# The Agglomerative Effects of Neighborhood and Building Specialization on Office Values

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## Abstract

We investigate how horizontal (neighborhood) and vertical (tenants) agglomeration impacts the value of office buildings. We find that industry specialization of a building's 5-digit zip code neighborhood and the extent to which a building is specialized by tenants within the same industry leads to a significantly higher rental rate and transaction price. By linking the within-building industry composition to its neighborhood industries, we find that spillovers are likely to be the most important attribute to the agglomeration gains in office building performance. We find that the agglomeration gains are also recognized by the stock market: REITs' experience positive (negative) abnormal returns when acquiring (disposing) a building with higher tenant industry concentration or neighborhood industry specialization. Our findings suggest that agglomeration economies are operative at the neighborhood level as well as within individual buildings. Commercial rents reflect horizontal and vertical agglomeration gains which can in turn be used as proxies for agglomeration economies.

## 1. Introduction

Agglomeration economies arise from the geographical clustering of economic activities that are primarily the result of input sharing, labor pooling and knowledge spillovers (see Marshall (1890)). Typically, productivity, wages, employment, and rent are used to measure agglomeration economies[4] Although prior studies have maintained that agglomeration economies are capitalized in commercial real estate rents and prices', few, if any empirical studies analyze the impact of agglomeration on rents or commercial real estate prices.

Of the few studies which do document a positive effect of agglomeration on commercial rents, an aggregated or pooled measure of either agglomeration, rents, or both (Drennan & Kelly, 2011; Jennen & Brounen, 2009; Koster et al., 2014; van der Vlist et al., 2021) are often used. The extent to which economies of agglomeration have an impact on commercial property value remains an open question. In this study, we use an identification strategy to address this question. Our empirical strategy allows us to measure agglomeration at both the neighborhood (horizontal) level as well as the individual building (vertical) level. We contribute to the literature on four main dimensions.

The first distinguishing feature of our study is our use of more refined measures for both transaction-based property values and industry agglomeration at the zip code level. Using REIT office transactions as our laboratory allows us to control for heterogeneous building characteristics which is essential for comparison purposes. Drennan and Kelly (2011) argue that the rising producer service industries in urban centers should enjoy the benefits of spatial concentration due

[4]See Rosenthal and Strange (2004, 2020). Some authors have noted however that there might exist some industry differences with respect to agglomeration economies including Dekle and Eaton (1999), Drennan and Kelly (2011), Eberts and McMillen (1999) and Koster et al (2014).

to enhanced information spillovers, and such benefits should in turn be reflected in land values. They find that office rents in CBD areas are higher than suburban areas in markets which have a higher concentration of producer service employment. Using a structural equation model, Koster et al. (2014) finds that firms' willingness to pay the rent increases in CBD areas with higher agglomeration levels. The biggest limitation of these studies is that their use of average rent in geographical areas or time periods ignores the heterogeneity of individual buildings and their locational characteristics. As such, these studies identify the pooled effects of agglomeration, at best. However, there are two studies which do examine individual office buildings. Jennen and Brounen (2009) find that rental rates are higher when the office buildings are located in office clusters in the Amsterdam market although they do not measure the agglomeration of economic activities. A more recent study by van der Vlist et al. (2021) finds that property-level cap rates are lower if the offices are located in areas with job clustering. While job clustering is a better proxy for agglomeration than office clustering, aggregated employment density without any consideration of specific industries can only generate limited inferences as agglomeration economies are clearly different across sectors.

Our study also adds to the literature on the spatial proximity of agglomeration economies. Agglomeration economies are conditional on the spatial proximity (Rosenthal & Strange, 2020). The existing literature records agglomeration effects at various geographical scales from regions, cities, urban areas to neighborhoods. It is widely acknowledged that the agglomeration benefits are stronger within a closer proximity (Arzaghi & Henderson, 2008; Bayer et al., 2008; Briant et al., 2010; Charlot & Duranton, 2004; Hellerstein et al., 2011; Kerr & Kominers, 2015; Li, 2014; Moretti, 2004; Rosenthal & Strange, 2001, 2003, 2008). The research interest in the industry composition within a building, which we refer to as 'vertical specialization', is a relatively new

development. Recent studies show that agglomeration economies also exist within buildings or even among building floors (Liu et al., 2018a, 2018b, 2020; Rosenthal & Strange, 2020). However, these studies only map the vertical spatial structure, identify the employment density within buildings or test the rent gradients among the tenants. They do not empirically examine the impact of vertical agglomeration on property valuations. In the commercial real estate literature, the focus has exclusively been on the horizontal structure of urban environment. As the agglomeration studies move toward a more local direction, i.e., distance-measured areas, the important role of buildings as spatial units where business takes place is inevitable. This study provides empirical evidence on how industry specialization at both the horizontal and vertical level affects the value of office buildings as well as how the market views such specialization.

Our empirical strategy partly involves the manual collection of tenants' information which allows us to link the vertical (inside) and horizontal (neighborhood) economic activities. By focusing on REIT owned properties, it also allows us to conduct event studies of transactions so that we can investigate the market's perceptions of such agglomerative benefits, hence our third contribution.

Our final contribution lies within our identification strategy which minimizes the endogeneity issue of agglomeration measures and directly tests the agglomeration channel e.g., which type(s) of agglomeration impacts property value. We map neighborhood agglomeration[5] at a very granular geographic location using zip code (5 digits) level employment census data. For a given property, a Herfindahl index (HHI) is used to measure neighborhood industry concentration. The HHI is based on the census data of employment in different industries in the zip code where

[5] Please note that the neighborhood in our study refers to a 5-digit zip code area which is well below the conventional neighborhood catchment.

the property is located during the property purchasing year. The industry sector is based on the NAICS industry classification with two digits. While concentration and specialization are sometimes used as interchangeable concepts, they are slightly different. The HHI measure does not capture the relative industry specialization. Therefore, we define the concentration and specialization variables separately for the horizontal (neighborhood) industry composition. To capture whether the building actually benefits from its surrounding neighborhood specialization, we need to link the (industry) specialization of a building to the neighborhood specialization, if any. We account for this as follows: 1) We identify the industry sector of the largest tenant in a building; 2) We construct the building-neighborhood specialization as the number of employees in the largest tenant's industry in the zip code area where the building is located divided by the total number of employees in the same industry across the nation. This identification strategy allows us to directly test the extent to which rental rates of office buildings are driven by the tenants' agglomeration gains as a result of locating in an area that specializes in those tenants' industry sectors.

Moreover, previous literature on the location choice focuses on the location of foreign investments, especially the greenfield investments (Hilber & Voicu, 2010), and new entrepreneurs at the city level (Glaeser et al., 2010; Rosenthal & Strange, 2005). This project provides micro-foundational evidence on the location choice by studying the rental rates, as higher demand for a particular location will lead to a higher rent and price.

We find that rents and prices are both higher for office buildings that are located in 5-digit zip code areas with industry specialization mirroring its largest tenant's industry. In terms of the vertical patterns, a concentrated tenant (industry) base as well as the existence of an anchor tenant and anchor sector leads to significantly higher rental rates. Most interestingly, we find that the

stock market does reward (punish) REITs for acquiring (disposing) a building that has either a concentrated industry (tenant) base or that is located in a neighborhood with an industry cluster (s) e.g., industry specialization.

This paper is organized as follows. In the next section, we review relevant literature and develop channels. In Section 3, we describe the data, the identification strategy, and the empirical models. In Section 4, we discuss the estimation results on property valuation and the market's reaction to property transaction with various degrees of agglomeration. Finally, Section 5 concludes.

## 2. Theoretical Framework

While the vast majority of the agglomeration literature has identified positive agglomeration externalities in manufacturing industries which are often manifested in productivity, wage, employment, growth and innovation,[6] the agglomeration economies also exist in other sectors such retail (Eberts & McMillen, 1999; Guven et al., 2019) and service (Arzaghi & Henderson, 2008; Drennan & Kelly, 2011; Koster et al., 2014) sectors. With manufacturing industries moving out of as well as producer service industries rising in urban centers, the benefits

[6] For literature on agglomeration economies, please refer to, among others, Arzaghi and Henderson (2008); Bayer et al. (2008); Billings and Johnson (2016); Charlot and Duranton (2004); Dekle and Eaton (1999); Duranton and Overman (2005); Eberts and McMillen (1999); Ellison et al. (2010); Kerr and Kominers (2015); Melo et al. (2009); Moretti (2004); Rosenthal and Strange (2004); Rosenthal and Strange (2001, 2003); Rosenthal and Strange (2020)

from spatial concentration are also reflected in aggregated commercial office rents as evident in Drennan and Kelly (2011) and Koster et al. (2014). While the important role of office buildings as spatial units where business takes place is beyond doubt, how agglomeration affects the valuation of properties lacks empirical investigation.

There are two dimensions to consider when examining the agglomeration at the individual building level. Firstly, a building is viewed as a unit in the horizonal spatial aggregation and is exposed to economic activities in the geographical area where it is located; in this sense, a building is comparable to a firm or a manufacturing plant in urban agglomeration studies and the key agent is the property owner or manager. Secondly, a building is also different in a way that it hosts tenants from various sectors and hence presents a unique vertical pattern of industry composition; in this case, the key agent is the tenant. To understand the agglomerative effects on building valuation, we need to look into the complex relationship between the agglomeration, at both horizontal and vertical levels, and the different components of property valuation. We propose two channels via which the agglomeration affects office building valuation; these two channels rely respectively on the two agents of commercial buildings – tenants and property owners or managers.

### 2.1 Willingness to Pay Channel

The knowledge spillover effects are closely tied with the literature on firm's choice of location. Following the neoclassical tradition, a large amount of literature investigates corporate location choice by focusing on the characteristics of the region where the corporate locates, such as agglomeration externalities, lower transport costs due to the proximity to customers and knowledge spillovers which improve a firm's productivity and efficiency (Figueiredo et al., 2002). Considering the importance of in-person interactions in knowledge transmission, knowledge quickly disseminates among neighbouring firms in industry clusters through spying, imitation, and

the rapid inter-firm movement of highly skilled labour (Aharonson et al., 2007; Glaeser et al., 1992; Glascock et al., 1998). Therefore, location choices may be endogenous to knowledge spillovers: firms have the motivation to choose the location to maximize their net spillovers as a function of locations' knowledge activities, their own capabilities, and competitors' anticipated actions (Barrios et al., 2006; Chidlow et al., 2009; Devereux et al., 2007). Francis et al. (2016) find that CEO compensation is significantly higher for urban agglomerate firms and argue that firms are willing to pay such premium for knowledge spillovers and highly skilled labour associated with spatial clustering. Similarly, the firms should be willing to pay for a higher rental rate for locations with higher agglomeration (Drennan & Kelly, 2011; Koster et al., 2014).

