MSA Geographic Allocations, Property Selection, and Performance Attribution in Public and Private Real Estate Market Returns

by

David C. Ling*, Andy Naranjo*, and Benjamin Scheick+

*Department of Finance, Insurance, and Real Estate
Warrington College of Business Administration
University of Florida
Gainesville, Florida 32611
Email: ling@ufl.edu; andy.naranjo@warrington.ufl.edu
Phone: (352) 273-0313; (352) 392-3781

+Department of Finance
Villanova School of Business
Villanova University
Villanova, Pennsylvania, 19085
Email: benjamin.scheick@villanova.edu
Phone: (610) 519-7994

Current Draft: April 2015

Abstract:

This paper examines the impact of differences in geographic portfolio concentrations on comparisons of return performance of U.S. public and private commercial real estate investors over the 1996-2013 time period. Returns are carefully adjusted for differences between public and private markets in financial leverage, property type focus, management fees, and geographic concentrations. With these adjustments, we are able to more accurately assess the relative performance of "geographically identical" public and private market portfolios. Furthermore, through formal attribution analysis we are able to provide insights on whether relative return performance is attributable to differences in MSA allocations versus individual property selection and management within MSAs. In particular, we find that the allocation effect constitutes a small portion of the total return difference, relative to the selection plus interaction effects. This indicates that the decision to allocate to a particular MSA is relatively less important than the manager's ability to select properties within that MSA.

We thank the National Association of Real Estate Investment Trusts for proving partial funding for the research.

1. Background and Motivation

Both direct private and public REIT markets can provide investors with exposure to the same underlying local property markets. However, as commonly measured, public and private real estate returns often exhibit significantly different risk-return characteristics, especially in the short-run. For example, several studies find that investments in direct private real estate, as proxied for by the National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index (NPI), produce lower average returns than comparable investments in publicly-traded real estate investment trusts (REITs), even after controlling for differences in financial leverage, property mix, and management fees (Riddiough et al., 2005; and Tsai, 2007).

More recently, Ling and Naranjo (2015) find that passive portfolios of unlevered core REITs (unconditionally) outperformed their private market benchmark by 49 basis points (annualized) over the 1994-2012 sample period. Although Ling and Naranjo (2015) carefully control for (firm-level) leverage, property type, and management fees in their comparisons of public and private market returns, they do not adjust for differences in the geographic MSA composition of underlying properties. As a result, the authors are unable to determine the extent to which the measured outperformance of equity REITs over their sample period is attributable to the magnitude and timing of MSA-level property sector allocations and/or individual property selection within these MSAs. Ling and Naranjo (2015) conclude that future research should attempt to address the extent to which public and private market performance differences are attributable to differences in the geographic distribution of REIT-owned properties relative to NCREIF properties. In this paper, we examine MSA geographic allocations, property selection, and performance attribution in public and private market real estate returns.

Prior research investigating the extent to which geographic allocations and property type selection affect value has yielded mixed results. Gyourko and Nelling (1996), Capozza and Seguin (1998) and Ambrose *et al.* (2000) find no economic benefit to geographic concentration. In contrast, Campbell *et al.* (2003) find that announcements of portfolio acquisitions by REITs are greeted more favorably if they reconfirm the buyers' geographic focus. Capozza and Seguin (1999) provide some additional evidence suggesting that REITs that are more diversified across property types (but not across geography) are in fact penalized. However, Hartzell *et al.* (2014) find that REITs diversifying into more locations tend to be valued lower than REITs with tighter geographic focus. In terms of asset selection, Cici *et al.* (2011) find that fund managers generate significant positive alpha with their selection ability but that geographic concentration strategies do not explain selection outperformance.

More recently, Hochberg and Muhlhofer (2014) find that REIT managers generally exhibit little market timing ability, but positive selection ability.

Our research contributes to this related research stream by examining the effects of geographic concentrations of real estate holdings on the relative return performance of US public and private real estate markets. In particular, we assess relative performance after carefully adjusting for differences in the geographic composition of property portfolios in these two markets. We then decompose performance differences into allocation, selection, and interaction effects through a formal attribution analysis.

To measure the MSA risk exposures of publicly-traded equity REITs, we first obtain time-varying property level location data from SNL's Real Estate Database. From this information, we compute the percentage allocations of equity REIT portfolios to each MSA at the beginning of each year based on various size measures. This allows us to compare the MSA concentrations of publicly-traded REITs, by core property type (i.e., apartments, industrial, office, and retail), to the MSA concentrations of the properties in the NCREIF database over the 1996-2013 sample period. We then calculate the extent to which adjusting for these differences in MSA exposure affects the NPI returns reported by NCREIF. This is accomplished by obtaining quarterly MSA-level NCREIF NPI returns for the four core property types and then reweighting these MSA-level returns to create returns for each core property type using the same time-varying MSA weights observed in the REIT data. With these careful adjustments, we are able to more accurately compare the geographically reweighted NPI returns to unlevered REIT returns and thereby assess the relative performance of "geographically identical" public and private market portfolios. We attribute performance differences after geographically reweighting NCREIF NPI returns to property (asset) selection within MSAs.

We document significant differences in geographic allocations of property portfolios between public and private markets. These differences vary significantly over time and across property type classifications. We further establish how accounting for time-series and cross-sectional differences in the geographic concentrations of the properties held by core equity REITs and NCREIF investors can significantly impact the performance comparison across markets. Adjusting private markets for differences in geographic concentrations with public markets, we find that core private market performance falls, consistent with the documented negative geographic allocation valuation effects in the prior literature. Focusing on property types, we find the biggest return difference in the retail sector. The benchmark return for retail NPI properties is 10.0 basis points lower than the corresponding quarterly unadjusted NPI return over our sample period; thus, its use in place of the

unadjusted NPI retail return decreases the measured relative performance of NCREIF investors. In contrast, the reweighted mean returns for industrial and office properties are 2.5 and 3.8 basis points, respectively, greater than the corresponding unadjusted quarterly NPI return. Thus, using reweighted returns slightly increases the average performance of industrial and office NCREIF investors relative to the performance of REIT investors in these property types over the 1996-2013 sample.

In addition to providing an improved methodology for comparing public and private market portfolio returns that controls for differences in geographic concentrations across investor groups, we also provide insights as to the importance of geographic allocation on relative return performance. We find that the allocation effect constitutes a small portion of the total return difference, relative to the selection plus interaction effects. This result indicates that the decision to allocate to a particular MSA is relatively less important than the manager's ability to select properties within that MSA, consistent with Capozza and Seguin's (1999) positive selection effect hypothesis. However, the sign and magnitude of the allocation effect varies significantly over the sample period and property type being examined.

The remainder of the paper proceeds as follows. The next section provides an initial comparison of public and private market performance over the 1996-2013 sample without any adjustments for differences in geographic allocations across markets. Section 3 describes our MSA level data and discusses our methodology for adjusting benchmark returns for differences in MSA concentrations. Section 4 presents a formal attribution analysis that examines whether differences in returns between public and private markets are attributable to differences in MSA allocations versus individual property selection and management within MSAs. Section 5 provides a simplified example of how our methodology can provide managers with an additional tool for analyzing firm performance at the individual firm level. In the final section, we provide concluding remarks.

2. Public vs. Private Market Returns: 1996-2013

It is well known that significant differences in financial leverage and property type mix complicates performance comparisons across public and private markets (Riddiough et al., 2005; and Tsai, 2007; Ling and Naranjo, 2015). To render total returns on equity REIT portfolios comparable to unlevered private market returns, it is necessary to adjust the composition and risk characteristics of publicly-traded REIT portfolios to match as closely as possible the composition and characteristics of their benchmark private market portfolios. Following the methodology of Ling and Naranjo (2015), we (1) remove the effects of financial leverage from firm-level REIT returns, (2) exclude from the final

analysis those equity REITs that do not invest in core property types, and (3) construct unlevered total return series for each of the four core property classifications.[1]

Our initial list of publicly-traded U.S. equity REITs is obtained from the CRSP-Ziman database. We collect the following data for each REIT at the beginning of each quarter: REIT identification number, property type and sub-property type focus, and equity market capitalization. We also obtain levered monthly total returns for each REIT in our sample from CRSP-Ziman, which we then compound to produce the levered total return on equity for each REIT in a particular quarter.

We obtain the balance sheet and income statement information necessary to unlever quarterly returns at the firm level by merging our initial REIT sample with data collected from the quarterly CRSP/Compustat database. We delete REITs that do not invest primarily in the four core property types. A detailed explanation of the delevering process and property type adjustments used to create the unlevered return series for core REITs is available in the Appendix.

Our primary source of return data in the private commercial real estate market is the National Council of Real Estate Investment Fiduciaries (NCREIF). Established in 1982, NCREIF is a not-for-profit industry association that collects, processes, validates, and disseminates information on the risk/return characteristics of commercial real estate assets owned by institutional (primarily pension and endowment fund) investors (see www.ncreif.org). NCREIF's flagship index, the NCREIF Property Index (NPI), tracks property-level quarterly returns on a large pool of properties acquired in the private market for investment purposes only. The property composition of the NPI changes quarterly as data contributing NCREIF members buy and sell properties. However, all historical property-level data remain in the database and index.

Any analysis of the relative return performance between public and private real estate returns must address the well-known smoothing and stale appraisal problems associated with the NCREIF NPI.[2] Our solution is to compare public and private market returns over time horizons of at least six

[1] A REIT is included in our retail index if it is classified by CRSP-Ziman as having a property type focus of 9 (retail) and a sub-property type focus of 5 (freestanding), 14 (outlet), 15 (regional), 17 (shopping center), or 18 (strip center). Our industrial index includes REITs classified by CRSP-Ziman as having a property type focus of 4 (industrial/office) and a sub-property type focus of 8 (industrial). Our quarterly office sample includes REITs with a property type focus of 4 (industrial/office) and a sub-property type focus of 13 (office). Finally, a REIT is included in our apartment index in a given quarter if it is assigned by CRSP-Ziman a property type focus of 8 (residential) and a sub-property type focus of 2 (apartments).

[2] Unless a constituent property happens to sell during the quarter, the reported quarterly capital gain on an individual property within the NCREIF NPI is based on the change in the property's appraised value. Appraisal-based indices are thought to suffer from two major problems. First, estimated price changes lag changes in "true" (but unobservable) market values; this smoothing of past returns understates return volatility. Second, formal appraisals of constituent properties in the NCREIF Index by third party appraisers are usually conducted

years. Such an approach largely mitigates the problems associated with smoothing and stale appraisals.[3]

Table 1 reports quarterly geometric means of our unlevered equity REIT returns (Panel A), unlevered raw NPI returns (Panel B), and the difference in geometric means across markets (Panel C) for the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. We report mean returns for each of the four core property types, as well as an aggregate core property type series. Consistent with Ling and Naranjo (2015), we find that portfolios of unlevered core REITs (unconditionally) outperform their private market benchmark from 1996-2013. However, the magnitude of this outperformance is smaller (22 basis points annually) due to our slightly different sample period.

