Institutional Property Type Herding in Real Estate Investment Trusts

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Abstract

This study examines whether institutional investors exhibit herding behavior by property type in real estate investment trusts (REITs). Our analysis of changes in institutional portfolio holdings indicates strong evidence of this behavior. Most of the autocorrelation in aggregate institutional demand is attributed to institutional investors following the trades of others. Although momentum trading explains a small amount of this herding, institutional property type demand is more strongly associated with lagged demand than lagged returns. The results suggest that correlated information signals drive herding in REITs. This herding occurs at the property type level, and not at the individual firm level.

Keywords: REITs, property types, herding behavior

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1 Introduction

This study examines herding by institutional investors in real estate investment trusts (REITs). Herding is usually interpreted as the tendency of investors to behave in a similar or coordinated manner. It may arise due to investors reacting to common information, reputational concerns by portfolio managers, or positive feedback trading. From a behavioral perspective, researchers attribute herding to the collective irrationality of investors, which can result in the mispricing of economic fundamentals (Shiller, 2005). Within the context of asset pricing, mispricing due to herding can cause price momentum and excess volatility (Nofsinger and Sias, 1999).

Herding in REITs is of interest for three main reasons. First, institutional investment in REITs has increased dramatically since the early 1990s, which is often referred to as the "modern" REIT era. This increase was facilitated by the Revenue Reconciliation Act of 1993, which made it easier for institutions to make significant investments in REITs. The increased presence of institutions and the associated increase in investment companies (including real estate mutual funds) that specialize in REITs may have elevated reputational concerns by portfolio managers. It may have also increased information production by analysts, and thus increased the ability of investors to react similarly.

Second, REITs have unique characteristics regarding income sources and dividend distributions, and exhibit return behavior that is different from that observed in equities in the broader stock market (Anderson, Boney, and Guirguis (2012), Zhou and Anderson (2012)). As a result, the evidence on herding in the general equity markets may not apply to REITs. From an investment perspective, understanding when and how herding in REITs occurs may help identify profitable investment opportunities. In addition, researchers have found evidence of momentum in REIT trading, which may be driven by herding. Ling and Naranjo (2003) report a positive association between REIT equity flows (i.e., the purchase of REIT shares during seasoned equity offerings) and prior returns, suggesting that REIT investors may follow momentum strategies. However, this behavior is limited to the pre-1993 time period. They note that, since 1993 returns do not affect flows, but flows affect subsequent REIT returns. In a related study (Ling and Naranjo (2006)), the authors examine REIT mutual funds, and find that fund flows are positively related to past returns, suggesting that REIT mutual fund investors may engage in momentum trading strategies.

Third, the existing literature on herding in REITs is sparse. To the best of our knowledge, the only two published studies on the topic are Zhou and Anderson (2013) and Ro and Gallimore (2014). Zhou and Anderson (2013) use the return-based approach of Chang, Cheng, and Khorana (2000) to examine the phenomenon at the market-wide level. The authors find evidence of herding in REITs, and that it is more likely to occur in declining markets than in rising markets. In addition, they find that REIT investors are more likely to herd in periods of high market volatility. They suggest that the structural developments in the REIT market have made “investors more responsive to market sentiment.” Their results document *when* herding in REITs is likely to occur. Our research complements theirs, in that the focus of our study is on institutional portfolio holdings, to provide insights as to *how* herding in REITs takes place.

Ro and Gallimore (2014) use the herding measure developed by Lakonishok, Shleifer, and Vishny (1992) to analyze trading by 159 real estate mutual funds (REMFs). They find evidence of herding in REITs, albeit at a lower level than for other stocks. The implication of this finding is that REITs appear to be relatively more transparent than other firms. In addition, the authors note that fund performance is inversely related to fund herding. They also find that herding in REITs is consistent with a disposition effect, in which portfolio managers tend to sell stocks that have posted gains, while continuing to hold stocks that have posted losses. These results are suggestive of herding, but focusing on REMFs may not fully capture the extent to which institutional herding occurs and impacts REIT returns. In our sample, we use a larger and broader segment of investors, including banks, pension funds, mutual funds, and insurance companies: on average, 1,697 institutions are trading in a given quarter.

Our examination of herding behavior in REITs is at the property-type level. Other studies provide evidence that REIT fundamentals differ across property types. Gyourko and Nelling (1996) document that the systematic risk of equity REITs varies by property type, which may cause investors to move in and out of property types based on their anticipation of future market conditions. Patterson (2009) analyzes reactions of REIT returns to changes in economic risk factors, and finds substantial differences across property types. Chiang (2010) notes that increased institutional investment in REITs has resulted in information transfers that have increased the correlation of firm-level prices and property-type common information. Based on the existing evidence, we expect that if herding in REITs does exist, it is likely to occur at the property-type level. We believe that our analysis aligns well with the market-wide focus of Zhou and Anderson (2013) and the focus of Ro and Gallimore (2014) on individual REITs.

We find significant evidence of herding in REIT property types by institutional investors. We measure buying demand for each property type in each quarter. Demand is strongly and positively correlated over consecutive quarters, and approximately 75% of this correlation is due to institutional investors following the lagged trades of others. Although institutional investors tend to follow their own lagged trades into the same stocks, they are more likely to follow lagged trades of other institutions in *different* stocks in the same property type. This suggests that herding behavior among REIT investors appears to be at the property-type level, rather than at the individual stock level.

We use portfolio holdings and the approach of Choi and Sias (2009) to examine institutional property-type herding in REITs. In contrast to the return-based approach, the holdings-based measure directly estimates the degree of correlated trading in demand. This measure decomposes the autocorrelation in demand into a component due to institutional investors following their own trades, and another component arising from institutional investors following the trades of others.

We find that REIT investors are positive-feedback traders, but momentum trading is not the primary source of property-type herding. On a related note, we find that property-type momentum strategies are not profitable. We also examine returns around changes in demand and find no evidence of return reversals, which suggests that correlated information signals are likely to drive herding in REITs.

We use the NCREIF Transaction Based Index (TBI) to measure the extent to which price effects of herding in REIT property types are reflected in the private real estate market. We find that the change in institutional demand appears to convey information to market participants. However, this information is reflected in prices quickly in public real estate markets, while it persists for longer periods in private markets.

The remainder of this paper is organized as follows. The data and methodology are discussed in the next section. We document the results of tests for institutional property type herding in Section 3. A summary is presented in the final section.

