**Does Work Performance Design Impact Value?**
**Linking Design Metrics to Financial Performance in Cities**

by

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# Abstract

For commercial office space, design has the potential to enhance employee productivity by developing spaces that support invention, creation and execution. However, there is limited evidence on whether enhancing design leads to real estate financial performance that can support or justify the use of design intervention in the first place. To measure this impact, we match an occupancy design proxy, Gensler's Work Performance Index (WPISM), to rental contracts in NYC over the 2005 to 2017 period. We find that spaces with below average Work Performance Index scores experience a statistically and economically significant discount in the marketplace of 10 percent per square foot or about $5.50 PSF, relative to a control sample of rental contracts within the same building. Our results provide the first analysis to link design metrics like occupancy analysis to financial performance, which helps negotiate differences between architectural design practice and the real estate community.

# 1. Introduction

Today, organizations look at workplaces less as utility and more as a series of experiences that focus on physical, cultural and technological dimensions (Morgan, 2015). Employee expectations about workplaces, specifically in today's connected and wired spaces, have evolved to respond to the current nature of work - one that calls for increased integration of different expertises supported by a mix of personal and virtual exchanges. At the same time, real estate's role goes beyond operating assets for cost efficiency, but for enhancing strategic resources contributing to organizational performance (Riratanaphong, 2014). In this way, it is in the best interest of corporate and institutional investors to create workplaces that support improved employee performance, which in turn results in better business outcomes for firms, and rent rolls alike.

Workplaces can be defined in terms of both physical as well as behavioral dimensions. Studies have shown that appropriately designed workplaces can result in employees becoming more engaged, satisfied, happy, and healthy (Wells, 2000; Roelfson, 2002; Pech and Slade, 2006). Research has also shown that employees' comfort on the job, determined by workplace conditions and the environment, can be an important factor for measuring their productivity (Leblebici, 2012; Mendis, 2016). Recent interior design (Gensler, 2016) and furniture industry (Steelcase, 2017) led studies have illuminated the links between workplace design, employee engagement and work performance. Moreover, in the service sector economy in which job growth is driven by knowledge-based businesses, there is evidence of scarcity of talent (Bessen, 2014; Mullaney et al, 2016). One can argue that workplace design has enormous importance and provides long term value towards a firm's success when attracting and retaining talent; corporate real estate officers are unsure of claims suggesting that investing in good workplace design can lead to business success; and as Miller (2016) suggests, landlords or institutional investors are in the business of marketing productivity and the more productive their spaces are, the more rents they can demand. Thereby, it is important for owner occupiers, landlords (or developers) to understand the link between design interventions and financial performance.

Yet, the direct connection between workplace environment and work performance is difficult to quantify. Different components that drive an employee's overall work experience and satisfaction are important tell-tale signs. Industry surveys have shown that the physical workplace environment is intimately linked to other dimensions of "workplace experience" such as social interactions, productivity, employee health and wellbeing.  Work performance benchmarks like Gensler's WPISM, Leesman's Lmi and Steelcase's Employee Engagement and Global Workplace metrics use a combination of physical and well-being dimensions in addition to now accepted employee performance drivers like motivation, satisfaction, engagement, etc. to measure workplace performance feedback. Leesman, Gensler and Steelcase use different approaches towards measuring workplace performance. While Steelcase's approach has employee engagement in the workplace as its focus, Gensler finds high value in spaces that fostered innovation and collaboration. Leesman, meanwhile, found data that supported the notion that workplace designs that supported varied workplace activities increased staff collaboration, productivity, pride and effectiveness. On the other hand, all three approaches agree that organizations are successful when their workplace design and environment promote collaboration, choice and control over how and where employees work.

Limited work has been done on exploring the correlations between financial performance and design that impacts the workplace environment. This study's main objective is to explore the correlation between workplace design that support higher workplace performance and its financial value. i.e., if workplaces are designed to a high employee performance measure like Gensler's Workplace Index (WPISM), do they result in higher financial outcomes as exhibited by higher effective rental rates? In this way, our study aims to document the impact of occupancy experiences and workplace design with the financial performance of buildings as measured by effective rents. Our objective is not to learn the drivers of workplace design that correlate with value, but rather to understand whether there is a financial incentive to invest in productive, healthy and engaging spaces.

To identify correlations between design and financial performance in real estate, we link Gensler's Workplace Performance Index (WPISM) scores on individual spaces to CompStak's database of Manhattan effective rents over the 2005 to 2015 period. Importantly, we identify spaces that have been "treated" or scored through the Workplace Performance Survey. For NYC, we have 139 buildings that have spaces within them that have a WPISM score and effective rent contracts. In total, this leads to 1,137 leases, of those leases 70 have WPISM scores broken down across quantiles - above average, average and below average and the remaining same building effective rent contracts are used as the control sample. This data is then used in a quasi-natural experiment regression model, where the within building treatment and control identification strategy is meant to tease out any building or neighborhood fixed effects that impact the whole of the building. In turn, remaining variation in effective rents per square foot

could be explained by variation in tenant quality, contract features or work performance design our variable of interest.

Results of this analysis suggest that spaces that have below average WPI scores, earn effective rents that are 10 percent or $5.50 psf less than a comparable rented space within the same building's control group. This signals that spaces that are not competitively designed for workplace performance receive a discount as measured by effective rents in the marketplace.

This study is the first to link building design metrics to incremental value as measured by rental performance in the real estate market. The study hopes to explore the economic impact of workplace performance by linking post-occupancy analysis to financial performance. This is a key contribution towards linking the architectural and real estate finance fields and thus build a precedent for the developer and architectural communities to communicate more effectively. What these findings show is that good design is a prerequisite in office markets of NYC today. Furthermore, as new office products come on-line there will be more attention to higher levels of design that support innovation. Thus, these results document a correlation between design and financial performance.

# 2. Workplace Design & Employee Performance

## 2.1 Evidence of Workplace Performance

The design of workplace environments has increasingly become less about achieving cost efficiency and more about increasing employee satisfaction and productivity. This is not surprising considering that employee related costs are very high compared to those related to corporate real estate. The physical design and layout of workplaces have undergone seismic changes in the last three decades. Organizations have gone from preferring cubicles to open space planning to shared workspaces and touchdown spaces. This change reflects the new realities in organizational dynamics and workplace expectations. Workplace design that can promote social networks, support spatial flexibility and interaction among employees is currently more valued.  The underlying objective is to increase workplace performance, while keeping the workplace related costs down.

Human capital is intrinsic to the financial performance of an organization (Koch and McGrath, 1996). Though it is easy to assume that employee compensation can be the most important motivation for employee performance, it has only a limited short term effect (Ryan and Deci, 2000). The more satisfied employees are with their jobs, the better probability for the company to increase profitability and productivity (Patterson et al., 2003). Because of the intimate relationship between work, the workplace and the tools of work, the work place is an integral part of work itself (Chandrasekar, 2011).

Numerous studies have documented the important role that corporate real estate plays in contributing to organizational performance (De Vries et al., 2008; Lindholm, 2006; Jensen et al., 2012). Others have noted that the physical layout of the workspace, when complemented by efficient management processes, plays a major role in boosting employees' productivity and improved organizational performance (Leaman and Bordass, 1993; Uzee, 1999).  In one study,

design improvements to workplace was found to increase employee performance by 5% to 10% (Brill, 1990). ) Another found that Workplaces that experience an improvement in job satisfaction also experience a related improvement in performance (Bryson et al., 2014). Riratanphong (2014) found that measuring employee satisfaction of the work environment can be used as a means to measure organizational performance.

The relationship between employees' perception of organizational behavior including workplace rules, tasks, seating arrangement, etc. and productivity are also pertinent. When employees are more in control over decisions affecting their work, it can enhance physical health and performance (Karasek & Theorell, 1990). Workplace interaction was perceived to have the most positive effect on productivity while distraction was perceived to be mostly negative (Haynes, 2008). Rather perceptively, Stallworth and Kleiner (1996) argued that innovative workspaces will need to encourage sharing of information and networking while at the same time reducing organizational role boundaries by allowing free cross-departmental communication.

Appropriate and supportive work conditions have been shown to produce not only greater employee commitment, retention and productivity (Weiss, 1999; Wise, Darling-Hammond and Berry, 1987) but also job satisfaction and perception of fairness of pay (Bockerman and Ilmakunnas, 2006). Workplace environment was also found to affect employee safety perceptions, which in turn could impact employee commitment Gyekye (2006). This validates findings that improving working environment results in reduced employee complaints and absenteeism, leading to increased productivity (Mohr, 1996; Gyeke, 2006).

