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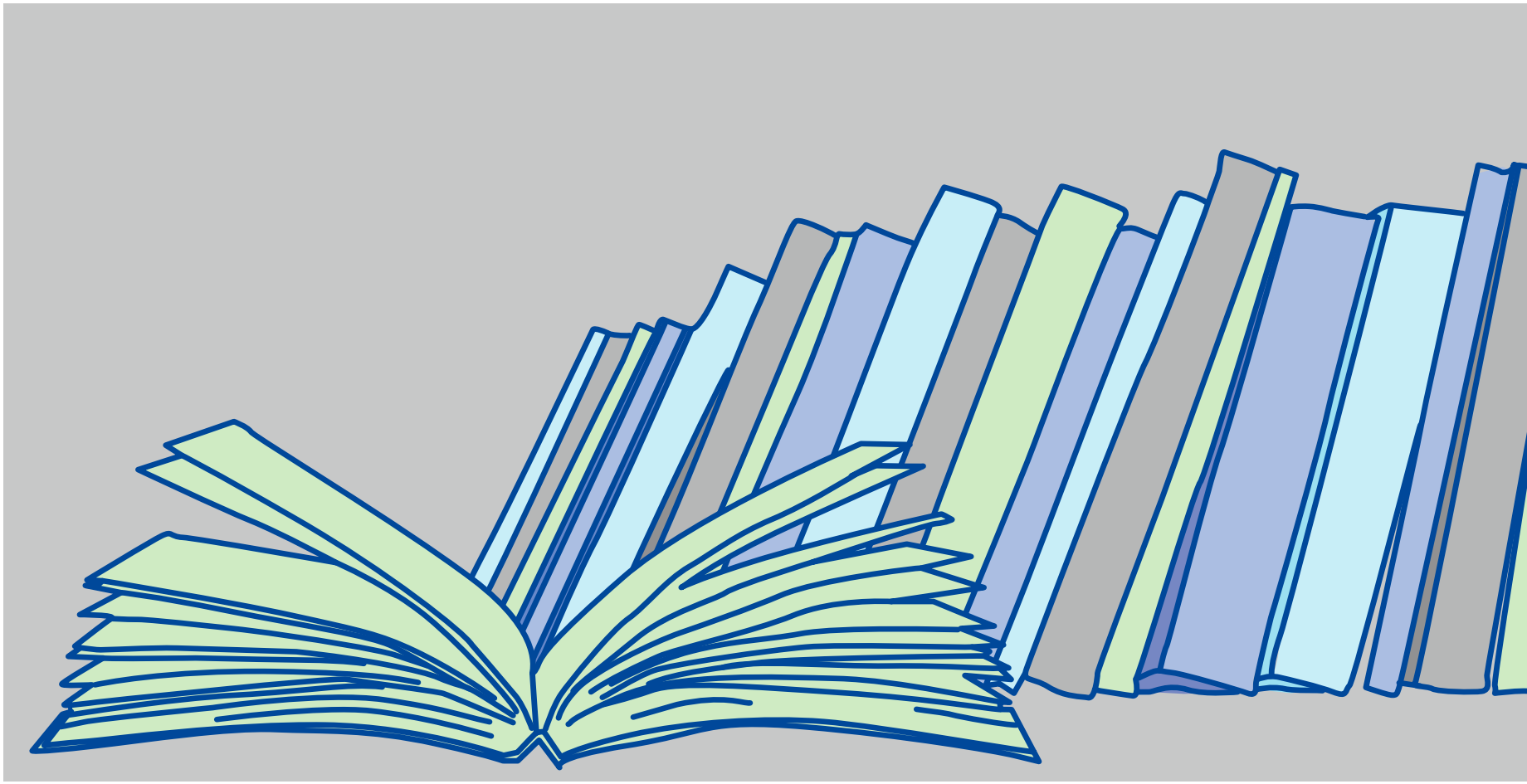

Understanding Real Estate Illiquidity Premiums Better **2018**

Research | Academic Paper

INREV is the European Association for Investors in Non-Listed Real Estate Vehicles. Our aim is to improve the accessibility of non-listed real estate vehicles for institutional investors by promoting greater transparency, accessibility, professionalism and standards of best practice.

As a pan European body, INREV represents an excellent platform for the sharing and dissemination of knowledge on the non-listed real estate industry.

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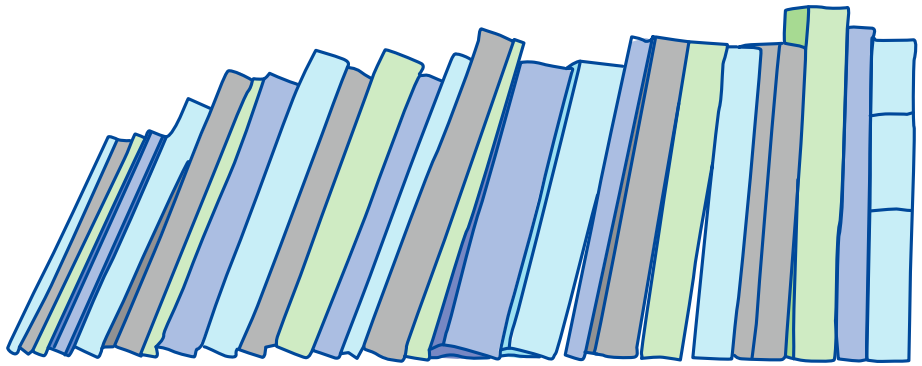

Executive summary

- Investors are rewarded for taking on liquidity risk in their non-listed real estate portfolios
- The illiquidity premium for non-listed funds was estimated to be 84 basis points (bps) per annum for a sample with an average annual return of 9.6%
- Non-listed real estate funds should also provide significant diversification benefits versus listed real estate vehicles at a portfolio level

Investors can gain exposure to real estate by investing in shares of real estate companies, non-listed real estate funds or direct real estate.

All three routes to real estate have costs and benefits in terms of transparency, liquidity and return characteristics, with differences being more pronounced in the short to medium term. Listed real estate is generally more liquid than non-listed but the returns are also more volatile. Therefore, the focus for this study is to better understand and attempt to measure the illiquidity premium of non-listed real estate.

The subject of illiquidity of non-listed real estate funds has not been studied extensively. Measuring liquidity across different types of real estate is challenging, although it is of great interest to those operating in this field. Therefore, the objective of this research is to deepen the understanding of the illiquidity premium available from non-listed real estate, to compare it to the illiquidity premium for REITs, and to compare the illiquidity of different types of real estate. The study focuses on quarterly data on non-listed real estate funds, REITs, and direct real estate in the United Kingdom (UK) for the period from 2010 to 2016.

The analysis adopted the Amihud measure of price impact as a liquidity measure. It measures how much a transaction of a given magnitude (the volume) moves the price (the absolute value of the return).[1] Secondary trading volume was used in the computation of the measure. For open end funds, the primary market could offer additional liquidity, though this may be subject to redemption suspensions. These may, for instance, occur when fund managers are facing many redemption requests and want to avoid having to sell real estate too quickly or under adverse market conditions.

Findings from the research show that the return characteristics are comparable across non-listed and direct real estate, and that REIT returns are more volatile. The returns and illiquidity of non-listed real estate funds and direct real estate tend to behave similarly over the long term. In contrast, the returns and illiquidity for listed REITs behave differently from the other two categories. As expected, for open end non-listed real estate funds, primary market activity seems more important, while for closed end funds secondary trading is the largest component.

‘Listed real estate is generally more liquid than non-listed but the returns are also more volatile.’

For non-listed real estate funds, an average annualised illiquidity premium of 84 bps was observed for the sample of 33 UK funds with an average return of 9.6%. The findings suggest that these funds generated an extra 84 bps to compensate for the illiquidity of the non-listed real estate market.

This illiquidity premium was an average across the funds in the sample. For individual funds, the total risk premium and its components may vary due to differing exposures to equity and real estate market risks, as well as different levels of illiquidity.

1 In perfectly liquid markets, it is possible to trade unlimited amounts of an asset at the equilibrium price with little effect on the price (Ametefe et al., 2015). The Amihud measure (Amihud, 2002) therefore measures illiquidity, since it is large when a small trade moves the price by a large amount, in which case an asset is illiquid according to the preceding definition.

1. Introduction and objectives

Great progress has been made over the last 30 years in improving real estate market knowledge and market transparency. The market itself has matured, and investors can now access the market via different routes: by acquiring shares in property companies traded publicly (such as Real Estate Investment Trusts, abbreviated as REITs), by investing in a suite of non-listed real estate vehicles, or by buying buildings directly.

Each of these routes has its specific characteristics. Public markets are transparent and have price efficiency. Non-listed real estate vehicles are less transparent and have limited liquidity (Fuerst and Matysiak, 2013). Direct investment in real estate is lumpy and it suffers from information asymmetry and low liquidity, even in the case of large portfolios.

Considering these features, real estate is considered as an asset class that offers high risk-adjusted returns, in part due to the liquidity risk premium (inter alia, Hoesli and Lekander, 2008). However, the illiquidity of non-listed real estate vehicles has not been studied extensively.

To fill the gap, this research sets out to deepen the understanding of illiquidity premiums through an assessment of the illiquidity premium for non-listed real estate funds and a comparison with the illiquidity premium of listed real estate funds. In addition the illiquidity of non-listed real estate funds is compared with the illiquidity of other real estate investment routes, namely listed and direct real estate investments.

The null hypothesis is that the illiquidity of listed, non-listed and direct real estate is the same. The alternative hypothesis is that at least one investment route exhibits a distinct illiquidity premium. In other words, this research sought to explore the following hypothesis:

1. The illiquidity of non-listed real estate is similar to that of listed real estate.

2. The illiquidity of non-listed real estate is similar to that of direct real estate.

3. The illiquidity of non-listed real estate varies over time.

The alternative hypothesis is that all three routes exhibit distinct illiquidity premiums.

The research uses quarterly data on non-listed real estate funds, listed REITs and direct real estate for the United Kingdom (UK) for the period from 2010 to 2016. The sample selected for this study covered 33 non-listed funds, 50 REITs, and national as well as sectoral direct real estate data provided by MSCI / IPD. The research focused on the UK where secondary market data was more readily available.

The report is organised as follows. Section 2 reviews previous studies on this topic. Section 3 describes the methodology, while Section 4 presents the data used in the analysis. Findings are discussed in Section 5, followed by the pricing of liquidity in Section 6. Section 7 provides concluding remarks.

This research report has been written by Professor Marc Francke of the University of Amsterdam and Ortec Finance and his team comprising Patrick Tuijp (Ortec Finance and University of Amsterdam), Erik Hennink (Ortec Finance) and Isabel de Heus (Ortec Finance) with support and guidance from the project focus group.

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- Charles Conrath, Vice President, Research and Strategy, JP Morgan Asset Management
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Professor Marc Francke and his team would like to thank Professor Joost Driessen, Professor Peter van Gool, and participants at the ERES 2017 conference, as well as the Real Estate Index Research Seminar at the University of Amsterdam, for useful comments and suggestions, and Rob Schuitemaker for research assistance.

This research grant was awarded in memory of the late Erwin Stouthamer who served on the INREV management board.

2. Literature review

Non-listed real estate is a private market. Compared to its public peers, it offers access to greater diversification benefits (Schweizer et al., 2013). Due to the very fact that it is private, the sector does suffer from lower liquidity levels. In perfectly liquid markets, buyers and sellers can trade unlimited amounts of assets at the equilibrium price at any moment, with low transaction costs and with little effect on price (Ametefe et al., 2015). However, this is not the case for non-listed real estate.

The relative illiquidity of public and private real estate markets has received some attention. Bond and Chang (2012) compared the liquidity of REITs to that of equities and direct commercial real estate investments. They found that REITs are less liquid and that public real estate market illiquidity affects that of private real estate markets. In addition, Subrahmanyam (2007) found illiquidity spillovers from REITs to non-REIT securities.

According to Brounen et al. (2009), the illiquidity of real estate securities is associated with fund market capitalisation, non-retail share ownership, and dividend yield. More recently, Blau et al. (2015) found similarly that bid-ask spreads tend to be greater among REIT series compared to non-REIT equities. Nonetheless, Jadevicius and Lee (2017) studied day-of-the-week effects and found that UK REITs showed similar performance attributes to equities.

For direct real estate investment, Fisher et al. (2003) note that in addition to the asynchronous, idiosyncratic, noisy market value indications obtained from transaction prices, typically only a fraction of all assets is traded and liquidity may be highly variable over time. They construct a liquidity measure for direct real estate that should capture time-variation while they try to limit the impact of other characteristics. Using this measure, they find that REIT price discovery leads to direct real estate index price discovery.

With regards to non-listed real estate illiquidity, Schweizer et al. (2013) documented that private funds may exhibit a discount of about 6% relative to net asset value (NAV) when share redemptions are temporarily suspended.

Aside from these earlier studies, and to the best of the authors' knowledge, no prior study quantified the illiquidity of all three real estate investment routes: direct, private and public. Given the gap, this current study not only examines the illiquidity levels for all three investment routes, but also studies the illiquidity premiums for listed and non-listed real estate investments.

3. Methodology

To explore the potential illiquidity of direct, private, and public real estate investment routes, the study adopts three well-established approaches. The first is the Amihud (2002) measure, the second is the cross-correlation, and the third is the Fama and MacBeth (1973) regression of returns.

The Amihud measure of illiquidity

The principle behind the Amihud measure is the relationship between transactions of a given magnitude (the volume) and how much it moves the price (the absolute value of the return). The higher the Amihud measure, the less liquid is the investment. The Amihud measure for investment i in period t is defined as:

$$\text{ILLIQ}_{i,t} = \frac{|R_{i,t}|}{\text{VOL}_{i,t}},$$

where $R_{i,t}$ denotes the return and $\text{VOL}_{i,t}$ the volume in millions of currencies on investment i in period t.[2] In this study $\text{VOL}_{i,t}$ is the secondary trading total.

