Real Estate Portfolio Diversification across U.S. Gateway and Non-Gateway Markets[*]

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Abstract

We assess the benefits of diversifying a portfolio of commercial real estate assets across gateway and non-gateway markets, a topic of significant relevance to institutional investors. Using simulation analysis and property-level data for the U.S., we compare various performance metrics for portfolios containing buildings in gateway markets only, both in gateway and non-gateway markets, and in non-gateway markets only, respectively. Our results suggest that the risk-adjusted performance is similar across types of markets. Gateway markets have higher appreciation and total returns, while non-gateway markets exhibit higher income returns even after accounting for capital expenditures. Downside risk appears to be slightly greater for gateway markets than for non-gateway markets; however, full drawdown and recovery lengths tend to be shorter for gateway markets. Our results further show evidence of momentum in appreciation returns, although no differences exist across types of markets. Income returns also appear to affect real estate pricing significantly, this effect being stronger for non-gateway than for gateway markets. By considering a large spectrum of performance metrics in a realistic investment setting, the results of the paper should provide investors with valuable information when allocating funds across gateway and non-gateway markets. The paper also provides important insights regarding how best to define gateway markets.

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JEL Codes: R33; C63; G11; G23

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1. Introduction

Consistent with studies that have documented the positive impacts of holding real estate assets in a mixed-asset portfolio (Hoesli et al., 2004; Lizieri, 2013; Pagliari, 2017; Delfim and Hoesli, 2019), survey results indicate that investors have a strong appetite for the asset class (PREA, 2021). Against this background, an important issue for investors is that of how to structure their exposure to commercial real estate. Much research, for instance, focuses on comparing listed and direct investment performance (Hoesli and Oikarinen, 2012; Ling and Naranjo, 2015; Ling, Naranjo, and Scheick, 2018). For many large investors, such as institutional investors and sovereign wealth funds, direct investments constitute the preferred route given the flexibility and the control that such investments provide, as well as the diversification benefits associated with holding properties directly. Those investors, but of course also REIT and fund managers, have a keen interest in assessing how best to diversify a portfolio of real estate assets.

Much of the early research in this area has looked at the benefits of investing across property types versus investing across geographies, defined in various ways. Using National Council of Real Estate Investment Fiduciaries (NCREIF) data, Fisher and Liang (2000) show that diversification across sectors is more effective than geographic diversification using four broadly defined areas. For the U.K., Byrne and Lee (2011) also find that sectors dominate regions, however defined. The authors also report that functional groups of regions provide greater risk reduction than administrative areas. Another line of research has been that of analyzing the number of assets to hold in order to reduce diversifiable risk (e.g., Byrne and Lee, 2001). Studies highlight the importance of portfolio size on the level of risk reduction, but many other factors are also at play.

Going beyond the analysis of portfolio diversification by sector and region, an important dimension in the portfolio allocation process is that of asset selection. Such examination has sparked a limited but informative number of studies, and the current paper seeks to expand this line of research. Many investors, in particular institutional investors, tilt their real estate holdings towards quality assets, as documented both for domestic (Malpezzi and Shilling, 2000) and international investors (McAllister and Nanda, 2015; Devaney, Scofield, and Zhang, 2019). This process involves selecting assets in gateway markets, purchasing larger and newer properties, and focusing on CBD locations. It is posited that such strategy is rational as prime assets and locations should exhibit lower risk, largely because those markets are more liquid and transparent (Riddiough, Moriarty, and Yeatman, 2005; Ling, Naranjo, and Scheick, 2018). Using NCREIF data, Plazzi, Torous, and Valkanov (2011) show that the optimal portfolio weights are tilted towards high capitalization rate, low vacancy rate, and high value properties when compared to a portfolio that holds these properties in proportion to their appraisal values. This is consistent with the results reported by Beracha, Downs, and MacKinnon (2017) who find that high capitalization rate properties outperform low capitalization rate properties on a risk-adjusted basis.

Gateway and non-gateway markets have also been examined in the context of REIT portfolios. Ling, Naranjo, and Scheick (2018) find evidence of U.S. REIT managers being able to time allocation decisions ahead of Metropolitan Statistical Area (MSA) outperformance, this effect being most prevalent in non-gateway markets. Wang and Zhou (2020) examine property sell-offs by U.S. REITs and find a negative relationship between the distance from the seller's headquarters to the sold properties and stock market reactions for non-gateway markets but not for gateway markets. This suggests that for non-gateway markets location risk dominates the proximity effect. Finally, using a broad set of 25 "gateway" markets in the U.S., Milcheva, Yildirim, and Zhu (2020) show that REITs with a low exposure to those markets have a higher return to compensate for a higher risk.

While research suggests that non-gateway markets have higher levels of information asymmetry and are less efficient than gateway markets, it is unclear what this implies in terms of diversification of a portfolio across both types of markets. In this paper, we analyze the implications of holding a portfolio with various weights of gateway and non-gateway markets on risk-adjusted returns, the breakdown of total returns in appreciation and income returns, downside risk, and portfolio diversification. Although not looking specifically at gateway versus non-gateway markets, some papers are related to ours. Using NCREIF data, Gang, Peng, and Thibodeau (2020) report that core properties have higher returns and lower systematic risk than noncore properties. Fisher *et al*. (2020) find that U.S. REITs with holdings in high-density locations earn higher risk-adjusted returns and carry higher systematic risk than their peers in low-density locations. Also using REIT data, Feng *et al*. (2021) report that geographic diversification is associated with higher REIT values for firms that are more transparent (i.e., that have high levels of institutional ownership or invest in core property types), whereas higher values are associated with more geographic concentration for less transparent firms.

This paper digs deeper into the portfolio allocation process by considering specifically the effects of diversification across gateway and non-gateway markets in the U.S. Using simulation analysis and property-level data sourced from NCREIF, we compare various return and risk metrics for portfolios with varying exposures to gateway and non-gateway markets. We also investigate whether appreciation returns for portfolios with different weights of gateway and non-gateway markets are related to past appreciation returns and/or income returns. The first effect makes it possible to shed additional light on the usefulness of momentum strategies, while the second effect shows whether investors seeking high levels of cash inflows influence the pricing of assets.

Our results show that gateway markets have a higher total return and standard deviation than their non-gateway counterparts, translating in comparable risk-adjusted performance across types of markets. The breakdown of total returns into income and appreciation components highlights that non-gateway markets have a significantly higher income return and a lower standard deviation of those returns than gateway markets. This holds true after accounting for capital expenditures. In contrast, gateway markets have a higher appreciation return and standard deviation than non-gateway markets. Gateway markets appear to have slightly higher downside risk than their non-gateway counterparts; however, recovery times are faster for the former than for the latter, consistent with the higher appreciation returns for gateway markets. Appreciation returns are driven largely by past returns for all types of markets, thus confirming previous evidence of momentum in real estate returns. Income returns also appear to affect appreciation returns significantly, this effect being stronger for non-gateway than for gateway markets. The conclusions are shown to be robust to holding sectoral weights constant across the two types of markets and to using various sizes of assets under management. A comparison of results with alternative numbers of gateway markets leads us to conclude that markets are best differentiated when our initial set of six gateway markets is considered, but a narrower set of three markets constitutes a valid alternative.

The paper contributes to the literature in the following ways. First, the use of simulation analysis makes it possible to derive return and risk metrics and their distribution that better reflect the performance of institutional portfolios. As replicating an index is not possible for direct real estate investors, return and risk measures calculated from that index are not an appropriate depiction of portfolio performance. In contrast, the sample distributions of performance metrics are a substantially more realistic indication of the return and risk that are achievable on the different types of real estate markets. Second, we propose an innovative way of correcting values for appraisal smoothing and the escrow lag. By using a randomly selected quantile of the sale price to appraised value ratio, instead of a central tendency measure of the ratio, we take full advantage of the information available concerning property sales during any given quarter. This is paramount to producing property values, and in turn performance metrics, that reflect market conditions. This procedure has the further benefit of incorporating the effects of the uncertainty stemming from any unobserved characteristics on property values. A further contribution pertains to how best to classify markets in gateway or non-gateway markets from an investment standpoint. We use various subsets of markets and test which classification produces the most clear-cut discrimination of markets based on performance metrics. A fourth contribution is to provide further evidence concerning the momentum in real estate returns. Again, the focus is on the effects of investing in gateway or non-gateway markets, a topic that has not been examined previously. Finally, our approach aims at mimicking real world investment constraints in that we explicitly model the cash management process. Our performance metrics reflect the use of any cash proceeds (from the net operating incomes, the growth in invested capital, and the disposition of properties) to invest in additional properties at market value.

The paper has the following practical implications for institutional investors. Our results show the effects of investing varying proportions of a portfolio to gateway and non-gateway markets on total, income, and appreciation returns and standard deviations. This permits to assess portfolio risk-adjusted performance for various levels of diversification across gateway and non-gateway markets. Our paper also provides evidence on the type of market that offers high and recurrent income returns. This is important as survey results (PREA, 2021) reveal that income returns are a major factor when institutions decide to invest in the asset class. In addition, our findings should help investors be better aware of the combinations of assets that minimize downside risk and recovery times after a drawdown.

The remainder of the paper is organized as follows. In the next section, we discuss our data. The following section presents our method. We then discuss our results, before providing some concluding remarks in a final section.

2. Data

In this section, we first discuss the various filters that we have implemented to clean the database. We then present the method that we use to correct the reported property values so that they more accurately reflect market conditions. Finally, we present some statistics for the cleaned dataset.

2.1 Data Cleaning

All real estate data are sourced from NCREIF. The data pertain to the properties held by NCREIF constituents that form the basis for constructing their appraisal-based property index (NPI). After scrutinizing the data and reviewing a number of papers that have relied on NCREIF data, in particular Plazzi, Torous, and Valkanov (2011) and Sagi (2020), we implemented filters to discard data points presenting anomalies or deemed inappropriate for our study. Properties were deleted if:

1) They had less than four quarters of data;
2) They had one quarter or more of missing data;
3) The CBSA was missing;
4) The CBSA changed during the period;
5) They did not have at least two external appraisals or one external appraisal and a sale price;[1]

[1] We only consider sales that are classified by NCREIF as being true sales.

6) They were classified as hotels for at least one quarter;

7) The sales code suggested that they are not investment-grade;

8) They had a total or capital return below -99.9% in any quarter;

9) The absolute value of NOI exceeded 20% of market value in any quarter;

10) The absolute value of capital expenditures or partial sales exceeded 50% of market value in any quarter.

We use data for the period 2003Q1-2020Q1. Some quarters of data are needed to calculate forward- or backward-looking metrics; hence, the period considered for our simulations is 2004Q1-2019Q4. After the filtering out of anomalous data, the number of properties in our dataset is 1,683 as of 2004Q1 and 4,065 as of 2019Q4. Table 1 contains sample descriptive statistics by sector and market type as of the beginning and end of our time period. The breakdown by type of market is 478 properties for gateway markets and 1,205 for non-gateway markets as of 2004Q1 and 1,477 properties for gateway markets and 2,588 for non-gateway markets as of 2019Q4. Thus, the relative importance of gateway markets has increased over the period from 28% to 36%. This is also true when the value of properties is used as the relative importance of gateway markets has risen from 42% to 51%. Gateway markets represent a larger relative share of the market when considering values as a result of the higher average value of properties in gateway markets than in non-gateway markets (e.g., 135.7 million versus 73.8 million as of 2019Q4). The aggregate value of properties is greater for non-gateway markets than for gateway markets for apartment, industrial, and retail sectors. However, the reverse holds for offices, this being particularly striking as of the end of the time period.

Table 1 also shows that, at the beginning of the time period, the capitalization rates are roughly identical across gateway and non-gateway markets. As displayed in Figure 1, capitalization rates declined significantly during the time period, this being particularly true for gateway markets. As a result, capitalization rates for gateway markets are on average 58 basis points lower than their non-gateway counterparts. Whereas capitalization rates in gateway markets were only lower in the office and apartment sectors at the beginning of the time period, they were lower for all sectors at the end of the period. The spread is the widest for office properties (83 basis points), likely reflecting much institutional interest for offices in gateway markets during the period. These differences could also be due to compositional differences in the samples over time.

A total of 11,632 properties fulfill the criterion of having at least one year's worth of data. There is much turnover in the dataset as 9,949 properties entered and 8,229 properties exited the dataset (including 5,694 properties exiting due to an arm length's transaction). A total of 199 properties were in the dataset for the entire 16-year period, 1,731 properties were in the sample for at least 10 years, and 5,031 properties were in the dataset for at least five years. Figure 2 depicts the number of entries, the number of exits, and the number of properties in the database over time. The figure shows the increase in the number of properties in the sample during the period. Given the constraint that properties need to be in the dataset for at least one year, the numbers of sales and exits[2] are equal to zero at the beginning of the period. Given the lack of external valuations subsequent to the end of the time period that are necessary to conduct the property value adjustments (discussed below), there is a large number of properties that exit the dataset during the last three quarters.

[2] Exits refer to properties that leave the dataset and that are not identified as sales or with a sale code that does not allow us to ascertain that such sales are arm's length transactions.

2.2 Property Value Adjustments

It is well known that appraised values suffer from smoothing and lagging (Geltner, 1993; Delfim and Hoesli, 2021). Given that the analyses will be biased because of this, it is important to adjust values so that they more accurately reflect market conditions. To undertake these adjustments, we use a sale price to appraisal method that is akin to that used until recently by NCREIF to construct their transaction-based indices (Geltner, 2011; Plazzi, Torous, and Valkanov, 2011).[3] The NCREIF database contains an indicator specifying the nature of the market value reported in a given quarter. The three categories are the following: internal appraisal, external appraisal, and value not recalculated (hence, the value corresponds to that of the previous quarter adjusted for any capital expenditures or partial sales). For the adjustment of values, we only consider external appraisals. We fill the gaps by linearly interpolating between external appraisals net of any capital expenditures or partial sales that have occurred between two external appraisals. Thus, we allocate linearly to each period any capital gain (or loss) above the effects of capital expenditures or partial sales. The adjusted estimated values are obtained by reinstating the effect of capital expenditures and partial sales.