Finally, why does design of the work place even matter when it comes to employee performance? In today's expanding economy in which job growth is driven by knowledge-based businesses there is evidence of scarcity of talent (Bessen, 2014; Mullaney et al, 2016). In such a scenario, companies can differentiate themselves by providing workplaces that not only attract new talent, but also help retain talent. It follows that companies that invest in spaces that cater to unique workplace experience will be more profitable and productive. The direct connection between workplace environment and work performance is difficult to quantify. However, different components that drive an employee's overall work experience and satisfaction are important tell-tale signs. Corporate real estate has become more than an operational asset -it is a strategic resource contributing to an organization performance. Workplaces today should not only be cost effective, but also support employee satisfaction, performance and productivity. And as Miller (2016) suggests, landlords are in the business of marketing productivity and the more productive their spaces are, the more rents they can demand.

## 2.2 Workplace Performance Benchmarks

There are three primary Workplace Performance Benchmarks by Steelcase, Gensler and Leesman. Steelcase, a US-based global leader in office furniture, developed the Employee Engagement and Global Workplace Study with the global research firm Ipsos to measure relevant dimensions of employee engagement and workplace satisfaction. Using a consistent Work Performance Indicator (WPI[SM]) survey, Gensler has been able to develop a database that represents hundreds of companies and the responses of thousands of employees across key industry sectors and thier pre- and post-occupancy experiences across the globe. Lastly in 2010, the Leesman Index launched a workplace effectiveness measurement benchmark based on data gathered from corporate workplaces in 63 countries, but primarily the UK.

The Steelcase study spanned 17 countries, 12,480 participants and produced 5 key findings.In order to understand how workplaces impact employee engagement, the study posed the following questions: "*Can the office be used as a strategic lever to impact engagement?*" *and "What kinds of changes to the work environment will make the biggest impact?". Results suggest that* employee engagement positively correlates with workplace satisfaction; engaged employees have more control over their experiences at work; fixed technology exceeds use of mobile technology by a ratio of 2:1; traditional work-styles still persist, with 2/3rds employees working in their individual or shared private offices; and the cultural context influences engagement levels -employees in developed countries were less engaged.

Gensler US Workplace Survey 2016 is the most recent installment of a 10-year Workplace Survey research effort. Using its proprietary Workplace Performance Index (WPI[SM]) online survey tool, a panel-based sample of over 4,000 US workers in 11 industries were surveyed. The survey provides critical insights on "how and where work is happening today, how effectively the workplace supports that work, and how the workplace environment impacts overall employee experience" (Gensler, 2017). Gensler's 2016 survey data uncovers a statistical link between the quality and functional makeup of the workplace, and the level of innovation employees ascribe to their companies. Moreover, the analysis identified innovation as a primary measure of employee performance. Gensler has also quantified the collected data to give workplaces an innovation score. Workplaces with high WPI[SM] scores also have higher innovation scores. Innovators are more autonomous at work, better able to work in the places and ways that suit them best and in a variety of their spaces.

At the heart of Leesman's analysis is the Leesman Lmi, a 'functionality and effectiveness' score which is calculated using the Leesman Index On-line Questionnaire completed by employees. The index measures workplace activities in addition to the physical features and the facilities and services that supports these activities. Because the Lmi score is standardized,

employers using the Leesman index can be used to compare effectiveness across workplaces across their different locations. The Leesman Lmi is calculated using two areas of analysis, namely Workplace Impact (the overall impact the workplace has on employee sense of pride, productivity, community, etc,) and Work Activities (which activities are important to an employee in their role and how well each is supported). A score is then reported on a simple 0-100 scale. The Index measures the performance of office environments based on four questions related to design, activity, physical features and service features.

Leesman, Gensler and Steelcase use slightly different approaches towards measuring workplace performance. While Steelcase's approach has employee engagement in the workplace as its focus, Gensler finds high value in spaces that fostered innovation and collaboration. Leesman, meanwhile, found data that supported the notion that workplace designs that supported varied workplace activities increased staff collaboration, productivity, pride and effectiveness. On the other hand, all three approaches also seems to agree that organizations are successful when their workplace design and environment promote collaboration, choice and control over how and where employees work.

# 3: Data for linking Design to Financial Performance

We geocode and address match Gensler Workplace Performance Index (WPI[SM]) data and CompStak[1] effective rent contract data for the New York City market.[2]  Analysis is executed for New York City (NYC) because of NYC's status as the premier commercial real estate market in the US in terms of capital market wealth, cross-border capital movement, global financial stability and financial market power (Sassen, 2001; Coe and Jones, 2010).

Gensler's WPI[SM] is an occupancy evaluation tool that scores workplaces based on the level of employee workplace performance that those spaces support. Gensler surveys annually a sample of over 4,000 U.S., 1,200 UK and 2,000 Asian office workers in 11 industries using their proprietary WPI[SM] platform, an online survey tool, which is built upon a core set of validated questions gauging workplace effectiveness and functionality that have been used and refined over the past 10 years.[3]  The survey analysis results in each space being given a WPI Score. CompStak uses a crowd-sourced model to gather real estate information that is generally hard to source, difficult to compile, or otherwise unavailable. On the CompStak Exchange platform, brokers, landlords, appraisers and researchers submit comps on completed commercial lease transactions. As a result, CompStak is able to build a continuously updated comprehensive database of all of the commercial lease deals completed in a given market[4].

1  CompStak is privately held and venture backed CRE data company founded in 2011 by former NYC broker Michael Mandel

2  Both datasets were shared by the respective companies with MIT's Real Estate Innovation Lab (REIL), which in turn shared the data with the study proponents.

3  Respondents represented all generations and roles in the workplace, companies of various sizes geographically spread across the U.S

4  In order to ensure accuracy, CompStak verifies the data submitted by contributors in the following different ways: A team of research analysts reviews and verifies every comp before it is uploaded into the CompStak database. Every member on CompStak Exchange is screened to verify his/her credentials, thus building a network of trusted users whose data quality is tracked over time. Machine learning algorithms with Statistical Anomaly Detection are used to flag comps containing suspicious information. CompStak analysts then review the flagged comps to ensure data quality. CompStak, on average, receives the same comp seven (7) times. Every submission is used as an opportunity review and refine the comp.
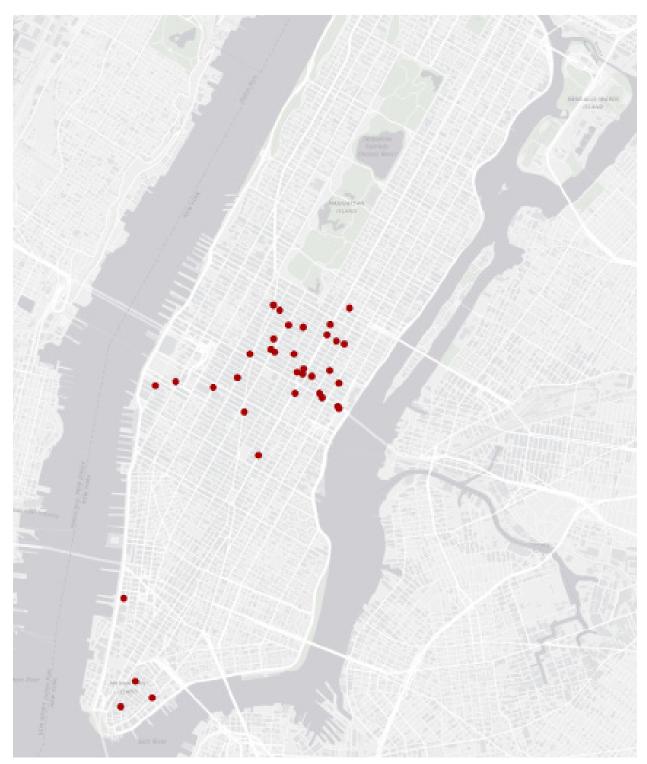
**Figure 3.1:** Location of Leases in sample set in Manhattan

Figure 3.1 illustrates the 139 building locations for the sample across 15 Manhattan submarkets in which our sample set of 1,137 leases are located.