The willing to pay channel is more notable when applied to individual buildings for two reasons. Firstly, compared to input sharing and labour pooling, knowledge spillovers have a local nature that knowledge and information sharing is facilitated by proximity. In other words, spillover effects are stronger within close spatial proximity as well as within the same industry (Ahlfeldt et al., 2015; Arzaghi & Henderson, 2008; Hsieh & Moretti, 2019; Rosenthal & Strange, 2001, 2003; Rosenthal & Strange, 2005). The knowledge spillover effects are likely to be more important in producer services industries and retailers (Drennan & Kelly, 2011; Koster et al., 2014) as well as innovative sectors (Matray, 2021) given the primacy of information exchange and education in these businesses. As service industries are precisely the key tenants in office buildings, they should enjoy agglomeration gains from intense economic activities within a close proximity of a building's location. In turn, they are willing to pay a premium in rent.

Secondly, Liu et al. (2018a, 2018b) find that agglomeration economies operate within individual buildings. Aside from the horizontal spillovers discussed above, tenants would benefit

from economic activities within the building. This generates a testable hypothesis that when there is an anchor tenant or anchor sector within the building, the rental rate will be higher.

### 2.2 Property Operation Channel

The positive effect of agglomeration on rents and prices can also be transmitted via property operation in several ways. Firstly, when tenants are attracted to business locations with higher agglomeration benefits, this in turn creates tenant pooling which makes it easier for the property managers to attract and maintain tenants, leading to a lower vacancy rate and higher rental income (van der Vlist et al., 2021). This is evident in Jennen and Brounen (2009) who find that, in the Amsterdam office market, office clustering generates higher rental incomes. While they use the density of office buildings, the underlying driving force is the clustering of economic activities. Secondly, the liquidity risk of a property is lower when it is located in an area with higher economic density. Due to the positive locational externalities, it is easier for the buyer to maintain the current tenant base or redeploy the building, resulting in higher liquidation value, hence a higher selling price (Liu et al., 2019). Finally, the operation efficiency of a building surrounded by a greater degree of agglomeration can benefit from highly skilled property managers as well as service providers as a result of labor pooling and knowledge spillovers, which is reflected in gains in rents and prices.

Both of the aforementioned channels, via tenants' willingness to pay or via property operation, provide a testable empirical relationship between the level of agglomeration and the property valuation.

## 3. Sample Data and Agglomeration Measures

In terms of the overall empirical setting, there are three stages: in the first stage, we map the industry composition outside and inside an office building and define the industry concentration or specialization at the horizontal and vertical level; in the second stage, we test the impacts of industry concentration and specialization on various components of property valuation; finally, we use the event study to investigate how the market reacts to the acquisition and disposition of specialized buildings.

### 3.1 Sample

In this study, we use the data of office buildings transacted by REITs from 2014 to 2020. The variables include 1) horizontal industry composition, 2) vertical industry composition, 3) building transaction information, including transaction year, transaction price per square meter, rent per square meter, and cap rate, 4) building characteristics, such as size, age, number of stories, the quality rating of the property, green building certificate (LEED or Energy Star label, 5) location characteristics such as transportation quality in the area, whether it is a suburban area and whether it is located in the REIT's headquarter state, 4) owners' characteristics, such as REIT size, leverage and stock return. Table 1 displays the detailed definition of all the variables.

<< Table 1 here >>

For the horizontal industry composition, we map the neighborhood agglomeration at a very fine geographic location level by using the employee census data at the zip code (5 digits) level. For the vertical industry composition, we use the tenant industry concentration. Building level

tenant information, including occupied size, tenant name, and tenant industry sector, as well as building characteristics, is manually collected from CoStar Database. ZIP code level business composition is collected from ZIP Codes Business Patterns from the US census bureau, which provides annual statistics for businesses with paid employees. We merge the CoStar database with S&P Market Intelligent database (Previously SNL database), to collect the information of REITs. Due to the missing value, especially the cap rate, our sample includes 457 office transactions made by 57 REITs. These buildings are occupied by 5,396 tenants. Table 2 illustrates the industry of tenants in our sample. The tenants in our sample distribute across 21 industry sectors, with Professional, Scientific, and Technical Services, and Finance and Insurance occupying most spaces (26.0% and 23.7%, respectively). Aside from 10.8% of manufacturing tenants, the other tenants are also mostly from services or service-related sectors including information (8.2%), publication administration (5.6%), retail and wholesale trade (4.6%), social work (4.2%), etc., supporting the argument that the knowledge spillover effect associated with agglomeration is the most prominent for office buildings given the underlying tenant composition.

<< Table 2 here>>

### 3.2 Measuring Horizontal (Neighborhood) Agglomeration

While concentration and specialization are sometimes used as interchangeable concepts, we define the concentration and specialization variables separately for the horizontal (neighborhood) industry composition. The Herfindahl index - **HHI_NHBRHD -** measures the level of industry concentration of the neighborhood where the office building is located:

$$HHI_{it}^{NHBRHD} = \sum_{k=1}^{K} \left( \frac{E_{t,i,k}^{NHB}}{E_{t,i}^{NHB}} \right)^2, \quad (1)$$

where $E_{t,i,k}^{NHB}$ is the number of employees in industry sector *k* in the zip code area where property *i* locates in year *t* when the building is transacted. The industry sector is defined based on 2-digit NAICS code. $E_{t,i}$ is the total number of employees in the zip code area where the property *i* locates. $HHI_{it}^{NHBRHD}$ measures the concentration of industry sectors, ranging from close to 0 to 1. If $HHI_{it}^{NHBRHD}$ has a value of one, it means all workers in that zip code area are in one sole industry. The lower the $HHI_{it}^{NHBRHD}$ value, the less concentrated the employment industry sectors in the neighborhood are. Figure 1A illustrates the histogram of neighborhood industry HHI. As shown in Figure 1A, over 75% of the zip code area has an HHI of around 0.1, implying a relatively diversified industry composition. As shown in Table 3, the average neighborhood industry HHI is 0.11, and the maximum is 0.5.

<< Figure 1 here >>

Additionally, we need to link the building specialization to the neighborhood specialization in order to capture the relative specialization and test the spillovers. We use a two-step identification strategy: 1) identify the industry sector of the largest tenant in a building; 2) construct the building-neighborhood specialization (**SPEC_NHBRHD**) as the number of employees in the largest tenant's industry in the zip code area where the building is located divided by the total number of employees in the same industry across the nation:

$$SPEC_{it}^{NHBRHD} = \frac{E_{t,i}^{NHB,LAEGE}}{E_{t}^{NATION,LARGE}}, \quad (2)$$

where $E_{t,i}^{NHB,LAEGE}$ is zip-code level total employees of the building's largest tenant industry sector. $E_t^{NATION,LARGE}$ is the total national employees in that sector in year *t*. For example, if the largest tenant industry in the building is IT, $EMP_{t,i}^{NHB,LAEGE}$ will be the number of IT employees in the zip code area where the building *i* locates and $E_t^{NATION,LARGE}$ is the total number of IT employees in that year. Thus, $SPEC_{it}^{NHBRHD}$ measures the concentration of the industry employments in the neighbourhood relative to the nation. If the building which is occupied by IT firms is located in Silicon Valley, $SPEC_{it}^{NHBRHD}$ will be relatively high, because US IT workers concentrate in Silicon Valley. The distribution of neighborhood specialization is illustrated in Figure 1B. The highest specialization is 0.58 bps, indicating that 0.0058% of national workers in the building's largest industry sector concentrate in the zip code of the building. On average, the neighborhood specialization is 0.03bps.

We are aware that the largest industry in a building is not necessarily the largest industry in a building's neighborhood, therefore we control for variable **LSECT_BLDG_NHBRHD,** which is the number of employees in the building's largest industry in the zip code area as a share of the total number of employees in the zip code area:

$$LSECT_{it}^{BIDG,NHBRHD} = \frac{E_{t,i}^{NHB,LAEGE}}{E_{t,i}^{NHB}} \quad , \tag{3}$$

where $E_{t,i}^{NHB,LAEGE}$ is number of employees of the building's largest tenant's industry sector in the zip code area in year *t*. $LSECT_{it}^{BIDG,NHBRHD}$ uses the total number of employees in the zip code area ($E_{t,i}^{NHB}$) as the denominator. $LSECT_{it}^{BIDG,NHBRHD}$ measures the concentration of a building's largest industry at the neighbourhood level. If the building's largest tenant sector is IT, $LSECT_{it}^{BIDG,NHBRHD}$ is the share of IT workers to the total number of employees in the zip code

area. If the building is located in Silicon Valley, $LSECT_{it}^{BIDG,NHBRHD}$ will be relatively high, as most workers in that zip code area are IT workers.[7] As shown in Table 3, in our sample, on average, around 11.6% of the employment in the neighborhood works in the same industry as the building's largest tenant industry sector. The maximum share is 54.1%.

### 3.3 Measuring Vertical (Tenant) Agglomeration

For the vertical industry composition, we use the tenant industry concentration measured by the Herfindahl index based on the tenants' industry sectors (**HHI_TENANT**). It is defined as:

$$HHI_{it}^{TENANT\_IND} = \sum_{l=1}^{L} \left( \frac{S_{t,i,l}^{TEN\_IND}}{s_i} \right)^2, \quad (4)$$

where $S_{t,i,l}^{TEN\_IND}$ is the rented area occupied by tenants in sector *l* in property *i* year *t*. $s_i$ is the total occupied area of the building. The $HHI_{it}^{TENANT\_IND}$ measures the concentration of industry sectors inside the building. The lower the $HHI_{it}^{TENANT\_IND}$ value, the less concentrated the employment industry sectors of the building. Figure 2 illustrates the distribution of building industry HHI. As shown in Figure 2A, the tenants' industries are relatively more concentrated, compared to that of neighborhoods. Over 50% of offices in our sample have an industry HHI over 50%. 35% of our buildings have one tenant sector. The average tenant HHI is 63%, as shown in Table 3.

<< Figure 2 about here >>

[7] $SPEC_{it}^{NHBRHD}$ quantifies the relative neighborhood specialization of a building's largest industry at the national level, while $LSECT_{it}^{BIDG,NHBRHD}$ captures the specialization of a building's largest industry relative to all industries at the neighborhood level.

We also use alternative measures to capture the industry composition and the anchor tenant effect inside the building. We define an anchor sector for a building (**ASECT_BLDG**)

$$ASECT_{it}^{BLDG} = \begin{cases} \max(\frac{S_{t,i,l}^{TEN\_IND}}{s_i}), & if\ \max(\frac{S_{t,i,l}^{TEN\_IND}}{s_i}) > ST \\ 0 & otherwise \end{cases}, \quad (5)$$

where $S_{t,i,l}^{TEN\_IND}$ and $s_i$ are defined as in the previous paragraph. *ST* is the threshold based on rental space occupation, which is set as 0%, 50% and 100%. When the threshold is set at 100%, the building is occupied by tenants from the same industry. When the threshold is set as 0%, $ASECT_{it}^{BLDG}$ shows the ratio of the largest tenant industry sector to the total rented area. As shown in Figure 2B, in over half of our office buildings, the largest tenant industry sector occupies over 70% of the rented areas.