In addition to the Amihud measure, other measures of illiquidity, including the premium or discount to net asset value, the percentage turnover and the percentage bid-ask spread were also explored.

Cross correlation

The cross correlation is employed to assess the level of co-variation between different variables as well as lead-lag relationships between them. The correlation between two series is expressed as follows (e.g. Koop, 2006):

$$r = \frac{\sum_{i=1}^{N} (Y_i - \bar{Y})\,(X_i - \bar{X})}{\sqrt{\sum_{i=1}^{N} (Y_i - \bar{Y})^2}\ \sqrt{\sum_{i=1}^{N} (X_i - \bar{X})^2}}$$

where $\bar{X}$ and $\bar{Y}$ are the means of variables *X* and *Y* respectively. The cross correlation is used to determine whether two or more variables move similarly.

Fama and MacBeth regression of returns

The Fama and MacBeth (1973) regression quantifies betas (risk exposures) and risk premiums for risk factors that are expected to be relevant for asset prices. A parsimonious specification was used that includes the direct real estate market as well as the stock market as risk drivers. The Amihud illiquidity measure is added to find the return premium commanded by illiquidity. The model is expressed as follows:

$$r_{i,t} - r_t^f = \lambda_{0,t} + \lambda_{1,t}\beta_{RE,i} + \lambda_{2,t}\beta_{EQ,i} + \lambda_{3,t}\text{ILLIQ}_{i,t} + \varepsilon_{i,t},$$

where $r_{i,t}$ denotes the return to fund i at time t, r_t^f the UK 3-month Gilt rate, $\beta_{RE,i}$ the market beta with respect to the direct real estate market,[3] $\beta_{EQ,i}$ the market beta with respect to the stock market, and $\text{ILLIQ}_{i,t}$ the Amihud illiquidity measure. The coefficients $\lambda_{1,t}$, $\lambda_{1,t}$, and $\lambda_{1,t}$ represent the prices of real estate market risk, equity market risk, and illiquidity. That is, they measure the premium per unit of exposure for each return driver included in the model. The $\lambda_{0,t}$ is the regression intercept.

2 The Amihud measure is typically a monthly average of daily observations. Since only quarterly observations are available, these are simply used without averaging.
3 Non-listed fund returns are measured at the NAV level. Although some of the underlying asset values are appraisal-based, the fraction of the NAV to which this applies may vary across funds and over time. Developing an unsmoothing approach for these funds is outside the scope of this paper. For reasons of consistency, direct real estate returns are therefore left unsmoothed with which the real estate market beta is estimated either.

4. Data sources and characteristics

This research study uses data from various sources for non-listed real estate funds, listed REITs and direct real estate for the United Kingdom over the period from 2001 to 2016.

Data for non-listed real estate funds

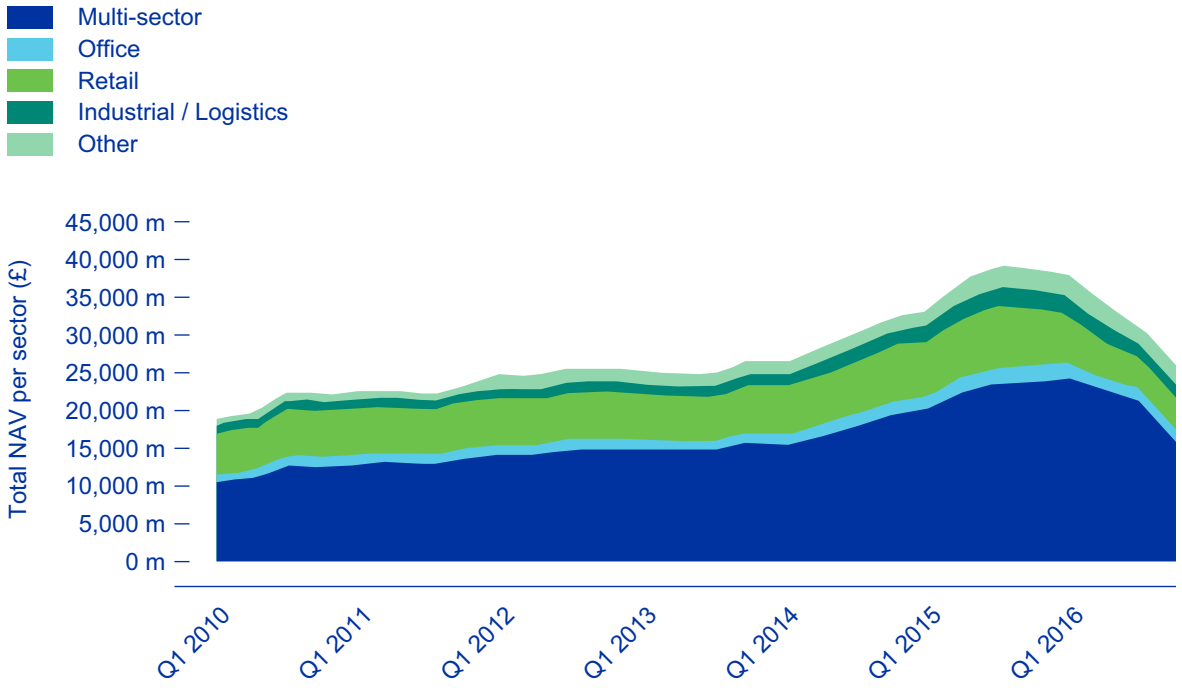
Data for non-listed real estate funds was sourced from INREV's proprietary dataset of European non-listed real estate funds. INREV fund performance is measured by net asset value based returns net of all fees and other costs, and represents the aggregate investor return. The INREV Annual Index time series is available from 2001 and is based on a frozen sample. However, the INREV Quarterly Index series is available from Q1 2010 and is based on an unfrozen sample, meaning that its historical data may change with future updates.

The analysis for this study used the INREV Quarterly Index sample. The INREV Annual Index sample was used for sensitivity analysis (see Appendix 5). The Quarterly Index sample was selected, as it provides a larger number of observations than the annual series. Only funds with a UK target country strategy were used for this research. Over the whole research period, the INREV Annual Index comprised 92 funds with a UK target country strategy, while the INREV Quarterly Index comprised 86 funds with such a strategy.

Matched sample for non-listed real estate funds

The INREV fund data was matched with transaction data from PropertyMatch[4]. The PropertyMatch database contains 1,161 transactions in total for 92 UK funds over the period from September 2009 to December 2016. In total, 33 UK funds from the INREV data were paired with 1,005 PropertyMatch transactions during the period from 2010 to 2016. The sample represents 38% of the number of UK funds in the INREV Quarterly Index sample and 87% of the number of PropertyMatch transactions.

Figure 1: NAV sector breakdown for non-listed UK real estate funds



Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016)

4 PropertyMatch was founded in 2009 through the collaboration of CBRE and the GFI Group. It is a large electronic pricing platform dedicated to non-listed real estate funds and processes a substantial share of secondary trading volume in the UK.

In total, the 33 funds represent an NAV of 27.7 billion GBP. For each transaction, information was available on the trade day, the fund, the number of units, the NAV, the premium/ discount and the unit trade price. There was an average number of 16 transactions per fund and the average volume per transaction was 6.8 million GBP. The smallest transaction stood at 2,427 GBP and the largest at 1.7 billion GBP.

The matched sample of 33 funds consists of 15 open end funds and 18 closed end funds. The open end funds represent a total NAV of 17.8 billion GBP on average over the sample period and the closed end funds a total NAV of 9.9 billion GBP on average. In terms of sectors, retail and office form the largest shares by NAV.

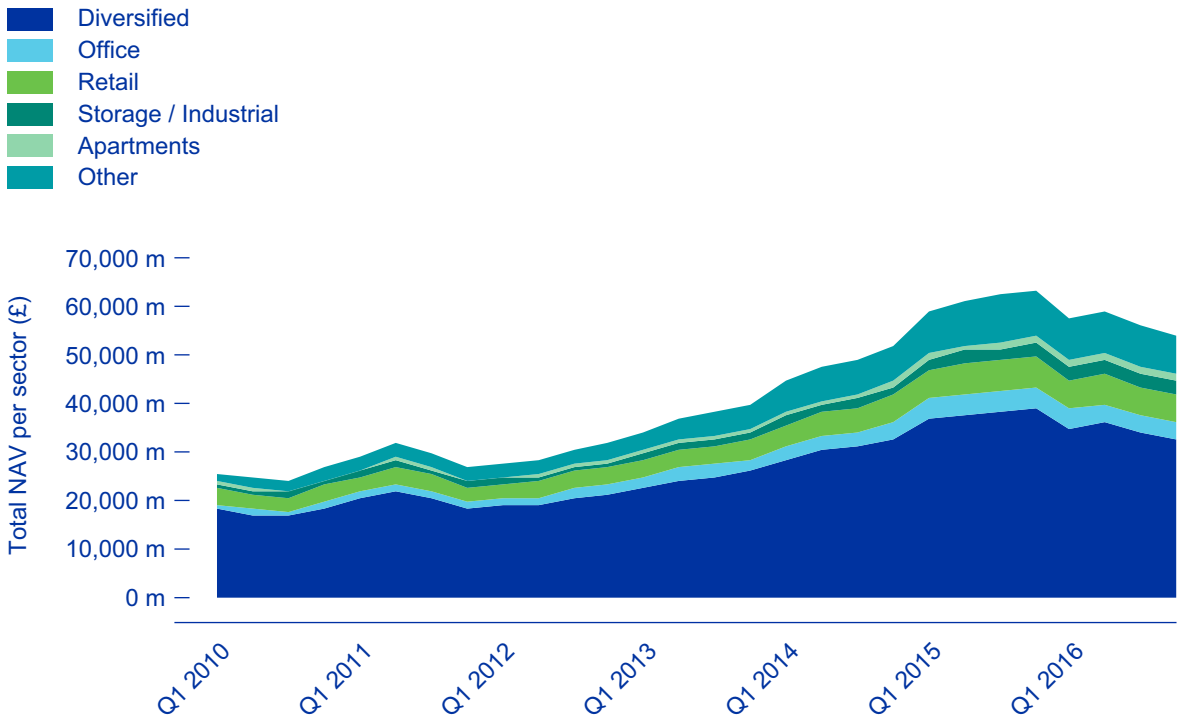
Data for listed REITs

Data for 50 listed UK REITs during the period from 2001 to 2016 was obtained from Bloomberg.[5] Daily aggregates contain returns, volume, market capitalisation, and bid and ask quotes for each series. Selected REITs represent a total market capitalisation of 40.4 billion GBP on average over the sample period. Gearing levels (defined as total debt divided by total assets) were available for 44 of the chosen REITs.

Data for direct real estate

Direct real estate data for the UK has been sourced from MSCI / IPD for the period from 2001 to 2016. The sample represents a capital value of 127.8 billion GBP. The direct real estate data consists of ungeared total returns of directly held standing investment properties. The index series include returns, capital value and turnover volume.

Figure 2: Total market capitalisation sector breakdown for listed UK REITs



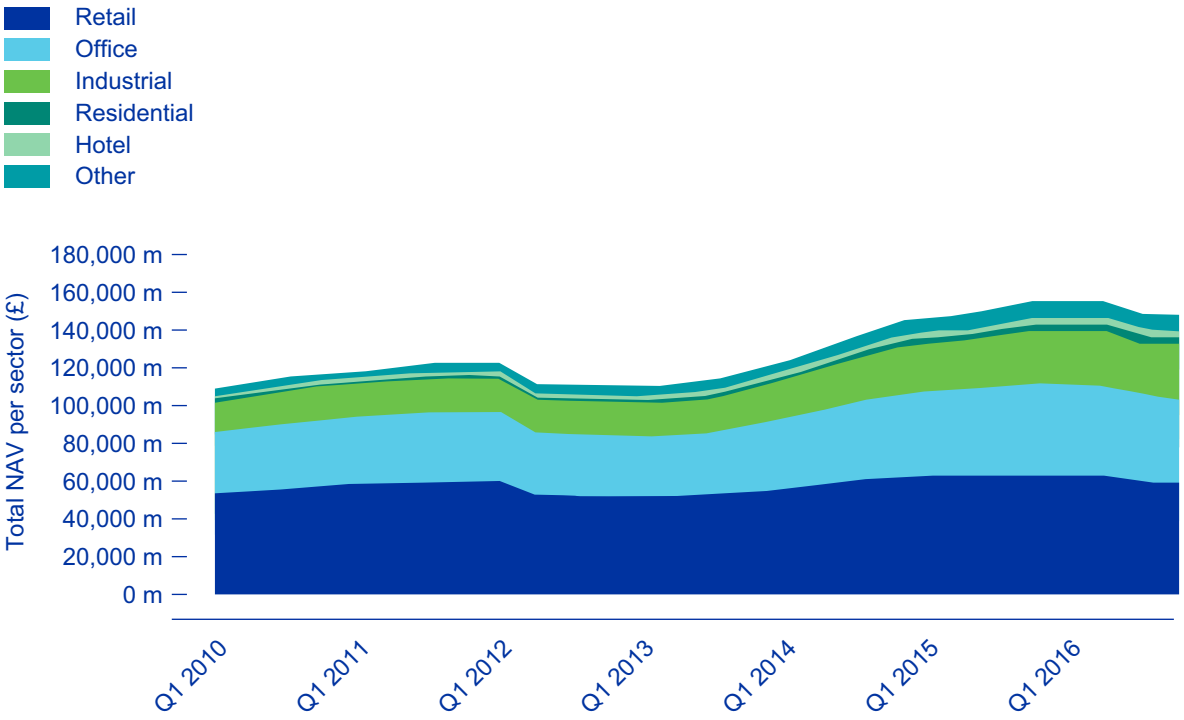
Source: Bloomberg (quarterly frequency from 2010 to 2016)

5 Note that the UK REIT regime was introduced in 2007. For the period before 2007, we take listed real estate investment companies that are now classified as REITs being considered. This does not affect main analysis, which is based on data for the period from 2010 to 2016.