2 Data and Methodology

We obtain data for this study from three resources. Data on prices and returns for equity REITs come from the Center for Research in Securities Prices (CRSP). REIT property type classifications come from NAREIT. All institutional investors with at least \$100 million under management are required to report to the Securities and Exchange Commission their equity positions greater than either 10,000 shares or \$200,000 in market value. We obtain quarterly changes in holdings of institutional investors for each REIT from the 13(f) report database maintained by Thomson Financial. Our sample consists of all institutional holdings reported during the period of the first quarter of 1993 through the last quarter of 2011 (a total of 76 quarters). This particular time period is specifically chosen to capture the impact of the Revenue Reconciliation Act of 1993 that has driven the potential to change the investment clientele within REITs. By establishing a "look-through" provision, this act has made investments in REITs more attractive to institutional investors. Chan, Leung, and Wang (1998) report that institutional ownership in REITs ranges from 12% to 14% between 1986 and 1992 and has increased to 17% in 1993, 26% in 1994, and 30% in 1995. In light of the increase in institutional ownership in real estate equity immediately after such tax legislation, examining investors behavior across different REIT property types during this time period is particularly interesting.

We classify managers as buyers or sellers in property type k in quarter t based on the product of prices at the beginning of the quarter and change in holdings held by a manager n at the end of the quarter. A manager n is considered a buyer in the REIT property type k if:

$$\sum_{i=1}^{I_{k,t}} P_{i,t-1}(Holdings_{n,i,t} - Holdings_{n,i,t-1}) > 0 \tag{1}$$

where $I_{k,t}$ is the number of securities in the REIT property type k in quarter t, $P_{i,t-1}$ is the price of the REIT security at the beginning of quarter t, and $Holdings_{n,i,t-1}$ and $Holdings_{n,i,t}$ are the number of shares of the REIT security i held by an institutional investor n at the beginning and end of quarter t. Similarly, an institutional investor is defined as a seller in the REIT property type k in quarter t if the term on the left side of Equation (1) is negative. We further define institutional property type demand ($\Delta_{k,t}$) as the number of institutional investors buying the REIT property type k in quarter t as a fraction of the total number of institutional traders in property type k in quarter t:

$$\Delta_{k,t} = \frac{\#buyers\ of\ property\ type\ k\ in\ quarter\ t}{\#buyers\ of\ property\ type\ k\ in\ quarter\ t + \#\ sellers\ of\ property\ type\ k\ in\ quarter\ t} \tag{2}$$

Table 1 reports the descriptive statistics of our sample. On average, 1697 institutional investors trade individual REITs each quarter (varying from 844 to 2899) over the chosen time period. The average institutional property type demand is 50.17% with a very small standard deviation of 1.43%, indicating that, on average, the number of buyers does not substantially differ from the number of sellers in the market for REITs. Panel B reports that, on average, the property type constitutes about 14% of the total REIT market capitalization, and the largest company in the property type accounts for about 28% of the property type capitalization. Panel C illustrates time-series summary statistics for all seven REIT property types, including the average number of companies in the REIT property type, the property type's market capitalization weight, the mean, and standard deviation of institutional property type demand. Panel C also shows the total number of firms in a property type (varying from a minimum of 19 in Healthcare to a maximum of 64 in Retail).

3 Institutional herding tests

3.1 Correlation between current and lag property type demand

Our tests for institutional herding are based on Choi and Sias (2009). They suggest that the herding behavior of institutional investors can be inferred from the cross-sectional correlation between investors' demand for securities in a given industry in quarter t and quarter $t-1$. Using 49 Fama and French industries over the period of 1983 to 2005, they find strong evidence of institutional industry herding. We follow their approach, using REIT property types instead of industries. We partition the correlation between REIT property type demand this quarter and last quarter as follows (see Choi and Sias (2009) for proof):

$$\begin{aligned} &\rho(\Delta_{k,t}, \Delta_{k,t-1}) \\ &= \frac{1}{(K-1)\sigma(\Delta_{k,t})\sigma(\Delta_{k,t-1})} \sum_{k=1}^{K} \sum_{n=1}^{N_{k,t}} (\frac{D_{n,k,t} - \overline{\Delta_{k,t}}}{N_{k,t}})(\frac{D_{n,k,t-1} - \overline{\Delta_{k,t-1}}}{N_{k,t-1}}) + \\ &\frac{1}{(K-1)\sigma(\Delta_{k,t})\sigma(\Delta_{k,t-1})} \sum_{k=1}^{K} \sum_{n=1}^{N_{k,t}} \sum_{m=1,m\neq n}^{N_{k,t-1}} (\frac{D_{n,k,t} - \overline{\Delta_{k,t}}}{N_{k,t}})(\frac{D_{m,k,t-1} - \overline{\Delta_{k,t-1}}}{N_{k,t-1}}) \end{aligned} \quad (3)$$

where K is the number of REIT property types (seven), $\underline{N_{k,t}}$ is the number of institutions trading property type k in quarter t, $\sigma(\Delta_{k,t})$ and $\overline{\Delta_{k,t}}$ are the cross-sectional standard deviation and average institutional demand in quarter t, respectively, $D_{n,k,t}$ equals one if institution n purchases the REIT property type k in quarter t and zero if institution n sells the REIT property type i in quarter t. In Eq. (3), the cross-sectional correlation between institutional investors' property type demand this quarter and last quarter is partitioned into two components: the first term is a portion of the correlation that arises from institutional investors following *their own* lagged demand for property type k and the second component arises from institutional investors following *other institutional investors'* lagged demand for property type k.

There are several reasons why a positive correlation between institutional REIT property type demand this quarter and last quarter may be detected. For instance, a positive correlation may originate when one institutional investor purchases (sells), say, Retail REITs in both quarter t and quarter $t-1$. Furthermore, a positive correlation may also arise when one institutional investor buys (sells) Retail REITs this quarter, and other institutional investors purchased (sold) them last quarter. Panel A of Table 2 reports the time-series average cross-sectional correlation coefficient between institutional REIT property type demand this quarter and last quarter. The average correlation coefficient of 0.5359, statistically significant at the 1% level, indicates that there is a strong correlation between institutional REIT property type demand in quarter t and quarter $t-1$. The second and third columns of Panel A in Table 2 indicate the portion of the correlation coefficient attributed to institutional investors following their own REIT property type demand (0.1337) and the portion of the correlation coefficient attributed to institutional investors following other institutions' lagged REIT property type demand (0.4022) from Eq. (3). Both partitioned correlation coefficients are statistically significant at the 1% level, based on t-statistics calculated using Newey-West standard errors from the time-series of regression coefficient estimates. The partitioned regression coefficient that arises from institutional investors following their own lagged demand constitutes about 25% of the total correlation, and the partitioned correlation coefficient attributed to institutional investors following lagged demand of other institutional investors constitutes other 75% of the total correlation, providing support for REIT property type herding behavior.

We further explore what types of REITs tend to drive the second portion of the correlation in Eq. (3). We examine the partitioned coefficient in the third column of Panel A by property type, and report the results in Panel B of Table 2. Institutions do not exhibit herding in Diversified REITs. This is not surprising, since Diversified REITs consist of holdings across multiple property types, and any information about a specific property type is likely to be less pronounced. The strongest herding effects occur in the property types of Office and Industrial, Healthcare, and Lodging and Resorts. We observe a weaker effect for Retail REITs. Since Gyourko and Nelling (1996) find that systematic risk varies by property type and is the highest for Retail REITs, it may be the case that institutions find the trades of others less informative in this property type. Ro and Gallimore (2014) also find a lower level of herding in Retail REITs compared to other property types.