We also calculate the share of the anchor tenant within a building at different thresholds (**ATENANT_BLDG**) - an anchor tenant is defined when the share of rented areas is above 0% or 50%, or equal to 100%:

$$ATENANT_{it}^{BLDG} = \begin{cases} \max(\frac{S_{t,i,h}^{TEN}}{s_i}), & if \max(\frac{S_{t,i,h}^{TEN}}{s_i}) > ST \\ 0 & otherwise \end{cases}, \quad (6)$$

where $S_{t,i,l}^{TEN}$ is the rented area occupied by tenant *h* in property *i* in year *t*. When the threshold is set at 100%, the presence of an anchor tenant means the building is occupied by a single tenant. When the threshold is set at 0%, this variable shows the share of the largest tenant in the building. As shown in Figure 2C, in over 50% of our office buildings, the largest tenants occupied over 50% of the space. Around 30% of our office buildings are rented to one single tenant. The average share of space occupied by the largest tenant is 59% (Table 3).

### 3.4 Building Transaction Information, Building Characteristics and REITs

The summary statistics of other variables are reported in Table 3. In our sample, the average transaction price is 3.12 USD/m2, the average NOI is 0.2 USD/m2, and the average yield is 7%. The sample offices have an average size of 1555 m2, located in the zip code areas with an average total employment of 26 thousand workers. The buildings have an average age of 26 years, with 9 floors and four Stars. Around 36% of the building has LEED and/or Energy Star Label, and about 49% of buildings are located in suburban areas. Additionally, we also collect the performance of the building's owners – REITs. Our sample consists of 57 REITs, with an average daily stock return of -0.02%. The average market capitalization is 5,791 thousand USD, the average debt to asset ratio is 50.8%, and the average Price to book ratio is 1.821.

<< Table 3 here >>

## 4. Empirical Setting and Analysis

### 4.1 Horizontal and Vertical Concentration

We start with estimating the impact of neighbourhood and tenant industry concentration on the components of property valuation separately, including rental rate, cap rate, and transaction price:

$$y_{it} = \alpha + \beta_1 HHI_{it}^{NHBRHD} + \beta_2 HHI_{it}^{TENANT} + \gamma X_i + D_t^Y + D_i^F + D_i^{MSA} + e_{it}, \qquad (7)$$

where $y_i$ represents the log of sell price, log of net operating income, or cap rate of property i at the time of transaction in year t. $HHI_{it}^{NHBRHD}$ and $HHI_{it}^{TENANT}$ are measures of industry concentration of the building's zip code area and tenants, as defined in Section 3.1. $X_i$ represents a vector of building and location characteristics that are important factors of property valuations. Specifically, for building characteristics, we control for property size (**SIZE_BLDG**), age (**AGE_BLDG)**, number of floors (**STORY_BLDG)**, quality classification (**QUALITY_BLDG)** and eco-label (**ECO_BLDG).** For location neighborhood characteristics, we control for the zip code area size based on employment (**SIZE_NHBRHD),** transportation quality (**TRANS_NHBRHD)**, and whether it is a suburban area (**SURBURBAN**). We also include a dummy to capture whether the property is located in the company's headquarter state (**HOME STATE**) to control for potential home bias. $D_t^Y$ is the transaction year fixed effect, $D_i^F$ is the REIT company fixed effect and $D_i^{MSA}$ is the MSA location fixed effect.

The results are reported in Table 4. Models (1), (2), and (3) include only concentration variables and year, firm, and MSA fixed effects, while Models (4), (5), and (6) include full specifications. Models (4) and (5) have returned positive coefficients of **HHI_NHBRHD** and **HHI_TENANT** on **PRICE** and **NOI** respectively, suggesting that the zip code area and tenant industry concentration have a significantly positive effect on office rental rate and transaction price. This supports our argument that individual properties indeed benefit from both the horizontal and vertical concentration of economic activities, which are reflected in increased rental rate and prices. It also provides empirical support to recent agglomeration literature which believes that agglomeration economies exist at very fine geographical level and even vertically within the individual buildings (Liu et al., 2018a, 2018b, 2020; Rosenthal & Strange, 2020). In addition, these results add micro-foundation evidence to Drennan and Kelly (2011) and Koster et al. (2014) who

identified agglomeration economies in pooled or aggregated commercial rents. When control variables are added, the impact drops slightly which is expected. Overall, the results on cap rate are generally weak. We find no significant impact of tenant concentration and a negative impact of neighborhood concentration, weakly significant at 10% in Model (6), on cap rate. The negative impact is in line with previous studies which argue that the risk of buildings located in areas with clustering of economic activities is lower (Jennen & Brounen, 2009; van der Vlist et al., 2021)

According to Model (4), (5), and (6), a one percent increase in neighborhood industry concentration will result in a 1.91% and 1.33% increase in the transaction price and NOI respectively, as well as a 0.0382% decrease in cap rate; a one percent increase in building-level tenant industry concentration is associated with a 0.27% and 0.29% increase in the transaction price and NOI respectively. The big difference in the impact between horizontal and vertical agglomeration is partly due to the difference in the standard deviation of the HHI in the vertical and horizontal dimensions. For comparison purpose, we calculate the economic impact, which is defined as the marginal effect of one standard deviation change in the concentration indicator. A one standard deviation change in the neighborhood industry concentration is associated with a 6.87% increase in the selling price, 4.78% increase in NOI, and 0.14% decrease in cap rate, while a one standard deviation change in the building-level tenant industry concentration is associated with an 8.61% increase in the selling price and a 9.25% increase in rental income, all of which are economically significant.

The coefficients of other control variables in Table 4 are in line with expectations. Larger buildings and older buildings have a lower transaction price and lower NOI. Taller buildings show a significantly higher price and NOI, and a lower yield, which is consistent with most of the empirical studies (Fuerst & McAllister, 2011; Goodman & Smith, 2021; Nase et al., 2019) .

Consistent with Fuerst and McAllister (2011) and Holtermans and Kok (2019), we also find green buildings achieve significantly higher prices and net rental incomes, and significantly lower yields, confirming the green premium. Additionally, locating in a suburban area reduces the selling price and rental income, in line with our expectations. Moreover, the selling price and rental income are also significantly higher for offices located in home MSA states, consistent with the argument by Ling et al. (2021) that local information can be beneficial to real estate assets.

<< Table 4 here>>

### 4.2 Industry Specialization and Spillovers

Both our willingness to pay channel and property operation channel heavily rely on the spillover effects. A tenant enjoys a higher level of spillover effect when it is located in an area which specializes in its industry. A building, therefore, enjoys a bigger gain as a result of hosting the industry that its neighborhood area specializes in. We argue that neighborhood industry concentration impacts property value via the spillover effect associated with industry specialization. While HHI measure the agglomeration of economic activities, it does not reflect the relative industry specialization at the property level.

To test this channel, we replace **HHI_NHBRHD** with **SPEC_NHBRHD**, as defined by Equation (2), which actually measures the building-neighborhood matched specialization, i.e., a high value of SPEC_NHBRHD indicates that a property is located in an area where there is a specialized industry and its largest tenant belongs to this industry. We then estimate the impact of

industry specialization on various components of property valuation, including rental rate, cap rate, and transaction price:

$$y_{it} = \alpha + \delta_1 SPEC_{it}^{NHBRHD} + \delta_2 LSECT_{it}^{BIDG,NHBRHD} + \gamma X_i + D_t^Y + D_i^F + D_i^{MSA} + e_{it}, \quad (8)$$

We are aware that the largest industry in a building is not necessarily the largest industry in a building's neighborhood, therefore we control for variable **LSECT_BLDG_NHBRHD** which is the number of employees in the building's largest industry in the zip code area as a share of the total number of employees in the zip code area, as defined by Equation (3). Dependent variables and all the other variables are defined as in the previous models.

The results are presented in Table 5. Interestingly, when we include **SPEC_NHBRHD** and **HHI_NHBRHD** in the same specifications, see Model (4), (5) and (6), the significance of the coefficients of **HHI_NHBRHD** on price, rents and cap rate disappears. Instead, we find a positive impact of industry specialization (**SPEC_NHBRHD**) on the transaction price and rental income, which is strongly significant at 5% or above, and consistent in Model (1), (2), (4) and (5). A one standard deviation change in the neighborhood specialization is associated with ca. 8.2% increase in the price, and ca. 6.9% increase in NOI. This supports our argument that it is the spillover attribute of the agglomeration that matters the most to the firms occupying the office buildings, in line with the agglomeration studies in producer service industries (Arzaghi & Henderson, 2008; Drennan & Kelly, 2011; Koster et al., 2014); the agglomeration gains associated with spillovers are then manifested in the rental and price premiums. Meanwhile, tenant industry concentration (**HHI_TENANT**) remains positive and significant after we control for neighborhood industry specialization. Overall, the results support our hypothesis that property value benefits from both horizontal and vertical industry concentration. When a property is located in an area where there

is a high level of industry concentration or when the industry concentration of its tenants is high, it generates significantly higher rental incomes.

<< Table 5 here>>

### 4.3 Anchor Sector and Anchor Tenant

The argument on the neighborhood industry specialization could also be applied to the industry composition within individual buildings. When a building is occupied by tenants that are mainly from the same industry, i.e., there is an anchor sector in the building, the spillover effects should be magnified. While HHI measure does capture the industry specialization of the tenants within a building to a large extent, it does not precisely measure the level of anchor sector and its prominence. Figure 3 shows different industry and tenant compositions within buildings. Building A and B illustrate a simple scenario where Building A has higher HHI, hence concentration, while Building B hosts a more notable anchor sector. To estimate the effect of anchor sector, we replace **HHI_TENANT** with **ASECT_BLDG** which is the share of the floor size occupied by the largest tenant's industry in a building, as defined by Equation (5). As there is no clear definition on how big is big enough to be considered as 'anchor', we test the anchor sector effect with three levels of threshold. When the threshold is set at 0%, it means that the anchor sector of any building is simply the largest tenant's industry; when the threshold is set at 50%, it means that only when the largest tenant's sector occupies more than 50% of the building will we consider this building to have an anchor sector; finally, when the threshold is set at 100%, the building is occupied by tenants from the same industry, which essentially captures the single sector effect. The results are reported in

Table 6 where the models are run under each threshold separately. The results on **SPEC_NHBRHD** remain consistent with the baseline results in Table 5. Overall, we find a positive effect of **ASECT_BLDG** on the price and rental income under all three thresholds, suggesting that higher industry specialization within a building indeed leads to a higher rental rate and price. However, under the 100% threshold where a building is occupied by one sole industry, the significance of the coefficients of **ASECT_BLDG** on **PRICE** and **NOI** sharply increases to 1%, indicating that the scale of the industry specialization impact within individual buildings does rely on the size of the anchor sector.