In terms of market capitalisation, the UK direct real estate sample is approximately two to three times the size (depending on the period) of the UK REITs sample and four to five times larger than the UK non-listed real estate sample. However, the average size of the non-listed real estate funds, as measured by NAV, stands at circa 1.0 billion GBP, which is similar to the average size of the listed UK REITs (1.1 billion GBP per fund).[6]

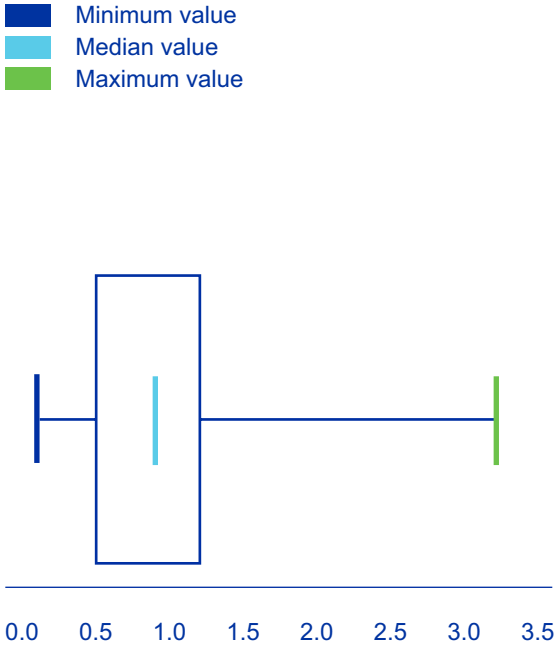
With regards to leverage, non-listed real estate funds have substantially lower gearing levels (with a cross-sectional average of 16.0%) compared to REITs, where the average is 37.8%. Note that the gearing aggregates presented here are on a cross-sectional basis for the latest available measurement period. Out of the 33 matched sample of non-listed funds, 10 funds used zero leverage.

Figure 3: NAV sector breakdown for direct UK real estate



Source: MSCI / IPD (quarterly frequency from 2010 to 2016)

Figure 4: Average NAV distribution of non-listed real estate funds (£ billion)



Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016)

6 On the full quarterly sample of non-listed funds, which also includes funds that do not have secondary trading data, a somewhat lower average fund size of 693 million GBP is being found.

5. Research findings

Return characteristics

When comparing the average returns across non-listed, listed and direct real estate, an interesting picture emerges. Although returns are comparable, the range in quarterly returns varies considerably. The volatility characteristics show that the listed REIT returns are much more volatile and feature larger downside risk.[7] One possible explanation for the high volatility in REIT returns is the high exposure they tend to have to default risk during financial crises through their relatively high leverage ratios.[8]

'Returns across non-listed, listed, and direct real estate are comparable, although REIT returns are more volatile'

Table 1: Summary statistics for non-listed funds, listed REITs and direct real estate

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Total returns										
INREV non-listed real estate	-1.2%	0.9%	2.1%	2.1%	3.1%	6.8%	1.7%	0.49	0.85	28
REIT listed real estate	-16.3%	1.1%	4.3%	2.6%	6.7%	9.6%	5.8%	-1.58	3.06	28
MSCI / IPD direct real estate	-1.2%	1.4%	2.3%	2.4%	3.3%	5.8%	1.5%	-0.01	0.18	28
Total market capitalisation (Millions of GBP)										
INREV non-listed real estate	18,929	23,276	25,788	27,690	31,811	39,316	5,856	0.72	-0.50	28
REIT listed real estate	23,985	28,396	37,005	40,440	53,624	62,475	13,420	0.34	-1.51	28
MSCI / IPD direct real estate	108,550	112,856	122,522	127,809	146,364	154,641	16,705	0.50	-1.42	28
Average market capitalisation per fund (Millions of GBP)										
INREV non-listed real estate	653	803	898	1,022	1,246	1,523	271	0.55	-1.18	28
REIT listed real estate	742	874	1,121	1,096	1,295	1,517	245	0.05	-1.49	28
Number of funds										
INREV non-listed real estate	21.00	27.00	28.00	27.50	29.00	30.00	2.17	-1.38	1.98	28
REIT listed real estate	34.00	34.00	35.00	37.43	39.50	45.00	4.20	0.94	-0.73	28

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds per quarter, and then computing the statistics on the resulting time series.

7 The direct real estate returns have not been unsmoothed, and that the unsmoothed volatility may be somewhat higher.
8 Chung et al. (2016).

Illiquidity statistics

A few interesting observations can be made regarding illiquidity. The sample shows that the volatility of the Amihud measure is highest for non-listed real estate investments, and approximately equal for direct and listed real estate investments. Listed REITs show the highest secondary market percentage turnover of 10.6% and non-listed real estate the lowest at 0.6%, offering a first indication that REITs are more liquid than non-listed funds, as expected based on the different market structure.

Taking into consideration primary market activity, the percentage turnover for non-listed real estate increases to 2.6%. This means that 2.6% of NAV is being traded each quarter. The 2.6% level of primary market activity is closer to the 4.1% turnover found for direct real estate and represents 707 million GBP in volume.

When looking at the premiums and discounts offered by non-listed real estate funds, the average discount to NAV for all funds stood at 1.3%. For open end funds, the average premium to NAV was 0.7%[9] with the largest discount to NAV being 2.7%. For closed end funds an average discount of 3.3% was found, greater than the largest discount of 2.7% for open end funds. Figure 5 shows that the average premium or discount for non-listed real estate funds varies over time, and that this variation is most apparent in the funds with discounts.

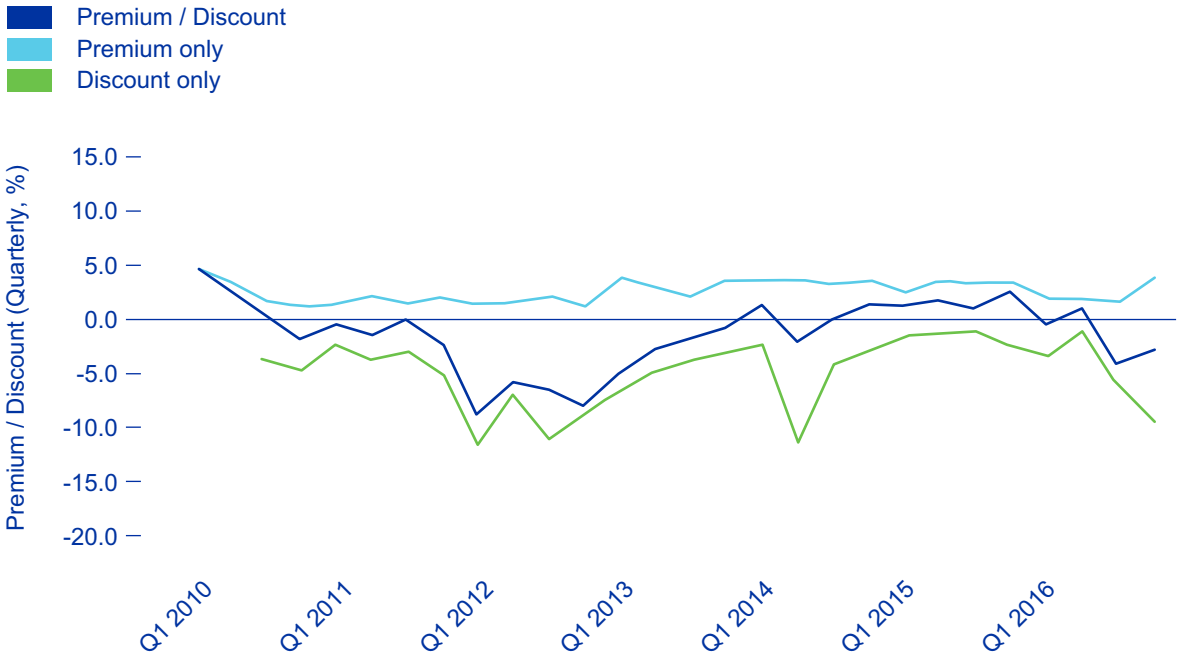
9 In line with the findings of Schweizer et al. (2013).

Primary market activity and secondary trading

For open end funds, primary market activity consists of subscriptions and redemptions, while for closed end funds it consists of capital calls and distributions. The statistics show that primary market activity is more relevant for open end funds, while secondary trading typically accounts for the largest part of closed end fund trading.

‘Primary market activity is more relevant for open end funds, while secondary trading typically accounts for the largest part of closed end fund trading’

Figure 5: Average non-listed real estate fund premium/discount to net asset value



Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016)

One of the drivers of illiquidity in securitised real estate markets is fund market capitalisation.[10] Although the total market capitalisation, as measured by NAV, of all non-listed real estate funds is smaller than that of listed REITs and direct real estate, the average fund size of UK non-listed real estate funds is similar to that of UK listed REITs (1.0 billion GBP and 1.1 billion GBP, respectively). Therefore, the size of the non-listed real estate funds in the sample does not indicate higher illiquidity than REITs.

Bid-ask spreads

The bid-ask spread, a direct measure of liquidity, was only available for the REIT data. For the non-listed real estate funds and for direct real estate, it was necessary to rely on the Amihud measure of liquidity. Therefore, the Amihud measure of liquidity for REITs was compared with the bid-ask spread, to investigate whether the Amihud measure indeed represents the liquidity as measured by the bid-ask spread. The results found using the Amihud measure and bid-ask spread are comparable for REITs and demonstrate that the Amihud measure is a suitable measure of liquidity for the purposes of this study.

The mean percentage bid-ask spread for UK REITs was found to be 2.2%, which is comparable to findings of earlier studies.[11] Over a sample from 2001 to 2011, the average bid-ask spread for both US REITs and US non-REIT equities decreased sharply, to 0.7% and 0.2%, respectively.[12] The reported bid-ask spread for REITs during the period from 2003 to 2007 was as low as 0.2%; authors of one of the earlier studies refer to this period as the 'REIT Bubble'.[13] The volatility of the bid-ask spread of our UK REITs sample is 0.7%, somewhat higher than the volatility of 0.2% found by an earlier study.[14]

To put the observed spread levels into perspective, a comparison was made with non-REIT spreads found in the literature. Earlier work finds that, controlling for market capitalisation, REIT bid-ask spreads are significantly higher than non-REIT bid-ask spreads, with an estimated difference of 0.5%.[15] For US stocks with a market capitalisation comparable to that of the UK REITs in our sample, earlier research finds bid-ask spreads of 0.9% to 1.0% for NYSE stocks and 0.7% for NASDAQ stocks over the period from 1993 to 2014.[16] In fact, over the period from 2004 to 2014 the average bid-ask spread for US stocks is substantially lower for even the lowest two size quintiles (1.6% and 0.3%, respectively) than that found for the UK REITs in our sample.[17]

In summary, it is possible to infer that the Amihud measure and bid-ask spread lead to similar results for REITS, showing that the Amihud measure is a suitable measure of liquidity for the purposes of this study. The REIT bid-ask spreads in the sample are comparable to those found by earlier studies, yet higher than bid-ask spreads for stocks with similar market capitalisations.

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10 Brounen et al. (2009).
11 Chung et al. (2016) found that the average bid-ask spread for US REITs was 2.1% over the period from 1997 to 2009. Marcato and Ward (2007) found that closing bid-ask spreads for US and UK REITs typically averaged between 1.5% and 4.0% over the period from 1993 to 2005. Blau et al. (2015) found an average bid-ask spread of 1.5% for US REITs and 1.3% for US non-REIT equities over the sample from 1993 to 2011.
12 Blau et al. (2015).
13 This period of low spreads was not included in the sample for this study, which may explain the higher average spread level that we observe. The earlier study is Blau et al. (2015).
14 Blau et al. (2015).
15 Blau et al. (2015).
16 DeGenarro et al. (2017).
17 Kalesnik and Beck (2015).

Table 2: Summary statistics for primary and secondary trading in non-listed funds

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Illiquidity (Percentage turnover, primary market)										
All non-listed funds	0.6%	1.2%	1.7%	1.9%	2.2%	4.5%	1.0%	1.06	0.38	28
Non-listed open-end funds	0.9%	1.4%	2.1%	2.8%	3.5%	7.9%	1.7%	1.25	1.61	28
Non-listed closed-end funds	0.0%	0.3%	1.1%	1.2%	1.8%	4.6%	1.0%	1.35	2.97	28
Illiquidity (Percentage turnover, secondary market)										
All non-listed funds	0.2%	0.4%	0.5%	0.6%	0.7%	1.7%	0.4%	1.66	2.22	28
Non-listed open-end funds	0.0%	0.3%	0.4%	0.6%	0.7%	2.8%	0.7%	2.53	6.60	28
Non-listed closed-end funds	0.1%	0.3%	0.4%	0.6%	0.8%	3.0%	0.6%	3.28	13.71	28
Illiquidity (Percentage turnover, primary and secondary market)										
All non-listed funds	1.1%	1.8%	2.3%	2.6%	3.1%	4.8%	1.0%	0.83	-0.30	28
Non-listed open-end funds	1.3%	2.3%	2.9%	3.4%	4.1%	7.9%	1.7%	1.21	1.17	28
Non-listed closed-end funds	0.4%	0.8%	1.7%	1.8%	2.5%	5.3%	1.1%	1.02	1.61	28
Trading volume (primary market, millions of GBP)										
All non-listed funds	271	349	477	566	766	1,396	268	1.26	1.86	28
Non-listed open-end funds	165	331	432	480	632	880	194	0.48	-0.72	28
Non-listed closed-end funds	0	32	62	87	114	516	101	3.13	12.38	28
Trading volume (secondary market, millions of GBP)										
All non-listed funds	32	94	127	141	160	459	87	1.96	5.82	28
Non-listed open-end funds	1	37	75	87	100	429	85	2.77	9.68	28
Non-listed closed-end funds	9	29	47	54	74	160	34	1.15	2.01	28

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Trading volume (primary and secondary market, millions of GBP)										
All non-listed funds	370	476	634	707	832	1,522	283	1.28	1.33	28
Non-listed open-end funds	218	419	508	567	681	1,114	213	0.88	0.40	28
Non-listed closed-end funds	30	75	123	141	157	593	109	2.90	10.85	28
Secondary trading as percentage of total trading activity										
All non-listed funds	26.1%	40.9%	48.1%	46.1%	52.8%	62.7%	10.1%	-0.71	-0.32	28
Non-listed open-end funds	7.6%	27.9%	31.9%	30.8%	38.6%	48.5%	11.8%	-0.57	-0.18	28
Non-listed closed-end funds	46.9%	60.8%	75.0%	72.0%	81.0%	100.0%	12.9%	-0.14	-0.39	28

Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), authors' calculations. The statistics for non-listed funds have been obtained by first taking the equally-weighted average across funds per quarter, and then computing the statistics on the resulting time series.