**Table 3.1:** Descriptive Statistics (Frequency Distribution)

| | | (a) Treated Group | | (b) Control Group | |
|---|---|---|---|---|---|
| | Variable | Percentage | N | Percentage | N |
| | **Observations** | | **70** | | **1067** |
| Interest Variable | **WPI Score* (percentage)** | | | | |
| | Below Average Performing Workplaces | 10.00 | 7 | | |
| | Average Performing Workplaces | 57.14 | 40 | | |
| | Top Performing Workplaces | 25.71 | 18 | | |
| Market Characteristics | **Submarket** | | | | |
| | Chelsea | 1.43 | 1 | 0.56 | 6 |
| | City Hall Insurance | 2.86 | 2 | 1.78 | 19 |
| | Columbus Circle | 4.29 | 3 | 7.12 | 76 |
| | Financial District | 2.86 | 2 | 2.53 | 27 |
| | Gramercy Park Union Square | 2.86 | 2 | 0.75 | 8 |
| | Grand Central | 10.00 | 7 | 11.62 | 124 |
| | Hudson Yards | 1.43 | 1 | 0.28 | 3 |
| | Madison/Fifth Avenue | 4.29 | 3 | 5.06 | 54 |
| | Midtown Eastside | 18.57 | 13 | 13.12 | 140 |
| | Park Avenue | 15.71 | 11 | 31.68 | 338 |
| | Penn Station | 5.71 | 4 | 6.75 | 72 |
| | Sixth Avenue | 17.14 | 12 | 14.71 | 157 |
| | Times Square | 5.71 | 4 | 3.00 | 32 |
| | UN Plaza | 7.14 | 5 | 1.03 | 11 |
| | **Lease Commencement Date (percentage)** | | | | |
| | 2005 or before | 12.86 | 9 | 15.28 | 163 |
| | 2006 - 2010 | 32.86 | 23 | 32.33 | 345 |
| | 2011 - 2015 | 38.57 | 27 | 40.96 | 437 |
| | After 2015 | 15.71 | 11 | 11.43 | 122 |
| Building Characteristics | **Building Age (percentage)** | | | | |
| | Less than 30 yrs old | 14.29 | 10 | 11.43 | 122 |
| | 30 - 60 yrs old | 65.71 | 46 | 63.07 | 673 |
| | 60 - 90 yrs old | 10.00 | 7 | 19.31 | 206 |
| | More than 90 yrs old | 10.00 | 7 | 6.19 | 66 |

| | Variable | (a) Treated Group | | (b) Control Group | |
|---|---|---|---|---|---|
| | | Percentage | N | Percentage | N |
| | **Observations** | | **70** | | **1067** |
| **Building Characteristics** | **Building Renovation Year (percentage)** | | | | |
| | 2000 or Before | 25.71 | 18 | 20.43 | 218 |
| | Between 2001 - 2005 | 14.29 | 10 | 16.78 | 179 |
| | Between 2006 - 2010 | 14.29 | 10 | 11.15 | 119 |
| | After 2011 | 20.00 | 14 | 32.43 | 346 |
| **Tenant Characteristics** | **Tenant Industry (percentage)** | | | | |
| | Finance | 27.14 | 19 | 43.21 | 461 |
| | Government | 2.86 | 2 | 0.94 | 10 |
| | Healthcare | 14.29 | 10 | 2.44 | 26 |
| | Media | 1.43 | 1 | 5.90 | 63 |
| | Non-Profit | 2.86 | 2 | 2.91 | 31 |
| | Products | 5.71 | 4 | 2.62 | 28 |
| | Service | 40.00 | 28 | 26.05 | 278 |
| | Technology | 5.71 | 4 | 6.65 | 71 |
| | Retail | | | 3.00 | 32 |
| | Other** | | | 6.28 | 67 |
| **Lease Characteristics** | **Type of Transaction (percentage)** | | | | |
| | Lease Expansion | 17.14 | 12 | 10.31 | 110 |
| | New Lease | 54.29 | 38 | 61.76 | 659 |
| | Lease Renewal | 18.57 | 13 | 15.75 | 168 |
| | Lease Renewal/Expansion | 1.43 | 1 | 1.22 | 13 |
| | **Transaction Size (percentage)** | | | | |
| | Under 10,000sqf | 7.14 | 5 | 36.08 | 385 |
| | 10,000sqf - 25,000sqf | 31.43 | 22 | 32.80 | 350 |
| | 25,000sqf - 50,000sqf | 20.00 | 14 | 17.62 | 188 |
| | Over 50,000sqf | 41.43 | 29 | 13.50 | 144 |
| | **Floors Occupied (percentage)** | | | | |
| | Partial Floor | 18.57 | 13 | 45.17 | 482 |
| | 1 Floor | 30.00 | 21 | 39.36 | 420 |
| | Between 2 - 5 Floors | 35.71 | 25 | 13.87 | 148 |
| | More than 5 Floors | 15.71 | 11 | 1.59 | 17 |

| | | (a) Treated Group | | (b) Control Group | |
|---|---|---|---|---|---|
| | Variable | Percentage | N | Percentage | N |
| | **Observations** | | **70** | | **1067** |
| Lease Characteristics | **Rent-free Period (percentage)** | | | | |
| | Less than 6 months free | 47.14 | 33 | 61.29 | 654 |
| | 6 - 12 months free | 28.57 | 20 | 26.90 | 287 |
| | 13 - 18 months free | 14.29 | 10 | 7.12 | 76 |
| | 19 - 24 months free | 4.29 | 3 | 0.75 | 8 |
| | **Lease Term (percentage)** | | | | |
| | 5yrs or less | 17.14 | 12 | 23.43 | 250 |
| | 6 - 10yrs | 12.86 | 9 | 31.12 | 332 |
| | 11 - 15yrs | 40.00 | 28 | 33.83 | 361 |
| | 16 - 20yrs | 24.29 | 17 | 10.12 | 108 |
| | More than 20yrs | 5.71 | 4 | 1.50 | 16 |

Notes: Table 3.1 highlights the characteristics of the different variables including the variable of interest (WPI Score), and the independent variables including those related to hedonic, market, tenant and contract, for both WPI score eligible (Treated Group) and the non-WPI scored leases (Control Group). *WPI Score is divided into three categories, based on scores below 55, between 55 and 70, and above 70. The independent variables were divided into categories of equitable ranges. **Within Tenant Industry, 'others' includes real estate, education, entertainment, hospitality, fitness, etc.

## 3.1 Descriptive Statistics

The data set analyzed contains a sample of 1,137 Manhattan lease transactions, of which 70 are WPI-treated and 1,067 do not have a WPI score. This was created by merging two data sources. We used Compstak's Manhattan transaction database for leases from 2005 to 2017 as our base data source for both treated and non-treated samples. The database provides information for each lease transaction including tenant name, landlord brokerage firm, building age, location, lease length, lease type and effective rent, etc. Next, we used Gensler's Workplace Performance Index database for Manhattan (139 buildings) to identify the treated sample of Manhattan spaces and their leases. We matched the WPI- treated database including their building location, tenant name and lease commencement date with CompStak to obtain a cross-section of 1,137 leases in these 139 buildings. Uniquely, the sample represents a building-matched treatment and control sample of leases where the variation from building and location are controlled for through building fixed-effects.[5]

5  Of course, we would be interested in understanding to what extent this sample of leases is representative to the greater Manhattan sample of leases, in this case, we have matched our sample across all independent and dependent variables, and the sample statistics are comparable. These statistics are available upon request.

**Table 3.2:** Descriptive Statistics (Mean and SD)

| Variable | (a) Treated Group | | | | (b) Control Group | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Min | Max | N | Mean | Min | Max | N |
| Average WPI* Score | 63.39 | 38.24 | 93.10 | 65 | | | | |
| | (8.57) | | | | | | | |
| Group Effective Rents** (ER) | 56.79 | 14.25 | 124.72 | 70 | 56.24 | 4.50 | 278.61 | 1067 |
| ($ psf) | (24.24) | | | | (23.11) | | | |
| Top Performing Eff. Rents | 72.40 | 20.83 | 124.72 | 18 | | | | |
| ($ psf) | (27.17) | | | | | | | |
| Avg. Performing Eff. Rents | 50.59 | 14.25 | 96.08 | 40 | | | | |
| ($ psf) | (19.76) | | | | | | | |
| Below Avg. Eff. Rents | 40.94 | 32.31 | 47.78 | 7 | | | | |
| ($ psf) | (5.51) | | | | | | | |
| Transaction Size | 105,209 | 1,481 | 1,869,752 | 70 | 30,087 | 129 | 650,008 | 1067 |
| (sq.ft) | (234566) | | | | (54869) | | | |
| Rent-free Period | 6.39 | 0 | 19 | 70 | 4.57 | 0 | 24 | 1067 |
| (months) | (5.10) | | | | (4.06) | | | |
| Lease Term | 10.67 | 1 | 21 | 70 | 8.19 | 1 | 38 | 1067 |
| (years) | (4.97) | | | | (4.46) | | | |

Notes: Table 3.2 highlights the Mean and SD of the different variables including the variable of interest (WPI Score), and the independent variables including those related to hedonic, market, tenant and contract, for both WPI score eligible (Treated Group) and the non-WPI scored leases (Control Group). *We have 65 WPI Scores out of a set of 70 WPI-eligible sample set. **WPI eligible set is divided into three categories, based on scores below 55 (Below Average Performing Effective Rents), between 55 and 70 (Average Performing Effective Rents), and above 70 (Top Performing Effective Rents). Standard deviation is in parenthesis.