<< Figure 3 here >>

<< Table 6 here >>

The anchor tenant effect has been widely discussed in the retail sector (Brueckner, 1993; Chacon, 2021; Konishi & Sandfort, 2003; Liu & Liu, 2013). Liu et al. (2018a) argue that the anchor tenant is also important for office buildings in a way that it attracts other tenants in the same industry, indicating that anchor tenant and anchor sector are potentially highly correlated. However, the Building C and D examples in Figure 3 illustrate a possible scenario: Building C has a low tenant concentration and no anchor tenant but has an absolute anchor sector, i.e. occupied by one industry; Building D has a high tenant concentration and an anchor tenant but has a smaller anchor sector presence compared to Building C. To account for this and in order to estimate the anchor tenant effect, we replace the anchor sector variable (**ASECT_BLDG**) with an anchor tenant variable as defined by Equation (6). Similarly, we define three levels of threshold at 0%, 50% and

100% where 100% threshold actually captures the single tenant effect. The results are reported in Table 7. As expected, we do find a positive anchor tenant effect under all three levels of threshold that a larger anchor tenant presence leads to a higher price or rental rate. More interestingly, we find that the significance of the anchor tenant effect clearly escalates from 10% under 0% threshold to 1% under 100% threshold, indicating that the anchor tenant effect is stronger when the share of the largest tenant increases so that the single tenant occupation generates the most significant impact. This result also supports the recent development in the REIT literature which documents a positive relationship between tenant concentration and REIT operating performance, particularly the NOI, as the single tenant represents the highest level of concentration (Chacon, 2021; Zheng & Zhu, 2021). As a robustness test, we also control for the aggregated share of other tenants who are also in the anchor tenant's industry as well as the tenant quality proxied by tenant size (Table 8 and 9 respectively); the main results do not change.

<< Table 7 here >>

<< Table 8 here >>

<< Table 9 here >>

**4.4 Market's Perception**

In the final stage, we take one step further and investigate the market's perception of the agglomeration economies at the individual building level. We adopt an event study and model how the stock market reacts to a REIT's acquisitions and dispositions of a building with various degrees of horizontal and vertical industry concentration / specialization. We use abnormal returns as our

risk-adjusted performance criterion. We firstly estimate the expected return for each REIT i using the Fama-French three-factor model plus the real estate factor (EPRA REIT return) as below:

$$r_{t,i} - r_{ft} = a_i + b_{1,i} r_t^M + b_{2,i} SMB_t + b_{3,i} HML_t + b_{4,i} WML_t + b_{5,i} EPRA_t + \varepsilon_{t,i}, (9)$$

where $r_{t,i}$ is the daily return on day t for REIT i and $r_{ft}$ is the corresponding risk-free rate as measured by the yield on the one-month Treasury bill. The data is obtained from Ken French's website. The factors comprise a market return index ($r_t^M$), the difference between the returns on diversified portfolios of small stocks and big stocks (SMB), the difference between the returns on diversified portfolios of high (value) and low (growth) book-to-market stocks (HML), and the investment factor (CMA), measured as the difference between the returns of firms that invest conservatively and aggressively. To control for the influence of aggregated real estate markets, we include US real estate returns by using the EPRA NAREIT US Index (EPRA). The estimated coefficients are then used to calculate the abnormal return ($AR_{t,d,i}$):

$$AR_{t,i} = r_{t,i} - r_{ft} - \hat{a}_i - \hat{b}_{1,i} r_t^M - \hat{b}_{2,i} SMB_t - \hat{b}_{3,i} HML_t - \hat{b}_{4,i} WML_t - \hat{b}_{5,i} EPRA_t . (10)$$

The risk-adjusted abnormal return ($AR_{t,i}$) are estimated for each REIT *i* in each day *t* within the event window of days $D_1$ through $D_2$, where $D_1$ and $D_2$ are the beginning and ending days of the event window. We then use individual abnormal returns to calculate the cumulative abnormal returns at the security level. The cumulative abnormal return for each REIT *i* across time is measured by adding up individual abnormal returns over the event window of days ($D_1$ to $D_2$):

$$CAR_i(D_1, D_2) = \sum_{d=D1}^{D2} AR_{d,i}. \quad (11)$$

We then study the impact of horizontal and vertical agglomeration on cumulative abnormal returns, while controlling other characteristics. For horizontal agglomeration, we use industry

concentration (**HHI_NHBRHD**) and specialization (**SPEC_NHBRHD**) separately and the models are specified as below:

$$CAR_i(D_1, D_2) = \alpha + \theta_1 HHI_i^{NHBRHD} + \theta_2 HHI_i^{TENANT} + \gamma X_i^B + \gamma X_i^F + D_i^Y + D_i^F + D_i^{MSA} + e_i, \quad (12)$$

$$CAR_i(D_1, D_2) = \alpha + \varphi SPEC_{it}^{NHBRHD} + \gamma X_i^B + \gamma X_i^F + D_t^Y + D_i^F + D_i^{MSA} + e_i, \quad (13)$$

where $CAR_i(D_1, D_2)$ is the cumulative abnormal return around the acquisition and disposition of the office building. $HHI_{it}^{NHBRHD}$, $HHI_{it}^{TENANT}$ and $SPEC_{it}^{NHBRHD}$ are defined as before. $X_i^B$ includes the building characteristics that are used in previous models. $X_i^F$ represents a vector of REIT characteristics, including the market capitalization (**REIT SIZE**), leverage ratio (**REIT LEV**), and price to book ratio (**REIT P/B)**. Similarly, we control for time, firm and MSA fixed effects.

Table 10 reports the results using the cumulative abnormal return one day after the acquisition and disposition as the dependent variable. Models (1) and (2) in Table 10 are based on Equation (12), while Models (3) and (4) are based on Equation (13). We find a strongly significant impact of tenant industry concentration or vertical agglomeration (**HHI_TENANT**): an increase in tenant industry concentration of a building leads to an increase in the abnormal returns of the REIT one day after purchasing it. Meanwhile, the abnormal return of a REIT decreases after selling a building with a high level of tenant industry concentration. Since REITs are expected to hold and manage buildings and distribute dividends, rather than speculatively trading properties, a portfolio with high-performance buildings is viewed as an advantage. The negative (positive) market reactions to the sales (purchase) of buildings with concentrated tenants indicate that the market views a concentrated tenant base as an advantage. Our results suggest that, if a REIT substitutes a

building with a completely diversified tenant base with a building with a single tenant, the market will react with a positive abnormal return of 3.02%. A one standard deviation increase in tenant industry concentration (**HHI_TENANT**) in the acquired building by a REIT is associated with a 0.49% increase in abnormal return of that REIT. Meanwhile, a standard deviation increase in tenant industry concentration (**HHI_TENANT**) of the sold building is associated with a 0.47% decrease in the abnormal return.

While we do not find any significant results on neighborhood industry concentration (**HHI_NHBRHD**), we do find that the building-neighborhood specialization (**SPEC_NHBRHD**) is valued by the market: the share price reacts positively to the acquisition of a building associated with agglomerative benefits that a one standard deviation increase in the neighborhood specialization of the purchased building is associated with a 0.15% increase in the abnormal return. This further supports our argument that the spillover effect is the most valuable element of agglomeration in terms of office building valuation.

<< Table 10 here>>

We also run the model on abnormal returns over various event windows. Table 11 presents the results including 57 trading day (D1=-28, D2=28), 29 trading days (D1=-28, D2=+28), 15 trading days (D1=-7, D2=+7), 7 trading days (D1=-3, D2=+3), 3 trading days (D1=-1, D2=+1), 1 trading day (D1=0, D2=+1), 4 trading days (D1=0, D2=+3), 8 trading days (D1=0, D2=+7), 15 trading days (D1=0, D2=+14) and 29 trading days (D1=0, D2=28). The impact is stronger in the days closer to the transaction. In the event of acquisition, the significant impact of tenant industry

concentration (**HHI_TENANT)** and industry specialization (**SPEC_NHBRHD**) only lasts one trading day. In the event of disposition, however, the negative impact of tenant industry concentration (**HHI_TENANT)** lasts over a 7-day event window, suggesting a heavier market punishment.

<< Table 11 here>>

## 6. Conclusion

Does diversification pay? From a real estate perspective, diversification means leasing a building to tenants who are in many different industries to reduce the risk of tenant default in addition to the risk of having too much exposure to any one industry. If an industry concentration exists in a given neighborhood, where the most probable tenants belong to the same industry group such as TAMI[8] then this might exacerbate the leasing to a diversified set of tenants. However, is it necessarily "bad" for a building to have an undiversified tenant mix especially with respect to rents charged and valuation implications? Our study investigates the extent to which building specialization coupled with neighborhood agglomeration has a positive or negative impact, if any, on office rents and value. In addition to this, we evaluate the stock price reaction to purchasing or selling a building that is subjected to horizontal and/or vertical agglomeration.

[8]Tenants who work the technology, advertising, media, and information sectors.

Exploiting the tenant industry information, we create an identification strategy which allows us to measure a building's relative industry specialization to its neighborhood. This allows us to test whether positive spillover externalities have rent and valuation consequences.

We find that both horizonal agglomeration and building specialization exert a positive effect on the rental rate and transaction price of the office buildings. Our findings are consistent with recent research on agglomeration that agglomeration economies exist at both the horizontal neighbourhood level in addition to the level of building specialization (Liu et al., 2018a, 2018b, 2020; Rosenthal & Strange, 2020). More importantly, we find that the significant impact only exists when both building specialization in addition to neighbourhood agglomeration are present but not if only horizontal neighborhood agglomeration exists. This suggests that agglomeration gains arise from knowledge spillovers tenants enjoy when they choose a location that caters to their sector; industry clientele effects appear to matter. Our findings provide additional insights to studies which argue that agglomeration economies attenuate and are stronger within close proximity and industries, and that the knowledge spillover effects are more prominent in service industries (Ahlfeldt et al., 2015; Arzaghi & Henderson, 2008; Hsieh & Moretti, 2019; Matray, 2021; Rosenthal & Strange, 2001, 2003; Rosenthal & Strange, 2005). This study also provides further empirical support that rents reflect the presence of agglomeration economies; Rent is another effective agglomeration measure in addition to productivity, wages and employment metrics (see for example Arzaghi and Henderson (2008); Drennan and Kelly (2011); Koster et al. (2014); Rosenthal and Strange (2004)).

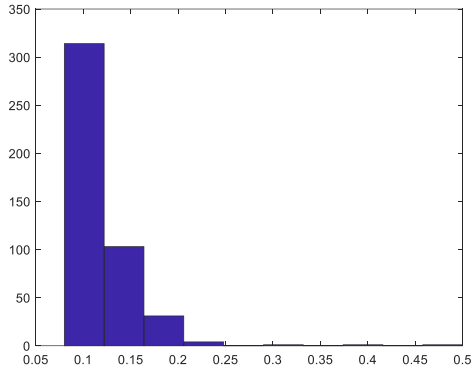
The impact of vertical agglomeration - tenant industry concentration within individual buildings – on office rental income and price is positive and robust with respect to our various models. This suggests that vertical industry composition does matter especially if there is an anchor

tenant in the same industry that is present in that building. As the anchor tenant takes up more space in the building, the more positive is the impact with respect to rent and the value of the building. While our study focuses on tenant sectors with respect to individual buildings, it also contributes to the recent empirical findings that a concentrated tenant base (a few tenants that account for most of the revenues in a real estate portfolio) generates higher rental income (Chacon, 2021; Zheng & Zhu, 2021).