For each quarter, we then calculate the ratio of sale price to adjusted estimated value two quarters ago for each property that was sold and for which the sale is classified by NCREIF as a true sale:

$$SPAEV_{p,q} = \frac{SP_{p,q+1}}{AEV_{p,q-1}} \quad (1)$$

where $SPAEV_{p,q}$ is the sale price to adjusted estimated value ratio for property p at quarter q, $SP_{p,q+1}$ is the sale price of property p in quarter $q-1$, and $AEV_{p,q-1}$ is the adjusted estimated value at time $q-1$. Similarly to NCREIF, we use a two-quarter lag between the sale price and the adjusted

[3] Due to the lack of transactions in 2020, the NCREIF transaction-based index has been discontinued.

estimated value. This is to ensure that the appraisal is independent from any subsequent sale. Figure 3 shows the number of sales in the cleaned dataset over the period. Whereas more than 150 sales occurred during some quarters, there were only 16 sales across all property types during 2009Q1. To smooth out some of the quarterly variations in the ratios of sale prices to appraised values, the ratio for each time period is calculated as the average over three quarters (the previous quarter, the current quarter, and the next quarter). Figure 4 depicts the median of the three-quarter average of the ratio of sale price to the lagged appraised value as well as some selected quantiles.[4] Focusing on the median ratios, appraised values appear to be 5% below transaction prices prior to the Global Financial Crisis (GFC). At the peak of the GFC, properties transacted some 15% below their estimated value. After the GFC, prices were again slightly higher than appraised values. This seems consistent with the much documented smoothing and lagging of appraisals and the effects of these throughout the cycle.

We use the empirical distribution of ratios at time q to determine the expected sale price of unsold properties at time q rather than $q+1$ as in the production of the NCREIF transaction-based index (NTBI). This is to take into account the well-documented escrow lag in commercial real estate; transaction prices were agreed upon several weeks prior to their recording. The one quarter lag we use is consistent with the 90-day escrow lag that is discussed in Hoesli, Oikarinen, and Serrano (2015). Given the selected quantile order (Q_o), the expected sale price of unsold properties is calculated as follows:

$$ESP_{p,q} = AEV_{p,q-1} \cdot Q_o(SPAEV_q) \qquad (2)$$

[4] We also calculated the ratio of sale price to the lagged appraised value for gateway and non-gateway markets separately. Given that there were no meaningful differences in the times series of the ratio across the two types of markets, we use only the overall ratio.

where $ESP_{p,q}$ is the expected sale price of property p at time q, $AEV_{p,q-1}$ is the adjusted estimated value of property p at time $q-1$, and $Q_o\left(SPAEV_q\right)$ is the empirical quantile of order o of the ratio of sale prices to adjusted estimated values for quarter q.

2.3 Dataset Statistics

Table 2 contains statistics for the cleaned dataset. Those statistics include the four moments of the distributions and the two downside risk measures that are used in this paper. The statistics pertaining to the distributions are reported for the three types of returns (total, income, and appreciation), whereas the downside risk measures are only included for total and appreciation returns. The statistics suggest that gateway markets have a higher return and risk than non-gateway markets. The appreciation return is significantly higher (109 basis points) for gateway markets, whereas the income return is higher (58 basis points) for non-gateway markets. The downside risk measures are comparable across gateway and non-gateway markets. Returns have high levels of autocorrelation, despite the adjustments of appraised values. In this respect, it must be noted that the objective of the method used to adjust values is not to reduce the level of autocorrelation. Instead, the aim is to take advantage of the available information concerning sales, while overcoming the high volatility of the sale price to adjusted estimated value ratio stemming from the limited number of sales during some quarters.

The summary statistics discussed above are of limited use to investors as they do not capture the sample distributions of performance metrics. The latter are a much more realistic indication of the return and risk that are achievable on the different types of real estate markets. The main objective of this paper is precisely to determine the sample distributions of various performance measures.

3. Method

In this section, we first discuss the classification between gateway and non-gateway markets. We then discuss how we construct the simulated portfolios, before presenting the performance metrics that are computed for our simulated portfolios. Finally, we discuss the method we use to analyze further appreciation returns.

3.1 Gateway vs. Non-Gateway Markets

Gateway cities can be defined as cities with wide appeal to international investors. Such cities have large international airports, diversified economies, and status. We use conventional wisdom and prior research (Devaney, Scofield, and Zhang, 2019) and consider Boston, Chicago, New York, Los Angeles, San Francisco, and Washington, D.C. as our initial set of gateway markets. Looking at GDP figures at the MSA level, those cities rank in the top three (New York, Los Angeles, and Chicago), fifth (Washington, D.C.), sixth (San Francisco), and ninth (Boston) in the country.

An important consideration is whether the whole MSAs should be considered as gateway or only some divisions. For the six markets and for each property type considered in this study (apartment, industrial, office, and retail), we analyzed capitalization rates and percent leased to assess whether divisions within an MSA were homogenous or not. With the exception of Los Angeles, there are clear differences within MSAs, indicating that only parts of those are to be considered gateway markets. Appendix 1, Panel A shows our classification of divisions for the six gateway markets.

For robustness check purposes, we consider two expanded sets of gateway markets using 2003 GDP figures at the MSA level from the Bureau of Economic Analysis. The first set considers markets that account for at least 2.4% of national GDP. This results in Dallas and Philadelphia being added to the initial six gateway markets. The second set uses a threshold of 2.2%. This leads to Atlanta, Houston, and Miami being also considered to be gateway markets. Appendix 1, Panel B shows the classification of divisions for those additional markets. We also consider two more restricted sets of markets. The first one only includes the three largest markets (New York, Los Angeles, and Chicago), while the second set additionally considers Washington, D.C.

3.2 Portfolio Simulations

Appendix 2 presents the flowchart of our simulation process. For a given amount of assets under management (AUM), we use Monte Carlo simulations to construct hypothetical portfolios with various weights for gateway and non-gateway markets. We start with gateway markets only, and modify weights by 10% increments until reaching portfolios with non-gateway markets only.[5] For each set of weights, we construct 1,000 hypothetical portfolios. Given the stringent filtering rules used to clean up the database, we maintain that the population from which the portfolios are drawn is representative of the institutional investment universe and hence we do not apply any stratification to the sampling scheme above that concerning location. Hence, we construct N (=1,000) portfolios of P properties (varies depending on AUM assumption) for each of the W (=11) weighting schemes. Note that a specific property can be included in multiple portfolios but only once in a given portfolio.

A crucial parameter in the simulation analyses is AUM. We start by considering an amount of USD 5 billion to be invested as of the beginning of 2004. We also use an amount of 2.5 and 7.5 billion, respectively, to assess whether portfolio size has an impact on the results. The amount invested has to be incremented to reflect the growth in assets managed by institutional investors over time. To proxy for such growth, we use data concerning U.S. total retirement assets as published by the

[5] We allow for a 1% margin of error in weights for initial portfolios.

Investment Company Institute.[6] We then estimate the value of real estate holdings by applying the allocations to real estate by all plan sponsors as published in various Pension Real Estate Association (PREA) reports and remove the effect of commercial real estate capital returns as measured by NCREIF index returns. We obtain an average annual growth in real estate holdings from 2004 to 2019 of 5.5%; hence, we apply a quarterly rate of increase of 1.35% to the invested capital at the beginning of the quarter. This results in a compound increase in invested capital that is independent from portfolio performance. We use a constant rather than time-varying rate to insure that our results are not affected by market timing. The increases in invested capital lead to additional properties being incorporated in our portfolios. This is desirable given the significant increase in the number of properties in the NCREIF database.

In addition to the growth in invested capital over time, it is also necessary to take into account properties that exit the dataset from which our portfolios are drawn. There are a number of properties that exit the dataset and that are not identified as sales or with a sale code that does not allow us to ascertain that such sales are arm's length transactions.[7] At the end of the period, there are also a number of properties for which we do not have an external appraisal (as such appraisals would be subsequent to the period under review) and that need to be removed from the dataset. These properties are removed from portfolios as of the quarter prior to their exiting the dataset at their expected sale price. As explained in section 2.2, the expected sale price of property p at time q is calculated by multiplying the adjusted estimated value at time $q-1$ by the empirical quantile of order o of the ratio of sale prices to adjusted estimated values for quarter q. At each portfolio inception, we draw for each property the order o that will be used to sample empirical quantiles for

[6] https://www.ici.org/.

[7] These include the following sale codes: *Consolidation*, *No longer qualifies*, *Owner exited database*, *Split into multiple properties*, and *Transfer of ownership*.

the entire lifespan of the property. For example, if the selected order for a given property is 0.5 (i.e., the median), then we use the medians of the ratios of sale price to adjusted estimated value computed for each quarter. So, for this example, we compute the expected sale price for quarter q on the basis of the median of the ratios pertaining to that period. Note that the order of the quantile is drawn randomly without taking into account the characteristics of properties. As such, the quantile for a given property will change with each iteration. Despite the fact that we do not take into account the attributes of properties, using quantiles rather than some central measure such as the median is useful to generate heterogeneity in simulation results, making it possible to explore more widely the solution space.

In the case of true sales, properties exit our portfolios at the reported sale price. For those properties, we know the true ratio of sale price to adjusted market value. We can thus determine the quantile order of the ratio within the distribution of ratios for that quarter. We use this quantile order to calculate the expected sale price of that property for previous quarters.

The proceeds from the sale and exiting of properties are combined with the increase in investment capital as well as the other items affecting cash flows and added to the initial cash balance to determine the funds available for purchases for a given quarter:

$$FAP_{n,q} = CB_{n,q-1} + \Delta IC_q + PSE_{n,q} + OCF_{n,q} \qquad (3)$$

where $FAP_{n,q}$ are the funds available for purchases for portfolio n during quarter q, $CB_{n,q-1}$ is the cash balance at the beginning of quarter q, ΔIC_q is the change in invested capital during quarter q, $PSE_{n,q}$ are the proceeds from the sale and exiting of properties during quarter q, and $OCF_{n,q}$ are the other items affecting cash flows during quarter q. The other items affecting cash flows include net operating incomes, capital expenditures, and partial sales. Provided that the funds available exceed

USD 50 million, they are used to purchase additional properties, maintaining portfolio weights for gateway and non-gateway markets as close as possible to targets.

At the end of the simulations, we check for the amount of cash held in portfolios as well as for the weights of gateway and non-gateway markets. Specifically, we remove any portfolio containing more than 2% of AUM in cash in absolute value or whose weights deviate by more than five hundred basis points from their targets.

3.3 Performance Metrics

The next step is to construct various portfolio performance metrics. The metrics are calculated for the 11 sets of 1,000 portfolios, and we compare the distributions across the 11 sets. The same approach is used for the robustness checks. We first calculate portfolio annualized total, income, and appreciation returns for each of the simulated portfolios. Returns are calculated in compliance with the NCREIF methodology. The only deviation from their methodology is that we use the properties' expected sale prices rather than their market values that are in most cases appraisal-based. We then consider the distributions of portfolio returns. This makes it possible to analyze both the standard deviation within a given market type weighting and across market weightings. We also consider portfolio standard deviations, which provide for an analysis of variations through time. We further calculate the following metrics: the Sharpe ratio, value-at-risk (VaR), and maximum drawdown (MDD). The Sharpe ratio is calculated for all three types of returns (total, income, and appreciation), whereas the downside risk measures are only computed for appreciation returns. For the Sharpe ratios, we use the three-month Treasury rate sourced from the Federal Reserve Bank of St. Louis. The Sharpe ratio is widely used in the investment world and measures the return in excess of the risk-free rate per unit of standard deviation. VaR and MDD are also widely used and pertain to downside risk. VaR_α

is calculated as the return level for which we expect a proportion $1-\alpha$ of the returns to be below that threshold. So, computing VaR_α involves solving the following equation for a given level of α:

$$P\left[Return < VaR_\alpha\right] = 1-\alpha \tag{4}$$

where we define $Return$ as the trailing compound appreciation return over four quarters. We consider both 95% and 99% confidence levels. MDD is the maximum capital loss from a peak to a trough over the simulation period. It is computed as:

$$MDD = \max_{t\,\in(0,T)}\left\{-\frac{(C_t - RunMax_t)}{RunMax_t}\right\} \tag{5}$$

where $RunMax_t$ is the highest peak (i.e., running maximum) observed during the period going from 0 to t and C_t is the capital value at time t. Examples of the limited use of those downside risk measures in the context of direct real estate investments include Gordon and Tse (2003), Hamelink and Hoesli (2004), and Amédée-Manesme, Barthélémy, and Keenan (2015).

We also calculate the recovery and drawdown cycle lengths. The recovery length is the number of years needed for the capital value to regain its pre-drawdown level from the trough. The drawdown cycle length is the number of years from the start of the drawdown to full recovery of capital losses. The cycle length thus contains both the length from peak to trough and that from trough to restoration of the capital back to the high-water mark.

3.4 Further Analysis of Appreciation Returns

We then turn to investigating whether appreciation returns are mainly related to lagged appreciation returns or to income returns. Such analysis is important for at least two reasons. First, it makes it possible to test the usefulness of momentum strategies for portfolios containing varying weights of gateway and non-gateway markets. This is related to the analyses of Beracha and Downs (2015), who also use NCREIF data. They find that positive momentum portfolios outperform negative momentum portfolios. As many institutional investors have a keen interest in holding properties that yield recurrent and substantial income returns, we also test for the importance of income returns in explaining appreciation returns for varying weights of gateway and non-gateway markets. Hence, our objective is to assess the extent to which income returns affect commercial real estate pricing across various market types. This analysis is undertaken using a regression framework. Specifically, our model is:

$$AR_q = \beta_0 + \beta_1 AR_{q-1} + \beta_2 IR_q + \varepsilon_q \tag{6}$$

where AR_q is the appreciation return for quarter q and IR_q is the income return for quarter q. We consider the contemporaneous income returns as those are known when the pricing of assets occurs at the end of the period. The model is estimated using OLS.

4. Results

In this section, we first present some descriptive statistics and graphs for our simulated portfolios. The performance analyses for portfolios containing varying weights of gateway and non-gateway markets are discussed next. We focus first on total returns, and then consider the income and appreciation components. As discussed above, we use various return and risk metrics. The following subsection contains various robustness checks, while a fourth subsection provides further analysis of appreciation returns.

4.1 Simulated Portfolios

Table 3 contains descriptive statistics concerning the number of properties in our simulated portfolios both at the beginning (Panel A) and at the end (Panel B) of our time period. The statistics are for the base case scenario of an AUM of USD 5 billion. Focusing first on the statistics as of 2004Q1, the median number of properties in the full portfolios ranges from 83 (when the portfolio is entirely invested in gateway properties) to 151 (when the entire allocation is in non-gateway markets). The greater median number of properties when the portfolio is entirely invested in non-gateway markets is to be expected given the lower value of properties in those markets. Some sub-portfolios contain only a limited number of properties when the weight of the related market type is small. For instance, if 10% of a portfolio is allocated to gateway markets, the median number of gateway properties is only 11 and the minimum is one. However, in most instances, portfolios contain a sufficient number of properties to achieve proper diversification. At the end of the time period, the median number of properties in portfolios is markedly larger (in the 215-369 range), reflecting the growth of assets under management during the 16-year time period of our study. As discussed in the previous section, this growth is largely attributable to the growth in invested capital and the reinvesting of NOIs. As of that date, the minimum number of properties in gateway and non-gateway sub-portfolios is never below 16.

