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Price-Signaling and Return-Chasing: International Evidence from Maturing REIT Markets

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Abstract

This paper examines the liquidity of international real estate securities across ten markets over the period 1990-2015. We apply and compare results for four different measures of liquidity, and find that while liquidity has increased consistently, wide variations still exist across markets, with the U.S. and Japan in the lead. Our results also suggest that the introduction of local REIT regimes did not have any pervasive effects on stock liquidity. When we study the relationship between liquidity and returns, we document new and consistent evidence for international return-chasing behavior, whose pattern is a function of local market efficiency, listed real estate market maturity, and stock ownership dispersion. The introduction of REIT regimes seems to weaken the importance of extra performance over and above general equity returns as investors tend to allocate funds to real estate securities within real estate rather than equity portfolios.

Keywords: Liquidity, Market Efficiency, Return Chasing, REITs

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1. Introduction

Publicly listed property shares have become an increasingly popular channel among investors to acquire real estate exposure. The convenience of selling and buying property investments swiftly at low costs through the stock market has been stressed as a unique selling point for these indirect real estate investments. However, the public stock listing of property shares by itself does not guarantee the liquidity institutional investors are looking for. Lieblich and Pagliari (1997) showed that the limited market capitalization of the average U.S. REIT hampered their appeal, since it was impossible to sell of large quantities of shares without suffering from a significant price impact. But while the U.S. equity REIT-market composed of only 58 firms with a total market capitalization of just over 5 billion dollars in 1990, by the end of 2016 the U.S. equity REIT market has grown in both numbers and value comprising of 170 firms representing a total market cap of over 350 billion U.S. dollars. This development may well have induced greater liquidity in the property share market.

Measuring and analyzing liquidity is far from straightforward, since liquidity is a rather vague and relative concept. According to Boulding (1955) "Liquidity is a quality of assets which is not a very clear or easily measurable concept". Sixty years later, his words still seem to remain true as there has been no unique definition and measure of financial asset liquidity. Kyle (1985) claims that liquidity of a financial asset includes three transactional characteristics: the cost of liquidating a position over a short period of time – tightness, the ability to buy or sell large quantities of shares with minimal price impact – depth, and the propensity of prices to recover quickly from a random shock to the market – resiliency.

Besides measurement, stock liquidity is also widely discussed in the finance literature due to its complex interrelation with stock returns. On the one hand, liquidity is deemed to be a cause of returns, as liquidity can reveal information, especially in market segments in which informational efficiency is imperfect – price signaling. On the other hand, the behavioral finance literature shows that stock traders tend to herd and rotate their sectoral preferences based on past returns. In other words, liquidity may well be caused by past returns – return chasing. The international REIT markets may serve as a very useful laboratory to learn more about this liquidity – return dialogue. REIT markets around the world have matured recently, and now offer time series in which market efficiency has improved. This process, however, differed widely across markets, with some markets heading the pack when it comes to market maturity and efficiency. This international time variation will be carefully exploited in our empirical analysis, to identify the moderating effects of market efficiency on the liquidity-return interaction.

This paper extends the available literature in multiple ways. First, we look at the period 1990 – 2015. Especially during the last fifteen years of this sample period, we have seen strong growth in the property share markets and institutional interest therein. This is likely to have had an impact on liquidity, and these years have not been covered in the existing literature. Second, we analyze liquidity internationally in order to find out whether the available findings for the U.S. REIT market also hold in the property share markets of France, Germany, the Netherlands, the U.K., Australia, Hong Kong, Japan, Singapore, and Canada. Finally, and perhaps most importantly, we exploit the international variation in market developments to empirically analyze the effect of time varying market maturity and efficiency on the liquidity-return interaction. To what extent does market maturity affect return chasing and price discovery in financial markets?

Our results show that while the liquidity of REIT markets has increased consistently, wide variations still exist across the sampled markets. Volumes, turnover, Amihud's illiquidity ratio, and the number of zero return days – identify the U.S., Japanese and Australian markets as the most liquid ones in the world. In all sampled markets, we observe a firm increase in liquidity measures over time, but our results give little reason to believe that the international introductions of the REIT regime has had any pervasive effects. Although stock ownership dispersion (and limits on blockholdings) are typically part of REIT legislation, we find little direct effects of REIT introduction on the aggregated liquidity numbers. When we link these liquidity statistics to the corresponding returns, we document new and consistent evidence for international trend chasing behavior in listed real estate markets. Liquidity is commonly a function of past returns. At the same time, we also find interesting international variations in our output suggesting that the observed return chasing patterns are a function of local market efficiency, listed real estate market maturity, and stock ownership dispersion. Return chasing is less prominent in efficient markets (or periods), when listed real estate markets have grown large compared to the local common equity market, and when stock ownership is more dispersed.

The remainder of the paper proceeds as follows. First, we offer an overview of the most relevant literature on liquidity, which helps us to model and empirically analyze our sample. In the third section we present our data and summary statistics and discuss the methodology we have selected for our analysis. We then proceed by explaining the cross-sectional variation in the observed evolution of stock liquidity across our international samples, and rank markets accordingly. Next, we examine the relationships between stock liquidity and returns, and analyze both price signaling and return chasing trends within our data, and across markets. We summarize our most important findings and their implications in the concluding section.

2. The Stock Liquidity - Stock Return Interaction

In this paper, we analyze the increasing liquidity of listed real estate, and the effects that these liquidity increases have had on the liquidity-return interaction. Bernstein (1987) argues "that no single measure tells the whole story about liquidity". In fact, his statement seems to be reflected in the multitude of proxies which can be found in the literature on the liquidity of financial assets trading on exchanges or in over-the-counter markets. Asset trading activity measures relate to the liquidity dimensions of time and quantity. The reasoning to relate these measures to liquidity is that assets which are traded more actively are easier to buy or to sell for investors than assets which are traded less actively, especially when dealing with larger positions within a shorter period of time. Trading volume (number of shares traded), dollar trading volume (value traded), turnover (trading volume adjusted by number of shares outstanding), and number of trades have been investigated in real estate studies like Wang, Erickson and Chan (1995), Below, Kiely and McIntosh (1995), Clayton and MacKinnon (1999), Benveniste, Capozza, and Seguin (2001), Chordia, Roll and Subrahmanyan (2001), Hasbrouck and Seppi (2001), and Das, Freybote and Marcato (2015). We apply all these measures to learn more about how the time varying market maturity affects the interlink between stock liquidity and stock returns.

Price signaling and pressure

Over the years, several lines of literature have introduced reasons why current returns respond to past liquidity. In most cases, these price signaling theories relate to market efficiency and start at the identification of the factors that causes variations in stock liquidity. For instance, Bolton and Von Thadden (1998) and Loughran and Schultz (2004) argued that the liquidity of a stock is a positive function of its market capitalization. Furthermore, Bolton and Von Thadden (1998) posit that this effect might be related to potential information asymmetries. Pritsker (2002, p.129) states that, in the presence of asymmetric information, "prices change in response to trades because of the information that the trades might convey about asset fundamentals". This way stock returns respond to past liquidity changes. These asymmetric information problems might, however, be mitigated by an asset's market capitalization. Specifically, Bolton and Von Thadden (1998, pp. 2-3) posit that "the number of investors willing to invest in information acquisition in a particular stock will be increasing with the anticipated gains from trade and, hence, in the stock's market capitalization". This has the consequence that stocks with larger market capitalizations should have tighter bid-ask spreads, higher trading volume, and greater liquidity ratios.

Ownership concentration also might have a significant effect on asset liquidity and informational spill-overs that can affect subsequent returns. Bolton and Von Thadden (1998) claim that block holdings effectively decrease the number of shareholders and, thus, the liquidity of a stock. Benston and Hagerman (1974), Holmstrom and Tirole (1993), and Amihud, Mendelson and Uno (1999) come to a similar conclusion in that ownership dispersion promotes liquidity, and changes the impact of liquidity on stock returns. Insider holdings might have an impact on asset liquidity via asymmetric information problems. According to Heflin and Shaw (2000), high insider ownership may lead to greater asymmetric information problems. Sarin, Shastri and Shastri (2000) document that information asymmetry faced by traders is positively related to insider ownership, with the effect of widening quoted bid-ask spreads. Moreover, institutional ownership levels have also been documented to potentially impact an asset's liquidity. As a robustness test, we will test this ownership effect, by isolating the REIT regime introduction that have occurred within our sample. REIT regimes stipulate requirements regarding stock ownership dispersion and put limits on large blockholdings. Hence, in line with Sarin, Shastri and Shastri (2000), we would therefore expect stock liquidity to increase after REIT regimes have been put in place.

For the listed real estate market, Nelling, Mahoney, Hildebrand and Goldstein (1995) were the first to document that bid-ask spreads are inversely related to institutional ownership levels. They attribute this relationship to the role of institutional investors in reducing information asymmetries. Following the reasoning of Ling and Ryngaert (1997), Cole (1998) argues that greater institutional ownership should increase adverse selection risks and thus spreads. His tests, however, merely find an insignificant positive relationship between institutional ownership levels and bid-ask spreads. Clayton and MacKinnon (2000) employ trade-by-trade data to investigate the liquidity of REITs in 1993 and 1996. Calculating Kyle's (1985) lambda, a measure of the price impact of trades, and find that the median price impact declined for equity REITs during the period examined. Furthermore, they show that adverse-selection costs due to the presence of more informed traders were more than compensated for by an increase in the number of uninformed traders, resulting in decreased information asymmetries faced by market makers. Marcato and Ward (2007) and Brounen et al (2009) extend this public real estate liquidity research beyond U.S. markets, and analyze REIT liquidity in an international setting. Even though these studies have little emphasis on cross-market liquidity, they are helpful in understanding the movements and determinants of market and individual company liquidity. However, these studies do not consider linkages between liquidity and corresponding returns.

The link between liquidity and returns has also been analyzed in the mutual fund literature. If investors simultaneously invest in or withdraw money from several mutual funds within the same investment category, the returns of underlying assets may be affected by so-called "price pressure". Warther (1995) finds evidence of price pressure through aggregate mutual fund flows. He reports that aggregate flows into equity mutual funds are positively related to contemporaneous stock returns, while he finds no relationship between returns and lagged flows. Coval and Stafford (2007) find evidence of price pressure across a common set of securities held by distressed funds. Funds experiencing large outflows tend to decrease existing positions, while funds experiencing large inflows tend to expand existing positions. Using aggregate flows into REIT mutual funds, Ling and Naranjo (2006) also only document a contemporaneous relationship between REIT returns and aggregate REIT mutual fund flows, but they do not find that flows predict returns. In the private real estate market, Fisher et al. (2009) find that US-based capital flows predict subsequent returns, whereas Ling et al. (2009) find no support for the price pressure hypothesis in the UK. Downs et al. (2014) examined the flow-performance relationship for German open-ended real estate mutual finds. Using a similar approach to Fischer et al. (2009), the authors employed a Vector Auto Regression (VAR) analysis to capture the dynamic relationship between flows and returns. They find evidence that suggests that aggregate flows into real estate funds are positively related to prior real estate returns, but not for the reverse – price signaling.

Return chasing

Return chasing – buying recent winners and selling recent losers – is one of the oldest stock-selection strategies still in place. The first records of these momentum strategies date back to James Grant's 1838 book The Great Metropolis Vol II, in which he referenced the Ricardo investment rule, which had made him a fortune speculating on the London Stock Exchange. Ricardo investment philosophy was simple: "cut short your losses, and let your profits run". Starting with Grinblatt, Titman, and Wermers (1995), several papers document that institutional investors engage in trend-based trading strategies. Some explain this investment style as a result of implemented mechanical strategies designed to exploit the momentum anomaly documented by Jegadeesh and Titman (1993). Alternatively, Alti et al. (2012) explain trend chasing not as the result of an existing anomaly, but as a rational response to new information. Especially, if investors face uncertainty regarding the precision of their private information, they revise their precision estimates in response to subsequent news. Since such news also moves the stock price, investors resemble trend chasers in their trading behavior. In other words, trend chasing is more prevalent in markets that are less efficient, and in which investors face more uncertainty. Real estate markets are famous for their informational asymmetries. The underlying private real estate markets in which listed real estate companies need to manage their asset portfolios have a local nature.

