value as a percentage of market capitalization:

$$V = \frac{V_t}{C_t} \tag{2}$$

where V is the total value of shares traded on day t and C is the market capitalisation on day t. Finally the third variable to be tested is the total return, which is calculated for each company and aggregated by company size and geography to allow global comparison. The analysis uses annualised arithmetic return data.

In order to test whether company characteristics such as size and geography are significant indicators of liquidity, two sets of grouped samples are created and a global index has been constructed for the two test variables bid-ask spreads and turnover percentage of market cap. The simple average is used to eliminate regional market sample size effects. The first grouping variable is company size, which distinguishes between large, small and medium size companies. The second grouping variable to be tested is geographic market, which separates the five regional markets.

The first part of the research then uses a one-way analysis of variance (ANOVA) to test the behaviour of the two market liquidity variables and their dependence on region or company size pre, during and post-crisis. The one-way ANOVA is used to determine whether there are any significant differences between the means of three or more independent (unrelated) groups. While it is possible to conduct individual t-tests, running multiple t-tests will increase the type I error in this case by 15 per cent, hence a one-way ANOVA analysis controls this problem and is the more appropriate test.

If the null hypothesis is true, then the sample groups' means will not differ significantly from each other, hence there is no difference between company size and their market liquidity or geographical market and liquidity.

ANOVA is particularly effective tool for analysing highly structured multilevel data. Generally, we can replicate the inferences we would obtain from ANOVA using regression but not always OLS regression. Multilevel models are needed for analysing hierarchical data structures, where between-group effects are compared to group-level errors, and within-group effects are compared to data-level errors. Gelman (2005) goes into great detail about this problem and effectively argues that ANOVA is an important statistical tool. ANOVA can be used with categorical explanatory variables (factors) in this case "country" and "company size" that take more than two values (levels). The proper way to test a factor in a regression context is to test the nested model with all factor dummies dropped against the full model with all factor dummies included. This test is identical to the one an ANOVA conducts. Although both types (ANOVA and regression) focus on the relationship between two variables one-factor ANOVA involves an independent variable that is qualitative in nature (i.e. country or company size) and the dependent variable is quantitative. Regression analysis usually uses two quantitative variables that are approximately continuously scaled and then adds dummy variables.

In the case of our ANOVA analysis the independent variables are "country" and "company size" and can be expressed like this:

$$y_{ij} = \mu_j + x_j + t_j + \varepsilon_{ij} \tag{3}$$

where y is the dependent variable, i.e bid-ask spreads and turnover of company i, which equals the sum of μ being the population mean of sample j, x and t the qualitative-level effects for sample j (the independent variables "country" and "time") and ε the error term. Although regression on dummy variables and ANOVA test for hypothesis about independent categorical variables and have the same R^2, they differ in the test they apply to the significance of the difference. The key question for ANOVA is how much the differences in the category make a difference in the result, this leads to a difference in the null hypothesis of regression and the null hypothesis of ANOVA.

While regression solves for the linear equation that minimises the sum of the squared errors; for each dummy variable it assigns a coefficient. So for regression, the F-statistic tests how likely it is that the coefficient is not 0 (against the null hypothesis that the coefficient is 0 and there is no effect), ANOVA uses the categories to split the overall population into sub-populations ("country" and "company size") and then tests against the null hypothesis that the sub-populations all have the same average value of the dependent variable. The F-statistic tests the probability that the means differ only by chance.

We could also use other multivariate test methods such as principal component analysis or discriminant analysis, both methods concentrate on dimensionality reduction and are sensitive to the scaling of variables, where ANOVA is more straight forward to apply. ANOVA will detect differences in group means between groups even if variables have the same variance. However, while the ANOVA analysis confirms that there are differences between the three groups, it does not classify which groups. In order to find the detailed differences among the subgroups, that could be otherwise undetected; a second test is needs, the so-called *post hoc* analysis. The *post hoc* test is designed for situations in which the researcher has already obtained a significant

omnibus *F*-test with a factor that consists of three or more means and additional exploration of the differences among means is needed to provide specific information on which means are significantly different from each other. Also, the descriptive statistics display the characteristics, functions, relationship and patterns of the research phenomena. It also explains and validates findings. For this study, the *p*-value is less than or equal to 5 per cent to indicate statistical significance and to control for type I and type II errors (Rigobon, 2003). In this case, the Tukey *post hoc* Honest Significant Difference (HSD) test will provide more evidence if companies liquidity differs by size, meaning the null hypothesis (H_0) can be reject:

$$H_0: \ \mu_1 = \mu_2 = \mu_3 = \mu_k \tag{4}$$

$$H_a: \ \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_k \tag{5}$$

where μ = group mean and k = number of groups. Accepting the alternative hypothesis (*Ha*) confirms that there are at least two group means that are significantly different from each other.