3.2 REIT individual stock herding vs. REIT property type herding

As reported in Panel B of Table 1, on average, the largest firm in a property type accounts for about 28% of the total property type capitalization, ranging from a minimum of 15.93% to a maximum of 98.75% (such a maximum is attributed to Lodging/Resorts with a few companies in the beginning of the 1990's, when Lodging/Resorts was in its early stages as a REIT property type). Given such descriptive statistics, it is plausible that institutional herding occurs in individual stocks, and not at the broader property type level. To explore this issue in more detail, we use an alternative measure to detect institutional REIT property type herding, defining the property type demand as the weighted average demand for stocks in each REIT property type. Specifically, the institutional demand for each REIT security i in quarter t is defined as the ratio of the number of institutional investors increasing their positions in stock i to the total number of the REIT stock i traders:

$$\Delta_{i,t} = \frac{\#of\ buyers\ of\ stock\ i\ in\ quarter\ t}{\#\ of\ buyers\ of\ stock\ i\ in\ quarter\ t{+}\#\ of\ sellers\ of\ stock\ i\ in\ quarter\ t} \tag{4}$$

The weighted institutional demand is, therefore, defined as the capitalization-weighted demand across stocks in property type k:

$$\Delta^*_{k,t} = \sum_{i=1}^{I_{k,t}} \omega_{i,t}\Delta_{i,t} \tag{5}$$

where $\omega_{i,t}$ is stock $i's$ market capitalization weight in REIT property type k at the end of quarter t.

The weighted cross-sectional correlation between weighted institutional demand in quarter t and quarter $t-1$ is then partitioned in the following four components (see Choi and Sias (2009) for proof):

$$
\begin{aligned}
&\rho(\Delta^*_{k,t}, \Delta^*_{k,t-1}) = \\
&\frac{1}{(K-1)\sigma(\Delta^*_{k,t})\sigma(\Delta^*_{k,t-1})} \sum_{k=1}^{K} \left(\sum_{i=1}^{I_{k,t}} \left(\omega_{i,t}\omega_{i,t-1} \left(\sum_{n=1}^{N_{i,t}} \left(\frac{D_{n,i,t} - \overline{\Delta^*_{k,t}}}{N_{i,t}} \bullet \right.\right.\right.\right. \\
&\left.\left.\left.\left. \frac{D_{n,i,t-1} - \overline{\Delta^*_{k,t-1}}}{N_{i,t-1}} \right)\right)\right)\right) + \frac{1}{(K-1)\sigma(\Delta^*_{k,t})\sigma(\Delta^*_{k,t-1})} \times \\
&\quad \times \sum_{k=1}^{K} \left(\sum_{n=i}^{I_{k,t}} \left(\omega_{i,t}\omega_{i,t-1} \left(\sum_{n=1}^{N_{i,t}} \sum_{m=1,m\neq n}^{N_{i,t-1}} \frac{D_{n,i,t} - \overline{\Delta^*_{k,t}}}{N_{i,t}} \bullet \frac{D_{m,i,t-1} - \overline{\Delta^*_{k,t-1}}}{N_{i,t-1}} \right)\right)\right) \\
&\quad + \frac{1}{(K-1)\sigma(\Delta^*_{k,t})\sigma(\Delta^*_{k,t-1})} \sum_{k=1}^{K} \left(\sum_{i=1}^{I_{k,t}} \sum_{j=1,j\neq i}^{I_{k,t-1}} \left(\omega_{i,t}\omega_{j,t-1} \left(\sum_{n=1}^{N_{i,t}} \right.\right.\right. \\
&\left.\left.\left. \frac{D_{n,i,t} - \overline{\Delta^*_{k,t}}}{N_{i,t}} \bullet \frac{D_{n,j,t-1} - \overline{\Delta^*_{k,t-1}}}{N_{j,t-1}} \right)\right)\right) + \frac{1}{(K-1)\sigma(\Delta^*_{k,t})\sigma(\Delta^*_{k,t-1})} \times \\
&\quad \times \sum_{k=1}^{K} \left(\sum_{i=1}^{I_{k,t}} \sum_{j=1,j\neq i}^{I_{k,t-1}} \left(\omega_{i,t}\omega_{j,t-1} \left(\sum_{n=1}^{N_{i,t}} \sum_{m=1,m\neq n}^{N_{j,t-1}} \frac{D_{n,i,t} - \overline{\Delta^*_{k,t}}}{N_{i,t}} \bullet \right.\right.\right. \\
&\left.\left.\left. \frac{D_{m,j,t-1} - \overline{\Delta^*_{k,t-1}}}{N_{j,t-1}} \right)\right)\right)
\end{aligned} \tag{6}
$$

where $N_{i,t}$ is the number of institutional investors trading the REIT stock i in quarter t and $D_{n,i,t}$ is a dummy variable that equals one if an institution purchases security i in quarter t and zero if an institution sells security i in quarter t. The first addendum of Eq. (6) is the component of the correlation coefficient attributed to institutional investors following *their own* trades in the *same* REIT security. The second addendum of Eq. (6) is the portion of the correlation coefficient that originates from institutional investors following *other* institutional investors into the *same* REIT stock. The third term is the portion of the correlation coefficient that arises from institutional investors following *their own* trades into *different* securities within the same REIT property type, and the last addendum of Eq. (6) is the component of the weighted correlation coefficient attributed to institutional investors following *others* into *different* REIT securities within the same property type.

Table 3 reports the partitioned correlation coefficients and their associated Newey-West t-statistics. The cross-sectional correlation between weighted institutional demand this quarter and last quarter averages 0.7896. Our decomposition of this correlation indicates that the largest component (0.6846) is due to investors following the lagged trades of others into *different* stocks in the same property type. In addition, we find that institutions do not follow others into the same stock (the partitioned correlation is 0.0216 and insignificant). These results suggest that herding behavior among REIT investors is more likely to occur at the property type level than at the individual stock level.

3.3 Alternative herding measure

Many existing studies of herding behavior among institutional investors employ a herding measure developed by Lakonishok, Shleifer, and Vishny (LSV) (1992). This measure, which was also used by Ro and Gallimore (2014), is designed to capture the disproportionate number of buyers and sellers of a given stock in a given quarter. The basic intuition behind the LSV herding measure is illustrated in the following example. Assuming that in a given quarter, aggregated across the population of investors and securities, 50% of the changes in shares are positive and 50% of the changes in shares are negative. If it happens that 50% of investors are buyers and 50% of investors are sellers, the LSV herding measure would indicate that there is no herding observed in the market. On the other hand, assume that for many securities, 70% of investors increase their holdings and the rest, 30% of investors, decrease their holdings. In this situation, more investors appear to be on one side of the market than on the other side of the market, and the measure would signal of herding behavior observed among investors.

