Specialization and Institutional Investors' Performance – Evidence from Publicly Traded Real Estate

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Abstract: We examine the extent to which 42,310 global institutional investors' specialization in publicly traded real estate securities is related to their investment performance. Consistent with information advantage theory (Merton 1987; Van Nieuwerburgh and Veldkamp 2009), we show a positive relation between the portfolio weight and active share of real estate of institutional portfolios and the risk-adjusted returns generated from these securities. Additionally, we find that the benefits related to specialization are more pronounced for securities with high levels of information asymmetry to the average investor.

1. Introduction

The active money management industry is predicated on investors believing that portfolio managers are able to use their investment expertise to make superior investment decisions. In other words, investors believe that portfolio managers possess an informational advantage, which they can use to generate abnormal returns. However, despite the significant amount of capital investors allocate to actively managed investments, $11 trillion invested in actively managed equity mutual funds in the U.S. alone (ICI 2017 Fact Book), and the substantial fees investors pay to portfolio managers, a large literature documents that, on average, portfolio managers are unable to beat passive benchmarks. Moreover, studies focusing on real estate investments find that, on average, active managers underperform the market (for example, Bond and Mitchell, 2010; O'Neal and Page, 2000; Chiang, Kozhevnikov, Lee, and Wisen, 2008). While these studies signify that the average portfolio manager is unable to generate abnormal returns, they do not imply that all managers are unable to deliver superior performance.

In this paper, we examine the relation between institutional investors' allocation to publicly traded real estate assets and their performance. Our analysis is based on information advantage theory, which asserts that an investor who specializes in a narrow set of assets may be able to generate superior returns by concentrating on securities on which they are better informed than the average investor (Merton, 1987; Van Nieuwerburgh and Veldkamp, 2009). Specifically, using a sample of over 40,000 global institutional portfolios, we investigate whether specialization in real estate securities and REITs allows institutions to generate abnormal returns on these investments.[1] To test whether specialization in real estate securities and REITs is positively related to

[1] By real estate securities we are referring to operating firms that are dependent on the real estate sectors. Table 1 shows the SIC codes of the firms we classify as "real estate securities". REITs belong to SIC 6798.

performance in those securities, we rely on two measures of specialization: The portion of the institution's portfolio allocated to real estate, and the portfolio's real estate active share, which is a measure of how much the portfolio holdings deviate from the underlying benchmark. Additionally, we compare the effects of specialization on performance between real estate securities and REITs. As information advantage theory asserts, the benefits to specialization should be larger in assets that are more informationally opaque (Van Nieuwerburgh and Veldkamp, 2009). Because REITs are commonly viewed as a fundamentally independent asset class, requiring a unique set of skills to understand and evaluate, we expect the benefits to specialization in REITs to be higher than in real estate securities.[2]

The results of the analyses can be summarized as follows. We find that while the average institution with real estate holdings is unable to beat its real estate benchmark, specialization is positively related to risk-adjusted returns, consistent with the information advantage theory. Specifically, we find that the proportion of the institution's portfolio dedicated to real estate is positively related to the risk-adjusted returns earned on those investments. Similarly, the portfolio's real estate active share is related to the risk-adjusted returns earned on the investments. We also find that the positive relation between specialization and risk-adjusted returns is more pronounced for REITs than for real estate securities, consistent with the information advantage theory. The differences in the risk-adjusted returns to specialized versus diversified portfolios are also economically significant. For instance, institutions with the largest REIT allocations (over

[2] The assertion that REITs require unique expertise is supported directly and indirectly by existing research. Kallberg, Liu and Trzcinka (2000) argue that the cost of information is higher for REITs. Moreover, Ro and Gallimore (2013) and Lantushenko and Nelling (2016) find little evidence of herding by REIT mutual funds. Herding by sophisticated investors is generally documented to be informational based, where investors respond to similar signals when transparency is low and information barriers are high. Cici, Corgel, and Gibson (2011) find that some mutual fund managers are able to better process REIT-specific information that leads to profitable investment decisions. The authors conclude that outperformance in REITs derives from "endemic abilities" of the managers to process information.

75% of their portfolio) earn a positive quarterly alpha of 0.66% on their REIT investments, compared to institutions with the lowest REIT allocations (less than 50%), that generate a quarterly alpha of negative 0.47%. Similarly, a one standard deviation increase in an institution's REIT active share is associated with a 0.29% increase in the institution's quarterly risk-adjusted return on the portion of portfolio invested in REITs.

Our study makes several contributions to the existing literature. First, while previous studies of institutional real estate investments have mainly focused on open-end real estate mutual funds, our paper examines allocation decisions and performance of all mutual funds, as well as pension funds, hedge funds, and off shore institutions. Also, rather than focusing solely on US institutions, as most previous papers have done, we employ a sample of institutional investors from around the world (institutions are from 76 countries with holdings in 92 different markets). This more inclusive examination of institutional real estate investment is important as institutions are playing an increasingly large role in the global real estate market (Devos, Ong, Spieler, and Tsang, 2013; Chan, Leung and Wang, 1998). Second, to be included in the sample, an institution must have at least some holdings in real estate, but the institution does not have to be fully invested in real estate. We compute performance measures from reported holdings, which allows us to compute returns to the sections of portfolio invested in real estate rather than observing the performance of the entire portfolio. This sample construction and method for return computation allows for a much larger number of institutions (42,310 in the sample) compared to previous studies. More importantly, because institutions hold varying levels of exposure to real estate securities and REITs, the sample provides a unique way to test information advantage theory and the benefits of specialization. Third, we examine the relation between specialization and performance for real estate securities and REITs separately. This comparison of two separate asset

classes provides a unique and controlled environment to explore the potential benefits of specialization in the framework of the information advantage theory. Exploring assets with varying degrees of information asymmetry, which require unique valuation skills, allows us to observe if the benefits of specialization increase with information asymmetry. The findings from these tests of information advantage theory can be generalized to other asset classes as well. Lastly, the results add to the real estate institutional and mutual fund performance literature that has shown conflicting evidence on whether actively managed portfolios are able to produce superior returns. In a large sample of institutional investors worldwide, it appears that when all institutions are considered, the institutions underperform passive benchmarks, on average. However, the underperformance against passive benchmarks disappears and turns positive in samples that include investors with high portfolio weights, especially in REITs, and when the investors' active share of the holdings is high.

The rest of the paper is organized in the following way: Section 2 reviews the related literature and states the testable hypotheses. Section 3 describes the data and details the methods. Section 4 presents the results and section 5 concludes.

2. Literature Review & Hypotheses Development

This paper contributes to two streams of literature: The literature that examines the relation between institutional investors' portfolio allocation and performance in the real estate market, and to the information advantage literature. The following section reviews prior research on these two streams of literature and presents our hypotheses.

2.1 Institutional investors and real estate securities

Chan, Leung, and Wang (1998) and Devos, Ong, Spieler and Tsang (2013) have observed the increasing importance of institutional investors in the US real estate market. Figure 1 presents evidence that this pattern is not limited to the US. The figure shows a steady growth in the number of institutions with real estate holdings around the world. Additionally, the figure illustrates that real estate represents an increasing portion of these institutions' investment portfolios.

While institutions are playing an increasingly important role in the real estate sector, relatively few papers examine their allocation decisions, trading behavior, or performance.[3] Moreover, the papers that do examine these issues tend to focus on a handful of US based real estate mutual funds, not real estate holdings within all types of institutional portfolios with different objectives and strategies.

Also, studies of the performance of real estate mutual funds present mixed evidence. For instance, Kallberg, Liu and Trzcinka (2000), Cici, Corgel, and Gibson (2011) and Chou and Hardin (2014) find that real estate mutual funds produce positive risk-adjusted returns, while, O'Neal and Page (2000) find that real estate mutual funds are not able to generate positive abnormal returns. Similarly, Hartzell, Mühlhofer, and Titman (2010) fail to find evidence of superior REIT fund performance, although they show that REIT funds overall do better than other real estate funds. O'Neal and Page (2000) and Chiang, Kozhevnikov, Lee, and Wisen (2008) also find that real estate funds of funds are not able to beat their benchmarks. Further, Bond and Mitchell (2010) examine fund manager's direct real estate investments, and find that managers are unable to consistently

[3] Papers that examine institutional investors in real estate include: Ciochetti, Craft, and Shilling (2002)'s study of institutional investors liquidity concerns; Lantushenko and Nelling (2016) and Freybote and Seagraves (2016)'s studies on institutions' herding behavior in real estate; Devos, Ong, Speiler, and Tsang (2013) and Das, Freybote, and Marcato (2014)'s studies on institutional investor behavior, before, during, and after the financial crisis; An, Wu and Wu (2016)'s study on the relation between institutional ownership and REIT crash risk.

produce positive risk-adjusted returns. Most recently, Ambrose, Cao, and D'Lima (2016) find no evidence of a relation between hedge funds' real estate exposure and performance.