The purpose of Tukey's HSD test is to determine which groups in the sample differ. Tukey's HSD test works through defining a value known as the HSD. This value is a number that acts as a distance between groups. It is calculated by dividing the mean squared error from the ANOVA analysis by the total number of data points for a given group. Then take the square root of the resulting value and multiplying this result by the studentised range statistic:

$$\text{HSD} = \frac{(M_1 - M_2)}{\sqrt{MS_w\left(\frac{1}{n}\right)}} \tag{6}$$

where M is the number of groups; and n, the number of objects in each group.

The HSD represents the minimum distance between two group means that must exist before the difference between the two groups is to be considered statistically significant.

The significance of these variables will be tested focusing on market changes pre, during and post-GFC and follows the approach of Das, Freybote and Marcato, who distinguish the periods of the REIT market pre-crisis (2002-2006), crisis (2007-2009) and post-crisis (2010-2012). The two relevant periods tested are pre- and post-crisis, where the post-crisis period starts with the shift to the sovereign crisis in Europe in 2010.

Results

Bid-ask spreads at three different time intervals

Over the past 12 years, REIT markets globally have experienced a general growth of the sector and improving liquidity conditions. This is demonstrated by bid-ask spreads declining across all markets geographically. Post-crisis overall lowest spreads and highest price efficiency can be found in the USA, where average spreads over the last five years post-GFC have been less than 10 bps. As a comparison, historically only US T-bills carry a bid-ask spread of less than 10 bps. The trend in the USA has been from large differences in spreads between company size to no significant spreads in any segment, indicating that this is a very liquid market which can sustain some market pressure. Overall, we expect to observe higher spreads in non-US equity markets due to their smaller market size and smaller market capitalisation and thus more limited

market depth. Our data confirms this and highest spreads can be observed in less developed markets such as Asia, where the spread for a large company over the past five years has been 37 bps (Table II). Japan is the exception where small companies persistently showed smaller spreads over the last five years than medium size companies.

Over a 12-year time horizon, the correlation of spreads measured across geographic regions by the Pearson's correlation coefficient show some long-term correlation between UK, USA and Europe and less correlation with Japanese and Asian markets (Table III). At times, correlations are not detected immediately because of time lags between markets; for example, both the UK and European samples show peaks of spreads around the periods June-September 2006 and October-December 2008, while Asia and Japan show a slight increase in spreads early on in the crisis mid-2007-2008.

Dependence of bid-ask spreads on company size vs geography

The section analyses the impact of company size and geography on bid-ask spreads. Although above averages confirm that there might be some differences in expected spreads for a company, there is no confirmation these differences are significant to distinguish between companies over time. ANOVA tests for dependence of observed spreads on company size and geography. Our analysis at three different time intervals confirms that differences found due to the small vs large cap effect shows that spreads are typically wider for smaller companies, while for the largest companies the bid-ask spread is nearly negligible. This applies globally and is largely true for the markets analysed. Especially post-crisis means show that there is a good deal of variation between the tree samples and the narrowing of the post-crisis spread variance in each sample indicates more homogenous groups and maturing markets.

Dependence is shown in the F score, which represents the ratio of explained variance vs error and the probability of an F of this magnitude. The F-score is significant and the null can be rejected if the probability is above 0.05 per cent significance level (Table IV). Following the ANOVA and Tukey *post hoc* tests, the results show that spreads by company size can be clearly distinguished and groups have become more closely

		5 year pre-GFC			5 year post-GFC average		
	Spreads	Large (%)	Medium (%)	Small (%)	Large (%)	Medium (%)	Small (%)
	USA	9.30	10.70	9.70	0.00	0.10	0.10
	EU	0.40	0.60	1.40	0.10	0.50	0.70
Table II.	UK	0.40	0.70	1.60	0.10	0.20	0.80
Historic bid-ask	Asia	0.30	0.70	1.00	0.40	0.50	0.80
spreads by market	Japan	0.40	0.60	0.50	0.40	0.50	0.40

		UK (%)	Europe (%)	USA (%)	Asia (%)	Japan (%)
Table III.	UK	100.00				
Pearson correlation	Europe	71.59	100.00			
coefficient for	USA	69.82	51.32	100.00		
bid-ask spread	Asia	18.50	15.73	8.52	100.00	
2002-2014	Japan	6.09	10.03	−9.77	15.78	100.00