For listed real estate securities, Stevenson (2002) was one of the first to report performance persistence in international markets both over short and medium term horizons. His analysis of Ricardo's winner strategy of selecting winners yielded a statistically significant outperformance up to 48 months after stock selection, providing evidence that return chasing was beneficial in listed real estate. Chou and Hardin (2014) provide similar results after analyzing the US real estate mutual fund market. They show that also in this market investors chase past performance to an extent that limits fund manager's ability to optimize investments. More recently, Moss et al. (2015) investigated whether the risk adjusted returns of a global REIT portfolio would be enhanced by adopting a trend following strategy (which is an absolute concept), a momentum based strategy (which is a relative concept and requires individual country allocations), or indeed a combination of the two. Their results show, that return chasing strategies help to reduce the volatility and enhance Sharpe ratio's by 0.1 to 0.5. However, although in recent years the interest in public real estate momentum has increased, no study thus far, has analyzed the time variation in trend chasing and linked it to the international variation on market maturities.

3. Methodology

To analyze the simultaneous interaction between stock liquidity and returns, we estimate a vector autoregressi (*VAR*) model of order *p* with exogenous variables as follows:

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + \Lambda X_t + \varepsilon_t\,,\; t = 1, \ldots, T \qquad (1)$$

where Y_t represents the endogenous variables in the system, X_t is an ($m \times 1$) matrix of exogenous variables, A and Λ represent parameter matrices and ε_t are the error terms in the system of simultaneous equations.

Particularly, our VAR system of equations is composed as follows:

$$Liquidity_t = \alpha + \sum_{s=1}^{p} \beta_i * Liquidity_{t-s} + \sum_{s=1}^{p} \gamma_i * TR_{t-s} + \sum_{i=1}^{m} \lambda_i * X_{i,t} \qquad (2)$$

$$TR_t = \alpha + \sum_{s=1}^{p} \beta_i * Liquidity_{t-s} + \sum_{s=1}^{p} \gamma_i * TR_{t-s} + \sum_{i=1}^{m} \lambda_i * X_{i,t} \qquad (3)$$

where $Liquidity_{i,t}$ and Total Return ($TR_{i,t}$) represent the endogenous variables of the system and p is the lag structure necessary to estimate the inter-temporal impact of liquidity on pricing and *vice versa* – as suggested in previous studies, we use 4 lags for quarterly models and 12 lags for monthly models. $X_{i,t}$ represents a vector of control exogeneous variables which are specified in line with the available real estate literature on VAR modeling and liquidity. We estimate the two equations simultaneously and present these regressions in a partial equilibrium framework, using equally-weighted returns on a quarterly basis. Other assets such as equities could be potentially considered endogenous in a more general equilibrium model. The previous literature however has not reached unanimous consensus on this issue and we believe that, albeit we could argue that pricing in the equity market could affect REITs pricing, the opposite is hard to theoretically justify, especially for an industry representing such a small portion of the overall equity market. We therefore include equity market returns as exogenous variable in our main model, but also extend this specification and offer a robustness test for a more general equilibrium model including endogenous equity returns. We obtain similar results and hence confirm our *apriori* initial assumption. As further robustness tests, we present estimations using capital-weighted returns, monthly returns, and models where we explicitly control for the time varying introduction of the REIT regime across markets during our sample period. All these results confirm our main findings and are discussed in a separate section.

If we expect return chasing behavior, we should find positive and significant coefficients for the lagged returns in our liquidity equation, meaning that lagged returns lead to more liquidity. If, instead, we expect price signaling effects with low liquidity generating higher returns, we would expect to find negative and significant coefficients for liquidity in our return equation. In our model estimation, we measure liquidity using both trading volumes (vol) and turnover (turn) as a robustness test.

Regarding our control variables, the literature predicts that inflation and interest rates reduce liquidity, while equity returns and GDP growth have a positive effect on liquidity. Regarding the return equation, the literature predicts that returns are positively affected by equity returns and GDP growth, and negatively by the term spread, interest rates, and inflation. Given the institutional variations and differing market maturities in our sample, we also analyze our estimation results with respect to international variations.

In this section, we analyze the significance of single lagged coefficients, but we also present Granger-causality tests to determine the direction of causality between the two variables returns and liquidity. These tests are helpful to shed light upon the existence of price revelation (when liquidity is priced in REIT stocks and hence predicts future movements in share prices) and/or return chasing behavior (when returns generate changes in future liquidity). Clive Granger documented that causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series. Moreover, he called a variable y_{2t} causal for variable y_{1t} if the information in past and present values of y_{2t} is helpful for improving the forecasts of y_{1t}. Clearly, the notion of Granger-causality does not suggest true causality. It only implies forecasting ability. In its simplest form, Granger-Causality tests seek to understand if changes in y_{2t} causes changes in y_{1t} and vice versa. We perform Granger-causality tests to evaluate the relation between trading volume and returns for ten different international markets.

4. Data and Liquidity Measures

We focus our empirical analysis on the ten largest listed property share markets – France, Germany, the Netherlands, the U.K., Australia, Hong Kong, Japan, Singapore, Canada and the U.S. – that today jointly represent over 75% of the total market capitalization of the Global listed real estate markets. Today, all ten markets have a local REIT regime in place, which in some cases was introduced during our sample period.

We obtain the required data from two main sources which provide access to individual REIT / property company data on a daily basis. To obtain reliable results and to compute monthly liquidity measures, we use a long time series of 615 companies (136 European, 204 Asia-Pacific, and 275 Northern American) for more than 4000 days over the period December 1995 to March 2015[§]. We initially download the following daily data from SNL Financials for all companies: share price [P], number of shares traded [NOSH] and total return [TR]. Market values are instead obtained from Datastream (Thomson Reuters group) after checking that other measures were consistent between these sources. The decision to use these sources jointly was to guarantee the maximum coverage possible. In fact, SNL Financials does not have great coverage of market values (especially at the beginning of our sample period) but showed better coverage for other data points. Finallly, macroeconomic data were also obtained from Datastream.

As this study focuses on variations in international listed real estate markets, we aggregate company level data in each country and produce market indices of both returns and liquidity measures to be used in our estimations. In table 1, we list the summary statistics of market returns and the four liquidity measures alongside all other control variables with a monthly frequency, This choice has been determined by the tradeoff between the need of a big enough number of observations for our model estimations and the presence of a generally medium- to long-term investment horizon for this type of securities.

- insert Table 1 [summary statistics] around here -

The statistics in Table 1 show that all countries (excl. the U.K.) enjoyed an average monthly REIT return between 0.5% and 1.5%, with volatilities between 4% and 9%. Value weighted returns are slightly lower than equally weighted returns. In our estimation, we use equally weighted returns and report only those for parsimonious reasons. Moreover, the REIT industry generally outperformed equity markets, but also exhibited a higher volatility. Interest rates varied across countries, from 1.22% (3 months) on average in Japan to 5.05% (10 years) in Australia. The term spread has been generally positive and around 1.0% to 1.5% (excl.

[§] Data for Germany is only available for all measures from the end of 2001.

Australia). Given the multidimensional nature of liquidity, we combine four different measures with a monthly frequency using daily data:

Trading volumes [VOLUME] are simply computed for each month as the sum of the daily numbers of traded shares multiplied by the stock price (computed as the average of the closing prices of current and previous day of trading. The implicit assumption in this calculation is that on average, transaction have been executed at a price between the closing prices of the two days). We present these volumes in U.S. dollars to allow fair comparisons across markets, but analyze trading volumes in local currencies to avoid the interactions with currency rates in the subsequent analysis when we use macroeconomic factors to explain the variation in liquidity.

Stock turnover [TURNOVER] are the trading volumes in local currencies divided by the corresponding market capitalizations. In other words, stock turnover measures the monthly share trades as a percentage of the total shares outstanding (i.e. the percentage of available shares traded every month).

Amihud (2002) suggests an alternative proxy for liquidity [ILLIQ] that captures market depth. More specifically, Amihud measures the illiquidity of stock i in a period t (for our study being a month) as follows:

$$ILLIQ_t^i = \frac{1}{Days_t^i} \sum_{d=1}^{Days_t^i} \frac{\left|R_{t,d}^i\right|}{V_{t,d}^i} \tag{4}$$

where $R_{t,d}^i$ and $V_{t,d}^i$ are, respectively, the stock's total return and dollar trading volume on day *d* in year *t*, and is the number of trading days in year *t* for stock *i*. ILLIQ is based on the notion that returns for illiquid stocks are more sensitive to trading volumes.

Our fourth and final measure of stock liquidity is the simple count of zero return days [ZERO] that occur during a month. This is a simple but common alternative measure for illiquidity, assuming that zero returns occur as a result of lack of stock trades. It is often used in studies involving emerging markets.

In Figure 1 Panel A, we plot the daily trading volumes in U.S. dollars for the ten markets in our sample for the past fifteen years. These numbers immediately reveal two compelling facts. First, trading volumes have grown massively in the past fifteen years. In the year 2000, daily trading volumes in our sample ranged between 13 to 16 $ bln., while today (2015) over 200 $ bln. worth of property stock is trade every day in the ten sampled markets. Second, the vast majority of these trading volumes occurred in the U.S. market, a market that accounts for 35% of the firms in our total sample but also for no less than 76% of the 2015 trading volumes. Clearly, if trading volume were the measure of stock liquidity, we could now firmly conclude that liquidity is strongest in the U.S. market. A fact that is true today and at the start of our sample, as the stake of total trading volumes of the U.S. market started at 63% in the year 2000, and gradually increased to the current stakes of 76%.

- insert Figure 1 [Monthly trading volumes] around here -

To ensure that these trends are not merely a reflection of an increase in the number of listed firms, we also repeat this trading volume comparison, by plotting the averaged volumes on a firm level for each market in Panel B, where the time trend changed. At the start of this sample period, the average firm offered investors a daily trading volume of $43 mln., a number that peaked in August 2007 at $314 mln., and equals $218 mln. at the end of our sample period. In other words, trading volumes five folded on a firm level. But also when comparing this number across markets, we find strong differences. In 2015 the average U.S. property share showed trading volumes in excess of $800 mln., while the average Canadian firm barely made $40 mln. worth of trades a day. For both markets, these numbers equaled $70 mln. (U.S.) and $4 mln. (Canada) in the year 2000, reflecting a comparable growth over time, but a pervasive difference in magnitude across markets.

To further enhance the comparability of liquidity across markets and firms, we need to control for the variations in firm size. Hence, we also include stock turnover – computed as the relative measure of trading volumes over firm size (measured as market capitalization) – in our analysis. Moreover, we also use Amihud's illiquidity ratio to measure the depth of liquidity, and the fraction of zero return days every month to capture the time varying illiquidity in our sampled markets. To compare the international distributions on all four liquidity measures, we compute the lower and upper confidence intervals of the average liquidity measures for the entire sample as follows:

$$L.ower\ Interval = Average - \frac{Standard\ Deviation}{No.\ Observations} \tag{5}$$

$$Upper\ Interval = Average + \frac{Standard\ Deviation}{No.\ Observations} \tag{6}$$

We present the graphs of the average (black line) of the four main liquidity measures along with their confidence intervals (green histogram around the mean) in Figure 2. This representation helps us to visualize the statistical difference of the country averages. In fact, if the green histograms of two histograms reach overlapping values, their average cannot be considered statistically different. In particular, trading volumes show that the ranking is also statistically significant if we exclude the second and third position where the upper limit of Hong Kong is slightly above the lower limit of Japan. As far as turnover is concerned (Graph

B), the overall averages of European countries are not always statistically different, with the Netherlands showing overlapping regions with both UK (upper) and France (lower). In Asia, Japan is the most liquid country followed by Australia and the pair Hong Kong and Singapore whose average measures do not appear to be statically different. Overall, these comparative graphs reveal consistency across measures. Volumes (Graph A) and turnovers (Graph B) display similar results, with the US and Japan leading, and Germany and Canada lagging behind. The biggest differences here relate to the distributions, which tend to be wider for turnover, and the odd case of the Netherlands which ranks low in trading volume, but high turnover. The latter, can be explained by the vast institutional holdings in Dutch REITs, which limits there numbers of shares outstanding. Low trading volumes, in that case, can still be scaled up in turnover.