To gain additional insights about institutional herding in REITs, we use this measure to evaluate the average herding across every REIT property type every quarter. The herding measure is defined as:

$$H_{k,t} = \mid \Delta_{k,t} - P_{k,t} \mid - AF_{k,t} \tag{7}$$

where $\Delta_{k,t}$ is the fraction of the number of managers buying property type k to the total number of active traders in property type k in quarter t, $P_{k,t}$ is defined as the expected proportion of institutions buying property type k in quarter t relative to the number of active traders (the cross-sectional average $\overline{\Delta_{k,t}}$), and $AF_{k,t}$ is the adjustment factor. The adjustment factor is the expected value of $\mid \Delta_{k,t} - P_{k,t} \mid$ and accounts for the fact that the absolute value of $(\Delta_{k,t} - P_{k,t})$ is positive under the null hypothesis of no herding. The adjustment factor, $AF_{k,t}$, is calculated based on the assumption that the number of investors in property type k in quarter t follows a binomial distribution with the probability of success, the probability of buying, equal to $P_{k,t}$.

In our analysis of herding behavior across REIT property types, the LSV herding measure averages 0.64% for 525 property-type-quarter observations (75 quarters $\times$ 7 property types) and is statistically different from zero (t-statistic is 2.69). The magnitude of the LSV measure we find for REITs is lower than that found by Ro and Gallimore (2014). This suggests that herding in REITs across a broad range of institutional investors occurs to a lesser extent than it does within real estate mutual funds. The basic interpretation of our result is that given the average institutional property type demand of 50.17% (as reported in Table 1), in any randomly selected property-type-quarter, we would expect 50.81% (50.17%+0.64%) of traders on one side of the market (buying or selling), and 49.19% of traders on the other. In summary, both the Choi and Sias (2009) and Lakonishok, Shleifer, and Vishny (1992) measures reveal evidence of property type herding by institutional investors in REITs.

3.4 Herding and reputation

Research on herding behavior suggests that institutions may be motivated to herd for reputational purposes. For instance, Sias (2004) proposes that if institutions herd due to reputational motives, they should be more likely to follow institutions of the same type, rather than institutions of a different type (e.g., banks will tend to follow the trades of other banks, instead of insurance companies). Moreover, since different types of institutions may operate under different aspects of regulatory pressure, have differences in financial or other constraints, or be more sensitive to the influence of their competitive environment, there is a reason to expect different degrees of herding across various types of institutional investors. For example, changes in a mutual fund's reputation would most likely be reflected in their net flows. Alternatively, changes in the reputational aspect of insurance companies may affect their net flows to a lesser extent. Therefore, since the functionality of investment companies, as well as financial advisors, is more prone to reputational factors than it is for other institutional investor types, one would expect the tendency of herding to be more pronounced among investment companies and financial advisors than among others.

Thomson Financial assigns all institutional investors into five major classifications: advisors, banks, insurance companies, investment companies, and other (pension funds, endowments, etc). We follow Choi and Sias (2009) to measure each investor type's propensity to herd in two ways: 1) as their average contribution from following institutions of a similar type and 2) their average contribution from following institutions of a different type. For example, each quarter, the average same-type herding contribution for banks is defined as following:

$$Same-type_t^{Banks} = \frac{1}{7}\sum_{k=1}^{7}\left(\sum_{b=1}^{B_{k,t}}\sum_{m=1,m\neq b,m\in B}^{B^*_{k,t-1}}\frac{(D_{b,k,t}-\overline{\Delta_{k,t}})(D_{m,k,t-1}-\overline{\Delta_{k,t-1}})}{B_{k,t}B^*_{k,t-1}}\right) \quad (8)$$

where $B_{k,t}$ is the number of banks trading property type k in quarter t and $B^*_{k,t}$ is the number of different banks trading property type k in quarter $t-1$. Similarly, the average different-type herding contribution for banks is the following:

$$Different-type_t^{Banks} = \frac{1}{7}\sum_{k=1}^{7}\left(\sum_{b=1}^{B_{k,t}}\sum_{m=1,m\notin B}^{N_{k,t-1}-B_{k,t-1}}\frac{(D_{b,k,t}-\overline{\Delta_{k,t}})(D_{m,k,t-1}-\overline{\Delta_{k,t-1}})}{B_{k,t}(N_{k,t-1}-B_{k,t-1})}\right) \quad (9)$$

where $N_{k,t-1}-B_{k,t-1}$ is the number of non-banks trading property type k in quarter $t-1$. Average same-type and different-type herding contributions are computed for each of the five institutional investor types. Using Equation (3), we compute the average contribution from following their own lagged trades for each investor type and the average contribution from following other investors' trades across all other trader types.

Table 4 reports the results of the herding tests by investor type. The first column reports the average contribution from investors following their own trades, and the second column shows the average contribution from following other institutional investors' trades into and out of property types. All contribution coefficients in both columns are positive and statistically significant at the 1% level for each investor type, except for investment companies' contribution from following others. The third column reports the average contribution from following similarly classified investors, and the fourth column documents the average contribution from following differently classified investors. Investment advisors tend to follow lagged trades of other institutional investors, regardless of their classification types. Banks tend to follow other banks. In contrast, insurance companies follow the lagged trades of differently classified investors. Investment companies, on average, do not appear to engage in herding behavior. The last column of Table 4 documents the difference between the third and fourth columns. This is a test of whether each investor type is more likely to herd after similarly classified investors or differently classified investors.

Overall, the herding behavior of financial advisors and banks is consistent with the reputational herding hypothesis. As expected, the nature of the competitive environment in which financial advisors operate can explain why they exhibit the strongest tendency to follow similar-type investors. Surprisingly, this is not found to hold for investment companies (e.g. mutual funds) - institutions for whom reputation is very important. The reputational hypothesis also holds for the case of banks. This finding seems intuitive, since bank trust departments' flows may also be driven by their past performance. In addition, it is reasonable that the reputational hypothesis does not hold for insurance companies and unclassified investors, since these types of institutional investors are less likely to experience changes in flows due to fluctuations in their reputation levels.