Figure 5 shows total returns for 50 portfolios for each of two weighting schemes (all gateway markets in Panel A and fully non-gateway markets in Panel B). The graphs also contain returns for the NPI and the NTBI. Figure 6 depicts appreciation returns in a similar fashion. Figures 5 and 6 show return patterns that are consistent with the well-documented cyclical nature of commercial real estate markets. For instance, the effects of the GFC appear clearly for both total and appreciation returns. Our portfolio returns are more volatile than NPI returns. This is to be expected given that the NPI is appraisal-based, whereas the value of the properties in our portfolios are adjusted on a quarterly basis using information pertaining to properties that have transacted (as discussed in section 2.2). On the other hand, portfolio returns are less volatile than those of the NTBI. This is also to be expected, as we implemented a method to filter out the noise in the NTBI resulting from the highly variable number of sales over time. Our method further takes into account the escrow lag in real estate markets, resulting in a more realistic depiction of market turning points. Figure 5 shows a similar pattern for total returns in gateway and non-gateway markets. This is also true for appreciation returns (Figure 6), although some differences in return magnitudes are visible. A more detailed analysis of various performance metrics across gateway and non-gateway markets is provided in the next subsection.

4.2 Performance Analysis

Figure 7 depicts the distributions of portfolio average annual total returns (Panel A), standard deviations (Panel B), and Sharpe ratios (Panel C) for the 11 weighting schemes. Each boxplot shows the median (thick line) and the 25% and 75% percentiles (the edges of the box). The whiskers represent the most extreme data points or one and a half the interquartile range, depending on which one is the least extreme. Any observation lying outside of the whiskers can be considered an outlier. Panel A shows that the median portfolio total return diminishes monotonously as a larger weight is allocated to non-gateway markets (median return of 8.40% for gateway markets versus 7.65% for non-gateway markets). Panel A also shows that the distribution of gateway total returns is almost symmetrical (skewness of 0.05). On the other hand, as we move to a larger weight for non-gateway markets, distributions start exhibiting positive asymmetry (skewness for non-gateway markets of 0.63). In line with median returns, the standard deviations also diminish as a larger fraction of a portfolio is allocated to non-gateway markets (median standard deviation of 5.33% and 4.92% for gateway and non-gateway markets, respectively). Considering that idiosyncratic risk is mostly diversified away due to the large portfolio sizes, the higher level of risk for gateway markets is in line with the higher level of systematic risk reported for high-density areas as compared with that for low-density locations (Fisher *et al*., 2020). The results contained in Panel B also suggest that the dispersion of portfolio standard deviations diminishes as the weight of non-gateway markets increases. As a result, the portfolio Sharpe ratios do not vary depending on the share of gateway and non-gateway markets (Panel C). It is interesting to contrast our results with those of Beracha, Downs, and MacKinnon (2017) who find that high capitalization rate properties dominate low capitalization rate properties on a risk-adjusted basis. Our results, on the other hand, suggest that there is no difference in performance across non-gateway and gateway markets, although the former have higher capitalization rates than the latter, with the exception of a few quarters at the beginning of the time period. Those somewhat diverging results could of course be due to many factors, including the fact that the time periods are different (1978-2015 for Beracha, Downs, and MacKinnon, 2017, and 2004-2019 for us) and the data filtering rules (our filtering rules do not accommodate for value-add properties).

We now turn to analyzing the two components of total returns, i.e., the income returns and capital returns. Figure 8 contains the distributions of income returns (Panel A), the standard deviations of those returns (Panel B), and the Sharpe ratios for those returns (Panel C). Panel A shows that median income returns are 50 basis points larger for non-gateway markets (5.77%) than for gateway markets (5.27%). Income returns exhibit a slight negative asymmetry (skewness from -0.12 to -0.32), with no clear trend with respect to the market type weight. Negative asymmetry would be expected for income returns as NOI surprises are more likely to be on the downside than the upside.

Income returns for non-gateway markets are also less volatile than their gateway counterparts (Panel B). This leads to higher income return Sharpe ratios for non-gateway markets relative to gateway markets (Panel C), indicating that the income return in excess of the risk-free rate per unit of risk is greater for non-gateway markets than for gateway markets. The ratio in fact increases monotonously with the share of non-gateway markets.

Income returns represent a share of 63% of total returns for gateway markets, whereas this figure is 69% for a portfolio with equal weights of both types of markets, and 75% for non-gateway markets. For gateway markets, there is a 50% probability that this figure is in the 60.6-64.9% range, whereas the range is 71.3-79.0% for non-gateway markets. This provides support for the fact that income returns as a percentage of total returns are consistently larger for non-gateway markets than for gateway markets. On the other hand, gateway markets offer a higher total return but as much as 37% of that return stems from capital appreciation which is uncertain from an *ex ante* point of view.

Net operating income does not necessarily provide the full picture regarding the cash flow generating ability of assets. For that purpose, we calculated the free cash flow return as the NOI minus capital expenditures divided by the property's market value at the beginning of the period. Free cash flow returns are approximately 150 basis points lower than income returns, with capital expenditures only 12 basis points higher for non-gateway markets. Moreover, the standard deviation of the spread in capital expenditures is constant across the various weighting schemes. This indicates that non-gateway markets offer significantly higher recurrent returns than gateway markets even after accounting for capital expenditures. These results should be of interest to institutional investors looking for sizeable and recurrent streams of cash flows in order to meet their commitments.

Focusing on the appreciation return component, Figure 9, Panel A shows that gateway markets have a 123 basis point larger median return (3.01%) than their non-gateway counterparts

(1.78%). Bearing in mind that the average compound inflation rate during the 2004-2019 period was 2.08%, this means that on average non-gateway markets did not provide capital protection in real terms. This is a clear disadvantage of investing in those markets, at least for the period under review. A minimum allocation of 30% in gateway markets would have been warranted to expect preservation of the invested capital in real terms. Appreciation returns display the same pattern of asymmetry as that of total returns, with skewness ranging from 0.05 to 0.68 for gateway and non-gateway markets, respectively. Hence, it appears that the shape of the total return distribution is largely inherited from that of appreciation returns. Gateway capital returns also come with a somewhat larger dispersion than for non-gateway markets (Panel B). However, the capital return Sharpe ratios are clearly in favor of gateway markets (Panel C). It should be borne in mind, of course, that capital appreciation does not generate cash inflows until a property is eventually disposed of. This is potentially an issue for investors seeking recurrent cash inflows.

Figure 10 contains portfolio downside risk measures. We focus on two measures: value-at-risk (VaR) and maximum drawdown (MDD). We report VaR results for both 95% and 99% confidence levels. The 95% VaR results (Panel A) indicate that downside risk is somewhat greater for gateway markets (19.6%) than for non-gateway markets (18.0%). This is confirmed by the 99% VaR figures (Panel B) of 25.2% and 23.8% for gateway and non-gateway markets, respectively. The MDD results (Panel C) further suggest that downside risk is greater for gateway markets (31.5%) than for non-gateway markets (30.4%). Unsurprisingly, these drawdowns occurred during the GFC. The lack of evidence of negative skewness or of differences in dispersion across market types suggests that VaR and MDD medians are robust estimates of downside risk. From a practical perspective, this analysis does not indicate material differences in downside risk across gateway and non-gateway markets. However, those results are *ex post* and what is true for the period considered here may not repeat itself in future years. As such, gateway markets appear riskier given that a larger fraction of total return originates from capital appreciation.

For investors, capital loss measures, albeit important, are not sufficient in ascertaining the riskiness of portfolios. Two complementary items are the recovery length, i.e., the number of years needed to revert to the pre-drawdown portfolio high-water mark and the drawdown cycle length, i.e., the number of years from the high-water mark to restoring that level. Those two measures are depicted in Figure 11. Panel A shows that the median recovery length is shorter for gateway markets (5.5 years) than for non-gateway markets (7.1 years). The shorter recovery length for gateway markets is a consequence of the greater appreciation returns for gateway markets. The recovery length standard deviations are lower for gateway markets, which reinforces the idea that those markets are quicker to recover. Nonetheless, portfolios that are heavily tilted towards gateway markets exhibit stronger positive skew than their non-gateway counterparts as evidenced by the outliers in Panel A. The length of full drawdown cycles (Panel B) is also shorter for gateway markets (7.3 years) than for non-gateway markets (9.0 years). Regarding standard deviations and skewness, the considerations mentioned above for recovery lengths also apply for drawdown cycles. For investors, those results suggest that portfolios that are too heavily tilted towards non-gateway markets could be problematic in an asset-liability management (ALM) framework. This is because the value of assets will take longer to regain the level of the associated liabilities. This is even more of an issue for leveraged investors, especially if the lender is monitoring closely the loan-to-value ratio as part of the agreed covenants.

The analysis of the performance of gateway and non-gateway markets would be incomplete without a comparison of the liquidity of the two types of markets. Figure 12 depicts the turnover ratio for both gateway and non-gateway markets, based on the sales in the cleaned NCREIF dataset.

The ratios are calculated as the dollar volume of sales during any given year divided by the value of assets at the end of the year. The measures are likely to constitute a conservative assessment of real estate turnover given the buy-and-hold policies of many NCREIF contributing members. Nonetheless, the ratios are broadly in line with those reported by Devaney and Scofield (forthcoming) for New York using Real Capital Analytics data. Figure 12 shows slightly higher levels of turnover for non-gateway markets than for gateway markets.[8] Whereas the turnover ratios were in a 6-14% range prior to the GFC, they declined markedly during the crisis, and have stabilized after the recovery at 4-9%. Hence, there does not appear to be any meaningful differences in liquidity across the two types of markets.

4.3 Robustness Checks

We perform three sets of robustness checks. The first set pertains to the definition of gateway markets, the second to the size of AUM, and the third to whether our main conclusions remain valid both at the sector level and at the aggregate level when sectoral allocation is held constant across gateway and non-gateway markets.

With respect to the first set of robustness checks, we consider various alternative sets of gateway markets. We use two expanded definitions of gateway markets using 2003 GDP figures at the MSA level.[9] The first definition considers markets that account for at least 2.4% of national GDP, resulting in Dallas and Philadelphia being added to the six gateway markets. The second definition uses a 2.2% threshold, leading to Atlanta, Houston, and Miami being also considered to be gateway markets. We also consider two more restrictive sets of gateway markets. The first only considers New York, Los Angeles, and Chicago, while the second additionally includes Washington, D.C.

[8] The same result is obtained for simulation turnover which considers both sales and exits from the database.
[9] We use 2003 figures to avoid look-ahead bias.

The results pertaining to five sets of gateway markets are contained in Table 4. We report total and income returns and standard deviations of those returns as well as maximum drawdown and 95% VaR for three types of portfolios (100% gateway, 50% gateway and 50% non-gateway, and 100% non-gateway). For each metric, the table also shows the difference in performance between 100% gateway and 100% non-gateway portfolios. Our results show that widening the definition of gateway markets from our base case of six markets leads to less pronounced differences between gateway and non-gateway markets. For instance, whereas gateway markets have a 75 basis point higher total return than their non-gateway counterparts in the base case analysis, this difference is only 49 basis points when eight markets are considered to be gateway and 41 basis points with 11 gateway markets. Also, whereas non-gateway markets have a 50 basis point higher income return with six gateway markets, the difference narrows slightly to 46 and 40 basis points with eight and 11 gateway markets, respectively. Differences in downside risk between gateway and non-gateway markets also diminish slightly as one expands the set of gateway markets.

Narrowing the definition of markets from the original six markets leads to mixed results. Whereas the three-market definition leads to the second best discrimination of markets behind the base case set of six markets, the four-market definition results in poor discrimination between gateway and non-gateway markets. For instance, whereas gateway markets have a 75 basis point higher total return than their non-gateway counterparts in the base case analysis, this difference is 65 basis points when three markets are considered to be gateway and only 29 basis points with four gateway markets. The difference in total returns between gateway and non-gateway markets displays a V-shape as one moves from a six-market definition to a three-market definition. This is due to a high-performing market (San Francisco) being discarded in the four-market definition. The difference in returns then increases again with the three-market definition given that a low-performing market

(Washington, D.C.) is not included in that definition. Downside risk measures confirm that the three- and six-market definitions provide the best discrimination across the two types of markets. Overall, the original set of six gateway markets leads to slightly better discrimination than a strategy that would only consider New York, Los Angeles, and Chicago. Using a set of six markets has the further advantage of widening the universe of investment opportunities.

A second robustness check consisted in calculating the performance metrics for assets under management of 2.5 billion and 7.5 billion, respectively, rather than the original assumption of 5 billion. The invested capital quarterly rate of increase is unchanged at 1.35%. The results remain by and large unchanged. The median of full drawdown cycle and recovery lengths, however, appear to be slightly longer for an AUM of 2.5 billion. We attribute this to the better performance of some larger properties that are less likely to be included in smaller portfolios.

The discussion of performance metrics in section 4.2 refers to portfolios that can include assets of any sector. This is motivated by liquidity concerns; if portfolio simulations were to include sectoral constraints, the resulting portfolios may not be achievable in practice for large investors given the size of some market segments. For instance, the NCREIF database only contained 65 retail properties in gateway markets as of 2004Q1. Nonetheless, an analysis which takes sectors into account is useful for at least two reasons. First, some types of investors may favor a given sector over others, e.g., if they have developed an expertise that is specific to a sector. Second, considering all sectors simultaneously may reveal differences in performance that are attributed to the type of markets (gateway versus non-gateway), whereas they can in fact be explained by different sector weights. For this third set of robustness checks, the analyses are undertaken for an AUM of USD 2.5 billion to account for the smaller pool of properties available at the sector level.

