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Tenants' ESG: influence on preferences and rent premiums for green buildings in commercial real estate

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ABSTRACT

This paper investigates the impact of Environmental, Social, and Governance (ESG) considerations on occupiers' preferences and willingness to pay (WTP) for sustainable buildings in commercial real estate. Using lease transactions of office and retail spaces in London, combined with ESG scores from the Refinitiv database, we analyse whether ESG-conscious firms are more likely to choose green-labelled properties, and how their WTP for such spaces varies according to their ESG profiles. Our findings indicate that publicly listed companies, which are more likely to emphasise ESG considerations, are more likely to occupy BREEAM-certified offices. Office tenants with higher Governance scores also exhibit a stronger preference for BREEAM-certified buildings. In contrast, these relationships are not observed in the retail sector. Although tenants' overall ESG scores are not significantly associated with WTP for green-labelled properties in either market, retailers with strong Governance scores are willing to pay a premium for BREEAM-certified spaces. The link between tenants' ESG scores and their demand for green-certified buildings appears to be stronger in recent years, reflecting the growing emphasis on ESG considerations. Our findings underscore the diverse priorities of tenants across the real estate market and offer valuable insights for property owners in developing effective leasing strategies.

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KEYWORDS
Tenants' ESG; green buildings; rent premiums; sustainability preferences; commercial real estate

1. Introduction

The real estate sector accounts for 40% of all greenhouse gas emissions globally (UNEP FI, 2022). Environmental, social, and governance (ESG) measures in the built environment have attracted significant attention among scholars, policy makers, and professionals. Prior studies primarily discuss various sustainable aspects of the built environment, including the operational performance of green buildings (Geng et al., 2019), advancements in building technology and building management (Kibert, 2016; Miller & Buys, 2008), investment decisions and benchmarking (Newell & Marzuki, 2022; Newell et al., 2023), and enhanced financial flexibility in indirect real estate investments (Brounen et al., 2021; Feng & Wu, 2023).

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

A considerable amount of research within real estate economics focuses on the financial benefits of green buildings, particularly the premium rents or prices they command due to their sustainability ratings or features (see for example, Chegut et al. (2014), Costa et al. (2018), P. Eichholtz et al. (2013), Fuerst and McAllister (2011a) and (2011b)). Green rental premiums, which signify tenants' willingness to pay (WTP) for sustainable features and ratings, are crucial for commercial building owners who often incur the costs of energy-efficient upgrades and retrofits, with tenants reaping the potential energy savings (Castellazzi et al., 2017; McAllister & Nase, 2023). While positive rental premiums for green buildings are well-documented in the existing empirical studies, tenant characteristics, particularly their ESG/CSR considerations are often not explicitly discussed in these studies.

Earlier studies based on surveys and interviews suggest that occupiers' demand for sustainable buildings is influenced by their CSR policies (Dixon et al., 2009; Sayce et al., 2009). However, some argue that sustainability is not as significant a consideration compared to factors such as location, attractiveness to staff, marketing, and flexibility (Levy & Peterson, 2013). Notably, the emphasis on ESG and CSR has significantly increased since the 2010s. Globally, regulatory requirements have been introduced to enhance energy performance and sustainability in the built environment. Firms, as users of commercial spaces, increasingly integrate CSR and ESG considerations into their location decisions to enhance legitimacy (Husted et al., 2016; Zamir & Saeed, 2020), improve employee well-being, and boost productivity (Simons et al., 2017).

In this study, we take the environmental performance of green rated buildings as read and assess occupiers' demand for sustainable buildings with a focus on their CSR/ESG agenda. Building on earlier findings on the role of sustainability in building selection (Dixon et al., 2009; Levy & Peterson, 2013; Sayce et al., 2009), we seek to provide further empirical evidence on whether ESG/CSR-conscious tenants are more likely to choose green-labelled spaces. Additionally, we expand on existing literature concerning tenants' WTP for green buildings, investigating how this willingness varies among tenants with different ESG profiles.

Using lease transactions of office and retail spaces in London, combined with ESG scores from the Refinitiv database, we find that publicly traded companies are more likely to occupy BREEAM-certified office spaces, reflecting their need to align with CSR mandates and signal environmental commitment to stakeholders. Among these publicly traded office tenants, those with higher Governance scores also exhibit a stronger preference for BREEAM-certified buildings. In contrast, these relationships are not observed in the retail sector. Consistent with previous studies on green buildings in London, we also confirm a BREEAM-related rent premium in the office market but not in the retail sector. In addition, while tenants' overall ESG scores are not significantly associated with WTP for BREEAM-certified properties in either market, retail tenants with strong Governance scores are associated with a rental premium for green-labelled spaces. Our temporal analysis also reveals that the association between tenants' ESG scores and their demand for green-certified buildings has strengthened post-2017, coinciding with a notable rise in firms' ESG scores and reflecting the growing emphasis on ESG considerations.

These findings shed light on the divergent behaviours and preferences for sustainable properties across different sectors in the commercial real estate market. We provide some

evidence that tenants' CSR policies may influence their building choice in the office and retail markets, in line with previous studies. This implies that as the focus on ESG continues to grow, the demand for sustainable buildings is likely to intensify, accelerating the adoption of sustainable construction practices and retrofitting strategies in the real estate sector. The variations in green premiums between the office and retail markets indicate that while there are income benefits for investors, property owners must recognise the heterogeneous nature of tenant demand and carefully weigh the costs of integrating sustainable features against potential future savings and long-term advantages. For policymakers, the results suggest that achieving energy efficiency improvements in retail properties may require targeted financial incentives or additional regulatory interventions, as these segments are less likely to show green premiums without such support. For real estate professionals, our findings may be leveraged to develop targeted leasing strategies, emphasising the value of green certifications more prominently in the office sector while approaching the retail sector with a differentiated strategy that perhaps focuses on the governance aspect of occupiers.

The remainder of the paper is structured as follows. Section 2 reviews the existing literature on ESG considerations in real estate and the role of green certifications in tenant decisions. Sections 3 and 4 describes the data sources, variable construction, and empirical methodology, respectively. Section 5 presents the main findings. Finally, Section 6 concludes the study, highlighting key takeaways and areas for future research.

2. Literature review

2.1. WTP for green buildings

The economic impact of green-labelled buildings has been extensively studied, focusing primarily on the rental and price premiums these buildings can command. Most studies indicate statistically significant rental premiums for green buildings, summarised in Table 1. Hedonic pricing models are commonly used, where green ratings are included alongside building characteristics and lease details as regressors to determine if they are associated with rental premiums. To mitigate potential selection biases between certified and non-certified buildings, some studies employ propensity score matching (PSM) techniques (Chegut et al., 2014; P. Eichholtz et al., 2013). A wide range of premiums is evident, reflecting the different rating systems and markets/sectors investigated, as well as the various study periods.

Existing studies have identified several factors that influence the WTP for green buildings. WTP can be influenced by the level of supply of sustainable buildings. One key determinant is the supply of sustainable buildings. Research suggests that rent premiums associated with green labels tend to be higher in smaller regions (P. Eichholtz et al., 2010) and developing markets (Costa et al., 2018), where certified properties are relatively scarce. Additionally, greater competition in the green building sector can lead to higher overall rents but reduce the marginal effect of certification (Chegut et al., 2014).

Beyond supply constraints, building characteristics also play a significant role in rental premiums. High-rated, newer, and smaller buildings are found to command higher premiums (Fuerst et al., 2013), whereas large new buildings and high-value properties

Table 1. Summary of empirical research on rent premiums on energy efficiency labels/ratings.

Authors	Sector	Market	Green measures	Rent premiums
Chegut et al. (2014)	Office	London, UK	BREEAM	2%
Costa et al. (2018)		Sao Paulo, Brazil	LEED	4–8%
Devine and Kok (2015)	Office	Canada & US	LEED	3.7–17.5%
			Energy Star	2.70%
			BOMA BESt[a]	− 1%
			BOMA BESt & LEED	9.40%
P. Eichholtz et al. (2010)	Office	US	Energy Star	3.30%
			LEED	No significant premium
			Either	2.8–3.5%
P. Eichholtz et al. (2013)	Office	US	Energy Star	2.1–6.5%
			LEED	5.8–6%
			Energy Star or LEED	2.6–7.6%
Fuerst and McAllister (2011a)	Office	US	Energy Star	3–4%
			LEED	4–5%
			Both	9%
Fuerst and McAllister (2011b)	Office	US	Energy Star	4%
			LEED	5%
			Both	5%
Fuerst and McAllister (2011c)	Office, Retail, Industrial	UK	EPC	No significant premium
			BREEAM	No significant premium
Fuerst et al. (2013)	Office	UK	EPC	11% premium of A-C rated properties compared to D rated
Fuerst and van de Wetering (2015)	Office	UK	BREEAM	23–26%
Gabe and Rehm (2014)	Office	Sydney, Australia	NABERS	No premium
Holtermans and Kok (2019)	Office	US	Energy Star	1.5–4%
			LEED	1.3–1.9%
			Both	2.2–4.6%
Kok and Jennen (2012)	Office	US	Energy Star	5.6–9.8%
			LEED	5–9%
Newell et al. (2014)	Office	Australia	NABERS	2.3–6.7% amongst the higher rated properties
Onishi et al. (2021)	Office	Tokyo, Japan	CASBEE[b], DBJ[c]	2.6–5.4%
Ott and Hahn (2018)	Office	Europe	BRREEAM, or LEED, or DGNB[d] or National certificate	No significant premium
Pivo and Fisher (2010)	Office	US	Energy Star	5.20%
Reichardt (2014)	Office	US	Energy Star	2.4–4.8%
			LEED	3.3–9.4%
			Both	10.20%
Reichardt et al. (2012)	Office	US	Energy Star	3.3–6.1% in 2004–2007, insignificant in 2008
			LEED	No significant premium
Robinson and McAllister (2015)	Office	US	Energy Star	1.5–2.5%
			LEED	5.2–12.3%
			Both	3–15.7%
Robinson et al. (2017)	Office	US	Energy Star	1.60%
			LEED	10.30%
Szumilo and Fuerst (2014)	Office	US	Energy Star	7–8%
Szumilo and Fuerst (2017)	Office	US	Energy Star	0.6%, but varies temporally
Veld and Vlasveld (2014)	Retail	The Netherlands	Energy Index[e]	No significant premium
Wiley et al. (2010)	Office	US	Energy Star	15–18%
			LEED	7–9%
Zhang et al. (2024)	Retail	The Netherlands	EPC	11%

[a]BOMA (the Building Owners and Managers Association) launched their Building Environmental Standards (BESt) in 2005 for existing buildings in North America.