### 3.1.1 Effective Rents

We analyzed the sample set of the effective rents in leases, which is calculated after accounting for lease term, lease schedule and rent-free period. For the control sample of 1,067 leases, we found an average effective rent of $ 56.24 psf with a SD of $ 23.11 psf. The lowest effective rent was $ 4.50 psf and the maximum was $ 278.61 psf. Out of 70 WPI-eligible observations, we had an average effective rent of $ 56.80 per square feet (psf) with a SD of $ 24.24. The lowest effective rent was $ 14.25 psf and the maximum was $124.72 psf. The average effective rent for Below Average Performing (7) leases was $ 40.94 psf with SD of $ 5.51 psf. However, the average effective rent for combined set of Average Performing (40) leases and Top Performing (23) leases was $ 58.55 psf with SD of $ 24.89 psf, which jumps to $ 72.40 with a SD of $ 27.17 psf when only the Top Performing WPI scores (23 leases) were considered.

### 3.1.2 WPI Scores

We matched sixty-five (65) WPI scores out of a set of 125 WPI scored spaces[6]. We then used these 65 lease contracts and their characteristics as our treated sample. The scores were categorized into three – Below Average Performing Workplace (less than 55), Average Performing Workplace (55-to-below 70) and Above Average Performing Workplaces (70 and above). The scores ranged from a minimum of 38.24 to a maximum of 93.10 with a mean of approximately 63.39 with a SD of 8.36. Based on the categorization, seven (7) workplaces were found to be Below Average, forty (40) were found to score average and eighteen (18) were found to score above average.

### 3.1.3 Market Characteristics

For both spatial and temporal fixed-effects, the samples were drawn from similar locations and time periods for robustness. Location/Sub-Market: Non-treated and treated lease events are spread across fourteen (14) sub-markets. For the non-treated sample the highest proportion of leases (31.68%) in the Park Avenue submarket. Hudson yards had lowest representation with three (3) leases. Of the 70 treated leases, Midtown East had the highest representation (18.57%) with two (2) submarkets – Hudson Yards and Chelsea – have lowest representation of one lease each. Commencement Date: To control for macroeconomic conditions in the real estate markets, the leases were categorized into four categories –Before 2005; Between 2005 and 2010; Between 2011 and 2015 & After 2015. Our analysis finds the largest number of leases around 40 percent signed between 2011 and 2015.

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6  Our sample started with 125 WPI survey responses across the New York market with viable WPI scores. From this sample, we were able to match addresses in Compstak and the WPI database to arrive at 65 effective rent contracts that had eligible WPI scores.

## 3.1.4 Building Characteristics

*Year Built:* In analyzing the age of the buildings, we created 5 categories of buildings that are less than 30 years old, and at 30-year intervals up to more than 90 years old. We found that the highest percentage just over 60 percent for the treated and non-treated leases were in buildings that were between 30 and 60 years old. Similarly, the lowest percentage of leases were in the more than 90 years old category at 10 percent and 6.19 percent.

*Year Renovated:* In analyzing building characteristics, we also found it important to analyze if the leases were in buildings that have undergone renovations in the periods that were covered by the lease terms. We categorized the renovation years into 4 categories –Year 2000 or before, between 2001-2005, between 2006 and 2010, and after 2010. Among the 1,067 non-treated leases, we found that only 80% had undergone renovations with the highest number of leases (32.43%) found in buildings renovated after 2010. Among the 70 treated leases, while 18 (25.71%) of them did not have renovations, the largest percentage (25.71%) were in buildings that had undergone renovations in 2000 or before.

## 3.1.5 Tenant Characteristics

*Tenant Industry:* We categorized the total of 1,137 tenants in the combined sample set (treated and non-treated) into ten (10) industries including Finance, Government, Healthcare, Media, Non-Profit, Retail, Products (Manufacturing, Light Industrial), Services (Legal, Brokerage, Documentation), Technology & Other (Real Estate, Education, etc.). Amongst the non-treated sample set of 1,067, not surprisingly, Finance (43.21%) had the most representation, followed by Service industry (26.05%), which, in turn was dominated by legal services. Government had the least representation (0.94%), followed by healthcare. Among the 70 treated sample set, Service industry had higher representation (40%) followed by Finance at 21.14%, with Media (1.43%) having the smallest representation.

## 3.1.6 Lease Characteristics

A combination of factors specific to each lease influence the lease pricing, or effective rents (Ibanez and Pennington-Cross, 2013). As a result, it is important to review the different lease characteristics that could impact variation in effective rents.

*Transaction Type:* The type of transaction, whether it is an expansion, extension, new lease, renewal, or renewal/expansion, affects the pricing of a lease. While our non-treated data set had an overwhelming majority were new leases (61.76%) with renewals coming second with 15.58%. Lease extensions had the lowest incidence with less than 1% (0.56%). Among the treated data set, again new leases had the largest (54.29%) representation while there was no incidence of lease extension.

*Transaction Size:* Transaction size, or the total area leased, is considered a critical factor in arriving at financial value of leases. We categorized the total lease area into four – under 10,000 sf, between 10,000 and 25,000 sf, between 25,000 and 50,000 sf and over 50,000 sf. Our analysis of the 1,067 non-treated sample set found that the largest number of leases (36.08%) were in the under 10,000 sf category and the least number (13.50%) were in the more-than 50,000 sf category. Contrastingly, for the treated leases, the largest group (31.43%) were between 10,000 to 25,000 sf category and smallest group (7.14%) in the under 10,000 sf category.

*Building Floors Occupied:* The study categorized the floors occupied into three –less than one or partial; one (1) floor, between 2 and 5 floors; and more than 5 floors. Among the non-treated samples, the highest distribution (45.17%) of leases occupied less than one or partial floor, while there was 39.36% of one (1) leases. Thus single floors and less than single floors/partial floors add up to 84.54%, while the lowest (1.59%) distribution was found in the more than 5 floors category. Among the treated samples, the largest distribution (37.71%) of leases occupying 2 to 5 floors, while the lowest (15.71%) distribution was found in the more than 5 floors category.

*Rent-free Period:* In analyzing the rent-free periods in the non-treated sample set, we found that while the maximum rent-free period was 24 months, the average was 4.50 months with a SD of 4.05 months. About 61.29% of the non-treated leases had a rent-free period of less than 6 months, while the smallest distribution (0.75%) had a rent-free period between 19 and 24 months. For the treated leases, the maximum rent-free period found to be 19 months, the average was 6.40 months with a SD of 5.10 months. About 47.14% of the treated leases had a rent-free period of less than 6 months, while the smallest distribution (4.29%) had a rent-free period between 19 and 24 months.

*Lease Term:* In analyzing lease terms in the sample set of 1,067 non-treated leases, the average lease term was about 8 years, 2 months (98.32 months) with a SD of about 4 years, 5 months (53.50 months). The largest lease term we found was for 21 years (252 months) and the minimum of 12 months. We also categorized lease terms in terms of 5 categories –less than 5 years, between 6 and 10 years, between 11 and 15 years, between 16 and 20 years and over 21 years. For the non-treated leases, the largest category was between 11 and 15 years (33.83%) and the smallest category (1.50%) was a term over 25 years. For the treated leases, the largest category was also between 11 and 15 years (40%) and the smallest category (5.71%) was a term over 21 years.

# 4. Method for Evaluating Performance

The design of a building could be correlated with attributes that result in better employee workplace performance. Using the results of the WPI score as a proxy for work performance experience of occupiers and existing hedonic pricing model frameworks for NYC, we seek to identify the correlation between WPI scores and effective rents paid by tenants. To execute our analysis, we employ a hedonic regression technique that provides parameter estimates of price variation for changes in the composition and quality of properties leased. Using the WPI-scored office leases and a control sample of non-treated office leases within the same building, we estimate a semi-log equation relating the office rents per net square foot to the hedonic characteristics of a building as represented by,

$$\log P_i = \alpha + \beta X_i + \delta W_i + \varepsilon_i. \qquad\qquad (4.1)$$

In equation (4.1), the dependent variable is the logarithm of the rental price per net square foot P in commercial office building i; X is a vector of hedonic characteristics (for example, building, class, age, renovation date and floor count), tenant characteristics (tenant industry), rental contract features (for example, lease length and rent-free period), market signals (lease commencement date and building location). W is a categorical variable representing WPI scores across three categories - where Below Average Performing Workplace (less than 55), Average Performing Workplace (55-to-below 70) and Above Average Performing Workplaces (70 and above) and zero otherwise; $\alpha$, $\beta$ and $\delta$ are estimated coefficients and $\varepsilon$ is an idiosyncratic error term, assumed to be i.i.d.

# 5: Results

Table 5.1 presents the regression results for the lease samples, relating the logarithm of effective rent per net square foot of commercial office space to a set of rented space hedonic characteristics, tenant industry type and lease contract features. These hedonic specifications explain over thirty percent of the variation in the logarithm of effective rents per net square feet with an adjusted R-squared ranging from 20% to 43%.