- insert Figure 2 [Liquidity measures and confidence intervals] around here -

In Graph C, the Amihud illiquidity measure reveals that the ranking in both Europe and Asia is statistically significant, with the Netherlands and Japan showing the highest market depth within each area. Overall, the US is behind all Asia-Pacific countries for this metric. This weaker ranking of the US may be partly due to the fact that in the Amihud measure returns are divided by dollar volumes. Since in all other markets this includes an exchange rate effect, this changes results somewhat. Moreover, the non-reported time variance that underlies this liquidity measure may particularly affect the US overall average. Up until the global financial crisis, the US Amihud values were small, indicating low illiquidity and therefore a ranking similar to other measures. As soon as the crisis started, US REIT returns responded swiftly and led a significant increase in volatility, which more than doubled compared to the values in the pre-crisis period. This translated into a relative increase in the Amihud measure, which almost tripled on average in the period after the crisis, therefore explaining why the aggregated scores in Figure 2 exceed the Asia-Pacific numbers. More recently, US values are again comparable to other leading Asia-Pacific markets. Besides US values, the Amihud illiquidity measure yields results consistent with other proxies and Germany confirms its position as the least liquid market.

Finally, Graph D reports zero return days. Lesmond et al. (1999) developed a model to estimate transaction costs from time series of daily stock returns, assuming that days of zero return should be observed when the expected return does not exceed the transaction cost, which is set as a threshold. Hence, the likely relationship between days of high transactions costs and days of zero return should be coupled with a relatively small incentive for investors to gain private information for shares with high transaction costs. As a result, most trades are noisy and, therefore, they should lead to zero-return days with volumes still likely to be positive. In emerging markets, Lesmond (2005) and Bekaert et al. (2007) find that this measure is highly correlated with other traditional measures of transaction costs – see also Lee (2011) for the pricing of liquidity risk in global financial markets. Moreover, using Trade and Quote (TAQ) data, Goyenko et al. (2005) find a similar pattern between transaction costs obtained with high-frequency data and the measure of zero-return days in the US market. Our results on the zero return days show overlapping confidence intervals for several countries in Graph D. European markets seem to be the least liquid, with Japan competing with the US as the most liquid country.

5. Price Signaling vs. Return-Chasing

Previous literature has established the existence of an interaction between pricing and trading, finding mixed results on the causality. In fact, on one hand high returns attract investors into the market – revealing a return chasing attitude –, hence improving the market liquidity. On the other hand, investors in less efficient markets or times, have been learning from previous trades to adjust their trading and pricing accordingly.

Since key to the problem is the causality of the two variables (returns and liquidity), we estimate a VAR (vector autoregressive) model, also including exogenous macroeconomic and financial indicators - the term spread, interest rates, equity returns, GDP growth and inflation. We discuss the results based on volume and turnover numbers, and report the VAR estimations using Amihud's illiquidity ratio and zero return days in appendices A1-A3. Results which are comparable but weaker.

We start our estimation report in Europe. Table 2 presents the results of both the liquidity (panel A) and return equations (panel B) for Germany, France, UK, and the Netherlands. The estimation was performed over the full sample period of 1995-2015, using quarterly data, since GDP growth numbers required this frequency.

- insert Table 2 [European VAR and Granger estimates] around here -

For the liquidity equation, we report compelling pan-European evidence for an autoregressive process, past liquidity tends to trigger future liquidity in each market. Moreover, we also find broad European evidence that indicates return chasing behavior, since we also find positive and significant coefficients for the lagged returns in the liquidity equation. Except for Germany, it appears that high returns lead up to higher liquidity of listed real estate securities. Regarding the control variables, our European results offer consistent evidence that the liquidity of real estate securities is reduced by increases in the term spread, inflation and interest rates, while the good news of strong equity returns and GDP growth enhances liquidity. Results that corroborate the literature, and that are independent of the use of trading volumes or turnover rates.

Within the return equation (Panel B of table 2), we find less compelling evidence suggesting that price signaling is only present in France and only in the short run. Within this return equation, the control variables appear to have a more heterogeneous effect. Overall, the term spread and interest rates carry the expected negative signs when results are significant. For inflation, the results are mixed, indicating that in Germany and France the returns of listed real estate securities have inflation hedging qualities, while in the UK and the Netherlands this is not the case. However, for a proper analysis of inflation hedge qualities, this total inflation rates ought to be decomposed into expected and unexpected inflation, which is beyond the scope of the analysis. The equity returns coefficients indicate that European real estate securities qualify as conservative stocks, since their beta's are well below 1.0 in all markets.

The Granger causality tests, listed at the bottom of panels A and B of table 2, confirm the VAR findings. The most prominent findings are reported for return chasing (the return equation). Returns lead to liquidity in France and in the Netherlands, both measured in volumes and turnover. In Germany, no granger causality is found, also not for the inverse relation, price signaling. This, however, is the case for France, the UK, and in the Netherlands, at least based on the trading volume estimates. The fact that Germany yields no significant Granger results is remarkable, since Germany was found to be lagging behind in liquidity scores. Assuming that this lack of liquidity also coincides with limits in marker efficiency, we would expect to find stronger results in Germany than in the more liquid and efficient markets like the UK and the Netherlands.

Table 3 offers the Asia-Pacific results for our liquidity and return analyses. Results that appear similar when it comes to the autoregressive process in liquidity, but weak regarding the trend chasing evidence. We document return chasing evidence only in Australia. Evidence that suggest that liquidity is triggered by past returns, a finding that is confirmed by the Granger causality results, but based on low coefficients. Liquidity in Asia-Pacific real estate securities are strongly affected by equity market returns, while inflation, interest rates and the term spread weaken liquidity just like in Europe. Regarding the return equation (Panel B), we find evidence for reversal behavior, in which low past returns are succeeded by positive (and vice versa). In no Asia-Pacific market, we find compelling evidence that indicates price signaling or price pressure. Only when analyzing Australian turnover rates and Hong Kong trading volumes, we find some evidence that returns are causing by lagged liquidity. Overall, the Asia-Pacific equity market beta are higher than in Europe, and inflation, term spread and interest rate all deteriorate real estate securities' returns. Interesting here is the international variation in results. We find the equity return effect is strongest in markets where the financial markets are dominant (Hong Kong and Singapore in Asia, and the UK in Europe).

- insert Table 3 [Asia-Pacific VAR and Granger estimates] around here -

In table 4, we present that regression results for the Canadian and US REITs. Also here, we find that liquidity is trending, and that returns trigger liquidity. Both in the US and Canadian REIT markets, we report evidence that suggest return chasing, both in the VAR and by the Granger causality tests. The size of these American coefficients is similar to the European, and the signs are again robust for the use of volumes and turnover. The control variables offer output that is different from what we reported in Europe and Asia. For instance, inflation, and (US) interest rates have a positive effect on listed real estate liquidity. This indicates that in North America investments in REITs increase when financial markets perform well. Perhaps, because in these mature markets listed real estate is seen as an industry unique from equity, which is confirmed by the mixed and partially insignificant equity return coefficients in the liquidity equation. Inflation has a positive and significant sign both in the liquidity and the return equation, which can be interpreted as that REITs are considered an inflation hedging store for value when the economy is softening.

Furthermore, we find no convincing evidence in the return equation regarding liquidity and autoregressive patterns. There is little evidence suggesting price pressure, also not in the less efficient Canadian market. Equity betas are below one, the positive inflation coefficients hints towards inflation hedge qualities.

- insert Table 4 [North American VAR estimates] around here -

Overall, our results offer new and consistent evidence for international trend chasing behavior in listed real estate market. Liquidity is commonly a function of past returns, but this interaction does not appear to be related to the liquidity and maturity of the markets, as we find the strongest results for liquid markets like the US, Australia and France, and not for Germany, where liquidity is lowest. At the same time, we do find interesting international variation in our output that suggests that the interaction with the equity market is dependent on the dominance of the local financial market. We also report evidence that the autoregressive patterns in both liquidity and returns of real estate securities, weaken when markets mature and become more efficient. Finally, we find that in these most mature markets, listed real estate effectively serves as an inflation hedging store for value when the economy weakens.

- insert Table 5 around here -

Finally, to ensure that our conclusions are not hampered by our model specifications, we have also performed several robustness checks in our VAR analysis. In Table 5, we report the Chi-squared probability of the Granger causality test for alternative VAR estimations to compare our main results for price signaling and return chasing behavior from Tables 2 to 4 and hereby reported in the first column ("Equally-Weighted") of Table 5. More specifically, the second column ("Value-Weighted") presents the results of models using value-weighted rather than equally-weighted returns, which show similar outcomes. Chi-squared probabilities are all of similar size and significance, indicating that our regression results are size-insensitive.

In the third column ("Monthly") we report estimates obtained with monthly data and 12 lags instead of quarterly data with four lags as in all other models. Once more, these results are consistent with the ones in column one, suggesting that the use of monthly over quarterly data does not lead to significantly different conclusions. The model in the fourth column ("REIT dummy") contains a dummy for countries where the REIT regime was introduced during the sample period. In particular four markets (US, Canada, Australia and Netherlands) had REIT regimes in place throughout the sample period, and have therefore been excluded from this robustness test. For the remaining six markets, results are in line with column 1, with Chi-squared probabilities of similar size and significance levels. Later in this paper, we will focus more on the moderating effects that the introduction of REIT regimes has had on the observed liquidity-return relationships.

In the last column ("Equity endogenous"), following, we extend our partial equilibrium to a more general equilibrium model and also include equity market returns as the third endogenous variable in the system. Our results are still consistent with the baseline model reported in column one.

6. Market Efficiency and Cross-Cross Country Differences in Return-Chasing Patterns

In this final part of our analysis, we estimate the VAR systems with 5 year rolling windows using a monthly frequency. We use a 12-month lag for the two endogenous variables and we obtain the t-test of the sum of the 12 lag coefficients being significantly different from zero for both price signaling (liquidity on returns) and return-chasing (returns on liquidity, i.e. blue line). The historical time series of t-statistics are reported in Figure 5 (orange line for price signaling and blue line for return-chasing behavior), where the horizontal lines represent the significance levels of the t-student distribution at 90% (external lines), 95% and 99% (internal lines).

In North America and Europe, we find a return-chasing behavior with positive sign (revealing momentum strategies), especially from the end-2007 onward. Germany and France also show this dynamic during the earlier period. Evidence of short periods with price signaling do exist in Europe, while stronger evidence (with negative sign) is found for the US from the end of 2007. In Asia we obtain a weaker evidence of return-chasing behavior in the second part of the sample period and very short periods where some evidence of price signaling exists.

- insert Figure 3 [T-statistics of rolling estimations] around here -

Overall, these results confirm our earlier findings that return-chasing is more prominent than price-signaling as the blue lines top the red consistently. The time variation that we observe in Figure 3 does not reveal any conclusive patterns. The introduction of local REIT regimes in Germany, Singapore, France, Japan, or the UK does not appear to have had any impact on these results. Moreover, the increase in return-chasing coefficients does not align with the international trend of increasing market liquidity that we reported earlier. In markets like the US, Canada, and France, we observe as reduction in the return-chasing coefficients during the second half of the sample period, when liquidity levels increased. But in Singapore, and the UK, where liquidity also rose over time, this coefficient increased as well. To better grasp this relation between market efficiency and our return-chasing results, we continue our analysis with a cross-country regression analysis.

As we find consistent evidence of return chasing behavior and little proof of price signaling, we decide to focus the last part of our analysis on the determinants of return chasing behavior. We model the country- and time-variation of return chasing coefficients obtained with rolling window estimations as our dependent variable. Particularly, we use the coefficients obtained with turnover measures of liquidity because their unit of measurement allows comparability across countries. Using transaction volumes (or the Amihud's illiquidity measure) in fact would raise the issue of cross-country comparability between markets because volumes in VAR estimations are measured in local currencies. Among several factors leading to return chasing, we identify four main drivers following existing theories presented in the literature review: we expect return chasing to decrease when market efficiency improves. Information should be updated and priced more frequently, with investors that may reduce their expectation of extra-profits purely based on past performances as return chasing behavior would suggest. Similarly, as the market matures, prices should reflect information more instantaneously and return chasing behavior should be weakened. Moreover, the presence of greater stock dispersion (or smaller portion of closely held shares) should lead to a reduction in return chasing behavior, which is less likely to occur when more diverse investors are involved. On a more behavioral note and all other things being equal, the presence of real estate momentum (i.e. strong past extra-returns in listed real estate over equities) may be positively related to return chasing, with investors deciding to follow these extra returns as they appear in different countries and over different time periods. Finally, we expect the establishment of a REIT regime to act as moderator effect by reducing return chasing behavior as listed real estate becomes more visible and attracts more investors who would price out inefficiencies further. The remainder of this section explains the construction of each variable, presents main descriptive statistics, introduces the estimation model and discusses results.