[b]CASBEE (Comprehensive Assessment System for Built Environment Efficiency) is a green building certification initiative launched by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan in 2001.

[c]The MLIT also established the Building – Housing Energy Efficiency Labelling System (BELS) to certify the energy consumption performance (energy-saving performance) of buildings.

[d]The DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen) certification system is a rating tool for the built environment developed by the German Sustainable Building Council.

[e]Energy index is a score calculated a formula that takes several energy efficiency measures of the property into account.

typically exhibit lower or absent premiums (Onishi et al., 2021; Robinson & McAllister, 2015). Robinson et al. (2017) explicitly incorporate green features into their rent hedonic models and find that the positive impact of these features diminishes when a LEED label is included, suggesting the presence of a branding effect.

Market conditions also influence WTP for green buildings, though findings are mixed. Early studies observe that premiums tend to rise during economic booms and fall during downturns (Kahn & Kotchen, 2010; Reichardt et al., 2012). However, later studies indicate that tenant demand for sustainable buildings remains robust even in weaker economic periods, suggesting a market appreciation for operational cost savings provided by more efficient buildings, irrespective of the business cycle stage (P. Eichholtz et al., 2013; Fuerst & van de Wetering, 2015).

Contrastingly, some research shows no significant rent premiums associated with sustainable labels in office markets (Fuerst & McAllister, 2011c; Gabe & Rehm, 2014; Miller et al., 2008), and in the retail sector (Veld & Vlasveld, 2014). One possible explanation is information asymmetry. Fuerst and McAllister (2011a) argue that labelling is intended to alleviate market failure caused by information asymmetry, effective only if labels credibly indicate superior environmental performance. Information asymmetry could be a concern for tenants who may overpay for sustainable features if the actual environmental performance is undisclosed upfront (Reichardt et al., 2012). Furthermore, the lack of WTP for sustainable labelled buildings could be due to the relatively small energy costs compared to the overall operational costs (Fuerst & McAllister, 2011b).

While much of the literature focuses on tenants' WTP for green buildings, the role of tenant characteristics, particularly their ESG/CSR practices, remains underexplored. There is anecdotal discussion linking tenants' demand for green buildings to their CSR practices. For example, Chegut et al. (2014) note that '*anecdotally, the move of tenants towards green real estate is due to enhanced reputation benefits, corporate social responsibility mandates and employee productivity*' (p.27). The authors also highlight that financial services firms, advertising and insurance sectors are dominant users of green space, aligning with findings from Cajias et al. (2014), that firms' CSR strategies differ significantly across industry sectors, with customer-oriented companies placing more emphasis on CSR than asset-driven sectors. Similarly, P. Eichholtz et al. (2010) assert that '*leasing space in a green building may send a concrete signal of the social awareness and superior social responsibility of the occupants*' (p. 2494). However, despite these insights, existing studies do not explicitly incorporate tenants' ESG/CSR profiles into empirical models, leaving a gap in understanding the direct impact of CSR/ESG commitments on green building demand.

2.2. Tenants' ESG/CSR and their demand for green buildings

Empirical evidence from corporate finance and strategic management literature suggests firms increasingly adopt ESG/CSR practices not only to manage return and risk but also to strengthen their market position and corporate reputation (Baldini et al., 2018; Schaltegger & Hörisch, 2017). To this end, location decisions play a crucial role in CSR strategies, as firms in areas with a higher density of sustainability-focused businesses tend to exhibit stronger CSR engagement and disclosure, further reinforcing their legitimacy (Husted, 2005; Zamir & Saeed, 2020). This aligns with the notion

in Chegut et al. (2014) and P. Eichholtz et al. (2010) mentioned above, that leasing space in a green building may enhance a company's reputation and reflect a commitment to social responsibility.

Earlier studies in corporate real estate (CRE) suggest that environmental considerations appear to have little impact on the building choice of occupiers (Sayce et al., 2006) and not all tenants with sustainable business mission statements were able to secure green space or willing to pay for it (Miller et al., 2008). While Levy and Peterson (2013) confirm that CRE can add value to businesses, they also note that sustainability is not as significant a consideration compared to factors such as location, attractiveness to staff, marketing, and flexibility. However, as ESG considerations gain prominence, sustainability is increasingly shaping property-related decision-making.

P. M. A. Eichholtz et al. (2016) identify two key determinants for the ecological responsiveness for firms: economic advantage and institutional pressure. They argue that firms in space-intensive sectors benefit most from the operational efficiencies and productivity gains associated with green buildings. Consistent with this, their empirical findings show that the concentration and size of establishments, as well as the availability of human capital within a metropolitan area, significantly influence the likelihood of occupying environmentally certified office space. The authors also find that firms in industries subject to higher institutional scrutiny, such as oil and gas, are prominent users of green office space. Similarly, based on survey and interview data, Dixon et al. (2009) and Sayce et al. (2009) suggest that demand for sustainable buildings is largely driven by occupiers' environmental and CSR policies. Robinson et al. (2016) find that tenants work for publicly listed companies are more likely to state a WTP for green labelled buildings, as listed companies are likely to publish/disclose their CSR policies. Jang et al. (2018) demonstrate through an experiment that green building certification significantly increases tenants' willingness to rent, particularly among those with higher levels of eco-friendliness. More recently, using a case study of Goldman Sachs, Akhtyrska and Fuerst (2024) demonstrate that ESG considerations are implicitly integrated in company's CRE strategies. The sustainability practices not only focus on reducing resource consumption but also enhance the firm's resilience and adaptive capacities.

At an institutional level, various regulations and sustainability standards have been introduced globally to improve energy efficiency in commercial real estate. In the UK, for instance, the Minimum Energy Efficiency Standards (MEES) mandate that properties meet certain energy efficiency criteria before being rented out,[1] which has led to a downward shift in rents for less efficient properties (Akhtyrska & Fuerst, 2024). Simultaneously, the supply of green-rated buildings has significantly increased. In London, the proportion of office stock with BREEAM certification has increased from approximately 6% in 2013 to 30% in 2023 (Harley, 2023). In the retail sector, although only 1% of the UK retail properties target a sustainability rating, the standard of sustainability achieved is relatively high (Barnstable, 2021; Dezfouli et al., 2017). Espinoza-Zambrano et al. (2024) argue that green certifications are becoming less about driving value and more about meeting market standards.

As sustainability continues to shape corporate strategies, firms are expected to place greater emphasis on occupying environmentally certified spaces. This shift underscores the need for updated research to capture the changing priorities of tenants and the evolving market dynamics in green real estate.

3. Data

The main dataset used in this research consists of commercial leases collated from CoStar's database of office lease transactions in London from January 2002 to December 2022. We also collated data from lease transactions in retail and industrial sectors in London from January 2012-December 2022.[2] However, the industrial sample was excluded from the analysis, as very few tenants can be identified in the sample. The final dataset consists of 18,596 office leases and 6,663 retail leases.

Table 2 shows all variables and their descriptions used in the analysis. Physical attributes include the total floor space leased, the total net internal floor area of the building (NIA), the floor level of the occupied space,[3] the year of construction and renovation, whether there are lifts and the number of parking spaces, and in addition the materials used in construction are also recorded. Lease details such as effective rent, lease length, break clauses, and repair and insuring obligations are also collated from CoStar. We further convert postcodes to geocodes (longitudes and latitudes) using Batch geocoding website (www.doogal.co.uk).

We use Building Research Establishment Environmental Assessment Method (BREEAM) certification to indicate if a building has green labels. A commercial building can receive BREEAM certification if it meets the minimum standards set in eight core dimensions: building management, health and wellbeing, energy efficiency, transport

Table 2. Variables and their descriptions, CoStar data and refinitiv ESG scores.

Variable name	Description
Lease characteristics	
R	Effective Rent per square foot per year
size	Total square feet Leased
floor	Highest Floor Occupied
term	lease length measured in months
FRI	= 1 if it is a full repairing and insuring lease
break	= 1 if there is a break; otherwise = 0
newlease	= 1 if it is a new lease, = 0 if it is a renewal
headlease	= 1 if it is a head lease; = 0 if it is sub lease
Year	the year lease contract signed
rentfree	Rent Free(month)
Building characteristics	
lat	Latitude
lng	Longitude
submarket	CoStar predefined submarket, used for fixed effect
NIA	Building's total NIA (SF)
stories	number of stories within the building
CoStar rating	A vector of dummy variables indicating CoStar rating of the space
Construction materials	A vector of dummy variables indicating the construction materials
parking	Number of parking spaces
lifts	Whether the property has lift(s)
BREEAM	= 1 if BREEAM certified, = 0 otherwise
yearbuilt	Building completed year
yearrenovation	Year of renovation
age	Calculated using either yearbuilt or yearrenovation
Tenant characteristics	
listed	= 1 if it is a publicly listed company, = 0 if private company
industry	A vector of variables indicating the industry sector of tenants
ESG	Tenant's Refinitiv ESG scores
E	Tenant's Refinitiv scores for the environmental pillar
S	Tenant's Refinitiv scores for the Social pillar
G	Tenant's Refinitiv scores for the Governance pillar

efficiency, water efficiency, material usage, pollution and land use ecology. BREEAM is a voluntary certification programme and offers multiple certification levels based on the achieved score. These levels typically include Pass, Good, Very Good, Excellent, and Outstanding, allowing buildings to be recognised for varying degrees of sustainability performance. BREEAM is adaptable to both residential and commercial properties. It can also be applied to various stages of a building's lifecycle, such as design, construction, and operation. At the time of writing, there are 1,399 offices and 862 retail properties in London that have been assessed or certified with BREEAM.