Column (1) reports the results that relate effective rents to the hedonic characteristic of submarket/location. When compared to Park Avenue rents, leases at the recently opened Hudson Yards development command a 24% premium in effective rents whereas the neighborhoods historically associated with the Manhattan office market like the Financial District, Times Square, and Penn Station show 49.6%, 38.6%, and 41.2% lower effective rents respectively. Despite Hudson Yards being still under development with limited subway connectivity, its promise of being the hottest real estate on the island could be reason for its premium. At this point, Top and Average WPI scoring does not seem to have any statistically significant impact on effective rents. However, we see that Below Average WPI scoring leases command 13.1% lower effective rents.

In Column (2), we add time-fixed effects in the form of lease commencement dates. We find that when compared to leases commencing before 2005, there is an increase in subsequent 5-year intervals; leases commencing between 2005 and 2010 command 30% higher rents, while those between 2011 and 2015 have a 19.3% and those after 2015 command 40.6% higher rents. The dip in the rent premium seen between 2011 and 2015 could be attributed to the aftermath of the financial crisis and the slow recovery of the economy. Importantly, the Top Performing WPI-dummy is positive and significant with a 12.7% premium over non-scored workplaces while the Below Average WPI scoring leases command 15.2% lower effective rents.

**Table 5.1:** The Impact of WPI Scores on Effective Rents

(Dependent variable: log EffectiveRents psf)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **WPI Score** | | | | | |
| Below Average Performing Workplaces | -0.131*** | -0.152*** | -0.101** | -0.120*** | -0.101** |
| | [0.049] | [0.041] | [0.051] | [0.041] | [0.051] |
| Average Performing Workplaces | -0.03 | -0.04 | -0.05 | -0.04 | -0.03 |
| | [0.056] | [0.057] | [0.059] | [0.060] | [0.057] |
| Top Performing Workplaces | 0.13 | 0.127* | 0.08 | 0.10 | 0.02 |
| | [0.090] | [0.075] | [0.065] | [0.069] | [0.065] |
| **LOCATION CHARACTERISTICS** | | | | | |
| **Neighborhoods (Base case: Park Avenue)** | | | | | |
| Chelsea | -0.364*** | -0.408*** | -0.385*** | -0.316** | -0.329** |
| | [0.120] | [0.118] | [0.147] | [0.152] | [0.133] |
| City Hall Insurance | -0.643*** | -0.594*** | -0.695*** | -0.673*** | -0.701*** |
| | [0.058] | [0.053] | [0.059] | [0.067] | [0.058] |
| Columbus Circle | -0.222*** | -0.267*** | -0.473*** | -0.434*** | -0.445*** |
| | [0.042] | [0.041] | [0.059] | [0.061] | [0.054] |
| Financial District | -0.496*** | -0.531*** | -0.596*** | -0.583*** | -0.614*** |
| | [0.041] | [0.039] | [0.046] | [0.049] | [0.049] |
| Gramercy Park Union Square | -0.465*** | -0.490*** | -0.277*** | -0.222** | -0.280*** |
| | [0.058] | [0.055] | [0.101] | [0.097] | [0.100] |
| Grand Central | -0.221*** | -0.237*** | -0.344*** | -0.313*** | -0.285*** |
| | [0.042] | [0.040] | [0.044] | [0.045] | [0.040] |
| Hudson Yards | 0.240*** | 0.152** | -0.04 | 0.07 | 0.02 |
| | [0.054] | [0.077] | [0.092] | [0.089] | [0.071] |
| Madison/Fifth Avenue | 0.06 | 0.04 | -0.251*** | -0.247*** | -0.249*** |
| | [0.044] | [0.041] | [0.060] | [0.059] | [0.057] |
| Midtown Eastside | 0.073** | 0.05 | -0.174*** | -0.158*** | -0.160*** |
| | [0.035] | [0.033] | [0.048] | [0.047] | [0.046] |
| Penn Station | -0.412*** | -0.431*** | -0.426*** | -0.394*** | -0.387*** |
| | [0.038] | [0.033] | [0.051] | [0.052] | [0.051] |
| Sixth Avenue | -0.068** | -0.095*** | -0.276*** | -0.247*** | -0.269*** |
| | [0.034] | [0.032] | [0.044] | [0.043] | [0.042] |
| Times Square | -0.386*** | -0.344*** | -0.395*** | -0.358*** | -0.328*** |
| | [0.081] | [0.082] | [0.109] | [0.111] | [0.102] |
| UN Plaza | -0.287*** | -0.303*** | -0.459*** | -0.407*** | -0.426*** |
| | [0.047] | [0.059] | [0.071] | [0.077] | [0.073] |

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **TIME-FIXED EFFECTS** | | | | | |
| **Lease Commencement Date (Base case: Before 2005)** | | | | | |
| Lease Commencement 2005 to 2010 | | 0.301*** | 0.305*** | 0.295*** | 0.305*** |
| | | [0.032] | [0.032] | [0.032] | [0.030] |
| Lease Commencement from 2011 to 2015 | | 0.193*** | 0.205*** | 0.199*** | 0.218*** |
| | | [0.030] | [0.030] | [0.030] | [0.029] |
| Lease Commencement after 2015 | | 0.406*** | 0.411*** | 0.395*** | 0.407*** |
| | | [0.041] | [0.041] | [0.042] | [0.040] |
| **BUILDING QUALITY CHARACTERISTICS** | | | | | |
| **Age (Base case: more than 90 years old)** | | | | | |
| Less than 30 years old | | | 0.404*** | 0.389*** | 0.437*** |
| | | | [0.103] | [0.106] | [0.098] |
| 30 - 60 years old | | | 0.317*** | 0.306*** | 0.340*** |
| | | | [0.088] | [0.090] | [0.085] |
| 60 - 90 years old | | | 0.13 | 0.14 | 0.14 |
| | | | [0.090] | [0.092] | [0.086] |
| **Year Renovated (Base case: Renovated after 2010)** | | | | | |
| Renovated 2000 or Before | | | 0.188*** | 0.177*** | 0.172*** |
| | | | [0.034] | [0.034] | [0.033] |
| Renovated Between 2001 - 2005 | | | -0.04 | -0.03 | -0.05 |
| | | | [0.036] | [0.036] | [0.034] |
| Renovated Between 2006 - 2010 | | | 0.120*** | 0.123*** | 0.115*** |
| | | | [0.046] | [0.046] | [0.043] |
| **TENANT INDUSTRY CHARACTERISTICS** | | | | | |
| **Tenant Industries (Base case: Technology)** | | | | | |
| Finance | | | | 0.138** | 0.09 |
| | | | | [0.062] | [0.056] |
| Government | | | | 0.04 | -0.05 |
| | | | | [0.121] | [0.117] |
| Healthcare | | | | 0.10 | 0.02 |
| | | | | [0.074] | [0.069] |
| Media | | | | -0.06 | -0.113* |
| | | | | [0.070] | [0.064] |
| Non-Profit | | | | 0.05 | -0.02 |
| | | | | [0.065] | [0.066] |
| Other | | | | 0.154** | 0.111* |
| | | | | [0.069] | [0.066] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Products | | | | 0.05 | 0.04 |
| | | | | [0.083] | [0.073] |
| Retail | | | | 0.12 | 0.05 |
| | | | | [0.094] | [0.087] |
| Service | | | | 0.07 | 0.02 |
| | | | | [0.061] | [0.057] |

**RENT-CONTRACT CHARACTERISTICS**

**Lease Type (Base case: New Lease)**

| | | | | | |
|---|---|---|---|---|---|
| Lease Expansion | | | | | 0.01 |
| | | | | | [0.029] |
| Lease Extension | | | | | 0.301*** |
| (1 = yes) | | | | | [0.058] |
| Lease Renewal | | | | | 0.059** |
| | | | | | [0.026] |
| Lease Renewal/Expansion | | | | | 0.08 |
| | | | | | [0.081] |

**Transacation Size (Base case: Under 10,000sqf)**

| | | | | | |
|---|---|---|---|---|---|
| 10,000sqf - 25,000sqf Leased | | | | | -0.078*** |
| (1 = yes) | | | | | [0.029] |
| 25,000sqf - 50,000sqf Leased | | | | | -0.098** |
| | | | | | [0.042] |
| Over 50,000sqf Leased | | | | | -0.05 |
| | | | | | [0.045] |

**Floors Occupied (Base case: Partial floor)**

| | | | | | |
|---|---|---|---|---|---|
| 1 Floor Occupied | | | | | -0.04 |
| | | | | | [0.025] |
| Between 2 - 5 Floors Occupied | | | | | -0.02 |
| | | | | | [0.037] |
| More than 5 Floors Occupied | | | | | -0.03 |
| (1 = yes) | | | | | [0.053] |