Further evaluation of Table 1 reveals that comparisons of public and private market return performance are sensitive to the time period selected for the analysis and the property type being examined. Focusing on the comparison of our core return series, the outperformance of equity REITs is concentrated in the most recent recovery period (2008-2013) as REITs outperformed their private market benchmark by 81 (328) basis points quarterly (annually). However, from 1996-2001 and 2002-2007, core REITs underperformed their private market benchmark by 25 (98) and 42 (165) basis points quarterly (annually), respectively. Moving on to individual property types, apartment, office, and retail REITs all outperformed the raw NPI series in the recent recovery period (2008-2013). However, in earlier sub-periods, only retail REITs (from 1996-2001) and industrial REITs (from 2002-2007) outperformed their private market benchmarks. These comparisons further underscore the importance of controlling for the mix of property types and carefully considering the appropriate investment horizon when comparing the relative performance of REIT and private market return series as suggested by Ling and Naranjo (2015).

3. Differences in MSA Allocations

The return differences reported in Panel C of Table 1 control for differences in leverage and property type. However, these return differences do not account for time-series and cross-sectional differences in the geographic concentrations of the properties held by core equity REITs and the data contributing members of NCREIF (primarily pension and endowment funds). Thus, we are unable to

annually; the property's asset manager is responsible for updating the appraisal internally in the intervening quarters. This leads to what is commonly called the "stale" appraisal problem.

[3] In addition to the NPI, NCREIF also produces a suite of Transaction Based Indices (TBIs). An advantage of the TBI indices is that the capital gain component of the TBI in each quarter is based only on the constituent properties in the NCREIF database that were sold that quarter. The TBI indices are available from NCREIF at the national level back to 1994Q1 for multifamily, office, industrial, and retail properties. However, these core TBI indices are not available at the MSA level, which precludes their use in this research.

determine the portion of public-private performance differences that are attributable to MSA allocations versus property selection and asset management within MSAs.

To examine the importance of time-varying geographic concentrations, we collect the following data from SNL's Real Estate Database on an annual basis for each property held by an equity REIT during the period 1996 to 2013: the property owner (institution name), property type, geographic location (MSA), acquisition date, sold date, book value, initial cost, and historic cost. Our analysis begins in 1996 (end of 1995) since this is the first period for which SNL provides historic book value and cost information at the property level. Although the property composition of the aggregate REIT portfolio changes as properties are bought and sold, all historical property-level data remain in the SNL database.

Over our 1996-2013 sample, we have 517,131 property-year observations in our dataset. At the beginning of 1996, equity REITs held 15,752 properties with a reported book value of over $34 billion. The corresponding property counts and book values for core equity REITs are 9,420 and $25 billion, respectively. By 2013, equity REITs owned 32,707 properties with a reported book value of over $419 billion. Core REITs held 15,510 properties with a reported book value of $242 billion. After excluding non-core REITs, 291,894 property-year observations remain.

To construct our time-varying measures of geographic allocations, we first sort equity REITs by their CRSP-Ziman property type and property subtype classifications. We then sort each core REIT's properties into MSA categories that mirror those MSAs tracked by the NCREIF NPI within a particular year. We compute the percentage of the REIT portfolio held in an MSA by REITs of property type f at the beginning of year T as follows:

$$GEO_{f,m,T}^{REIT} = \frac{\sum_{i=1}^{N_{m,T}} \left(BV_{i,m,T}\right)}{\sum_{m=1}^{N_T} \left(\sum_{i=1}^{N_{m,T}} \left(BV_{i,m,T}\right)\right)} \quad , \tag{1}$$

where $BV_{i,m,T}$ is the reported book value of property i in Metropolitan Statistical Area m at the beginning of year T.[4] The total number of core properties in a particular MSA at the beginning of year T is denoted as $N_{m,T}$. The total number of NCREIF MSA classifications as of the beginning of year T is denoted as N_T.

As a robustness check, we create two additional time-varying geographic concentration measures for each of the four property types. First, we replace the book value of each property by its

[4] SNL's net book value variable (SNL Key Field: 221784) is defined as the historical cost of the property and improvements, net of accumulated depreciation.

"adjusted cost" (*ADJCOST*) at the beginning of each year, defined by SNL as the maximum of (1) the reported book value, (2) the initial cost of the property, and (3) the historic cost of the property including capital expenditures and tax depreciation.[5] In a separate analysis, we also weight each property by a simple property count variable (*PROPCOUNT*), which takes a value of 1 for each unique property observation.

To compare the geographic exposure of the NCREIF portfolio with that of our sample of equity REITs, we calculate geographic concentrations for each of the four core property NCREIF NPI portfolios as follows:

$$GEO_{f,m,T}^{NPI} = \frac{\sum_{i=1}^{N_{m,T}} \left(MV_{i,m,T}\right)}{\sum_{m=1}^{N_T} \left(\sum_{i=1}^{N_{m,T}} \left(MV_{i,m,T}\right)\right)} \quad , \tag{2}$$

where $MV_{i,m,T}$ is the market (appraised) value of property i in Metropolitan Statistical Area m at the beginning of year T. The total number of properties of type f in a particular MSA at the beginning of year T is denoted as $N_{m,T}$. The total number of MSA classifications as of the beginning of year T is again denoted as N_T.

At the beginning of 1996, the NCREIF NPI was composed of 2,379 core properties with an estimated market value of $50 billion. NCREIF does not report a quarterly return for property type f in MSA m unless there are at least four properties available for the return calculation. This is done to protect the identity of the individual properties and owners. We classify the MSA location of any properties held outside of these listed MSAs as "Other." The NPI contained four or more apartment, industrial, office, or retail properties in 58 MSAs, with its greatest concentration in Washington, D.C. (7.1 percent). In comparison, equity REITs held 6.5 percent of their core portfolio (based on book value) in the D.C. area. By the beginning of 2013, the NPI index contained 6,968 core properties with an estimated market value of $366 billion. The NPI database contained four or more of one of the core properties in 106 MSAs, with its greatest concentration in New York (10.4 percent). In comparison, equity REITs held 13.8 percent of their core assets in New York in 2013.

3.1. Allocations to Gateway MSAs

Much has been written by industry professionals about the desirability of investing in major "gateway" MSAs, most frequently defined as Boston, Chicago, Los Angeles, New York, San Francisco,

[5] SNL's initial cost variable (SNL Key Field: 221778) is defined as the historic cost currently reported on the financial statements, which may be different than the cost reported at time of purchase. SNL's historic cost variable (SNL Key Field: 221782) is defined as the book value of the property before depreciation.

and Washington, D.C. These MSAs are thought to have significant investment advantages over the remaining 300-plus MSAs, including increased liquidity, due to the size and depth of these markets, as well as constraints on the production of new supply that puts upward pressure on rental rates. Therefore, the degree to which public and private market investors allocate investment capital to these markets, and the timing of these investments, may be an important determinant of their portfolio's performance.

In Figure 1, we present the concentrations of equity REIT and NCREIF core properties located in gateway MSAs. At first glance, both REIT and NCREIF investors appear to hold a similar proportion of core assets in these six major markets. On average, NCREIF investors held approximately 34 percent of their portfolio in gateway MSAs over our sample period; equity REITs held approximately 32 percent of their core assets in these six metropolitan areas.

Although investment allocations to gateway markets appear to be similar on average, we observe differences in allocations over time and by property type. For example, REITs held a slightly larger portion of their core portfolio in gateway MSAs during the period of real estate expansion from 2003 to 2006. In 2006, over 35 percent of the equity REIT portfolio was concentrated in gateway markets. However, as the recent credit crisis unfolded, NCREIF investors held a significantly higher proportion of their portfolio in these six cities. In fact, in 2008 NCREIF investors increased their concentrations in gateway MSAs to constitute nearly 40 percent of their core portfolio.

Figure 2 presents the concentrations of equity REIT and NCREIF properties located in gateway MSAs, disaggregated by property type. In Panel A, we present allocations to gateway MSAs for apartment properties. Panels B-D of Figure 2 display geographic concentrations in these six markets for industrial, office, and retail properties, respectively.

There are several key takeaways from these comparisons. First, within a particular year there are often significant differences between the proportion of properties held by NCREIF data contributing members and those held by equity REITs in gateway markets. For example, in 2003 equity REITs held approximately 50 percent of their industrial assets in gateway cities (Figure 2, Panel B). During the same year, NCREIF investors held just 21 percent of their industrial property portfolio in these six major markets. During most of our sample period, equity REITs hold larger portions of their apartment, industrial, and office properties in gateway cities. Since 2003, however, NCREIF investors have been significantly more exposed to gateway retail than equity REITs.

Second, we observe significant variation in the time-series distribution of these portfolio concentrations. For example, from 2000-2013 equity REITs increased the concentration of their apartment portfolios in gateway markets from approximately 10 percent to nearly 50 percent. This

represents a massive reallocation of REIT apartment portfolios to gateway markets. In contrast, from 2000-2013 NCREIF investors increased their exposure to gateway apartment properties from nearly 11 percent to approximately 35 percent. Moreover, private market investors decreased their gateway apartment allocations during the 2009-2013 period.

For industrial properties, we also observe a significant negative correlation between changes in gateway allocations by equity REITs and NCREIF investors. For example, from 2004-2008 equity REITs shifted their industrial portfolio away from gateway cities, decreasing their holdings from over 50 percent of their portfolio to approximately 34 percent. During this same period NCREIF investors increased the proportion of industrial properties owned in these markets from 19 percent to 28 percent of their portfolio. Nevertheless, industrial REITs retained much larger allocations to gateway markets than their private market counterparts.

In contrast, changes in portfolio holdings in gateway markets within the office property type appear to be positively correlated across investor types for much of our sample period. From 2000-2008 both equity REITs and NCREIF investors significantly increased their office holdings in gateway cities by 20 percent and 10 percent, respectively. From 2008-2013, at least 65 percent of office REIT assets were located in these six markets.

In the retail sector, however, there is less correlation between changes in concentration across investor groups. Since 2005, equity REITs have maintained a fairly consistent allocation to gateway markets in their retail portfolios, ranging from 18 percent to 20 percent. In contrast, NCREIF investors have reduced their allocations to gateway retail from 30 percent to 20 percent during the same period. In comparing public and private market geographic concentrations across property types, it is evident that differences exist within a particular year and across time.

As we narrow our focus to portfolio concentrations in specific gateway cities, the points observed previously at the aggregate level become more evident. In Panel A of Figure 3, we present the concentrations of equity REIT and NCREIF apartment properties located in Chicago. The corresponding Chicago exposures for industrial, office, and retail properties are presented in Panels B-D, respectively. Figures 4-8 display core property geographic concentrations for the remaining five gateway MSAs: Los Angeles, New York, Washington, D.C., Boston, and San Francisco, respectively.

As observed in the aggregate data, there are significant differences between the proportion of properties held by NCREIF data contributing members and those held by equity REITs, significant variation in the time-series distribution of these portfolio concentrations, and notable differences across property types when comparing public and private market geographic concentrations within a gateway MSA. For example, in 2013 NCREIF investors held approximately 7.0 percent of their

apartment assets in Chicago. During the same year, equity REITs held approximately 1.0 percent of their apartment assets in Chicago. From 2006 to 2013, NCREIF investors substantially increased the concentration of their apartment portfolios in Chicago, while equity REITs were decreasing their exposure to apartment properties in Chicago during this period. These are strikingly different "bets" on the attractiveness of the Chicago apartment market. In contrast, since at least 2006 public and private market investors have allocated similar proportions of their capital to Chicago industrial and office properties. Finally, in recent years NCREIF investors have been significantly more exposed to Chicago retail properties than retail REITs.