In addition to BREEAM ratings, several other certification systems are used in the UK to assess building performance. One of the most common is the Energy Performance Certificate (EPC), a standardised measure that evaluates and reports a building's energy efficiency. An EPC provides information on a property's energy use, typical energy costs, and recommendations for reducing energy consumption and lowering expenses. Although an EPC is required whenever a property is built, sold, or rented, very few EPC ratings are recorded in the CoStar lease dataset. Two other widely recognised energy efficiency ratings in the UK are Leadership in Energy and Environmental Design (LEED) and the National Australian Built Environment Rating System UK (NABERS UK). There are fewer than 500 LEED-certified or registered buildings in the UK, while NABERS UK was only launched in November 2022. Beyond energy efficiency ratings, other certification systems assess different aspects of building performance. For example, WiredScore focuses on digital connectivity and technology infrastructure, while Fitwel evaluates health and wellbeing features. However, these ratings are not recorded in the CoStar lease transactions dataset. As this study primarily focuses on green labelled buildings, they are not included in this analysis.

To quantitively measure a tenant's ESG, we use company names and trading tickers of the tenants in the CoStar sample as identifiers and manually match lease data to Refinitiv[4] ESG ratings. Refinitiv ESG rating is a performance measurement, evaluating a company's impact on the environment, its relationship with its employees, customers, communities and other stakeholders, and the structure and practices that guide how a company is managed and controlled. The matrix used in Refinitiv is summarised in Table 3.

As Refinitiv scores are updated on a weekly basis (Refinitiv, 2022), we match tenants' ESG scores at the time of the lease being signed. If a tenant is a private company with a parent company that is publicly listed, the parent's company's ESG scores are used, as Refinitiv only reports on currently listed companies. In the office sample, out of the 1,595 leases with tenants being publicly listed companies, 993 can be identified to have Refinitiv ESG scores.[5] In the retail sample, a similar proportion of tenants can be identified using Refinitiv scores. We also attempted to match the CoStar data with Bloomberg ESG disclosing scores, however very few tenants can be matched, hence we are not able to include Bloomberg's measures.

As ESG scores are not available for all tenants in our dataset, to demonstrate the general changes in ESG scores in firms, and reflect the diversity of occupiers in London, we use the average ESG scores for firms identified in the Refinitiv ESG database.[6] The changes in ESG scores for these firms over the time are illustrated in Figure 1.[7]

The fluctuations in the ESG scores suggest that market attitude towards ESG activities changes over time (Bird et al., 2007). The average scores for the S and

Table 3. Refinitiv ESG materiality matrix.

Pillars	Categories	Themes
Environmental	Emission	Emissions
		Waste
		Biodiversity
		Environmental management systems
	Innovation	Product innovation
		Green revenues, research and development (R&D) and capital expenditures (CapEx)
	Resource use	Water
		Energy
		Sustainable packaging
		Environmental supply chain
Social	Community	Equally important to all industry groups, hence a median weight of five is assigned to all
	Human rights	Human rights
	Product responsibility	Responsible marketing
		Product quality
		Data privacy
	Workforce	Diversity and inclusion
		Career development and training
		Working conditions
		Health and safety
Governance	CSR strategy	CSR strategy
		ESG reporting and transparency
	Management	Structure (independence, diversity, committees)
		Compensation
	Shareholders	Shareholder rights
		Takeover defences

Source (Refinitiv, 2022, p. 10).Source (Refinitiv, 2022, p. 10).

G pillars follow very similar patterns as the overall average ESG scores, with the G pillar having the highest scores, indicating a strong emphasis on the internal structure, policies, and decision-making process among these listed companies. Notably, the environmental pillar score behaved differently. In the early 2000s, environmental regulations and compliance were primarily seen as a cost item (Porter & Van Der Linde, 2017), hence many firms focused on meeting minimum regulatory standards for environmental protection, reflected in the relatively low scores in the E pillar. Between 2004 and 2014, international awareness of environmental issues continued to grow, particularly related to climate change. Governments worldwide began introducing stricter environmental regulations and standards.[8] Companies responded by taking measures to comply with these regulations, which often led to improved environmental performance. During 2014–2018, climate change emerged as a mainstream public concern. The adoption of the Paris Agreement in 2015 marked a significant milestone, prompting governments to introduce more ambitious environmental targets. These developments increased pressure on firms to enhance transparency and improve their environmental practices. At the same time, ESG rating agencies adopted more conservative and stringent scoring methodologies, particularly in response to economic cycles such as recessions and booms (Alp, 2013; Baghai et al., 2014; Bolton et al., 2012). As a result, Environmental pillar scores declined, reflecting both rising expectations and tighter assessment standards. Notably, despite the variations, all scores began rising from 2017 onward, further reinforcing the growing emphasis on ESG practices in recent years.

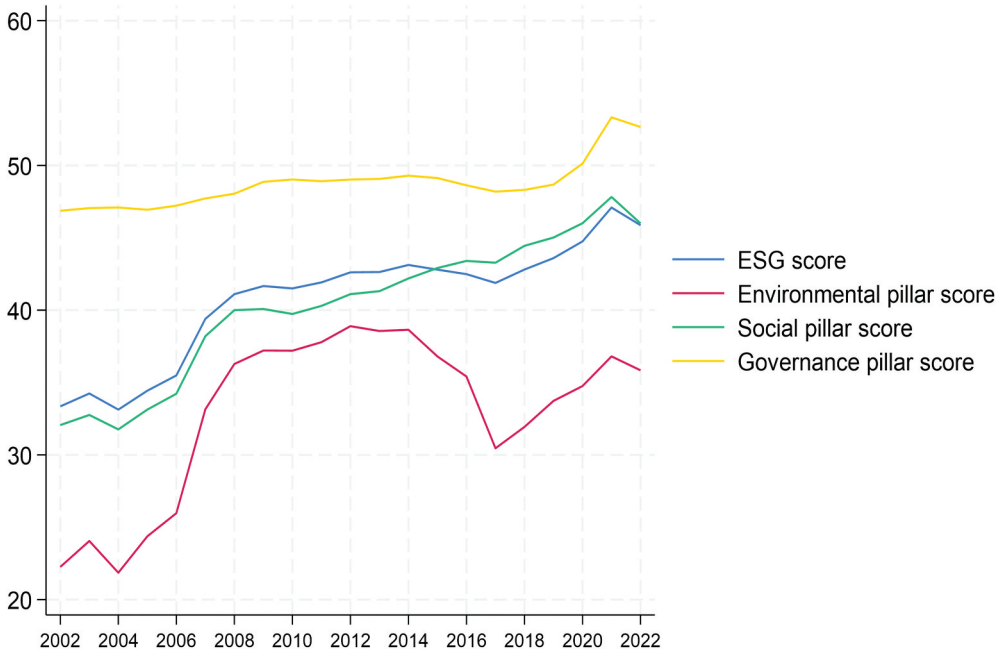

Figure 1. The average ESG scores and the average scores for each pillar for all firms, 2002–2022. Source: Refinitiv.

Table 4 presents the number of lease transactions across the two samples, grouped into five-year intervals. The table highlights a substantial volume of transactions during the 2010–2019 period, reflecting heightened market activity. In contrast, the lower number of observations in earlier periods likely stems from reduced leasing activity as a result of the Great Financial Crisis (GFC), as well as data availability limitations in CoStar's database. Additionally, leasing activity in both sectors declined during the 2020–2022 period, largely due to the impact of the COVID-19 pandemic.

Descriptive statistics for key variables are presented in Table 5. Additionally, Table 6 provides an unconditional comparative analysis of BREEAM-certified and non-BREEAM-certified buildings across both sectors. As expected, BREEAM-certified buildings tend to be newer, larger, taller, and command higher effective rents. In the office sector, certified properties also offer more parking spaces, a trend not observed in the retail sector. The standard T-tests confirm that the differences in these characteristics between certified and non-certified buildings are statistically significant. Furthermore,

Table 4. Number of observations per 5 – year block.

	Office		Retail	
Years	n	%	n	%
2000–2004	338	1.82		
2005–2009	1,499	8.06		
2010–2014*	5,749	30.92	1,409	21.15
2015–2019	9,424	50.68	4,162	62.46
2020–2022	1,586	8.53	1,092	16.39
Total	18,596	100	6,663	100

*For retail, data starts from 2012.

Table 5. Descriptive statistics for key variables in the office and retail samples.

	Office			Retail		
Variable name	N	Mean	SD	N	Mean	SD
R	18,596	43.32	23.09	6,663	61.12	75.58
size	18,596	7773	21807	6663	2793	5536
floor	18,366	3.19	3.94	6,580	0.16	1.01
term	18,596	92.52	51.11	6,663	136.59	55.64
FRI	18,596	0.67	0.47	6,663	0.67	0.47
break	18,596	0.46	0.50	6,663	0.39	0.49
newlease	18,596	0.92	0.28	6,663	0.84	0.37
headlease	18,596	0.86	0.34	6,663	0.94	0.23
rentfree	18,596	6.12	9.39	6,663	3.69	6.23
NIA	18,596	83275	147330	6663	161116	400769
stories	18,580	8.02	6.29	6,629	5.39	4.14
parking	18,596	13.44	100.42	6,663	343.55	1114.72
lifts	18,596	0.74	0.44	6,663	0.35	0.48
age	18,406	43.86	61.24	6,039	63.53	56.38
HQ	18,594	0.26	0.44	6,663	0.06	0.23
international	18,594	0.34	0.48	6,663	0.30	0.46
listed	17,582	0.09	0.28	6,241	0.15	0.36
ESG	993	49.85	17.73	662	52.12	18.14
E	966	52.74	29.69	662	60.93	26.56
S	966	58.58	22.26	662	64.18	22.76
G	965	58.34	22.71	662	56.81	21.80

Table 6. Descriptive analysis of BREEAM buildings and non-BREEAM buildings.