**Lease Term (Base case: 5yrs or less)**

| | | | | | |
|---|---|---|---|---|---|
| Lease term 6 - 10yrs | | | | | 0.151*** |
| (1 = yes) | | | | | [0.027] |
| Lease term 11 - 15yrs | | | | | 0.290*** |
| | | | | | [0.031] |
| Lease term 16 - 20yrs | | | | | 0.378*** |
| | | | | | [0.043] |
| Lease term more than 20yrs | | | | | 0.462*** |
| | | | | | [0.074] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Rent-free Period (Base case: Less than 6 months)** | | | | | |
| Rent-free period 6 - 12 months | | | | | -0.063*** |
| (1 = yes) | | | | | [0.024] |
| Rent-free period 13 - 18 months | | | | | -0.188*** |
| | | | | | [0.032] |
| Rent-free period 19 - 24 months | | | | | -0.13 |
| | | | | | [0.107] |
| Constant | 4.066*** | 3.857*** | 3.638*** | 3.539*** | 3.461*** |
| | [0.018] | [0.028] | [0.089] | [0.097] | [0.093] |
| | | | | | |
| Observations | 1,137 | 1,137 | 1,137 | 1,137 | 1,137 |
| R-squared | 0.22 | 0.30 | 0.34 | 0.36 | 0.46 |
| Adj R2 | 0.2 | 0.29 | 0.32 | 0.34 | 0.43 |

Notea: The dependent variable is logarithm of effective rent per square feet. Standard errors are in parentheses. all models included building address fixed effects to control for location, and time-fixed effects to control for time-variation in rental prices. *,**,*** denotes significance at the ten, five and one percent level, respectively.

Column (3) relates effective rents to more hedonic characteristics of building age and year of renovation. When compared to buildings that are more than 90 years old, we find that buildings less than 30 years old command 40.4% higher effective rents while those that are between 30 and 60 years old command a premium of 31.7% effective rents. This confirms our hypothesis that newer buildings have higher rents. With respect to year of renovation after 2010, we find that buildings renovated in 2000 or before command the highest premium of 18.8%. This is contradictory to our hypothesis that more recently renovated buildings should command higher rents. This possible anomaly may be explained by the fact that year of renovation and lease contracts might not be captured in the same five-year-period. We see that once building quality characteristics are factored, the Top and Average WPI scoring leases does not seem to have any significant impact on effective rents while Below Average WPI scoring leases still experience a discount at 10.1% lower effective rents.

In Column (4), the specification is reported with controls for the tenant industry. We find that compared to Technology firms, Finance commands 13.8% higher effective rents. The impact of other industry type is not significant enough to make any inferences. Also, the Top and Average WPI scoring leases do not seem to have any significant impact on effective rents, but Below Average WPI scoring leases still command 12.0% lower effective rents.

Column (5) reports how the rent contract characteristics like lease type, transaction size, floors occupied, lease term and free-rent period affect the effective rents. When compared to new leases as a lease type, lease extensions were found to have 30.1% higher effective rents. For transaction sizes, we find that leases under 10,000 sf command the highest effective rents with bigger transactions sizes between 10,000 to 25,000 sf and 25,000 to 50,000 sf command 7.8% and 9.8% lower rents respectively. The number of floors occupied was not found to have a significant impact on effective rents. With respect to lease terms, we find that lease terms periods greater than five years all command higher effective rents with longest lease periods commanding the highest rents. This contradicts our expectation that longer lease terms are offered at discounts. Compared to less than 6 month rent-free periods, we find that high rent free periods of 13 to 18 months results in 18.8% lower effective rents. Again, we see that the Top and Average WPI scoring leases does not seem to have any significant impact on effective rents, but Below Average WPI scoring leases command 10.1% lower effective rents.

# 6: Implications of Linking Design Metrics to Finance

Our study's objective is to explore the correlation between workplace design that supports workplace performance and financial value in the real estate sector. Real estate is increasingly being identified as a strategic resource contributing to organizational performance. Nascent research has documented that workplace design for performance can result in employees becoming more engaged, satisfied, happy, and healthy. But little has been documented about how these impacts drive financial stakeholders to make decisions. We document that spaces with Below Average Performing Workplaces achieve 10 percent lower effective rents than non-treated leases, which amounts to an statistically and economically marginal decrease in effective rents per square foot of $5.50, relative to a control sample of within building spaces.

We show that high performing workplaces have an economically significant impact on effective rents of Manhattan's office market in general and WPI-eligible leases in particular. The premium effect of WPI-scored leases is best observed when analyzed with respect to location characteristics (neighborhoods) and time-fixed effect (lease commencement date) reflecting a premium of 12.7% over non-scored leases. We also observe that the impact of leases identified as Top Performing Workplaces is correlated to the market, contract and hedonic characteristics. This is seen by the decreasing magnitude of the relative rent premiums as additional characteristics are brought into consideration across the specifications.

According to these findings, organizations should consider the financial gains in investing in workplaces that support increased workplace performance leading to better business outcomes for the firms they. This analysis suggests that interventions in design have an impact on the value scene by tenants in renting space. However, the study design does have its limitations. Our objective was not to learn the drivers of workplace design that correlate with value, but rather to understand the financial incentive for landlords to invest in productive, healthy and engaging spaces. To this end, the study links occupancy analysis of office spaces as captured in a survey-based score index for the Manhattan market to effective rents. As evident from the literature, a direct connection between workplace environment and work performance has been difficult to quantify and this study does not infer causality to support this. Although

industry led studies have repeatedly shown that the physical quality of workplaces influence employee productivity, this study is a first step towards linking workplace performance to effective rents to highlight the financial implications of developing high performing workplaces.

In addition, the hedonic models used in existing pricing studies primarily focus on the external factors that could impact financial value of existing properties. By using WPI score as a metric of quantifying employee efficiency as a product of workplace design, we identify the value impact of specific design factors. Higher work performance indicator scores are correlated with higher satisfaction scores by surveyed employees in the areas of critical time spent on work in addition to layout design, lighting, air quality, storage access, furniture comfort and privacy of employees. In turn, it is these factors with higher scores that are correlated with higher effective rents. This deconstruction is important because it is these factors that can aid the architecture/ interior design and real estate fields to find common ground. Moreover, this can help to develop precedents for budgeting decisions to guide the developer and design communities to communicate more effectively in the design phase of buildings. The conclusions from the present study are of value to all the stakeholders involved -real estate developers, landlords, tenants, architects, interior designers, etc., for whom it is important to understand the value and risk implications of the increasing focus on workplace performance.

The basis of the variable of interest -WPI Score-is an index devised by Gensler to test the performance of the workspaces that they have designed. Design & fit-out of the Manhattan office market is multi-billion dollar industry involving over hundreds of firms. As such, the WPI Score does not capture the workspaces design by other firms. Though WPI score is the result of well-designed research and analysis, we realize that it is not the only method to identify high performing workplaces. In addition, WPI Score does not necessarily reveal the physical attributes that make the spaces more conducive to increased work performance. It would also have been beneficial to know the exact budget for the TI work executed as a part of the spaces that were WPI scored. Designing the study to account for increased pricing due to specific tenant improvements as well as changes in work and workplace brought about by automation and AI will be of critical value in the future.

We also recommend that WPI score should be standardized in a way it can be applied to all workplace change initiatives at the design and implementation stage and not an ex-post assessment. In other words, it is beneficial for all stakeholders if WPI scoring is standardized and administered by a 3rd party independent entity, similar to how USGBC administers LEED protocols and rating system or BREEAM assessment. That way, the value of workplace performance can be measured on a continuous basis across multiple leases and lease terms thus enabling the building of a comprehensive growing body of data and knowledge.

As per Leblebici, behavioral workplace environment might have a greater effect on employee performance than just the physical workplace environment. While Leblebici's research highlights the importance of behavioral workplace environment, the findings do not diminish the case for physical design interventions for improving employee performance. In fact, because it is a proven fact that spaces affect individual behavior, the importance of behavioral workplace environment strengthens the case for organizations to invest in workplace design that supports and enhance the "well-being" of the employee, which in turn will lead to superior workplace performance.