There are also noticeable differences in how NCREIF investors and equity REITs allocate their portfolios to specific gateway markets within property types. For example, apartment REITs hold a relatively larger proportion of their apartment assets in Los Angeles, Washington, D.C., Boston, and San Francisco; in contrast, NCREIF investors tend to dedicate greater concentrations of their apartment portfolio to Chicago than equity REITs. The two groups of investors hold similar proportions of their apartment portfolio in New York.

In the retail property type, NCREIF investors concentrate a greater proportion of their holdings in Chicago, Los Angeles, Washington, D.C., and San Francisco; in contrast, equity REITs have chosen to concentrate their retail portfolio in New York and Boston. Equity REITs hold a significantly larger proportion of industrial properties in New York, Washington, D.C., and San Francisco. However, allocations to industrial properties in Chicago and Boston have historically been similar across the two investor groups. Finally, in the office property type we observe less variation across investor group. NCREIF investors and equity REITs hold comparable portions of their office portfolios in each of the six gateway markets.

Overall, it is clear that the MSA composition of NCREIF and REIT apartment, industrial, office, and retail properties at a particular point in time often varies significantly across gateway markets; moreover, these relative allocations can vary significantly over time. It is therefore important to understand the extent to which these differences in MSA allocations affect the return performance of public and private market investors, both in the short- and long-run.

3.2. Have Gateway MSAs Outperformed?

To determine how these differences in allocations may impact portfolio returns it is important to first establish that there are in fact significant performance differences between gateway and non-gateway markets. To conduct this analysis, we begin with quarterly NCREIF NPI returns disaggregated by property type and MSA. We then create a value-weighted gateway return series for

each property type, as well as an aggregate core property series, in which the weights are the market (appraised) values of properties held by NCREIF within each of the six gateway cities as of the beginning of the year. Similarly, we construct value-weighted non-gateway return series in which the weights are the market (appraisal) values of properties held by NCREIF in each of the remaining non-gateway cities.[6]

Table 2 reports quarterly geometric means of our gateway NPI returns (Panel A), non-gateway NPI returns (Panel B), and the difference in geometric means between gateway and non-gateway returns (Panel C) for the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. We report mean returns for each of the four core property types, as well as an aggregate core property type series. Focusing on our full sample period (1996-2013), gateway markets outperform non-gateway markets for all property type classifications, including the aggregate core series. In fact, the only indication of underperformance in gateway markets appears in the recovery period for apartment and industrial properties. Focusing on our core property type series, gateway markets outperform non-gateway markets by 26 (106) basis points quarterly (annually) over the 1996-2013 sample period. The most significant difference in performance between gateway and non-gateway markets at the property type level is in the office sector. Over our full sample period, gateway office outperformed non-gateway office by 44 (177) basis points quarterly (annually). During the period of rapid expansion in commercial real estate markets (2002-2007), this return difference was even larger as gateway markets outperformed non-gateway markets by 96 (387) basis points quarterly (annually).

To further establish differences in performance across MSAs, Table 3 reports quarterly geometric means of NPI returns for each of the six gateway cities by core property type for the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. Within property type, there is significant variation in returns across the six gateway markets. In addition, the relative performance varies significantly with the particular sample period being examined. For example, in the apartment property type, Washington, D.C. outperforms the remaining five gateway markets over the full sample. However, in the recovery period (2008-2013), Washington, D.C. underperforms San Francisco, Boston, and Chicago apartments. Since equity REITs tend to hold a larger proportion of their apartment portfolio in Washington, D.C. than NCREIF investors, particularly in the recovery period, we expect this difference in geographic concentrations to significantly impact the comparison of portfolio returns across public and private markets for apartments.

[6] Though unreported we obtain similar results when using equally weighted portfolios.

We also notice that there are significant differences in specific gateway market performance across property types. For example, the performance in Boston apartments and retail is significantly lower than that of Boston industrial and office properties. Since equity REITs have chosen to concentrate a larger proportion of their apartment and retail portfolio in Boston than NCREIF investors, we again would expect these differences in concentration to significantly affect aggregate comparisons of public and private market performance if not properly controlled for. However, in property types and MSAs where geographic allocations do not vary much across investor groups (e.g., Chicago industrial) the impact on portfolio returns would be less important.

3.3. Adjusting Private Market Returns for Differences in MSA Concentrations

The observed differences in the MSA concentrations of core property investments and performance across MSAs highlights the importance of controlling for MSA exposure when comparing private market returns to the corresponding REIT returns, particularly if both public and private investment managers have at least some discretion over the MSAs in which they are able to invest. We therefore reweight NPI MSA-level returns using the time-varying MSA weights of the corresponding REIT portfolio, as detailed in equation (1). In particular, for each core property type *f*, the total MSA-weighted return in quarter *t* is defined as:

$$ADJRET_{f,t}^{NPI} = (w_{t,m=1}^{REIT} r_{t,m=1}^{NPI} + w_{t,m=2}^{REIT} r_{t,m=2}^{NPI} + w_{t,m=3}^{REIT} r_{t,m=3}^{NPI} + \ldots + w_{t,m=n}^{REIT} r_{t,m=n}^{NPI}), \quad (3)$$

where $r_{t,m=n}^{NPI}$ is the NPI total return for property type *f* in Metropolitan Statistical Area *n* in quarter *t* and $w_{t,m=n}^{REIT}$ is the (book value) weight of the REIT property portfolio concentrated in Metropolitan Statistical Area n and property type *f* as of the beginning of year *t*. This weighting and aggregation process is repeated each quarter to produce a time series of reweighted NPI returns for each of the four core property types from 1996Q1 to 2013Q4. Note we hold our MSA weights, $w_{t,m=n}^{REIT}$, constant for each quarter within a calendar year. However, the reweighted return ($ADJRET_{f,t}^{NPI}$) varies quarterly because the MSA-level NPI return ($r_{t,m=n}^{NPI}$) varies quarterly.

We also construct an aggregate core property NPI total return series using SNL MSA weights. We first calculate annual property type weights using the book value of all properties held by equity REITs for each of the four core property type classifications. More specifically, the core portfolio weight assigned to property type *f* in quarter *t* is:

$$w_{f,T}^{REIT} = \frac{BV_{f,T}}{\sum_{f=1}^{4}(BV_{f,T})}, \quad (4)$$

where $f = 1…4$ for multifamily (apartment), office, industrial and retail properties, respectively, and $BV_{f,T}$ is the total book value of properties held by equity REITs classified as property type f as of the beginning of year T.[7] Thus, the total return in quarter t on our core-properties reweighted NPI index is defined as:

$$R_t^{NPI} = \sum_{f=1}^{4} w_{f,T}^{REIT} \, ADJRET_{f,t}^{NPI} \quad , \tag{5}$$

where $ADJRET_{f,t}^{NPI}$ is the total return on our reweighted NPI index for property type f in quarter t as detailed in equation (3). This aggregation of property type NPI returns is repeated each quarter to produce a time series of aggregate core reweighted NPI returns.

Table 4 provides summary statistics for the quarterly differences between our raw NPI and reweighted NPI return series, by core property type and by reweighting methodology. The reweighted mean NPI apartment return using book value weights (Panel A) varies little from the unadjusted NPI apartment return over the 1996-2013 sample. The median return, standard deviation, and serial correlation of the reweighted NPI apartment returns are also very similar in magnitude to the corresponding summary statistics for the unadjusted NPI apartment returns.

The reweighted mean returns for industrial and office properties, using book value weights, are 2.5 and 3.8 basis points, respectively, greater than the corresponding unadjusted quarterly NPI return. Thus, using reweighted returns slightly increases the average performance of industrial and office NCREIF investors relative to the performance of REIT investors in these property types over the 1996-2013 sample. In contrast, the reweighted mean return for retail NPI properties is 10.0 basis points lower than the corresponding unadjusted NPI return; thus, its use in place of the unadjusted NPI retail return decreases the measured relative performance of NCREIF investors.

The differences in geographically reweighted NPI returns and unadjusted NPI returns are very similar when MSA weights are based on the adjusted cost of REIT properties (Table 4, Panel B). More specifically, the mean reweighted NPI return for industrial and office properties are, respectively, 1.9 and 4.4 basis point higher than the unadjusted returns. For retail, the reweighted return is 10.6 basis points lower than the unadjusted return.

The geographic reweighting of apartment, industrial, and office properties does not produce notable differences in mean or median private market returns over the full sample when the weights

[7] In alternate specifications, we also construct these property weights using our ADJCOST and PROPCOUNT variables as defined previously.

are based on book value or adjusted cost (Panels A and B). However, these sample means and medians mask significant differences over time as shown by the large minimum and maximum differences in Table 4. To better display this time-series variation in return differences, we plot quarterly differences between reweighted and unadjusted NPI returns for apartment properties in Panel A of Figure 9. The solid line captures quarterly differences in returns assuming MSA weights are based on the book value of the underlying REIT properties. The dashed line plots differences using MSA weights based on the adjusted cost of the underlying REIT properties. A point on any curve greater than zero percent indicates the reweighted NPI return for apartments in that quarter is greater than the unadjusted NPI return; that is, the unadjusted NPI return understates the performance of the NPI for the purpose of comparing private market performance to returns on equity REITs.

Although the mean return difference for apartment properties is clearly centered around zero, there are significant quarterly differences over the 1996 to 2013 sample period. For example, in the second quarter of 2005, the reweighted NPI return (using book value) is less than the unadjusted return by 0.97 percentage points (97 basis points), or 388 basis points annually. In contrast, the reweighted NPI return is greater than the unadjusted NPI return in the first quarter of 2007 by 84 basis points, or 336 basis points annually. These are large and economically meaningful differences that could significantly distort short-run comparisons between public and private real estate markets.

In Panels B-D of Figure 9, we plot quarterly differences in reweighted and unadjusted NPI total returns for industrial, office and retail properties, respectively. Similar to apartment properties, reweighting MSA-level NPI returns produces large changes in many quarters. For example, in the fourth quarter of 2008, reweighted NPI returns are less than unadjusted office returns (using book value geographic concentrations) by 165 basis points (660 basis points annually). In contrast, reweighted NPI returns are greater than unadjusted NPI office returns by 137 basis points (548 basis points annually) in the fourth quarter of 2006. Similarly large differences in quarterly returns are observable in the industrial and retail property returns. In addition, the return differences can remain positive, or negative, for sustained periods of time. The serial correlations of the return differences (last column in Table 4), especially for industrial and office properties, also indicate statistically significant persistence in return differences. Given that many investment management contracts have durations of three-to-five years, these persistent differences could significantly affect the measured performance of a manager.

4. Attribution Analysis

A primary objective is to better understand the extent to which the return differences in public and private CRE markets reported in Table 1 are attributable to differences in MSA allocations versus individual property selection and management within MSAs. It is generally impossible to define unique, break-downs of total returns that correspond to clear investment management functions. Nevertheless, useful insights can be obtained from performance attribution.