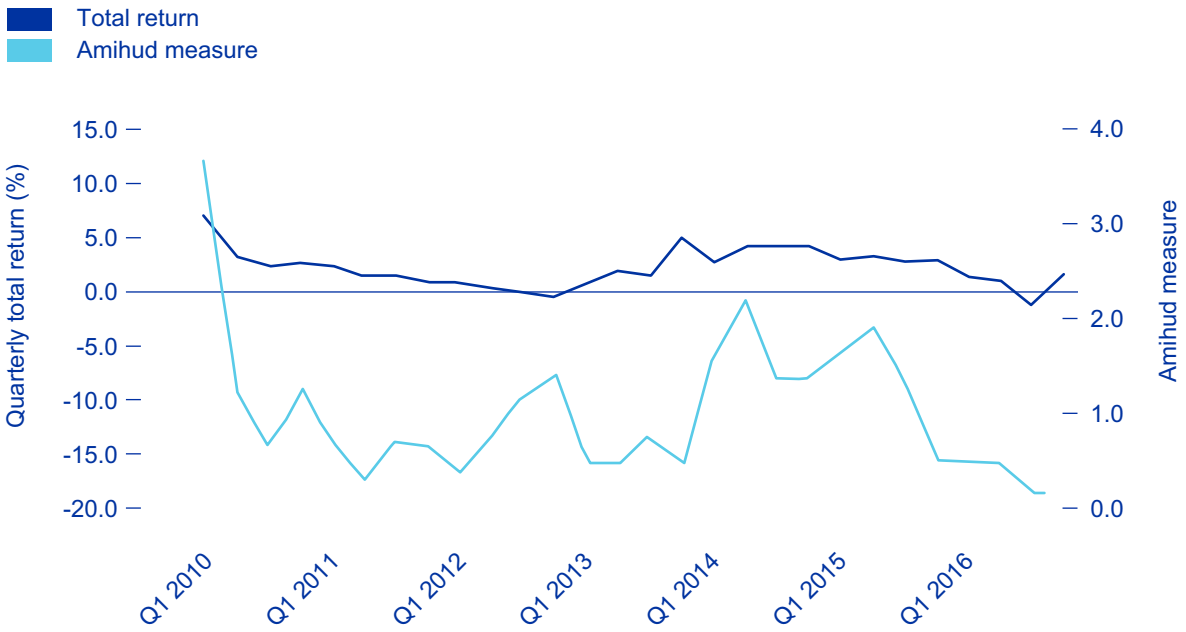
Relationships between returns and illiquidity measures

Next, the analysis looks at the relationship between returns and illiquidity, as measured by the Amihud measure. For the non-listed and listed funds, the equally-weighted average return series was used.

The estimates suggest that the return and illiquidity properties of non-listed and direct real estate are comparable. However, the volatility of illiquidity of non-listed real estate funds is greater than that of REITs and direct real estate.

For REITs, large spikes in illiquidity were observed, even when returns were reasonably stable. The Brexit vote does not appear as an illiquidity spike, despite redemption suspensions occurring for open end funds.[18] This could be due to quarterly data being used, which may smooth out effects that would be visible at a higher frequency.

Figure 6: Non-listed real estate fund returns and Amihud illiquidity measure



Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), of which 45% is open end and 55% is closed end.

Note: higher Amihud measure value means less liquidity. Levels of the Amihud measure have been scaled by dividing by their means.

18 PwC (2016), "Brexit Monitor – Impact on the real estate sector".

Correlation estimates

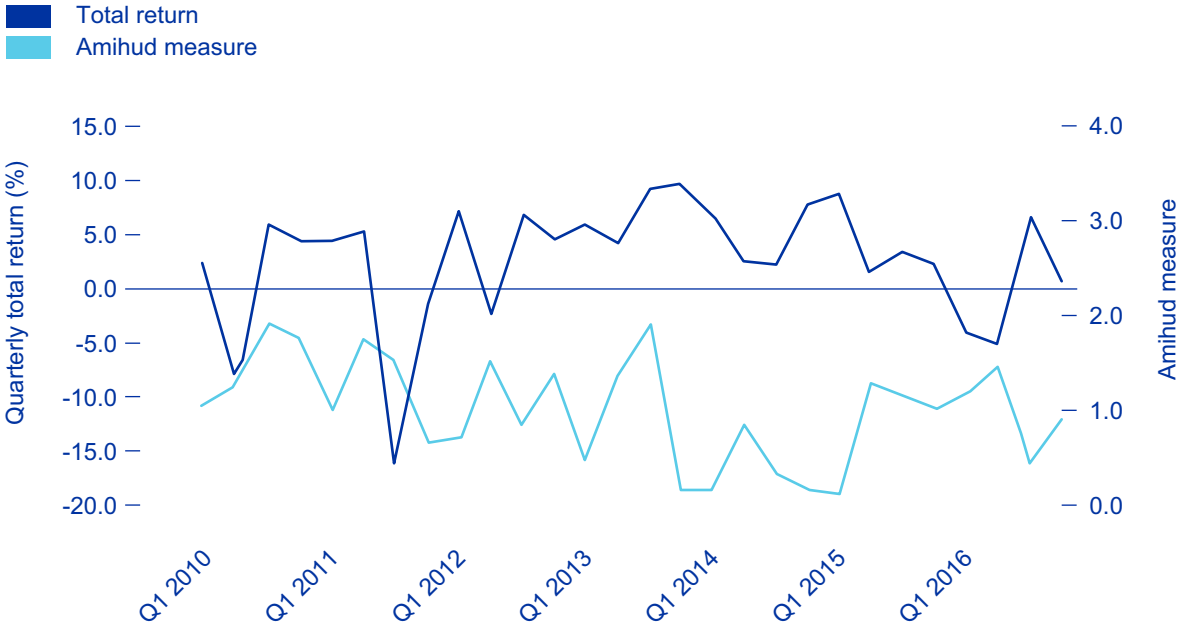
The correlations between returns and illiquidity measures suggest that non-listed fund returns and direct real estate returns on aggregate move together. Their illiquidity also varies similarly over time.

The correlations between the return and the Amihud measure for non-listed and direct real estate are strongly positive, while the corresponding correlation for REITs is not significantly different from zero. There are no significant correlations between the percentage turnover and the Amihud measure across all types of investments.

While no significant contemporaneous correlation between REIT series and the other types of investments[19] was found, significant correlations appeared when the REIT data was lagged by one quarter. This indicates that REITS lead the other investments.[20]

The correlation between non-listed real estate fund returns and illiquidity is an early indication that a liquidity risk premium may exist for non-listed real estate funds. This is not the case for REITs.

Figure 7: REIT returns and Amihud illiquidity measure



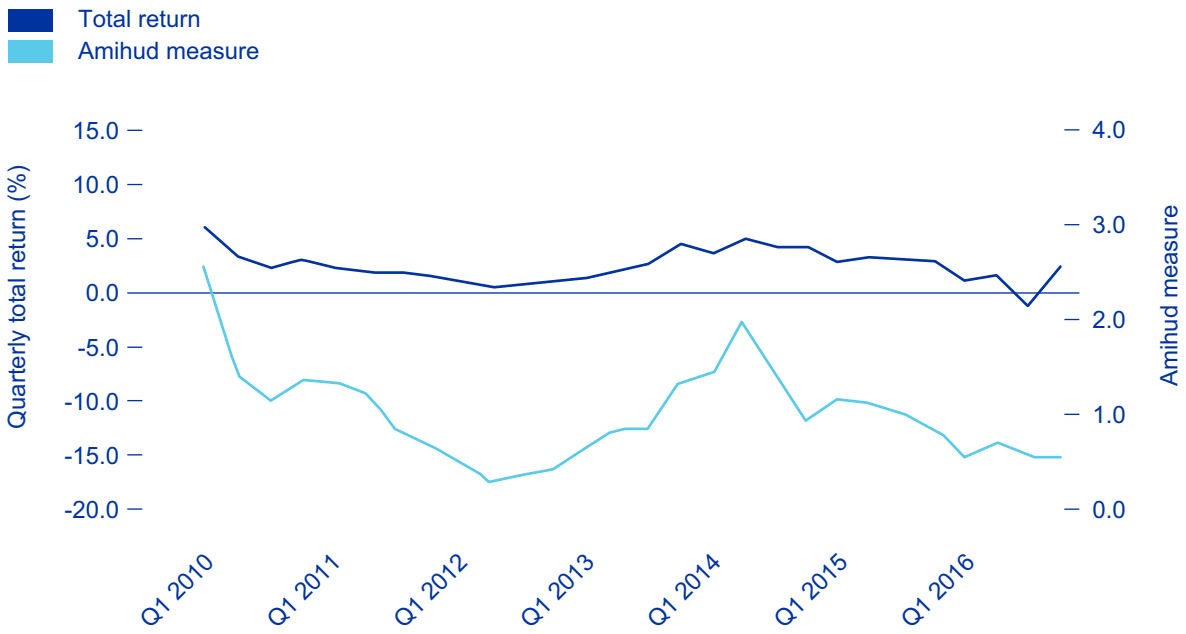
Source: Bloomberg (quarterly frequency from 2010 to 2016)

19 In line with the findings of Schweizer et al. (2013).
20 Similar to the results of Oikarinen et al. (2011) for REITs and direct real estate.

Correlations between illiquidity measures

This research also investigated cross-correlations between illiquidity measures within and across asset types. The correlations for funds are shown in two different ways. Firstly, the correlation for each individual fund was computed and the average correlation for each investment type was reported. Then two equal-weighted portfolios, one consisting of non-listed funds and the other of listed funds were constructed. Correlations were then calculated at the portfolio level.

Figure 8: Direct real estate returns and Amihud illiquidity measure



Source: MSCI / IPD (quarterly frequency from 2010 to 2016)

For non-listed real estate, the percentage turnover is negatively correlated with the Amihud measure for both measurement types. The premiums, however, show a positive correlation with the Amihud measure, meaning that higher premiums on average correspond to more illiquidity for the equal-weighted portfolio. For individual non-listed real estate funds, no significant correlation between the Amihud measure and the discount or premium was observed.

For the individual listed REITs, the Amihud measure is negatively correlated with the percentage turnover, while there is no significant correlation for the equal-weighted portfolio. The Amihud measure of listed REITs is positively correlated with the percentage bid-ask spread for both measurement types. For direct real estate, the Amihud measure shows a small positive correlation with the percentage turnover.

Based on these results, the Amihud measure seems to be a good proxy for illiquidity, in particular for listed REITs. The Amihud measure moves together with the other illiquidity measures, notably the bid-ask spread.[21] The fact that the Amihud measure does correlate with the bid-ask spread supports the notion that the Amihud measure can be used as a proxy for measuring illiquidity.

21 The finding that the percentage turnover does not show a strong connection with the Amihud measure is in line with Lesmond (2005), who concludes for emerging market equities that the percentage turnover is not significantly associated with the bid-ask spread and hence the Amihud measure. Similarly, Avramov et al. (2006) conclude for US equities that turnover is only weakly correlated with the Amihud measure. Based on the correlation with the bid-ask spread for REITs and these findings from the literature, the Amihud measure over the percentage turnover as a measure of illiquidity is preferred.