	Office BREEAM = 0			Office BREEAM = 1			
Variable	n	Mean	Std. dev.	n	Mean	Std. dev.	t test p value
R	15,697	41.91	23.04	3,217	50.57	21.80	0.0000
NIA	15,697	64643.96	133234.10	3,217	172625.60	175503.70	0.0000
stories	15,681	7.20	4.84	3,217	11.95	9.90	0.0000
parking	15,697	10.75	98.84	3,217	26.13	103.07	0.0000
lifts	15,697	0.70	0.46	3,217	0.94	0.23	0.0000
age	15,510	50.88	64.09	3,213	10.15	25.34	0.0000
ESG	596	49.17	17.83	434	50.77	17.30	0.1514
E	552	50.23	29.67	415	56.15	29.41	0.0021
S	552	56.54	22.53	415	61.37	21.67	0.0008
G	551	57.72	22.96	415	59.18	22.34	0.3223
	Retail BREEAM = 0			Retail BREEAM = 1			
Variable	n	Mean	Std. dev.	n	Mean	Std. dev.	t test *p* value
R	6,185	60.27	75.73	478	72.12	72.73	0.0009
NIA	6,185	158143.50	413256.70	478	199584.40	166048.60	0.0294
stories	6,151	5.03	3.62	478	9.98	6.82	0.0000
parking	6,185	367.12	1153.14	478	38.55	123.19	0.0000
lifts	6,185	0.32	0.46	478	0.79	0.40	0.0000
age	5,745	67.47	58.81	478	16.65	31.26	0.0000
ESG	605	51.99	18.27	57	53.47	16.82	0.5557
E	605	60.72	26.49	57	63.14	27.48	0.5107
S	605	63.98	22.70	57	66.23	23.51	0.4769
G	605	56.62	21.88	57	58.85	21.06	0.4614

The last column displays the p-values from t-tests, assessing whether the mean statistics differ significantly between BREEAM buildings and non-BREEAM buildings in the office and retail markets.

tenants in BREEAM-certified buildings exhibit higher overall ESG scores, as well as higher individual E, S, and G scores. However, while differences in ESG scores between occupiers of certified and non-certified buildings in the retail sector are not statistically

significant, significant differences are observed in the E and S scores within the office sector.

4. Empirical methods

4.1. Choice of BREEAM certified buildings

To understand a tenant's choice of locating in a sustainable building, we estimate a series of probit models, where whether a space has BREEAM label is used as an indication for sustainable spaces. Our baseline model is expressed in Equation (1):

$$P(BREEAM_i = 1) = \Phi\left(\beta_0 + X_i\beta_1 + \alpha_k + \delta_t + \varepsilon_i\right) \tag{1}$$

Where $BREEAM_i = 1$ if the building in which tenant i is located is BREEAM certified, 0 otherwise. $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. X_i denotes a vector of variables on building and lease characteristics. Buildings with certain physical attributes are likely to meet certain BREEAM criterion and therefore, are more likely to be BREEAM certified. Tenants' preference of BREEAM certified spaces maybe associated with the characteristics of the lease. For instance, tenants requiring larger space may have stronger preference for BREEAM labelled spaces due to the potential savings associated with higher level of energy efficiency. Furthermore, submarket (k) and year (t)levels are included to count for the potentially unobservable geographical and temporal variations respectively. Following Robinson et al. (2016), who find that publicly listed tenants are more likely to state a WTP for green building labels, we included $listed_i$ in Equation (2) to see if publicly listed tenants are more likely to select a BREEAM-certified building. To allow further control for tenants' characteristics, Equation (2) also includes dummy variables indicating tenants' industry sectors, as the probability of selecting a green labelled building could also vary among industry sectors. (Chegut et al., 2014; Robinson et al., 2016)

$$P(BREEAM_i = 1) = \Phi\left(\beta_0 + X_i\beta_1 + listed_i\beta_2 + industry_i\beta_3 + \alpha_k + \delta_t + \varepsilon_i\right) \tag{2}$$

Moving on to tenants' ESG profiles, the overall Refinitiv *ESG* scores are included in Equations (3), and separate scores for the E, S and G pillars are included in Equation (4), while allowing controls for *submarket*, *year* and *industry* sectors. If tenants with higher ESG scores are more likely to select a BREEAM certified building, the coefficients associated with the ESG scores would be significantly positive.

$$P(BREEAM_i = 1) = \Phi\left(\beta_0 + X_i\beta_1 + ESG_i\beta_4 + industry_i\beta_3 + \alpha_k + \delta_t + \varepsilon_i\right) \tag{3}$$

$$P(BREEAM_i = 1) = \Phi\left(\beta_0 + X_i\beta_1 + E_i\beta_5 + S_i\beta_6 + G_i\beta_7 + industry_i\beta_3 + \alpha_k + \delta_t + \varepsilon_i\right) \tag{4}$$

We estimate Equations (1)-(4) for the office and retail samples separately.

4.2. Willingness to pay (WTP) for BREEAM and tenants' ESG

In real estate research, hedonic modelling is the standard method for examining price/rent determinants. We start with a baseline hedonic model, Equation (5), where it is assumed that the rental price of a commercial space can be broken down into its individual physical attributes, lease characteristics and locational measures:

$$lnR_i = \alpha_0 + \alpha_1 X_i + \alpha_2 BREEAM_i + \theta_k + \vartheta_t + \varepsilon_i \tag{5}$$

Where lnR_i is the natural logarithm of effective rent per square foot. To treat the outliers in our sample, we winsorised effective rent at the 99% and 1% percentiles (Chinloy et al., 2013; Nicholas & Scherbina, 2013; Robinson et al., 2017). X_i is a vector of explanatory variables including the physical attributes of the building[9]; the specifics of lease *i*; spatial coordinators (longitudes and latitudes) and their cross products to smooth the unobservable geographic differences of the properties (Dubin, 1992). We further include a dummy variable, $BREEAM_i$ to indicate if the building has a BREEAM certification and allow fixed effect at submarket *k* and year *t* levels to further control for locational and temporal effects. α_1 represents the respective vectors of parameters to be estimated. α_2 denotes the potential green rental premium or WTP. ε_i is a random error and stochastic disturbance term that is expected to take the form of a normal distribution.

Following P. Eichholtz et al. (2013) and Chegut et al. (2014), we employ a propensity score matching technique to minimise the potential selection bias between certified and non-certified buildings by matching on the basis of physical characteristics (i.e. buildings with certain features are more likely to be BREEAM certified). Weight, based on propensity score, $\sqrt{w_i}$, is applied in Equation (6):

$$\sqrt{w_i} lnR_i = \sqrt{w_i}\alpha_0 + \sqrt{w_i}\alpha_1 X_i + \sqrt{w_i}\alpha_2 BREEAM_i + \sum_k \sqrt{w_i}\theta_k + \sum_t \sqrt{w_i}\delta_t + \sqrt{w_i}\varepsilon_i \tag{6}$$

Next, we include *listed* and *listed* × *BREEAM* in the hedonic model, to assess if the WTP for green labelled building differ among large, listed companies, who are more likely to be more ESG conscious. Notably, PSM weighting is applied, but not explicitly expressed in these equations to simplify the presentation.

$$lnR_i = \alpha_0 + \alpha_1 X_i + \alpha_2 BREEAM_i + +\alpha_3 listed_i + \alpha_4 listed \times BREEAM_i + \theta_k + \vartheta_t + \varepsilon_i \tag{7}$$

Bond et al. (2008) argue that lease term and rent can be potentially endogenous due to the simultaneous determination of these variables during lease negotiations. In particular, the choice of lease term may not be independent of rent, as both are influenced by factors such as the bargaining power of tenants and landlords, market conditions, and the specific requirements of the tenant. To address this issue, we employ a two-stage least squares (2SLS) model, using instrumental variables (IVs) that capture tenant-specific characteristics to instrument for the endogenous lease term (*lnterm*). Researchers have shown that tenants' preferences for lease term are heavily influenced by their own characteristics, such as size, stability, and business strategy (Crosby et al., 2003, 2006; McCann & Ward, 2004). Consequently, we use variables that measure these characteristics, including whether a tenant is a publicly traded company (*listed*), whether the

tenant is an *international* firm (indicating a multinational presence), the tenant's industry sector, and whether the leased property is used as a headquarter (*HQ*) location. To test the presence of endogeneity in lease term, we conduct the Wu-Hausman and Durbin-Wu tests.

In the last step, we assess tenants' ESG scores and their impact on the WTP for green buildings explicitly. As we only have ESG scores for publicly traded tenants, this part of the analysis utilises the 'publicly traded tenants only' sub-sample and estimates Equations (8) and (9). These equations include tenants' overall ESG scores, the individual scores for each of the three ESG pillars, as well as their interaction terms with BREEAM certification. As in the previous analysis, PSM weighting and 2SLS are applied to this sub-sample.

$$lnR_i = \alpha_0 + \alpha_1 X_i + \alpha_2 BREEAM_i + \alpha_5 ESG_i + \alpha_6 ESG \times BREEAM_i + \theta_k + \vartheta_t + \varepsilon_i \quad (8)$$

$$\begin{aligned} lnR_i = {} & \alpha_0 + \alpha_1 X_i + \alpha_2 BREEAM_i + \alpha_7 E_i + \alpha_8 E \times BREEAM_i + \alpha_9 S_i + \alpha_{10} S \times BREEAM_i \\ & + \alpha_{11} G_i + \alpha_{12} G \times BREEAM_i + \theta_k + \vartheta_t + \varepsilon_i \end{aligned} \quad (9)$$

We repeat Equations (1)-(9) for each of the office and retail samples respectively.

5. Results

5.1. Choice of BREEAM certified buildings

The results from the probit regressions for both office and retail samples are presented in Table 7. The Pseudo R^2 values indicate a 33–37 % improvement in log-likelihood over a null model in the office sample, and a 45–50% of improvement in the retail sample, suggesting a reasonably strong model fit in both cases.

Focusing first on the office segment (Columns (1) - (4)), in line with descriptive analysis in Table 6, the probability of a building being BREEAM certified is significantly influenced by its physical attributes. For example, newer and larger buildings, as well as those with parking and lifts, are more likely to have BREEAM certification. Lease characteristics also play a significant role. Tenants occupying larger floor areas and signing longer leases are more likely to choose BREEAM certified buildings, likely due to the greater potential for energy savings and lower flexibility requirements associated with longer commitments. Additionally, tenants are more inclined to select BREEAM certified buildings when entering new leases. Conversely, leases with early termination options are associated with a lower likelihood of selecting BREEAM certified buildings. Other factors, such as floor level, repairing and insuring obligations, and whether the lease is a head lease, do not show a significant impact on the likelihood of BREEAM selection.

Moving on to tenants' characteristics, Column (2) reveals that publicly listed companies are approximately 3.8% more likely to choose BREEAM certified buildings compared to private companies, consistent with Robinson et al. (2016). This finding suggests that the greater need for CSR disclosure may motivate listed firms to locate in sustainable buildings. Firms in asset-intensive sectors, such as real estate, and those with specialised functions, such as healthcare, are less likely to choose BREEAM certified buildings. This

Table 7. Probit regression results for the office and retail samples.