Groups	Count	Sum	Pre-GFC average	Variance	GFC average	Variance	Post-GFC average	Variance	
Small	60	168.14	2.80	2.84	1.12	0.58	0.54	0.04	
Large	60	130.28	2.17	1.76	0.30	0.04	0.20	0.01	
Medium	60	160.25	2.67	1.77	0.57	0.11	0.37	0.01	
ANOVA results									
(5 year post-GFC)									
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)	
Between groups	3.62	2	1.81	107.12	0.00	3.05	0.02	0.08	
Within groups	2.99	177	0.02					0.55	
Total	6.60	179							
ANOVA results (in GFC)									
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)	
Between groups	12.42	2	6.21	25.48	0.00	3.08	0.08	0.39	
Within groups	25.58	105	0.24					0.33	
Total	38.00	107							
ANOVA results									
(5 year pre-GFC)									
Source of Variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)	
Between groups	13.30	2	6.65	3.13	0.05	3.05	0.19	0.88	
Within groups	376.16	177	2.13					0.03	
Total	389.46	179							
Post-Tukey HSD test									
Pair	Max-Min	*Q*	Pre-GFC result	Max-Min	*Q*	Post-GFC result	Max-Min	*Q*	GFC result
S/L	0.63	3.35	Yes	0.35	20.70	Yes	0.81	4.33	Yes
L/M	0.50	2.65	Yes	0.17	10.32	Yes	0.26	1.40	Yes
M/S	0.13	0.70	No	0.17	10.38	Yes	0.55	2.92	Yes

Table IV.
Group results ANOVA and Tukey *post hoc* test for bid-ask spreads

defined post-crisis, where sample F is 107.11 compared to a critical value for $\alpha = 0.05$ per cent and $k = 3$ of 3.04.

The next step focuses on testing liquidity dependence on geography. Although the F score 181.65 (Table V) given by the ANOVA result is above the critical significance level, the Tukey *post hoc* test shows that pre-crisis spreads by geographic market show that, with exception of the US market, there is no differentiation between markets based on level of spreads; however, markets have moved apart starting during the crisis to the five years post-crisis and while spread levels in Japan and Asia have not significantly changed pre- and post-crisis spreads in UK, Europe and USA have declined, although at different rates.

In summary, we can see that within the sample for each country and company size the results are clustered together, as indicated by the declining small variance or standard deviation, especially when compared with the differences across the samples. In other words, there are distinct differences from country to country and large to small companies, but there is similarity within each country and company size group.

Further there have been significant changes in markets in the three tested time intervals showing a progression from pre-GFC, during GFC to post-GFC. While pre-crisis ANOVA analysis shows less differences in sample means, post-crisis market developments indicate that markets have moved further apart, trading at different liquidity levels in terms of spreads and expected stock turnover.

Stock turnover at three different time intervals

Stock turnover has been highly correlated for the five years post the GFC between all five global markets analysed and over the long-run period of 12 years correlations are visible (Table VI). Similar to spreads, certain markets experience a time lag or might be influenced by local economics. Until 2007, markets in Japan, Europe and USA are well correlated; however, very low correlations are found during the period of 2007-2009, indicating that regional stock markets have been influenced by other factors than just macro-economic factors, such as differences in monetary policy.

Although globally correlated, when analysing average trading levels, markets are significantly different (Table VI). While trading volumes noticeably declined in Asia and UK, US volumes have been increasing throughout the period between the Lehman collapse and the start of quantitative easing. The UK market shows a slight increase due to the start of quantitative easing, but in the rest of Europe this had very little impact.

Overall, trading volumes in all markets have been at historically lowest levels since the European sovereign crisis in 2010 and show no significant signs of recovery. Especially UK trading volumes (6 per cent) for large companies over the last five years have remained significantly below pre-crisis levels of 11.5 per cent. The USA is the only market where trading levels have significantly improved and are now double the amount for small companies compared to pre-crisis levels (Table VII).

The samples of Asia and Japan show no significant market development between pre- and post-crisis levels.