There are noteworthy differences across sectors. Whereas the total return spread between gateway and non-gateway markets is 87 basis points in the overall analysis, the spread is markedly higher for office and industrial properties (210 and 169 basis points, respectively). For retail, the spread (84 basis points) is in line with the overall spread. Interestingly, the total return for apartments is greater for non-gateway than for gateway markets (spread of 37 basis points). A similar pattern emerges for appreciation returns: office and industrial properties perform significantly better in gateway than in non-gateway markets (281 and 191 basis points, respectively). Apartments do only slightly better in gateway than in non-gateway markets (18 basis points). Results for the retail sector are again consistent with overall results. The main conclusion pertaining to downsize risk, i.e., that gateway markets tend to be slightly riskier than non-gateway markets holds across sectors, with the exception of apartments which tend to be slightly riskier in non-gateway markets. Finally, the difference in income returns between non-gateway and gateway markets is of similar magnitude across all sectors.

The robustness checks pertaining to sectors also make it possible to analyze whether differences across gateway and non-gateway markets in the overall analysis are due to different allocations across sectors for the two types of markets. For this purpose, we consider a sectoral composition for both gateway and non-gateway markets that is equal to the sectoral composition of the entire sample (rather than that by type of market) at the beginning of each quarter. By doing so, any differences in performance will be due purely to the type of market. This results mainly in a lower weight for office properties and a higher allocation for retail in gateway markets, while the changes in allocations are in the opposite direction for non-gateway markets. The analysis yields that the superiority of gateway markets over their non-gateway counterparts with respect to total and appreciation returns is reinforced. For instance, whereas gateway markets has an 87 basis points higher return than their non-gateway counterparts when sectoral composition is not constrained, this spread rises to 114 basis points when sector constraints are implemented. Also, the spread in income returns between non-gateway and gateway markets increases slightly from 46 to 54 basis points. Hence, our conclusions are not driven by sectoral composition effects across the two types of markets.

4.4 Further Analysis of Appreciation Returns

This section contains a discussion of regression results for Equation (6) presented above. Figure 13 depicts the distributions of regression adjusted R-squares (Panel A), of estimated coefficients for lagged appreciation returns (Panel B), and of estimated coefficients for income returns (Panel C) for the 11 weighting schemes pertaining to gateway and non-gateway markets. Adjusted R-squares amount to approximately 0.63 and are fairly constant across weighting schemes. Interestingly, the median estimated coefficient on lagged appreciation returns is about 0.81 and rises very marginally as a larger weight is allocated to non-gateway markets. This result is reinforced by the fact that the coefficient on lagged appreciation is significant in all instances, as can be seen in Table 5 which contains information on the percentages of regression coefficients that are significant for each of the 11 weighting schemes (at the 0.05 level). Our findings suggest momentum in real estate returns, with the extent of momentum not appearing to be related to the fraction of a portfolio that is allocated to gateway or non-gateway markets.

The median estimated coefficients for income returns exhibit positive values ranging from 1.86 for gateway portfolios to 2.55 for non-gateway portfolios. The median coefficient rises monotonously with the portfolio weight in non-gateway markets. Also, the proportion of significant coefficients increases with the weight allocated to non-gateway markets (23% for gateway markets and 72% for non-gateway markets). This provides evidence of income returns playing an important role in commercial real estate pricing, this being particularly true for non-gateway markets. Given that income returns do not exhibit much volatility, a large impact of income returns on the pricing of assets, as is mostly the case for non-gateway markets, will transpire into lower levels of appreciation return volatility (as can be seen in Figure 9, Panel B).

5. Conclusions

This paper has sought to investigate the effects of diversification across gateway and non-gateway markets. Using simulation analysis and property-level data, we compare various return and risk metrics for portfolios with varying exposures to gateway and non-gateway markets. The sample distributions of performance metrics that are derived are a more realistic indication of the return and risk that are achievable on the different types of real estate markets than if index level data were used. We also analyze whether appreciation returns for portfolios with different weights of gateway and non-gateway markets are related to past appreciation returns and/or income returns. All analyses are conducted using property values that have been corrected using an innovative procedure so as to reflect market values more accurately.

Our results show that gateway markets have a higher total return and standard deviation than their non-gateway counterparts, leading to comparable risk-adjusted performance across types of markets. The breakdown of total returns into income and appreciation components highlights that non-gateway markets have a significantly higher income return than gateway markets, even after accounting for capital expenditures. On the other hand, gateway markets exhibit higher appreciation returns. Gateway markets appear to have slightly higher downside risk than their non-gateway counterparts; however, recovery times are shorter for the former than for the latter, consistent with the higher appreciation returns for gateway markets. For both types of markets, appreciation returns are driven largely by past returns, thus confirming previous evidence of momentum in real estate returns. Income returns also appear to affect appreciation returns significantly, this effect being stronger for non-gateway than for gateway markets.

Our conclusions are shown to be robust across alternative assumptions pertaining to AUM and when the same sectoral weights for the two types of markets are used. The sector level analysis reveals that income returns are consistently larger for non-gateway markets than for gateway markets across all sectors. Also, the spread in total and appreciation returns is markedly larger for office and industrial properties than for retail assets and apartments. In fact, for the latter sector, there is no meaningful difference in total and appreciation returns across the two types of markets. In relation to the number of markets being considered to be gateway, our results show that differences in return and risk metrics generally become more blurred as markets are added to or removed from the initial set of six gateway markets. The differentiation of markets is best achieved with this set of markets, although a narrow definition that only includes the three largest markets (New York, Los Angeles, and Chicago) also leads to appropriate segregation of markets.

There are various ways in which our knowledge of commercial real estate gateway markets could be expanded. First, it would be interesting to analyze how the importance of a city can change over time. Obvious examples of cities which have grown fast during the period are San Francisco, Dallas, or Houston. Second, a more granular set of areas than metropolitan divisions could be used to delineate markets in order to capture the effects of micro-location more precisely. Finally, a fruitful avenue for future research would be to analyze whether our main conclusions hold for other regions or globally. There are many international gateway markets, such as Toronto, Paris, or Tokyo, and comparing commercial real estate performance between those cities and more regional markets should prove informative.

References

Amédée-Manesme, C.-O., F. Barthélémy, and D. Keenan, 2015, "Cornish-Fisher Expansion for Commercial Real Estate Value at Risk", *Journal of Real Estate Finance and Economics*, 50(4), 439-464.

Beracha, E. and D. H. Downs, 2015, "Value and Momentum in Commercial Real Estate: A Market-Level Analysis", *Journal of Portfolio Management*, 41(6), 48-61.

Beracha, E., D. H. Downs, and G. MacKinnon, 2017, "Are High-Cap-Rate Properties Better Investments?" *Journal of Portfolio Management*, 43(6), 162-178.

Byrne, P. J. and S. Lee, 2001, "Risk Reduction and Real Estate Portfolio Size", *Managerial and Decision Economics*, 22(7), 369-379.

Byrne, P. and S. Lee, 2011, "Sector, Region or Function? A MAD Reassessment of Real Estate Diversification in Great Britain", *Journal of Property Investment and Finance*, 29(2), 167-189.

Chaney, A. and M. Hoesli, 2015, "Transaction-Based and Appraisal-Based Capitalization Rate Determinants", *International Real Estate Review*, 18(1), 1-43.

Cherchavidze, S., J. Costello, and W. Wheaton, 2010, "The Secular and Cyclical Determinants of Capitalization Rates: The Role of Property Fundamentals, Macroeconomic Factors, and Structural Changes", *Journal of Portfolio Management*, 35(5), 50-69.

Clayton, J., D. Ling, and A. Naranjo, 2009, "Commercial Real Estate Valuation: Fundamentals versus Investor Sentiment", *Journal of Real Estate Finance and Economics*, 38(1), 5-37.

Delfim, J.-C. and M. Hoesli, 2019, "Real Estate in Mixed-Asset Portfolios for Various Investment Horizons", *Journal of Portfolio Management*, 45(7), 141-158.

Delfim, J.-C. and M. Hoesli, 2021, "Robust Desmoothed Real Estate Returns", *Real Estate Economics*, 49(1), 75-105.

Devaney, S. and D. Scofield, forthcoming, "Estimating the Value, Ownership Structure and Turnover Rate for Investible Commercial Real Estate from Transaction Datasets", *Journal of Property Investment and Finance*.

Devaney, S., D. Scofield, and F. Zhang, 2019, "Only the Best? Exploring Cross-Border Investor Preferences in U.S. Gateway Cities", *Journal of Real Estate Finance and Economics*, 59(3), 490-513.

Feng, Z., M. Pattanapanchai, S. M. Price, and C. F. Sirmans, 2021, "Geographic Diversification in Real Estate Investment Trusts", *Real Estate Economics*, 49(1), 267-286.

Fisher, G., E. Steiner, S. Titman, and A. Viswanathan, 2020, "How Does Property Location Influence Investment Risk and Return?" working paper, Real Estate Research Institute.

Fisher, J. D. and Y. Liang, 2000, "Is Property-Type Diversification More Important than Regional Diversification?" *Real Estate Finance*, 17(3), 35-40.

Gang, J., L. Peng, and T. G. Thibodeau, 2020, "Risk and Returns of Income Producing Properties: Core versus Noncore", *Real Estate Economics*, 48(2), 476-503.

Geltner, D., 1993, "Estimating Market Values for Appraised Values without Assuming an Efficient Market", *Journal of Real Estate Research*, 8(3), 325-346.

Geltner, D., 2011, *A Simplified Transactions Based Index (TBI) for NCREIF Production*, TBI White Paper, Chicago: NCREIF.

Gordon, J. N. and E. W. K. Tse, 2003, "VaR: A Tool to Measure Leverage Risk", *Journal of Portfolio Management*, 29(5), 62-65.

Hamelink, F. and M. Hoesli, 2004, "Maximum Drawdown and the Allocation to Real Estate", *Journal of Property Research*, 21(1), 5-29.

Hoesli, M., J. Lekander, and W. Witkiewicz, 2004, "International Evidence on Real Estate as a Portfolio Diversifier", *Journal of Real Estate Research*, 26(2), 161-206.

Hoesli, M. and E. Oikarinen, 2012, "Are REITs Real Estate: Evidence from International Sector Level Data", *Journal of International Money and Finance*, 31(7), 1823-1850.

Hoesli, M., E. Oikarinen, and C. Serrano, 2015, "Do Public Real Estate Returns Really Lead Private Returns?" *Journal of Portfolio Management*, 41(6), 105-117.

Ling, D. C. and A. Naranjo, 2015, "Returns and Information Transmission Dynamics in Public and Private Real Estate Markets", *Real Estate Economics*, 43(1), 163-208.

Ling, D. C., A. Naranjo, and B. Scheick, 2018, "Geographic Portfolio Allocations, Property Selection and Performance Attribution in Public and Private Real Estate Markets", *Real Estate Economics*, 46(2), 404-448.

Lizieri, C., 2013, "After the Fall: Real Estate in the Mixed Asset Portfolio in the Aftermath of the Global Financial Crisis", *Journal of Portfolio Management*, 39(5), 43-59.

McAllister, P. and A. Nanda, 2015, "Does Foreign Investment Affect U.S. Office Real Estate Prices?", *Journal of Portfolio Management*, 41(6), 38-47.

Malpezzi, S. and J. D. Shilling, 2000, "Institutional Investors Tilt their Real Estate Holdings Toward Quality, Too", *Journal of Real Estate Finance and Economics*, 21(2), 113-140.

Milcheva, S., Y. Yildirim, and B. Zhu, 2020, "Distance to Headquarter and Real Estate Equity Performance", *Journal of Real Estate Finance and Economics*, https://doi.org/10.1007/s11146-020-09767-4.

Pagliari Jr, J.L., 2017, "Another Take on Real Estate's Role in Mixed-Asset Portfolio Allocations", *Real Estate Economics*, 45(1), 75-132.

Plazzi, A., W. Torous, and R. Valkanov, 2008, "The Cross-Sectional Dispersion of Commercial Real Estate Returns and Rent Growth: Time Variation and Economic Fluctuations", *Real Estate Economics*, 36(3), 403-439.

Plazzi, A., W. Torous, and R. Valkanov, 2011, “Exploiting Property Characteristics in Commercial Real Estate Portfolio Allocation”, *Journal of Portfolio Management*, 37(5), 39-50.

Pension Real Estate Association, 2021, *Investment Intentions Survey 2021*, Hartford (CT): PREA.

Riddiough, T. J., M. Moriarty, and P. J. Yeatman, 2005, “Privately Versus Publicly Held Asset Investment Performance”, *Real Estate Economics*, 33(1), 121-146.

Sagi, J. S., 2020, “Asset-Level Risk and Return in Real Estate Investments”, *Review of Financial Studies*, https://doi.org/10.1093/rfs/hhaa122.

Wang, C. and T. Zhou, 2020, “Trade-Offs between Asset Location and Proximity to Home: Evidence from REIT Property Sell-Offs”, *Journal of Real Estate Finance and Economics*, https://doi.org/10.1007/s11146-020-09770-9.