Four measures

When returns follow a random walk, their variance should be a linear function of the time interval over which they are computed. For example, the variance of weekly returns should be equal to five times the variance of daily returns over the same period. We follow Lo and MacKinlay (1988) and calculate a measure of market efficiency using the variance ratio. We expect the variance ratio of efficient markets to be equal to 1.00 showing that returns are uncorrelated. Oscillations away from 1.00 indicate market inefficiency, with values in excess of 1.00 indicating trending, and values below 1.00 indicating mean reversion in the data. In each market we determine a five-year rolling window and determine the ratio *(VRT_{it})* between the variance of monthly returns $\left(\sigma^2_{m,it}\right)$ and 21 times the variance of daily return $\left(\sigma^2_{d,it}\right)$ as follows:

$$VRT_{it} = \frac{\sigma^2_{m,it}}{21 * \sigma^2_{d,it}} \tag{7}$$

We also proxy the maturity of REIT markets using the ratio between the market values of REITS ($MV_{REIT,it}$) and the overall stock market ($MV_{equity,it}$) for market *i* at time *t*:

$$maturity_{it} = \frac{MV_{REIT,it}}{MV_{equity,it}} \tag{8}$$

As the REIT market becomes more mature, it also tends to increase in market value and as such the REIT industry should become a bigger component of the economy and hence of the overall equity market. This ratio proxies this measure of market maturity using public data and the stocks traded in REIT and other industries. We expect that more mature markets exhibit more efficiency, and therefore give less room and reason for return chasing behavior.

Furthermore, closely held shares are not publicly traded similarly to common shares. Companies with a high proportion of closely held shares may trade less frequently and in smaller volumes. We use annual data of shares closely held by insiders as defined by Worldscope to proxy for stock dispersion. This category includes cross-holdings, corporations, holding companies, government, employees and individuals/insiders, but excluding shares under option exercisable within sixty days, held in a fiduciary capacity, preferred stocks or debentures convertible into common shares, bank and trust, endowment funds, finance companies, foundations, hedge funds, insurance companies, investment companies, mutual funds, pension funds, private equity, research firms, sovereign wealth fund, venture capital and stock options and employees shares held through pension plans. The closely held ratio for country *i* at time *t* (CHR_{it}) is computed for the listed real estate market as a percentage of closely held shares $(clheld_{it})$ over the total number of shares $(totshares_{it})$ available at time t:

$$CHR_{it} = \frac{clheld_{it}}{totshares_{it}} \tag{9}$$

In line with Dennis and Strickland (2003), we expect that blockholdings and ownership identity matter for stock trading patterns. Hence, we expect that greater stock dispersion – in this case proxied by smaller portion of closely held shares - should lead to a reduction in return chasing behavior, which is less likely to occur when more diverse investors are involved.

Finally, we compute real estate momentum of market *i* at time *t* $(remom_{it})$ as the differential between past real estate $(ret_{REIT,-6m})$ and overall equity returns $(ret_{equity,-6m})$. Particularly we compute this proxy using the past one, three, six and twelve months. Since estimation results are confirmed with all four investment horizons, we only report the one using the past six months as follows:

$$remom_{it,-6m} = ret_{REIT_{it,-6m}} - ret_{equity_{it,-6m}} \tag{10}$$

Both listed real estate and equity returns are obtained from the initial analysis. Normally, return chasing should be positively related to real estate momentum because in periods of strong past real estate excess performance more investors gain an interest in real estate investments, and we therefore expect an increase in return chasing activities. However, if contrarian strategies are followed, return chasing behavior may indicate investors shifting their allocation after periods of excess return for real estate industry.

Descriptive statistics

Table 6 presents the main descriptive statistics for the four independent variables as well as the return chasing coefficients by market. This shows both the averages, and distributions of the key variables in our return chasing analysis. Return chasing is on average positive in eight out of ten markets, but also varies greatly over time, as already indicated by Figure 3. In our panel regression analysis, we explain the observed variance in return chasing coefficients by the remaining variables in Table 6. The reported variance ratios are mostly in excess of 1.00, indicating trending. However, the distribution diagnostics indicate that values below 1.00 have not been uncommon. Our market maturity metric – the ratio of listed real estate market values over common equity values – varies between 1.02% in Germany and 15.27% in Hong Kong, on average. Moreover, this variance has been wider over time, and our final analysis will assess its importance for the occurrence of return chasing behavior. We generally observe listed real estate returns to overperform common equities, with real estate momentum being positive in eight out of ten markets and possibly affecting return chasing activities. Finally, when comparing summary statistics for closely held shares, we observe the strongest variation across our ten sampled markets. These average percentages range between 15.77% in the UK to 57.63% in Hong Kong. As the existence of closely held shares introduces a natural limit to stock ownership dispersion, we expect the percentage of closely held shares to impact on liquidity and particularly return chasing behavior.

- insert Table 6 around here -

Estimation Model

Using the main variables described above, we construct a panel dataset with i assigned to each of the ten markets and t representing time (month). We model return chasing behavior (i.e. coefficients) as a combination of variance ratio, market maturity, closely held shares and real estate momentum as follows:

$$rc_{it} = \alpha + \beta_1 VRT_{it} + \beta_2 maturity_{it} + \beta_3 CHR_{it} + \beta_4 remom_{it,-6m} + \varepsilon_{it} \qquad (11)$$

We initially estimate the model with random effects. However, we subsequently obtain estimates with fixed effects and test for the need to do so with the Hausman test whose null hypothesis is not rejected. Therefore, we generally use and report random effects models, but we also present coefficients obtained with fixed effects for the first specification[**]. To the baseline specification, we also add a REIT dummy to indicate in each market the periods when a REIT regime was in place (as in Table 5) – in the Netherlands, Australia, Canada and the US, a REIT regime was effective for the whole sample period. The REIT dummy is used both as an intercept and as an interaction term with either closely held shares or real estate momentum:

$$rc_{it} = \alpha + \beta_1 VRT_{it} + \beta_2 maturity_{it} + \beta_3 CHR_{it} + \beta_4 remom_{it,-6m} + \beta_5 REIT_{it} + \varepsilon_{it} \quad (12)$$

$$\alpha + \beta_1 VRT_{it} + \beta_2 maturity_{it} + \beta_3 CHR_{it} + \beta_4 remom_{it,-6m} + \beta_5 REIT_{it} + \beta_6 REIT_{it}\ \ CHR_{it} + \varepsilon_{it} \quad (13)$$

$$rc_{it} = \alpha + \beta_1 VRT_{it} + \beta_2 maturity_t + \beta_3 CHR_{it} + \beta_4 remom_{it,-6m} + \beta_5 REIT_{it} + REIT_{it} * remom_{it,-6m} + \varepsilon_{it} \quad (14)$$

Main Results

Our results largely confirm the above expectations. Table 7 reports the results from our random and fixed effect estimations. In all specifications of our model, we find a strong and significant effect for market inefficiency, proxied here by the variance ratio. The higher the variance ratio, the stronger the market inefficiency in the market, and the more return chasing is observed in our data. These results are consistent with earlier work by Alti et al (2012). A similar robust result is also found for market maturity, which we measure as the ratio of market values of listed real estate over their common equities. The higher this ratio, the more mature listed real estate is within the home market and the less return chasing is expected to occur. This is confirmed by our coefficient estimates (see Table 7), which are negative and strongly significant across all model specifications.

For closely held shares, results are less straightforward. In line with theory, we would expect that larger fractions of closely held shares limit stock ownership dispersion, which would trigger more return chasing behavior as this behavior is less likely to occur when more diverse investors are involved. Our results indeed report this positive link between closely held shares and return chasing coefficients, but they lack statistical significance in the random effect specifications. Only after controlling for the moderating REIT regime effects, we find the expected dispersion results to gain statistical significance. Coefficients of the interaction term of REIT regimes and closely held shares show that any effect of stock dispersion is limited to non-

[**] The Hausman test has also been applied to all other specifications and it was never found significant.

REITs regimes/periods. The combined coefficients for REIT regimes/periods are close to zero. In other words, stock dispersion is more important for return-chasing behavior for property companies than for REITs. Once the REIT regime is in place, the net effect of closely held shares is reduced to zero, which is a likely effect of the stock ownership dispersion criteria (like the former 5-50 rule) that associate most REIT regimes around the world. REIT regimes cause an increase of stock ownership dispersion and thereby weaken the effects of closely held shares in our data.

This is also the case for real estate momentum, where we report the expected positive coefficient, indicating that positive listed real estate excess returns (over common equity) attract investors and trigger return chasing. However, this result is weak at best. Only in our last model specification, in which we control for the interaction with the REIT regime, we find statistically significant momentum effects. More specifically, our results show that in fact, this momentum effect is negative for non-REIT regimes/periods in our sample. For firms without REIT status, momentum triggers a contrarian investment strategy, where historic strong real estate outperformance over equity leads to sale orders. This is different for REITs, as indicated by the REIT interaction term: the sum of both momentum coefficients is slightly positive, but statistically insignificant, meaning that once markets adopt the REIT regime, all signs of contrarian strategies disappear from our data. These findings may be explained by the formation of investment portfolios. If listed real estate are part of equity allocations, the differential in performance between real estate stocks and other equities matter, leading investors to withdraw money avoiding overheating situation in markets where real estate equities grew significantly more than general equities. However, once the REIT regime is adopted, performances in the listed real estate sector tend to correlate more with direct real estate and real estate stocks may be seen as part of real estate rather than equity allocations. As a result, the differential in performance between real estate and general equities matters less and does not affect return chasing behavior anymore.

In order to assess whether these weak relations between return chasing and closely held shares and real estate momentum differ across markets and market regimes, we have also included interaction effects for both with the REIT regime. REIT regimes in general yield strong and significant results in our model estimation. In other words, return chasing is or becomes much stronger when REIT regimes are introduced within our sampled markets. This is somewhat surprising, as REIT regimes are often discussed as means to enhance market liquidity, maturity and efficiency, all aspects which would normally weaken return chasing behavior. However, once we include the interaction effects between REIT regimes and closely held shares and real estate momentum we learn more about the channels through which the REIT regimes affects return chasing.

- insert Table 7 around here -

7. Conclusions

In this paper we examine the liquidity of listed property companies since 1995 in France, Germany, the Netherlands, UK, Australia, Hong Kong, Japan, Singapore, Canada and the US. For all ten markets, we apply and compare four different liquidity measures – trading volume, stock turnover, Amihud's illiquidity ratio, and the number of zero return days. Our results show both consistent patterns across metrics, as wide variations across markets. All four measures identify the U.S., Japanese and Australian markets as the most liquid ones in the world, and in all three markets the liquidity measures have been high all through the sample period. Moreover, the introduction of a local REIT regimes does not to have any pervasive effects on stock liquidity, as European REIT markets like Germany and France still lag behind.

When we analyse the dynamic interaction of liquidity statistics and corresponding market returns, we find little evidence for price signaling, but we document new and consistent evidence for international trend chasing behavior in listed real estate markets. Liquidity is commonly a function of past returns and this phenomenon is time variant and dependent upon several market features. Particularly we show that return chasing patterns are more pronounced in less efficient markets/periods and they shrink as a market matures over time. Secondly, we find compelling evidence that improvements in stock ownership dispersion reduce the level of return chasing activity, which is determined by excess performance in real estate over and above general equities only for non-REIT regimes.

Our results indicate that the prevailing of return chasing behavior has been affected by the introduction of REIT regimes. On one hand, the improvement in market efficiency and market maturity have inhibitied the opportunity to obtain protracted extra-profits and therefore it reduced return chasing attitudes. On the other hand, the existence of such compelling regimes has made real estate equities behave more similarly to private real estate. As a consequence, investors pay less attention to extra performance over and above general equity market returns as they tend to allocate funds to real estate securities within real estate portfolios rather than equity ones. Market efficiency, maturity and stock dispersion all represents important indicators signaling the likelihood of return chasing behavior happening in a market at any given point in time.