	Office				Retail			
	(1) Eq (1)	(2) Eq (2)	(3) Eq (3)	(4) Eq (4)	(5) Eq (1)	(6) Eq (2)	(7) Eq (3)	(8) Eq (4)
NIA	− 1.2e-07	− 1.9e-07	− 6.0e-09	− 2.2e-08	1.3e-06***	1.2e-06***	1.8e-06	1.7e-06
	(1.4e-07)	(1.4e-07)	(4.1e-07)	(4.3e-07)	(2.7e-07)	(2.7e-07)	(1.5e-06)	(1.4e-06)
stories	.0191***	.0196***	− .00409	− .00348	− .00189	2.4e-05	.0162	.0201
	(.00414)	(.00429)	(.0115)	(.0128)	(.00807)	(.00863)	(.0456)	(.0453)
parking	.0004***	.00037***	.0023***	.00255***				
					− .00153***	− .00159***	− .00212***	− .00204***
	(.00013)	(.00013)	(.00069)	(.00072)	(.00016)	(.00017)	(.00054)	(.00053)
lifts	.563***	.53***	.276	.263	.206**	.2**	.381	.412
	(.0503)	(.052)	(.171)	(.176)	(.0875)	(.0901)	(.304)	(.3)
age	− .016***	− .0157***			− .0105***	− .0108***	− .0167**	− .0171**
			− .021***	− .0216***				
	(.00123)	(.00131)	(.00506)	(.00517)	(.00159)	(.00153)	(.00713)	(.00737)
age^2	4.9e-05***	4.8e-05***	.00011***	.00011***	2.0e-05***	2.2e-05***	4.4e-05	4.6e-05
	(5.6e-06)	(6.1e-06)	(2.6e-05)	(2.6e-05)	(6.5e-06)	(5.5e-06)	(3.6e-05)	(3.7e-05)
size	5.9e-06***	5.0e-06***	1.8e-06	1.8e-06	6.7e-06	6.2e-06	3.4e-06	7.1e-06
	(1.1e-06)	(1.1e-06)	(1.9e-06)	(1.9e-06)	(9.6e-06)	(1.0e-05)	(4.6e-05)	(4.7e-05)
$size^2$	− 8.9e-12***	− 7.8e-12**	− 3.0e-12	− 2.7e-12	− 6.4e-11	− 5.9e-11	− 6.1e-10	− 6.3e-10
	(3.4e-12)	(3.1e-12)	(2.2e-12)	(1.8e-12)	(1.3e-10)	(1.3e-10)	(1.5e-09)	(1.5e-09)
floor	− .00487	− .00506	.0195	.0198	− .0243	− .0233	.127	.119
	(.00455)	(.00471)	(.013)	(.0136)	(.0184)	(.019)	(.157)	(.157)
lnterm	.263***	.276***	.625***	.635***	.132*	.111	.86***	.895***
	(.0304)	(.0323)	(.135)	(.141)	(.0781)	(.0865)	(.307)	(.303)
FRI	.0131	.0358	.0158	− .0373	.101	.0923	.122	.145
	(.0292)	(.0304)	(.115)	(.117)	(.0747)	(.0768)	(.258)	(.255)
break	− .133***	− .154***	− .154	− .135	− .184**	− .174**	− .362	− .312
	(.0285)	(.0297)	(.108)	(.109)	(.0747)	(.0769)	(.249)	(.253)
newlease	.248***	.261***	.262	.256	.214*	.217*	− .201	− .224
	(.0517)	(.053)	(.177)	(.181)	(.119)	(.122)	(.388)	(.387)
headlease	− .039	− .0158	.205	.206	.289*	.255*	1.76***	1.66***
	(.0404)	(.042)	(.142)	(.145)	(.15)	(.153)	(.502)	(.496)
rentfree	.0107***	.0107***	.00528	.0054	.0192***	.0193***	.0214	.018
	(.00162)	(.00168)	(.00452)	(.00454)	(.00475)	(.00491)	(.0197)	(.0197)
listed		.21***				− .0732		
		(.044)				(.11)		
Consumer discretionary		− .248	− .352	− .115		.165	.63	.567
		(.154)	(.661)	(.671)		(.171)	(.427)	(.443)
Consumer stables		− .182	− .0337	.259		.0347	.767**	.766*
		(.122)	(.38)	(.386)		(.138)	(.389)	(.396)
Energy & utilities		− .0313	.316	.408				
		(.142)	(.426)	(.433)				
Financials		.0281	.25	.495		.28	.875*	.803*
		(.113)	(.363)	(.368)		(.244)	(.456)	(.472)
Health care		− .252*	− .611	.174		− .0738		
		(.138)	(.703)	(.708)		(.314)		
Industrials		− .0316	− .0218	.291		− .00832	1.15**	1.14**
		(.109)	(.351)	(.357)		(.171)	(.499)	(.506)
IT		.0415	.125	.409		− .394		
		(.116)	(.367)	(.375)		(.333)		
Non profit		− .0415						
		(.157)						
Real Estate		− .241**	− .22	.076		.204		
		(.12)	(.389)	(.398)		(.38)		
ESG			.00131				.00498	
			(.00288)				(.00611)	
E				.00061				.00515
				(.00281)				(.00717)
S				.00132				− .00433
				(.0037)				(.00904)
G				.00535**				− .00337
				(.00269)				(.00689)
Constant	− 3.63***	− 3.6***	− 10.4***	− 11***	− 1.07	− .878	− 12.6***	− 12.3***

(*Continued*)

Table 7. (Continued).

	Office				Retail			
	(1) Eq (1)	(2) Eq (2)	(3) Eq (3)	(4) Eq (4)	(5) Eq (1)	(6) Eq (2)	(7) Eq (3)	(8) Eq (4)
	(.44)	(.468)	(1.32)	(1.41)	(.767)	(.828)	(2.08)	(2.15)
submarket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	Yes	Yes	Yes	No	Yes	Yes	Yes
CoStar rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
construction materials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	18138	16077	950	926	5074	4641	487	487
Pseudo R2	0.3255	0.3253	0.3601	0.3727	0.4830	0.4851	0.5432	0.5434
Log pseudolikelihood	− 5646.50	− 5206.08	− 416.81	− 398.80	− 814.27	− 769.84	− 78.45	− 78.40

Estimated results for Probit regressions. Dependent variable: BREEAM. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

aligns with existing literature, which indicates that demand for sustainable buildings varies across industries (Cajias et al., 2014; Chegut et al., 2014; Robinson et al., 2016).

For the ESG measures, the analysis is based on a smaller subsample consisting only of publicly traded tenants with Refinitiv ESG scores. In Column (3), firms with higher overall ESG scores show a positive but statistically insignificant coefficient, indicating that the overall ESG performance among publicly traded firms is not significantly associated with their selection of sustainable properties. However, in Column (4), when ESG pillars are examined separately, the estimated coefficient associated governance (G) score is 0.0012, suggesting that a one score increase in G is associated with 0.1% increase in the probability of selecting a BREEAM certified space. At first glance, this result may appear to contradict the findings in Table 6, where the mean E and S scores are significantly different between tenants of BREEAM and non-BREEAM buildings, while the mean G scores are not significantly different. One possible explanation is that firms with strong corporate governance are more likely to systematically implement sustainability initiatives, such as obtaining building certifications, regardless of the extent to which they publicly emphasise environmental metrics. Although the effect appears modest, it is statistically significant at the 5% level.

Notably, some of the coefficients associated with lease terms (such as break clauses, rent-free periods, and whether it is a new lease) become insignificant in the listed tenants-only subsample estimations. As the subsamples consist only of publicly traded tenants, not only could the significantly reduced sample size impact the consistency of the estimated coefficients, but also the estimations are based on these tenants who may have different leasing behaviours and preferences for certain types of buildings (as shown in Table 7). Therefore, the subsamples do not represent the overall market, and hence our interpretation of the results based on the subsamples is in the context of listed tenants only.

The probit regression results for the retail sample are presented in Columns (5) to (8). Consistent with the office sample, newer buildings are more likely to be BREEAM certified, and tenants are more likely to select a BREEAM certified building when signing new leases. However, in contrast to the office sample, the size of the lease space does not yield significant coefficient, but the size of the building does. In addition, tenant publicly listed status and their ESG scores do not yield significant coefficients in the retail market.

These results imply that retail tenants are less influenced by sustainability factors compared to office tenants when selecting properties, and their decision-making appears to be driven by the physical and locational characteristics of the space (Reynolds & Wood, 2010), rather than broader corporate governance or CSR strategies.

A potential issue is that the separate E, S, and G scores may be highly correlated, leading to multicollinearity, which could explain the observed insignificance of the coefficients for the E and S scores. To address this concern, we conduct a Variance Inflation Factor (VIF) test to assess multicollinearity among the predictors in our model. The results indicate that the VIFs for the three separate scores are 2.70, 2.78, and 1.54, respectively for the office market, and in the retail market, they are 3.71, 4.1, and 1.71, respectively. These relatively low VIF values suggest that multicollinearity does not significantly inflate the variance of our coefficient estimates.

To further validate our findings and mitigate the concern regarding potential false positives due to the high number of coefficients, we simplified the model to include fewer explanatory variables. For example, a model includes only building characteristics combined with separate E, S, and G scores, and or a model that incorporates building characteristics alongside tenants' characteristics. The coefficient estimates of the E, S, and G scores remain consistent across these different model specifications for the office and retail samples.

5.2. Rent, WTP for BREEAM and ESG

The hedonic regression results for the full office and retail samples are presented in Table 8. Again, focusing first on the office segment, column (1) shows the estimates in the baseline model, column (2) includes PSM weights, column (3) also includes PSM weights along with *listed* and its interactive term with BREEAM, and column (4) shows the 2SLS estimation where the natural logarithm of lease term (lnterm) is instrumented using tenant characteristics and the presence of a break option. Both Hausman-related tests (the Score test and the Robust regression F-test) fail to reject the null hypothesis that the lease term is exogenous.

The models explain approximately 59%–60% of the variation in effective rents, which is comparable to the adjusted R^2 values reported by Chegut et al. (2014) for office properties in London. The significance and direction of most coefficients remain consistent across different model specifications,[10] with only minor variations in the estimated magnitudes. For instance, higher effective rents are observed for properties with superior quality attributes, such as newer buildings and the presence of amenities like parking and lifts, all else being equal. Notably, BREEAM-certified office buildings generate a rent premium ranging from 8.3% to 9.5% across all models, which falls between the estimates reported in Chegut et al. (2014) and Fuerst and van de Wetering (2015).