Table 1. Sample Descriptive Statistics by Sector and Market Type

Panel A. Beginning of Time Period (2004Q1)

	Apartment	Industrial	Office	Retail	All
# Properties					
All CBSAs	399	518	521	245	1,683
Gateway	72	159	182	65	478
Non-Gateway	327	359	339	180	1,205
Aggregate Value of Properties (USD billion)					
All CBSAs	15.0	10.4	28.4	16.7	70.5
Gateway	5.0	3.6	15.9	5.4	29.9
Non-Gateway	10.0	6.8	12.5	11.3	40.5
Average Property Value (USD million)					
All CBSAs	37.5	20.1	54.6	68.0	41.9
Gateway	69.4	22.7	87.5	83.3	62.6
Non-Gateway	30.5	19.0	36.9	62.5	33.6
Capitalization Rates (%)					
All CBSAs	5.20	7.30	7.07	6.98	6.69
Gateway	4.92	7.61	6.94	7.03	6.70
Non-Gateway	5.34	7.13	7.24	6.95	6.67
Spread in Capitalization Rates between Non-Gateway and Gateway Markets (bps)					
	42	-48	30	-8	-2

Panel B. End of Time Period (2019Q4)

As of 2019Q4	Apartment	Industrial	Office	Retail	All
# Properties					
All CBSAs	901	1,752	710	702	4,065
Gateway	316	582	353	226	1,477
Non-Gateway	585	1,170	357	476	2,588
Aggregate Value of Properties (USD billion)					
All CBSAs	87.2	63.5	145.2	95.4	391.3
Gateway	40.1	23.4	104.8	32.1	200.4
Non-Gateway	47.2	40.1	40.4	63.3	190.9
Average Property Value (USD million)					
All CBSAs	96.8	36.2	204.5	135.8	96.3
Gateway	126.8	40.3	269.8	141.8	135.7
Non-Gateway	80.6	34.2	113.1	133.0	73.8
Capitalization Rates (%)					
All CBSAs	4.25	4.48	4.26	4.60	4.37
Gateway	3.98	4.28	4.02	4.31	4.09
Non-Gateway	4.47	4.60	4.86	4.75	4.67
Spread in Capitalization Rates between Non-Gateway and Gateway Markets (bps)					
	49	32	83	44	58

Table 2. Dataset Performance Metrics

Panel A. Total Returns

	Apartment	Industrial	Office	Retail	All
Average Compound Return (%)					
All CBSAs	6.56	8.72	6.94	9.00	7.64
Gateway	6.44	9.85	7.64	9.38	7.95
Non-Gateway	6.68	8.13	5.88	8.81	7.41
Standard Deviation (%)					
All CBSAs	4.95	5.05	5.05	5.34	4.93
Gateway	4.97	5.42	5.46	5.50	5.16
Non-Gateway	5.00	4.89	4.53	5.31	4.80
Skewness					
All CBSAs	-1.15	-2.08	-1.98	-1.07	-1.75
Gateway	-1.11	-1.91	-1.86	-0.65	-1.74
Non-Gateway	-1.12	-2.11	-1.91	-1.26	-1.70
Excess Kurtosis					
All CBSAs	2.25	4.83	4.25	1.99	3.79
Gateway	2.34	4.37	3.82	1.40	3.68
Non-Gateway	2.10	4.90	4.39	2.33	3.64
VaR 95% (%)					
All CBSAs	-13.05	-15.06	-14.55	-10.67	-14.50
Gateway	-13.27	-15.69	-14.88	-8.45	-14.51
Non-Gateway	-12.94	-14.67	-13.91	-11.70	-13.65
MDD (%)					
All CBSAs	-23.20	-24.73	-25.95	-21.06	-23.56
Gateway	-23.29	-25.29	-27.45	-19.08	-24.36
Non-Gateway	-23.17	-24.39	-23.09	-22.08	-23.00
Autocorrelation (First order)					
All CBSAs	0.84	0.83	0.83	0.84	0.84
Gateway	0.84	0.82	0.84	0.81	0.85
Non-Gateway	0.82	0.82	0.80	0.85	0.83

Panel B. Income Returns

	Apartment	Industrial	Office	Retail	All
Average Compound Return (%)					
All CBSAs	4.86	5.93	5.37	5.76	5.44
Gateway	4.51	5.76	5.08	5.50	5.13
Non-Gateway	5.08	6.03	5.93	5.89	5.71
Standard Deviation (%)					
All CBSAs	0.22	0.37	0.41	0.42	0.36
Gateway	0.22	0.42	0.43	0.46	0.39
Non-Gateway	0.21	0.35	0.36	0.40	0.32

Skewness					
All CBSAs	0.64	0.57	0.68	0.22	0.50
Gateway	0.62	0.76	0.78	0.26	0.62
Non-Gateway	0.82	0.47	0.68	0.22	0.47
Excess Kurtosis					
All CBSAs	0.00	-0.22	-0.56	-0.79	-0.59
Gateway	-0.36	-0.14	-0.36	-0.72	-0.53
Non-Gateway	0.45	-0.15	-0.32	-0.76	-0.38
Autocorrelation (First order)					
All CBSAs	0.96	0.97	0.93	0.96	0.97
Gateway	0.94	0.96	0.95	0.95	0.97
Non-Gateway	0.95	0.97	0.94	0.96	0.97

Panel C. Appreciation Returns

	Apartment	**Industrial**	**Office**	**Retail**	**All**
Average Compound Return (%)					
All CBSAs	1.64	2.66	1.51	3.11	2.11
Gateway	1.87	3.91	2.47	3.74	2.72
Non-Gateway	1.54	2.01	-0.06	2.80	1.63
Standard Deviation (%)					
All CBSAs	4.92	5.15	5.02	5.23	4.90
Gateway	4.94	5.51	5.42	5.34	5.11
Non-Gateway	4.97	4.99	4.53	5.23	4.79
Skewness					
All CBSAs	-1.29	-2.17	-2.16	-1.31	-1.96
Gateway	-1.25	-2.01	-2.04	-0.90	-1.97
Non-Gateway	-1.25	-2.19	-2.07	-1.48	-1.88
Excess Kurtosis					
All CBSAs	2.57	4.99	4.83	2.59	4.39
Gateway	2.67	4.56	4.39	1.86	4.34
Non-Gateway	2.38	5.04	4.82	2.96	4.17
VaR 95% (%)					
All CBSAs	-17.92	-20.38	-19.05	-16.72	-19.22
Gateway	-17.81	-20.82	-19.09	-14.38	-18.98
Non-Gateway	-17.99	-20.12	-18.96	-17.80	-19.41
MDD (%)					
All CBSAs	-31.18	-33.64	-32.94	-28.27	-31.05
Gateway	-30.66	-34.06	-33.82	-25.71	-31.61
Non-Gateway	-31.69	-33.48	-31.34	-29.74	-30.95
Autocorrelation (First order)					
All CBSAs	0.84	0.84	0.83	0.84	0.84
Gateway	0.84	0.83	0.84	0.81	0.85
Non-Gateway	0.82	0.83	0.81	0.85	0.84

Table 3. Portfolio Descriptive Statistics

Panel A. Beginning of Time Period (2004Q1)

Number of Properties in Portfolio (AUM = 5bn)											
Full Portfolio											
Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Median	83	93	100	107	114	121	128	133	140	149	151
Mean	84	93	100	108	114	120	127	133	140	148	150
St. Dev.	13	13	14	14	16	16	17	18	17	18	19
Maximum	123	136	153	149	160	172	175	183	187	204	201
Minimum	48	52	47	57	70	71	75	66	89	95	89
Gateway Sub-Portfolio											
Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Median	83	75	67	59	51	43	35	27	19	11	0
Mean	84	75	68	59	51	43	35	27	19	11	0
St. Dev.	13	12	11	11	10	9	8	7	6	4	0
Maximum	123	115	105	92	87	74	60	48	37	21	0
Minimum	48	37	36	22	22	17	9	6	3	1	0
Non-Gateway Sub-Portfolio											
Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Median	0	19	33	49	63	77	93	106	122	138	151
Mean	0	18	33	48	63	77	92	106	121	137	150
St. Dev.	0	5	8	10	12	14	14	17	17	18	19
Maximum	0	32	56	78	95	116	130	150	168	195	201
Minimum	0	2	6	15	26	36	55	52	69	82	89

Panel B. End of Time Period (2019Q4)

Number of Properties in Portfolio (AUM = 5bn)											
Full Portfolio											
Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Median	215	255	282	302	317	332	345	355	365	369	348
Mean	216	254	281	301	317	332	345	355	364	368	348
St. Dev.	17	18	21	20	21	22	24	23	26	27	27
Maximum	273	309	347	357	369	405	438	425	433	444	430
Minimum	161	185	214	222	244	260	252	268	267	279	258
Gateway Sub-Portfolio											
Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Median	215	197	180	162	144	126	106	88	68	45	0
Mean	216	197	180	162	144	126	107	88	68	45	0
St. Dev.	17	16	15	15	13	12	12	10	9	6	0
Maximum	273	245	239	215	183	171	147	117	92	59	0
Minimum	161	148	138	117	107	89	70	59	37	16	0
Non-Gateway Sub-Portfolio											
Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Median	0	58	103	141	174	207	239	267	297	324	348
Mean	0	58	101	140	173	206	238	267	296	323	348
St. Dev.	0	9	14	16	18	19	21	22	25	26	27
Maximum	0	78	139	183	217	267	297	332	368	398	430
Minimum	0	17	44	73	106	149	156	183	217	238	258

Table 4. Selected Performance Metrics for Various Sets of Gateway Markets

	Total Returns (%)				Income Returns (%)			
Gateway Weight	**1.0**	**0.5**	**0.0**	**Δ**	**1.0**	**0.5**	**0.0**	**Δ**
3 Markets	8.4	8.1	7.8	65	5.2	5.5	5.7	-48
4 Markets	8.2	8.1	7.9	29	5.3	5.5	5.7	-44
6 Markets (Base Case)	8.4	8.0	7.6	75	5.3	5.6	5.8	-50
8 Markets	8.2	8.0	7.8	49	5.3	5.6	5.8	-46
11 Markets	8.1	7.9	7.7	41	5.4	5.6	5.8	-40
	Standard Deviation of Total Returns (%)				**Standard Deviation of Income Returns (%)**			
Gateway Weight	**1.0**	**0.5**	**0.0**	**Δ**	**1.0**	**0.5**	**0.0**	**Δ**
3 Markets	5.4	5.1	5.0	48	0.4	0.4	0.4	3
4 Markets	5.4	5.1	5.0	40	0.4	0.4	0.4	3
6 Markets (Base Case)	5.3	5.1	4.9	41	0.4	0.4	0.3	7
8 Markets	5.2	5.0	4.9	29	0.4	0.4	0.3	5
11 Markets	5.2	5.0	4.9	24	0.4	0.3	0.3	3
	Maximum Drawdown (%)				**95% VaR (%)**			
Gateway Weight	**1.0**	**0.5**	**0.0**	**Δ**	**1.0**	**0.5**	**0.0**	**Δ**
3 Markets	-31.9	-31.0	-30.3	-167	-19.8	-19.3	-18.4	-138
4 Markets	-30.4	-30.6	-30.8	37	-18.8	-18.8	-18.8	-6
6 Markets (Base Case)	-31.5	-30.8	-30.4	-111	-19.6	-19.0	-18.0	-159
8 Markets	-31.1	-30.7	-30.4	-71	-19.3	-18.8	-18.2	-114
11 Markets	-30.7	-30.7	-30.4	-28	-19.1	-18.8	-18.3	-80

Notes: Δ denotes the spread in basis points between 100% gateway and 100% non-gateway markets. 3 Markets = New York, Los Angeles, and Chicago; 4 Markets = New York, Los Angeles, Chicago, and Washington D.C.; 6 Markets = New York, Los Angeles, Chicago, Washington D.C., Boston, and San Francisco; 8 Markets = New York, Los Angeles, Chicago, Washington D.C., Boston, San Francisco, Dallas, and Philadelphia; and 11 Markets = New York, Los Angeles, Chicago, Washington D.C., Boston, San Francisco, Dallas, Philadelphia, Atlanta, Houston, and Miami.

Table 5. Percentages of Significant Regression Coefficients (0.05 level)

Gateway Weight	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
AR(t-1)	100	100	100	100	100	100	100	100	100	100	100
IR(t)	23	22	28	30	35	40	42	51	57	62	72

Note: AR(t-1) denotes the appreciation return lagged by one quarter, whereas IR(t) is the contemporaneous income return.