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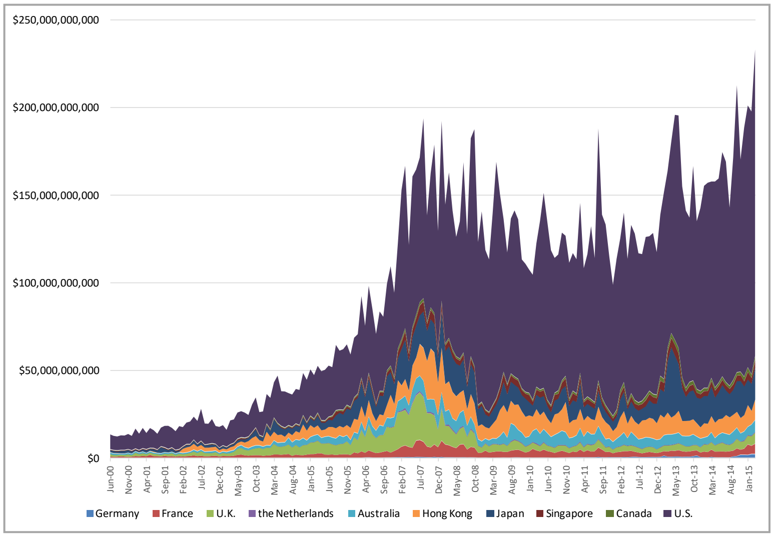
Exhibits

Figure 1: Monthly trading volumes

Panel A: Global trading volumes (in $ value)



Panel B: Average trading volume per company.

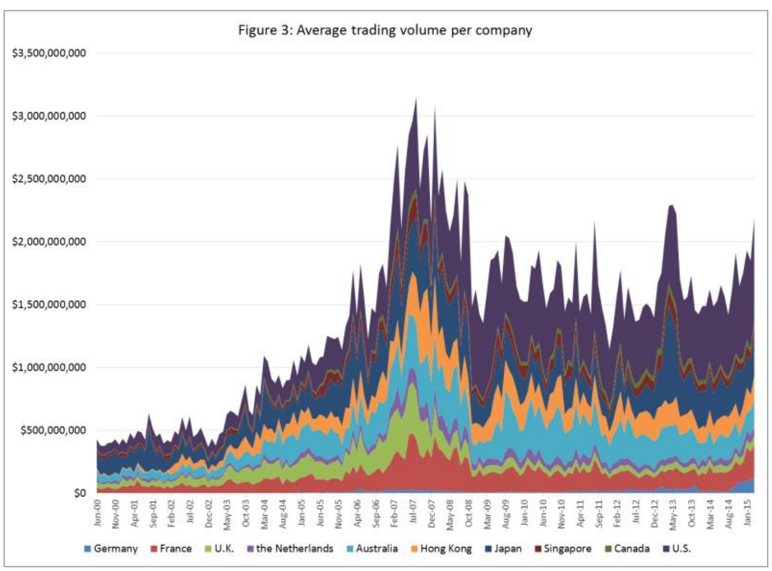
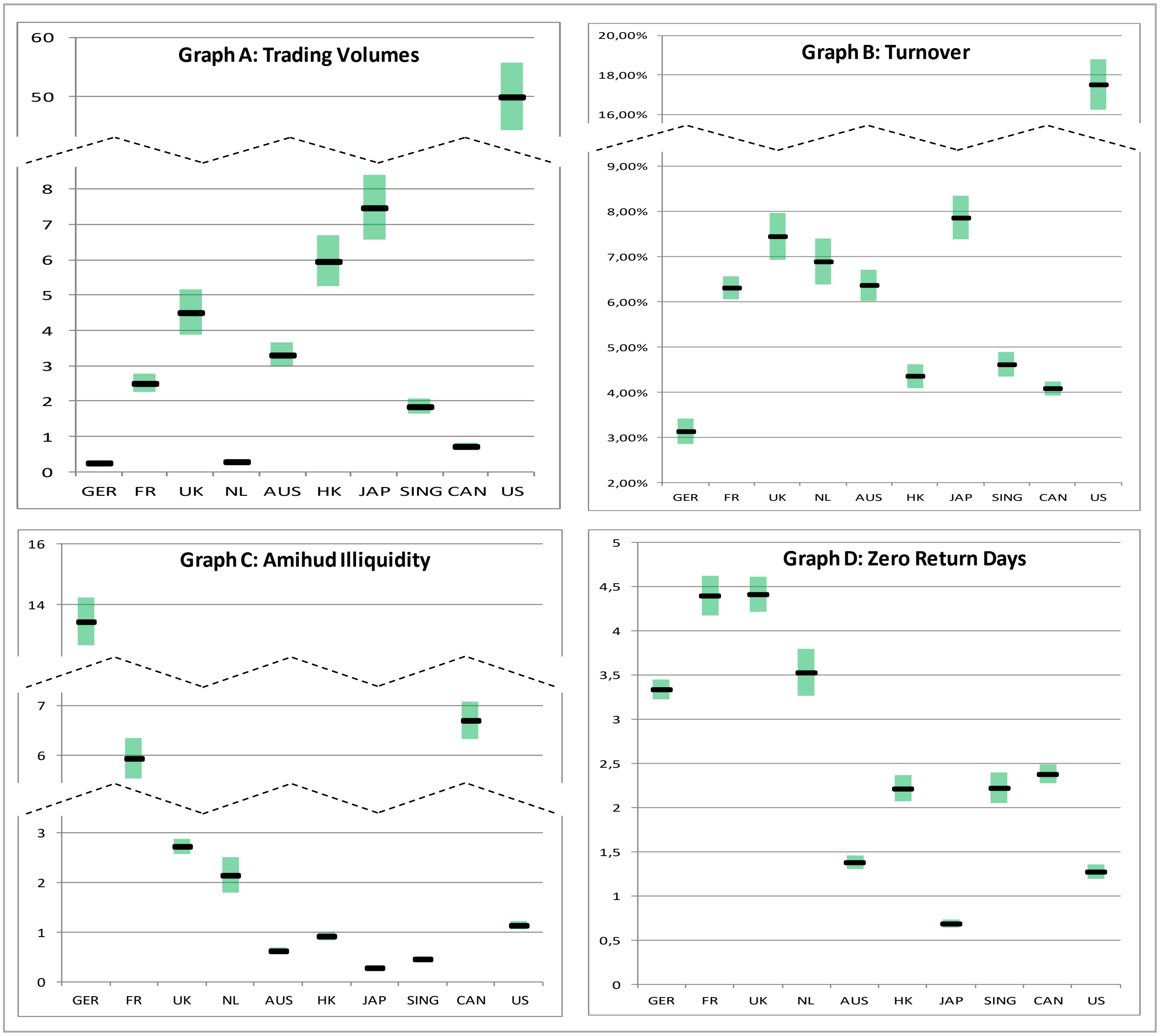


Figure 2: Liquidity measures and confidence intervals.

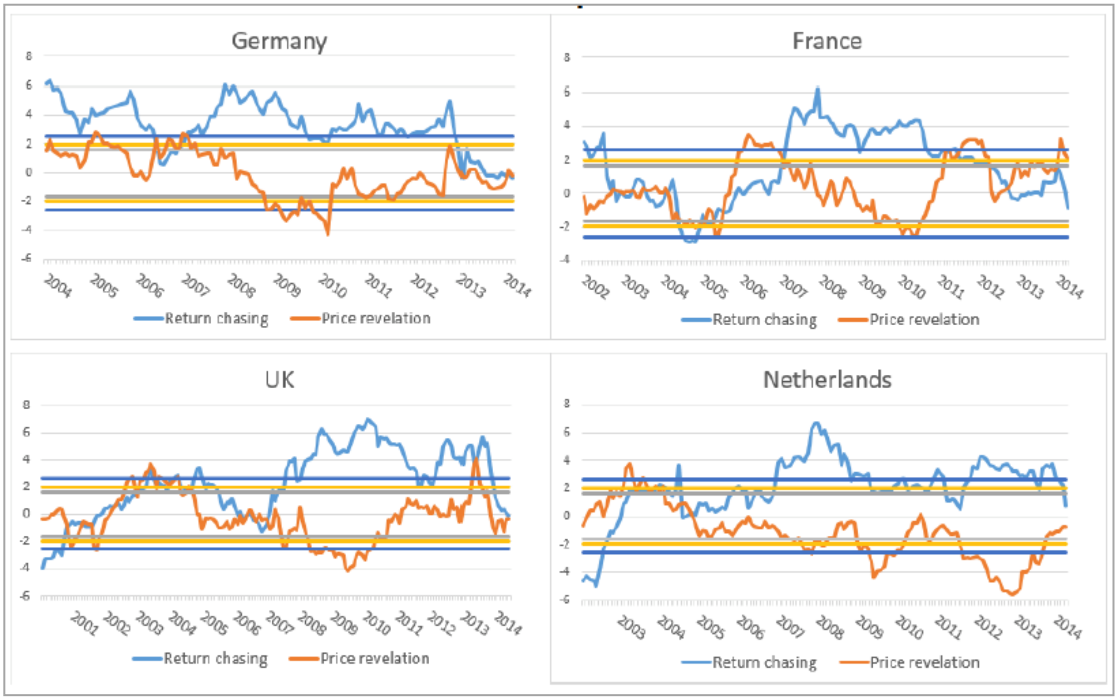


Here the distributions of the four different liquidity measures are plotted. Results are measured over the full sample period. The lines indicate the averages, and the green bars represent the distribution across firms within each market.

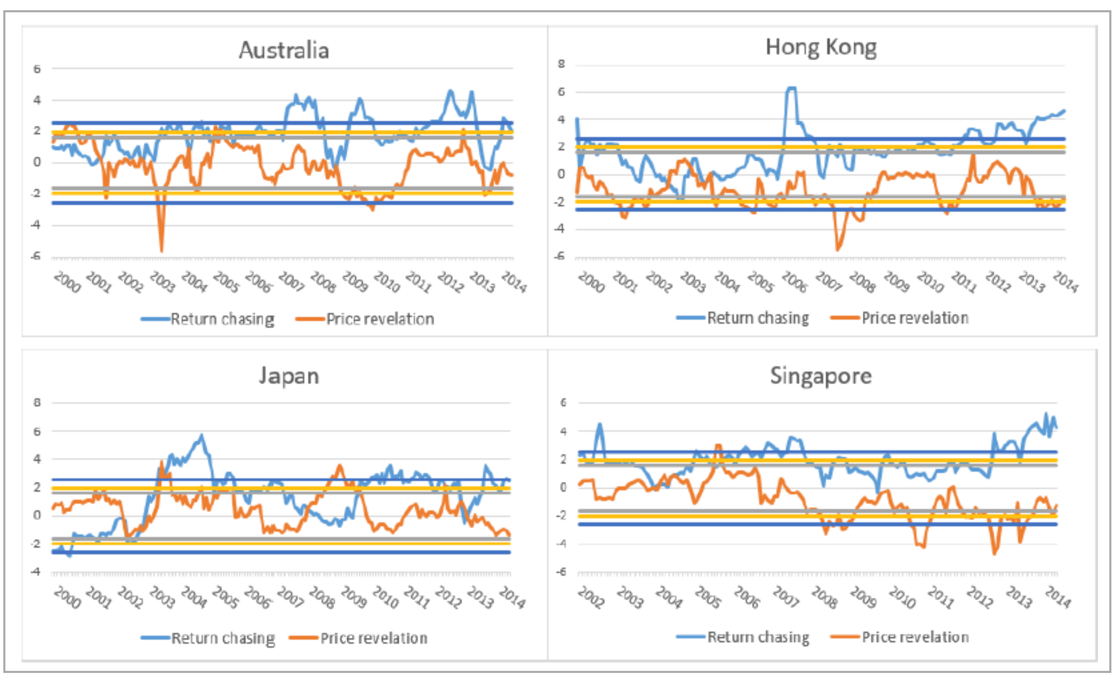
Figure 3: T-statistics of Rolling Estimations

In these figures, we plot the time variance of the t-statistics of the return-chasing (in blue) and price-signaling (in orange) coefficients. These coefficients are estimated over rolling five year periods, and represent the sum of all four lags in the VAR framework.