3.5 Herding and property type momentum

Institutional investors may herd in and out of REIT property types because property type demand is positively associated with lagged property type returns. In other words, momentum can drive institutional herding. To examine this possibility, we run cross-sectional regressions of institutional property type demand on lagged property type returns, measured over the previous quarter, six months, or one year. Property type returns are value-weighted. In addition, we also estimate regressions of contemporaneous institutional demand on the lagged institutional property type demand over the previous quarter, six months, and one year. To facilitate the interpretation of the coefficient estimates, we standardize both institutional demand and property type returns by subtracting their cross-sectional mean and dividing them by their cross-sectional standard deviation. In each quarter, we estimate the following regression model and report the average coefficients for the 74 cross-sectional regressions (the standardized variables are marked by the tildes):

$$\tilde{\Delta}_{k,t} = \beta_{1,t}\tilde{\Delta}_{k,t-1} + \beta_{2,t}\tilde{R}_{k,t-1} + \varepsilon_{k,t} \tag{10}$$

Table 5 presents the results of the cross-sectional regressions of institutional demand on lagged institutional demand and lagged property type returns. Consistent with the results reported in Table 2, the coefficient of institutional property type demand on lagged property type demand is 0.5359. To obtain the lagged six-month property type demand and the lagged yearly property type demand, we define a manager as a buyer or a seller based on changes in holdings (Eq. (1)) over the previous six months or one year, respectively. The fourth and seventh columns of Table 5 indicate that institutional property type demand is strongly and positively associated with demand measured over the previous six months or a year. The second, fifth, and eighth columns of Table 5 report that institutional demand is positively correlated with property type returns measured over the previous quarter or six months and negatively correlated with property type returns measured over the previous year.

These findings suggest that REIT investors appear to engage in momentum trading at the property type level.

The third and sixth columns of Table 5 reveal that REIT property type demand is positively associated with both the lagged demand and lagged property type return measured over the previous quarter and the previous six months, respectively. However, the last column of Table 5 indicates that demand is positively correlated with the lagged demand and *inversely* correlated with the lagged return, measured over the previous year. This suggests the evidence that positive-feedback trading affects REIT investors' property type demand over short-term horizons.

As illustrated by Table 5, in the regression of institutional demand on the lagged demand and property type returns measured over the previous quarter, the coefficient associated with lag standardized returns averages 0.1709 and is statistically significant at the 1% level. Because the variables are standardized, this result is interpreted as a one standard deviation increase in last quarter's return leads to 0.1709 standard deviation greater in contemporaneous property type demand. However, institutional momentum trading constitutes a smaller portion of institutional herding. More specifically, adding a lag return to the regression has a very little influence on the average coefficient on the previous quarter's property type demand. As supported by Table 5, the average coefficient associated with the lagged demand measured over the previous quarter decreases from 0.5359 to 0.5022, when lagged return is added to the model. Since all variables are standardized, the coefficients are directly comparable - the average coefficient on the lagged demand is about 200% larger than the average coefficient associated with lagged property type return. The suggests that a one standard deviation change in lagged demand predicts a 200% greater change in the following quarter's demand than a one standard deviation change in lagged return. In addition, adding lagged returns increases the explanatory power of the model by only a small amount, as evidenced by the marginal increase in adjusted R^2.

Overall, the findings reveal substantial evidence that REIT investors engage in positive-feedback trading over short-term horizons. However, the relation between contemporaneous property type demand and lagged demand does not change much after accounting for past property type returns. Hence, momentum trading does not appear to be the primary driver of institutional herding among REIT investors.

To further investigate institutional investors' tendency to engage in momentum trading, we analyze if various property type momentum strategies appear to be profitable. Similar to the industry momentum strategy of Moskowitz and Grinblatt (1999), we experiment with possible REIT property type momentum strategies for various formation and holding periods. To start, we calculate monthly value-weighted REIT property type returns from January 1993 through December 2011. Each month, all REITs are ranked based on their property sectors' past performance over the p-month horizon. The number of months in the formation period, p, includes 3, 6, 9, and 12 months. Based on the past performance sort, the top two property types form the winner portfolio, and the bottom two property types constitute the loser portfolio. The property type returns in the winner and loser portfolios are equally-weighted. The winner and loser portfolios are held for the following q months. The number of months in the holding period, q, includes 3, 6, 9, and 12 months. For example, in month t of a (9;6) REIT property type momentum strategy, we rank property types based on their $(t-9)$ to $(t-1)$ returns. We then compute the equally-weighted return of the top two property types (winner portfolio) and the equally-weighted return of the bottom two property types (loser portfolio) from t to $(t+5)$. The return to the REIT property type momentum strategy in this month is the difference between returns for the winner and loser portfolios.

Table 6 reports the returns for the REIT property type strategies for various formation and holding periods. None of the momentum strategies are profitable, as the difference in returns between winner and loser portfolios is statistically indistinguishable from zero. Therefore, consistent with the evidence reported in Table 5, momentum is not likely to be the primary source of source of institutional property type herding.

3.6 REIT property type demand and returns

One possible explanation for herding behavior suggests that investors may trade in the same direction as a result of reacting to correlated information signals. Therefore, herding may contribute to the process of a correct price adjustment (Wermers, 1999). In contrast, recent research also suggests that herding may drive prices further away from fundamentals (Gutierrez and Kelley, 2009; Sias, Starks, and Titman, 2006).

In this section, we attempt to differentiate between the correlated signals explanation from alternative explanations by studying the relationship between institutional demand and lagged, contemporaneous, and subsequent returns. If herding behavior among investors reflects correlated signals being incorporated into prices, then institutional demand should be positively associated with current property type returns and not negatively associated with subsequent returns, as institutions engage in the price correction process. On the other hand, if herding tends to move prices away from their intrinsic values, then institutional demand should be positively correlated with contemporaneous property type returns and negatively associated with subsequent returns.

We start examining this hypothesis by identifying property types with highest excess demand and lowest excess demand relative to the quarterly cross-sectional average demand. Each quarter, excess demand is computed as the difference between the demand in a given property type and average cross-sectional demand aggregated across all seven property types. We next calculate value-weighted returns of the identified property types with the highest and lowest excess demands starting two quarters prior to the formation period and up to three quarters following formation. In addition, having the time-series of quarterly returns, we estimate abnormal returns following Fama and French (1993):[1]

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p(R_{m,t} - R_{f,t}) + \beta_{SMB}R_{SMB,t} + \beta_{HML}R_{HML,t} + \varepsilon_{p,t} \qquad (11)$$

where $R_{p,t}$ is the quarterly return of property type with highest (lowest) excess demand, $R_{f,t}$ is the risk-free rate, and $R_{m,t}$, $R_{SMB,t}$, and $R_{HML,t}$ are the Fama-French market, size, and value factors, respectively.[2]

Panel A of Table 7 reports average value-weighted returns (the first two columns), as well as Fama-French three-factor model alphas (the fourth and fifth columns), for property types with highest and lowest excess demands from two quarters prior to the formation quarter and up to three quarters following formation. The third column reveals the difference between returns of property types with highest and lowest excess demands and their associated t-statistics. The last column of Panel A reports the difference in alphas (based on Eq. (11)), obtained from time-series regressions of returns of property types with highest and lowest excess demands.