Figure 1. Capitalization Rates for Gateway and Non-Gateway Markets

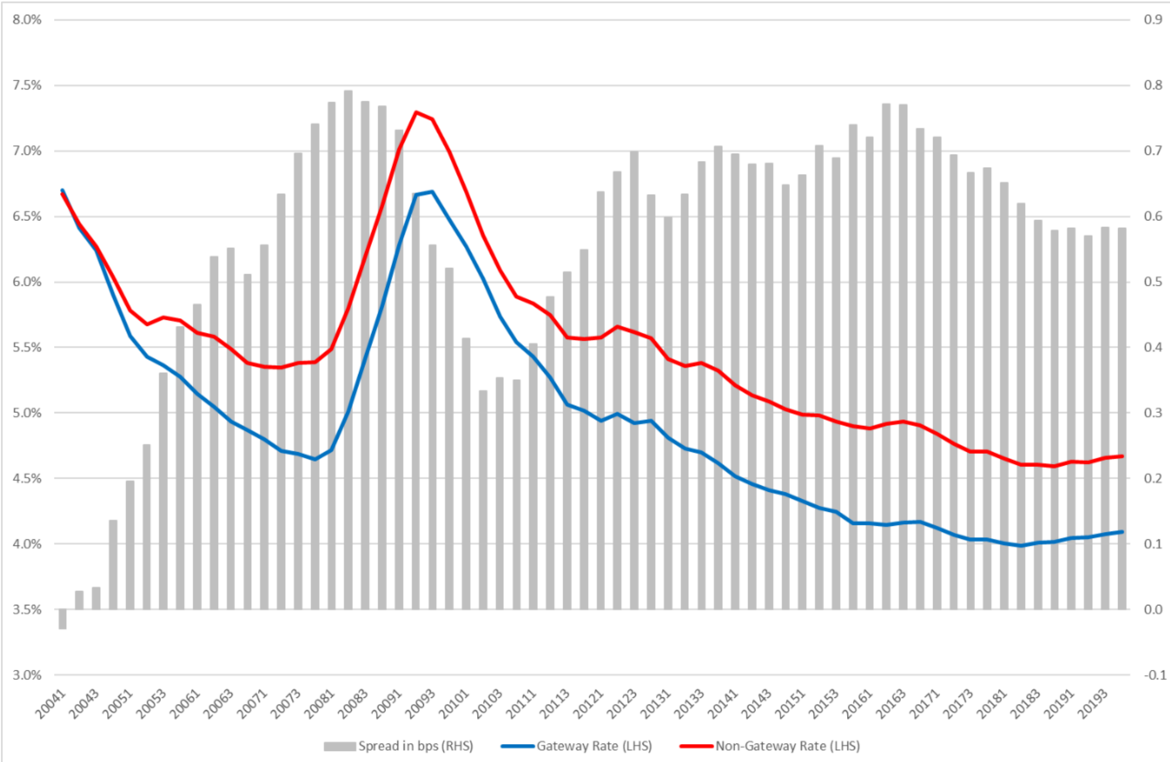
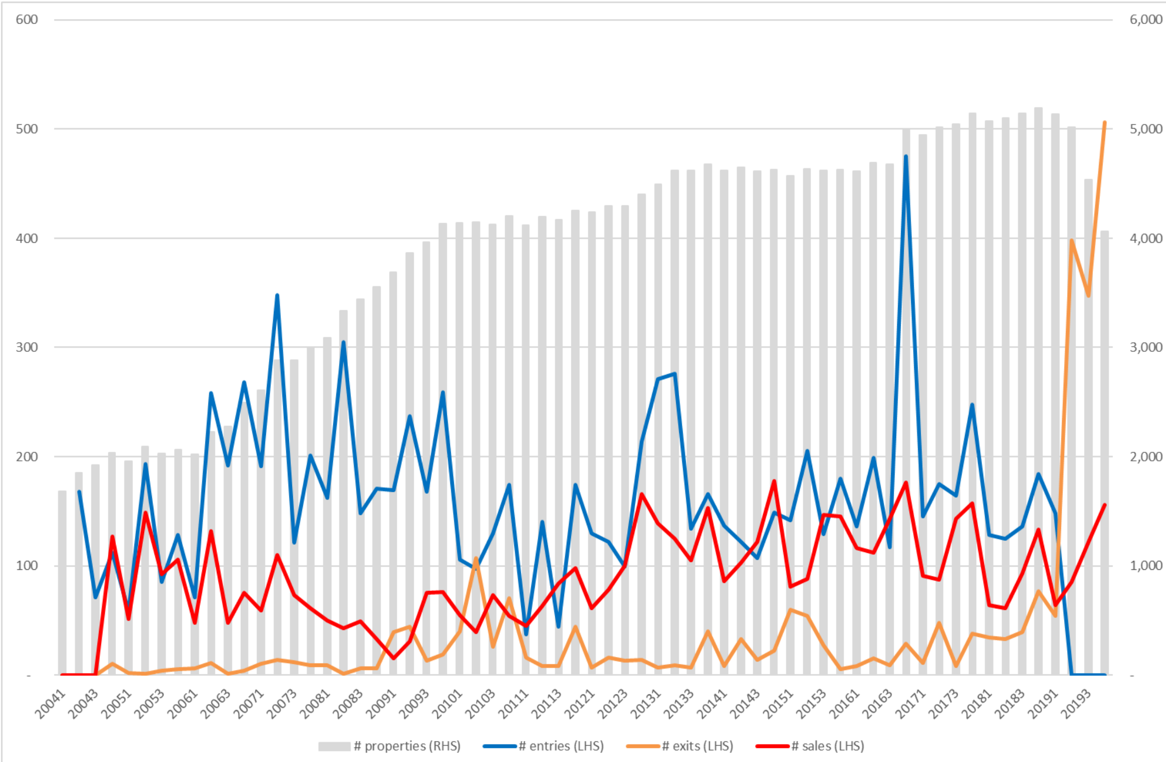
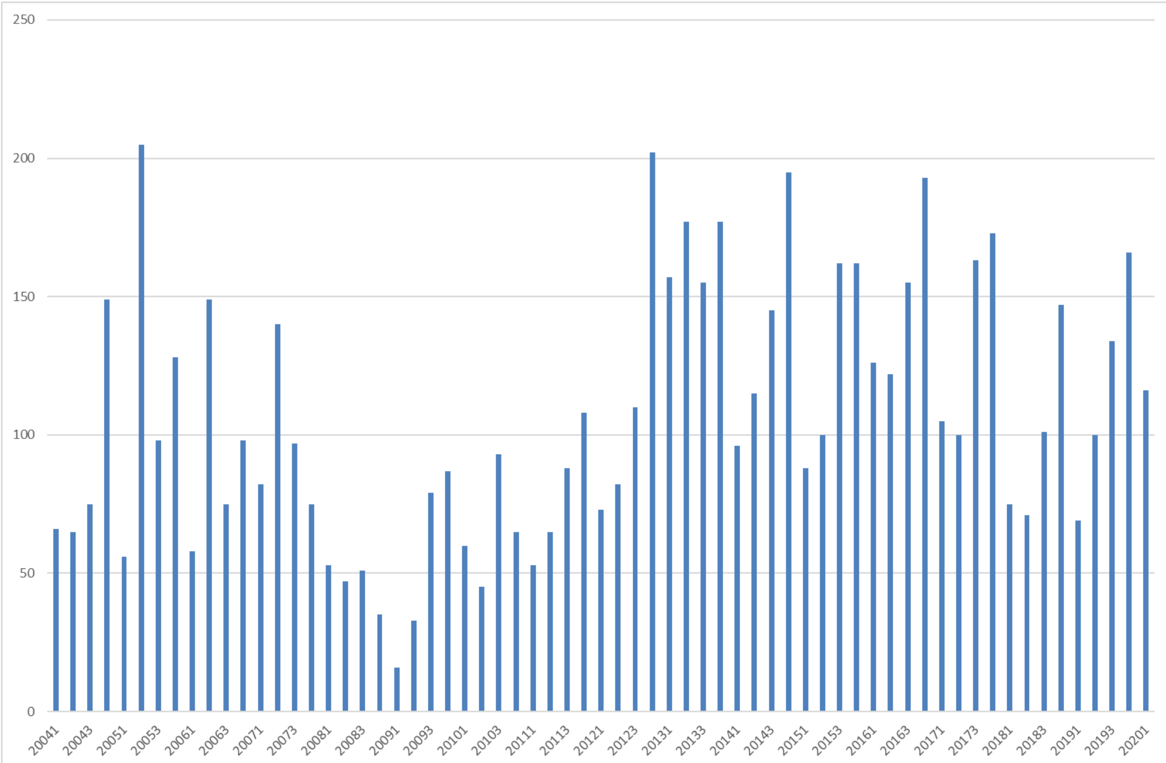


Figure 2. Properties Entering and Exiting the Database and Number of Properties in the Database



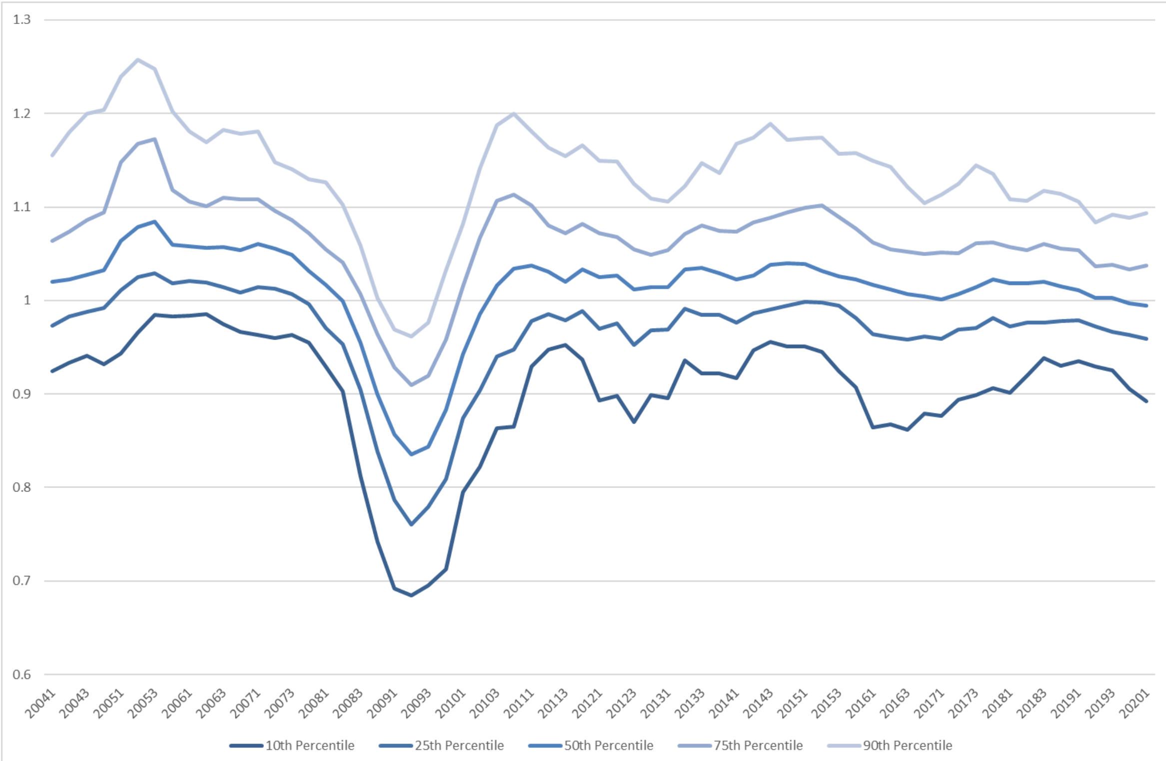
Note: The number of exits refers to the number of properties that leave the dataset and that are not identified as sales or with a sale code that does not allow us to ascertain that such sales are arm's length transactions.

Figure 3. Number of True Sales



Note: The figure displays the number of true sales in the cleaned dataset.

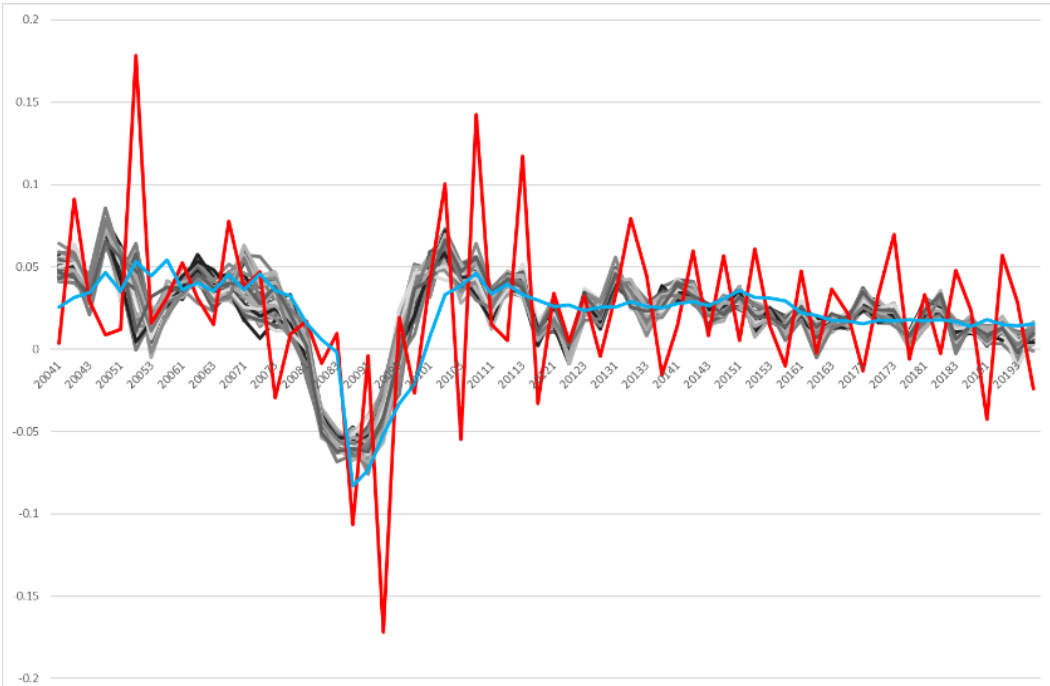
Figure 4. Ratios of Sale Prices to Appraised Values



Note: The figure depicts the median (50th percentile) of the three-quarter average of the ratio of sale price to the lagged appraised value as well as the 10th, 25th, 75th, and 90th percentiles.

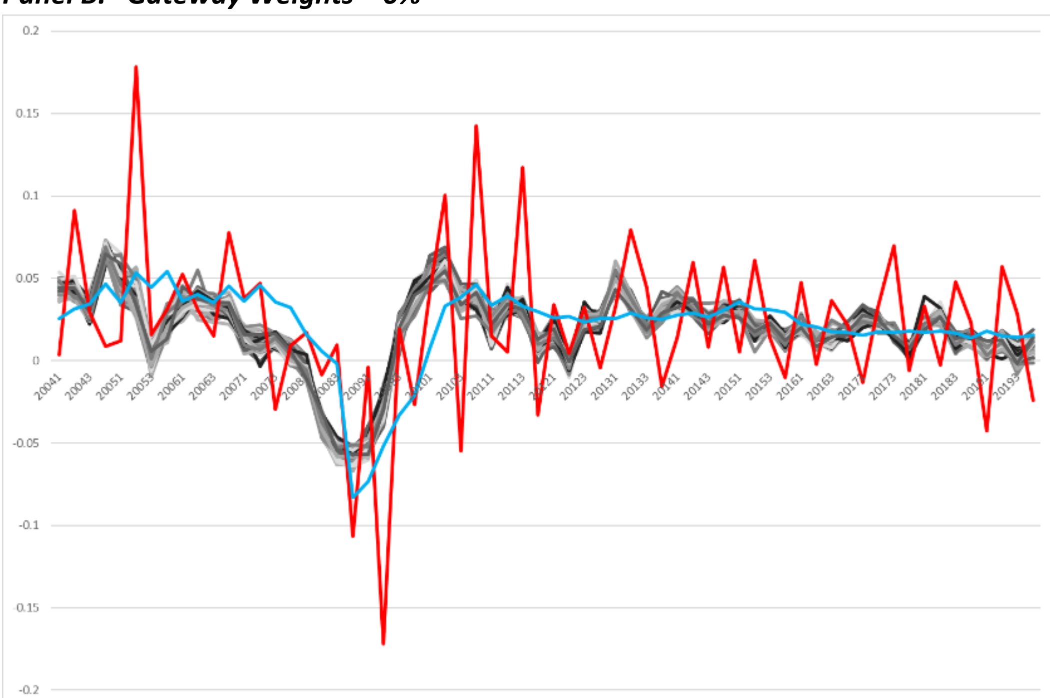
Figure 5. Portfolio and Market Total Returns

Panel A. Gateway Weights = 100%



Note: The grey lines are the returns of 50 randomly-selected portfolios, the blue line is the NCREIF Property Index (NPI), and the red line the value-weighted NCREIF Transaction-Based Index (NTBI).

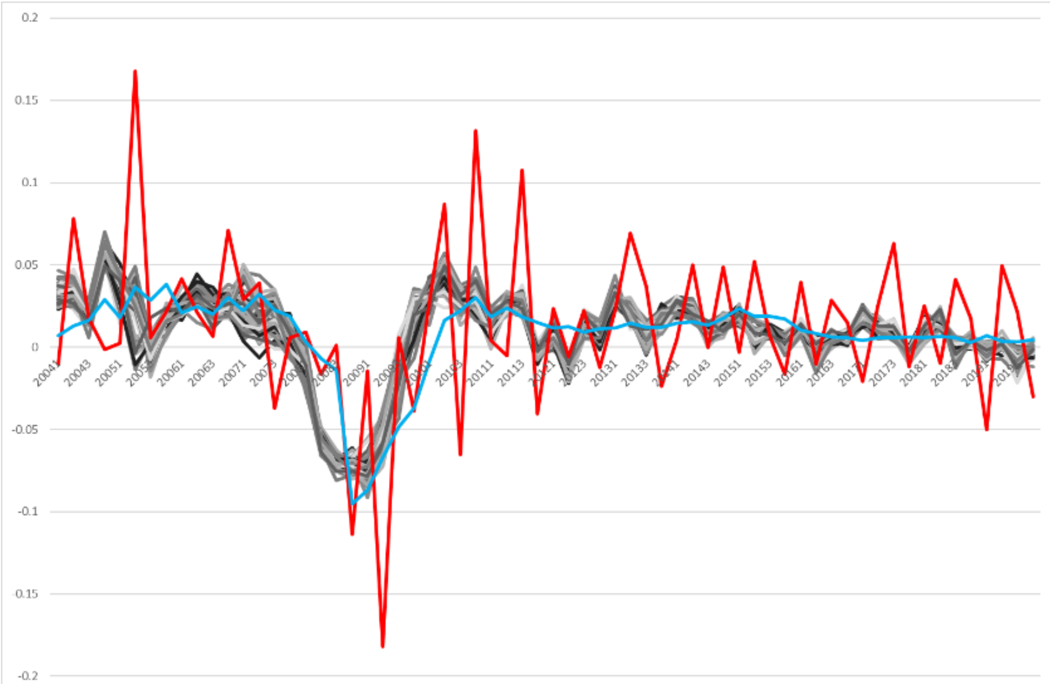
Panel B. Gateway Weights = 0%



Note: The grey lines are the returns of 50 randomly-selected portfolios, the blue line is the NCREIF Property Index (NPI), and the red line the value-weighted NCREIF Transaction-Based Index (NTBI).