In terms of lease details, lease term is positively related to the rental level, indicating an overall upward-sloping lease term structure (Bond et al., 2008; Grenadier, 1995). New leases command a higher rent compared to lease renewals, and the longer the rent-free period, the lower the overall effective rent. Larger leased spaces are associated with lower rents due to the presence of quantum discounts. Additionally, tenants pay a rent premium for units on higher floors, reflecting a preference for superior views.

Table 8. Hedonic regression results for the full office and retail samples.

	Office				Retail			
	(1) baseline	(2) PSM	(3) Listed	(4) 2sls	(5) baseline	(6) PSM	(7) Listed	(8) 2sls
BREEAM	.0953***	.083***	.0931***	.0877***	− .056	− .0447	− .0243	.0766
	(.00783)	(.00859)	(.00896)	(.011)	(.0494)	(.0673)	(.0692)	(.0804)
listed			.0453***	.0415***			.218***	.167**
			(.0143)	(.0151)			(.0624)	(.0796)
listed_BREEAM			− .0539***	− .0517**			.169	.0265
			(.0201)	(.0205)			(.119)	(.133)
parking	9.2e-05***	8.5e-05***	8.9e-05***	8.8e-05***	.00018***	.00029***	.00029***	− .00012
	(2.8e-05)	(3.0e-05)	(3.1e-05)	(3.1e-05)	(2.1e-05)	(.0001)	(9.8e-05)	(.00018)
lifts	.0343***	.0186*	.0203*	.0276**	.00812	− .0279	− .0511	− .0876
	(.00776)	(.0113)	(.0116)	(.0123)	(.0309)	(.0661)	(.0616)	(.075)
age					.00036	.00015	.0003	− .00086
	− .00118***	− .00201***	− .00204***	− .00191***				
	(.00013)	(.00023)	(.00024)	(.00025)	(.00042)	(.00112)	(.00112)	(.00154)
age^2	4.6e-06***	6.3e-06***	6.3e-06***	5.9e-06***	1.4e-06	2.9e-06	2.5e-06	7.6e-06
	(5.5e-07)	(1.0e-06)	(1.0e-06)	(9.9e-07)	(1.6e-06)	(6.8e-06)	(6.8e-06)	(7.7e-06)
size	− 3.0e-07*	− 3.2e-07*	− 3.3e-07*	− 5.3e-07*	− 6.7e-05***	− 6.2e-05***	− 6.4e-05***	− 2.9e-05**
	(1.8e-07)	(1.8e-07)	(1.9e-07)	(3.2e-07)	(4.1e-06)	(7.6e-06)	(7.4e-06)	(1.2e-05)
$size^2$	2.7e-13	1.8e-13	1.7e-13	3.5e-13	6.5e-10***	5.5e-10***	5.7e-10***	3.4e-10***
	(2.4e-13)	(1.9e-13)	(2.0e-13)	(3.0e-13)	(8.1e-11)	(8.4e-11)	(8.5e-11)	(1.0e-10)
floor	.0121***	.0116***	.0116***	.0117***	.0285**	.0217**	.0215*	.00866
	(.00081)	(.00074)	(.00075)	(.00078)	(.0134)	(.0106)	(.011)	(.014)
lnterm	.0975***	.125***	.123***	.183***	.0158	.0156	.0216	− 1.47***
	(.00629)	(.00877)	(.00896)	(.0587)	(.022)	(.0537)	(.0533)	(.447)
FRI	− .00453	− .00076	− .00231	− .00895	.0184	.008	.0046	.0168
	(.00583)	(.00675)	(.00682)	(.00783)	(.0202)	(.05)	(.0499)	(.0653)
break	− .0137**	− .0191***	− .0182***		− .0634***	− .0982*	− .144**	
	(.0056)	(.00659)	(.00663)		(.0205)	(.0561)	(.0567)	
newlease	.0399***	.0231**	.0253**	.0191	− .00051	− .0188	.0172	.291**
	(.00981)	(.0117)	(.0118)	(.0139)	(.0286)	(.0724)	(.0704)	(.125)
headlease	.00814	.026***	.0275***	.0147	.0183	.0703	.0443	.225
	(.00831)	(.00915)	(.00926)	(.0158)	(.0405)	(.0869)	(.0844)	(.14)
rentfree								.0102
	− .00493***	− .00632***	− .00639***	− .00734***	− .00501***	− .00747**	− .00519*	
	(.00037)	(.00035)	(.00036)	(.0009)	(.00172)	(.00325)	(.003)	(.00629)
constant	2.94***	2.82***	2.81***	2.56***	4.25***	5.04***	4.82***	12.2***
	(.0942)	(.0967)	(.098)	(.299)	(.181)	(.735)	(.725)	(2.37)
submarket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
geocodes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
construction materials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CoStar rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	18091	18053	17108	16003	6142	5079	4852	4648
R squared	0.5833	0.5926	0.5958	0.5917	0.3072	0.2699	0.2818	
Wu-Hausman/score test				1.88093				62.5063***
Durbin-Wu/Robust regression F test				1.08879				20.0393***

Hedonic regression results. Dependent variable: lnR. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Contrary to the expectation that more established, publicly traded companies might use their negotiating power to secure lower rents, the results in column (3) and (4) show that listed companies pay approximately 4.5% more in rent compared to private firms. A plausible explanation for this premium is that publicly traded companies typically have greater financial stability and may be willing to pay higher rents to secure prestigious buildings or prime locations that enhance their corporate image (Tay et al., 1999). Moreover, publicly traded companies may prioritise visibility and reputation over operational cost savings, making them less price sensitive.

The interactive term $Listed_i \times BREEAM_i$ in columns (3) and (4) is significantly negative, suggesting that the combined effect of a publicly traded tenant occupying a BREEAM-certified building results in a lower-than-expected rent premium compared to what would be anticipated if the individual effects were simply additive. Several factors may account for this reduced WTP for BREEAM labels among listed tenants: it could be a result of increased supply that is specific to listed firms, as discussed in Chegut et al. (2014), the marginal WTP for sustainable buildings tends to decline as the supply of such buildings increases. Listed companies, which are often larger in size, may see relatively smaller cost savings from energy efficiency improvements compared to their overall operational costs (Fuerst & McAllister, 2011c). Consequently, while these firms may prefer sustainable spaces, the marginal benefit of occupying a BREEAM-certified building may not justify a substantial rent premium. For some publicly traded firms, especially those in sectors with strong sustainability mandates, BREEAM certification might be viewed as a standard expectation rather than a differentiating factor (Espinoza-Zambrano et al., 2024). As a result, these firms may not view BREEAM certification as a reason to pay a higher rent.

Turning to the rent estimation in the retail sector, the models exhibit relatively low explanatory power, ranging from 27% to 31%. This suggests that there are other determinants of rent that are either unobservable or not captured in the current dataset. The estimated coefficients for physical and lease attributes are generally consistent with expectations. Similar to findings in Veld and Vlasveld (2014), BREEAM certification does not appear to be associated with a rental premium across all models.

Publicly listed tenants in the retail sector also tend to pay higher rents (Columns (7) and (8)), and this listed premium is substantially higher than that observed in the office sample. However, retail tenants' marginal WTP for BREEAM certification is not statistically significant. In line with the results in probit estimations, these findings suggest that for large retailers, factors such as building prestige or prime location are more important drivers of rental decisions than sustainability certification.

Tests in the 2SLS specification indicate that the lease term is endogenous in the retail sample. The 2SLS results also differ from those in columns (5)-(7) with respect to lease characteristics. Specifically, the 2SLS models reveal a downward-sloping lease term structure, suggesting that longer lease terms are associated with lower rents. The rent-free period is no longer a significant determinant of effective rent, whereas retailers appear to pay higher rent for a new lease. These findings reveal the different dynamics between effective rent and lease characteristics when lease term endogeneity is accounted for. Moreover, they align with the broader trend of declining occupier demand in the retail market.

The hedonic regression results for the 'publicly traded tenants only' subsamples, in both the office and retail markets are presented in Table 9. The overall goodness-of-fit decreases for the office sample but improves significantly for the retail sample, suggesting that when focusing on publicly traded tenants, the model captures more variation in rents in the retail market. Although Hausman-related tests do not detect endogeneity in the lease term, the 2SLS results are still reported in Columns (2), (4), (6), and (8) for robustness.

The results indicate that publicly traded tenants value different building attributes and lease features differently across the two sectors. In the office market, similar to the

estimated the results using the full sample, tenants place a rent premium on newer buildings, parking availability, and higher floor levels. With the retail subsample however, unlike in Table 8, these characteristics are not associated with higher rent in the retail market. Conversely, retailers demand rent discounts for head leases, while there is no significant rent difference between head leases and subleases among office tenants. Additionally, rent-free periods continue to yield significant negative coefficients in the office market, but the effect is insignificant in the retail sector.

As discussed above, the subsamples consist of a smaller number of transactions of listed companies only, hence the results presented in Table 9 should not be generalised to all tenants in the London markets. In the office market, the overall ESG score, individual pillar scores, and their interaction terms with BREEAM are statistically insignificant, indicating that large publicly traded firms show little WTP for green-labelled buildings, irrespective of their ESG performance or emphasis. This supports the view that for these office tenants, BREEAM certification may be perceived as a baseline standard rather than a unique value-adding feature, and thus, certification alone does not justify a rent premium.

While a similar pattern is observed in the retail sample in Columns (5) and (6), the results in Columns (7) and (8) reveal more nuanced relationships between the separate ESG pillar scores and rent levels. Specifically, the Social (S) score is positively associated with rent, whereas the Governance (G) score is negatively associated with rent, highlighting the complexity of tenants' preferences when it comes to building and location choices based on different ESG dimensions.

The positive coefficient for the Social (S) score suggests that retail tenants who place a stronger emphasis on social factors are willing to pay a premium that goes beyond traditional building quality and location features. This indicates that these firms may value intangible or less quantifiable attributes that align with their social commitments. For example, locations and properties are known for fostering community engagement and inclusivity. In contrast, the negative coefficient for the Governance (G) score suggests that retailers with a strong focus on governance tend to pay lower rents. These firms may leverage their strong governance practices and perceived stability to negotiate lower rent, positioning themselves as attractive long-term anchor tenants.