2.2. Information advantage theory and hypotheses

The empirical focus of our paper is on the relation between real estate specialization and performance. While the traditional asset pricing literature suggest that investors achieve mean variance efficiency through a diversified portfolio (Sharpe, 1964); information advantage theory argues that investors, confronting incomplete information, are better off specializing (Merton, 1987). Merton (1987) shows that when investors are endowed with limited information regarding a subset of assets, specialization produces superior mean variance efficiency compared to a diversified market portfolio. Most recently, Ling, Naranjo and Scheick (2018) provide evidence that portfolio managers with geographical concentration in commercial real estate produce superior results, especially when the concentration occurs in market with higher level of information asymmetry. Van Nieuwerburgh and Veldkamp (2009) explore a joint model of investment and information acquisition. The authors show that when information acquisition is subject to increasing returns to scale, an investor who possesses more precise information regarding a subset of assets should specialize, while an average investor with no informational advantage should hold a diversified portfolio.

More support for the information advantage theory is provide by Coval and Moskowitz (2001), who find that geographically concentrated mutual funds earn positive alphas. Moreover, Choi, Fedenia, Skiba, and Sokolyk (2017) show that institutions that concentrate their portfolio within a few countries outperform institutions that are diversified across countries. Similarly, Kacperczyk, Sialm, and Zheng (2005) show that industry concentrated mutual funds earn higher

alphas than diversified mutual funds. Lastly, Ivković, Sialm, and Weisbenner (2008) find that households with more concentrated brokerage accounts outperform households with more diversified brokerage accounts.

Based on the information advantage theory, and the findings of the prior empirical literature, we hypothesize that institutions that specialize in real estate earn higher risk-adjusted returns on their real estate investments compared to institutions with diversified positions. Formally, we test:

> *H1: Specialization in real estate increases an institution's risk-adjusted returns on those securities*

Throughout the analyses we measure an institution's specialization in real estate in two different ways. First, is the portion of the institution's portfolio allocated to real estate, which allows us to test if a simple increase in the portfolio weight of a specific asset class is positively related to risk-adjusted returns to the asset. However, an institution could simply allocate a portion of its portfolio to a real estate index to gain real estate exposure without attempting to beat the benchmark. Therefore, in addition to using the percentage of a portfolio allocated to real estate as a measure of specialization, we also compute active share of holdings. Active share quantifies the deviation between the portfolio's real estate allocations and that of the underlying benchmark. The more an institution's allocations deviate from those of the benchmark, the higher the institution's active share. The more an institution's allocations deviate from the benchmark, the more likely it is that the institution is specializing, as the institution is likely to be using information when determining its allocations.

As mentioned above, information advantage theory also implies that the benefits to specialization are larger for assets that the average investor finds harder to analyze and evaluate and that the benefits to specialization increase with the asset's level of information asymmetry. In

our paper, we consider REITs to have higher levels of information asymmetry than real estate securities to the average investor. Therefore, we expect that benefits to specializing in REITs will be larger than the benefits associated with specializing in real estate securities. Formally, we hypothesize:

H2: Benefits of specialization are greater in REITs than in real estate securities

To test H2, we calculate specialization measures for real estate securities and REITs separately. We expect to observe a greater positive effect of portfolio weight and active share on returns in a sample of REITs compared to real estate securities.

3. Data and methods

3.1. Data

The main dataset employed in this paper is quarterly institutional holdings of publicly traded securities from Q1:1999 - Q1:2015, provided by FactSet (former LionShares). FactSet compiles public filings of institutional investors from around the world. For example, for US institutions the data are from mandatory filings (such as 13-F, N-Q, and N-CSR filings). FactSet uses similar public filings for institutions located in other countries. FactSet contains institutional holdings data for over 60,000 institutions from over 70 countries.[4] FactSet also provides information on security characteristics, accounting information, as well as trading data.

For this paper, we limit the sample to institutions with exposure to publicly traded real estate securities. This requires that we first identify real estate securities to narrow the holdings dataset down to those institutions with at least some real estate securities in their portfolio in a

[4] For institutions with multiple portfolios, FactSet provides holdings information for each portfolio. We treat each portfolio as an individual observation throughout the paper.

given quarter. We identify real estate securities based on their NAICS name, and their four-digit Standard Industrial Classification (SIC) code. Table 1 presents the distribution of the real estate securities across SIC codes. We note that our sample of institutions invest in 886 REITs and 3,966 real estate securities across 40 different SIC codes. The largest number of securities is from Real Estate Agents and Managers (1,221; SIC code 6531), followed by Subdividers and Developers (574; SIC code 6552), and Hotels and Motels (543; SIC code 7011). Table 2 presents the geographic dispersion of the real estate securities and REITs in the sample. As we split the sample between real estate securities and REITs to test whether information asymmetry magnifies the relation between specialization and performance, we report the number of both groups of securities for each country separately. We note that the securities are domiciled in 92 countries. The largest number of real estate securities are domiciled in Japan (396), United Kingdom (211), and Thailand (210). The largest number of REITs are domiciled in the United States (356), United Kingdom (78), and Japan (65).

To construct the main holdings dataset, each quarter we limit the sample to those institutions that hold at least one real estate security or REIT. We also limit the sample to observations with non-missing data on institutional investors' characteristics such as home country and type, security characteristics and security returns. This results in a sample of 42,310 distinct institutional investors with some real estate exposure during the sample period. 40,138 institutions have at least some exposure to real estate securities and 20,507 institutions have at least some exposure to REITs.

When we investigate institutions' portfolio active share within the real estate securities, we construct active share measures either based on the SIC code of the security or by REIT type. REIT type data are obtained from SNL.

Real estate benchmark indexes for this study are constructed from FactSet security return data. Other systematic risk factors are obtained from Kenneth French's data library.

3.2. Methodology

To test the main hypothesis of the paper, we construct several measures of portfolio specialization and performance. These measures are detailed in the subsections that follow.

3.2.1. Portfolio specialization measures

The simplest measure of portfolio specialization is the actual market value of publicly traded real estate securities as a percentage of the institutional investors' total portfolio. We compute this percentage by aggregating the market value, in US Dollars (USD), of all securities that belong to any of the four-digit real estate SIC codes identified in Table 1, scaled by the total market value of the investor's portfolio. For all analyses, we make a distinction between REITs and all other publicly traded real estate securities because of REITs unique features. More formally, the measure of portfolio weight of real estate securities is:

$$RE\ weight_{iS} = \frac{\sum_{j \in J_{iS}} p_j}{\sum_{j \in J_i} p_j}, \tag{1a}$$

$$REIT\ weight_{iS} = \frac{\sum_{j \in J_{iS}} p_j}{\sum_{j \in J_i} p_j}, \tag{1b}$$

where institutions are denoted by $i \in I$, securities by $j \in J$, and SIC real estate industries by $s \in S$. Key subsets include: J_s, which induces all securities that belong to a four digit real estate SIC code

s; J_S, which includes all real estate securities *S*; J_i, which includes all securities held by institution *i*; J_{iS}, which includes all real estate securities *S* held by institution *i*; J_{is}, which includes all securities that belong to a four digit real estate SIC code, *s*, held by institution *i*. Finally, p_j is the market value of security *j*.

RE weight$_{iS}$ (equation 1a) indicates the proportion of institution *i*'s portfolio invested in real estate securities. While *REIT weight*$_{iS}$ (equation 1b) signifies the proportion of institution *i*'s portfolio invested in REITs. These measures are computed each quarter.

The second specialization measure is active share, which aggregates the deviations between the institution's actual portfolio allocations and the allocations associated with a benchmark index. In this paper, we construct active share measures for each institution's real estate holdings and for REITs against market value weighted real estate security and REIT benchmarks. This methodology is similar to Cremers and Petajisto (2009). We require institutions to hold at least 10 securities to be included in the active share analysis.