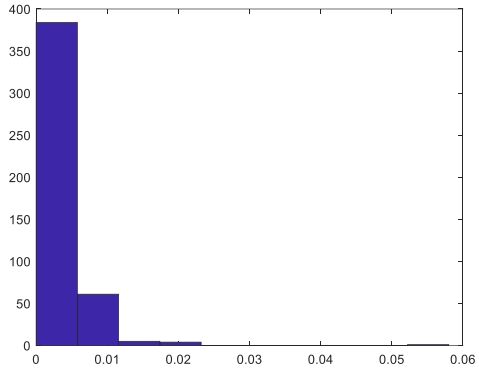
Our use of REIT transaction data also allows us to study how the market reacts to the acquisition and disposition of a building that is subjected to varying degrees of horizontal and vertical agglomeration. Overall, the stock market views tenant industry concentration as an advantage. Consequently, the price reaction is negative (positive) to the sales (purchase) of buildings with sector-concentrated tenants. We also observe a positive abnormal return subsequent to a REIT's acquisition of a building that is located within a neighborhood that features an industry cluster(s). This is consistent with the choice of firm location studies in finance literature suggesting that there are positive knowledge spillover externalities associated with a firm's location choice.

**Figure 1: Degree of Horizontal Agglomeration**

**1A: Neighborhood Industry HHI**




**1B : Neighborhood Industry Specialization of Building's Largest Tenant Sector**




**1C: Neighborhood Concentration of Building's Largest Tenant Sector**

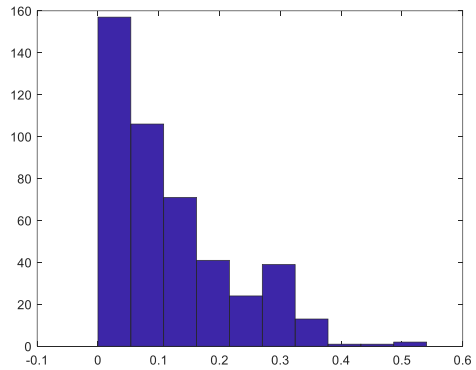
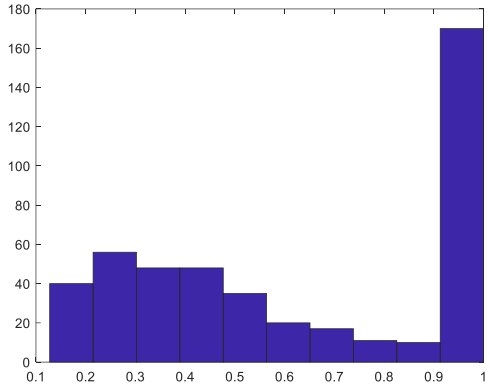
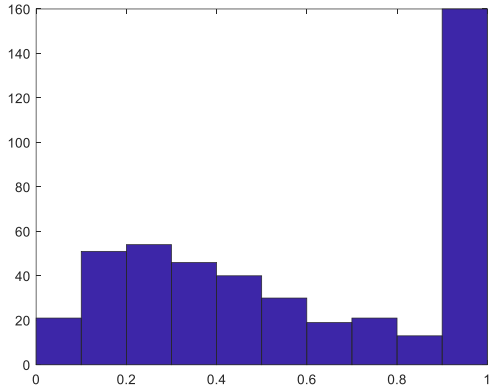


**Figure 2: Degree of Vertical Agglomeration**

**2A: Tenant Industry HHI**




**2B: Share of Building Largest Industry Sector**




**2C: Share of Largest Tenant**

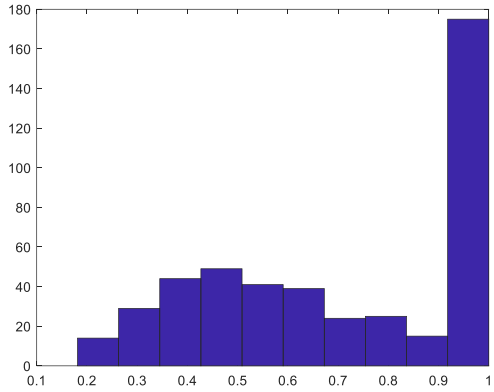
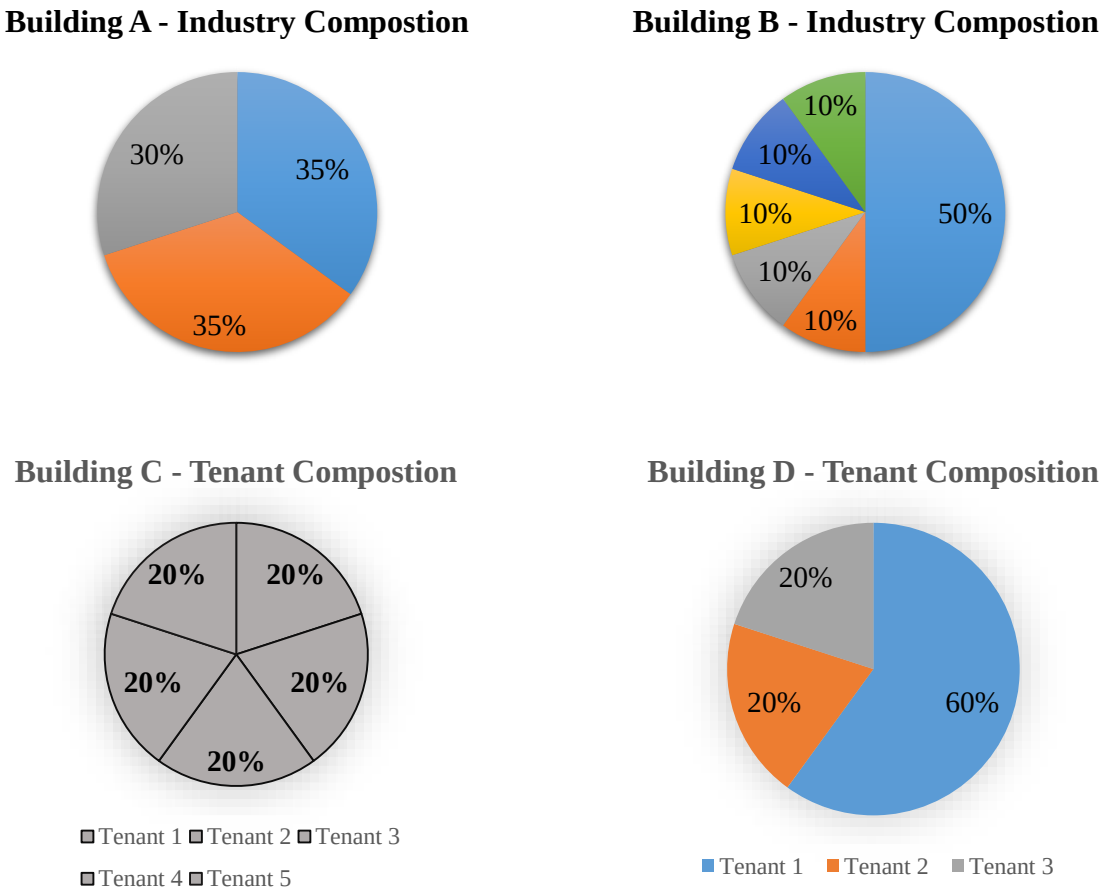


**Figure 3 Tenant Industry Concentration and Anchor Sector**




Note: the color indicates industries.

**Table 1 Variable Definition**

| Variable | Definition |
|---|---|
| **PRICE** | Property purchase price per square feet |
| **NOI** | Net operating income of the property |
| **CAP** | Property purchase cap rate |
| **HHI_NHBRHD** | The level of industry concentration of the neighbourhood where the property is located during the purchasing year, measured by the Herfindahl index based on the number of employees in different industries in the zip code (5 digits) area where the property belongs |
| **HHI_TENANT** | The industry concentration within the property, measured by HHI index based on tenants' industries |
| **SPEC_NHBRHD** | Neighbourhood industry specialisation at the zip code level, measured as the number of employees of the building's largest tenant's sector in the zip code area divided by the total number of employees in the nation who work in the same industry (For example, if the largest tenant industry in the building is IT. We calculate the proportion of IT workers in the zip code area to the total amount of IT workers in the country.) |
| **LSECT_BLDG_NHBRHD** | The number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area |
| **ASECT_BLDG** | Share of the anchor sector in the building (largest sector, rental share above 0% or 50%, or equal to 100%) |
| **ATENANT_BLDG** | Share of the anchor tenant in the building (largest tenant, rental share above 0% or 50%, or equal to 100%) |
| **TENANT_ATENANT_BLDG** | Share of tenants in the Anchor tenant's sector (anchor tenant rental share threshold at 0%, 50% and 100%), excluding the share of the Anchor tenant |
| **SIZE_BLDG** | Property size in 1000 square feet |
| **AGE_BLDG** | Property age in years |
| **SIZE_NHBRHD** | Zip code area size control, measured as the total number of employees in the zip code where the property locates in the purchasing year, log transformed |
| **STORY_BLDG** | Log of number of stories in a building |
| **QUALITY_BLDG** | Quality rating of the property |
| **ECO_BLDG** | Dummy that equals 1 if the building has LEED or Energy Star label |
| **TRANS_NHBRHD** | Transportation quality in the building area, measured as the sum of dummy variables for bus line, car charging, commuter rail and metro/subway |
| **SURBURBAN** | Dummy that equals 1 if the property is located in suburban areas |
| **HOME** | Dummy that equals 1 if the property is located in the company's home state |

**Table 2: Distribution of Tenant Industry Sector**

| Sector (SIC) | Description | Occupied Area (1000 M2) | Share |
|---|---|---|---|
| 11 | Agriculture, Forestry, Fishing and Hunting | 84 | 0.08% |
| 21 | Mining, Quarrying, and Oil and Gas Extraction | 677 | 0.62% |
| 22 | Utilities | 2339 | 2.15% |
| 23 | Construction | 1317 | 1.21% |
| 31-33 | Manufacturing | 11728 | 10.79% |
| 41/42 | Wholesale Trade | 2280 | 2.10% |
| 44-45 | Retail Trade | 2678 | 2.46% |
| 48-49 | Transportation and Warehousing | 685 | 0.63% |
| 51 | Information | 8936 | 8.22% |
| 52 | Finance and Insurance | 25791 | 23.73% |
| 53 | Real Estate and Rental and Leasing | 3639 | 3.35% |
| 54 | Professional, Scientific, and Technical Services | 28281 | 26.02% |
| 55 | Management of Companies and Enterprises | 150 | 0.14% |
| 56 | Administrative and Support and Waste Management and Remediation Services | 2733 | 2.51% |
| 61 | Educational Services | 1409 | 1.30% |
| 62 | Health Care and Social Assistance | 4594 | 4.23% |
| 71 | Arts, Entertainment, and Recreation | 522 | 0.48% |
| 72 | Accommodation and Food Services | 2010 | 1.85% |
| 81 | Other Services | 2741 | 2.52% |
| 91/92 | Public Administration | 6034 | 5.55% |
| 99 | No classifiable Establishments | 68 | 0.06% |
| Sum | | 108694 | |