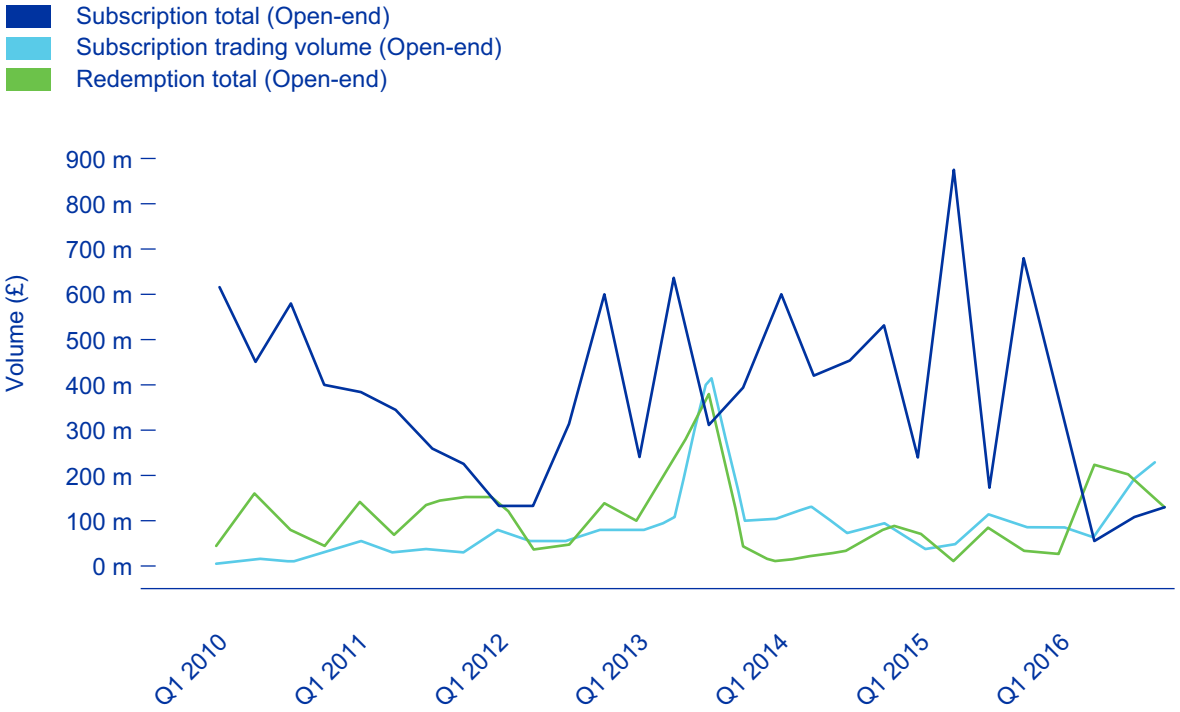
Primary and secondary market liquidity

Next, both primary and secondary market liquidity were assessed. For open end non-listed real estate funds, primary market liquidity through subscriptions and redemptions is measured, while for closed end funds, it is measured through capital calls and distributions.

For the open end funds, the secondary trading volume was correlated with redemptions (correlation coefficient of 0.59), while the Amihud measure was correlated with subscriptions (correlation coefficient of 0.39). For closed end non-listed real estate funds there are no strong correlations. This may indicate that for open end funds primary and secondary market liquidity are to a certain extent substitutes, while this does not hold for closed end funds. This is in line with the fact that closed end fund capital calls and distributions occur at the discretion of the fund manager rather than the investor.

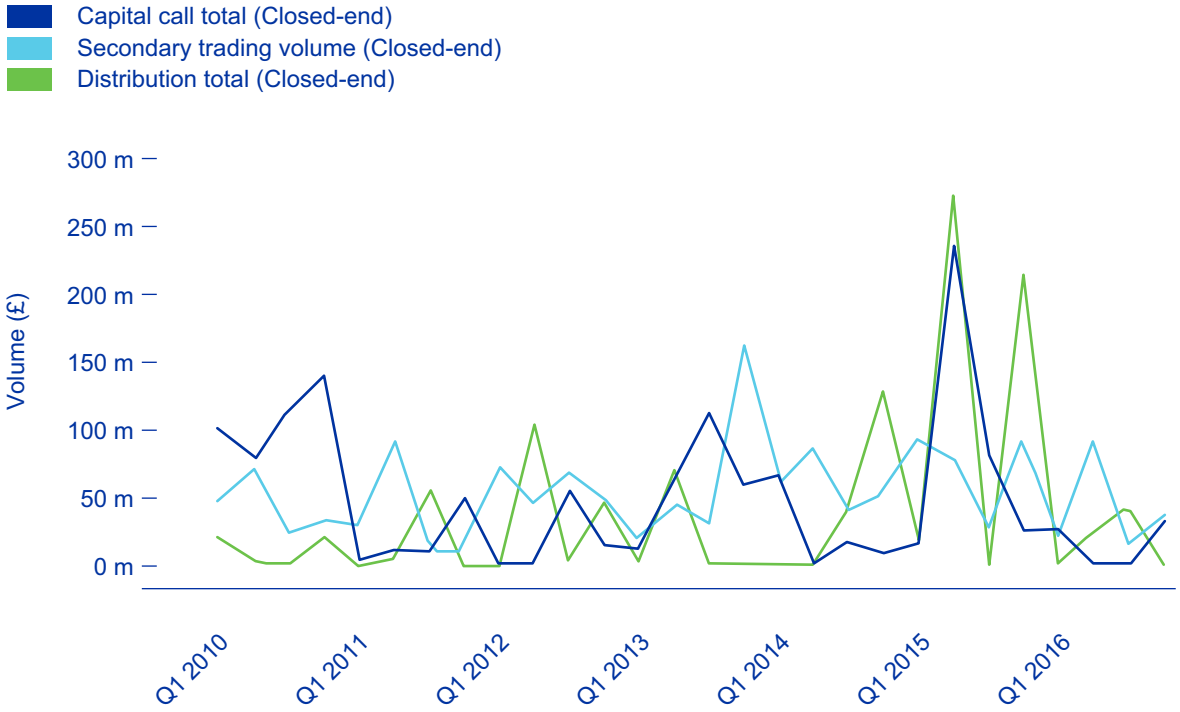
‘The Amihud measure correlates with the bid-ask spread, supporting the notion that this is a suitable measure for illiquidity’

Figure 9: Primary and secondary market liquidity for open end non-listed real estate funds



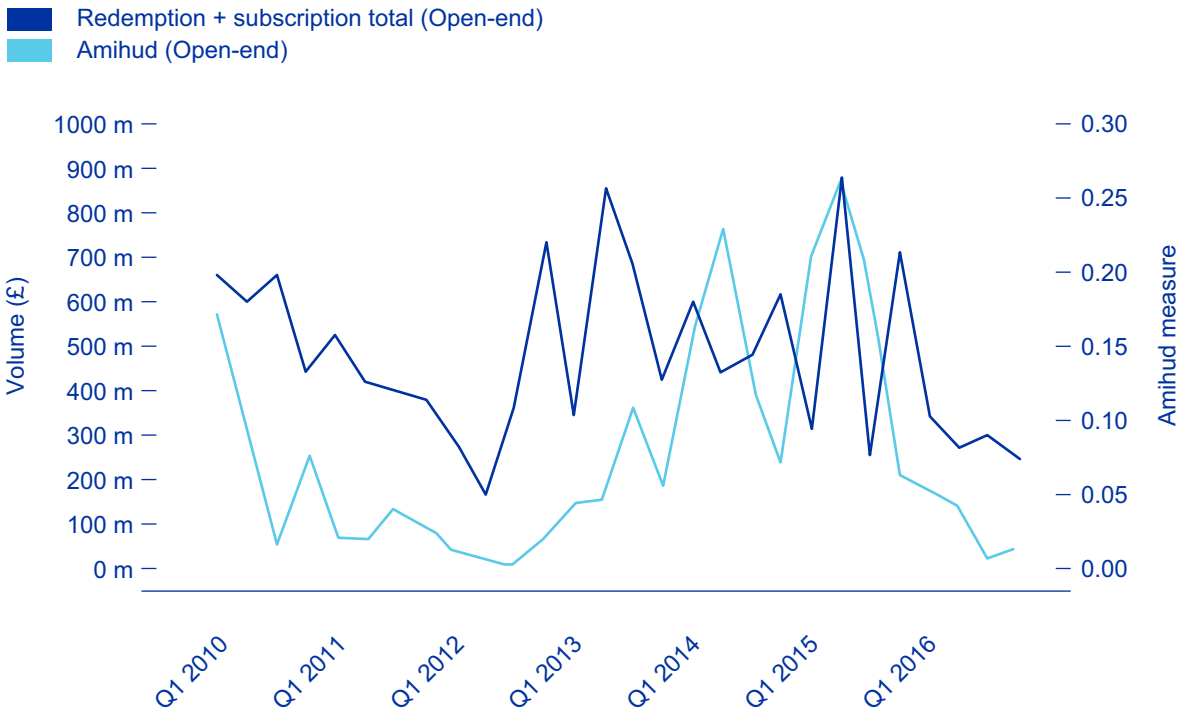
Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), of which 45% is open end and 55% is closed end

Figure 10: Primary and secondary market liquidity for closed end non-listed real estate funds



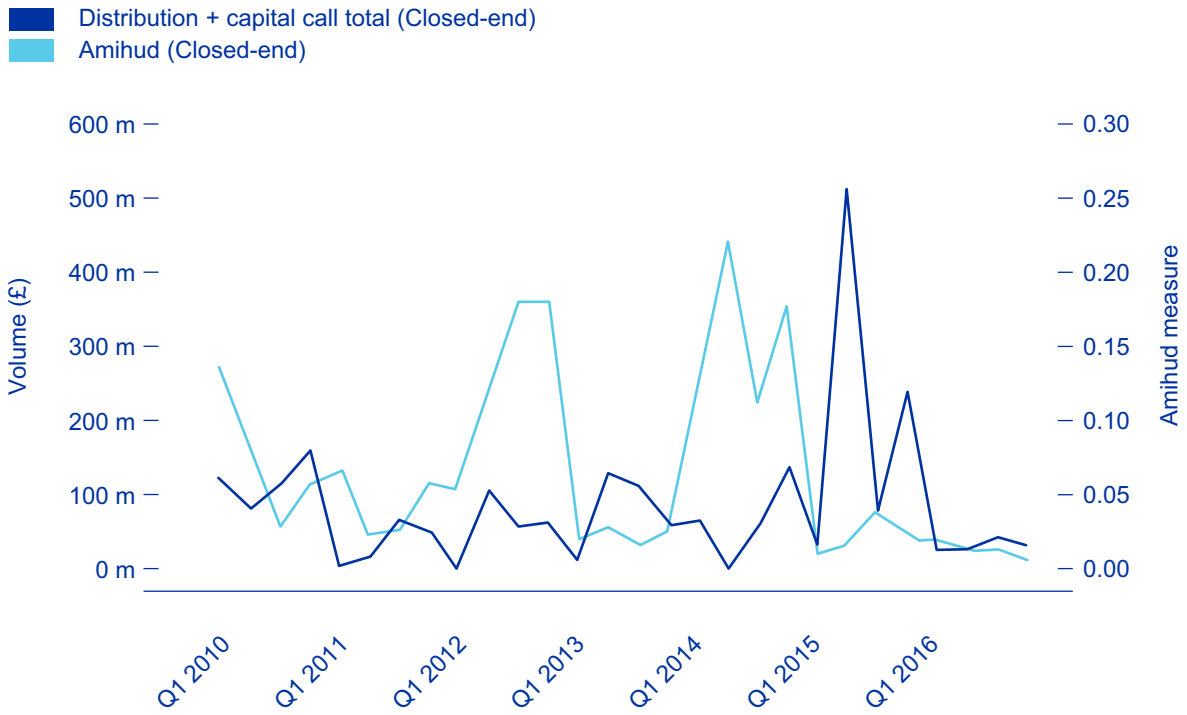
Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), of which 45% is open end and 55% is closed end

Figure 11: Primary and secondary market liquidity for open end non-listed real estate funds



Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), of which 45% is open end and 55% is closed end

Figure 12: Primary and secondary market liquidity for closed end non-listed real estate funds



Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), of which 45% is open end and 55% is closed end

6. Pricing of illiquidity

The results from the Fama-MacBeth estimation suggest that illiquidity is priced for non-listed real estate funds. The results indicate that the average quarterly illiquidity premium is around 21 bps, relative to an average return of 2.4% per quarter for funds in the regression sample. This means that 21 bps per quarter are available as compensation for the sample of 33 funds that deliver an average return of 2.4% per quarter. In other words, if these funds were perfectly liquid then the average expected return would be 2.2% per quarter, instead of 2.4%.

This corresponds to an annualised illiquidity premium for non-listed real estate funds of 84 bps for an annualised return of 9.6%. This 84 bps illiquidity premium is an average for the 33 funds in the sample. The illiquidity premium for a specific fund may differ since it could have a different illiquidity exposure (value of the Amihud measure).

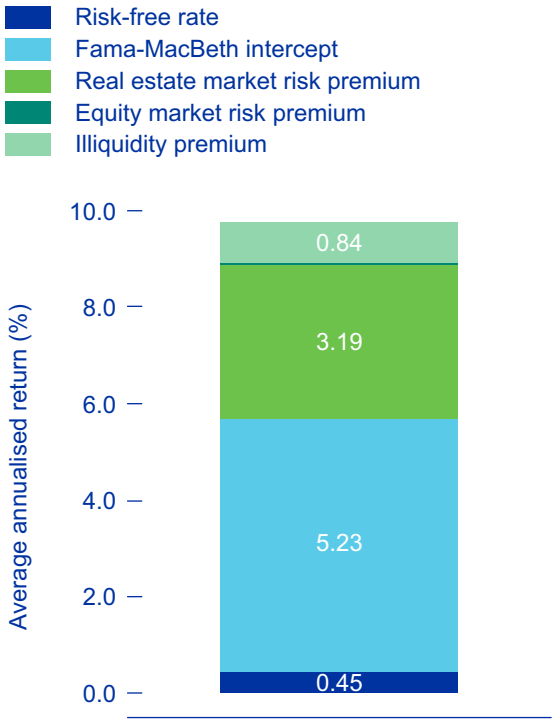
Looking at the composition of the average non-listed real estate fund return, it is seen that real estate market exposure commands the largest premium of 3.19% per annum, followed by illiquidity, with a premium of 84 bps per annum. The Fama-MacBeth intercept represents the part of the average risk premium that cannot be explained by the risk drivers included in the model.[22]

For REITs, there is no evidence that the level of illiquidity is priced in. The absence of an illiquidity premium is in line with the fact that listed REITs are normally more liquid than their non-listed peers. However, this does not necessarily imply that REITs are less risky. As noted earlier, although return levels are comparable between REITs and non-listed funds, the volatility REITs exhibit is three times greater than the volatility of non-listed real estate.

> ‘A risk premium for the illiquidity of non-listed real estate funds exists’

To check the validity of the Amihud measure as a proxy for illiquidity, a Fama-MacBeth regression was run for listed REITs using the bid-ask spread as an illiquidity measure. The results of this specification correspond to the REIT regression results based on the Amihud measure as a proxy for illiquidity. This is an indication that the Fama-MacBeth results are not sensitive to our choice of illiquidity measure.