First, the difference between the actual and expected allocation to each four-digit real estate SIC code (*RE bias*$_{is}$) is as follows:

$$RE\ bias_{is} = \frac{\sum_{j \in J_{is}} p_j}{\sum_{j \in J_{iS}} p_j} - \frac{\sum_{j \in J_s} p_j}{\sum_{j \in J_S} p_j} \quad , \tag{2}$$

where the first term on the right-hand side is the percent of all real estate securities allocated to an SIC code by an institution and the second term on the right hand side is the percent of that SIC code's securities of all publicly traded real estate securities.

We then aggregate the institution's *RE bias* measures from equation (2) to one portfolio level active share measure:

$$RE\ AS_i = \frac{\sum_{s \in S} \left| RE\ bias_{is} \right|}{2} \tag{3}$$

where *RE AS* for institution *i* is the sum of the absolute values of the bias measures from equation (2), divided by 2. The active risk measure takes values from 0 to 100, so that institution that perfectly invests its real estate securities according to expected market weights have an active share measure of 0 and the most concentrated investor has an active share measure that approaches 100. The interpretation of active share is "the percent of the portfolio that should be reallocated to achieve perfect diversification in line with the benchmark weights."

We calculate REIT active share from REIT allocation biases, similar to equations (2) and (3). First, we compute differences between an institution's actual and market capitalization expected allocations to each REIT property type. Specifically, we calculate REIT bias as follows:

$$REIT\ bias_{is} = \frac{\sum_{j \in J_{is}} p_j}{\sum_{j \in J_i} p_j} - \frac{\sum_{j \in J_s} p_j}{\sum_{j \in J} p_j}, \tag{4}$$

where the first term on the left-hand side is the actual allocation to a REIT property type by institution as a share of their total REIT holdings. The second term is the excepted weight of that property type, computed as the market value of the REIT property type as a share of the total REIT market capitalization. Similar to equation (3), we aggregate the REIT bias measures from equation (4) to one portfolio level REIT active share measure:

$$REIT\ AS_i = \frac{\sum_{s \in S} \left| REIT\ bias_{is} \right|}{2}. \tag{5}$$

REIT AS is the fraction of the institution's REIT holdings that should be reallocated across REIT property types to achieve perfect REIT diversification. The measure takes values between 0 and 100, so that perfectly diversified portfolio that contains allocations in REIT property categories

exactly in proportion with REIT property type market capitalization weights has active share of 0 and *REIT AS* approaches 100 for the most concentrated REIT portfolios.[5]

3.2.2. Performance measures

We follow the methodology of Cici et al. (2011) and calculate institutions' returns to real estate securities and REITs based on the quarterly reported holdings by the institutions. Specifically, an institution's quarterly returns to real estate, gross of fees, are the value-weighted returns of the individual securities belonging to each category in USD. An advantage of this methodology is that it allows us to compute the returns generated by different segments of the institution's portfolio. The disadvantage of the methodology is that we assume the securities are held for three months and we do not observe mid reporting period trades. To lessen the likelihood that mid reporting period trading is influencing our results, we also compute quarterly returns based on security returns from one month prior to reporting to two months after (-1,2), two months prior to one month after (-2,1), and from three months prior to the reporting quarter (-3,0). While we do not tabulate the results of the analysis examining these alternative performance windows, we note that they produce qualitatively similar results.

In the performance analyses, we control for the systematic risk exposure in the returns. To do so, we control for several benchmark risk factors traditionally used in finance literature. The baseline equation to explain returns to institutions' real estate securities ($RE\ Ret_{iqS}$) is:

$$RE\ Ret_{iqS} - Rf_q = \alpha_{iS} + \beta_{iS} \times \left(RE\ premium_q \right) + \chi_{iS} \times SMB_q + \delta_{iS} \times HML_q + \gamma \times UMD_q + \varepsilon_{iqS}, \qquad (6)$$

and for returns in REITs ($REIT\ Ret_{iqS}$) it is:

[5] REIT property types are obtained from SNL.

$$REIT\ Ret_{iqS} - Rf_q = \alpha_{iS} + \beta_{iS} \times \left(REIT\ premium_q \right) + \chi_{iS} \times SMB_q + \delta_{iS} \times HML_q + \gamma \times UMD_q + \varepsilon_{iqS} . \quad (7)$$

The systematic risk of the returns is captured on the right hand side by the value weighted return to all real estate securities in excess of the global risk-free rate (*RE premium*) in equation (6) and by the value weighted return to all REITs in excess of the global risk free rate (*REIT premium*) in equation (7); *SMB* is the global size factor that captures the performance differential between small and large capitalization securities; *HML* is the global value factor that captures the return differential between high and low book-to-market securities; *UMD* is the global momentum factor that captures the return differential between winning and losing securities based on previous six months of returns. The value weighted real estate and REIT benchmarks are computed based on the FactSet universe of publicly traded real estate and REIT securities using float market capitalization weights. The returns to both these benchmarks are shown in Figure 2. The rest of the systematic risk factors are obtained from Kenneth French's data library and used previously in global performance studies (for example, Fama French, 2012).

Additionally, we include the investor's home country and the investor's type as fixed effects to control for variation in investor characteristics. Finally, we control for the total market value of the investor's portfolio in all the specifications. All errors in the regressions are clustered by time and institution or by institution.

4. Results

4.1. Summary Statistics

Table 3 presents the breakdown of the sample by institution type. Panel A presents the breakdown for the 40,138 institutions with real estate holdings, and the mean and median percentage of their portfolio allocated to real estate. Mutual funds represent over half of the sample, followed by hedge

funds and off shore funds, then pension funds. On average, real estate securities comprise 6.1% of mutual fund portfolios, 6.1% of hedge fund portfolios, and 3.1% of pension fund portfolios. Panel B shows the breakdown of the 20,507 institutions with REIT exposure. Among institutions with REIT exposure, REITs represent 7.3% of mutual fund portfolios, 4.8% of hedge funds and offshore funds' portfolio, and 5.0% of pension funds. For our empirical analysis, we drop index funds from the sample because they, by definition, do not attempt to generate abnormal returns. Additionally, we drop banks and insurance from the sample due to their small sample size. Results on the main variables of interest remain similar, however, with inclusion of banks and insurance portfolios.

Appendix A illustrates the sample distribution by the home country of the institutions, which are located in 76 countries. The appendix shows both the number of institutions with either some real estate or REIT holdings as well as the average percentage of each held by the institutions in the sample. The largest number of institutions with real estate are from the United States (9,162), Spain (4,546), and United Kingdom (4,424). The largest number is institutions with REIT holdings are from the United States (8,297), United Kingdom (2,977), and Canada (1,211). For robustness, because many countries only include a handful of institutions, we also run the analysis for the set of countries with at least 10 institutions. Also for robustness, we run all analyses without the institutions domiciled in "tax havens."[6] Results are similar to the baseline analysis as the investor home country fixed effects largely eliminate the potential issues that may be caused by inclusion of the institutions from these markets.

4.2. Portfolio performance of institutions' real estate securities and REITs

[6] The list of "tax-haven" countries includes: Hong Kong, Andorra, Bahamas, Bermuda, Cayman Islands, Cyprus, Gibraltar, Iceland, Monaco and Malta.

We begin the analysis by examining the risk-adjusted performance of institutional investors in real estate securities and REITs. We do this by partitioning the sample based on the real estate or REIT weight of the institutions and by measuring the abnormal performance of the institution's returns from regression equations (6) and (7). The purpose of this exercise is twofold. First, we want to compare the performance of real estate investors to passive benchmarks to see how the performance in this unique sample of real estate investors around the world compares to the findings of previous studies. Second, by partitioning the sample by real estate portfolio weight, we test hypothesis 1 that specialization is positively related to the investor's risk-adjusted returns.

Table 4 presents the results from this analysis. Specifications (1)-(5), show results from analysis in which the dependent variable is the institution's return to real estate securities in excess of the global risk-free rate. Systematic risk is captured by *RE premium*, *SMB*, *HML*, and *UMD*. We also include fixed effects for the institution's type. In specification (1), we analyze the performance of all institutions with real estate holdings; in specifications (2) and (3) we analyze the performance of institutions that hold less than and more than 50% of their portfolio in real estate securities, respectively. In specifications (4) and (5) we analyze the performance of institutions that hold less than and more than 75% of their portfolio in real estate securities.