**Table 3: Summary Statistics**

| | Mean | Std | Max | Min |
|---|---|---|---|---|
| **Horizontal Agglomeration** | | | | |
| HHI_ NHBRHD | 0.118 | 0.036 | 0.500 | 0.080 |
| SPEC_NHBRHD (Bps) | 0.031 | 0.041 | 0.580 | 0 |
| LSECT_BLDG_NHBRHD | 0.116 | 0.103 | 0.541 | 0 |
| **Vertical Agglomeration** | | | | |
| HHI_Tenant | 0.633 | 0.319 | 1 | 0.128 |
| ASECT_BLDG | 0.712 | 0.264 | 1 | 0.181 |
| ATENANT_BLDG | 0.595 | 0.345 | 1 | 0 |
| **Building Transaction Information** | | | | |
| PRICE (USD/m2) | 3.120 | 3.003 | 27.252 | 0.013 |
| NOI (USD/m2) | 0.202 | 0.166 | 1.561 | 0.001 |
| Caprate | 7.01% | 1.70% | 16.40% | 2.38% |
| **Building Characteristics** | | | | |
| Size_NHBRHD | 1555 | 1032 | 6723 | 2 |
| SIZE (m2) | 26562 | 31643 | 254359 | 335 |
| Age | 26 | 18 | 114 | 0 |
| Story | 9 | 12 | 83 | 1 |
| Quality | 4 | 1 | 5 | 2 |
| Eco | 0.355 | 0.473 | 1 | 0 |
| Trans | 0.470 | 0.765 | 3 | 0 |
| Surburban | 0.488 | 0.500 | 1 | 0 |
| **Owners' Information** | | | | |
| Daily return | -0.02% | 8.46% | 907.68% | -909.38% |
| Market Capitalization | 5791 | 7370 | 36159 | 451 |
| Debt to Asset Ratio | 50.8% | 10.0% | 70.7% | 26.5% |
| Price to Book Ratio | 1.821 | 0.480 | 3.029 | 1.146 |

**Table 4 Industry Concentration and Purchase Price, Rental Income and Cap Rate**

| Dependent Variable | PRICE | NOI | CAP | PRICE | NOI | CAP |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **HHI_NHBRHD** | 2.9431*** | 1.9949*** | -6.3507*** | 1.9061** | 1.3332* | -3.8217* |
| | (0.7018) | (0.6047) | (1.6248) | (0.7698) | (0.7509) | (2.0456) |
| **HHI_TENANT** | 0.1986 | 0.2624** | 0.3284 | 0.2754** | 0.2924** | 0.0563 |
| | (0.1316) | (0.1283) | (0.2706) | (0.1382) | (0.1340) | (0.2701) |
| **SIZE_BLDG** | | | | -0.1913*** | -0.1886*** | 0.0019 |
| | | | | (0.0652) | (0.0640) | (0.1105) |
| **AGE_BLDG** | | | | -0.1223** | -0.1151** | 0.0908 |
| | | | | (0.0534) | (0.0504) | (0.1237) |
| **STORY_BLDG** | | | | 0.1542*** | 0.1158** | -0.2311* |
| | | | | (0.0558) | (0.0560) | (0.1377) |
| **QUALITY_BLDG** | | | | 0.0206 | 0.0051 | -0.0851 |
| | | | | (0.0628) | (0.0619) | (0.1285) |
| **ECO_BLDG** | | | | 0.1747*** | 0.1202* | -0.4486*** |
| | | | | (0.0659) | (0.0663) | (0.1639) |
| **SIZE_NHBRHD** | | | | 0.0273 | 0.0028 | -0.1297 |
| | | | | (0.0365) | (0.0359) | (0.0942) |
| **TRANS_NHBRHD** | | | | 0.0822* | 0.0483 | -0.2224** |
| | | | | (0.0495) | (0.0494) | (0.1023) |
| **SUBURBAN** | | | | -0.2432*** | -0.2078*** | 0.2217 |
| | | | | (0.0721) | (0.0719) | (0.1683) |
| **HOME** | | | | 0.1424* | 0.1532** | 0.1292 |
| | | | | (0.0793) | (0.0780) | (0.1854) |
| **Year FE** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes | Yes | Yes |
| **No. of obs** | 457 | 457 | 457 | 455 | 455 | 455 |
| **R2** | 0.4567 | 0.4173 | 0.3894 | 0.5244 | 0.4696 | 0.4399 |

Note: This table reports the results of cross-sectional regression based on Equation (7). The dependent variable is log of price (**PRICE**), log of NOI (**NOI**) or cap rate (**CAP**). **HHI_NHBRHD** is the industry concentration of the zip code (5-digit) area where the building locates. **HHI_TENANT** is the concentration of tenants' industry. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). Transaction year, REIT firm and MSA fixed effects are included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

**Table 5 Neighborhood Specialization and Purchase Price, Rental Income and Cap Rate**

| Dependent Variable | PRICE | NOI | CAP | PRICE | NOI | CAP |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **SPEC_NHBRHD** | 2.1674*** | 1.7641** | -3.3153 | 2.0598*** | 1.6816** | -3.3195 |
| | (0.6382) | (0.6800) | (2.5939) | (0.6320) | (0.6949) | (2.6241) |
| **LSECT_BLDG_** | 0.1393 | 0.1245 | -0.1408 | 0.0213 | 0.0746 | -0.1167 |
| **NHBRHD** | (0.2758) | (0.2713) | (0.7789) | (0.3050) | (0.3017) | (0.7874) |
| **HHI_NHBRHD** | | | | 1.5203* | 0.9498 | 0.0617 |
| | | | | (0.7906) | (0.7918) | (0.2839) |
| **HHI_TENANT** | | | | 0.2775** | 0.2953** | 0.0159 |
| | | | | (0.1366) | (0.1332) | (0.1166) |
| **SIZE_BLDG** | -0.1855*** | -0.1795*** | 0.0636 | -0.1978*** | -0.1940*** | 0.0647 |
| | (0.0623) | (0.0618) | (0.1269) | (0.0617) | (0.0609) | (0.1339) |
| **AGE_BLDG** | -0.1282** | -0.1256*** | -0.0016 | -0.1191** | -0.1124** | 0.0014 |
| | (0.0504) | (0.0473) | (0.0879) | (0.0527) | (0.0485) | (0.0876) |
| **STORY_BLDG** | 0.1253** | 0.0844 | -0.0918 | 0.1399** | 0.1038* | -0.0919 |
| | (0.0568) | (0.0577) | (0.1213) | (0.0551) | (0.0555) | (0.1297) |
| **QUALITY_BLDG** | 0.0106 | -0.0075 | -0.4778*** | 0.0194 | 0.0031 | -0.4778*** |
| | (0.0613) | (0.0596) | (0.1648) | (0.0620) | (0.0603) | (0.1694) |
| **ECO_BLDG** | 0.1886*** | 0.1301** | -0.2637** | 0.1902*** | 0.1339** | -0.2630** |
| | (0.0662) | (0.0658) | (0.1048) | (0.0657) | (0.0655) | (0.1023) |
| **SIZE_NHBRHD** | -0.0501 | -0.0570* | -0.2267 | -0.0172 | -0.0341 | -0.2360* |
| | (0.0338) | (0.0325) | (0.1387) | (0.0370) | (0.0372) | (0.1378) |
| **TRANS_NHBRHD** | 0.0998** | 0.0596 | 0.2423 | 0.0935* | 0.0580 | 0.2440 |
| | (0.0481) | (0.0470) | (0.1777) | (0.0481) | (0.0473) | (0.1756) |
| **SUBURBAN** | -0.2605*** | -0.2219*** | 0.1381 | -0.2341*** | -0.2004*** | 0.1201 |
| | (0.0714) | (0.0717) | (0.1874) | (0.0708) | (0.0708) | (0.1862) |
| **HOME STATE** | 0.1507* | 0.1638** | -0.6623 | 0.1454* | 0.1562** | -0.6665 |
| | (0.0866) | (0.0824) | (0.5372) | (0.0817) | (0.0778) | (0.5357) |
| **Year FE** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes | Yes | Yes |
| **No. of obs** | 456 | 456 | 456 | 455 | 455 | 455 |
| **R2** | 0.5224 | 0.4655 | 0.4403 | 0.5304 | 0.4745 | 0.4401 |

This table reports the results of cross-sectional regression based on Equation (7). The dependent variable is log of price (**PRICE**), log of NOI (**NOI**) or cap rate (**CAP**). **SPEC_NHBRHD** is the building's neighborhood specialization measured by the number of employees of the building's largest tenant's sector in the zip code area divided by the total number of employees in the nation who work in the same industry. **LSECT_BLDG** is the number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area. **HHI_NHBRHD** is the industry concentration of the zip code area where the building locates. **HHI_TENANT** is the concentration of tenants' industry. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). Transaction year, REIT firm and MSA fixed effects are included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