Assume that both REIT and NCREIF managers do not have discretion over the core property type in which they invest. Assume also that the effects of leverage have been removed from the underlying REIT returns in the REIT portfolio. Then, for property type *f* in year *t*, the difference in REIT and NCREIF NPI total returns, $R_{f,t}^{REIT}$- $R_{f,t}^{NPI}$, is equal to:

$$R_{f,t}^{REIT} - R_{f,t}^{NPI} = allocation + selection + interaction \quad , \tag{6}$$

where *allocation* is the portion of the return differential due to MSA allocations, *selection* is the portion of the return differential due to property/asset picking and operational management, and *interaction* is the portion of the return differential that resulted from the synergy between allocation and selection decisions.

Using the total unlevered return earned by NCREIF managers on property type *f* in year *t* as the benchmark, we can attribute the differential performance of REIT managers to allocation,$A_{f,t}^{REIT} - A_{f,t}^{NPI}$, and selection, $S_{f,t}^{REIT} - S_{f,t}^{NPI}$. The pure effect of REIT managers' asset allocation, relative to the benchmark return of NCREIF NPI mangers, is quantified as the sum across all MSAs of the difference between REIT allocation and NCREIF allocation to an MSA, multiplied by the NCREIF NPI return in that MSA. More formally, the return differential for property type *f* in year *t* attributable purely to differences in MSA allocations is

$$A_{f,t}^{REIT} - A_{f,t}^{NPI} = r_{m=1}^{NPI}(w_{m=1}^{REIT} - w_{m=1}^{NPI}) + r_{m=2}^{NPI}(w_{m=2}^{REIT} - w_{m=2}^{NPI}) + r_{m=3}^{NPI}(w_{m=3}^{REIT} - w_{m=3}^{NPI}) + \cdots + r_{m=n}^{NPI}(w_{m=n}^{REIT} - w_{m=n}^{NPI}), \tag{7}$$

where $r_{m=n}^{NPI}$is the NPI return in MSA *n* in year *t*, $w_{m=n}^{REIT}$is the percentage of the REIT portfolio invested in MSA *n* in year *t,* and $w_{m=n}^{NPI}$ is the percentage of the NCREIF portfolio invested in MSA *n* in year *t*.

The pure effect of REIT managers' asset selection in year *t*, relative to the benchmark NCREIF NPI return, is quantified as the sum across all MSAs of the difference between the REIT portfolio's return and the NPI return in an MSA, weighted by the allocation of the NCREIF NPI portfolio in that MSA. More formally, the return differential attributable to property/asset selection MSA allocations is

$$S_{f,t}^{REIT} - S_{f,t}^{NPI} = w_{m=1}^{NPI}(r_{m=1}^{REIT} - r_{m=1}^{NPI}) + w_{m=2}^{NPI}(r_{m=2}^{REIT} - r_{m=2}^{NPI}) + w_{m=3}^{NPI}(r_{m=3}^{REIT} - r_{m=3}^{NPI}) + \cdots + w_{m=n}^{NPI}(r_{m=n}^{REIT} - r_{m=n}^{NPI}), \quad (8)$$

where $r_{m=n}^{REIT}$ is the return on the REIT portfolio in MSA *n*.

As detailed in equation (6), the sum of the pure allocation and selection effects do not equal the total differential between REIT and NCREIF NPI returns. The remaining differential is due to the combined effect of REIT managers' allocation and selection performances interacting together. Unfortunately, there is no meaningful way to disentangle this interaction effect and allocate it to either one of the two pure effects. Typically, if the allocation of capital across MSAs is the primary decision facing REIT and NCREIF managers, the interaction effect is added to the selection effect to keep the allocation effect pure. This would be appropriate, in this application, if REIT mangers generally pursued a top-down investment strategy (MSA selection then property selection). In contrast, if REIT managers generally follow a bottom-up investment strategy—finding the best properties without a primary concern for MSA allocations—it would be appropriate to add the interaction effect to the allocation effect to keep the selection effect pure. However, data on REIT returns by property type at the MSA level ($r_{m=n}^{REIT}$ in equation (6) above) are not available. We are therefore unable to calculate a pure selection effect (using the private market return series as our benchmark) and thus must lump together the pure selection and interaction effects.

Performing attribution analysis for one quarter, as depicted in equation (7), is relatively straight-forward if the MSA-level NPI returns ($r_{m=n}^{NPI}$), as well as NPI and REIT MSA weights ($w_{m=n}^{NPI}$ and $w_{m=n}^{REIT}$), are known. However, NPI and REIT portfolio allocations change over time and these changes must be accounted for when explaining relative performance over the duration of a typical asset management contract.

To facilitate a multi-year attribution analysis, we start with equation (7). Using the distributive property and regrouping terms, equation (7) can be rewritten as

$$A_{f,t}^{REIT} - A_{f,t}^{NPI} = (w_{m=1}^{REIT} r_{m=1}^{NPI} + w_{m=2}^{REIT} r_{m=2}^{NPI} + w_{m=3}^{REIT} r_{m=3}^{NPI} \ldots + w_{m=n}^{REIT} r_{m=n}^{NPI}) - (w_{m=1}^{NPI} r_{m=1}^{NPI} + w_{m=2}^{NPI} r_{m=2}^{NPI} + w_{m=3}^{NPI} r_{m=3}^{NPI} \ldots + w_{m=n}^{NPI} r_{m=n}^{NPI}). \quad (9)$$

Note that the top term in parentheses is the return on the reweighted NPI for property type *f* in quarter *t* (i.e., $ADJRET_{f,t}^{NPI}$ from equation (3)), using REIT allocations for the reweighting. The bottom term in parentheses is simply the "raw" NPI return for property type *f* in quarter *t*. Thus, by subtracting the raw NPI return for a particular property type from the re-weighted NPI, we are left with the pure allocation effect in quarter *t* using NPI as the benchmark.

For a T quarter analysis period, equation (9) can be rewritten as follows to produce the geometric average return over T quarters:

$$A_{f,T}^{REIT} - A_{f,T}^{NPI} = \left(\sqrt[T]{\prod_1^T (1 + ADJRET_{f,t}^{NPI})} - 1\right) - \left(\sqrt[T]{\prod_1^T (1 + r_{f,t}^{NPI})} - 1\right). \quad (10)$$

Table 5 displays results from our attribution analysis using NPI returns as the benchmark for each of the four core property types, as well as the aggregate core property type series. We report the quarterly difference in geometric means between our unlevered REIT returns and the raw NPI returns, the geometric mean of the pure allocation effect, and the geometric mean of the selection plus interaction effects for the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. In each of the core property types and for all reported return horizons, the allocation effect constitutes a small portion of the total return difference, relative to the selection plus interaction effects. This indicates that the decision to allocate to a particular MSA is relatively less important than the manager's ability to select properties within that MSA. However, the sign and magnitude of the allocation effect varies significantly over the period and property type being examined. For example, in the retail property type, the allocation decisions of REIT managers resulted in a 10 (40) basis point quarterly (annual) underperformance relative to the private market benchmark over the full sample period. However, the asset selection (plus interaction) of REIT managers resulted in a 27 (107) basis point outperformance of the benchmark portfolio. In this case the allocation effect reduced the value added of the manager's selection ability. In contrast, if we focus on the pure allocation effect in the industrial property type, the difference in allocations across markets resulted in value added over three of the four sample periods examined.

4.1. Robustness Check Using REIT Returns as the Benchmark

As discussed above, data on REIT returns by property type at the MSA level are not available. We therefore were unable to calculate a pure selection effect using NPI returns as the benchmark; thus, we included the selection effect with the interaction effect. However, if we instead use REIT returns as the benchmark, we are able to compute a pure selection effect that can be compared to our results using NPI returns as the benchmark.

The pure effect of NCREIF managers' selection, relative to the benchmark REIT return, is quantified as the sum across all MSAs of the difference between the NPI returns and returns on the REIT portfolio, weighted by the allocation of the REIT portfolio in each MSA. More formally, the

return differential between NPI returns and REIT returns in quarter t attributable purely to property/asset selection and management is

$$S_{f,t}^{NPI} - S_{f,t}^{REIT} = w_{m=1}^{REIT}(r_{m=1}^{NPI} - r_{m=1}^{REIT}) + w_{m=2}^{REIT}(r_{m=2}^{NPI} - r_{m=2}^{REIT}) + w_{m=3}^{REIT}(r_{m=3}^{NPI} - r_{m=3}^{REIT}) + \cdots + w_{m=n}^{REIT}(r_{m=n}^{NPI} - r_{m=n}^{REIT}) . \quad (11)$$

Using the distributive property and regrouping terms, equation (11) can be rewritten as:

$$S_{f,t}^{NPI} - S_{f,t}^{REIT} = (w_{m=1}^{REIT} r_{m=1}^{NPI} + w_{m=2}^{REIT} r_{m=2}^{NPI} + w_{m=3}^{REIT} r_{m=3}^{NPI} \ldots + w_{m=n}^{REIT} r_{m=n}^{NPI}) -$$

$$(w_{m=1}^{REIT} r_{m=1}^{REIT} + w_{m=2}^{REIT} r_{m=2}^{REIT} + w_{m=3}^{REIT} r_{m=3}^{REIT} \ldots + w_{m=n}^{REIT} r_{m=n}^{REIT}) . \quad (12)$$

The top term in parentheses is the return on the reweighted NPI for property type f in quarter t (i.e., $ADJRET_{f,t}^{NPI}$ from equation (3)), using REIT allocations for the reweighting. The bottom term in parentheses is the REIT return in quarter t where each MSA-level REIT return is weighted by the REIT allocation to the MSA in quarter t. Upon inspection of equation (11) it appears the pure selection effect using REIT returns as a benchmark cannot be computed because we do not know MSA-level REIT returns ($r_{t,m=n}^{REIT}$). However, we are able to compute the second summation in equation (12); that is, we can compute the mean annualized return for unlevered REITs of property type f over any holding period within our 1996-2013 quarterly sample period. Thus, by subtracting the unlevered REIT series for a particular property type from the reweighted NPI return, we are left with the pure selection effect using REIT returns as the benchmark.

For a T quarter analysis period, equation (12) can be rewritten as follows to produce the average annualized return over T quarters:

$$S_{f,T}^{NPI} - S_{f,T}^{REIT} = (\sqrt[T]{\prod_1^T (1 + ADJRET_{f,t}^{NPI})} - 1) - (\sqrt[T]{\prod_1^T (1 + r_{f,t}^{REIT})} - 1) . \quad (13)$$

As before, the sum of the pure selection effect and allocation effect do not equal the total differential between NPI and REIT returns. The remaining differential is due to the combined effect of REIT managers' selection and allocation performances interacting together. As discussed above, if NCREIF managers generally follow a bottom-up investment strategy—finding the best properties without a primary concern for MSA allocations—it is appropriate to add the interaction effect to the allocation effect to keep the selection effect pure. However, because REIT returns by property type at the MSA level are not available, we are unable to calculate a pure allocation effect using REIT returns as the benchmark. Therefore, we must lump together the pure allocation effects and interaction effects.

Table 6 displays results from our attribution analysis using REIT returns as the benchmark for each of the four core property types, as well as the aggregate core property type series. We report the quarterly difference in geometric means between our raw NPI returns and our unlevered REIT returns, the geometric mean of the pure selection effect, and the geometric mean of the allocation plus interaction effects for the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. Examination of Table 6 confirms our previous results reported in Table 5 when using the NPI as our benchmark return series. In particular, the selection effect is the most significant portion of the return difference between private and public market portfolios.