Dependence of stock turnover on company size vs geography

ANOVA results for the second selected variable stock turnover (percentage of market cap) also confirm differences by company size and most significant differences are found between large vs small companies in stock turnover, while medium companies

Groups	Count	Pre-GFC average	Variance	GFC (count 36)	Variance	Post-GFC average	Variance	
UK	60	0.59	0.07	0.25	0.02	0.15	0.00	
Europe	60	0.48	0.05	0.33	0.04	0.20	0.01	
USA	60	9.56	26.81	0.37	1.35	0.03	0.00	
Asia	60	0.48	0.02	0.54	0.06	0.46	0.02	
Japan	60	0.43	0.18	0.49	0.17	0.40	0.07	
ANOVA results (5 year post-GFC)								
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)
Between groups	7.70	4	1.92	90.29	0.00	2.40	0.02	0.07
Within groups	6.29	295	0.02					0.55
Total	13.98	299						
ANOVA results (3 year during GFC)								
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)
Between groups	1.98	4	0.50	1.52	0.20	2.42	0.10	0.36
Within groups	57.09	175	0.33					0.03
Total	59.07	179						
ANOVA results (5 year pre-GFC)								
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)
Between groups	3,942.45	4.00	985.61	181.65	0.00	2.40	0.301	1.37
Within groups	1,600.60	295.00	5.43					0.71
Total	5,543.05	299.00						

(*continued*)

Table V.
Country results ANOVA and Tukey *post hoc* test for bid-ask spreads

Table V.

Post-Tukey HSD test Pair	Max-Min	*Q*	Pre-GFC result	Max-Min	*Q*	Post-GFC result	Max-Min	*Q*	In GFC result
UK/EU	0.11	0.37	No	0.05	2.79	Yes	0.08	0.26	No
UK/USA	8.97	29.82	Yes	0.12	6.13	Yes	0.12	0.39	Yes
UK/Asia	0.11	0.37	No	0.32	16.79	Yes	0.29	0.95	Yes
UK/Japan	0.16	0.53	No	0.25	13.31	Yes	0.24	0.79	Yes
EU/USA	9.08	30.19	Yes	0.17	8.92	Yes	0.04	0.13	No
EU/Asia	0.00	0.00	No	0.26	14.00	Yes	0.21	0.69	Yes
EU/Japan	0.05	0.16	No	0.20	10.52	Yes	0.16	0.54	Yes
USA/Asia	9.08	30.19	Yes	0.43	22.92	Yes	0.17	0.56	Yes
USA/JP	9.13	30.34	Yes	0.37	19.44	Yes	0.12	0.41	Yes
Asia/JP	0.05	0.16	No	0.07	3.48	Yes	0.05	0.16	No

do not show a clear distinction (Table VIII). Sample means and variance of medium-sized companies shows high similarity with small companies pre- and post-crisis, however, there is a clear distinction during the GFC and variances are significantly increased as well as overall turnover levels. Also F score results show that the null hypothesis can be rejected and there is at least one sample group with is significantly different from the other.

Despite results for the Tukey *post hoc* test for small vs medium companies showing the lowest scores still all three groups are significantly different from each other.

This paragraph examines differences in regional market samples for bid-ask spreads and stock turnover (percentage of market cap) using the same methodology as above. When testing for significance in regional market samples, ANOVA results show regional market differences are more significant when assessing turnover ratios compared to spreads shown in the higher F score (Table IX). Variances within groups indicate the groups are closely clustered around their group means with the exception of the US sample post-crisis, showing an exception ally high variance. Stock turnover levels are highest in the USA, followed by Japan and Europe, while Asia has the lowest turnover levels. Intuitively, an increase in turnover levels for REITs with their superior income component to other equity sectors would be expected during a period of artificially induced low-interest rates. Comparing the three time intervals the period during the GFC all samples show an increased level of variance and turnover, which both adjust back to lower levels post-GFC.

The following Tukey *post hoc* test shows which pairs are significantly different at an α level of 0.05 per cent (critical value 3.86) (Table IX). The regional market results for turnover per cent of market cap show that markets generally differ in terms of turnover. Especially the US market liquidity in terms of stock turnover can be distinguished from other markets.

Relationship between REIT market liquidity and market performance

The final part of the analysis links market liquidity and performance. While trading levels differ by geography and small companies show higher spreads than large

Table VI. Regional market correlations stock turnover percentage of market cap 2002-2014

	USA (%)	UK (%)	Asia (%)	Europe (%)	Japan (%)
USA	100.00				
UK	43.20	100.00			
Asia	62.88	71.83	100.00		
Europe	58.34	22.71	42.29	100.00	
Japan	46.35	50.84	68.23	40.30	100.00

Table VII. Regional market stock turnover percentage of market cap

	5 year pre-GFC			5 year post-GFC average		
	Large (%)	Medium (%)	Small (%)	Large (%)	Medium (%)	Small (%)
USA	8.10	9.70	9.50	12.00	20.00	20.00
EU	3.60	4.10	4.20	7.00	4.00	3.00
UK	11.50	7.10	3.20	6.00	4.00	3.00
Asia	4.70	3.70	4.20	4.00	3.00	2.00
Japan	9.30	5.00	6.30	10.00	6.00	6.00