Figure 13: Risk premium composition for the sample of 33 UK non-listed real estate funds



Source: Fama-MacBeth regression based on INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016). The Fama-MacBeth intercept represents the part of the average risk premium that cannot be explained by the risk drivers that have been included in the model. Figures have been annualised.

22 This intercept should be interpreted with caution. A parsimonious specification was used due to data limitations and therefore additional risk drivers may remain. This means that the constant may not necessarily represent fund alpha and may instead absorb these additional risk premiums

7. Concluding remarks and future research

This research has provided some interesting insights into the real estate illiquidity premium. In particular, it found that:

- The returns and illiquidity of non-listed real estate funds and direct real estate behave similarly over time
- Investors are compensated by 84 bps per annum for the illiquidity of non-listed real estate funds
- The Amihud measure of illiquidity is a suitable proxy for illiquidity in the context of this study

The real estate illiquidity premium has long been an area of interest among market participants. This study set out to explore the illiquidity premium across three main routes of real estate investment, non-listed real estate funds, listed REITs and direct real estate, and to investigate whether the illiquidity premium of non-listed real estate varies over time. The research focused on the UK market, where data was more readily available across these three streams.

> 'The returns and illiquidity of non-listed real estate funds and direct real estate behave similarly over time '

The findings from the research indicate that the returns and illiquidity of non-listed real estate funds and direct real estate behave similarly over time. In contrast, the returns and illiquidity for listed REITs behave differently from the other two categories. The substantial difference between the time-variation in returns and illiquidity of non-listed funds versus listed REITs suggests that there is potential for diversification.

For non-listed real estate funds, an average annualised illiquidity premium of 84 bps was observed for the sample of 33 UK funds, which delivered an annualised return of 9.6%. In other words, this means that investors are compensated for the illiquidity of non-listed real estate funds by an extra 84 bps on average.

The 84 bps illiquidity premium is an average observed across the funds in the sample. For individual funds, the total risk premium as well as the illiquidity premium would vary, due to differing exposures to equity and real estate market risks, as well as different individual levels of illiquidity. For REITs, the research found no significant illiquidity premium.

This research analysis was based mainly on secondary trading data. It is worth noting that for open end funds primary trading may also provide liquidity. Primary trading, however, may be subject to redemption suspensions, as for example occurred following the Brexit vote. More generally, redemption suspensions may for instance occur when fund managers are facing many redemption requests and want to avoid having to sell real estate too quickly or under adverse market conditions.

This could be an area for further research.

As the sample of data improves, this research topic could expand in several directions.

> 'The illiquidity premium for non-listed real estate funds was 84 basis points per annum for the sample in this study'

A further exploration of the time-variation of illiquidity is one possible area, which would be of relevance to opportunistic investors, for whom timing is of importance.

Future research might also consider the relationship between gearing and illiquidity, which could help in understanding the links between return, risk and illiquidity. It could also investigate the role of the illiquidity premium for non-listed real estate funds as part of the real estate portfolio, and in particular how portfolios might be structured to take advantage of this premium.

Appendices

Appendix 1: Summary statistics

Table 3: Illiquidity statistics for non-listed funds, listed REITs and direct real estate

Quarterly illiquidity statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Illiquidity (Amihud)										
INREV non-listed real estate	0.17	0.45	0.71	1.00	1.36	3.64	0.75	1.77	4.44	28
REIT listed real estate	0.10	0.58	1.04	1.00	1.39	1.93	0.55	-0.17	-1.02	28
MSCI / IPD direct real estate	0.29	0.62	0.88	1.00	1.32	2.53	0.50	1.12	1.90	28
Illiquidity (Percentage turnover)										
INREV non-listed real estate (secondary)	0.2%	0.4%	0.5%	0.6%	0.7%	1.7%	0.4%	1.66	2.22	28
INREV non-listed real estate (all activity)	1.1%	1.8%	2.3%	2.6%	3.1%	4.8%	1.0%	0.83	-0.30	28
REIT listed real estate	7.6%	9.6%	10.6%	10.7%	12.1%	13.3%	1.6%	-0.06	-0.98	28
MSCI / IPD direct real estate	2.8%	3.6%	4.1%	4.3%	4.8%	6.9%	1.1%	0.75	0.12	28
Illiquidity (Premium or discount)										
INREV non-listed real estate	-8.9%	-2.7%	-0.5%	-1.3%	1.1%	4.8%	3.3%	-0.64	0.05	28
Illiquidity (Percentage bid-ask spread)										
REIT listed real estate	1.0%	1.9%	2.3%	2.2%	2.6%	3.6%	0.7%	-0.19	-0.60	28

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds per quarter and then computing the statistics on the resulting time series. Levels of the Amihud measure have been scaled by dividing by their means for comparability purposes.

Table 4: Summary statistics for non-listed funds and listed REITs

Fund descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Funds
Gearing										
INREV non-listed real estate	0.0%	0.0%	8.7%	16.0%	29.3%	59.0%	18.6%	0.88	-0.37	33
REIT listed real estate	17.2%	29.0%	37.1%	37.8%	47.8%	64.9%	13.1%	0.54	-0.56	44
Real estate market beta										
INREV non-listed real estate	-1.30	0.79	1.06	1.17	1.24	6.39	1.29	2.08	8.24	33
REIT listed real estate	-2.03	-0.03	0.58	0.74	1.22	6.94	1.49	1.55	5.38	50
Equity market beta										
INREV non-listed real estate	-0.62	-0.03	-0.01	-0.02	0.03	0.13	0.13	-3.25	14.28	33
REIT listed real estate	-4.57	0.18	0.51	0.43	0.73	2.06	0.88	-3.59	21.27	50

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds are based on the averages for each fund over time. Levels of the Amihud measure have been scaled by dividing by their means for comparability purposes. Financial leverage (gearing) is defined as total debt divided by total assets. For listed real estate, the cross-sectional statistics on gearing at the end of the sample period is reported due to data availability reasons. The real estate and equity market betas are simultaneously estimated using direct real estate and equity returns.

Appendix 2: Correlation analysis

Table 5: Correlations between returns and illiquidity measures for non-listed funds, listed REITs and direct real estate

Quarterly correlations	INREV non-listed real estate	REIT listed real estate	MSCI / IPD direct real estate
Total returns			
REIT listed real estate	0.08		
MSCI / IPD direct real estate	0.96***	0.10	
Illiquidity (Amihud)			
REIT listed real estate	-0.10		
MSCI / IPD direct real estate	0.71***	-0.08	
Illiquidity (Percentage turnover)			
REIT listed real estate	0.12		
MSCI / IPD direct real estate	0.17	-0.24	
Total returns x Illiquidity (Amihud)			
INREV non-listed real estate	0.67***		
REIT listed real estate		-0.36*	
MSCI / IPD direct real estate			0.84***
Total returns x Illiquidity (Percentage turnover)			
INREV non-listed real estate	-0.20		
REIT listed real estate		-0.30	
MSCI / IPD direct real estate			0.60***

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds, and then computing the statistics on the resulting time series. * indicates significance at the 10% level, ** significance at the 5% level, and *** significance at the 1% level

Table 6: Lagged correlations between returns and illiquidity measures for non-listed funds and direct real estate with lags of REIT listed real estate

Quarterly correlations	INREV non-listed real estate	MSCI / IPD direct real estate
Total returns		
REIT listed real estate t	0.08	0.10
REIT listed real estate t-1	0.37*	0.42**
REIT listed real estate t-2	0.39*	0.45**
Illiquidity (Amihud)		
REIT listed real estate t	-0.10	-0.08
REIT listed real estate t-1	-0.46**	-0.11
REIT listed real estate t-2	-0.55***	-0.16
Illiquidity (Percentage turnover)		
REIT listed real estate t	0.12	-0.24
REIT listed real estate t-1	0.59***	0.14
REIT listed real estate t-2	0.21	0.25

Source: INREV Quarterly Index sample of the 33 matched funds (quarterly frequency from 2010 to 2016), Bloomberg, MSCI / IPD, authors' calculations. The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds, and then computing the statistics on the resulting time series. * indicates significance at the 10% level, ** significance at the 5% level, and *** significance at the 1% level

Table 7: Correlations between illiquidity measures for non-listed funds, listed REITs and direct real estate

Quarterly correlation with Amihud measure	INREV non-listed real estate	REIT listed real estate	MSCI / IPD direct real estate
Percentage turnover			
Equal-weighted portfolio	-0.34*	0.04	0.21
Average of within-fund correlations	-0.54***	-0.31**	
Premium or discount			
Equal-weighted portfolio	0.41**		
Average of within-fund correlations	0.07		
Percentage bid-ask spread			
Equal-weighted portfolio		0.61***	
Average of within-fund correlations		0.28*	

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds, and then computing the statistics on the resulting time series. * indicates significance at the 10% level, ** significance at the 5% level, and *** significance at the 1% level

Appendix 3: Fama-MacBeth estimation results

Table 8: Fama-MacBeth results for non-listed funds and listed REITs

	Constant	Real Estate Market	Equity Market	Illiquidity
INREV non-listed real estate				
Coefficient	0.02***			0.64***
T-value	4.61			2.60
Average quarterly premium	1.97%			0.35%
Partial R-squared	0%			24%
Number of funds (average)	12			
Number of periods	28			
Average cross-sectional R-squared	0.26			
INREV non-listed real estate				
Coefficient	0.01***	0.01	0.00	0.52**
T-value	4.12	1.19	-0.06	1.96
Average quarterly premium	1.31%	0.80%	0.01%	0.21%
Partial R-squared	0%	29%	9%	18%
Number of funds (average)	12			
Number of periods	28			
Average cross-sectional R-squared	0.51			

	Constant	Real Estate Market	Equity Market	Illiquidity
REIT listed real estate				
Coefficient	0.03**			-0.10*
T-value	2.34			-1.89
Average quarterly premium	2.64%			-0.27%
Partial R-squared	0%			16%
Number of funds (average)	36			
Number of periods	28			
Average cross-sectional R-squared	0.16			
REIT listed real estate				
Coefficient	0.03***	0.00	0.01	-0.09
T-value	3.72	-1.03	0.44	-1.33
Average quarterly premium	2.62%	-0.39%	0.30%	-0.16%
Partial R-squared	0%	11%	14%	16%
Number of funds (average)	36			
Number of periods	28			
Average cross-sectional R-squared	0.34			

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The real estate data beta is estimated using the direct real estate returns. Significance based on OLS standard errors is being reported. In addition Shanken (1992) adjusted standard errors to adjust for exposure measurement error was considered. Since the Shanken (1992) adjustment is an asymptotic result and considering sample limitations, OLS standard errors were nonetheless employed. * indicates significance at the 10% level, ** significance at the 5% level, and *** significance at the 1% level

Table 9: Fama-MacBeth results for listed REITs with the bid-ask spread as illiquidity measure

	Constant	Real Estate Market	Equity Market	Illiquidity
REIT listed real estate (using percentage bid-ask spread)				
Coefficient	0.03***			-0.38**
T-value	2.69			-2.34
Average quarterly premium	3.23%			-0.86%
Partial R-squared	0%			19%
Number of funds (average)	30			
Number of periods	28			
Average cross-sectional R-squared	0.18			
REIT listed real estate (using percentage bid-ask spread)				
Coefficient	0.03***	0.00	0.01	-0.25
T-value	3.34	-0.41	0.42	-1.59
Average quarterly premium	3.01%	-0.25%	0.22%	-0.60%
Partial R-squared	0%	12%	12%	20%
Number of funds (average)	30			
Number of periods	28			
Average cross-sectional R-squared	0.36			

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The real estate data beta is estimated using the direct real estate returns. Significance based on OLS standard errors is being reported. In addition Shanken (1992) adjusted standard errors to adjust for exposure measurement error was considered. Since the Shanken (1992) adjustment is an asymptotic result and considering sample limitations, OLS standard errors were nonetheless employed. * indicates significance at the 10% level, ** significance at the 5% level, and *** significance at the 1% level

Appendix 4: Drivers of illiquidity

The drivers of illiquidity for non-listed real estate funds, listed REITs and direct real estate were investigated using the approach of Chordia et al. (2001). The risk-free rate was included as a short-term interest rate to proxy for margin requirements, the term spread to measure the relative attractiveness of the bond market and the default spread to proxy for inventory risk. This leads to the regression for a given illiquidity measure $L_{i,t}$ for fund i:

$$\Delta L_{i,t} = \beta_0 + \beta_1 \Delta \mathrm{DEF}_t + \beta_2 \mathrm{MKTDOWN}_t + \beta_3 r_t^{m,EQ} + \beta_4 r_t^{m,RE} + \beta_5 \Delta r_t^f + \beta_6 \Delta \mathrm{TS}_t + \varepsilon_{i,t},$$

where $\Delta \mathrm{DEF}_t$ represents the change in the default spread, $\mathrm{MKTDOWN}$ the market return when it is negative and zero otherwise, $r_t^{m,EQ}$ denotes the equity market return, $r_t^{m,RE}$ the direct real estate market return Δr_t^f the change in the risk-free rate and $\Delta \mathrm{TS}_t$ the change in the term spread.

The market return should be negatively associated with liquidity, especially when declines occur, which for instance lead to increased future volatility.[23] As short rates reflect the cost of margin trading, the risk-free rate should be positively associated with overall illiquidity.

The results show that based on the sample of non-listed real estate investment funds it is difficult to draw conclusions regarding the drivers of illiquidity, although there seems to be some impact of negative equity market returns on the illiquidity of non-listed real estate funds.