5. A Simplified Example: Equity Residential

The discussion to this point has centered on controlling for differences in geographic concentrations between public and private market investors in an attempt to provide a better benchmark for return comparisons as well as insights on the importance of allocation and selection in return performance at the portfolio level. However, our methodology can easily be applied on a firm level basis. For example, REIT managers can utilize our reweighting procedure to generate a private benchmark return series that is "geographically identical" to their particular portfolio. They also can utilize the attribution framework to better understand how allocation and selection decisions impact firm return performance.

We consider the case of Equity Residential (EQR), a large multifamily (apartment) REIT, to implement our framework on a firm level basis. In particular, we construct unlevered REIT returns for EQR on a quarterly basis following the methodology of Ling and Naranjo (2015). For our initial comparison to a private market benchmark, we utilize quarterly raw NPI returns for the apartment property type. We then create a reweighted NPI return series using MSA-level returns and the time-varying MSA weights of EQR's property portfolio, as detailed in equation (1). In particular, for EQR, the total MSA-weighted return in quarter t is defined as:

$$ADJRET^{NPI}_{EQR,t} = (w^{EQR}_{t,m=1} r^{NPI}_{t,m=1} + w^{EQR}_{t,m=2} r^{NPI}_{t,m=2} + w^{EQR}_{t,m=3} r^{NPI}_{t,m=3} + \ldots + w^{EQR}_{t,m=n} r^{NPI}_{t,m=n}), \quad (14)$$

where $r^{NPI}_{t,m=n}$ is the NPI total return in Metropolitan Statistical Area n in quarter t and $w^{EQR}_{t,m=n}$ is the (book value) weight of EQR's property portfolio concentrated in Metropolitan Statistical Area n as of the beginning of year t.

Panel A of Table 7 reports the geometric means for EQR's unlevered REIT returns, the raw NPI apartment returns, and the reweighted NPI return series using EQR's geographic concentrations as

weights for the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. Over each return horizon, the raw NPI series overstates benchmark returns, though the differences are relatively small in magnitude. For example, over the full sample period there is a 2.5 (10) basis point quarterly (annually) difference between the raw NPI and the reweighted NPI that makes use of EQR's geography composition. Therefore, the use of the raw NPI series leads to an overstatement in the relative underperformance of EQR to its private market benchmark. During the period of real estate expansion (2002-2007), the magnitude of this effect is a bit larger. The raw NPI overstates the benchmark performance by 5.5 (22) basis points quarterly (annually) over this horizon. While these differences are relatively small, we expect there to be significant cross-sectional variation across equity REITs. In particular, we expect this reweighting procedure to matter most for firms whose geographic concentration differs significantly from that of the benchmark property type NPI series.

Panel B of Table 7 reports results from our firm level attribution analysis. In particular we decompose the return difference between EQR's unlevered returns and the raw NPI apartment returns into a pure allocation effect and selection plus interaction effects. We report geometric means of our return components over the following periods: 1996-2001, 2002-2007, 2008-2013, and 1996-2013. Consistent with our earlier results at the portfolio level, we find that the pure allocation effect constitutes a small portion of the total return difference, relative to the selection plus interaction effects. For example, over our full sample period the allocation effect constituted 2.5 (10) basis points of the 21 (84) basis point quarterly (annual) difference between EQR's unlevered returns and the NPI benchmark series.

6. Conclusion

While private and public REIT markets can provide investors with exposure to the same underlying local property markets, they often exhibit significantly different risk-return characteristics. This paper examines the impact of differences in geographic portfolio concentrations on return performance comparisons of U.S. public and private commercial real estate investors over the 1996-2013 time period. By adjusting returns for differences between public and private markets in financial leverage, property type focus, management fees, and geographic concentrations we are able to more accurately assess the relative performance of "geographically identical" public and private market portfolios. Furthermore, through formal attribution analysis, we are able to disentangle whether the relative return performance is attributable to differences in MSA allocations or individual property selection and management within MSAs.

In comparing the MSA concentrations of publicly-traded REITs, by core property type, to the MSA concentrations of the properties in the NCREIF database, we document significant differences in geographic allocations of property portfolios between public and private market investors. Since these differences vary significantly over time and across property type classifications, we find that accounting for time-series and cross-sectional differences in the geographic concentrations of the properties held by core equity REITs and NCREIF investors significantly impacts the performance comparison across markets.

Controlling for the geographic composition of property portfolios in these two markets, we continue to find that public market real estate returns outperform comparable private market returns. Through our attribution analysis, we find that the MSA allocation effect constitutes a small portion of the total return difference relative to selection effects. This result indicates that the decision to allocate to a particular MSA is relatively less important than the manager's ability to select properties within that MSA. Taken together, our results suggest that additional follow-on research examining real estate geographic allocation and selection effects is important to understanding return performance and effective investment strategies.

References

Ambrose, B., S. Ehrlich, W. Hughes and S. Wachter. 2000. REIT Economies of Scale: Fact or Fiction? *The Journal of Real Estate Finance and Economics* 20: 211–224.

Campbell, R., Petrova, M., Sirmans, C.F.. 2003. Wealth effects of diversification and financial deal structuring: evidence from REIT property portfolio acquisitions. *Real Estate Economic* 31, 347–366.

Capozza, D.R. and P.J. Seguin. 1998. Managerial Style and Firm Value. *Real Estate Economics* 26: 131–150.

Capozza, D.R. and P.J. Seguin. 1999. Focus, Transparency, and Value: The REIT Evidence. *Real Estate Economics* 27: 587–619.

Cici, Gjergji, Jack Corgel, and Scott Gibson. 2011. Can Fund Managers Select Outperforming REITs? Examining Fund Holdings and Trades. *Real Estate Economics* 39: pgs. 455-486.

Gyourko, J. and E. Nelling. 1996. Systematic Risk and Diversification in the Equity Market. *Real Estate Economics* 24: 493–515.

Hartzell, Jay C., Libo Sun, and Sheridan Titman. 2014. Institutional investors as monitors of corporate diversification decisions: Evidence from real estate investment trusts. *Journal of Corporate Finance* 25: pgs. 61-72.

Hochberg, Yael V. and Tobias Muhlhofer. 2014. Market Timing and Investment Selection: Evidence from Real Estate Investors. Working Paper.

Ling, David C. and Andy Naranjo. 2015. Returns and Information Transmission Dynamics in Public and Private Real Estate Markets. *Real Estate Economics, Forthcoming*.

Riddiough, Timothy J., Mark Moriarty, and P.J. Yeatman. 2005. Privately versus Publicly Held Asset Investment Performance. *Real Estate Economics* 33: pgs. 121-146.

Tsai, Jengbin Patrick. 2007. A Successive Effort on Performance Comparison between Public and Private Real Estate Equity Investment. Working Paper.

Figure 1: Gateway City Concentrations of Core Properties – NCREIF vs. REITs

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in Gateway cities for all core property types over the 1996-2013 sample period. Gateway cities are defined as Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, D.C. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

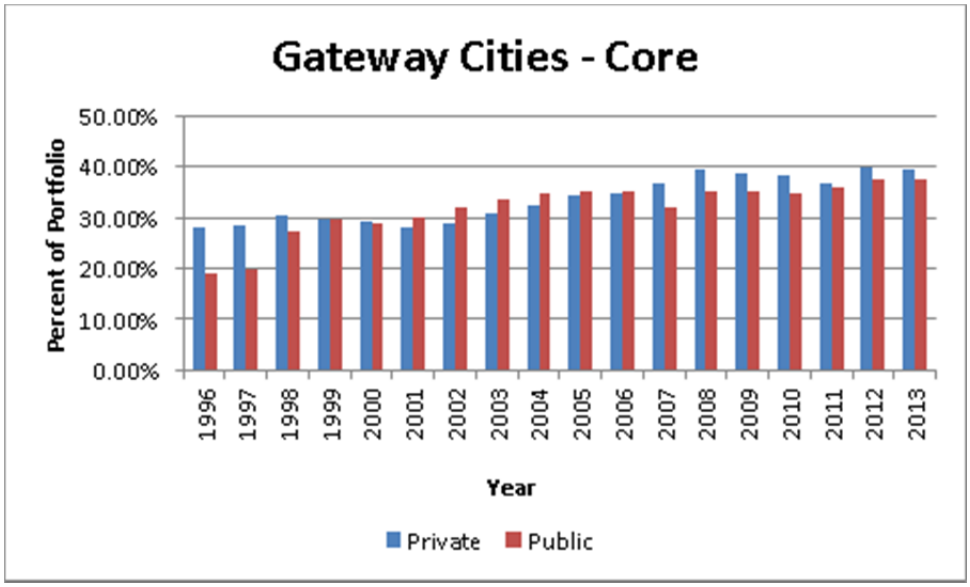
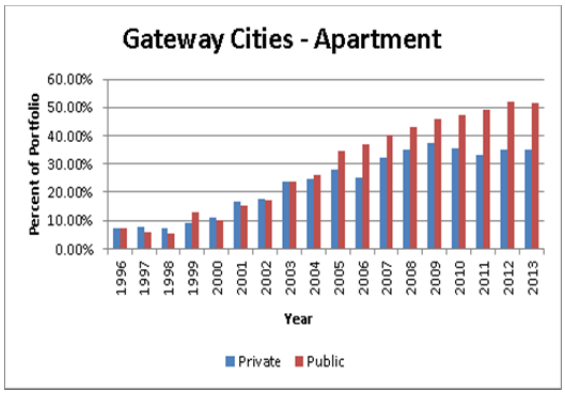


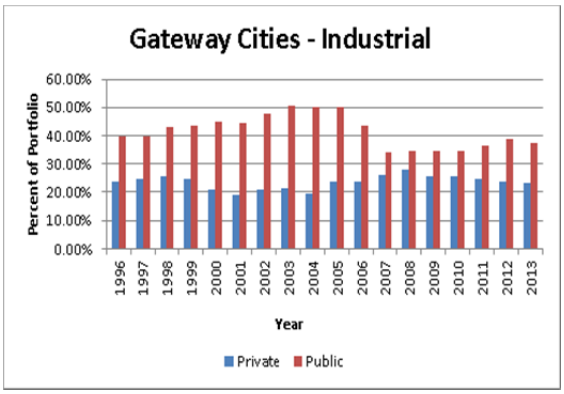
Figure 2: Gateway City Concentrations by Core Property Type – NCREIF vs. REITs

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in Gateway cities for each of the four core property types over the 1996-2013 sample period. Gateway cities are defined as Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, D.C. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

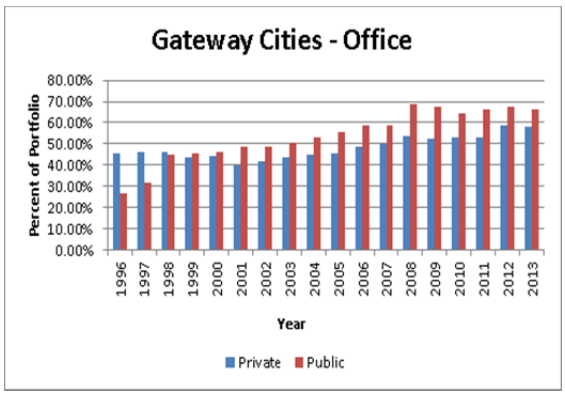
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office