Interestingly, the interaction term between the Governance (G) score and BREEAM certification is positive, indicating that retailers with strong governance practices are willing to pay a premium for BREEAM-certified buildings. This suggests that while these tenants generally seek to minimise rental costs, they recognise and value the alignment of BREEAM-certified properties with their emphasis on operational efficiency, ethical management, and long-term sustainability, leading to a higher WTP for such spaces.

Overall, these results suggest that the impact of ESG characteristics on rent varies significantly across sectors and that the drivers of WTP for sustainable attributes differ depending on the specific ESG dimension prioritised by the tenant.

5.3. Further analysis

In this section, we provide further analysis to consider the potential temporal effects and other robustness checks. Figure 1 shows a notable increase in the ESG scores of all firms beginning in 2017. Tests for structural breaks confirm that 2017 constitutes a significant

Table 9. Hedonic regression results for the 'publicly traded tenants only' subsamples in the office and retail markets.

	Office				Retail			
	(1) ESG	(2) ESG 2SLS	(3) E, S, G	(4) E, S, G 2SLS	(5) ESG	(6) ESG 2SLS	(7) E, S, G	(8) E, S, G 2SLS
BREEAM	.118	.145	.0899	.134	.267	.186	.0497	.00886
	(.0924)	(.098)	(.0894)	(.112)	(.399)	(.411)	(.407)	(.382)
ESG	.00039	.00054			− .00245			
						− .00312		
	(.00094)	(.00093)			(.00278)	(.00281)		
ESG_BREEAM	− .00121	− .00118			− .00134			
						− .00069		
	(.00167)	(.00155)			(.00709)	(.00683)		
E			− .00077	− .00065			− .00538	− .00551
			(.00086)	(.00089)			(.00368)	(.00346)
E_BREEAM			− .00035	− .00028			.00135	.00281
			(.00106)	(.00105)			(.00673)	(.00764)
S			.0006	.00069			.00949**	.00931**
			(.00132)	(.00125)			(.0048)	(.00435)
S_BREEAM			.00021	− .00021			− .0115	− .0128
			(.00162)	(.00169)			(.00809)	(.00886)
G			.00074	.00086				
							− .00567*	− .00577**
			(.00099)	(.00098)			(.00301)	(.00282)
G_BREEAM			− .00052	− .00053			.0133**	.0131**
			(.0012)	(.00117)			(.00632)	(.00586)
parking	.00025*	.00028**	.00026*	.00028**	4.7e-05	7.0e-05	.0001	.00011
	(.00013)	(.00014)	(.00013)	(.00013)	(.00021)	(.00019)	(.0002)	(.00018)
age	− .00408**	− .00544**	− .00407**	− .00521**	.00221	.00247	.00199	.0022
	(.00187)	(.00234)	(.00192)	(.00244)	(.0028)	(.00273)	(.00259)	(.00251)
age^2	2.1e-05*	3.0e-05**	2.1e-05*	2.8e-05*	3.3e-06	2.2e-06	2.7e-06	1.6e-06
	(1.1e-05)	(1.5e-05)	(1.1e-05)	(1.5e-05)	(1.6e-05)	(1.5e-05)	(1.5e-05)	(1.4e-05)
size	7.8e-08	5.9e-07	1.8e-07	6.1e-07	− 6.5e-05***	− 6.9e-05***	− 6.6e-05***	− 6.9e-05***
	(3.3e-07)	(5.7e-07)	(3.4e-07)	(6.1e-07)	(1.0e-05)	(1.2e-05)	(1.0e-05)	(1.1e-05)
$size^2$	− 1.8e-13	− 5.6e-13	− 2.5e-13	− 5.8e-13	5.7e-10***	5.8e-10***	5.8e-10***	5.9e-10***
	(3.0e-13)	(4.5e-13)	(3.1e-13)	(5.0e-13)	(9.3e-11)	(9.6e-11)	(8.9e-11)	(8.8e-11)
floor	.00828***	.0085***	.00822***	.00852***	.196	.191	.157	.156
	(.00215)	(.0021)	(.00213)	(.0021)	(.145)	(.133)	(.14)	(.128)
headlease	.0424	.079	.0413	.0715	− .285**		− .302**	− .325**
						− .312**		
	(.0295)	(.0492)	(.03)	(.0524)	(.143)	(.138)	(.146)	(.14)
rentfree					.0117	.0106	.00415	.00342
	− .00758***	− .00592***	− .00755***	− .00616***				
	(.00119)	(.00205)	(.00119)	(.00217)	(.00822)	(.00806)	(.00725)	(.00691)
lnterm	.0397	− .144	.0324	− .122		− .113		− .148
					− .308***		− .335***	
	(.0352)	(.182)	(.0381)	(.199)	(.114)	(.376)	(.111)	(.408)
constant	3.54***	4.41***	3.58***	4.3***	7.07***	6.21***	7.67***	6.81***
	(.219)	(.681)	(.233)	(.719)	(.751)	(1.71)	(.746)	(1.94)
submarket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
geocodes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
construction materials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
building attributes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(*Continued*)

Table 9. (Continued).

	Office				Retail			
	(1) ESG	(2) ESG 2SLS	(3) E, S, G	(4) E, S, G 2SLS	(5) ESG	(6) ESG 2SLS	(7) E, S, G	(8) E, S, G 2SLS
lease attributes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	972	967	946	943	588	587	588	587
R squared	0.4973	0.4670	0.4913	0.4697	0.5130	0.5082	0.5340	0.5296
Wu-Hausman /score test		1.4593		0.9500		0.3701		0.3246
Durbin-Wu /Robust regression F test		0.9288		0.5615		0.2761		0.2245

Hedonic regression estimates, ESG subsamples. Dependent variable: lnR. Results of insignificant coefficients are omitted from the table for presentation purposes. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

breakpoint in the overall ESG scores, as well as in the individual E and G scores. Consequently, both the office and retail samples are divided into two subperiods at this juncture. Moreover, the MEES, which were implemented on 1 April 2018, signify another critical date. These standards likely reduced the availability of buildings with exceedingly poor energy performance. This date is utilised as an alternative breakpoint to explore potential temporal heterogeneity within our dataset. The results of the probit regressions for the office and retail samples are presented in Tables 10 and 11, respectively.

In the office sample as shown in Table 10, the coefficients of *listed* remain similar to the results in Table 7 and consistent across different subperiods, indicating that publicly listed tenants consistently prefer BREEAM-certified buildings compared to private companies, irrespective of regulatory changes or increasing focus on ESG practices. In the sample comprising only publicly listed tenants, the likelihood of selecting a BREEAM-certified space does not appear to be significantly linked to the overall ESG scores or individual scores prior to 2017 or before the implementation of the MEES in April 2018. However, post-2017 and following the MEES implementation, the coefficients for E and G scores turned significantly positive. These results imply that the alignment between environmental performance and corporate leasing decisions may have become an increasingly significant consideration among listed companies.

For the retail sample as shown in Table 11, listed tenants seemed less likely to occupy a BREEAM-certified building before 2017 or prior to the MEE standards. As noted earlier, this may be because larger retailers tend to prioritise central locations, where retail properties are typically older and less likely to have sustainability certifications. However, the probability of selecting a BREEAM-certified space becomes positive and statistically significant in later subperiods as ESG considerations gain prominence. Similar to the office sample, the coefficient for the overall ESG score is marginally significantly positive post-2017, and the G score also yields a significantly positive coefficient post-MEES. This suggests a possible increasing alignment between environmental performance and corporate leasing decisions among larger retailers.

The hedonic rent estimation results for the subperiods are detailed in Table 12. Given the similarity in results across both sets of subperiods, we focus our temporal analysis using 2017 as a division point. In the office sample, the interaction term$listed_i \times BREEAM_i$, no longer exhibits a negative coefficient in later periods, indicating that listed tenants do not pay a smaller rental premium for BREEAM certification compared to private tenants. The other estimated coefficients, including those associated with ESG scores and their interactions with BREEAM, are consistent across both subperiods as shown in Table 9. This implies that there is no significant temporal heterogeneity in our office sample only consists of listed tenants. Similarly, results for the retail sample remain largely consistent, with the notable exception that the BREEAM premium associated with high Governance (G) scores is only observed in the later period. The temporal analysis suggests that a possible increasing alignment between environmental performance and corporate leasing decisions and their WTP for green labelled buildings, particularly among larger retailers. However, given that our estimates are based on small subsamples, the results should be interpreted with caution.

We further consider other factors such as mixed-use buildings, different types of BREEAM ratings, and the financial performance such as profitability and market capitalisation of firms. To account for additional firm characteristics, we included firm size, measured by the natural logarithm of market capitalisation, and profitability, indicated by return on assets (ROA). Financial data was sourced from Refinitiv; however, only about 50% of the tenants in our sample could be successfully matched. These variables were incorporated into both the probit and hedonic regressions for the office sample. The results are presented in Table 13. With the inclusion of firms' financial characteristics, the estimated relationships between tenant characteristics and BREEAM certification in both the probit and hedonic regressions remain consistent with the previous results. Market capitalisation is positively associated with the likelihood of occupying a BREEAM-certified building, reinforcing earlier findings that larger companies are more likely to lease green-labelled office space. Due to the retail sample comprising fewer than 200 observations with available financial measures, we opted not to repeat this analysis for the retail segment.

Additionally, approximately 50% of the observations are identified as mixed-use properties. Therefore, our analysis is applied to this subset of mixed-use properties only. The results are presented in Table 14. As indicated, the findings are consistent with our earlier analyses.

Previous research on BREEAM has also examined the price effects of different BREEAM ratings. These results are presented in Table 15. The findings confirm that in the office sample, higher BREEAM ratings are associated with greater green premiums. However, in the retail sample, only BREEAM_Good yields a rental premium. For Equations (7)-(9), incorporating multiple interaction terms between different BREEAM ratings and listed status/ESG scores increases model complexity, making the results difficult to interpret. To address this, we replace the binary BREEAM variable with alternative classifications, such as BREEAM Excellent and above, BREEAM Very Good and above, and BREEAM Good and above. The results from both the probit and hedonic regressions remain consistent with those reported in in Tables 7–9, and available upon request.

Table 10. Probit regression results with temporal considerations, the office sample.