**Table 6 The impact of anchor sector in the building, anchor sector threshold at 0%, 50%, and 100%**

| Dependent Variable | PRICE | NOI | CAP | PRICE | NOI | CAP | PRICE | NOI | CAP |
|---|---|---|---|---|---|---|---|---|---|
| | | >0% | | | >50% | | | ==100% | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **SPEC_NHBRHD** | 2.1354*** | 1.7288** | -3.3558 | 2.1505*** | 1.7450** | -3.3524 | 2.0438*** | 1.6372** | -3.3485 |
| | (0.6320) | (0.6966) | (2.6320) | (0.6276) | (0.6942) | (2.6517) | (0.6418) | (0.6930) | (2.6302) |
| **LSECT_BLDG_** | 0.1728 | 0.1615 | -0.1185 | 0.1647 | 0.1532 | -0.1157 | 0.2438 | 0.2318 | -0.1281 |
| **NHBRHD** | (0.2754) | (0.2714) | (0.7873) | (0.2746) | (0.2705) | (0.7865) | (0.2736) | (0.2693) | (0.7745) |
| **ASECT_BLDG** | 0.2908* | 0.3209** | 0.1575 | 0.1720* | 0.1947** | 0.1417 | 0.2448*** | 0.2512*** | 0.0199 |
| | (0.1569) | (0.1538) | (0.3482) | (0.1014) | (0.0988) | (0.2205) | (0.0658) | (0.0648) | (0.1786) |
| **SIZE_BLDG** | -0.1981*** | -0.1935*** | 0.0144 | -0.1974*** | -0.1931*** | 0.0114 | -0.1904*** | -0.1846*** | 0.0209 |
| | (0.0616) | (0.0609) | (0.1184) | (0.0618) | (0.0611) | (0.1184) | (0.0613) | (0.0612) | (0.1129) |
| **AGE_BLDG** | -0.1127** | -0.1085** | 0.0713 | -0.1132** | -0.1086** | 0.0753 | -0.1112** | -0.1082** | 0.0643 |
| | (0.0518) | (0.0480) | (0.1342) | (0.0518) | (0.0480) | (0.1351) | (0.0499) | (0.0460) | (0.1296) |
| **STORY_BLDG** | 0.1456*** | 0.1067* | -0.2246* | 0.1447** | 0.1063* | -0.2196 | 0.1530*** | 0.1128** | -0.2334 |
| | (0.0556) | (0.0557) | (0.1359) | (0.0557) | (0.0558) | (0.1351) | (0.0559) | (0.0565) | (0.1425) |
| **QUALITY_BLDG** | 0.0185 | 0.0012 | -0.0941 | 0.0177 | 0.0004 | -0.0926 | 0.0129 | -0.0052 | -0.0982 |
| | (0.0619) | (0.0601) | (0.1298) | (0.0622) | (0.0604) | (0.1297) | (0.0600) | (0.0585) | (0.1286) |
| **ECO_BLDG** | 0.1947*** | 0.1369** | -0.4761*** | 0.1985*** | 0.1413** | -0.4713*** | 0.1902*** | 0.1317** | -0.4793*** |
| | (0.0657) | (0.0656) | (0.1707) | (0.0662) | (0.0660) | (0.1736) | (0.0655) | (0.0652) | (0.1673) |
| **SIZE_NHBRHD** | -0.0455 | -0.0520 | 0.0016 | -0.0464 | -0.0529 | 0.0022 | -0.0430 | -0.0497 | -0.0003 |
| | (0.0341) | (0.0325) | (0.0877) | (0.0340) | (0.0325) | (0.0878) | (0.0360) | (0.0339) | (0.0880) |
| **TRANS_NHBRHD** | 0.1019** | 0.0619 | -0.2653** | 0.1006** | 0.0605 | -0.2658** | 0.1119** | 0.0720 | -0.2655*** |
| | (0.0478) | (0.0467) | (0.1026) | (0.0481) | (0.0469) | (0.1028) | (0.0475) | (0.0462) | (0.1020) |
| **SUBURBAN** | -0.2497*** | -0.2100*** | 0.2469 | -0.2494*** | -0.2093*** | 0.2502 | -0.2533*** | -0.2145*** | 0.2416 |
| | (0.0711) | (0.0706) | (0.1747) | (0.0702) | (0.0697) | (0.1743) | (0.0719) | (0.0716) | (0.1772) |
| **HOME STATE** | 0.1521* | 0.1653** | 0.1380 | 0.1506* | 0.1636** | 0.1371 | 0.1580* | 0.1713** | 0.1378 |
| | (0.0845) | (0.0800) | (0.1880) | (0.0845) | (0.0799) | (0.1876) | (0.0840) | (0.0793) | (0.1877) |
| **Year FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **No. of obs** | 456 | 456 | 456 | 456 | 456 | 456 | 456 | 456 | 456 |
| **R2** | 0.5278 | 0.4731 | 0.4407 | 0.5272 | 0.4726 | 0.4410 | 0.5336 | 0.4792 | 0.4404 |

This table reports the results of cross-sectional regression based on Equation (7). The dependent variable is log of price (**PRICE**), log of NOI (**NOI**) or cap rate (**CAP**). **SPEC_NHBRHD** is the building's neighborhood specialization measured by the number of employees of the building's largest tenant's sector in the zip code area divided by the

total number of employees in the nation who work in the same industry. **LSECT_BLDG** is the number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area. **ASECT_BLDG** is the share of the anchor sector in the building. There are three levels of threshold based on the occupied rental space to define the anchor sector, i.e., 50% means only when the largest sector occupies more than 50% of the building space, we consider it as an anchor sector. 100% means the building is occupied by one sole industry. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). Transaction year, REIT firm and MSA fixed effects are included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

**Table 7 The impact of anchor tenant in the building, anchor sector threshold at 0%, 50%, and 100%**

| Dependent Variable | PRICE | NOI | CAP | PRICE | NOI | CAP | PRICE | NOI | CAP |
|---|---|---|---|---|---|---|---|---|---|
| | | >0% | | | >50% | | | =100% | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **SPEC_NHBRHD** | 2.1245*** | 1.7224** | -3.3299 | 2.0722*** | 1.6712** | -3.3257 | 2.0853*** | 1.6804** | -3.3428 |
| | (0.6334) | (0.6927) | (2.6061) | (0.6403) | (0.7093) | (2.5952) | (0.6392) | (0.6864) | (2.6277) |
| **LSECT_BLDG_** | 0.2817 | 0.2628 | -0.1651 | 0.2719 | 0.2539 | -0.1544 | 0.2404 | 0.2275 | -0.1313 |
| **NHBRHD** | (0.2933) | (0.2903) | (0.7837) | (0.2886) | (0.2874) | (0.7818) | (0.2757) | (0.2723) | (0.7752) |
| **ATENANT_BLDG** | 0.2671* | 0.2594* | -0.0535 | 0.2207** | 0.2153** | -0.0295 | 0.2210*** | 0.2251*** | 0.0116 |
| | (0.1411) | (0.1342) | (0.2593) | (0.1046) | (0.1004) | (0.1917) | (0.0644) | (0.0627) | (0.1763) |
| **SIZE_BLDG** | -0.2027*** | -0.1963*** | 0.0247 | -0.2042*** | -0.1979*** | 0.0238 | -0.1897*** | -0.1839*** | 0.0211 |
| | (0.0617) | (0.0609) | (0.1179) | (0.0613) | (0.0607) | (0.1179) | (0.0613) | (0.0612) | (0.1127) |
| **AGE_BLDG** | -0.1101** | -0.1080** | 0.0593 | -0.1088** | -0.1067** | 0.0603 | -0.1160** | -0.1132** | 0.0635 |
| | (0.0522) | (0.0483) | (0.1340) | (0.0519) | (0.0482) | (0.1345) | (0.0496) | (0.0459) | (0.1289) |
| **STORY_BLDG** | 0.1605*** | 0.1185** | -0.2426* | 0.1663*** | 0.1243** | -0.2411* | 0.1542*** | 0.1137** | -0.2341 |
| | (0.0563) | (0.0559) | (0.1410) | (0.0555) | (0.0551) | (0.1407) | (0.0562) | (0.0568) | (0.1432) |
| **QUALITY_BLDG** | 0.0168 | -0.0015 | -0.0996 | 0.0173 | -0.0011 | -0.0993 | 0.0109 | -0.0073 | -0.0984 |
| | (0.0614) | (0.0596) | (0.1295) | (0.0611) | (0.0594) | (0.1295) | (0.0597) | (0.0582) | (0.1287) |
| **ECO_BLDG** | 0.1850*** | 0.1266* | -0.4787*** | 0.1867*** | 0.1282** | -0.4792*** | 0.1809*** | 0.1222* | -0.4798*** |
| | (0.0649) | (0.0648) | (0.1664) | (0.0651) | (0.0650) | (0.1668) | (0.0655) | (0.0654) | (0.1675) |
| **SIZE_NHBRHD** | -0.0456 | -0.0527 | -0.0018 | -0.0440 | -0.0511 | -0.0017 | -0.0458 | -0.0527 | -0.0007 |
| | (0.0337) | (0.0325) | (0.0878) | (0.0339) | (0.0327) | (0.0880) | (0.0354) | (0.0335) | (0.0879) |
| **TRANS_NHBRHD** | 0.1030** | 0.0626 | -0.2671*** | 0.1040** | 0.0636 | -0.2670*** | 0.1125** | 0.0724 | -0.2658*** |
| | (0.0476) | (0.0466) | (0.1024) | (0.0480) | (0.0470) | (0.1025) | (0.0477) | (0.0466) | (0.1020) |
| **SUBURBAN** | -0.2539*** | -0.2155*** | 0.2397 | -0.2501*** | -0.2118*** | 0.2396 | -0.2534*** | -0.2147*** | 0.2414 |
| | (0.0714) | (0.0713) | (0.1774) | (0.0710) | (0.0709) | (0.1769) | (0.0721) | (0.0719) | (0.1773) |
| **HOME STATE** | 0.1669* | 0.1795** | 0.1340 | 0.1685** | 0.1811** | 0.1349 | 0.1659** | 0.1792** | 0.1380 |
| | (0.0853) | (0.0811) | (0.1902) | (0.0852) | (0.0810) | (0.1901) | (0.0846) | (0.0800) | (0.1882) |
| **Year FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **No. of obs** | 456 | 456 | 456 | 456 | 456 | 456 | 456 | 456 | 456 |
| **R2** | 0.5291 | 0.4728 | 0.4404 | 0.5304 | 0.4743 | 0.4404 | 0.5320 | 0.4770 | 0.4404 |

This table reports the results of cross-sectional regression based on Equation (7). The dependent variable is log of price (**PRICE**), log of NOI (**NOI**) or cap rate (**CAP**). **SPEC_NHBRHD** is the building's neighborhood specialization measured by the number of employees of the building's largest tenant's sector in the zip code area divided by the

total number of employees in the nation who work in the same industry. **LSECT_BLDG** is the number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area. **ATENANT_BLDG** is share of the anchor tenant in the building. There are three levels of threshold based on the occupied rental space to define the anchor tenant, i.e., 50% means only when the largest tenant occupies more than 50% of the building space, we consider it as an anchor tenant. 100% means the building is occupied by one single tenant. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). Transaction year, REIT firm and MSA fixed effects are included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

**Table 8 Control for the share of tenants in the same industry as the anchor tenant**

| Dependent Variable | PRICE | NOI | CAP | PRICE | NOI | CAP | PRICE | NOI | CAP |
|---|---|---|---|---|---|---|---|---|---|
| | | >0% | | | >50% | | | =100% | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **SPEC_NHBRHD** | 2.1487*** | 1.7390** | -3.3874 | 2.0690*** | 1.6693** | -3.3148 | 2.1452*** | 1.7419** | -3.3325 |
| | (0.6366) | (0.6904) | (2.6303) | (0.6397) | (0.7085) | (2.5986) | (0.6336) | (0.6913) | (2.6089) |
| **LSECT_BLDG_** | 0.3495 | 0.3092 | -0.3264 | 0.2688 | 0.2520 | -0.1435 | 0.1928 | 0.1800 | -0.1429 |
| **NHBRHD** | (0.2969) | (0.2926) | (0.7508) | (0.2897) | (0.2882) | (0.7829) | (0.2882) | (0.2844) | (0.7798) |
| **ATENANT_BLDG** | 0.2308* | 0.2347* | 0.0327 | 0.2252** | 0.2180** | -0.0450 | 0.1696** | 0.1637** | -0.0727 |
| | (0.1392) | (0.1337) | (0.2636) | (0.1030) | (0.0990) | (0.1921) | (0.0808) | (0.0788) | (0.1851) |
| **TENANT_ATENANT_** | -0.3378* | -0.2306 | 0.8031 | -0.3175 | -0.1912 | 1.1067 | | | |
| **BLDG** | (0.1852) | (0.1767) | (0.5116) | (0.5985) | (0.5879) | (1.8294) | | | |
| **Control Variables** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Year FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **No. of obs** | 456 | 456 | 456 | 456 | 456 | 456 | 456 | 456 | 456 |
| **R2** | 0.5320 | 0.4744 | 0.4438 | 0.5306 | 0.4744 | 0.4410 | 0.5289 | 0.4722 | 0.4421 |