Panel D: Retail

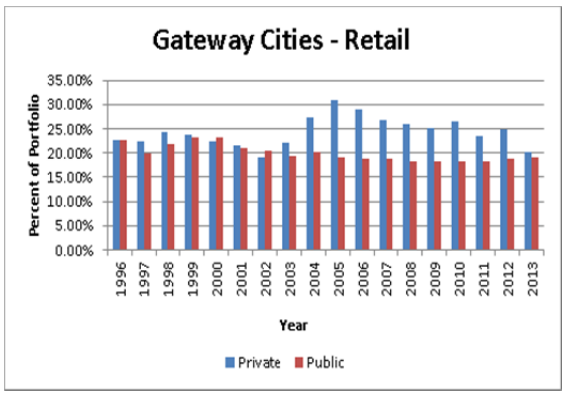
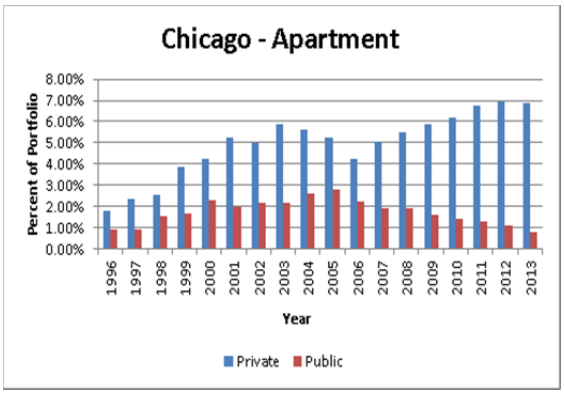


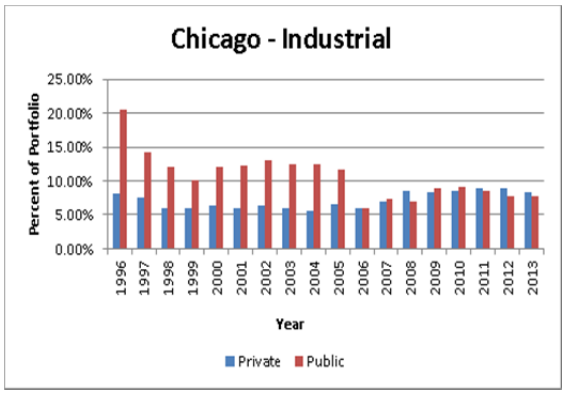
Figure 3: Geographic Concentrations – NCREIF vs. REITs (Chicago)

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in Chicago for each of the four core property types over the 1996-2013 sample period. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

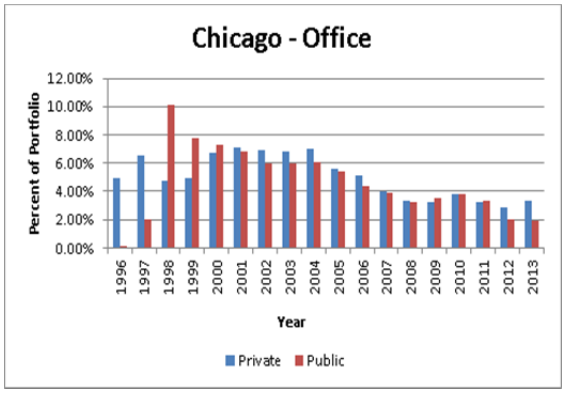
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office



Panel D: Retail

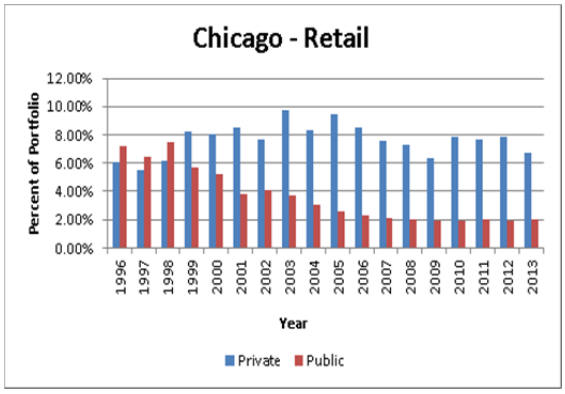
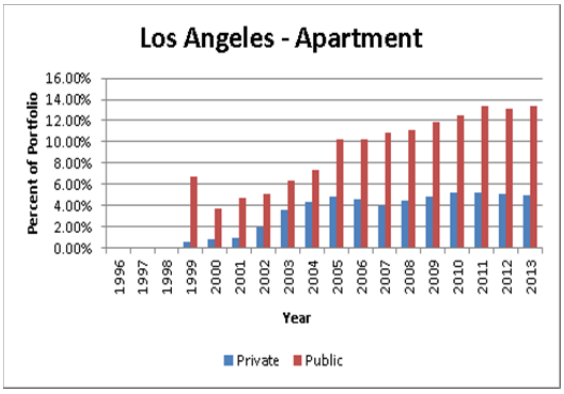


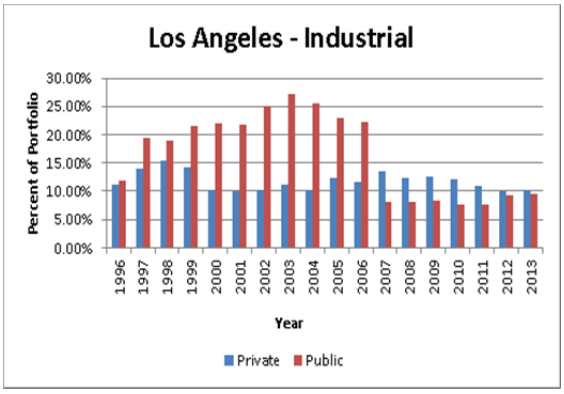
Figure 4: Geographic Concentrations – NCREIF vs. REITs (Los Angeles)

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in Los Angeles for each of the four core property types over the 1996-2013 sample period. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

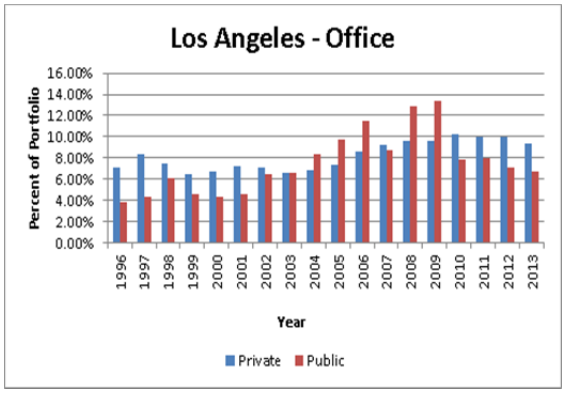
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office

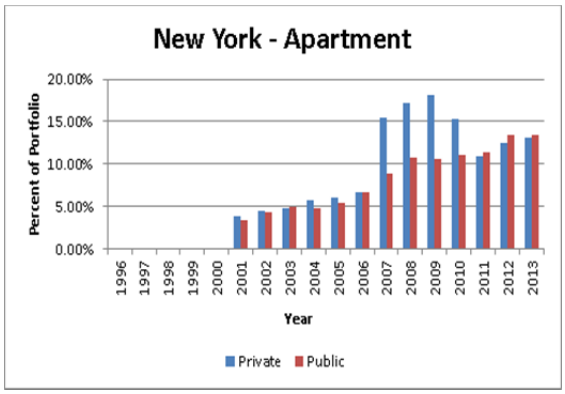


Panel D: Retail

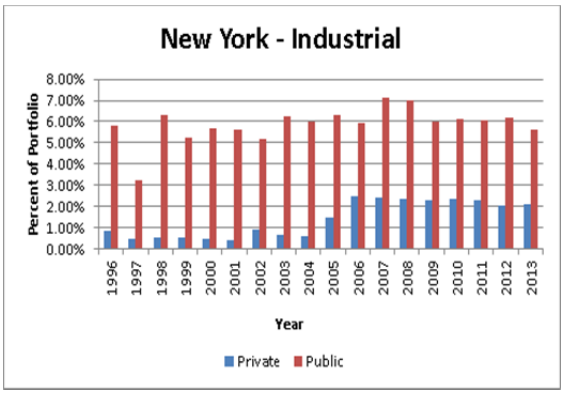
Figure 5: Geographic Concentrations – NCREIF vs. REITs (New York)

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in New York for each of the four core property types over the 1996-2013 sample period. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

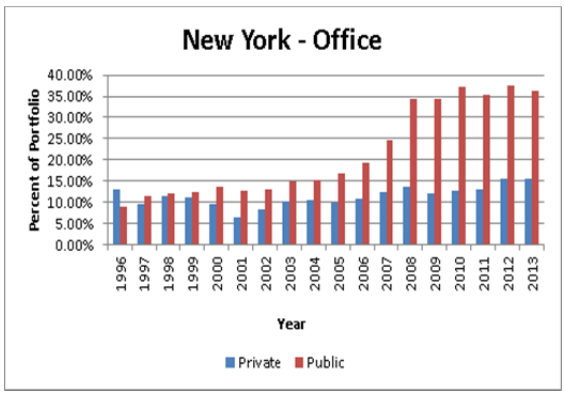
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office



Panel D: Retail

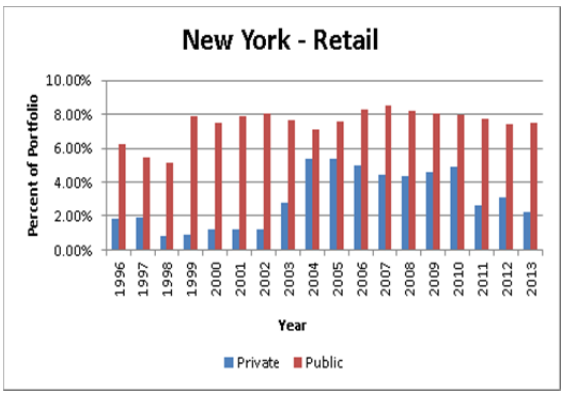
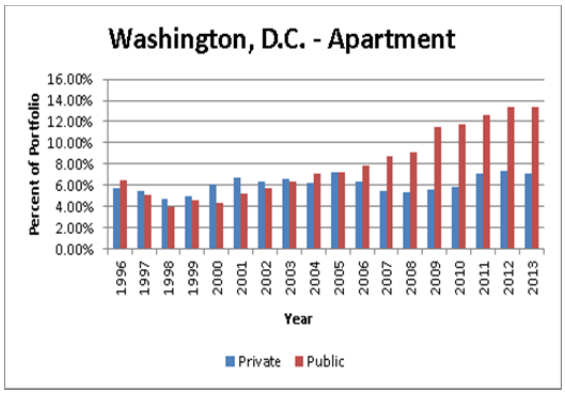


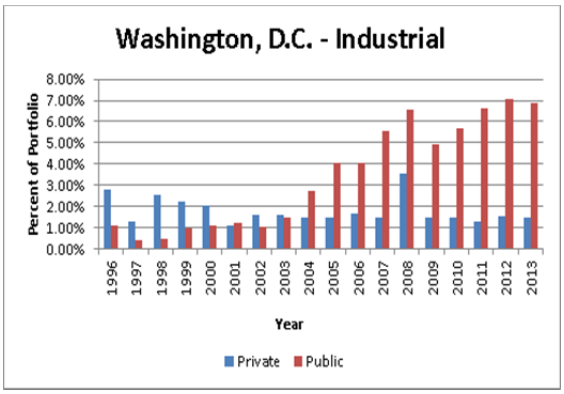
Figure 6: Geographic Concentrations – NCREIF vs. REITs (Washington, D.C.)