Table VIII.
Group results
ANOVA and Tukey *post hoc* test for stock turnover

Groups	Count	Sum	Pre-GFC average	Variance	GFC average	Variance	Post-GFC average	Variance	
Small	60	328.18	5.47	1.49	11.95	13.54	7.38	2.53	
Large	60	450.50	7.51	2.55	16.03	20.89	8.19	3.58	
Medium	60	352.01	5.87	1.50	13.00	7.08	7.68	2.44	
ANOVA results (5 year post-GFC)									
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)	
Between groups	20.05	2	10.03	3.52	0.03	3.047012	0.22	1.02	
Within groups	504.46	177	2.85					0.04	
Total	524.5146	179							
ANOVA results (in GFC)									
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)	
Between groups	323.80	2	161.90	11.70	0.00	3.082852	0.62	2.91	
Within groups	1,452.85	105	13.84					0.18	
Total	1,776.652	107							
ANOVA results (5 year pre-GFC)									
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)	
Between groups	140.17	2	70.08	37.98	0.00	3.047012	0.18	0.82	
Within groups	326.63	177	1.85					0.30	
Total	466.7966	179							
Post-Tukey HSD test									
Pair	Max-Min	*Q*	Pre-GFC result	Max-Min	*Q*	Post-GFC result	Max-Min	*Q*	GFC result
S/L	2.04	11.62	Yes	0.81	3.71	Yes	4.08	23.29	Yes
L/M	1.64	9.36	Yes	0.51	2.35	Yes	3.03	17.29	Yes
M/S	0.40	2.26	Yes	0.29	1.35	Yes	1.05	6.00	Yes

Groups	Count	Pre-GFC average	Variance	GFC (count 36)	Variance	Post-GFC average	Variance	
USA	60	8.53	3.61	30.88	319.83	13.72	21.40	
UK	60	10.16	3.76	16.70	26.51	5.51	2.01	
Asia	60	4.80	0.95	7.38	2.86	4.64	0.97	
Europe	60	3.78	1.78	7.52	4.22	6.73	3.10	
Japan	60	8.77	6.18	14.00	11.62	9.40	8.49	
ANOVA results (5 year post-GFC)								
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)
Between groups	3,222.68	4	805.67	111.96	0.00	2.40	0.35	1.31
Within groups	2,122.80	295	7.20					0.60
Total	5,345.48	299						
ANOVA results (3 year during GFC)								
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)
Between groups	13,308.20	4.00	3,327.05	45.57	0.00	2.42	1.424	6.51
Within groups	12,776.60	175.00	73.01					0.51
Total	26,084.80	179.00						
ANOVA results (5 year pre-GFC)								
Source of variation	SS	df	MS	*F*	*p*-value	*F* crit	*q*	Critcal *q* (0.05)
Between groups	1,825.41	4.00	456.35	140.07	0.00	2.40	0.233	1.06
Within groups	961.09	295.00	3.26					0.66
Total	2,786.50	299.00						

(*continued*)

Table IX.
Country results ANOVA and Tukey *post hoc* test for stock turnover

Table IX.

Post-Tukey HSD test Pair	Max-Min	*Q*	Pre-GFC result	Max-Min	*Q*	Post-GFC result	Max-Min	*Q*	GFC result
UK/USA	1.62	6.96	Yes	8.20	23.68	Yes	14.18	60.87	Yes
USA/Asia	3.73	16.01	Yes	9.07	26.20	Yes	23.50	100.86	Yes
USA/EU	4.75	20.40	Yes	6.99	20.18	Yes	23.36	100.24	Yes
USA/JP	0.24	1.02	No	4.32	12.46	Yes	16.88	72.46	Yes
UK/Asia	5.35	22.97	Yes	0.87	2.52	Yes	9.32	40.00	Yes
UK/EU	6.38	27.36	Yes	1.21	3.51	Yes	9.18	39.37	Yes
UK/JP	1.38	5.94	Yes	3.89	11.22	Yes	2.70	11.59	Yes
Asia/EU	1.02	4.39	Yes	2.09	6.03	Yes	0.14	0.62	No
Asia/JP	3.97	17.03	Yes	4.76	13.74	Yes	6.62	28.40	Yes
EU/JP	4.99	21.42	Yes	2.67	7.71	Yes	6.47	27.78	Yes

companies, what is the impact on companies' performance? Performance is analysed by market and company size on an annual basis over the past 12 years and indicates that small companies have outperformed large companies in general 58 per cent of the time. Only in the US large companies have shown superior performance. The Japanese data set has limited data availability, which does not allow a clear conclusion.