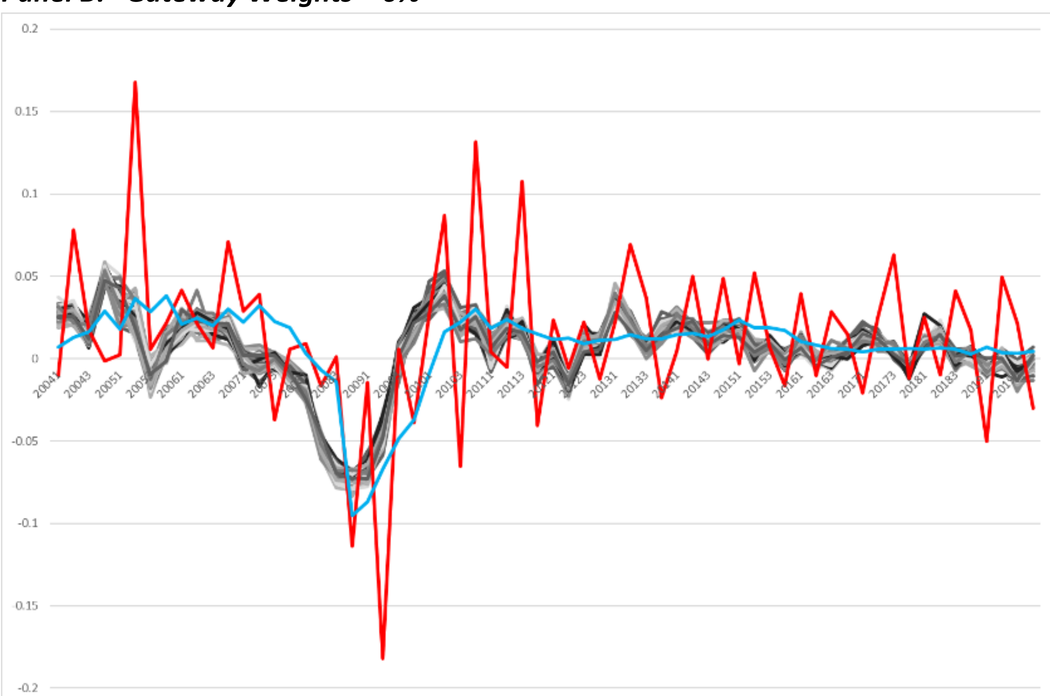
Figure 6. Portfolio and Market Appreciation Returns

Panel A. Gateway Weights = 100%



Note: The grey lines are the returns of 50 randomly-selected portfolios, the blue line is the NCREIF Property Index (NPI), and the red line the value-weighted NCREIF Transaction-Based Index (NTBI).

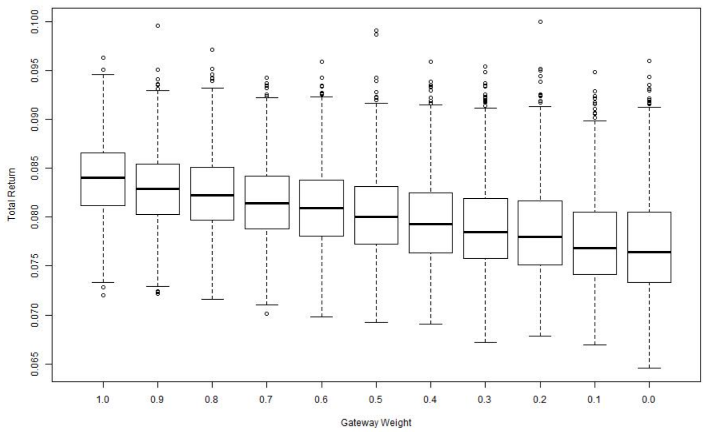
Panel B. Gateway Weights = 0%



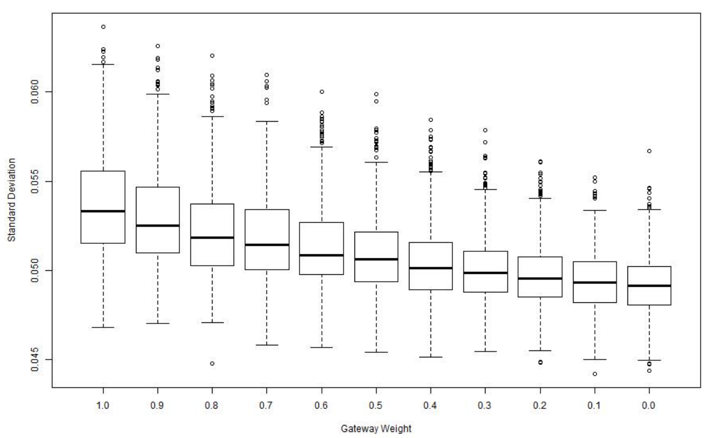
Note: The grey lines are the returns of 50 randomly-selected portfolios, the blue line is the NCREIF Property Index (NPI), and the red line the value-weighted NCREIF Transaction-Based Index (NTBI).

Figure 7. Distributions of Portfolio Total Returns, Standard Deviations, and Sharpe Ratios

Panel A. Annualized Total Returns



Panel B. Standard Deviations



Panel C. Sharpe Ratios

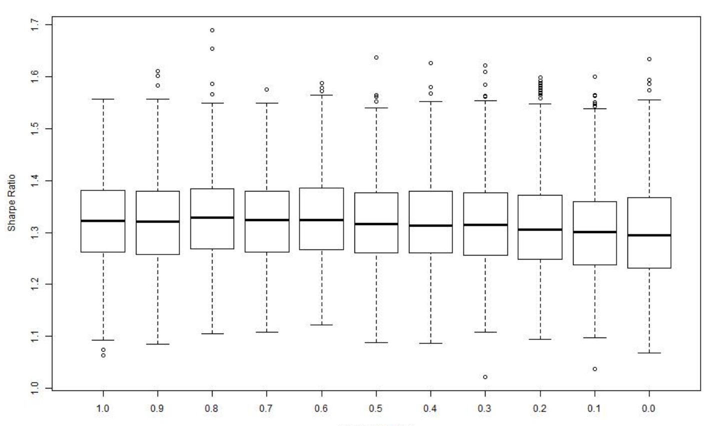
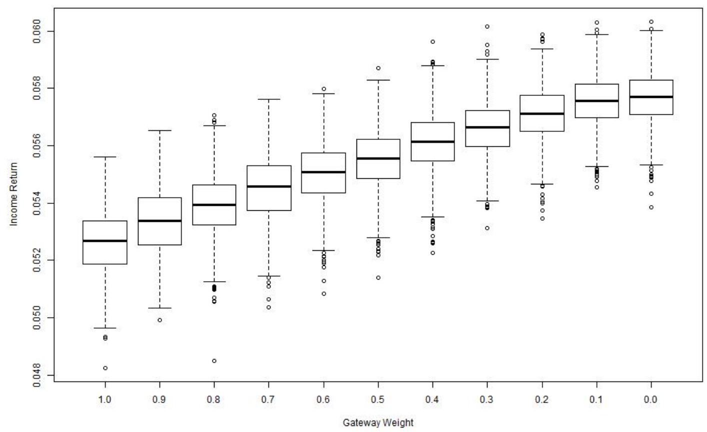
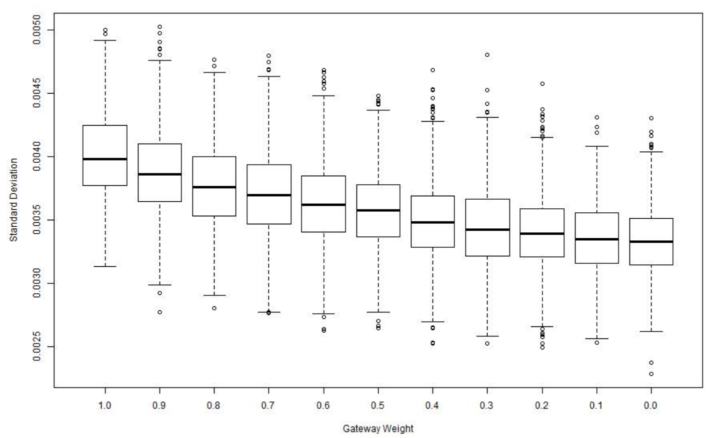


Figure 8. Distributions of Portfolio Income Returns, Standard Deviations, and Sharpe Ratios

Panel A. Annualized Income Returns



Panel B. Standard Deviations



Panel C. Sharpe Ratios

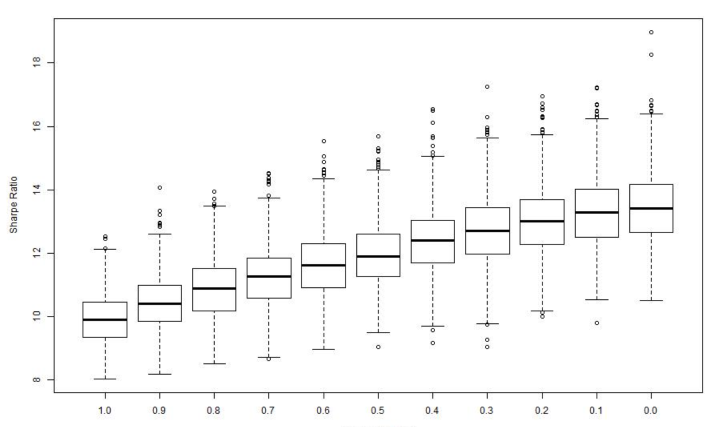
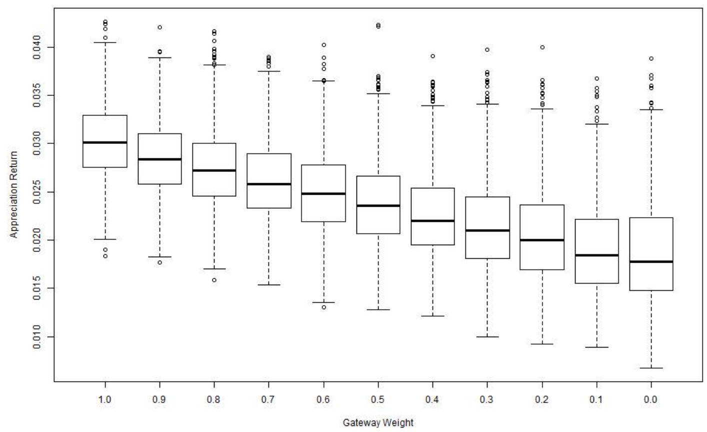
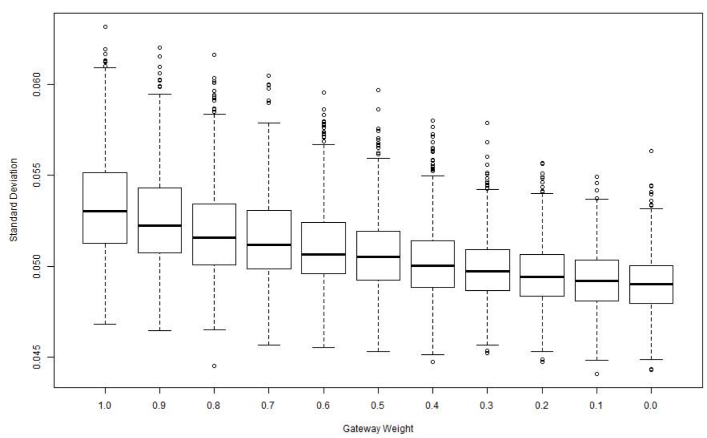


Figure 9. Distributions of Portfolio Appreciation Returns, Standard Deviations, and Sharpe Ratios

Panel A. Annualized Appreciation Returns



Panel B. Standard Deviations



Panel C. Sharpe Ratios

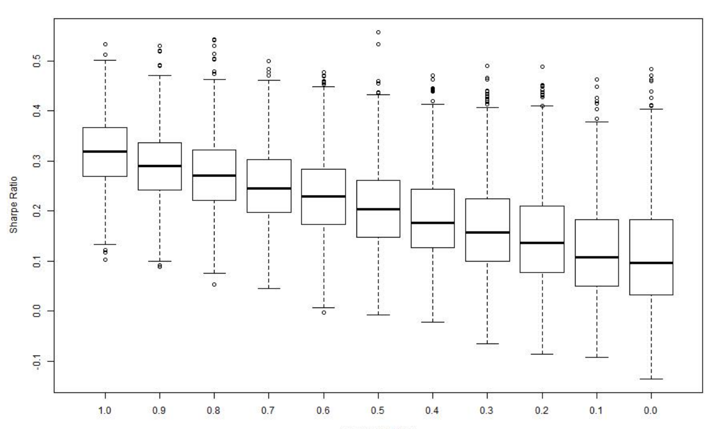
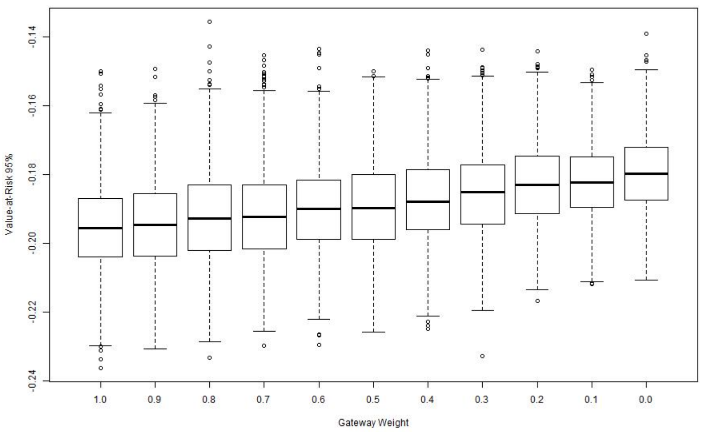
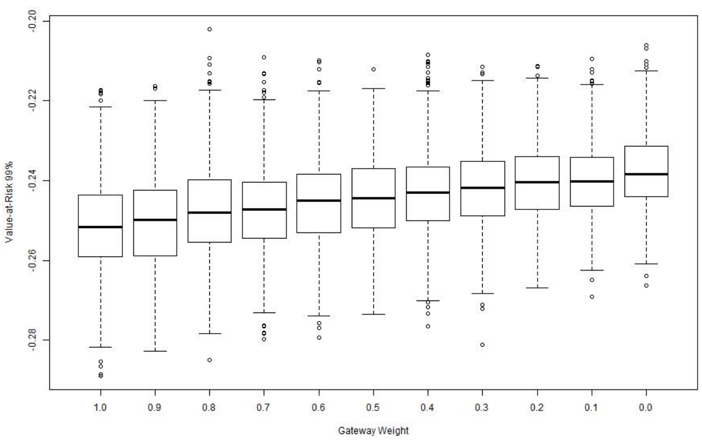