Panel A: European Markets



Panel B: Asia-Pacific Markets



Panel C: North American Markets

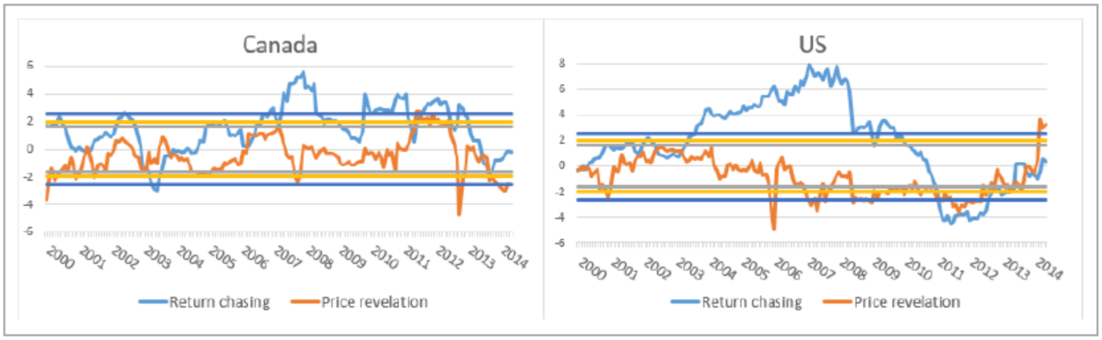


Table 1: Summary statistics

	France	Germany	Netherlands	UK	Australia	Hong Kong	Japan	Singapore	Canada	US
Average										
REIT return (Equally-W)	0.82%	1.06%	0.76%	0.15%	1.01%	1.31%	1.02%	0.96%	1.53%	1.56%
REIT return (Value-W)	0.48%	0.93%	0.63%	0.62%	0.67%	1.02%	0.73%	0.68%	1.07%	0.98%
Liq. Volume (ml)	202	2,334	3,167	255	4,950	60,462	981,381	3,203	1,020	64,250
Liq. Turnover	0.032	0.059	0.083	0.061	0.073	0.042	0.092	0.045	0.040	0.170
Liq. Amihud	13.626	5.696	3.958	2.959	0.551	0.533	0.250	0.410	7.102	1.306
Liq. Zero	3.365	3.941	4.399	3.948	1.314	2.670	0.779	2.707	2.668	0.964
Equity return	0.29%	0.12%	0.33%	0.10%	0.69%	0.50%	0.15%	0.54%	0.41%	0.37%
Interest rate 3m	2.22%	2.22%	3.10%	2.22%	4.83%	1.76%	0.27%	1.19%	2.42%	2.08%
Interest rate 10y	3.28%	3.55%	3.88%	3.46%	5.05%	3.42%	1.22%	2.74%	3.70%	3.65%
GDP growth	-0.03%	-0.10%	0.02%	-0.08%	-0.06%	7.32%	0.02%	2.73%	-0.06%	-0.06%
Inflation (CPI)	1.55%	1.59%	2.23%	2.02%	2.93%	1.55%	0.03%	2.07%	1.98%	2.30%
Term spread	1.06%	1.34%	0.77%	1.24%	0.21%	1.66%	0.94%	1.55%	1.28%	1.56%
Standard Deviation										
REIT return (Equally-W)	8.74%	5.22%	5.13%	5.76%	6.27%	8.77%	6.73%	7.08%	4.77%	6.92%
REIT return (Value-W)	6.00%	5.98%	5.73%	4.95%	5.21%	7.69%	7.55%	7.18%	3.81%	6.45%
Liq. Volume (ml)	319	1,285	2,506	159	2,517	40,047	744,137	2,115	720	42,568
Liq. Turnover	0.022	0.017	0.041	0.027	0.024	0.016	0.033	0.018	0.011	0.110
Liq. Amihud	5.033	2.861	1.141	3.151	0.319	0.265	0.000	0.181	2.174	0.625
Liq. Zero	0.842	1.692	1.765	2.210	0.553	0.940	0.319	1.166	0.600	0.321
Equity market return	6.50%	5.55%	4.36%	6.22%	4.01%	6.32%	5.43%	5.57%	4.65%	4.92%
Interest rate 3m	1.58%	1.58%	2.11%	1.58%	1.32%	1.74%	0.32%	1.01%	1.41%	1.93%
Interest rate 10y	1.27%	1.08%	1.12%	1.20%	0.99%	1.57%	0.40%	0.73%	1.22%	1.11%
GDP growth	1.96%	1.76%	1.37%	1.62%	0.93%	10.01%	1.95%	5.31%	1.38%	1.16%
Inflation (CPI)	0.71%	0.80%	1.08%	0.97%	1.09%	2.87%	1.13%	2.16%	0.95%	1.32%
Term spread	0.85%	0.90%	1.30%	0.87%	0.88%	1.30%	0.41%	0.85%	1.03%	1.32%

In this table, we present the sample averages and their standard deviation for the most important variables in our analysis, separate for each market.

Table 2: VAR and Granger estimations (European markets)

A: Liquidity equation	Germany		France		UK		Netherlands	
Liquidity	vol	turn	vol	turn	vol	turn	vol	turn
lag 1	0.618***	0.635***	0.486***	0.376***	0.623***	0.657***	0.386***	0.449***
lag 2	0.216***	-0.037	0.083	0.052	0.081	0.229*	-0.15	0.053
lag 3	0.038	0.201	-0.058	-0.147	0.179	-0.099	0.424***	0.251*
lag 4	-0.022	-0.055	0.441***	0.375***	0.068	0.124	0.174	0.132
EW market return								
lag 1	0.311	-0.009	0.769***	0.011	0.742***	0.006	0.567**	0.007
lag 2	0.601*	0.012	0.304	-0.005	0.488**	0.043**	0.472*	0.028***
lag 3	0.28	0.011	0.646***	0.012	-0.082	0.001	0.67***	0.022**
lag 4	-0.504	-0.007	0.625***	0.023**	0.354	0.023	0.11	-0.006
Control variables								
Term spread	-22.242*	-0.439	-10.399***	-0.584***	-5.733*	-0.414***	-6.266	-0.502**
10 year interest rate			-5.834**	0.036		-0.053	-6.51**	-0.215
3 month interest rate	-13.495**	-0.106			-2.779			
Equity market return (beta)	0.383	0.003	0.201	-0.01	0.548**	-0.015	0.029	-0.013
GDP growth	7.283***	0.156**	1.592	-0.005	3.763***	0.278***	2.46**	0.112*
Inflation (total CPI)	-23.762**	-0.482	-3.665	0.021	2.716	0.52**	-17.792***	-0.549***
Constant	3.763***	0.021**	1.424	0.025***	1.006	-0.013	4.021***	0.03***
Granger causality test								
$\chi 2$	3.344	2.504	34.928	11.954	16.031	8.394	17.232	13.441
Prob > $\chi 2$	0.125	0.578	0.000***	0.122	0.002***	0.101	0.015**	0.029**

B: Return equation	Germany		France		UK		Netherlands	
Liquidity	vol	turn	vol	turn	vol	turn	vol	turn
lag 1	-0.046	1.919	-0.109**	-2.496***	0.002	-0.658	-0.043	-0.836
lag 2	-0.007	-1.797	0.057	1.212	-0.003	0.982	-0.051	-0.153
lag 3	-0.03	-0.126	0.003	0.08	0.028	-0.742	-0.005	-1.223
lag 4	0.054**	-1.347	0.001	-0.581	-0.057	0.01	0.019	0.236
EW market return								
lag 1	0.342***	0.239*	0.089	0.057	0.121	0.154*	-0.065	-0.087
lag 2	0.196	0.174	0.03	-0.013	-0.118	-0.14	-0.292**	-0.139
lag 3	0.333***	0.236*	-0.092	-0.119	-0.204**	-0.129	0.01	-0.064
lag 4	-0.127	-0.09	0.227***	0.234***	0.171*	0.136	0.194**	0.154*
Control variables								
Term spread	-1.961	0.46	-0.663	0.049	-2.353**	-0.297	-2.468	-1.045
10 year interest rate			0.627	3.379***		-1.161	1.299	1.54
3 month interest rate	-3.469*	-2.195			-1.98***			
Equity market return (beta)	0.42***	0.57***	0.674***	0.755***	0.853***	0.838***	0.325***	0.292***
GDP growth	-0.363	-1.79**	-1.584**	-1.547**	-0.485	-0.46	-0.704	-1.282**
Inflation (total CPI)	6.778**	10.891***	3.887***	4.468***	-1.579	-2.138**	-3.244*	-0.788
Constant	0.572*	-0.044	1.064*	-0.026	0.834***	0.16***	1.707***	0.133
Granger causality test								
$\chi 2$	2.8941	3.294	9.7808	12.891	0.961	3.241	2.363	3.241
Prob > $\chi 2$	0.117	0.452	0.034**	0.052*	0.130	0.189	0.035**	0.087*

The table presents the results of our VAR system with two simultaneous equations modeling aggregate market-level REIT (equally-weighted) returns and liquidity as endogeneous variables. We use quarterly data from December 1995 to March 2015 with four lags and include several exogenous/control variables (listed after the two endogenous variables in each equation). Panels A and B respectively report the estimates of the liquidity and return equations. At the bottom of each Panel, we present the Granger causality test for REIT returns causing liquidity in Panel A (liquidity equation) and for liquidity causing REIT returns in Panel B (return equation). For each European market, we report results using two liquidity measures: volumes (in local currency) in the first column and turnover in the second column.

Table 3: VAR and Granger estimations (Asia-Pacific markets)

A: Liquidity equation	Australia		Hong Kong		Japan		Singapore	
Liquidity	vol	turn	vol	turn	vol	turn	vol	turn
lag 1	0.687***	0.385***	0.913***	0.45***	0.874***	0.568***	0.552***	0.53***
lag 2	-0.033	0.112	-0.193	-0.179	-0.132	0.067	0.061	0.06
lag 3	0.197	0.26**	0.339*	0.28*	0.177	-0.002	0.28**	0.219**
lag 4	0.146	0.17	-0.158	0.157	0.081	0.148	-0.011	-0.048
EW market return								
lag 1	0.258*	-0.007	-0.223	-0.013	0.427*	0.035**	0.316	-0.014
lag 2	0.032	-0.024***	-0.495	0.01	-0.201	-0.003	0.064	-0.02**
lag 3	0.154	-0.019**	-0.505	-0.002	-0.022	-0.005	-0.173	-0.014*
lag 4	0.546***	0.021**	-0.307	-0.015*	-0.061	0.014	-0.245	-0.004
Control variables								
Term spread	-3.565	0.051	-2.362	-0.187	4.813	-0.897	-13.075***	-0.564***
10 year interest rate	5.984**	0.327**	-11.303**	-0.128			-13.66***	-0.355**
3 month interest rate					1.039	1.968**		
Equity market return (beta)	0.724***	0.02	1.424***	0.036***	0.912***	0.025	0.654***	0.002
GDP growth	-2.202*	0.054	2.974	0.022	4.027***	0.171	0.465	0.003
Inflation (total CPI)	-1.153	0.013	-6.619**	-0.151**	-4.293	-0.253	-1.515	-0.128*
Constant	-0.063	-0.014*	3.039*	0.02***	0.027	0.022**	3.301***	0.033***
Granger causality test								
$\chi 2$	22.821	22.572	3.307	3.031	9.246	6.538	2.476	4.329
Prob > $\chi 2$	0.000 ***	0.000***	0.466	0.192	0.188	0.135	0.131	0.081*

B: Return equation	Australia		Hong Kong		Japan		Singapore	
Liquidity	vol	turn	vol	turn	vol	turn	vol	turn
lag 1	0.056	-1.824*	-0.055*	-2.037	0.074	0.797	-0.007	-0.753
lag 2	-0.125	0.931	-0.035	-1.197	-0.031	-0.004	-0.031	0.67
lag 3	0.016	-1.919**	0.104**	3.437**	-0.115*	-0.929	-0.025	-1.14
lag 4	0.033	2.283***	0.007	-1.125	0.05	0.515	0.049	0.955
EW market return								
lag 1	-0.157*	-0.089	-0.237**	-0.17	-0.221**	-0.166	-0.196*	-0.226**
lag 2	-0.154*	-0.095	-0.027	-0.012	-0.427***	-0.423***	0.096	-0.017
lag 3	-0.033	-0.06	-0.116	-0.163	-0.075	-0.132	-0.175*	-0.251***
lag 4	0.06	0.091	-0.231***	-0.157*	0.042	-0.048	0.025	-0.019
Control variables								
Term spread	4.373**	5.315***	0.764	-3.146**	-8.536***	-0.173	-3.135**	-3.188**
10 year interest rate	-1.802	-1.583	-3.004**	-3.138***			-5.573***	-5.976***
3 month interest rate					-5.188	-12.962**		
Equity market return (beta)	0.973***	0.993***	0.757***	0.911***	0.746***	0.725***	0.758***	0.667***
GDP growth	0.43	1.023*	1.137**	-0.677	1.616**	1.476**	0.123	0.696**
Inflation (total CPI)	-1.611*	0.297	-4.504***	-2***	-2.626**	-2.852**	-2.543***	-2.972***
Constant	0.564	0.052	-0.307	0.289***	0.78*	0.06	0.582	0.276***
Granger causality test								
$\chi 2$	2.713	9.122	14.032	7.722	7.345	3.735	1.893	2.106
Prob > $\chi 2$	0.410	0.037**	0.008***	0.087*	0.088*	0.517	0.737	0.697

The table presents the results of our VAR system with two simultaneous equations modeling aggregate market-level REIT (equally-weighted returns and liquidity as endogeneous variables. We use quarterly data from December 1995 to March 2015 with four lags and include several exogenous/control variables (listed after the two endogenous variables in each equation). Panels A and B respectively report the estimates of the liquidity and return equations. At the bottom of each Panel, we present the Granger causality test for REIT returns causing liquidity in Panel A (liquidity equation) and for liquidity causing REIT returns in Panel B (return equation). For each Asia-Pacific market, we report results using two liquidity measures: volumes (in local currency) in the first column and turnover in the second column.