Over the last five years post-GFC small companies have outperformed large companies in less mature markets like Europe and Asia, while in the UK and US small companies no longer have an advantage (Table X). These are also the markets with highest stock turnover levels.

Conclusions

To date, the most influential research into the determinants of international share liquidity in USA, UK, EU and Australia is that by Brounen *et al.* (2009). Brounen *et al.* (2009) find a relationship between market capitalisation or firm value and liquidity, which is further confirmed by our analysis. The ANOVA results and the Tukey *post hoc* test confirm market liquidity is driven by company size and geography for the selected data set and time horizon. Another significant observation is that spread levels are more characterised by company size and the general decline in spreads and narrowing of variances within groups indicate that REIT markets are maturing and developing globally in the same direction. This trend has continued through all three tested time intervals from post-GFC, during GFC to post-GFC. Results post-GFC from 2010 onwards show that despite higher general market correlation averages for both bid-ask spreads and turnover have moved further apart between regional markets with the Tukey HSD test showing all regional market pairs are above the threshold significance level. Especially differences in stock turnover are more driven by geographic market and have been more affected to show increased variances during the volatile period of the GFC, which is in line with previous findings by Cannon and Cole (2011) and Bhasin *et al.* (1997).

Our initial purpose was to answer the question of whether liquidity in listed real estate markets is dependent on geography and company size. From our analysis the following conclusions can be drawn:

(1) bid-ask spreads were historically more dependent on company size;

(2) volatility of spreads has reduced in each market and size group;

(3) across all size bands, and regions there has been a downward trend in bid-ask spreads reflecting, inter alia, increased competition amongst market participants;

(4) as expected, it is also true that throughout the period the percentage bid-ask spread reflects the overall liquidity of the stock, i.e. more liquid stocks have lower bid-ask spreads;

(5) the European sector also saw a general increase in spreads starting in the summer of 2011, reflecting investor concerns regarding the Euro crisis; and

(6) overall, it can be concluded that regional market is a less important variable when distinguishing between liquidity of companies than their market capitalisation by size.

Table X.
Aggregated stock performance

	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)
Asia											
Asia large	37.20	18.93	44.13	42.04	−53.19	78.45	14.89	−26.23	50.93	−9.43	9.72
Asia medium	46.34	25.96	46.23	29.02	−48.65	67.14	26.62	−11.90	35.98	−11.20	11.13
Asia small	45.65	22.15	55.24	29.14	−58.42	82.74	18.56	−18.20	80.51	−6.31	15.17
Large over small	−8.44	−3.22	−11.11	12.90	5.24	−4.29	−3.67	−8.03	−29.58	−3.12	−5.45
Medium over small	0.69	3.82	−9.00	−0.12	9.77	−15.60	8.06	6.30	−44.53	−4.89	−4.05
Europe											
Europe large	56.85	0.03	70.88	−9.71	−33.08	53.70	2.51	−19.12	26.18	18.48	6.25
Europe medium	44.60	−1.53	73.64	−13.30	−40.95	40.46	29.66	−24.52	23.25	14.05	5.42
Europe small	31.24	15.79	86.31	−16.56	−64.51	79.95	44.39	−26.49	44.60	35.90	6.47
Large over small	25.61	−15.76	−15.43	6.85	31.43	−26.25	−41.88	7.37	−18.42	−17.42	−0.22
Medium over small	13.36	−17.33	−12.67	3.27	23.57	−39.49	−14.72	1.96	−21.36	−21.84	−1.05
Japan											
Japan large	35.75	55.19	38.97	−8.56	−28.90	3.17	25.46	−21.20	63.00	35.68	−23.25
Japan medium	37.02	5.11	36.65	−5.46	−24.64	13.73	42.02	−13.84	17.21	10.81	7.64
Japan small	46.58	16.96	23.85	4.39	−36.54	−1.47	55.13	−26.19	26.21	17.52	19.82
Large over small	−10.83	38.23	15.12	−12.95	7.65	4.64	−29.67	4.99	36.79	18.16	−43.07
Medium over small	−9.56	−11.85	12.79	−9.84	11.90	15.20	−13.12	12.35	−9.00	−6.72	−12.18
UK											
UK large	53.33	7.17	70.66	−35.57	−56.88	18.80	−1.35	−11.25	38.26	24.94	15.87
UK medium	60.35	11.12	79.44	−28.70	−57.80	66.35	15.05	−6.06	39.55	15.01	17.41
UK small	52.76	19.39	61.39	−30.01	−51.12	54.64	−12.81	−23.80	44.16	54.76	−0.42
Large over small	0.57	−12.22	9.27	−5.56	−5.76	−35.83	11.46	12.55	−5.90	−29.82	16.29
Medium over small	7.59	−8.28	18.05	1.31	−6.69	11.72	27.86	17.74	−4.61	−39.75	17.83
USA											
US large	34.48	22.14	35.59	−14.36	−23.86	25.17	36.29	19.18	17.91	1.38	30.32
US medium	25.54	0.88	38.13	−1.92	−21.38	34.30	35.47	6.79	28.34	14.34	35.93
US small	29.81	6.16	35.85	−29.96	−32.33	2.10	20.71	−13.52	24.63	9.62	12.89
Large over small	4.67	15.97	−0.25	15.60	8.48	23.07	15.58	32.70	−6.72	−8.24	17.44
Medium over small	−4.27	−5.29	2.29	28.04	10.95	32.20	14.76	20.31	3.71	4.73	23.04