The results from this analysis show that, on average, institutional investors with holdings in real estate securities underperform the passive benchmark. This is evident in the quarterly *Alpha* that is about -0.74% for the sample that includes all institutional investors in specification (1). When the sample includes investors with holdings of less than 50% or 75% in real estate securities, the quarterly *Alpha* is similar to specification (1), -0.70% and -0.72%, respectively. These alphas are also statistically significant. While the *Alpha* is also negative when the sample includes investors with higher concentrations in real estate securities (specifications 3 and 5), the *Alpha*

loses its statistical significance in the sample that includes the highest concentration or real estate securities. Overall, however, these results suggest that an increase in investors' allocation to real estate securities does not increase investors' risk-adjusted returns. This result does not support hypothesis 1.

Specifications (6)-(10) report the results from return analysis of institutional holdings of REITs. Similar to specification (1)-(5), specifications (6)-(10) show that institutions that hold REITs in small quantities achieve negative abnormal performance. The quarterly *Alpha* in specifications (6), (7) and (9) is -0.48%, -0.47% and -0.49%, respectively, and the alphas are statistically significant. However, unlike with real estate securities, the REIT *Alpha* turns positive and statistically significant for investors with large REIT holdings (specifications 8 and 10). The quarterly REIT *Alpha* for institutions with more than 50% of their holdings in REITs is 0.50%, and for investors with 75% or more of their holdings in REITs, the *Alpha* is 0.66%. This is more than a percentage point higher compared with the *Alpha* in the sample that includes all REIT investors. The result for REITs supports hypothesis 1 that specialization is positively related to investors' performance.

Overall, the results from Table 4 reveal several interesting facts. First, we provide evidence for overall underperformance by investors in publicly traded real estate. The underperformance is larger in magnitude for investors in real estate securities versus REITs. Also, we find a positive relation between portfolio weight and performance, consistent with information advantage theory and benefits to specialization. However, this relation is only present in the sample that contains the REIT investors. The fact that we find benefits to specialization only in a sample of REITs also supports information advantage theory and provides preliminary support for hypothesis 2. This is

because REITs require a unique level of expertise and when information asymmetry of an asset class is high to the average investor, benefits of specialization become more evident.

4.3. Specialization and institutions' excess returns to real estate securities and REITs

In this section, we continue to test whether specialization in real estate securities is positively related to risk-adjusted returns. We also examine whether investing in securities characterized by higher information barriers to the average investor affect the relation between specialization and risk-adjusted returns. As we mentioned earlier in the text, REITs require unique expertise in analysis, i.e. information barriers in REITs are higher to the average investor. Segmentation of the data into real estate securities and REITs allows us to examine whether the benefit from specialization is magnified when information barriers to the average investor are higher. Thus, we expect to observe a stronger positive relation between specialization and returns in the sample that includes REITs.

To test the effect of specialization on investor's returns, we use the return regressions of equations (6) and (7) and add *RE weight* (equation 1a) and *REIT weight* (equation 1b) of the investor's portfolio as additional explanatory variables into the equations. We also control for the logarithm of market value of the investor's portfolio and include investor home country and investor type fixed effects. Table 5 shows the results from this analysis. Panel A shows the results of real estate securities and panel B shows the results for REITs.

The results presented in panel A show that the *RE weight* coefficient is positive and statistically significant at the 1% level in specifications (1), (2) and (4), which include institutional investors with more than 0%, less than 50% and less than 75% real estate holdings, respectively. These results suggest that the higher the weight institutional investors invest in real estate

securities, the better their risk-adjusted performance. For institutions that already have high concentration of real estate holdings (specifications 3 and 5), *RE weight* coefficient is also positive, and especially in specification (5) large in magnitude, but also not statistically significant. Depending on the specification, the economic significance of *RE weight* is also quite large. A one standard deviation increase in *RE weight* increases the quarterly risk-adjusted return, depending on the specification, from about 0.14% to 0.40% per quarter.

In panel B, we repeat the above analysis for REITs. The coefficient of *REIT weight* is positive and statistically significant across the five different specifications, regardless of the institutions' REIT exposure. Also, the economic magnitude of the *REIT weight* coefficient is large across the specifications. A one standard deviation increase in *REIT weight* is associated with 0.50% to 0.70% increase in quarterly risk-adjusted returns from the low levels of REIT exposure to the sample that includes institutions with more than 75% of their holdings in REITs. These results suggest that the more institutional investors specialize in REITs the better their risk-adjusted performance.

Overall, the results presented in Table 5 provide further support for the information advantage theory and hypothesis 1 that specialization is positively related to risk-adjusted returns. Additionally, the discovery in panel B, that the *REIT weight* coefficients are larger than the *RE weight* coefficients in panel A and that increase in *REIT weight* continues to enhance the performance of institutions even with the highest levels of REIT holdings, are especially interesting. These findings further suggest that specialization in securities that are characterized with higher levels of information barriers to the average investor and that require unique skillset provides larger benefits to the investors. This result is also consistent with the information advantage theory and supports hypothesis 2.

Next, we repeat the analysis conducted for Table 5. However, instead of using a continuous measure of real estate or REIT weight as the explanatory variable to test the relation between specialization and returns, we generate indicator variables for quartiles of real estate and REIT weights of investors' portfolios. The main variables of interest are the weight quartiles, so that *Quartile 1* (*Quartile 4*) includes investors with the least (most) amount of real estate securities or REITs in their portfolio, in a given quarter. Specifications (1) and (2) of Table 6 include the samples of real estate securities and REITs, respectively. *Quartile 1* is the omitted category in these analyses.

The results presented in Table 6 are in line with the results from the analyses presented in the previous tables. In both specifications, compared to the omitted category, *Quartiles 2, 3* and *4* each outperform *Quartiles 1*. The monotonic increase in performance from *Quartile 1* to *Quartile 4* indicates that performance is positively related to real estate specialization. These findings provide further support for hypothesis 1 and are consistent with the information advantage theory. Also, the economic magnitude of the coefficients is large and similar to the previous findings. Specialization enhances returns for both real estate securities and for REITs (specification 1 and 2, respectively). The relative outperformance of *Quartile* 4 is especially large for REITs, suggesting that the yield from specialization is more pronounced when investors are highly specialized in investments that require unique expertise. *Quartile 4* of REITs earns 0.76% higher quarterly risk-adjusted return compared to *Quartile 1*, compared to 0.18% higher quarterly risk-adjusted return earned by *Quartile 4* of real estate securities compared to *Quartile 1*.

4.4. Active share analysis

Active share is an alternative way to consider specialization by investors. Instead of focusing on the pure weight of the portfolio invested in real estate securities and REITs, we can also test if deviations from the value weighted benchmark index result in higher risk-adjusted performance. By definition, a portfolio manager who invests his portfolio perfectly in line with benchmark weights will not earn positive alpha, so the only way to earn superior returns is to deviate from the underlying benchmark weights. Investors with some inherent skill in analyzing securities will be more likely to take on larger deviations from the benchmark. We test the relation between active share and performance by including the active share of real estate securities (equation 3) and active share in REITs (equation 5) in the regression equations (6) and (7) as the main explanatory variable. As we detailed in the methodology section, the active share measure employed in this analysis takes a value between 0 and 100. A value of 0 signifies a perfectly diversified portfolio based on weights of the securities available in a given quarter, while 100 signifies a portfolio that would have to be 100% reallocated in order to achieve perfect diversification.

Table 7 shows the results from the active share analysis. Panel A shows results for real estate securities and panel B for REITs. Results in panel A show that, when real estate securities are considered, less diversified portfolios (higher active share) are associated with higher returns. The *AS RE* coefficients are positive across the specifications that include samples of investors with varying levels of real estate security exposure. However, the *AS RE* coefficient is not statistically significant in all specifications. On the other hand, the coefficients of *AS REIT* are statistically significant in all the specifications in panel B, regardless of the REIT weight threshold of the overall portfolio. These coefficients increase in magnitude as the investor's portfolio weight in REITs increases. Results also suggest that high active share in a REIT portfolio is not beneficial for investors who do not hold a high portfolio weight in REITs (negative coefficient in

specification 1, 2, and 4) and increasingly beneficial, the higher the institutional investor's portfolio weight is in REITs. The economic significance of active share is also meaningful. A one standard deviation (which is roughly an 8% increase in the required reallocation to achieve perfect diversification) increase in active share results in 0.13% and 0.25% increase in the institutions' quarterly risk-adjusted return in the portfolios that contain more than 50% and 75% of their weight in REITs, respectively.