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# Appendix

## Regression 1: Basic Regression

(Dependent variable: log EffectiveRents psf)

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **LOCATION CHARACTERISTICS** | | | | | |
| **Neighborhoods (Base case: Park Avenue)** | | | | | |
| Chelsea | -0.369*** | -0.414*** | -0.00 | 0.03 | 0.03 |
| | [0.119] | [0.118] | [0.233] | [0.244] | [0.223] |
| City Hall Insurance | -0.646*** | -0.599*** | -0.601*** | -0.552*** | -0.569*** |
| | [0.058] | [0.053] | [0.093] | [0.099] | [0.093] |
| Columbus Circle | -0.222*** | -0.267*** | -0.376*** | -0.339*** | -0.346*** |
| | [0.042] | [0.041] | [0.066] | [0.066] | [0.059] |
| Financial District | -0.493*** | -0.528*** | -0.243** | -0.257*** | -0.328*** |
| | [0.041] | [0.039] | [0.095] | [0.095] | [0.091] |
| Gramercy Park Union Square | -0.471*** | -0.498*** | -0.17 | -0.12 | -0.15 |
| | [0.057] | [0.054] | [0.157] | [0.151] | [0.142] |
| Grand Central | -0.223*** | -0.240*** | -0.166*** | -0.134** | -0.131** |
| | [0.042] | [0.039] | [0.063] | [0.062] | [0.061] |
| Hudson Yards | 0.232*** | 0.141* | -0.246** | -0.14 | -0.15 |
| | [0.056] | [0.075] | [0.114] | [0.120] | [0.110] |
| Madison/Fifth Avenue | 0.07 | 0.04 | 0.12 | 0.12 | 0.09 |
| | [0.044] | [0.041] | [0.088] | [0.086] | [0.087] |
| Midtown Eastside | 0.078** | 0.05 | -0.130* | -0.10 | -0.10 |
| | [0.034] | [0.032] | [0.070] | [0.069] | [0.068] |
| Penn Station | -0.414*** | -0.434*** | -0.208** | -0.189* | -0.186** |
| | [0.038] | [0.032] | [0.095] | [0.097] | [0.090] |
| Sixth Avenue | -0.070** | -0.097*** | -0.284*** | -0.251*** | -0.256*** |
| | [0.034] | [0.033] | [0.046] | [0.046] | [0.044] |
| Times Square | -0.392*** | -0.352*** | -0.17 | -0.15 | -0.10 |
| | [0.081] | [0.082] | [0.159] | [0.164] | [0.148] |
| UN Plaza | -0.314*** | -0.334*** | -0.467*** | -0.417*** | -0.404*** |
| | [0.042] | [0.053] | [0.146] | [0.149] | [0.142] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **TIME-DUMMY VARIABLE** | | | | | |
| **Lease Commencement Date (Base case: Before 2005)** | | | | | |
| Lease Commencement 2005 to 2010 | | 0.299*** | 0.304*** | 0.295*** | 0.303*** |
| | | [0.033] | [0.031] | [0.031] | [0.030] |
| Lease Commencement from 2011 to 2015 | | 0.190*** | 0.207*** | 0.202*** | 0.217*** |
| | | [0.030] | [0.029] | [0.029] | [0.028] |
| Lease Commencement after 2015 | | 0.406*** | 0.406*** | 0.391*** | 0.402*** |
| | | [0.041] | [0.041] | [0.042] | [0.040] |
| **BUILDING QUALITY CHARACTERISTICS** | | | | | |
| **Age (Base case: more than 90 years old)** | | | | | |
| Less than 30 years old | | | 0.521*** | 0.496** | 0.553*** |
| | | | [0.201] | [0.207] | [0.187] |
| 30 - 60 years old | | | 0.363** | 0.334** | 0.382*** |
| | | | [0.156] | [0.156] | [0.141] |
| 60 - 90 years old | | | 0.396** | 0.381** | 0.374** |
| | | | [0.170] | [0.171] | [0.153] |
| **Year Renovated (Base case: Renovated after 2010)** | | | | | |
| Renovated 2000 or Before | | | 0.074* | 0.07 | 0.06 |
| | | | [0.042] | [0.042] | [0.043] |
| Renovated Between 2001 - 2005 | | | -0.156** | -0.131** | -0.137** |
| | | | [0.063] | [0.064] | [0.061] |
| Renovated Between 2006 - 2010 | | | 0.156* | 0.158* | 0.157** |
| | | | [0.082] | [0.085] | [0.080] |
| **Building Size (Base case: Over 1,500,000sqf)** | | | | | |
| 500,000sqf or less | | | -0.13 | -0.14 | -0.166* |
| | | | [0.092] | [0.091] | [0.089] |
| 500,000sqf - 1,000,000sqf | | | -0.213** | -0.214** | -0.209** |
| | | | [0.087] | [0.089] | [0.089] |
| 1,000,000sqf - 1,500,000sqf | | | -0.314*** | -0.306*** | -0.268*** |
| | | | [0.060] | [0.060] | [0.059] |
| **Building Floors (Base case: 31 - 45 Floors)** | | | | | |
| 15 Floors or less | | | 0.02 | 0.03 | 0.02 |
| | | | [0.230] | [0.240] | [0.214] |
| 16 - 30 Floors | | | -0.00 | -0.00 | 0.02 |
| | | | [0.081] | [0.080] | [0.069] |
| 46 - 60 Floors | | | 0.06 | 0.05 | 0.07 |
| | | | [0.049] | [0.049] | [0.045] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **TENANT INDUSTRY CHARACTERISTICS** | | | | | |
| **Tenant Industries (Base case: Technology)** | | | | | |
| Finance | | | | 0.122** | 0.08 |
| | | | | [0.061] | [0.056] |
| Government | | | | 0.06 | -0.01 |
| | | | | [0.126] | [0.118] |
| Healthcare | | | | 0.06 | -0.01 |
| | | | | [0.071] | [0.067] |
| Media | | | | -0.08 | -0.115* |
| | | | | [0.068] | [0.063] |
| Non-Profit | | | | 0.04 | -0.02 |
| | | | | [0.064] | [0.066] |
| Other | | | | 0.142** | 0.11 |
| | | | | [0.068] | [0.065] |
| Products | | | | 0.05 | 0.05 |
| | | | | [0.082] | [0.070] |
| Retail | | | | 0.12 | 0.05 |
| | | | | [0.090] | [0.083] |
| Service | | | | 0.06 | 0.02 |
| | | | | [0.060] | [0.056] |
| **RENT-CONTRACT CHARACTERISTICS** | | | | | |
| **Lease Type (Base case: New Lease)** | | | | | |
| Lease Expansion | | | | | 0.01 |
| | | | | | [0.030] |
| Lease Extension | | | | | 0.315*** |
| | | | | | [0.055] |
| Lease Renewal | | | | | 0.069*** |
| | | | | | [0.026] |
| Lease Renewal/Expansion | | | | | 0.10 |
| | | | | | [0.086] |
| **Transacation Size (Base case: Under 10,000sqf)** | | | | | |
| 10,000sqf - 25,000sqf Leased | | | | | -0.090*** |
| | | | | | [0.028] |
| 25,000sqf - 50,000sqf Leased | | | | | -0.130*** |
| | | | | | [0.044] |
| Over 50,000sqf Leased | | | | | -0.104** |
| | | | | | [0.048] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Floors Occupied (Base case: Partial floor)** | | | | | |
| 1 Floor Occupied | | | | | -0.03 |
| | | | | | [0.025] |
| Between 2 - 5 Floors Occupied | | | | | -0.00 |
| | | | | | [0.037] |
| More than 5 Floors Occupied | | | | | -0.03 |
| | | | | | [0.054] |
| **Lease Term (Base case: 5yrs or less)** | | | | | |
| Lease term 6 - 10yrs | | | | | 0.155*** |
| | | | | | [0.027] |
| Lease term 11 - 15yrs | | | | | 0.291*** |
| | | | | | [0.030] |
| Lease term 16 - 20yrs | | | | | 0.368*** |
| | | | | | [0.042] |
| Lease term more than 20yrs | | | | | 0.443*** |
| | | | | | [0.074] |
| **Rent-free Period (Base case: Less than 6 months)** | | | | | |
| Rent-free period 6 - 12 months | | | | | -0.061** |
| | | | | | [0.024] |
| Rent-free period 13 - 18 months | | | | | -0.178*** |
| | | | | | [0.033] |
| Rent-free period 19 - 24 months | | | | | -0.12 |
| | | | | | [0.108] |
| Constant | 4.066*** | 3.859*** | 3.652*** | 3.584*** | 3.481*** |
| | [0.018] | [0.028] | [0.161] | [0.152] | [0.136] |
| | | | | | |
| Observations | 1,137 | 1,137 | 1,137 | 1,137 | 1,137 |
| R-squared | 0.21 | 0.30 | 0.36 | 0.37 | 0.47 |
| Adj R2 | 0.2 | 0.29 | 0.34 | 0.35 | 0.45 |