23 Brunnermeier and Pedersen (2009), Comerton-Forde et al. (2010), and Kyle and Xiong (2001).

Table 10: Drivers of illiquidity for non-listed funds

	Constant	Default spread	Equity market return	Equity market return (neg)	Real estate market return	Risk-free rate	Term spread
INREV non-listed real estate							
Coefficient	0.00	0.17	-0.52	0.88**	0.02	-0.17	-0.02
T-value	0.02	0.64	-1.37	2.16	0.05	-0.67	-0.11
Number of observations	27						
Adjusted R-squared	-0.01						
REIT listed real estate							
Coefficient	-0.02	0.09	-0.45	0.30	-0.20	0.20	0.09
T-value	-0.10	0.31	-1.12	0.68	-0.62	0.71	0.38
Number of observations	27						
Adjusted R-squared	-0.17						
MSCI / IPD direct real estate							
Coefficient	0.02	-0.17	0.23	0.24	0.13	0.02	0.19
T-value	0.12	-0.75	0.71	0.68	0.49	0.09	0.98
Number of observations	27						
Adjusted R-squared	0.24						

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The real estate data beta is estimated using the direct real estate returns. * indicates significance at the 10% level, ** significance at the 5% level, and *** significance at the 1% level

Appendix 5: Sample selection sensitivity

This appendix examines biases resulting from funds and sample period selection.

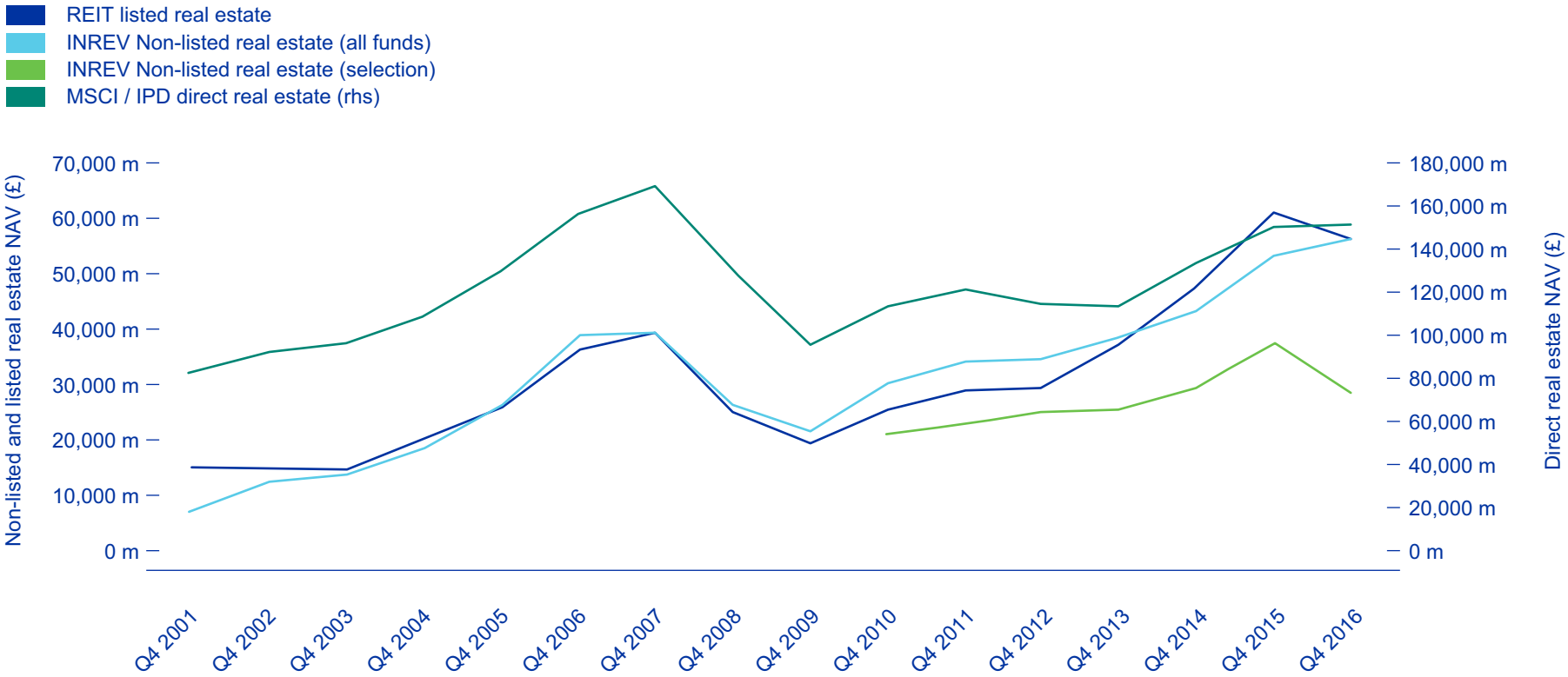
Sensitivity to fund selection

The INREV database contains 92 non-listed real estate UK funds for the period from 2001 to 2016. Over the period from 2010 to 2016 a sample of 33 funds, out of 86, was matched with transaction data from PropertyMatch.

The return characteristics of selected funds are comparable to those of all 86 funds. The correlation between quarterly returns is 0.94. The average quarterly return of selected funds (2.1%) is slightly higher than the return of all funds (1.8%). At the same time, the volatility of this group of funds (1.7%) is lower than the volatility of the overall sample (2.0%).

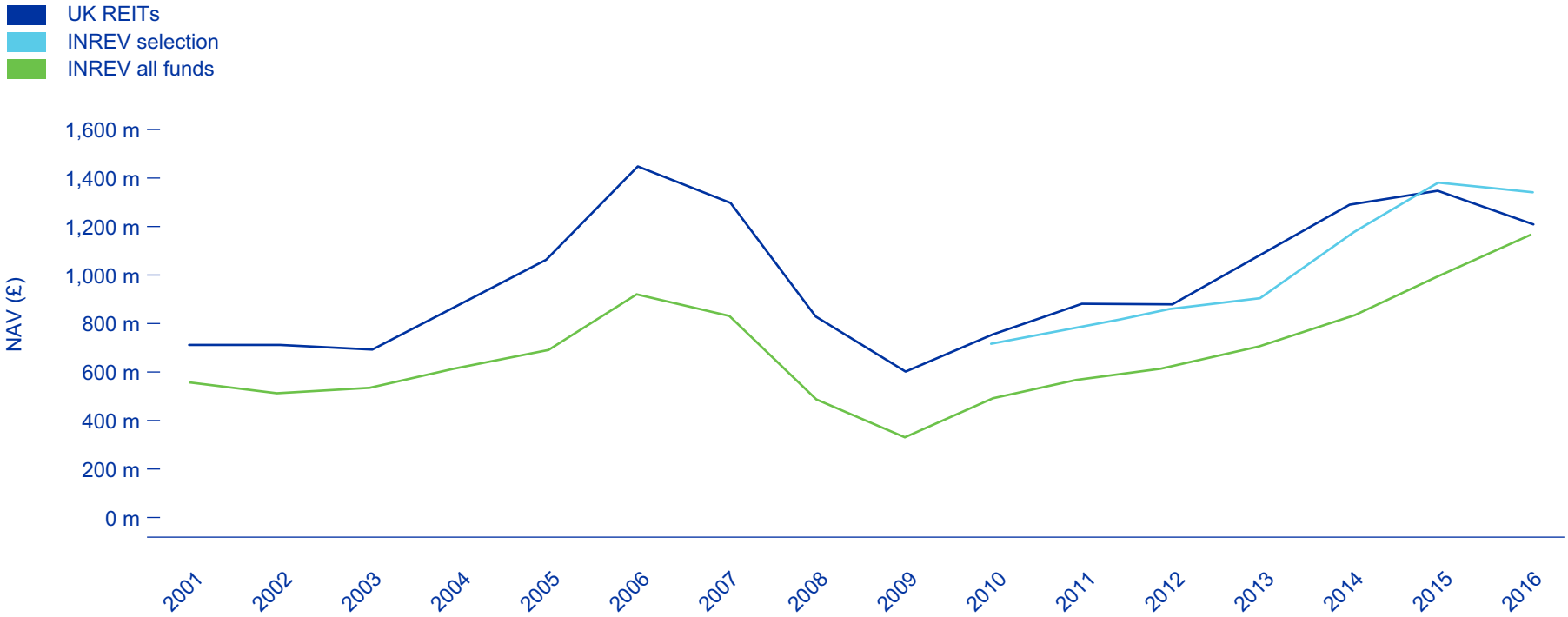
In terms of NAV, the selected group of funds covers 50% to 70% of the total for all UK funds in the sample. On average, the size of selected funds is approximately 1.5 times greater than the average NAV of individual UK funds in the universe.

Figure 14: Total NAV for all investment types



Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD (annual frequency from 2001 to 2016).

Figure 15: Average NAV per fund



Source: INREV Quarterly Index sample of the 33 matched funds (INREV selection), INREV Annual Index sample (INREV all funds), Bloomberg (annual frequency from 2001 to 2016).

Table 11 provides descriptive statistics for open end and closed end non-listed funds separately. Of all 86 funds, 50% are open end and 50% are closed end, while our sample is made up of 45% open end funds and 55% closed end funds. The sector distribution of the funds in the selection is comparable to the sector distribution of all funds.

For the non-listed real estate funds, the open end funds have more variable Amihud measures than closed end funds. Also, the correlation between the Amihud measure of open end and closed end funds is low (0.25). So, although the return characteristics are similar, illiquidity differs between open end and closed end funds.

To summarise, the selection of non-listed real estate funds gives a good representation of the universe of non-listed funds.

Table 11: Summary statistics for INREV open end and closed end non-listed funds

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Total returns										
Non-listed open-end funds	-0.6%	1.4%	2.1%	2.3%	3.3%	6.0%	1.5%	0.28	0.40	28
Non-listed closed-end funds	-2.0%	0.4%	1.8%	1.9%	3.1%	7.5%	2.0%	0.52	0.94	28
Illiquidity (Amihud)										
Non-listed open-end funds	0.05	0.26	0.42	1.00	1.06	10.33	1.93	4.51	22.14	28
Non-listed closed-end funds	0.18	0.38	0.74	1.00	1.37	2.44	0.76	0.78	-0.81	28
Illiquidity (Percentage turnover)										
Non-listed open-end funds	0.3%	0.6%	0.9%	1.2%	1.4%	4.6%	1.0%	2.37	5.85	28
Non-listed closed-end funds	0.4%	0.9%	1.1%	1.7%	1.8%	11.2%	2.0%	4.30	20.73	28
Illiquidity (Premium or discount)										
Non-listed open-end funds	-2.7%	-0.5%	0.7%	0.7%	1.8%	7.8%	2.1%	1.07	3.51	28
Non-listed closed-end funds	-15.7%	-6.4%	-2.1%	-3.3%	0.2%	4.3%	5.1%	-0.75	-0.08	28
Total market capitalisation (Millions of GBP)										
Non-listed open-end funds	10,585	13,675	16,050	17,814	21,393	27,069	4,961	0.59	-0.83	28
Non-listed closed-end funds	7,072	9,191	9,628	9,876	10,491	12,954	1,326	0.60	0.64	28

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Average market capitalisation per fund (Millions of GBP)										
Non-listed open-end funds	814	1,052	1,234	1,383	1,713	2,082	396	0.44	-1.18	28
Non-listed closed-end funds	522	601	616	689	804	925	125	0.67	-1.04	28
Number of funds										
Non-listed open-end funds	12.00	13.00	13.00	12.93	13.00	14.00	0.54	-0.08	0.83	28
Non-listed closed-end funds	9.00	14.00	15.00	14.57	16.00	16.00	1.91	-1.69	2.36	28
	Min	**1Q**	**Median**	**Mean**	**3Q**	**Max**	**St. dev.**	**Skew.**	**Kurt.**	**Funds**
Gearing										
Non-listed open-end funds	0.0%	0.0%	0.0%	8.5%	6.1%	59.0%	16.8%	2.38	5.65	15
Non-listed closed-end funds	0.0%	2.8%	24.5%	22.3%	32.9%	54.1%	18.1%	0.21	-0.94	18
Real estate market beta										
Non-listed open-end funds	-0.12	0.38	0.50	0.60	0.63	2.75	0.65	2.86	9.99	15
Non-listed closed-end funds	-1.00	0.36	0.66	0.92	0.84	7.71	1.81	3.36	13.12	18
Equity market beta										
Non-listed open-end funds	-0.18	-0.07	-0.05	-0.05	-0.01	0.10	0.06	0.17	2.02	15
Non-listed closed-end funds	-0.49	-0.08	-0.02	-0.05	0.01	0.15	0.13	-2.12	6.60	18

Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds, and then computing the statistics on the resulting time series. Levels of the Amihud measure have been scaled by dividing by their means for comparability purposes