Overall, the results presented in Table 7 suggest that institutions that have more of their portfolio invested in REITs with higher active share achieve even higher risk-adjusted return. The same is not necessarily true for the real estate securities. The evidence that higher active share in REITs yields superior performance provides additional support to our previous findings and is in line with the information advantage theory.

Lastly, in order to ensure that our results are not driven by the unique market conditions that existed during the financial crisis, in untabulated analysis, we replicate the analyses mentioned above excluding data from the crisis (Q3:2007-Q4:2008). We note that we obtain qualitatively similar results, when we exclude the global financial crisis, as we reported in our tables. These untabulated results suggest that our findings are not driven by the financial crisis.

5. Conclusion

In this paper, we examine the performance of institutional investors in publicly traded real estate securities. Utilizing the quarterly real estate security and REIT holdings of over 40,000 institutional investors from around the world, we examine the implications of the information advantage theory. Specifically, we explore whether specialization allows investors to generate

superior returns. Additionally, we explore whether the benefits associated with specialization are greater in institutions' REIT holdings, which are more informationally opaque.

We find that institutions in publicly traded real estate are not able to generate abnormal returns, on average. However, higher real estate portfolio weight and active share - both measures of specialization - are associated with greater risk-adjusted returns. Additionally, we find that the benefits of specialization are larger in REITs, which have higher levels of information asymmetry. Overall, our findings are consistent with the predictions of information advantage theory. Namely, investors can benefit from concentrating their holdings in assets in which they possess more information than the average investor.

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Table 1
Real estate securities and REITs used to define the sample

Table 1 displays the four-digit SIC code for real estate securities and REITs used to compute institution's real estate exposure and performance. The last column shows the number of securities in the sample period that belong to each SIC.

SIC	SIC Name	Number of securities
6798	REAL ESTATE INVESTMENT TRUSTS	886
1521	SINGLE-FAMILY HOUSING CONSTRUCTION	139
1522	RESIDENTIAL CONSTRUCTION, NEC	248
1531	OPERATIVE BUILDERS	194
1541	INDUSTRIAL BUILDINGS AND WAREHOUSES	217
1542	NONRESIDENTIAL CONSTRUCTION, NEC	93
1711	PLUMBING, HEATING, AIR-CONDITIONING	25
1721	PAINTING AND PAPER HANGING	1
1731	ELECTRICAL WORK	54
1742	PLASTERING, DRYWALL, AND INSULATION	4
1743	TERRAZZO, TILE, MARBLE, MOSAIC WORK	10
1751	CARPENTRY WORK	5
1752	FLOOR LAYING AND FLOOR WORK, NEC	2
1761	ROOFING, SIDING, AND SHEETMETAL WORK	6
1771	CONCRETE WORK	8
1781	WATER WELL DRILLING	4
1791	STRUCTURAL STEEL ERECTION	22
1793	GLASS AND GLAZING WORK	2
1794	EXCAVATION WORK	5
1795	WRECKING AND DEMOLITION WORK	3
1796	INSTALLING BUILDING EQUIPMENT	20
1799	SPECIAL TRADE CONTRACTORS, NEC	43
2451	MOBILE HOMES	4
2452	PREFABRICATED WOOD BUILDINGS	14
3716	MOTOR HOMES	3
4221	FARM PRODUCT WAREHOUSING AND STORAGE	3
4222	REFRIGERATED WAREHOUSING AND STORAGE	13
4225	GENERAL WAREHOUSING AND STORAGE	40
4226	SPECIAL WAREHOUSING AND STORAGE, NEC	17
5271	MOBILE HOME DEALERS	2
6162	MORTGAGE BANKERS AND CORRESPONDENTS	53
6512	NONRESIDENTIAL BUILDING OPERATORS	118
6513	APARTMENT BUILDING OPERATORS	76
6514	DWELLING OPERATORS, EXCEPT APARTMENTS	9
6515	MOBILE HOME SITE OPERATORS	13
6519	REAL PROPERTY LESSORS, NEC	137
6531	REAL ESTATE AGENTS AND MANAGERS	1,221
6552	SUBDIVIDERS AND DEVELOPERS, NEC	574
7011	HOTELS AND MOTELS	543
7021	ROOMING AND BOARDING HOUSES	1
7349	BUILDING MAINTENANCE SERVICES, NEC	24
	TOTAL	4,856

Table 2
Real estate securities and REITs by domicile

Table 2 shows the number of real estate securities and REITs from Table 1 by their country of domicile. Each security must be "investable" to both domestic and foreign investors to be included in the sample.

Country	Number of real estate securities	Number of REITs	Country	Number of real estate securities	Number of REITs
ARE	18	0	LKA	54	0
ARG	12	0	LTU	1	0
AUS	141	55	LUX	12	1
AUT	19	0	LVA	1	0
BEL	23	11	MAR	8	0
BGD	3	0	MCO	1	0
BGR	8	7	MEX	26	6
BHR	5	0	MLT	2	0
BMU	86	2	MUS	14	0
BRA	56	0	MWI	1	1
BWA	5	1	MYS	133	18
CAN	76	56	NAM	0	1
CHE	46	0	NGA	3	1
CHL	23	0	NLD	24	8
CHN	189	1	NOR	29	0
CIV	1	0	NZL	12	7
CYM	98	2	OMN	9	0
CYP	18	2	PAK	5	0
CZE	2	0	PAN	1	0
DEU	148	8	PER	8	0
DNK	24	3	PHL	60	0
EGY	50	3	POL	57	0
ESP	47	3	PRT	14	0
EST	6	0	PSE	7	1
FIN	12	2	QAT	7	0
FRA	126	14	ROU	10	0
GBR	212	79	RUS	16	4
GGY	3	11	SAU	18	0
GRC	37	2	SGP	85	32
HKG	68	10	SRB	2	0
HRV	22	1	SVK	2	0
HUN	6	1	SVN	4	0
IDN	69	0	SWE	88	2
IMN	2	5	THA	210	3
IND	207	0	TUN	4	0
IRL	8	4	TUR	27	16
ISL	1	1	TWN	88	12
ISR	97	7	UKR	11	0
ITA	29	1	USA	168	356
JAM	2	2	VEN	6	2
JEY	3	2	VGB	8	4
JOR	39	9	VNM	118	7
JPN	396	65	ZAF	64	16
KEN	2	0	ZMB	2	0
KOR	44	15	ZWE	3	0
KWT	54	3			
LBN	3	0	Total	3966	886

Table 3
Sample description by investor type

Table 3 presents the breakdown of the sample by institution type. Panel A is limited to the 40,138 institutions with investments in real estate securities. Panel B is limited to the 20,507 institutions with REIT investments. Both panels also report the mean and median percentage of the portfolio invested in the relevant real estate sector.

Panel A: Institutions with investments in real estate securities

Investor type	Total Number	Average RE weight	Median RE weight
Banks & Insurance	216	0.104	0.040
Hedge funds & Offshore	7,301	0.061	0.033
Index	2,294	0.058	0.031
Mutual funds	27,736	0.061	0.032
Pension funds	2,591	0.031	0.017
Total (Average)	40,138	(0.063)	(0.031)

Panel B: Institutions with investments in REITs

Investor type	Total Number	Average REIT weight	Median REIT weight
Banks & Insurance	107	0.046	0.010
Hedge funds & Offshore	3,851	0.048	0.019
Index	1,282	0.074	0.026
Mutual funds	13,108	0.073	0.023
Pension funds	2,159	0.050	0.019
Total (Average)	20,507	(0.058)	(0.019)

Table 4
Portfolio performance by investors in real estate securities and REITs

Table 4 shows results from cross-sectional regressions examining the determinants of investors' excess returns on real estate securities and REITs from the first quarter of 1999 to the second quarter of 2015. The dependent variable is the quarterly value-weighted return of the investor's real estate securities (specifications 1-5) or REITs (specifications 6-10) in its portfolio in excess to the global risk-free rate over the same quarter. The value-weighted quarterly return is computed based on the consecutive 3-month security returns following the reporting period. The independent variables include the value weighted return to real estate securities or REITs in excess of the global risk-free rate (*RE premium* in specifications 1-5, *REIT premium* in specifications 6-10) as well as the global Fama French risk factors to capture other systematic risk in returns (*SMB, HML, UMD*). The top row displays the constant, which is the unexplained, or abnormal, return *Alpha* from regression equations (6) and (7) and the main variable of interest of this table. Specifications display results from regressions that include investors with varying levels of exposure to real estate securities and REITs. Specifications (1) and (6) include investors with at least some exposure, specifications (2) and (7) include investors with less than 50%, specifications (3) and (8) investors with more than 50%, specifications (4) and (9) investors with less than 75%, and specifications (5) and (10) investors with 75% or more exposure in any given quarter. Specifications also include investor type fixed effects. Errors are investor-quarter clustered. The robust t-statistics are reported in brackets (* significant at 10%, ** significant at 5%, *** significant at 1% level).[7]

Table 4 continues

[7] We replicate the analysis without the quarters during the Global Financial Crisis (Q3:2007-Q4:2008). The statistical and economic significance of the main results are similar without this time period.