Table 4: VAR estimations (North American markets)

A: Liquidity equation	Canada		USA	
Liquidity	vol	turn	vol	turn
lag 1	0.516***	0.477***	0.495***	0.793***
lag 2	0.253**	0.182	0.068	0.126
lag 3	0.122	0.042	0.27**	-0.158
lag 4	-0.023	-0.095	0.216*	0.065
EW market return				
lag 1	0.849***	0.029***	0.184	-0.096*
lag 2	0.76**	0.008	0.103	0.002
lag 3	-0.203	-0.003	0.352**	0.067
lag 4	0.301	0.022**	0.265*	-0.006
Control variables				
Term spread	-4.056	-0.217**	0.658	-0.703*
10 year interest rate	-11.611***	-0.029	5.816**	-0.177
3 month interest rate				
Equity market return (beta)	0.641***	0.008	0.131	-0.209***
GDP growth	-1.001	-0.091*	2.437**	-0.37
Inflation (total CPI)	5.569*	0.041	3.43**	-0.253
Constant	3.219***	0.02***	-1.596**	0.073***
Granger causality test				
$\chi 2$	30.167	8.001	11.696	7.379
Prob > $\chi 2$	0.000***	0.008***	0.013**	0.105

B: Return equation	Canada		USA	
Liquidity	vol	turn	vol	turn
lag 1	-0.004	-0.584	-0.037	-0.771**
lag 2	-0.005	-0.825	-0.054	0.007
lag 3	-0.001	-0.162	0.072	0.195
lag 4	-0.007	-0.355	0.016	0.022
EW market return				
lag 1	-0.014	0.043	0.097	-0.05
lag 2	0.158	0.165*	-0.069	-0.215*
lag 3	-0.111	-0.026	-0.014	-0.11
lag 4	0.004	0.078	0.001	-0.02
Control variables				
Term spread	3.222***	2.035**	2.244**	1.22
10 year interest rate	-0.998	0.992*	0.636	1.172
3 month interest rate				
Equity market return (beta)	0.56***	0.591***	0.858***	0.897***
GDP growth	0.119	-0.831**	-0.379	-1.729**
Inflation (total CPI)	2.224**	0.587	2.377**	-1.852*
Constant	0.363	0.06	0.001	0.185***
Granger causality test				
$\chi 2$	0.369	1.326	1.673	1.136
Prob > $\chi 2$	0.845	0.255	0.848	0.018***

The table presents the results of our VAR system with two simultaneous equations modeling aggregate market-level REIT (equally-weighted returns and liquidity as endogeneous variables. We use quarterly data from December 1995 to March 2015 with four lags and include several exogenous/control variables (listed after the two endogenous variables in each equation). Panels A and B respectively report the estimates of the liquidity and return equations. At the bottom of each Panel, we present the Granger causality test for REIT returns causing liquidity in Panel A (liquidity equation) and for liquidity causing REIT returns in Panel B (return equation). For each North American market, we report results using two liquidity measures: volumes (in local currency) in the first column and turnover in the second column.

Table 5: Alternative VAR estimations

	Equally-Weighted Prob>chi2	Value-Weighted Prob>chi2	Monthly Prob>chi2	REIT dummy Prob>chi2	Equity endogenous Prob>chi2
Germany					
return chasing	0.125	0.048**	0.037**	0.152	0.105
price signaling	0.117	0.288	0.866	0.177	0.016**
France					
return chasing	0.000***	0.000***	0.000***	0.000***	0.000***
price signaling	0.034**	0.237	0.032**	0.063*	0.053*
United Kingdom					
return chasing	0.002***	0.001***	0.001***	0.006***	0.000***
price signaling	0.130	0.64	0.016**	0.911	0.565
Netherlands					
return chasing	0.015**	0.028**	0.056*		0.031**
price signaling	0.035**	0.002***	0.280		0.046**
Australia					
return chasing	0.000 ***	0.053*	0.001***		0.004***
price signaling	0.410	0.607	0.092*		0.311
Hong Kong					
return chasing	0.466	0.995	0.108	0.102	0.979
price signaling	0.008***	0.056*	0.021**	0.008***	0.000***
Japan					
return chasing	0.188	0.157	0.122	0.186	0.050*
price signaling	0.088*	0.069*	0.019**	0.159	0.080*
Singapore					
return chasing	0.131	0.12	0.093*	0.132	0.250
price signaling	0.737	0.744	0.077*	0.608	0.990
Canada					
return chasing	0.000***	0.001***	0.000***		0.000***
price signaling	0.845	0.284	0.017**		0.812
United States					
return chasing	0.013**	0.031**	0.140		0.068*
price signaling	0.848	0.551	0.767		0.872

The table presents alternative estimations of our VAR system for robustness check. The sample period goes from December 1995 to March 2015 as for the main models and we use the same exogenous/control variables. We estimate models with two simultaneous equations modeling aggregate market-level REIT (equally-weighted returns and liquidity as endogeneous variables. We only report the Chi-squared probability of the Granger causality test to compare results for price signaling and return chasing behavior with our main findings which are taken from Tables 2 to 4 and reported in the first column (*"Equally-Weighted"*). The second column (*"Value-Weighted"*) presents the results of models using value-weighted rather than equally-weighted returns. In the third column (*"Monthly"*) we report estimates obtained with monthly data and 12 lags instead of quarterly data with four lags as in all other models. The model in the fourth column (*"REIT dummy"*) contains a dummy for countries where the REIT regime was introduced during the sample period (exc.. Netherlands, Australia, Canada and the US where the REIT regime was introduced earlier). In the last column (*"Equity endogenous"*) we also include equity market returns as the third endogenous variable to test a more general equilibrium model.

Table 6: Main descriptive statistics for the cross-country analysis of return chasing behavior.

	GER	FR	UK	NL	AU	HK	JP	SG	CA	US
Return chasing										
Average	0.05	-0.11	0.08	0.47	-0.11	0.17	0.12	0.02	0.11	0.22
Standard Deviation	0.17	0.35	0.81	0.42	0.24	0.26	0.51	0.16	0.25	1.36
Minimum	-0.25	-0.96	-1.89	-0.44	-0.76	-0.42	-0.89	-0.30	-0.39	-4.00
Maximum	0.39	0.69	1.48	1.70	0.71	0.84	1.48	0.82	1.00	3.17
Variance ratio										
Average	1.08	1.06	1.10	1.01	0.84	1.12	0.94	1.25	0.97	0.98
Standard Deviation	0.09	0.07	0.19	0.13	0.08	0.10	0.08	0.12	0.11	0.18
Minimum	0.88	0.94	0.83	0.85	0.72	0.89	0.80	1.03	0.79	0.72
Maximum	1.19	1.27	1.37	1.33	1.08	1.36	1.12	1.65	1.30	1.36
Market maturity										
Average	1.02%	2.59%	1.78%	3.10%	7.97%	15.27%	2.89%	14.96%	2.81%	1.97%
Standard Deviation	0.40%	0.94%	0.35%	1.39%	1.44%	2.19%	1.24%	4.43%	0.58%	0.81%
Minimum	0.26%	0.71%	1.02%	1.11%	5.08%	10.98%	0.89%	8.05%	1.00%	0.45%
Maximum	2.44%	4.03%	2.77%	7.18%	11.06%	19.91%	5.46%	22.49%	3.89%	3.64%
Real estate momentum										
Average	-2.58%	4.75%	2.06%	2.57%	-0.45%	1.24%	4.12%	1.29%	3.41%	3.87%
Standard Deviation	11.82%	9.75%	11.57%	10.49%	8.83%	8.88%	11.56%	8.44%	10.04%	10.75%
Minimum	-35.90%	-18.51%	-34.24%	-21.79%	-31.09%	-13.43%	-24.28%	-15.63%	-20.95%	-27.55%
Maximum	23.44%	33.53%	29.03%	31.61%	15.82%	33.88%	31.32%	25.02%	30.88%	33.20%
Closely held shares										
Average	51.32	55.99	15.77	36.69	31.71	57.63	35.00	53.02	19.87	14.69
Standard Deviation	1.06	2.08	2.04	2.98	6.95	1.30	4.20	7.19	4.89	4.41
Minimum	49.59	51.97	12.32	31.97	17.72	55.07	27.17	40.56	14.33	7.69
Maximum	52.27	59.38	17.81	44.75	41.91	59.56	41.96	61.48	29.17	19.04

The table presents the main descriptive statistics (average, standard deviation, minimum and maximum) of return chasing coefficients from our VAR estimations with rolling windows and four main driving factors used in our analysis. Variance ratio represents market inefficiency. Market maturity is proxied by the ratio between the market value of real estate stocks and of the overall equity market. Real estate momentum represents the past (previous 6 months) excess performance of real estate over and above equity markets. Closely held shares proxy the inverse of stock dispersion. The sample period is January 2002 to March 2015 and the data was collected at market level with a monthly frequency.

Table 7: Cross-country analysis of return chasing behavior.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variance Ratio	0.447***	0.454***	0.453***	0.829***	1.196***	0.828***
t-stat	*3.65*	*3.78*	*3.69*	*6.55*	*9.22*	*6.54*
Market Maturity	-2.728***	-2.292***	-2.345***	-2.692***	-2.373***	-2.717***
t-stat	*-3.18*	*-3.38*	*-3.36*	*-3.83*	*-3.32*	*-3.76*
Closely Held RE	0.003	0.002	0.002	0.004**	0.028***	0.004**
t-stat	*1.34*	*1.26*	*1.28*	*2.22*	*8.85*	*2.24*
RE momentum (6m)			0.001	0.137	0.105	-1.328**
t-stat			*0.01*	*0.96*	*0.75*	*-2.56*
REIT dummy				0.569***	1.749***	0.479***
t-stat				*9.32*	*12.57*	*7.01*
REIT * Closely held RE					-0.027***	
t-stat					*-9.37*	
REIT * RE momentum (6m)						1.577***
t-stat						*2.94*
Constant	-0.311*	-0.325**	-0.325**	-1.279***	-2.719***	-1.193***
t-stat	*-1.94*	*-2.13*	*-2.05*	*-6.72*	*-11.01*	*-6.01*
Fixed Effects	Y	N	N	N	N	N
R-squared	0.11	0.10	0.12	0.14	0.19	0.17
F-stat	14.38	30.81	31.17	120.17	215.08	129.95
p-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Hausman	3.18					
p-value	*0.364*					

We estimate a panel data regression with fixed effects (first column) as well as random effects (all other columns) to explain return chasing coefficients (dependent variable) with all measures we included in Table 6. REIT represents a dummy variable with value 1 when the REIT regime was effective in a market at any given point in time. Our estimations use a monthly frequency and a sample period from January 2002 to March 2015.