The results, reported in Panel A of Table 7, provide the support for the hypothesis that institutional demand impacts prices. In the formation quarter and up to two quarters prior to formation, property types with highest excess demands outperform those with lowest excess demands by 2.60%, 4.01%, and 4.38% per quarter, respectively. The differences in alphas between portfolios with highest excess demand and lowest excess demand are 3.41%, 3.91%, and 4.83% (all are statistically significant at the 1% level) during the formation period, one quarter prior to formation, and two quarters prior to formation, respectively. This outcome can be explained, at least

[1]Derwall et al (2009) suggest that the conventional multi-factor models do not fully explain the cross-section of REIT returns, and find that a REIT momentum factor provides additional explanatory power. Our study is at the property-type level, and our results in Table 6 show that a momentum-based strategy does not yield abnormal returns. As a result, we are comfortable with interpreting the alphas from three-factor models.

[2]Quarterly market, size, and value factors were obtained from Ken French's web site.

partially, by institutional momentum trading (the results in Table 5 also support this conjecture). However, while the results indicate a strong positive relation between property type demand and returns during and prior to the formation quarter, there is no evidence of subsequent return reversals. Overall, these findings reveal that correlated information signals drive institutional property type herding.

We further explore the correlated signals explanation for institutional herding behavior by analyzing returns in the private commercial real estate market. A number of studies examine the interactions between private and public real estate markets. One widely-observed phenomenon is that returns in the public REIT market predict returns in the private real estate market. For example, Yunus, Hansz, and Kennedy (2012) find that price discovery occurs first in the public real estate market, and later in the private market. Exploring the cointegrated behavior of the NCREIF[3] index, which represents returns of privately held commercial real estate, and the NAREIT index, Li, Mooradian, and Yang (2009) document that REIT returns Granger-cause NCREIF returns. However, Ling and Naranjo (2015) do not find support for this lead-lag relation, after standard asset pricing control variables are included in the analysis. Based on this evidence, Ling and Naranjo conclude that fundamental asset pricing information is incorporated in REIT returns more quickly than in private market returns.

As noted above, the analysis in Panel A of Table 7 suggests that correlated information signals are likely to explain our finding of institutional herding. If this is true, then given the evidence on the lead-lag relation between the private and public real estate markets, we expect that the information content of herding in property types is likely to be reflected more quickly in REIT prices than in the private commercial real estate market.

We use the NCREIF Transaction Based Index (TBI) to measure the performance in the private real estate market. This index is available at the property type level, and reports quarterly performance of commercial real estate properties acquired in the private market for investment purposes only.[4] The available property types include Apartment, Retail, Industrial, and Office. For comparability of the NCREIF property types and REIT property sectors in our sample, we treat the NCREIF Apartment category as REIT Residential. In addition, our property type definitions combine Office and Industrial, whereas the NCREIF index reports them separately. To mitigate this issue, we take an equally-weighted average return of the NCREIF Office and Industrial property sectors. Overall, given the data availability, our analysis of the NCREIF TBI index is restricted to the following three property types:

[3]National Council of Real Estate Investment Fiduciaries

[4]These data are obtained at https://www.ncreif.org/tbi-returns.aspx.

Retail, Residential, and Office/Industrial.

To explore how price effects of institutional herding behavior are transmitted from the public real estate market to the private market, we perform a similar analysis described in Panel A of Table 7. However, we now use the NCREIF TBI property index quarterly returns. Among the three property types (Retail, Residential, and Office/Industrial), we identify those with the highest and lowest excess demand in each quarter (the formation quarter). We then estimate the performance of these property types before, during, and after the formation quarter. The results are reported in Panel B of Table 7.

Consistent with our earlier findings in Panel A, the difference in the NCREIF TBI index returns for property types with the highest and lowest excess demand is statistically significant in one and two quarters prior to the formation quarter. The raw NCREIF TBI property index return, as well as the abnormal return (three-factor alpha), for the property sector with the highest excess demand is also significantly greater than that with the lowest excess demand during the formation and in each of the two quarters *after* the formation quarter. The lack of a return reversal is consistent with the correlated signals explanation for institutional herding. Moreover, the persistence in returns after the formation quarter is consistent with the documented lead-lag relation between the private and the public real estate markets. In summary, the change in institutional demand conveys information to investors, but this information dissipates quicker in public real estate markets than in private markets.

4 Conclusion

This study documents that institutional investors exhibit herding behavior in REIT property types. We demonstrate that property type demand in this quarter is strongly and positively correlated with property type demand in the previous quarter, and approximately 75% of this correlation is attributed to institutional investors following lagged trades of other institutional investors. To a small extent, institutional investors tend to follow their own lagged trades into the same stocks. However, the main cause of herding in REITs is the tendency of institutions to follow the lagged trades of others into and out of different stocks in the same property type. This suggests that herding behavior in REITs appears to be at the property type level, rather than at the individual stock level. In addition, the results reveal that REIT investors are positive-feedback traders, but momentum trading does not seem to be the primary source of herding among REIT institutional investors. We find no evidence of return reversals after herding, which suggests that correlated information signals drive institutional property type herding. Any information reflected in the change in institutional demand dissipates quicker in public than in private commercial real estate markets.

References

[1] Anderson, Randy, Vaneesha Boney, and Hany Guirguis, 2012. The impact of switching regimes and monetary shocks: An empirical analysis of REITs. *Journal of Real Estate Research* 34, 157-181.

[2] Chan, Su, Wai Leung, and Ko Wang, 1998. Institutional investment in REITs: Evidence and Implications. *Journal of Real Estate Research* 16, 357-374.

[3] Chang, Eric, Joseph Cheng, and Ajay Khorana, 2000. An examination of herd behavior in equity markets: An international perspective. *Journal of Banking and Finance* 24, 1651-1679.

[4] Chiang, Kevin, 2010. On the comovement of REIT prices. *Journal of Real Estate Research* 32, 187-199.

[5] Choi, Nicole, and Richard Sias, 2009. Institutional industry herding. *Journal of Financial Economics* 94, 469-491.

[6] Derwall, Jeroen, Joop Huij, Dirk Brounen, and Wessel Marquering, 2009. REIT momentum and the performance of real estate mutual funds. *Financial Analyst Journal* 65, 24-34.

[7] Fama, Eugene, and Kenneth French, 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33, 3-56.

[8] Gutierrez, Roberto, and Eric Kelley, 2009. Institutional herding and future stock returns. *Working paper*.

[9] Gyourko, Joseph, and Edward Nelling, 1996. Systematic risk and diversification in the equity REIT market. *Real Estate Economics* 24, 493-515.

[10] Lakonishok, Josef, Andrei Shleifer, and Robert Vishny, 1992. The impact of institutional trading on stock prices. *Journal of Financial Economics* 32, 23-43.

[11] Li, Jinliang, Robert Mooradian, and Shiawee Yang, 2009. The information content of the NCREIF index. *Journal of Real Estate Research* 31, 93-116.

[12] Ling, David, and Andy Naranjo, 2003. The dynamics of REIT capital flows and returns. *Real Estate Economics* 31, 405-434.

[13] Ling, David, and Andy Naranjo, 2006. Dedicated REIT mutual fund flows and REIT performance. *Journal of Real Estate Finance and Economics* 32, 409-433.