Table 4 continues

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Investors	All	<50%	>50%	<75%	>75%	All	<50%	>50%	<75%	>75%
Securities	RE	RE	RE	RE	RE	REIT	REIT	REIT	REIT	REIT
Alpha	-0.0074***	-0.0070***	-0.0141*	-0.0072***	-0.0161	-0.0048***	-0.0047***	0.0050**	-0.0049***	0.0066**
	[-77.188]	[-98.691]	[-1.724]	[-87.323]	[-0.927]	[-18.476]	[-47.151]	[2.018]	[-36.526]	[2.248]
RE premium	0.0352***	0.0294***	0.5763***	0.0329***	0.6475***					
	[86.955]	[101.957]	[35.304]	[94.433]	[17.237]					
REIT premium						0.0805***	0.0401***	0.9130***	0.0508***	1.0715***
						[75.081]	[91.567]	[113.768]	[83.655]	[110.617]
SMB	0.0136***	0.0159***	0.0391	0.0142***	0.2286**	-0.0025	0.0048***	-0.0890***	-0.0007	-0.1705***
	[16.331]	[24.823]	[0.914]	[19.471]	[2.273]	[-1.418]	[6.053]	[-4.776]	[-0.678]	[-6.785]
HML	0.0028***	-0.0026***	0.5260***	0.0007	0.5320***	-0.0326***	-0.0319***	0.0426**	-0.0335***	0.0340
	[3.392]	[-4.505]	[13.787]	[1.060]	[6.213]	[-16.878]	[-38.824]	[2.356]	[-30.497]	[1.429]
UMD	-0.0078***	-0.0079***	0.0262	-0.0076***	0.0433	-0.0029**	-0.0066***	0.0599***	-0.0045***	0.1006***
	[-14.156]	[-20.793]	[1.155]	[-16.670]	[0.869]	[-2.231]	[-11.422]	[6.222]	[-5.880]	[8.643]
Observations	383,457	379,553	3,904	382,111	1,346	184,439	175,785	8,654	179,084	5,355
Adjusted R^2	0.0962	0.1298	0.4709	0.1147	0.3961	0.1059	0.1555	0.7908	0.1330	0.8285

Table 5
Determinants of excess returns in real estate securities

Table 5 shows results from cross-sectional regressions examining the determinants of investors' excess returns on real estate securities (panel A) and REITs (panel B) from the first quarter of 1999 to the second quarter of 2015. The dependent variable is the quarterly value-weighted return on the investor's real estate securities or REITs in excess of the global risk-free rate over the same quarter. The value-weighted quarterly return is computed based on the consecutive 3-month security returns following the reporting period. The main independent variable of interest is the share of real estate securities (*RE weight* in panel A) or share of REITs (*REIT weight* in panel B) investor holds as a share of the total market value of its portfolio from equations (1a) and (1b). We also control for the logarithm of total market value of the investor's portfolio (*MVE*), and include several systematic risk factors. The risk factors include the value weighted return on real estate securities or REITs in excess of the global risk-free rate (*RE premium, REIT premium* in panels A and B, respectively) as well as the global Fama French factors (*SMB*, *HML*, *UMD*). The specifications in both panels include investors with >0% of real estate or REIT holdings in any given quarter in specification (1), <50% in specification (2), >50% in specification (3), <75% in specification (4) and > 75% in specification (5). Regressions are run with investor home country and investor type fixed effects. Errors are investor-quarter clustered. The robust t-statistics are reported in brackets (* significant at 10%, ** significant at 5%, *** significant at 1% level) below the coefficients.[8]

Panel A: Real Estate Securities

Specification	(1)	(2)	(3)	(4)	(5)
Investors	All	<50%	>50%	<75%	>75%
RE weight	0.0152***	0.0169***	0.0115	0.0181***	0.0435
	[9.490]	[14.962]	[1.119]	[13.848]	[1.258]
MVE	0.0062***	0.0025**	0.1574**	0.0045***	0.0297
	[3.905]	[2.460]	[2.294]	[3.605]	[0.183]
RE premium	0.0420***	0.0359***	0.5935***	0.0395***	0.6788***
	[117.269]	[143.585]	[43.154]	[131.059]	[22.151]
SMB	0.0133***	0.0153***	0.0398	0.0139***	0.2426**
	[15.929]	[24.069]	[0.961]	[19.078]	[2.548]
HML	0.0073***	0.0013**	0.5182***	0.0049***	0.5340***
	[8.737]	[2.260]	[14.024]	[7.007]	[6.459]
UMD	-0.0031***	-0.0034***	0.0202	-0.0030***	0.0223
	[-5.781]	[-9.290]	[0.942]	[-6.930]	[0.486]
Fixed effects					
Home Country	Yes	Yes	Yes	Yes	Yes
Type	Yes	Yes	Yes	Yes	Yes
Observations	383,457	379,553	3,904	382,111	1,346
Adjusted R^2	0.1094	0.1434	0.5015	0.1306	0.4453

[8] We replicate the analysis without the quarters during the Global Financial Crisis (Q3:2007-Q4:2008). The statistical and economic significance of the main results are similar without this time period.

Panel B: REITs

Specification	(1)	(2)	(3)	(4)	(5)
Investors	All	<50%	>50%	<75%	>75%
REIT weight	0.0369***	0.0361***	0.0401***	0.0339***	0.0526***
	[31.007]	[22.782]	[12.310]	[26.881]	[5.461]
MVE	-0.0028	0.0058***	-0.0312	0.0059***	-0.0538
	[-0.930]	[4.394]	[-1.072]	[3.498]	[-1.347]
REIT premium	0.0827***	0.0426***	0.8900***	0.0532***	1.0321***
	[68.143]	[96.925]	[101.554]	[81.680]	[101.006]
SMB	-0.0008	0.0064***	-0.1048***	0.0028***	-0.1800***
	[-0.499]	[8.229]	[-5.751]	[2.804]	[-7.265]
HML	-0.0305***	-0.0306***	0.0392**	-0.0311***	0.0497**
	[-16.540]	[-37.888]	[2.150]	[-29.564]	[2.042]
UMD	-0.0012	-0.0046***	0.0432***	-0.0023***	0.0756***
	[-0.937]	[-8.338]	[4.112]	[-3.105]	[5.736]
Fixed effects					
Home Country	Yes	Yes	Yes	Yes	Yes
Type	Yes	Yes	Yes	Yes	Yes
Observations	184,439	175,785	8,654	179,084	5,355
Adjusted R^2	0.1825	0.2067	0.7992	0.1947	0.8336

Table 6
Determinants of excess returns to real estate securities and REITs by portfolio weight quartiles

Table 6 repeats analysis of Table 5 while including quartiles of real estate and REIT weights of investors' portfolios as independent variables. The dependent variable is the quarterly value-weighted return on the investor's real estate securities or REITs in excess of the global risk-free rate over the same quarter. The value-weighted quarterly return is computed based on the consecutive 3-month security returns following the reporting period. The main independent variables of interest in specifications (1) and (2) are the real estate weight quartiles so that *Q1* (*Q4*) incudes investors with the least (most) amount of real estate securities or REITs in a given quarter in their portfolio (*Q1* is the omitted category). We also control for the logarithm of total market value of the investor's portfolio (*MVE*), and we include several benchmarks to capture systematic risk in the excess returns. Benchmarks include the value weighted return to real estate securities or REITs (specifications 1 and 2, respectively) in excess of the global risk-free rate as well as the global Fama French factors to capture other systematic risk in returns (*SMB*, *HML*, *UMD*). Return benchmarks are omitted from the table in the interest of brevity. Regressions are run with investor home country and investor type fixed effects. Investor type fixed effects are reported and *Pension Funds* are the omitted category. Errors are investor-quarter clustered. The robust t-statistics are reported in brackets below the coefficients (* significant at 10%, ** significant at 5%, *** significant at 1% level).[9]

Specification	(1)	(2)
Securities	Real Estate	REIT
Q2	0.0003***	0.0003***
	[9.387]	[6.545]
Q3	0.0007***	0.0008***
	[21.309]	[15.181]
Q4	0.0018***	0.0076***
	[22.771]	[39.703]
MVE	0.0008*	-0.0019***
	[1.891]	[-3.130]
Fixed effects		
Home Country	Yes	Yes
Type	Yes	Yes
Observations	392,690	189,905
Adjusted R^2	0.1049	0.1277

[9] We replicate the analysis without the quarters during the Global Financial Crisis (Q3:2007-Q4:2008). The statistical and economic significance of the main results are similar without this time period.