Finally, while market liquidity differs by company size and geography, on an aggregate basis the small cap vs large cap effect, with regards to performance, does not always hold and depends on market maturity. In some markets, an inverse relationship can persist. Hence finding of Amihud and Mendelson (2002) and Hibbert that the liquidity premium for small caps translates into excess returns is of limited use in listed real estate markets. The maturity of markets and economic cycle are more relevant in determining the performance of these markets. Thus, there is no obvious advantage that by investing specifically in small or large companies or Asia vs USA provides any higher probability of out performance. However, investing in more liquidity markets and companies might still reduce overall trading costs and make investment more efficient than when picking a less liquid market.

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(The Appendix follows overleaf.)

Appendix

Company	Market cap (end 2014)	Spread pre-GFC (%)	Spread post-GFC (%)	Turnover (% market cap) pre-GFC (%)	Turnover (% market cap) post-GFC (%)	Group	Market cap USD	Region
Stockland	11,076	0.49	0.90	6.16	9.66	Large	8,418	Asia
CapitaLand Ltd	15,290	0.70	0.36	5.98	5.99	Large	11,621	Asia
Wharf Holdings Ltd	28,350	0.42	0.43	3.30	3.34	Large	21,546	Asia
Sun Hung Kai Properties	57,220	0.29	0.24	5.07	4.06	Large	43,487	Asia
Hysan Development Co.	6,589	0.78	0.67	3.15	2.82	Medium	5,008	Asia
CapitaMall Trust	7,307	0.76	0.53	2.59	4.49	Medium	5,553	Asia
Novion Property Group	7,570	0.89	0.95	4.89	7.36	Medium	5,753	Asia
Sino Land Co.	12,718	0.68	0.45	3.86	3.05	Medium	9,666	Asia
BWP Trust	1,914	1.18	1.39	2.64	4.53	Small	1,455	Asia
Investa Office Fund	2,468	0.91	1.15	5.02	9.25	Small	1,876	Asia
Keppel Land Ltd	7,016	0.70	0.47	6.00	4.68	Small	5,332	Asia
New World China Land Ltd	7,298	1.05	0.85	3.53	1.12	Small	5,546	Asia
Wereldhave NV	2,152	0.40	0.13	4.88	12.10	Large	2,388	Europe
Corio NV	5,005	0.32	0.11	2.93	3.18	Large	5,556	Europe
Klepierre	13,414	0.48	0.20	3.74	8.11	Large	14,890	Europe
Unibail-Rodamco SE	25,262	0.00	0.08	0.00	8.23	Large	28,041	Europe
Vastned Retail NV	887	0.46	0.31	3.87	5.72	Medium	985	Europe
Sponda OYJ	1,266	1.27	0.51	3.35	3.31	Medium	1,405	Europe
Wihlborgs Fastigheter AB	1,437	0.23	0.40	1.78	4.31	Medium	1,595	Europe
Beni Stabili SPA	1,661	0.28	1.36	4.54	3.27	Medium	1,844	Europe
Vastned Offices/ Industrial	190	0.63	0.23	5.34	2.93	Small	211	Europe
Ste de la Tour Eiffel	302	2.60	0.73	2.12	3.95	Small	335	Europe
DIC Asset AG	665	0.30	0.54	0.54	3.70	Small	738	Europe
Fastighets AB Balder-B SHRS	2,549	6.20	0.75	4.53	2.98	Small	2,829	Europe
Nippon Building Fund Inc.	847,200	0.59	0.50	4.96	6.20	Large	6,862	Japan
Sumitomo Realty & Development	1,957,189	0.70	0.35	16.07	13.53	Large	15,853	Japan
Mitsui Fudosan Co. Ltd	3,258,317	0.54	0.32	9.64	11.28	Large	26,392	Japan