Figure 10. Portfolio Downside Risk Measures

Panel A. 95% Value-at-Risks



Panel B. 99% Value-at-Risks



Panel C. Maximum Drawdowns

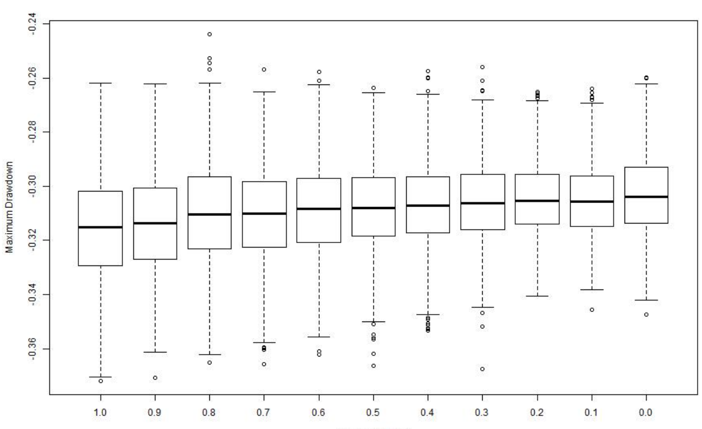
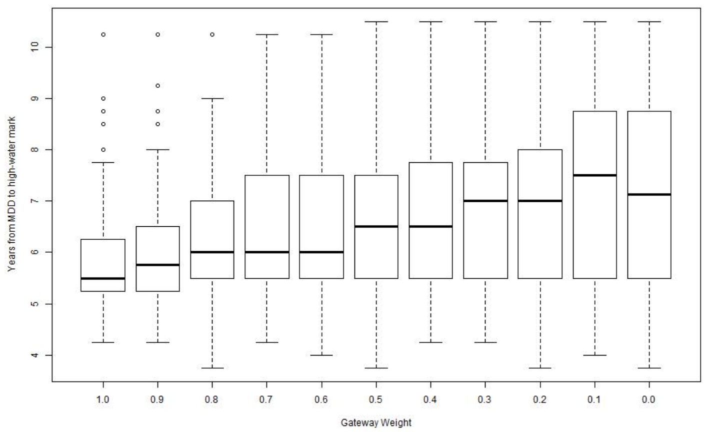


Figure 11. Portfolio Recovery and Drawdown Cycle Lengths

Panel A. Recovery Lengths



Panel B. Drawdown Cycle Lengths

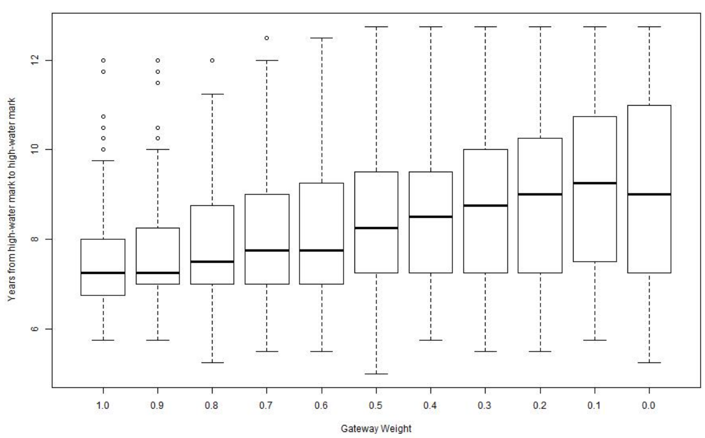
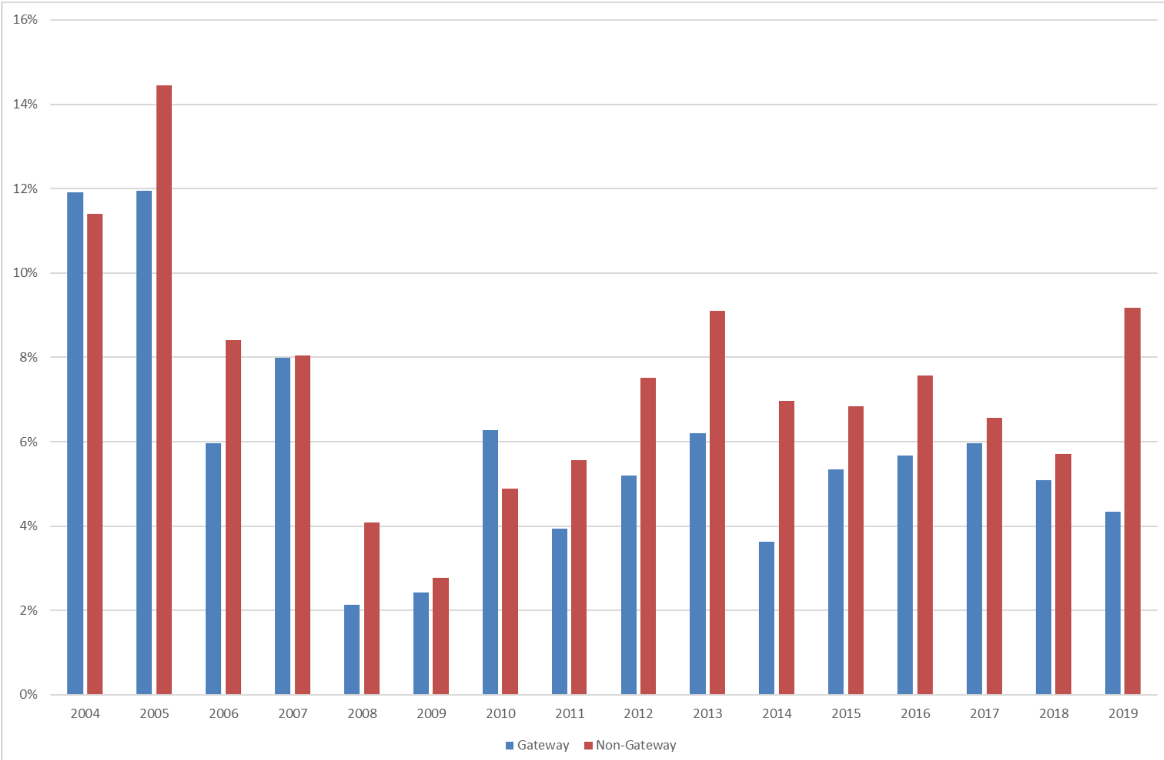


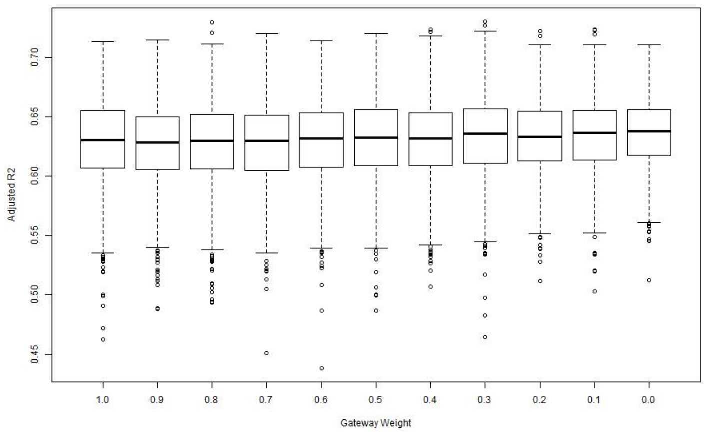
Figure 12. Turnover Ratios for Gateway and Non-Gateway Markets



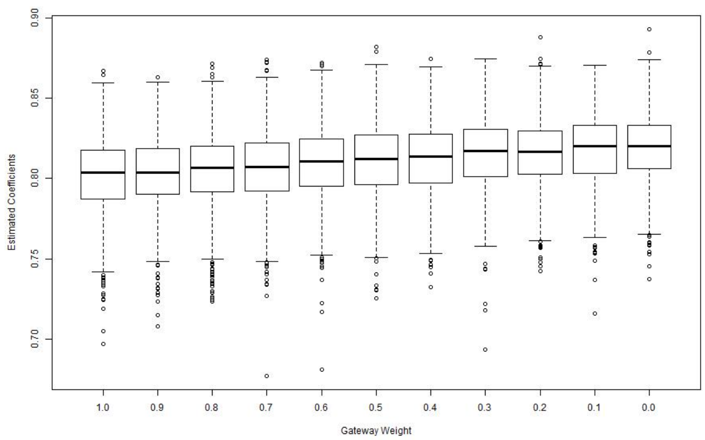
Note: The ratios are calculated as the dollar volume of sales during any given year divided by the value of assets at the end of the year.

Figure 13. Distributions of Regression R-squares and Estimated Coefficients

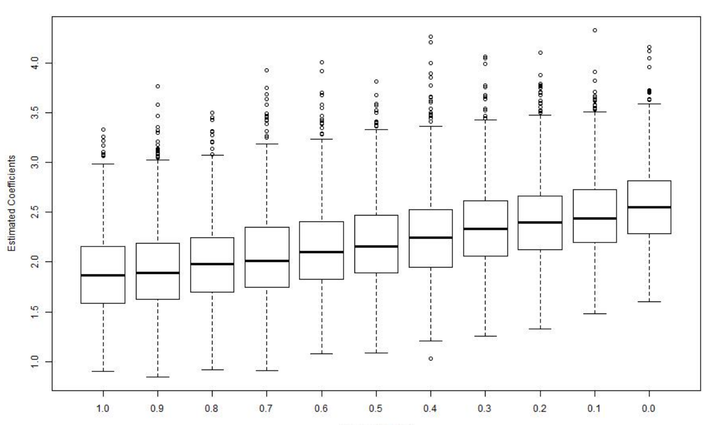
Panel A. Distribution of Regression R-squares



Panel B. Distribution of Estimated Coefficients for Lagged Appreciation Returns



Panel C. Distribution of Estimated Coefficients for Income Returns



Appendix 1. Classification of Divisions

Panel A. Six Gateway Markets

MSA	CBSA	Div.	CBSA Name	Apart.	Ind.	Office	Retail
Boston	14460	14454	MA-Boston	G	G	G	G
Boston	14460	15764	MA-Cambridge-Newton-Framingham	G	G	G	G
Boston	14460	40484	NH-Rockingham County-Strafford County	N-G	N-G	N-G	N-G
Chicago	16980	16974	IL-Chicago-Naperville-Arlington Heights	G	G	G	G
Chicago	16980	20994	IL-Elgin	N-G	N-G	N-G	N-G
Chicago	16980	29404	IL-WI-Lake County-Kenosha County	N-G	N-G	N-G	N-G
Chicago	16980	23844	IN-Gary	N-G	N-G	N-G	N-G
Los Angeles	31080	11244	CA-Anaheim-Santa Ana-Irvine	G	G	G	G
Los Angeles	31080	31084	CA-Los Angeles-Long Beach-Glendale	G	G	G	G
New York	35620	35084	NJ-PA-Newark	N-G	N-G	G	N-G
New York	35620	20524	NY-Dutchess County-Putnam County	N-G	N-G	N-G	N-G
New York	35620	35004	NY-Nassau County-Suffolk County	N-G	N-G	N-G	N-G
New York	35620	35614	NY-NJ-New York-Jersey City-White Plains	G	G	G	G
San Francisco	41860	36084	CA-Oakland-Hayward-Berkeley	G	G	G	G
San Francisco	41860	41884	CA-San Francisco-Redwood City-South San Francisco	G	G	G	G
San Francisco	41860	42034	CA-San Rafael	N-G	N-G	N-G	N-G
Washington DC	47900	47894	DC-VA-MD-WV-Washington-Arlington-Alexandria	G	G	G	G
Washington DC	47900	43524	MD-Silver Spring-Frederick-Rockville	N-G	N-G	N-G	N-G

Note: G = Gateway; N-G = Non-Gateway.

Panel B. Additional Markets

MSA	CBSA	Div.	CBSA Name	Apart.	Ind.	Office	Retail
Atlanta	12060	12060	GA-Atlanta-Sandy Springs-Roswell	G	G	G	G
Dallas	19100	19124	TX-Dallas-Plano-Irving	G	G	G	G
Dallas	19100	23104	TX-Fort Worth-Arlington	G	G	N-G	N-G
Houston	26420	26420	TX-Houston-The Woodlands-Sugar Land	G	G	G	G
Miami	33100	22744	FL-Fort Lauderdale-Pompano Beach-Deerfield Beach	G	G	G	G
Miami	33100	33124	FL-Miami-Miami Beach-Kendall	G	G	G	G
Miami	33100	48424	FL-West Palm Beach-Boca Raton-Delray Beach	G	G	G	G
Philadelphia	37980	15804	NJ-Camden	G	G	N-G	N-G
Philadelphia	37980	33874	PA-Montgomery County-Bucks County-Chester County	G	G	G	G
Philadelphia	37980	37964	PA-Philadelphia	G	G	G	G
Philadelphia	37980	48864	DE-MD-NJ-Wilmington	N-G	N-G	N-G	N-G

Note: G = Gateway; N-G = Non-Gateway.

Appendix 2. Flowchart of Simulation Process