Table 7
Active share in real estate securities and REITs

Table 7 repeats analysis of Table 5 while including the active share measure of investors' real estate securities or REITs as the main measure of investor specialization. The dependent variable is the quarterly value-weighted return on the investor's real estate securities (panel A) or REITs (panel B) in excess of the global risk-free rate over the same quarter. The value-weighted quarterly return is computed based on the consecutive 3-month security returns following the reporting period. The main independent variables of interest are active share in real estate securities (*RE AS*) in panel A and active share in REITs (*AS REIT*) in panel B. These active share measures take a value between 0 and 100. A value of 0 signifies a perfectly diversified portfolio based on weights of the securities available in a given quarter while a value of 100 signifies a portfolio that would have to be 100% reallocated in order to achieve perfect diversification. To be included in the sample, the investor is required to hold at least ten real estate securities or REITs. We also control for the logarithm of total market value of the investor's portfolio (*MVE*), and we include several benchmarks to capture systematic risk in the excess returns. Benchmarks include the value weighted return to real estate securities or REITs (panel A and panel B, respectively) in excess of the global risk-free rate as well as the global Fama French factors to capture other systematic risk in returns (*SMB*, *HML*, *UMD*). Regressions are run with investor home country and investor type fixed effects. Errors are investor-quarter clustered. The robust t-statistics are reported in brackets below the coefficients (* significant at 10%, ** significant at 5%, *** significant at 1% level).[10]

Panel A: Real Estate Securities

Specification	(1)	(2)	(3)	(4)	(5)
Investors	All	<50%	>50%	<75%	>75%
RE AS	0.0131***	0.0033	0.0236*	0.0107***	0.0431
	[4.554]	[1.500]	[1.920]	[4.049]	[1.263]
MVE	-0.0001	-0.0001	0.0005	-0.0001	0.0014
	[-0.256]	[-0.583]	[0.777]	[-0.664]	[0.807]
RE premium	0.3112***	0.2184***	0.5791***	0.2861***	0.7358***
	[61.864]	[61.006]	[48.979]	[62.735]	[23.521]
SMB	-0.0689***	-0.0621***	-0.0841**	-0.0681***	0.0072
	[-5.668]	[-7.139]	[-2.456]	[-6.008]	[0.083]
HML	0.1722***	0.0833***	0.4532***	0.1600***	0.3488***
	[14.732]	[10.432]	[14.333]	[15.138]	[4.355]
UMD	0.0435***	0.0382***	0.1110***	0.0418***	0.2136***
	[5.534]	[6.739]	[6.104]	[5.787]	[4.455]
Fixed effects					
Home Country	Yes	Yes	Yes	Yes	Yes
Type	Yes	Yes	Yes	Yes	Yes
Observations	10,674	8,232	2,442	10,108	566
Adjusted R^2	0.4673	0.514	0.6463	0.4877	0.6022

[10] We replicate the analysis without the quarters during the Global Financial Crisis (Q3:2007-Q4:2008). The statistical and economic significance of the main results are similar without this time period.

Panel B: REITs

Specification	(1)	(2)	(3)	(4)	(5)
Investors	All	<50%	>50%	<75%	>75%
REIT AS	-0.0187***	-0.0054**	0.0163**	-0.0165***	0.0361***
	[-6.060]	[-2.396]	[2.522]	[-6.896]	[3.669]
MVE	0.0000	-0.0003**	0.0001	-0.0003*	0.0000
	[-0.230]	[-2.545]	[0.501]	[-1.664]	[-0.034]
REIT premium	0.5888***	0.2710***	0.9511***	0.3832***	1.0730***
	[72.635]	[48.942]	[116.974]	[60.459]	[126.217]
SMB	-0.0436***	-0.0403***	-0.1192***	-0.0722***	-0.2078***
	[-3.571]	[-4.838]	[-7.952]	[-7.457]	[-10.206]
HML	0.0722***	0.0505***	0.0710***	0.0261***	0.0672***
	[6.152]	[5.748]	[5.069]	[2.627]	[3.989]
UMD	0.0126	-0.0115	0.0721***	0.0068	0.0924***
	[1.363]	[-1.585]	[7.103]	[0.894]	[7.714]
Fixed effects					
Home Country	Yes	Yes	Yes	Yes	Yes
Type	Yes	Yes	Yes	Yes	Yes
Observations	14,897	7,986	6,911	10,729	4,168
Adjusted R^2	0.6246	0.5851	0.8706	0.6015	0.9025

Figure 1: Institutional investment in real estate

Figure 1 shows the total number of institutional portfolios (left axis) in each sample year with greater than 0% of holdings in either REITs or real estate securities. The figure also shows the average percent of all institutional holdings in both REITs and real estate securities (right axis) of those institutions with at least some real estate exposure.