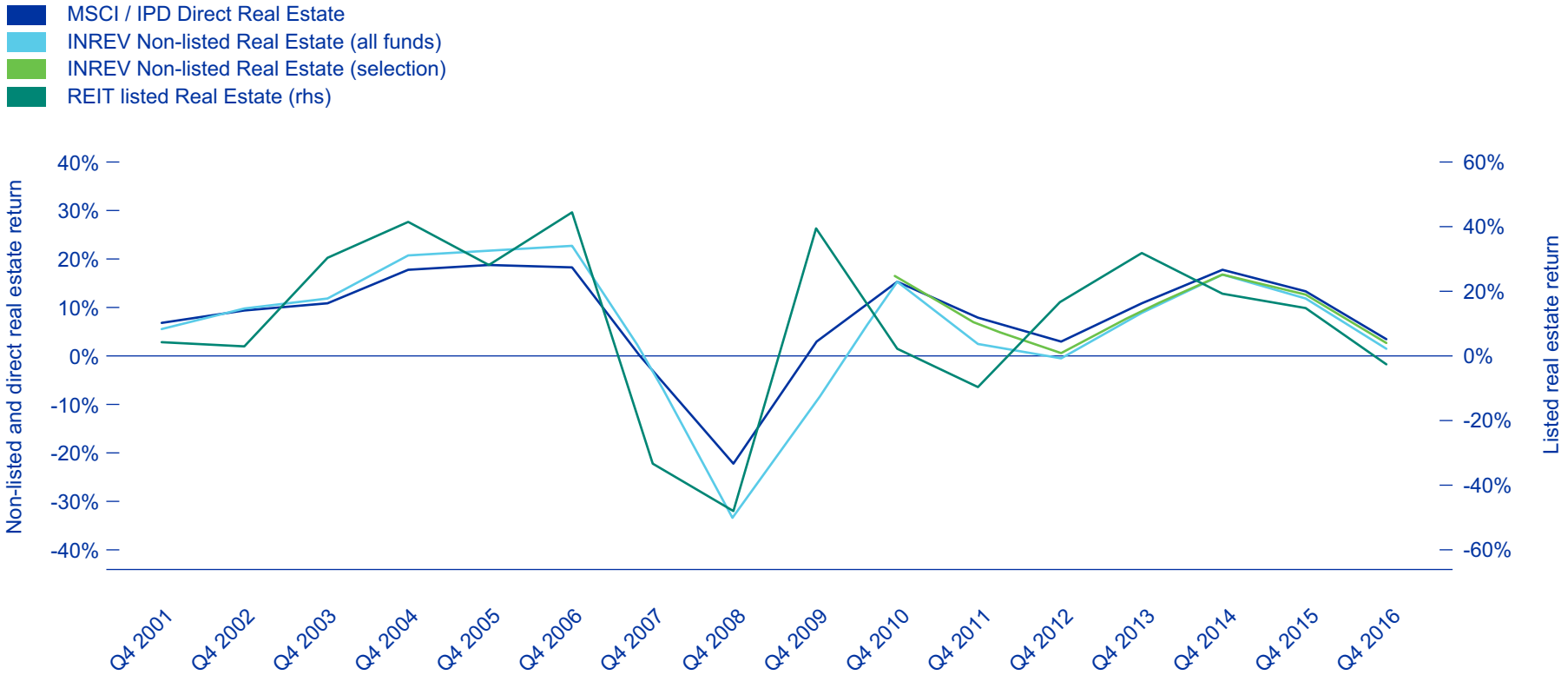
Sensitivity to sample period selection

The quarterly return and illiquidity statistics for non-listed real estate and listed REITs are compared over the sample period from 2010 to 2016. In this section, annual statistics are provided over a longer sample period, from 2001 until 2016.

The annual return on non-listed real estate, as well as direct real estate, is lower for the longer time period than the shorter period. However, the annual return on listed REITs is higher for the longer period. This contrasts with the results for the sample period from 2010 to 2016, when listed REITs provide only slightly higher returns than non-listed and direct real estate, although the ordering remains the same. Nonetheless, the ratio between annual returns on non-listed real estate and direct real estate remains similar.

For both REITs and non-listed real estate, volatility is about twice as high over the longer period. This higher volatility can partly be

Figure 16: Annual total returns for all investment types

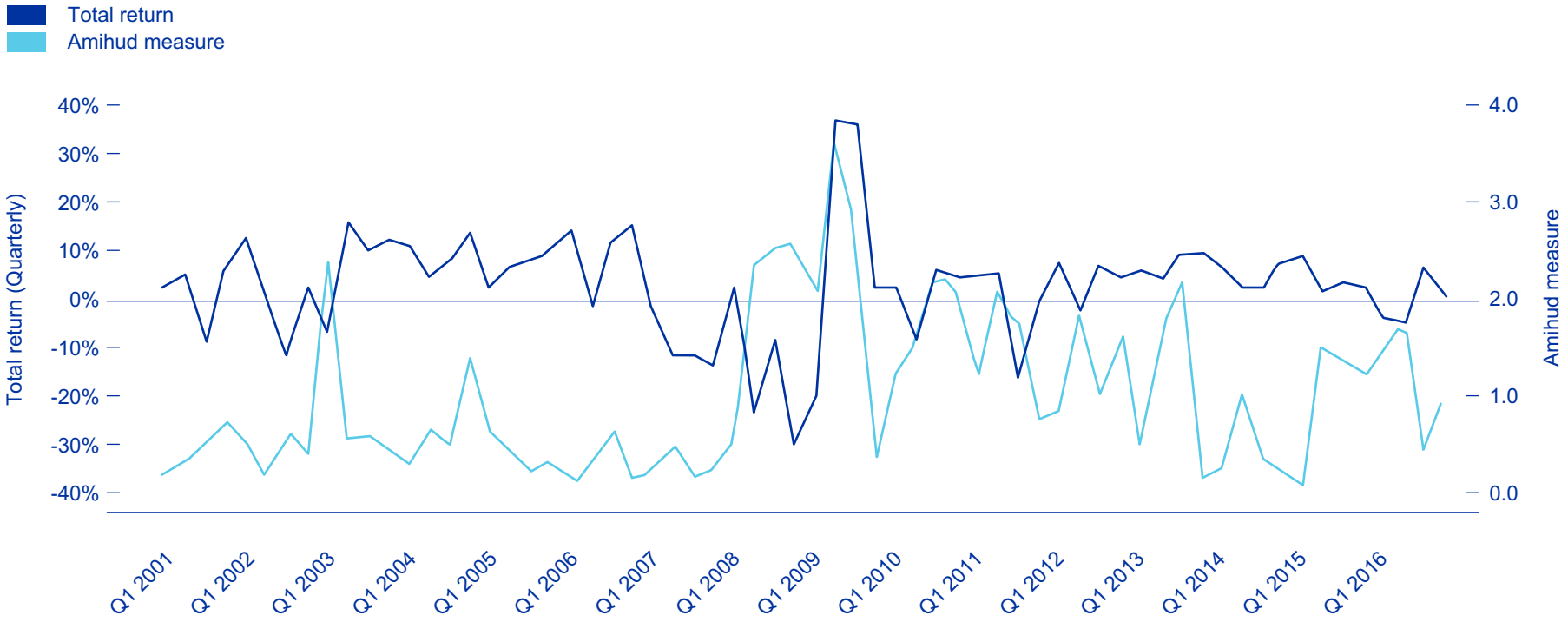


Source: INREV Quarterly Index sample of the 33 matched funds, Bloomberg, MSCI / IPD (annual frequency from 2001 to 2016).

attributed to the financial crisis of 2009, which is not included in the selected sample period. Also, for direct real estate, volatility is higher for the longer period. The ratio of volatility between the different types of investment is similar for the long and short period.

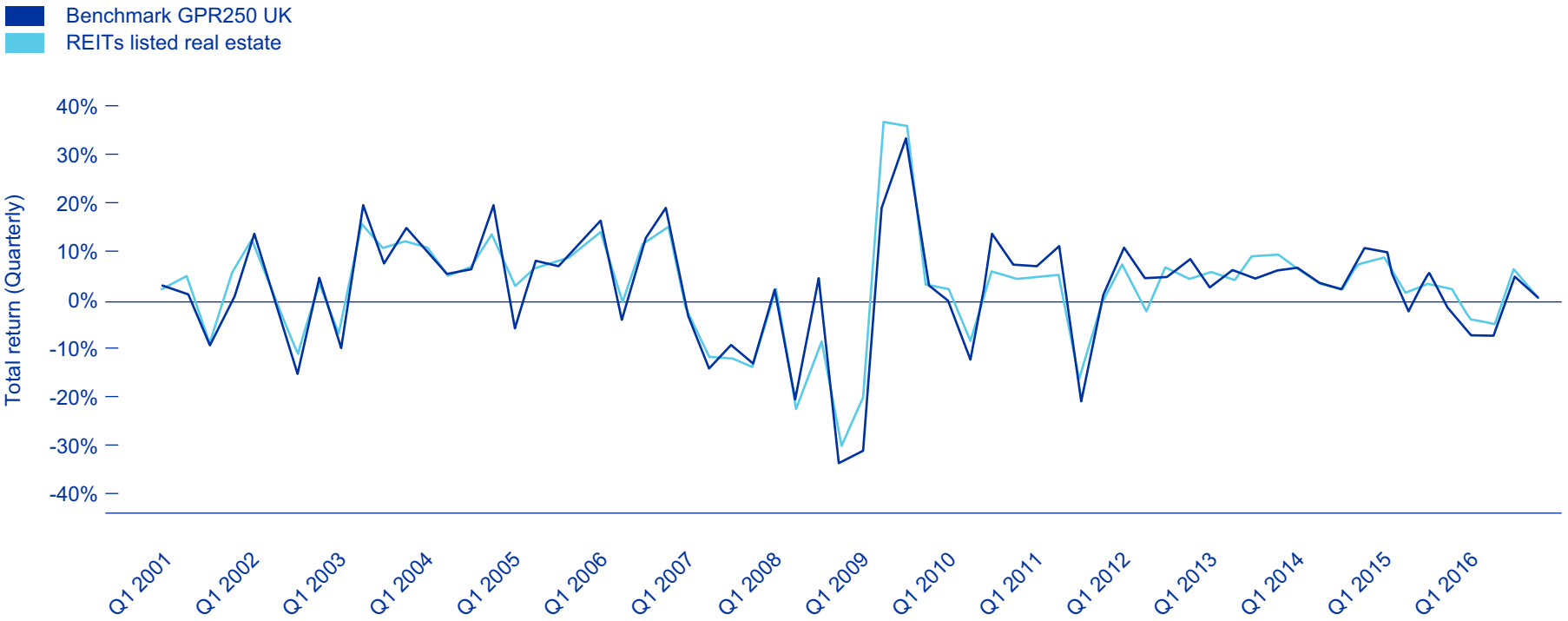
For the listed real estate investment type, 50 REITs were selected. The average return of the REIT sample was compared to a listed real estate benchmark (GPR UK) over a longer period. The returns are similar to the benchmark – they are highly correlated (0.93) on a quarterly basis. The volatility of total returns of REITs in the sample (12%) is comparable to the listed real estate benchmark (11%). Therefore, it is possible to conclude that REIT sample is representative of the listed real estate universe.

Figure 17: UK REIT listed real estate fund returns and Amihud illiquidity measure over time



Source: Bloomberg, authors' calculations (annual frequency, extended sample from 2001 to 2016)
Note: higher Amihud measure value means less liquidity. Levels of the Amihud measure have been scaled by dividing by their means.

Figure 18: Total returns of listed real estate



Source: Bloomberg (quarterly frequency, extended sample from 2001 to 2016)

Sensitivity to region selection

UK funds were the focus for this study, due to the availability of secondary market transaction data on which the main illiquidity measure was based. In this section, descriptive statistics for non-listed funds in other regions is being provided to give an indication of how similar or dissimilar they are.

There is considerable regional variation in terms of average return and return volatility. The UK funds on average make up 52% of the total NAV of the funds in the database and on average make up the largest number. Individual UK funds are also larger on average than funds in other countries.

Table 12: Summary statistics for INREV non-listed funds by country

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Total returns										
France	-3.0%	-0.2%	0.5%	0.8%	1.4%	5.1%	1.9%	0.63	0.39	28
Germany	-0.5%	0.5%	0.9%	1.0%	1.5%	3.6%	0.9%	0.60	1.07	28
Netherlands	-3.5%	-0.3%	0.4%	0.5%	1.3%	3.5%	1.5%	-0.09	1.46	28
United Kingdom	-2.0%	0.4%	1.9%	1.8%	3.0%	6.4%	2.0%	0.20	-0.04	28
Total market capitalisation (Millions of GBP)										
France	850	1,493	2,061	2,063	2,702	3,332	660	0.00	-1.21	28
Germany	4,768	5,653	6,887	7,842	9,868	12,783	2,645	0.60	-1.02	28
Netherlands	10,634	14,623	15,902	15,804	16,419	19,501	1,643	-0.60	3.09	28
United Kingdom	27,664	34,234	36,312	39,946	45,256	58,187	8,335	0.87	-0.18	28
Average market capitalisation per fund (Millions of GBP)										
France	106	123	129	134	153	160	17	0.35	-1.25	28
Germany	145	164	173	187	206	284	36	1.26	0.95	28
Netherlands	443	518	531	564	596	780	85	1.51	1.57	28
United Kingdom	432	532	611	693	828	1,100	202	0.66	-0.91	28

Quarterly descriptive statistics	Min	1Q	Median	Mean	3Q	Max	St. dev.	Skew.	Kurt.	Periods
Number of funds										
France	8.00	12.00	16.00	15.07	18.00	21.00	3.44	-0.26	-0.99	28
Germany	30.00	33.00	45.00	41.11	48.00	51.00	7.68	-0.26	-1.81	28
Netherlands	24.00	27.00	28.00	27.79	29.25	30.00	2.01	-0.72	-0.45	28
United Kingdom	42.00	58.00	58.50	58.75	64.00	69.00	6.71	-1.05	0.84	28
	Min	**1Q**	**Median**	**Mean**	**3Q**	**Max**	**St. dev.**	**Skew.**	**Kurt.**	**Funds**
Gearing										
France	0.0%	0.0%	31.9%	23.9%	39.9%	57.8%	21.9%	0.07	-1.64	23
Germany	0.0%	31.2%	44.2%	37.9%	47.2%	79.8%	17.7%	-0.78	0.65	61
Netherlands	0.0%	0.0%	0.0%	10.9%	15.8%	100.0%	19.8%	2.97	11.19	36
United Kingdom	0.0%	0.0%	0.0%	14.3%	28.1%	100.0%	21.3%	1.76	3.35	86

Source: INREV Quarterly Index sample, Bloomberg, MSCI / IPD, authors' calculations (quarterly frequency from 2010 to 2016). The statistics for non-listed and listed funds have been obtained by first taking the equally-weighted average across funds, and then computing the statistics on the resulting time series. Financial leverage (gearing) is defined as total debt divided by total assets. For this table, all funds available, including those funds without secondary trading data are included.

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