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

# Regression 2: Impact of WPI Eligible on Effective Rent

(Dependent variable: log EffectiveRents psf)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **VARIABLE OF INTEREST** | | | | | |
| WPI Eligible | 0.03 | 0.02 | -0.02 | -0.01 | -0.02 |
| | [0.043] | [0.042] | [0.042] | [0.041] | [0.041] |
| **LOCATION CHARACTERISTICS** | | | | | |
| **Neighborhoods (Base case: Park Avenue)** | | | | | |
| Chelsea | -0.372*** | -0.416*** | 0.00 | 0.03 | 0.03 |
| | [0.119] | [0.118] | [0.233] | [0.244] | [0.222] |
| City Hall Insurance | -0.648*** | -0.600*** | -0.599*** | -0.553*** | -0.571*** |
| | [0.058] | [0.053] | [0.093] | [0.099] | [0.093] |
| Columbus Circle | -0.222*** | -0.267*** | -0.375*** | -0.339*** | -0.346*** |
| | [0.042] | [0.041] | [0.066] | [0.067] | [0.059] |
| Financial District | -0.494*** | -0.528*** | -0.238** | -0.254*** | -0.323*** |
| | [0.041] | [0.039] | [0.095] | [0.095] | [0.091] |
| Gramercy Park Union Square | -0.476*** | -0.501*** | -0.16 | -0.12 | -0.14 |
| | [0.058] | [0.056] | [0.158] | [0.152] | [0.142] |
| Grand Central | -0.224*** | -0.240*** | -0.164*** | -0.134** | -0.131** |
| | [0.042] | [0.039] | [0.063] | [0.062] | [0.061] |
| Hudson Yards | 0.226*** | 0.138* | -0.245** | -0.14 | -0.15 |
| | [0.060] | [0.076] | [0.114] | [0.120] | [0.109] |
| Madison/Fifth Avenue | 0.07 | 0.04 | 0.13 | 0.12 | 0.09 |
| | [0.044] | [0.041] | [0.089] | [0.087] | [0.087] |
| Midtown Eastside | 0.077** | 0.05 | -0.129* | -0.10 | -0.10 |
| | [0.034] | [0.033] | [0.070] | [0.070] | [0.068] |
| Penn Station | -0.415*** | -0.434*** | -0.205** | -0.188* | -0.184** |
| | [0.038] | [0.032] | [0.095] | [0.097] | [0.090] |
| Sixth Avenue | -0.071** | -0.097*** | -0.284*** | -0.250*** | -0.256*** |
| | [0.034] | [0.033] | [0.046] | [0.046] | [0.044] |
| Times Square | -0.395*** | -0.353*** | -0.17 | -0.15 | -0.10 |
| | [0.081] | [0.082] | [0.159] | [0.164] | [0.148] |
| UN Plaza | -0.322*** | -0.339*** | -0.465*** | -0.415*** | -0.403*** |
| | [0.043] | [0.055] | [0.146] | [0.149] | [0.141] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **TIME-DUMMY VARIABLE** | | | | | |
| **Lease Commencement Date (Base case: Before 2005)** | | | | | |
| Lease Commencement 2005 to 2010 | | 0.299*** | 0.304*** | 0.295*** | 0.303*** |
| | | [0.033] | [0.031] | [0.031] | [0.030] |
| Lease Commencement from 2011 to 2015 | | 0.190*** | 0.207*** | 0.202*** | 0.217*** |
| | | [0.030] | [0.029] | [0.029] | [0.028] |
| Lease Commencement after 2015 | | 0.405*** | 0.407*** | 0.392*** | 0.402*** |
| | | [0.041] | [0.041] | [0.042] | [0.040] |
| **BUILDING QUALITY CHARACTERISTICS** | | | | | |
| **Age (Base case: more than 90 years old)** | | | | | |
| Less than 30 years old | | | 0.525*** | 0.499** | 0.556*** |
| | | | [0.200] | [0.206] | [0.186] |
| 30 - 60 years old | | | 0.367** | 0.336** | 0.386*** |
| | | | [0.156] | [0.156] | [0.141] |
| 60 - 90 years old | | | 0.403** | 0.384** | 0.380** |
| | | | [0.170] | [0.171] | [0.153] |
| **Year Renovated (Base case: Renovated after 2010)** | | | | | |
| Renovated 2000 or Before | | | 0.073* | 0.06 | 0.06 |
| | | | [0.042] | [0.042] | [0.043] |
| Renovated Between 2001 - 2005 | | | -0.158** | -0.132** | -0.138** |
| | | | [0.064] | [0.064] | [0.061] |
| Renovated Between 2006 - 2010 | | | 0.158* | 0.159* | 0.159** |
| | | | [0.082] | [0.085] | [0.080] |
| **Building Size (Base case: Over 1,500,000sqf)** | | | | | |
| 500,000sqf or less | | | -0.14 | -0.15 | -0.168* |
| | | | [0.092] | [0.091] | [0.089] |
| 500,000sqf - 1,000,000sqf | | | -0.215** | -0.215** | -0.211** |
| | | | [0.087] | [0.089] | [0.089] |
| 1,000,000sqf - 1,500,000sqf | | | -0.318*** | -0.308*** | -0.270*** |
| | | | [0.060] | [0.060] | [0.059] |
| **Building Floors (Base case: 31 - 45 Floors)** | | | | | |
| 15 Floors or less | | | 0.03 | 0.03 | 0.03 |
| | | | [0.227] | [0.238] | [0.211] |
| 16 - 30 Floors | | | 0.00 | -0.00 | 0.02 |
| | | | [0.081] | [0.080] | [0.069] |
| 46 - 60 Floors | | | 0.07 | 0.05 | 0.07 |
| | | | [0.049] | [0.049] | [0.045] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **TENANT INDUSTRY CHARACTERISTICS** | | | | | |
| **Tenant Industries (Base case: Technology)** | | | | | |
| Finance | | | | 0.122** | 0.08 |
| | | | | [0.061] | [0.056] |
| Government | | | | 0.06 | -0.01 |
| | | | | [0.126] | [0.118] |
| Healthcare | | | | 0.06 | 0 |
| | | | | [0.071] | [0.067] |
| Media | | | | -0.08 | -0.116* |
| | | | | [0.068] | [0.063] |
| Non-Profit | | | | 0.04 | -0.02 |
| | | | | [0.064] | [0.066] |
| Other | | | | 0.142** | 0.11 |
| | | | | [0.068] | [0.066] |
| Products | | | | 0.06 | 0.05 |
| | | | | [0.082] | [0.070] |
| Retail | | | | 0.12 | 0.05 |
| | | | | [0.091] | [0.084] |
| Service | | | | 0.06 | 0.02 |
| | | | | [0.060] | [0.056] |
| **RENT-CONTRACT CHARACTERISTICS** | | | | | |
| **Lease Type (Base case: New Lease)** | | | | | |
| Lease Expansion | | | | | 0.02 |
| | | | | | [0.029] |
| Lease Extension | | | | | 0.314*** |
| | | | | | [0.056] |
| Lease Renewal | | | | | 0.069*** |
| | | | | | [0.026] |
| Lease Renewal/Expansion | | | | | 0.10 |
| | | | | | [0.086] |
| **Transacation Size (Base case: Under 10,000sqf)** | | | | | |
| 10,000sqf - 25,000sqf Leased | | | | | -0.089*** |
| | | | | | [0.028] |
| 25,000sqf - 50,000sqf Leased | | | | | -0.130*** |
| | | | | | [0.044] |
| Over 50,000sqf Leased | | | | | -0.103** |
| | | | | | [0.048] |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Floors Occupied (Base case: Partial floor)** | | | | | |
| 1 Floor Occupied | | | | | -0.03 |
| | | | | | [0.025] |
| Between 2 - 5 Floors Occupied | | | | | -0.00 |
| | | | | | [0.038] |
| More than 5 Floors Occupied | | | | | -0.03 |
| | | | | | [0.055] |
| **Lease Term (Base case: 5yrs or less)** | | | | | |
| Lease term 6 - 10yrs | | | | | 0.155*** |
| | | | | | [0.026] |
| Lease term 11 - 15yrs | | | | | 0.291*** |
| | | | | | [0.030] |
| Lease term 16 - 20yrs | | | | | 0.368*** |
| | | | | | [0.042] |
| Lease term more than 20yrs | | | | | 0.442*** |
| | | | | | [0.075] |
| **Rent-free Period (Base case: Less than 6 months)** | | | | | |
| Rent-free period 6 - 12 months | | | | | -0.062** |
| | | | | | [0.024] |
| Rent-free period 13 - 18 months | | | | | -0.178*** |
| | | | | | [0.033] |
| Rent-free period 19 - 24 months | | | | | -0.12 |
| | | | | | [0.109] |
| Constant | 4.065*** | 3.859*** | 3.650*** | 3.582*** | 3.478*** |
| | [0.018] | [0.028] | [0.160] | [0.151] | [0.136] |
| | | | | | |
| Observations | 1,137 | 1,137 | 1,137 | 1,137 | 1,137 |
| R-squared | 0.21 | 0.30 | 0.36 | 0.37 | 0.47 |
| Adj R2 | 0.2 | 0.29 | 0.34 | 0.35 | 0.45 |

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1