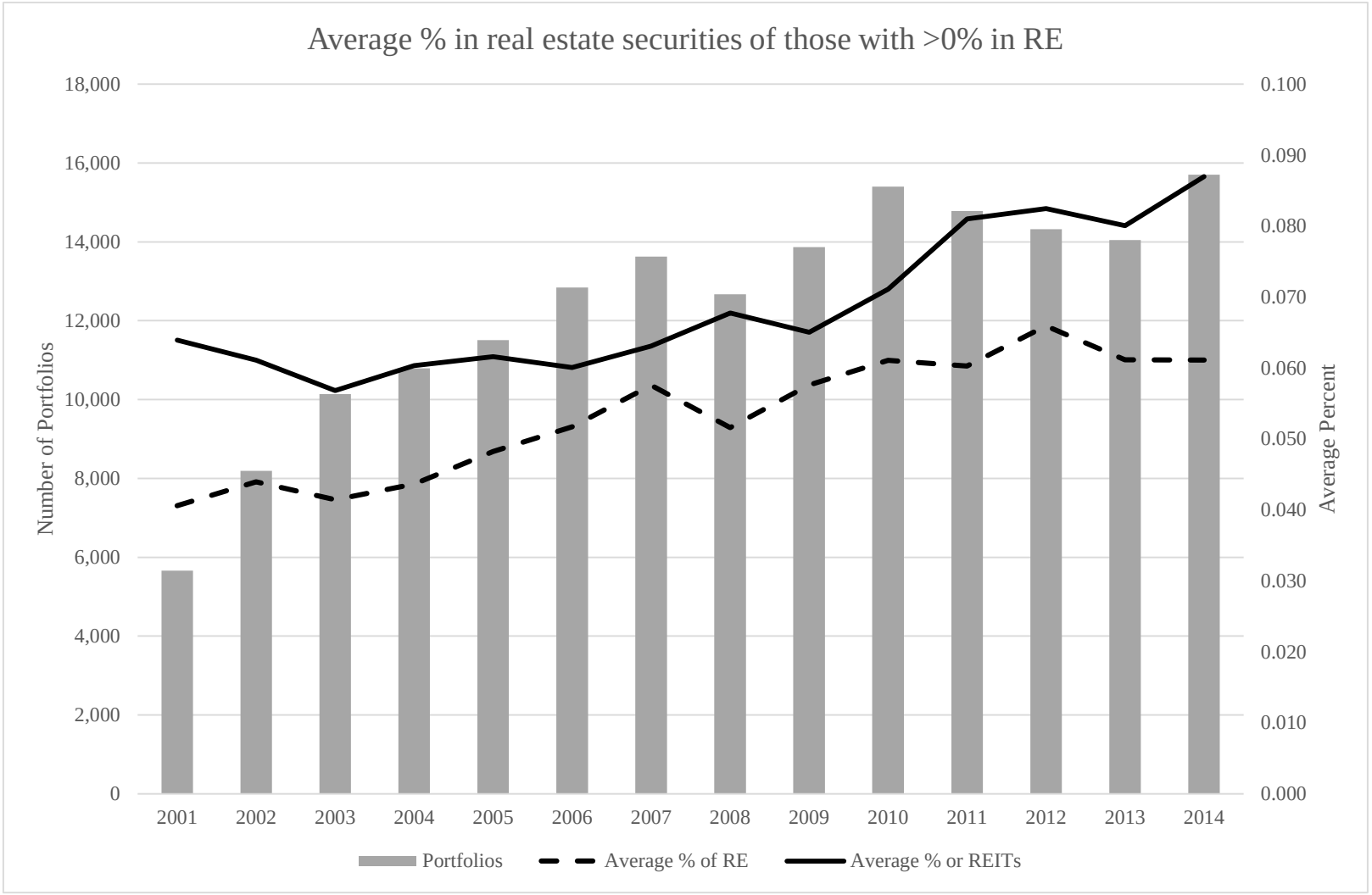
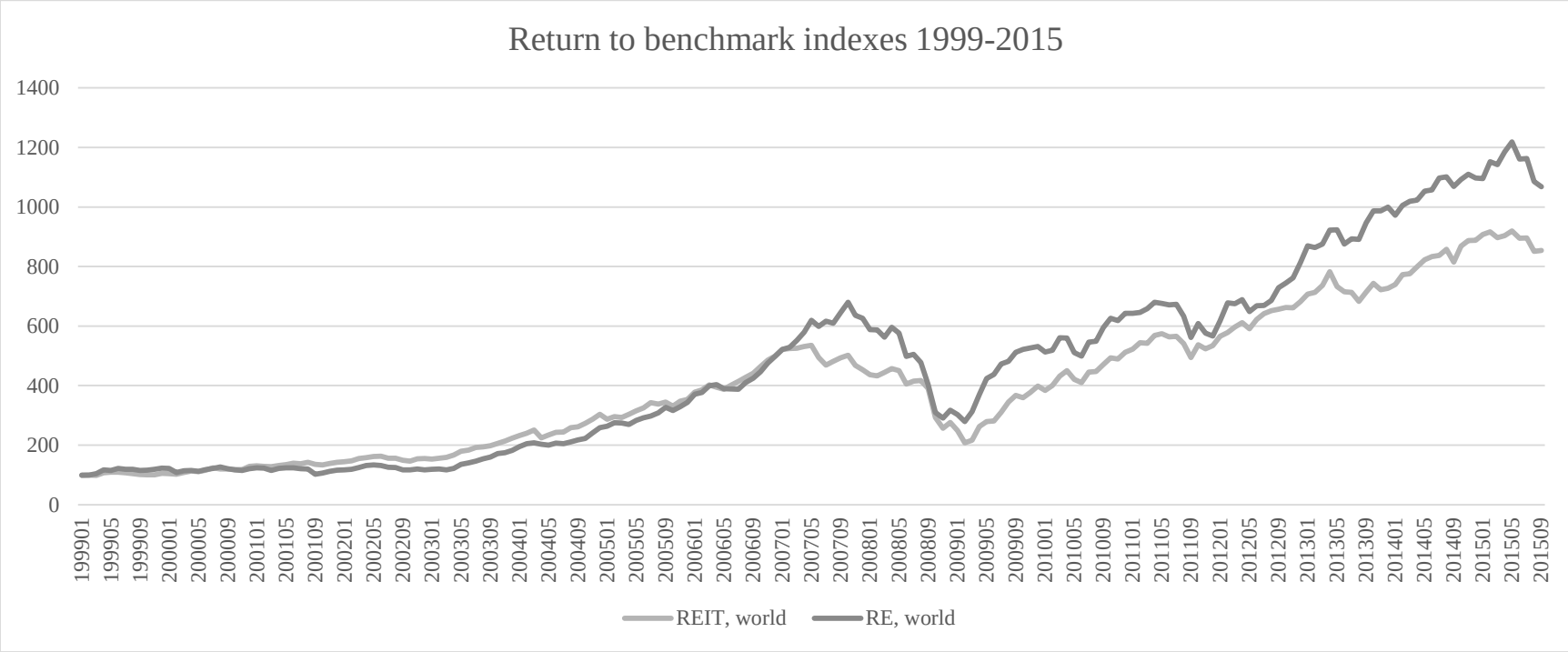


Figure 2: Return to benchmarks

Figure 2 shows the monthly performance of the two real estate benchmarks used in the study. All benchmarks are computed based on value-weighted returns on the securities in the benchmark. All security returns are first converted to USD based on the exchange rate during each month. REIT securities are those that belong to SIC code 6798. Real estate securities industry SIC's are reported in Table 1.



Appendix A
Sample description by investor's domicile

Appendix A shows the sample averages for portfolio weights of real estate securities and REITs by institutions' domiciles. The first column shows the number of investors from each domicile during the sample period and the last two columns show the average portfolio weights in real estate related securities and REITs. The table includes all investors with at least some portfolio weight in either real estate securities or REITs.

Domicile	Number RE	Number REITs	Portfolio weight RE	Portfolio weight REIT	Domicile	Number RE	Number REITs	Portfolio weight RE	Portfolio weight REIT
AND	2		0.0580		JPN	918	185	0.0625	0.2218
ARE	25	1	0.2844	0.0171	KOR	75	3	0.0383	0.0112
ARG	6	1	0.0821	0.0095	KWT	6		0.2348	
AUS	547	225	0.1849	0.1884	LBN	1		0.1417	
AUT	342	148	0.0938	0.0663	LIE	103	35	0.1085	0.0775
BEL	475	319	0.0559	0.0430	LKA	3		0.2233	
BGR	2	1	0.0592	0.1430	LTU	10		0.1056	
BHR	3		0.0912		LUX	597	272	0.0541	0.0485
BHS	20	6	0.0335	0.0118	LVA	3	1	0.0127	0.0124
BMU	16	6	0.0544	0.0183	MCO	1	1	0.0806	0.1303
BOL	1		0.0468		MEX	82	4	0.0926	0.0431
BRA	877	10	0.1478	0.0216	MLT	7	1	0.0621	0.0283
CAN	1,857	1,211	0.0398	0.0570	MYS	178	104	0.0989	0.0529
CHE	1,498	734	0.0669	0.0495	NAM	5	5	0.0713	0.0323
CHL	158	14	0.0951	0.0399	NLD	482	328	0.0953	0.1102
CHN	565	11	0.0682	0.1793	NOR	254	95	0.0381	0.0169
CYM	4	3	0.0446	0.0398	NZL	17	10	0.0962	0.0979
CYP	1		0.0442		OMN	4		0.2269	
CZE	25	10	0.1164	0.0639	PAK	25		0.0274	
DEU	2,952	906	0.0407	0.0349	PHL	10	1	0.2038	0.0077
DNK	435	233	0.0412	0.0287	POL	228	99	0.0816	0.0186
EGY	1		0.3213		PRT	176	32	0.0372	0.0143
ESP	4,546	835	0.0614	0.0964	QAT	1		0.0920	
EST	25	13	0.0840	0.0544	ROU	8		0.1519	
FIN	272	77	0.0757	0.0754	RUS	8	5	0.0876	0.0948
FRA	2,821	1,036	0.0586	0.0432	SAU	11	2	0.1586	0.3618
GBR	4,424	2,977	0.0516	0.0539	SGP	427	227	0.0973	0.0572
GIB	2	2	0.0528	0.0128	SVK	9	4	0.1513	0.0461
GRC	87	30	0.0432	0.0238	SVN	75	40	0.0381	0.0396
HKG	646	286	0.1203	0.0420	SWE	715	266	0.0472	0.0178
HRV	24	9	0.1543	0.0768	THA	138	1	0.0330	0.0092
HUN	34	15	0.0773	0.0351	TTO	1	1	0.0343	0.0434
IDN	13		0.0693		TUR	17	15	0.0512	0.0480
IND	1,014	5	0.0642	0.0223	TWN	400	123	0.0743	0.0733
IRL	240	135	0.0350	0.0181	USA	9,162	8,297	0.0377	0.0753
ISL	4	1	0.0376	0.0227	VNM	7	3	0.1646	0.0817
ISR	601	296	0.1294	0.0445	ZAF	566	462	0.0890	0.0958
ITA	842	329	0.0377	0.0361					
JOR	1		0.0765		Total (Avg)	40,138	20,507	0.0895	0.0596