Appendix

Table A1: VAR and Granger estimations (European markets) – illiq and zero

A: Liquidity equation	Germany		France		UK		Netherlands	
Liquidity	illiq	zero	illiq	zero	illiq	zero	illiq	zero
lag 1	0.411***	0.559***	0.389***	0.276**	0.245**	0.582***	0.561***	0.399***
lag 2	0.153	0.016	0.28**	0.143	0.122	0.173	0.209	0.065
lag 3	-0.113	-0.013	0.338***	0.352***	0.262**	-0.069	-0.363***	0.329**
lag 4	-0.088	0.192	-0.073	0.192	-0.128	0.199*	0.13	0.044
EW market return								
lag 1	-0.535	0.598	-3.032**	-6.107***	-3.541***	-5.179***	-0.044	-2.415
lag 2	-6.137***	-1.883	0.284	-3.62*	-1.3	1.462	1.853	-4.809**
lag 3	-3.355*	-3.515***	-1.399	-1.603	-1.534	-2.689*	0.865	-3.464*
lag 4	1.478	0.54	-0.931	-5.883***	-1.914*	0.161	-3.137**	0.116
Control variables								
Term spread	-63.121*	-23.764	0.988	74.116***	19.653**	-39.648**	-64.459**	-133.571**
10 year interest rate	-104.335***		-16.599	1.17	-10.062		-68.015**	93.34**
3 month interest rate		9.401				-32.149**		
Equity market return (beta)	-6.764***	0.095	-2.618*	-2.373	-4.003***	-1.655	-3.384*	-2.824
GDP growth	-27.939**	-36.169***	10.281	41.075**	3.375	-12.405*	-21.35*	-95.094***
Inflation (total CPI)	-20.938	64.096*	-52.035**	-37.45	-22.775**	38.077**	-22.607	-15.606
Constant	14.38***	2.411	1.561*	-1.03	2.795***	2.918**	5.907***	4.083**
Granger causality test								
$\chi 2$	9.562	14.459	11.696	13.386	8.102	16.046	8.702	4.822
Prob > $\chi 2$	0.048**	0.006***	0.020*	0.011**	0.088*	0.003***	0.069*	0.306

B: Return equation	Germany		France		UK		Netherlands	
Liquidity	illiq	zero	illiq	zero	illiq	zero	illiq	zero
lag 1	-0.011	-0.007	-0.002	0.013**	-0.01	0.005	-0.01	-0.002
lag 2	0.001	0.021	-0.007	-0.002	0.021*	-0.02**	0.006	0.007
lag 3	0.012	-0.002	0.013*	-0.006	-0.009	0	-0.013	0.013***
lag 4	-0.008	0.005	0.008	0.001	0.015	0.012	0.003	-0.019***
EW market return								
lag 1	0.252**	0.279**	0.047	0.089	0.154	0.222**	-0.058	0.03
lag 2	0.16	0.178	-0.056	0.14	-0.081	-0.126	-0.115	-0.038
lag 3	0.223	0.24*	-0.13	-0.104	-0.131	-0.292***	-0.069	-0.034
lag 4	-0.237*	-0.128	0.214***	0.205**	0.209**	0.137	0.143	0.223***
Control variables								
Term spread	4.679*	-1.406	-0.398	0.899	-0.198	-2.496*	3.267*	4.622**
10 year interest rate	-0.611		-0.246	-0.779	-0.578		-0.273	-1.088
3 month interest rate		-1.637				-2.391**		
Equity market return (beta)	0.549***	0.593***	0.664***	0.65***	0.883***	0.929***	0.293**	0.225**
GDP growth	-0.757	-0.868	-1.663**	-1.426	-0.138	-0.449	-0.251	1.077
Inflation (total CPI)	7.833**	8.757**	3.268**	0.466	-2.063**	-1.748	0.958	1.74
Constant	-0.056	-0.23	-0.036	-0.015	0.026	0.214***	-0.009	-0.072
Granger causality test								
$\chi 2$	4.289	2.949	3.197	5.177	5.666	7.731	2.719	31.051
Prob > $\chi 2$	0.368	0.566	0.525	0.271	0.226	0.102	0.606	0.000***

The table presents the results of our VAR system with two simultaneous equations modeling aggregate market-level REIT (equally-weighted returns and liquidity as endogeneous variables. We use quarterly data from December 1995 to March 2015 with four lags and include several exogenous/control variables (listed after the two endogenous variables in each equation). Panels A and B respectively report the estimates of the liquidity and return equations. At the bottom of each Panel, we present the Granger causality test for REIT returns causing liquidity in Panel A (liquidity equation) and for liquidity causing REIT returns in Panel B (return equation). For each European market, we report results using two liquidity measures: Amihud (illiq) in the first column and zero returns in the second column.

Table A2: VAR and Granger estimations (Asia-Pacific markets) – illiq and zero

A: Liquidity equation	Australia		Hong Kong		Japan		Singapore	
Liquidity	illiq	zero	illiq	zero	illiq	zero	illiq	zero
lag 1	0.172	0.444***	0.283**	0.818***	0.212**	0.35***	0.402***	0.67***
lag 2	-0.092	0.115	0.282**	-0.075	0.097	0.323***	0.198	0.062
lag 3	-0.036	0.139	-0.01	0.18	0.089	0.119	-0.138	0.313**
lag 4	0.182	-0.017	0.053	-0.154	0.121	0.179	0.101	-0.185
EW market return								
lag 1	-0.143	0.363	-0.199*	-0.226	0.000	-0.479	-0.515***	-3.444**
lag 2	0.086	-0.586	-0.11	-0.174	0.000	-0.681	0.000	-2.322*
lag 3	-0.188	0.84	-0.368***	0.963	0.000	0.16	-0.015	-1.35
lag 4	-0.247	-0.447	-0.058	-0.02	0.000	-0.888*	-0.294***	-0.477
Control variables								
Term spread	2.727	33.478**	-5.274**	49.143**	-0.001	33.775*	-0.707	-92.741**
10 year interest rate	-4.025	-35.417**					0.362	
3 month interest rate			-2.274*	-6.522	0.019***	-93.443***		-100.784***
Equity market return (beta)	-0.386	-0.556	-0.26*	-1.732	-0.001***	-0.376	-0.396***	1.419
GDP growth	3.441**	-1.506	1.76**	3.316	0.001	-0.471	0.362	8.454**
Inflation (total CPI)	-2.026	-18.458**	-2.923***	4.71	-0.002	-0.097	-0.713	-28.202**
Constant	0.505***	3.714***	0.346**	1.002	0.12***	0.056	0.197**	4.361***
Granger causality test								
$\chi 2$	3.633	3.086	15.273	1.756	5.846	1.942	24.756	2.728
Prob > $\chi 2$	0.458	0.544	0.004***	0.789	0.211	0.746	0.000***	0.604

B: Return equation	Australia		Hong Kong		Japan		Singapore	
Liquidity	illiq	zero	illiq	zero	illiq	zero	illiq	zero
lag 1	0.022	-0.012	-0.014	-0.008	-93.332	0.006	0.216*	-0.001
lag 2	0.036	0.018*	-0.039	-0.004	-153.464	0.012	-0.148	-0.004
lag 3	0.083	-0.008	0.141	0.004	-5.573	0.019	0.111	0.001
lag 4	0.115**	0.011	0.066	0.018*	98.391	-0.026	0.060	0.01
EW market return								
lag 1	-0.192**	-0.108	-0.205**	-0.285***	-0.200*	-0.115	-0.198*	-0.246**
lag 2	-0.203**	-0.09	-0.158	-0.211***	-0.48***	-0.362***	0.045	0.049
lag 3	-0.084	-0.054	-0.039	-0.109	-0.217**	-0.161	-0.299***	-0.270***
lag 4	0.130	0.153**	-0.190*	-0.179**	-0.045	-0.013	0.066	0.002
Control variables								
Term spread	7.022***	6.071***	-1.692	-5.308***	-7.206**	-0.639	-3.434**	-1.397
10 year interest rate	-1.063	-2.089					-5.168***	
3 month interest rate			-1.353	-2.527**	-12.186**	-12.453**		-1.872
Equity market return (beta)	0.843***	0.994***	0.919***	0.865***	0.764***	0.761***	0.667***	0.858***
GDP growth	0.851	0.959*	0.716	-0.906**	0.369	0.348	0.764**	0.305
Inflation (total CPI)	-2.667**	0.431	-2.168**	-1.913***	-3.052**	-1.966	-2.24***	-2.387***
Constant	-0.050	0.002	0.024	0.175*	38.705	0.062	0.128	0.063
Granger causality test								
$\chi 2$	4.609	7.275	4.992	7.511	4.223	2.355	3.501	0.911
Prob > $\chi 2$	0.331	0.122	0.559	0.111	0.337	0.671	0.478	0.923

The table presents the results of our VAR system with two simultaneous equations modeling aggregate market-level REIT (equally-weighted returns and liquidity as endogeneous variables. We use quarterly data from December 1995 to March 2015 with four lags and include several exogenous/control variables (listed after the two endogenous variables in each equation). Panels A and B respectively report the estimates of the liquidity and return equations. At the bottom of each Panel, we present the Granger causality test for REIT returns causing liquidity in Panel A (liquidity equation) and for liquidity causing REIT returns in Panel B (return equation). For each Asia-Pacific market, we report results using two liquidity measures: Amihud (illiq) in the first column and zero returns in the second column.

Table A3: VAR estimations (North American markets) – illiq and zero

A: Liquidity equation	Canada		USA	
Liquidity	illiq	zero	illiq	zero
lag 1	0.738***	0.708***	0.777***	0.875***
lag 2	-0.042	-0.059	-0.081	-0.045
lag 3	0.307**	0.321**	0.157	-0.014
lag 4	-0.073	-0.05	0.051	0.11
EW market return				
lag 1	-2.272*	-3.329***	0.04	-1.235***
lag 2	-2.522*	-3.027**	-0.12	-0.193
lag 3	-1.987*	-1.063	0.005	-0.432
lag 4	-3.237***	-1.02	0.096	-0.427
Control variables				
Term spread	17.188	19.475*	-6.808**	-0.118
10 year interest rate	22.34***	11.393		2.099
3 month interest rate			-2.267	
Equity market return (beta)	-2.049**	-1.568	0.004	0.932*
GDP growth	18.95***	13.198**	-3.709**	-0.5
Inflation (total CPI)	-45.528***	-31.615*	3.001	-6.111
Constant	-0.092	0.428	0.362**	0.337
Granger causality test				
$\chi 2$	15.537	13.811	4.121	8.329
Prob > $\chi 2$	0.004***	0.008***	0.391	0.081*

B: Return equation	Canada		USA	
Liquidity	illiq	zero	illiq	zero
lag 1	-0.006	0.009	0.086	0.007
lag 2	0.011	0.002	-0.016	-0.011
lag 3	-0.004	0.005	-0.137*	0.004
lag 4	0.007	-0.009	0.002	0.008
EW market return				
lag 1	0.008	0.048	0.144	0.118
lag 2	0.122	0.161	-0.004	-0.07
lag 3	-0.067	-0.028	0.033	-0.027
lag 4	0.041	0.1	0.045	-0.006
Control variables				
Term spread	1.831**	1.933**	-0.452	2.258**
10 year interest rate	1.006*	0.758		0.039
3 month interest rate			-1.863	
Equity market return (beta)	0.576***	0.568***	0.825***	0.831***
GDP growth	-0.521	-0.832**	-0.767	-0.596
Inflation (total CPI)	-0.159	1.036	-0.91	2.313*
Constant	-0.057*	-0.066*	0.199**	-0.063
Granger causality test				
$\chi 2$	2.181	2.051	7.207	0.658
Prob > $\chi 2$	0.703	0.726	0.125	0.956

The table presents the results of our VAR system with two simultaneous equations modeling aggregate market-level REIT (equally-weighted returns and liquidity as endogeneous variables. We use quarterly data from December 1995 to March 2015 with four lags and include several exogenous/control variables (listed after the two endogenous variables in each equation). Panels A and B respectively report the estimates of the liquidity and return equations. At the bottom of each Panel, we present the Granger causality test for REIT returns causing liquidity in Panel A (liquidity equation) and for liquidity causing REIT returns in Panel B (return equation). For each North American market, we report results using two liquidity measures: Amihud (illiq) in the first column and zero returns in the second column.