Table AI.
Key data by company

(*continued*)

Company	Market cap (end 2014)	Spread pre-GFC (%)	Spread post-GFC (%)	Turnover (% market cap) pre-GFC (%)	Turnover (% market cap) post-GFC (%)	Group	Market cap USD	Region
Mitsubishi Estate Co. Ltd	3,884,074	0.36	0.43	7.55	8.68	Large	31,461	Japan
Japan Logistics Fund Inc.	201,939	0.19	0.44	6.08	7.57	Medium	1,636	Japan
Nomura Real Estate Office FU	222,042	0.39	0.59	9.46	5.53	Medium	1,799	Japan
Frontier Real Estate Invest	279,248	0.40	0.48	4.65	4.82	Medium	2,262	Japan
Japan Prime Realty Investment	354,337	0.49	0.59	4.22	5.65	Medium	2,870	Japan
Premier Investment Corp	175,424	0.48	0.53	5.92	6.85	Small	1,421	Japan
Kenedix Office Investment Co.	275,727	0.16	0.53	8.49	8.09	Small	2,233	Japan
MORI Trust Sogo Reit Inc.	340,296	0.35	0.43	4.30	4.81	Small	2,756	Japan
NTT Urban Development Corp	403,172	0.28	0.31	6.98	6.18	Small	3,266	Japan
Segro PLC	3,196	0.45	0.13	8.97	5.19	Large	4,994	UK
Hammerson PLC	5,298	0.54	0.08	9.35	6.28	Large	8,278	UK
British Land Co. PLC	8,449	0.26	0.10	14.09	7.10	Large	13,202	UK
Land Securities Group PLC	9,929	0.21	0.09	11.46	5.90	Large	15,514	UK
Shaftesbury PLC	2,260	1.12	0.23	6.20	3.82	Medium	3,531	UK
Great Portland Estates PLC	2,753	0.73	0.17	8.81	4.77	Medium	4,302	UK
Derwent London PLC	3,707	0.80	0.14	7.19	3.98	Medium	5,792	UK
Intu Properties PLC	4,655	0.33	0.10	6.83	4.58	Medium	7,273	UK
Development Securities PLC	314	1.66	1.08	4.41	2.61	Small	491	UK
Primary Health Properties	428	1.60	0.67	4.11	3.93	Small	669	UK
Helical Bar PLC	473	1.60	0.50	3.72	2.81	Small	739	UK
St Modwen Properties PLC	1,074	1.61	0.80	2.35	2.54	Small	1,678	UK
Prologis Inc.	21,873	2.98	0.03	8.56	15.90	Large	21,873	USA
Equity Residential	28,023	13.15	0.02	8.42	14.81	Large	28,023	USA
Public Storage	34,081	5.65	0.02	5.91	10.04	Large	34,081	USA
Simon Property Group Inc.	59,847	11.55	0.04	9.26	11.86	Large	59,847	USA

(*continued*)

Table AI.

Company	Market cap (end 2014)	Spread pre-GFC (%)	Spread post-GFC (%)	Turnover (% market cap) pre-GFC (%)	Turnover (% market cap) post-GFC (%)	Group	Market cap USD	Region
National Retail Properties	5,332	6.17	0.14	1.89	7.02	Medium	5,332	USA
Omega Healthcare Investors	5,553	20.04	0.04	7.72	22.36	Medium	5,553	USA
Apartment Invt & Mgmt Co.-A	5,889	20.51	0.04	8.73	20.34	Medium	5,889	USA
WP Carey Inc.	7,133	9.25	0.03	12.53	24.97	Medium	7,133	USA
Mack-Cali Realty Corp	1,676	12.78	0.05	10.12	22.52	Small	1,676	USA
Cousins Properties Inc.	2,322	3.67	0.13	6.93	15.46	Small	2,322	USA
First Industrial Realty TR	2,356	13.62	0.09	11.11	20.51	Small	2,356	USA
Corporate Office Properties	2,746	4.05	0.05	9.37	20.04	Small	2,746	USA

Table AI.

Corresponding author
Nicole Lux can be contacted at: nicole.lux@city.ac.uk