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in Washington, D.C. for each of the four core property types over the 1996-2013 sample period. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

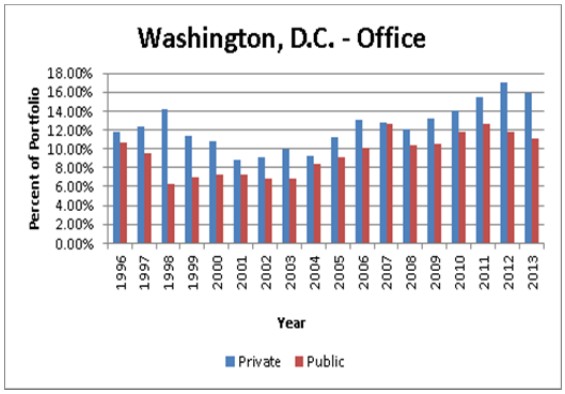
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office



Panel D: Retail

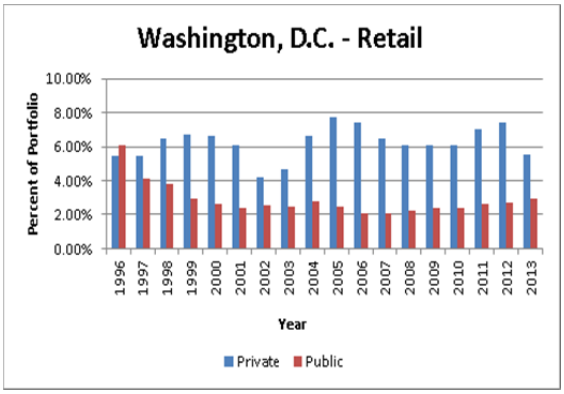
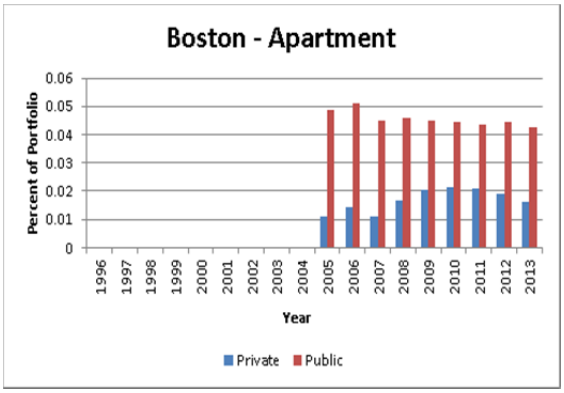


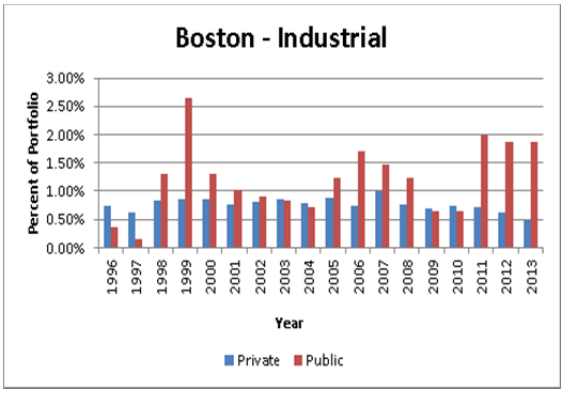
Figure 7: Geographic Concentrations by Core Property Type – NCREIF vs. REITs (Boston)

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in Boston for each of the four core property types over the 1996-2013 sample period. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

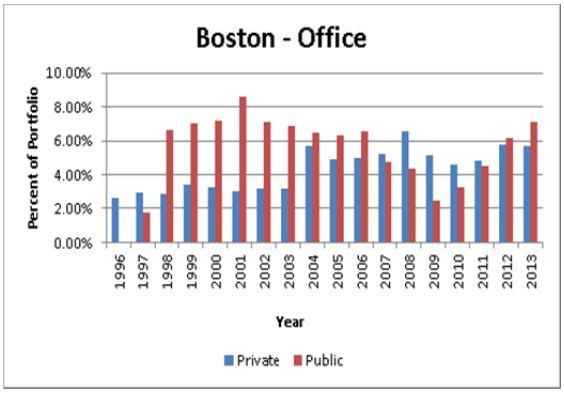
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office



Panel D: Retail

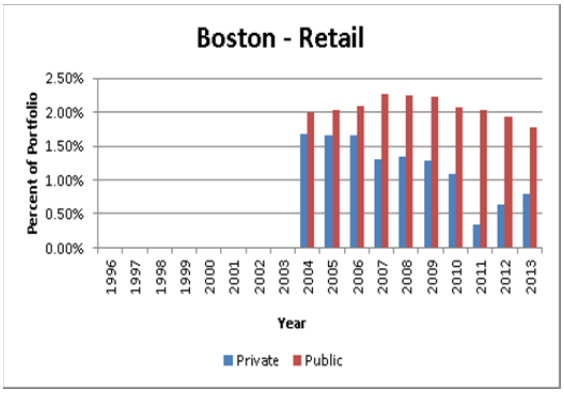
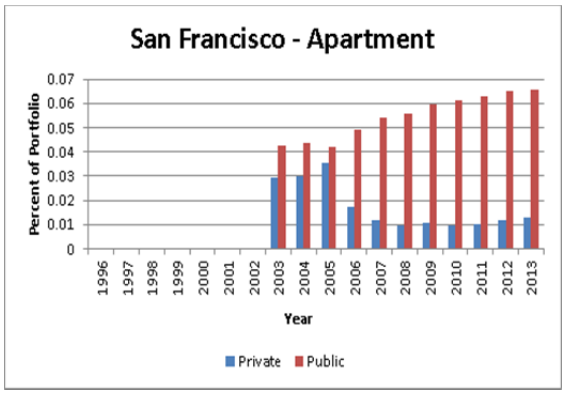


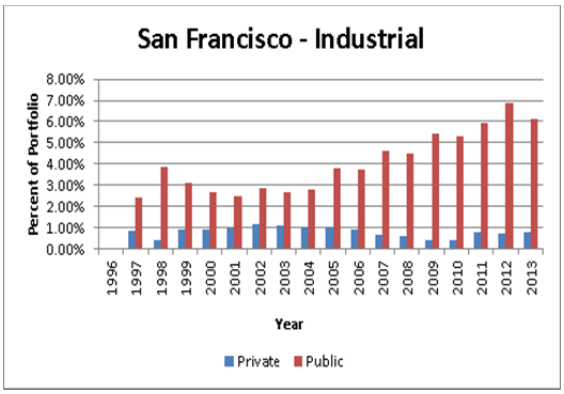
Figure 8: Geographic Concentrations by Core Property Type – NCREIF vs. REITs (San Francisco)

This figure plots the geographic concentrations of private (NCREIF) and public (equity REIT) commercial real estate portfolios in San Francisco for each of the four core property types over the 1996-2013 sample period. Private market concentrations are calculating using market (appraised) value of each core property held by the NCREIF NPI in gateway cities. Public market concentrations are calculated using reported book value of each core property held by equity REITs in gateway cities.

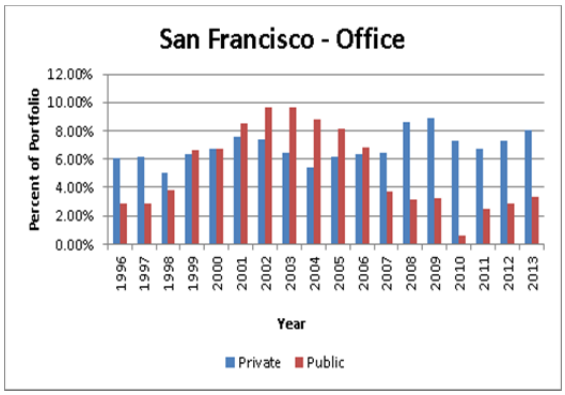
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office

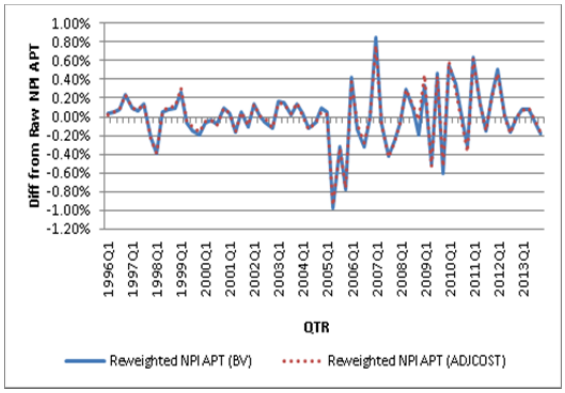


Panel D: Retail

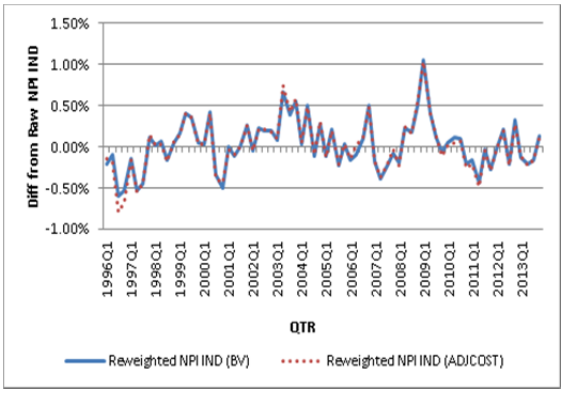
Figure 9: Differences in Reweighted NPI Returns and Raw NPI Returns

This figure plots quarterly differences between the reweighted and unadjusted NPI return series for each of the four core property types. The solid line captures quarterly differences in returns assuming MSA weights are based on the book value of the underlying REIT properties. The dashed line plots differences using MSA weights based on the adjusted cost of the underlying REIT properties.

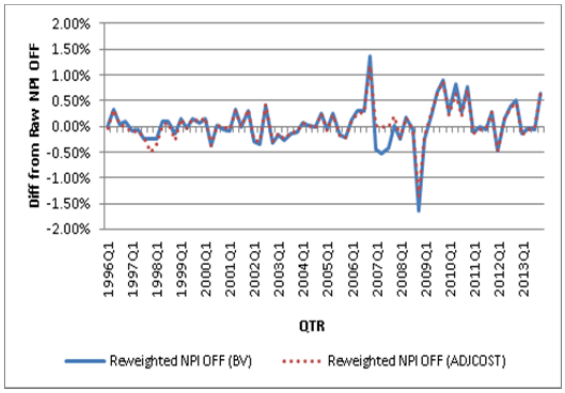
Panel A: Multifamily (Apartments)



Panel B: Industrial



Panel C: Office



Panel D: Retail

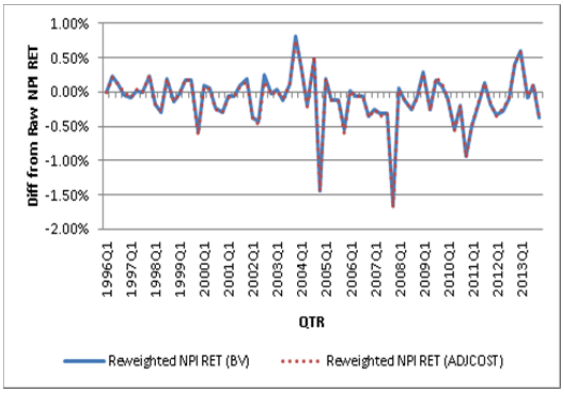


Table 1: Average Return Comparison: Public and Private Real Estate Markets

This table reports quarterly geometric means of our unlevered equity REIT returns, unlevered raw NPI returns, and the difference between the two series over the following periods: 1996-2001, 2002-2007, 2008-2013, 1996-2013. Returns are reported in percentage form.