[14] Ling, David, and Andy Naranjo, 2015. Returns and information transmission dynamics in public and private real estate markets. *Real Estate Economics* 43, 163-208.

[15] Moskowitz, Tobias, and Mark Grinblatt, 1999. Do industries explain momentum? *Journal of Finance* 54, 1249-1290.

[16] Newey, Whitney, and Kenneth West, 1987. A simple, positive, semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica* 55, 703-708.

[17] Nofsinger, John, and Richard Sias, 1999. Herding and feedback trading by institutional and individual investors. *Journal of Finance* 54, 2263-2295.

[18] Patterson, Gary, 2009. The relationship between REIT propery types and economic risk factors. *Academy of Business Disciplines Journal* 1, 19-28.

[19] Ro, SeungHan, and Paul Gallimore, 2014. Real estate mutual funds: Herding, momentum trading and performance. *Real Estate Economics* 42, 190-222.

[20] Shiller, Robert, 2005. Irrational exuberance. *Princeton University Press.*

[21] Sias, Richard, 2004. Institutional herding. *Review of Financial Studies* 17, 165-206.

[22] Sias, Richard, Laura Starks, and Sheridan Titman, 2006. Changes in institutional ownership and stock returns: Assessment and methodology. *Journal of Business* 79, 2869-2910.

[23] Wermers, Russ, 1999. Mutual fund trading and the impact on stock prices. *Journal of Finance* 54, 581-622.

[24] Yunus, Nafeesa, Andrew Hansz, and Paul Kennedy, 2012. Dynamic interactions between private and public real estate markets: Some international evidence. *Journal of Real Estate Finance and Economics* 45, 1021-1040.

[25] Zhou, Jian, and Randy Anderson, 2013. An empirical investigation of herding behavior in the U.S. REIT market. *Journal of Real Estate Finance and Economics* 47, 83-108.

[26] Zhou, Jian, and Randy Anderson, 2012. Extreme risk measures for international REIT markets. *Journal of Real Estate Finance and Economics* 45,152-170.

Table 1: Summary statistics on institutional trading in REITs

Panel A reports the quarterly cross-sectional summary statistics of institutional trading and demand on a quarterly basis over the period 1993-2011. Panel B displays the time-series average of the property type market capitalization and the portion attributed to the largest firm. The first column of Panel C reports the total number of REITs in the sample by property type. All other columns of this panel report time-series descriptive statistics for all seven REIT property types: the average number of companies in the property type, the property type's market capitalization weight, and the mean and standard deviation of institutional demand for each REIT property type. The institutional demand for each REIT property type quarter is defined as the ratio of the number of institutional buyers to the total number of institutional buyers and sellers in the property type over one quarter.

	Panel A: Institutional investor statistics				
	Mean	Median	Minimum	Maximum	Std.dev.
# of institutions trading in a REIT type	1697	1478	844	2899	739
# of advisors trading	757	666	374	1315	335
# of banks trading	269	244	140	443	112
# of insurance companies trading	125	107	56	221	60
# of investment companies trading	151	126	74	272	72
# of unclassified investors trading	395	343	199	653	165
# buyers/(# buyers+# sellers)	50.17%	49.62%	48.54%	52.39%	1.43%

	Panel B: Property type statistics				
	Mean	Median	Minimum	Maximum	Std.dev.
Property type capitalization	14.29%	14.55%	7.11%	21.75%	3.54%
Largest firm in property type	27.73%	23.48%	15.96%	98.75%	12.27%

	Panel C: Statistics by property type				
Property type				Property type demand	
	# of firms in the sample	Average # of firms	%Market capitalization	Mean	Std. dev.
Diversified	54	21	10.73%	0.4958	0.1246
Healthcare	19	11	8.67%	0.5063	0.1324
Lodging/Resorts	27	13	7.78%	0.5239	0.1658
Office/Industrial	59	26	22.40%	0.5160	0.1380
Other	38	12	10.76%	0.4854	0.1211
Residential	48	22	16.44%	0.4962	0.1265
Retail	64	30	23.22%	0.4886	0.1260

Table 2: Correlations in REIT property type institutional demand

Panel A of this table reports the results of partitioning the correlation coefficient in institutional demand from Eq. (3). The first column reports the time-series average correlation coefficient between institutional property type demand in quarter t and quarter $t-1$. The second column displays the portion of the correlation coefficient attributed to institutional investors following their own lagged demand, and the third column reports the portion attributed to institutional investors following the lagged demand of others. Panel B reports the results of further partitioning of the coefficient in the third column of Panel A by property type. T-statistics are calculated using Newey-West (1987) standard errors from the time-series of regression coefficient estimates. Symbols ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Panel A: Partitioned autocorrelation coefficient		
	Average autocorrelation coefficient	Institutions following their own lagged property type demand	Institutions following other instutions' lagged property type demand
Property type demand	0.5359 (10.81)***	0.1337 (2.81)***	0.4022 (5.22)***

Panel B: Institutions following other institutions' lagged demand - by property type

	Average portion	t-statistic
Diversified	0.0009	(0.07)
Healthcare	0.0928**	(2.51)
Lodging/Resorts	0.0815***	(2.68)
Office/Industrial	0.0973***	(2.72)
Other	0.0588***	(3.69)
Residential	0.0411**	(2.45)
Retail	0.0296	(1.30)

Table 3: Institutional herding at the property type vs. individual REIT level

The table reports the time-series average correlation coefficient between weighted institutional property type demand in quarter t and quarter $t-1$ by property type. The top left-hand cell reports the portion of correlation attributed to institutional investors following *themselves* into the *same* stock. The left-hand cell in the middle row contains a portion of correlation attributed to institutional investors following *others* into the *same* stock. The middle cell in the top row displays a portion of correlation that arises from institutional investors following *themselves* into *different* REITs in the same property type, and the middle cell in the middle row illustrates a portion of correlation attributed to institutional investors following *other* institutions into *different* REITs in the same property type. T-statistics are calculated using Newey-West (1987) standard errors from the time-series of regression coefficient estimates. Symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Partitioned correlation coefficient		
	Into the same stock	Into different stocks in the same property type	Total
Following themselves	0.0154	0.0680	0.0834
	(2.84)***	(1.82)*	(1.96)**
Following others	0.0216	0.6846	0.7062
	(1.27)	(11.39)***	(10.18)***
Total	0.0370	0.7526	0.7896
	(2.37)**	(23.22)***	(21.88)***