This table reports the results of cross-sectional regression based on Equation (7). The dependent variable is log of price (**PRICE**), log of NOI (**NOI**) or cap rate (**CAP**). **SPEC_NHBRHD** is the building's neighborhood specialization measured by the number of employees of the building's largest tenant's sector in the zip code area divided by the total number of employees in the nation who work in the same industry. **LSECT_BLDG** is the number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area. **ATENANT_BLDG** is share of the anchor tenant in the building. There are three levels of threshold based on the occupied rental space to define the anchor tenant, i.e., 50% means only when the largest tenant occupies more than 50% of the building space, we consider it as an anchor tenant. 100% means the building is occupied by one single tenant. **TENANT_ATENANT_BLDG** is the share of tenants in the Anchor tenant's sector. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). Transaction year, REIT firm and MSA fixed effects are included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

**Table 9 Control for Tenant Size**

| Dependent Variable | PRICE | NOI | CAP | PRICE | NOI | CAP | PRICE | NOI | CAP |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **HHI_NHBRHD** | 2.0200* | 1.7665* | -1.1771 | | | | 1.3188 | 0.9980 | -0.9920 |
| | (1.0452) | (0.9854) | (2.8285) | | | | (1.1469) | (1.0841) | (3.3629) |
| **HHI_TENANT** | 0.3820*** | 0.3774*** | -0.0396 | | | | 0.3749*** | 0.3705*** | -0.0407 |
| | (0.1368) | (0.1342) | (0.3966) | | | | (0.1368) | (0.1352) | (0.3981) |
| **SPEC_NHBRHD** | | | | 1.8842*** | 1.9350*** | -0.2681 | 1.6792*** | 1.7564*** | -0.1791 |
| | | | | (0.5669) | (0.5645) | (1.3900) | (0.5583) | (0.5546) | (1.4405) |
| **LSECT_BLDG_** | | | | 0.3299 | 0.3238 | -0.2393 | 0.2001 | 0.2372 | -0.1092 |
| **NHBRHD** | | | | (0.3392) | (0.3477) | (0.8518) | (0.3736) | (0.3891) | (1.0166) |
| **TENANT SIZE** | -0.0168 | -0.0150 | 0.0304 | -0.0066 | -0.0051 | 0.0280 | -0.0167 | -0.0148 | 0.0301 |
| | (0.0141) | (0.0129) | (0.0420) | (0.0149) | (0.0138) | (0.0451) | (0.0140) | (0.0129) | (0.0415) |
| **Control Variables** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Year FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **No. of obs** | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 |
| **R2** | 0.6952 | 0.6387 | 0.5806 | 0.6909 | 0.6358 | 0.5804 | 0.7025 | 0.6483 | 0.5806 |

This table reports the results of cross-sectional regression based on Equation (7). The dependent variable is log of price (**PRICE**), log of NOI (**NOI**) or cap rate (**CAP**). **SPEC_NHBRHD** is the building's neighborhood specialization measured by the number of employees of the building's largest tenant's sector in the zip code area divided by the total number of employees in the nation who work in the same industry. **LSECT_BLDG** is the number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area. **HHI_NHBRHD** is the industry concentration of the zip code area where the building locates. **HHI_TENANT** is the concentration of tenants' industry. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). Transaction year, REIT firm and MSA fixed effects are included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively

**Table 10 Industry Concentration and Abnormal Return**

| | Acquisition CAR(0,+1) | Disposition CAR(0,+1) | Acquisition CAR(0,+1) | Disposition CAR(0,+1) |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **HHI_NHBRHD** | 0.0855 | -0.0091 | | |
| | (0.0880) | (0.0292) | | |
| **HHI_TENANT** | 0.0154*** | -0.0148*** | | |
| | (0.0050) | (0.0054) | | |
| **SPEC_NHBRHD** | | | 0.0358** | 0.0274 |
| | | | (0.0156) | (0.0359) |
| **Size** | -0.0011 | -0.0034 | -0.0011 | -0.0044* |
| | (0.0026) | (0.0024) | (0.0025) | (0.0026) |
| **Age** | 0.0010 | -0.0028 | 0.0007 | -0.0027 |
| | (0.0023) | (0.0021) | (0.0024) | (0.0021) |
| **SIZE_NHBRHD** | 0.0038 | -0.0005 | -0.0002 | -0.0009 |
| | (0.0034) | (0.0014) | (0.0027) | (0.0011) |
| **STORY_BLDG** | 0.0042** | 0.0000 | 0.0014 | 0.0026 |
| | (0.0019) | (0.0021) | (0.0016) | (0.0021) |
| **QUALITY_BLDG** | 0.0040 | 0.0008 | 0.0045* | 0.0011 |
| | (0.0028) | (0.0028) | (0.0027) | (0.0030) |
| **ECO_BLDG** | -0.0004 | -0.0053* | -0.0008 | -0.0059* |
| | (0.0025) | (0.0032) | (0.0028) | (0.0034) |
| **TRANS_NHBRHD** | 0.0019 | -0.0011 | 0.0036 | -0.0009 |
| | (0.0022) | (0.0018) | (0.0024) | (0.0017) |
| **SUBURBAN** | 0.0065 | -0.0104*** | 0.0055 | -0.0066* |
| | (0.0064) | (0.0038) | (0.0047) | (0.0034) |
| **HOME STATE** | -0.0053 | 0.0066** | -0.0054 | 0.0058* |
| | (0.0041) | (0.0030) | (0.0034) | (0.0030) |
| **REIT SIZE** | 0.0012 | 0.0006 | 0.0002 | 0.0014 |
| | (0.0037) | (0.0052) | (0.0036) | (0.0056) |
| **REIT LEV** | 0.0025 | 0.0039 | -0.0087 | 0.0021 |
| | (0.0101) | (0.0038) | (0.0129) | (0.0038) |
| **REIT P/B** | -0.0006 | 0.0003 | 0.0001 | 0.0040 |
| | (0.0048) | (0.0033) | (0.0045) | (0.0031) |
| **Year FE** | Yes | Yes | Yes | Yes |
| **Firm FE** | Yes | Yes | Yes | Yes |
| **MSA FE** | Yes | Yes | Yes | Yes |
| No. of obs | 68 | 158 | 68 | 158 |
| R2 | 0.5726 | 0.2858 | 0.5391 | 0.2319 |

Note: This table reports the results of cross-sectional regression based on Equations (12) and (13). The dependent variable is abnormal return of a REIT over a one-day event window after the acquisition and disposition of an office building. **SPEC_NHBRHD** is the building's neighborhood specialization measured by the number of employees of the building's largest tenant's sector in the zip code area divided by the total number of employees in the nation who work in the same industry. **LSECT_BLDG** is the number of employees in the building's largest industry in the zip code area as a share of total number of employees in the zip code area. **HHI_NHBRHD** is the industry concentration of the zip code area where the building locates. **HHI_TENANT** is the concentration of tenants' industry. Control variables include property size (**SIZE_BLDG**), property age (**AGE_BLDG**), number of floors (**STORY_BLDG**), quality classification of the building (**QUALITY_BLDG**), eco-label of the building (**ECO_BLDG**), neighborhood size measured by total employment in the zip code area where the property locates (**SIZE_NHBRHD**), transport facility (**TRANS_NHBRHD**), being in the suburban area (**SUBURBAN**), and a dummy for whether the building locates in the home MSA of the REIT (**HOME**). REIT market capitalization (**REIT SIZE**), leverage (**REIT LEV**)

and price-to-book ratio (**REIT P/B**) are included. Transaction year, REIT firm and MSA fixed effects are also included. Standard errors are reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

**Table 11 Industry Concentration and Abnormal Return over Different Event Windows**

| | Acquisition | | | Disposition | | |
|---|---|---|---|---|---|---|
| | ***HHI_ NHBRHD*** | ***HHI_ TENANT*** | ***SPEC_ NHBRHD*** | ***HHI_ NHBRHD*** | ***HHI_ TENANT*** | ***SPEC_ NHBRHD*** |
| ***-28,+28*** | -0.7410 | 0.0107 | 0.1546 | -0.0087 | -0.0025 | -0.2489 |
| | (0.4892) | (0.0513) | (0.0971) | (0.1733) | (0.0235) | (0.2082) |
| ***-14;+14*** | 0.1717 | -0.0050 | 0.1412* | 0.1331 | -0.0174 | -0.2121 |
| | (0.3498) | (0.0398) | (0.0733) | (0.1654) | (0.0247) | (0.1881) |
| ***-7;+7*** | 0.0389 | 0.0109 | 0.1479*** | 0.1807* | -0.0173 | -0.0632 |
| | (0.3244) | (0.0225) | (0.0491) | (0.0967) | (0.0153) | (0.1245) |
| ***-3;+3*** | 0.0186 | 0.0073 | 0.0046 | 0.0871 | -0.0234*** | 0.0333 |
| | (0.1919) | (0.0111) | (0.0362) | (0.0785) | (0.0089) | (0.0832) |
| ***-1;+1*** | 0.0542 | 0.0033 | 0.0126 | -0.0106 | -0.0180*** | 0.0539 |
| | (0.1134) | (0.0068) | (0.0183) | (0.0439) | (0.0068) | (0.0459) |
| ***0;+1*** | 0.0855 | 0.0154*** | 0.0358** | -0.0091 | -0.0148*** | 0.0274 |
| | (0.0880) | (0.0050) | (0.0156) | (0.0292) | (0.0054) | (0.0359) |
| ***0; +3*** | 0.0274 | 0.0150 | -0.0183 | 0.0339 | -0.0191** | 0.0428 |
| | (0.1143) | (0.0117) | (0.0320) | (0.0515) | (0.0075) | (0.0702) |
| ***0; +7*** | -0.2937 | 0.0216 | 0.0042 | 0.1188 | -0.0157 | 0.0322 |
| | (0.1926) | (0.0193) | (0.0397) | (0.0759) | (0.0104) | (0.0880) |
| ***0; +14*** | -0.5188 | 0.0278 | 0.0795 | 0.0155 | -0.0244 | -0.0361 |
| | (0.3891) | (0.0303) | (0.0756) | (0.1190) | (0.0171) | (0.1425) |
| ***0; +28*** | -0.4606 | 0.0290 | 0.0518 | 0.0429 | 0.0003 | -0.1407 |
| | (0.4279) | (0.0331) | (0.0836) | (0.1370) | (0.0203) | (0.1783) |

Note: This table reports abnormal returns over various event windows, including 57 trading day (D1=-28, D2=28), 29 trading days (D1=-28, D2=+28), 15 trading days (D1=-7, D2=+7), 7 trading days (D1=-3, D2=+3), 3 trading days (D1=-1, D2=+1), 1 trading day (D1=0, D2=+1), 4 trading days (D1=0, D2=+3), 8 trading days (D1=0, D2=+7), 15 trading days (D1=0, D2=+14) and 29 trading days (D1=0, D2=28).

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