Panel A: Unlevered Equity REIT Returns

	1996-2001	2002-2007	2008-2013	1996-2013
Apartment	2.584	2.022	1.728	2.111
Industrial	2.560	3.439	0.133	2.034
Office	2.734	2.346	1.205	2.093
Retail	2.333	3.184	1.692	2.401
Aggregate: Core Properties	2.393	2.650	1.511	2.183

Panel B: Unlevered Raw NPI Returns

	1996-2001	2002-2007	2008-2013	1996-2013
Apartment	2.696	2.879	0.840	2.134
Industrial	2.986	2.926	0.585	2.159
Office	3.095	2.913	0.372	2.119
Retail	1.828	3.742	1.146	2.233
Aggregate: Core Properties	2.637	3.066	0.700	2.129

Panel C: Unlevered REIT Returns minus Unlevered Raw NPI Returns

	1996-2001	2002-2007	2008-2013	1996-2013
Apartment	-0.113	-0.857	0.888	-0.024
Industrial	-0.426	0.513	-0.452	-0.125
Office	-0.361	-0.567	0.833	-0.026
Retail	0.505	-0.558	0.546	0.169
Aggregate: Core Properties	-0.245	-0.416	0.811	0.054

Table 2: Average NPI Return Comparison: Gateway and Non-Gateway Markets

This table reports quarterly geometric means of unlevered raw NPI returns for gateway and non-gateway markets, and the difference between the two series for each of the four core property types, and all core properties, over the following periods: 1996-2001, 2002-2007, 2008-2013, 1996-2013. Return series are value-weighted based on the market (appraised) value of the properties held by the NCREIF NPI. Gateway cities are defined as Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, D.C. Returns are reported in percentage form.

Panel A: Gateway NPI Returns

	1996-2001	2002-2007	2008-2013	1996-2013
Apartment	3.507	3.376	0.612	2.490
Industrial	3.345	3.437	0.761	2.507
Office	3.388	3.618	0.673	2.551
Retail	2.239	4.308	1.457	2.661
Aggregate: Core Properties	3.114	3.627	0.781	2.500

Panel B: Non-Gateway NPI Returns

	1996-2001	2002-2007	2008-2013	1996-2013
Apartment	2.832	2.979	1.278	2.360
Industrial	3.139	3.045	0.789	2.319
Office	3.237	2.664	0.457	2.112
Retail	1.962	3.813	1.321	2.360
Aggregate: Core Properties	2.690	3.063	0.970	2.237

Panel C: Gateway NPI Returns minus Non-Gateway NPI Returns

	1996-2001	2002-2007	2008-2013	1996-2013
Apartment	0.675	0.397	-0.666	0.129
Industrial	0.206	0.392	-0.028	0.188
Office	0.151	0.955	0.217	0.439
Retail	0.277	0.496	0.136	0.302
Aggregate: Core Properties	0.424	0.564	-0.189	0.263

Table 3: Average Return Comparison: Individual Gateway Markets

This table reports quarterly geometric means of unlevered raw NPI returns for individual gateway markets for each of the four core property types over the following periods: 1996-2001, 2002-2007, 2008-2013, 1996-2013. Return series are value-weighted based on the market (appraised) value of the properties held by the NCREIF NPI. Gateway cities are defined as Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, D.C. Returns are reported in percentage form.

Panel A: Apartment

	1996-2001	2002-2007	2008-2013	1996-2013
Chicago	3.218	2.527	1.573	2.437
Los Angeles	2.041	3.631	0.798	2.150
New York	0.732	3.189	-0.289	1.200
Washington, D.C.	3.824	4.071	1.376	3.083
Boston	-	1.157	1.593	0.914
San Francisco	-	3.264	1.985	1.741

Panel B: Industrial

	1996-2001	2002-2007	2008-2013	1996-2013
Chicago	2.585	2.669	0.454	1.898
Los Angeles	3.537	4.015	0.852	2.792
New York	3.204	3.292	1.396	2.627
Washington, D.C.	3.785	3.593	1.129	2.829
Boston	4.073	1.797	-0.539	1.759
San Francisco	4.170	3.025	0.768	2.644

Panel C: Office

	1996-2001	2002-2007	2008-2013	1996-2013
Chicago	3.171	2.201	0.227	1.859
Los Angeles	3.285	3.916	0.532	2.567
New York	3.415	4.649	0.785	2.937
Washington, D.C.	2.884	3.794	0.949	2.535
Boston	4.017	3.767	-0.081	2.550
San Francisco	4.607	2.605	1.090	2.757

Panel D: Retail

	1996-2001	2002-2007	2008-2013	1996-2013
Chicago	1.749	4.045	1.491	2.422
Los Angeles	2.683	4.325	1.078	2.687
New York	2.793	4.600	1.812	3.062
Washington, D.C.	1.875	4.733	1.554	2.711
Boston	-	2.682	0.209	0.956
San Francisco	3.179	4.252	1.867	3.095

Table 4: Reweighted NPI Returns minus Unadjusted NPI Returns

This table reports summary statistics of the quarterly differences between our reweighted NPI returns and the raw NPI returns for each of the core property types, and all core properties, over the 1996-2013 sample period. Returns are reported in percentage form. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

Panel A: Using Book Value (BV) Reweighting of NCREIF MSA Returns

	Mean	Median	Std Dev	Min	Max	Serial Correlation
Apartment	-0.002	0.021	0.290	-0.973	0.842	-0.08
Industrial	0.025	0.021	0.303	-0.593	1.050	0.40***
Office	0.038	0.006	0.393	-1.649	1.371	0.18*
Retail	-0.100	-0.065	0.374	-1.662	0.818	0.02
Aggregate: Core Properties	-0.024	-0.024	0.406	-0.947	1.279	0.63***

Panel B: Using Adjusted Cost (ADJCOST) Reweighting of NCREIF MSA Returns

	Mean	Median	Std Dev	Min	Max	Serial Correlation
Apartment	0.000	0.012	0.284	-0.941	0.765	-0.07
Industrial	0.019	0.017	0.318	-0.787	1.042	0.45***
Office	0.044	0.008	0.348	-1.369	1.175	0.19*
Retail	-0.106	-0.071	0.378	-1.696	0.763	0.02
Aggregate: Core Properties	-0.017	-0.029	0.391	-0.829	1.292	0.61***

Table 5: Attribution Analysis Using NPI as Benchmark and Book Value Weights

This table reports quarterly geometric means of our attribution analysis using NPI as the benchmark for each of the four core property types over the following periods: 1996-2001, 2002-2007, 2008-2013, 1996-2013. Returns are reported in percentage form.

Panel A: Apartment

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT return minus raw NPI	-0.113	-0.857	0.888	-0.024
Pure allocation effect	-0.004	-0.065	0.062	-0.002
Selection effect plus interaction	-0.109	-0.792	0.826	-0.022

Panel B: Industrial

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT return minus raw NPI	-0.426	0.513	-0.452	-0.125
Pure allocation effect	-0.073	0.096	0.060	0.028
Selection effect plus interaction	-0.353	0.417	-0.512	-0.153

Panel C: Office

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT return minus raw NPI	-0.361	-0.567	0.833	-0.026
Pure allocation effect	0.009	-0.020	0.113	0.035
Selection effect plus interaction	-0.370	-0.547	0.720	-0.061

Panel D: Retail

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT return minus raw NPI	0.505	-0.558	0.546	0.169
Pure allocation effect	-0.020	-0.172	-0.105	-0.099
Selection effect plus interaction	0.525	-0.386	0.651	0.267

Panel E: Core Properties (Aggregate)

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT return minus raw NPI	-0.245	-0.416	0.811	0.054
Pure allocation effect	-0.217	-0.019	0.174	-0.019
Selection effect plus interaction	-0.027	-0.397	0.637	0.074

Table 6: Attribution Analysis Using REITs as Benchmark

This table reports quarterly geometric means of our attribution analysis using equity REITs as the benchmark for each of the four core property types over the following periods: 1996-2001, 2002-2007, 2008-2013, 1996-2013. Returns are reported in percentage form.

Panel A: Apartment

	1996-2001	2002-2007	2008-2013	1996-2013
Raw NPI return minus Unlevered REIT return	0.113	0.857	-0.888	0.024
Pure selection effect	0.109	0.792	-0.826	0.022
Allocation effect plus interaction	0.004	0.065	-0.062	0.002

Panel B: Industrial

	1996-2001	2002-2007	2008-2013	1996-2013
Raw NPI return minus Unlevered REIT return	0.426	-0.513	0.452	0.125
Pure selection effect	0.353	-0.417	0.512	0.153
Allocation effect plus interaction	0.073	-0.096	-0.060	-0.028

Panel C: Office

	1996-2001	2002-2007	2008-2013	1996-2013
Raw NPI return minus Unlevered REIT return	0.361	0.567	-0.833	0.026
Pure selection effect	0.370	0.547	-0.720	0.061
Allocation effect plus interaction	-0.009	0.020	-0.113	-0.035

Panel D: Retail

	1996-2001	2002-2007	2008-2013	1996-2013
Raw NPI return minus Unlevered REIT return	-0.505	0.558	-0.546	-0.169
Pure selection effect	-0.525	0.386	-0.651	-0.267
Allocation effect plus interaction	0.020	0.172	0.105	0.099

Panel E: Core Properties (Aggregate)

	1996-2001	2002-2007	2008-2013	1996-2013
Raw NPI return minus Unlevered REIT return	0.245	0.416	-0.811	-0.054
Pure selection effect	0.027	0.397	-0.637	-0.074
Allocation effect plus interaction	0.217	0.019	-0.174	0.019

Table 7: Sample Firm Analysis – Equity Residential (EQR)

This table reports quarterly geometric means of the unlevered REIT return for Equity Residential, the raw NPI apartment return series, the reweighted NPI index using Equity Residential's geographic allocations, and firm level attribution analysis using the NCREIF NPI as the benchmark over the following periods: 1996-2001, 2002-2007, 2008-2013, 1996-2013. Returns are reported in percentage form.

Panel A: Return Series

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT Return (EQR)	2.177	2.619	1.581	2.125
Raw NPI Returns - Apartment	2.896	3.079	1.040	2.334
Reweighted NPI Returns (using EQR Weights)	2.887	3.024	1.029	2.309

Panel B: Attribution Analysis

	1996-2001	2002-2007	2008-2013	1996-2013
Unlevered REIT return (EQR) minus raw NPI - Apartment	-0.719	-0.461	0.541	-0.210
Pure allocation effect	-0.009	-0.056	-0.011	-0.025
Selection effect plus interaction	-0.710	-0.405	0.552	-0.185