Table 4: Herding analysis by investor type

This table reports the partitioned correlation in institutional demand by investor type. The first column presents each investor type's propensity to follow their own lagged property type demand and the second column presents investors' propensity to follow other institutional investors into the same property type. The third column reports the average contribution to the correlation from different investor types following similarly classified institutions, e.g., insurance companies following other insurance companies. The average contribution that arises from investors following other investors of a different type is reported in the fourth column. The last column reports the difference between the average contribution from following same-type traders and the average contribution from following different-type traders. All t-statistics are calculated based on Newey and West (1987) standard errors. Symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) Average contribution from following their own trades	(2) Average contribution from following others' trades	(3) Average contribution from following same-type traders	(4) Average contribution from following different-type traders	(3)-(4) Average "same contribution" less "different contribution"
Advisors	0.00024	0.00011	0.00118	0.00003	0.00115
	(6.01)***	(3.51)***	(3.27)***	(2.24)**	(3.27)***
Banks	0.00091	0.00005	0.00251	0.00002	0.00249
	(2.44)**	(1.78)*	(3.70)***	(1.53)	(3.72)***
Insurance companies	0.00090	0.00002	0.00096	0.00001	0.00095
	(2.94)***	(3.09)***	(1.07)	(2.34)**	(1.06)
Investment companies	0.00247	0.00000	-0.00018	0.00000	-0.00018
	(2.83)***	(0.05)	(-0.34)	(0.38)	(-0.34)
Other	0.00189	0.00004	0.00129	0.00001	0.00128
	(3.25)***	(3.35)***	(1.64)	(1.89)*	(1.63)

Table 5: REIT property type herding and momentum

Each column in this table reports the time-series average coefficient from 74 cross-sectional regressions (from September 1993 to December 2011) of standardized institutional property type demand in a given quarter on standardized lagged institutional property type demand over the previous quarter, six months, or year and/or standardized property type returns the previous quarter, six months, or year. All t-statistics are adjusted based on Newey and West (1987) standard errors, computed from the time-series of coefficient estimates, and are reported in parentheses. Symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Measured over previous quarter			Measured over previous six months			Measured over previous year		
Lagged institutional demand	0.5359 (10.81)***		0.5022 (8.49)***	0.5015 (12.76)***		0.4694 (11.09)***	0.3927 (8.75)***		0.3923 (6.56)***
Lagged return		0.1873 (3.41)***	0.1709 (3.85)***		0.2721 (4.25)***	0.2392 (5.93)***		-0.1665 (-2.21)**	-0.1829 (-2.92)***
Adjusted R^2	26.69%	5.21%	26.80%	23.02%	7.37%	26.02%	33.59%	20.95%	16.69%

Table 6: Returns from REIT property type momentum strategies

This table reports the average monthly portfolio returns from January 1993 through December 2011 for REIT property momentum strategies. Portfolios are formed based on past p-month REIT property type returns and held for the following q-months. The property type return is calculated as the value-weighted average return of REITs in that type. The winner (loser) portfolio is constructed as an equally-weighted portfolio of the top (bottom) two property types sorted based on the past p-month REIT property type return. T-statistics are reported in parentheses. Symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Strategy $(p;q)$	Winners	Losers	Difference
(6;6)	1.29	1.01	0.28
	(3.81)***	(2.34)**	(1.31)
(3;3)	1.27	1.05	0.22
	(3.73)***	(2.43)**	(1.09)
(3;6)	1.22	1.06	0.16
	(3.60)***	(2.53)**	(0.86)
(3;9)	1.20	1.04	0.16
	(3.57)***	(2.49)**	(0.95)
(3;12)	1.20	1.06	0.14
	(3.54)***	(2.54)**	(0.95)
(6;3)	1.34	1.03	0.31
	(3.85)***	(2.32)**	(1.28)
(6;9)	1.28	1.03	0.25
	(3.81)***	(2.39)**	(1.22)
(6;12)	1.25	1.05	0.20
	(3.76)***	(2.48)**	(1.08)
(9;3)	1.32	0.99	0.33
	(3.82)***	(2.26)**	(1.32)
(9;6)	1.31	0.98	0.33
	(3.89)***	(2.28)**	(1.52)
(9;9)	1.26	0.99	0.27
	(3.76)***	(2.33)**	(1.30)
(9;12)	1.24	1.02	0.22
	(3.71)***	(2.43)**	(1.11)
(12;3)	1.30	0.99	0.31
	(3.88)***	(2.18)**	(1.24)
(12;6)	1.30	0.99	0.31
	(3.88)***	(2.28)**	(1.33)
(12;9)	1.26	0.98	0.28
	(3.78)***	(2.28)**	(1.23)
(12;12)	1.24	1.03	0.21
	(3.72)***	(2.41)**	(1.00)

Table 7: Price effects of property type herding

Panel A of this table reports quarterly value-weighted REIT returns and abnormal returns for property types with highest and lowest excess demands over the formation quarter (Quarter 0), up to two quarters prior to formation, and up to three quarters after formation. Excess demand is defined as the difference between the demand in a given property type and average cross-sectional demand aggregated across all seven property types each quarter. Panel B reports the NCREIF TBI property index returns and three-factor alphas, estimated using these index returns. The highest and lowest excess demand for the NCREIF property types are identified based on the three available property sectors: Residential, Retail, and Office/Industrial. T-statistics (reported in parentheses) are based on Newey-West standard errors (1987). Symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Panel A : REIT property type returns

	Property type value-weighted returns			Fama-French three-factor model alphas		
	Highest excess demand	Lowest excess demand	Difference	Highest excess demand	Lowest excess demand	Difference
Quarter -2	0.0690	0.0252	0.0438	0.0649	0.0166	0.0483
			(3.74)***			(3.85)***
Quarter -1	0.0548	0.0147	0.0401	0.0496	0.0105	0.0391
			(3.45)***			(3.09)***
Quarter 0	0.0585	0.0325	0.0260	0.0294	-0.0047	0.0341
			(2.66)***			(2.72)***
Quarter +1	0.0462	0.0345	0.0117	0.0282	0.0208	0.0074
			(1.34)			(0.56)
Quarter +2	0.0375	0.0516	-0.0141	0.0283	0.0520	-0.0237
			(-1.12)			(-1.72)*
Quarter +3	0.0461	0.0589	-0.0128	0.0413	0.0590	-0.0177
			(-0.99)			(-1.27)

Panel B : NCREIF TBI property type returns

	Property type NCREIF returns			Fama-French three-factor model alphas		
	Highest excess demand	Lowest excess demand	Difference	Highest excess demand	Lowest excess demand	Difference
Quarter -2	0.0239	0.0194	0.0045	0.0171	0.0128	0.0043
			(2.99)***			(2.50)**
Quarter -1	0.0240	0.0202	0.0038	0.0169	0.0132	0.0037
			(1.91)*			(1.94)*
Quarter 0	0.0265	0.0195	0.0070	0.0181	0.0111	0.0070
			(3.91)***			(3.77)***
Quarter +1	0.0259	0.0198	0.0061	0.0172	0.0116	0.0056
			(2.79)***			(3.04)***
Quarter +2	0.0257	0.0201	0.0056	0.0154	0.0113	0.0041
			(2.03)**			(2.17)**
Quarter +3	0.0248	0.0215	0.0033	0.0143	0.0114	0.0029
			(1.26)			(1.55)