	Office											
	Before Jan 2017			After Jan 2017			Before 01 Apr 2018			After 01 Apr 2018		
	(7) Eq(2)	(8) Eq(3)	(9) Eq(4)	(10) Eq(2)	(11) Eq(3)	(12) Eq(4)	(1) Eq(2)	(2) Eq(3)	(3) Eq(4)	(4) Eq(2)	(5) Eq(3)	(6) Eq(4)
Listed	.218***			.174**			.21***			.146		
	(.0546)			(.0843)			(.051)			(.108)		
ESG		.00431			−.00096			.0029			.0198	
		(.00368)			(.0054)			(.00329)			(.0132)	
E			.00116			.00355			.00019			.0914***
			(.00367)			(.00574)			(.00322)			(.0209)
S			.00228			−.00918			.00091			.00575
			(.00471)			(.00796)			(.00428)			(.0277)
G			.00522			.0159***			.00599*			.0806***
			(.0035)			(.00518)			(.00324)			(.0243)
Constant	−4.07***	−11.6***	−11.9***	−1.05**	−3.13**	−3.85**	−4.34***	−10.6***	−11***	−.73	−4.6*	−15.1***
	(.588)	(1.63)	(1.83)	(.41)	(1.53)	(1.57)	(.571)	(1.35)	(1.54)	(.474)	(2.53)	(5.44)
Submarket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CoStar rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Construction materials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	10859	655	611	5146	313	290	12779	778	730	3276	184	173
Psedudo R2	0.3288	0.3972	0.4051	0.3262	0.3890	0.4214	0.3339	0.3804	0.3949	0.3201	0.5902	0.7197
Log pseudolikelihood	−3427.90	−269.16	−249.04	−1747.05	−131.63	−115.83	−4066.54	−330.00	−303.09	−1111.49	−51.98	−33.54

Estimated results for Probit regressions. Dependent variable: BREEAM. Other explanatory variables included, but not presented in the table. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table 11. Probit regression results for subperiod after the MEE was announced and took effect, the retail sample.

	Retail											
	Before Jan 2017			After Jan 2017			Before 01 Apr 2018			After 01 Apr 2018		
	(7) Eq(2)	(8) Eq(3)	(9) Eq(4)	(10) Eq(2)	(11) Eq(3)	(12) Eq(4)	(1) Eq(2)	(2) Eq(3)	(3) Eq(4)	(4) Eq(2)	(5) Eq(3)	(6) Eq(4)
listed	−.312**			.276*			−.211*			.445**		
	(.154)			(.153)			(.125)			(.199)		
ESG		−.00314			.052*			.00141			.0249	
		(.00932)			(.0302)			(.00704)			(.0159)	
E			.0111			.0121			.00692			.0108
			(.0129)			(.0147)			(.00917)			(.0155)
S			−.0107			−.0224			−.00525			−.0295
			(.0146)			(.018)			(.0112)			(.0246)
G			−.013			.0185			−.0113			.0839***
			(.0103)			(.0149)			(.00769)			(.0286)
constant	−3.8***	−9.07***	−9.45***	−1.48*	−5.23	−8.17***	−.658	−8.68***	−8.19***	−2.21**	−2.07	−6.81**
	(.816)	(2.57)	(2.67)	(.887)	(4.24)	(2.56)	(.581)	(2.04)	(2.14)	(.946)	(1.57)	(2.67)
submarket	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
CoStar rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
construction materials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
N	2281	309	309	2327	169	193	3131	387	387	1470	97	97
Psedudo R2	0.4862	0.5727	0.5832	0.4765	0.7261	0.6990	0.4770	0.5505	0.5596	0.4776	0.4879	0.6392
Log pseudolikelihood	−396.48	−42.07	−41.04	−376.45	−20.33	−23.51	−573.51	−62.53	−61.26	−201.60	−18.59	−13.10

Estimated results for Probit regressions. Dependent variable: BREEAM. Other explanatory variables included, but not presented in the table. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table 12. Hedonic regression results for office and retail samples, by sub-periods.

	Office						Retail					
	Before Jan 2017			After Jan 2017			Before Jan 2017			After Jan 2017		
	(1) Listed	(2) ESG	(3) E/S/G	(4) Listed	(5) ESG	(6) E/S/G	(7) Listed	(8) ESG	(9) E/S/G	(10) Listed	(11) ESG	(12) E/S/G
BREEAM	.0836***	.0578	.0532	.0891***	.232	.269	.0545	.524	.69	.114	.0529	− .612
	(.0109)	(.109)	(.0999)	(.0141)	(.165)	(.205)	(.134)	(.444)	(.568)	(.114)	(.729)	(.74)
listed	.0692***			− .00742			.109			.303***		
	(.0152)			(.0315)			(.117)			(.117)		
listed_BREEAM	− .0699***			− .00564			− .135			.171		
	(.0226)			(.0411)			(.222)			(.16)		
ESG		.00021			.0017			− .00205			.00175	
		(.00099)			(.00223)			(.00296)			(.00631)	
ESG_BREEAM		− .00093			− .00173			− .0069			− .0021	
		(.00199)			(.00301)			(.00721)			(.0117)	
E			− .00036			− .00065			− .00113			− .0124*
			(.00087)			(.00194)			(.00329)			(.0073)
S			.00105			− .00095			.00607			.0285***
			(.00128)			(.00314)			(.00399)			(.0106)
G			− .0006			.00247			− .00466*			− .0118***
			(.0008)			(.00222)			(.00252)			(.00376)
E_BREEAM			− .00034			.00041			.00772			.00483
			(.00123)			(.00222)			(.00999)			(.0111)
S_BREEAM			− .00074			− .00051			− .018			− .0141
			(.00181)			(.00372)			(.0113)			(.0114)
G_BREEAM			.00041			− .0021			.00524			.0201***
			(.0011)			(.00282)			(.00755)			(.00609)
constant	2.68***	3.75***	3.68***	3.38***	3.54***	3.5***	13.5***	4.51	9.76***	8.42***	7.65***	10.7***
	(.114)	(.292)	(.316)	(.0852)	(.35)	(.424)	(3.26)	(3.02)	(2.87)	(2.06)	(1.92)	(2.07)
submarket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
geocodes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
construction materials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
building attributes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lease attributes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2SLS	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	11883	676	637	6485	334	310	2282	348	348	2368	239	239
R2	0.6000	0.5641	0.5440	0.5156	0.3453	0.3519	.	0.4363	0.2001	0.1014	0.5509	0.5900

Hedonic regression results for subperiods. Dependent variable: lnR. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table 13. Probit and hedonic regression results with inclusion of firms' other characteristics, office sample.

	Office			
	(1) probit (ESG)	(2) probit (E, S, G)	(3) hedonic (ESG)	(4) hedonic (E, S, G)
BREEAM			.0561	.068
			(.104)	(.129)
ESG	− .00289		.00129	
	(.00422)		(.00161)	
lnmarketcap	.0807**	.0819**	− .00928	− .0102
	(.0356)	(.0413)	(.00736)	(.00845)
ROA	1.1	.0189	− .82	− .721
	(2.76)	(2.91)	(.693)	(.762)
ESG_BREEAM			.0006	
			(.00179)	
E		− .00427		− .00036
		(.00441)		(.00134)
S		.00668		.0001
		(.00616)		(.00239)
G		.00266		.00164
		(.00419)		(.00163)
E_BREEAM				.00027
				(.00147)
S_BREEAM				.00062
				(.00243)
G_BREEAM				− .00082
				(.00184)
constant	− 11.8***	− 13.3***	3.29***	3.25***
	(1.65)	(1.86)	(.24)	(.281)
submarket	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes
industry	Yes	Yes	No	Yes
N	518	480	534	497
Psedudo R2/R2	0.3952	0.4120	0.5741	0.5715
Log pseudolikelihood	− 216.76	− 195.45		

Probit and hedonic regression results with the inclusion of firms' other characteristics, office sample. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

6. Conclusion

As global concerns in sustainability, corporate responsibility, and social impact continue to grow, understanding occupiers' ESG initiatives has become increasingly relevant to property owners, managers, and policy makers. Understanding occupiers' demand for sustainable buildings can help mitigate risks related to regulatory changes, environmental liabilities, and evolving market preferences. This study is one of the first few studies that provide quantitative evidence on the occupiers' preference and WTP for sustainable buildings with the consideration of their ESG profiles.

Our results show that publicly listed companies are more likely to occupy BREEAM-certified office spaces, highlighting their need to align CSR mandates and signal environmental commitment to stakeholders. However, this relationship is not evident in the retail sector, suggesting that sustainability certifications are less relevant for retail tenants when choosing properties.

The study further confirms the existence of a BREEAM-related rent premium in the office market in general, but such green premium is only evident among tenants with

Table 14. Probit and hedonic regression results, mixed-used buildings subsample, office and retail sectors.

	Office				Retail			
	(1) probit (ESG)	(2) probit (E, S, G)	(3) hedonic (ESG)	(4) hedonic (E, S, G)	(5) probit (ESG)	(6) probit (E, S, G)	(7) hedonic (ESG)	(8) hedonic (E, S, G)
BREEAM			.0608	.116			.142	.115
			(.115)	(.109)			(.385)	(.395)
ESG	.00252		.00054		.00999		− .00021	
	(.00425)		(.0012)		(.0079)		(.00387)	
ESG_BREEAM			− .00013				.00219	
			(.00215)				(.00643)	
E		.00626				.0068		
				− .00255**				− .00313
		(.00443)		(.00122)		(.00797)		(.00418)
S				.003*		− .00179		.0108**
		− .00333						
		(.00674)		(.00168)		(.0102)		(.00478)
G		.00676		− 6.3e-05		− .00378		
								− .00661
		(.00431)		(.00128)		(.00695)		(.00414)
E_BREEAM				.0014				
								− .00552
				(.0016)				(.00859)
S_BREEAM				− .00208				− .005
				(.00215)				(.0104)
G_BREEAM				− .00014				.0147**
				(.00164)				(.00726)
constant	− 9.21***	− 10.4***	3.38***	3.24***	− 5.8***	− 5.5**	7.34***	7.64***
	(1.97)	(2.04)	(.434)	(.479)	(2.07)	(2.15)	(1.21)	(1.18)
submarket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	482	459	518	492	242	242	280	280
Psedudo R2/R2	0.4395	0.4447	0.5693	0.581	0.4573	0.4563		
Log pseudolikelihood	− 187.23	− 176.65			− 65.42	− 65.54	− 210.11	− 199.43

Probit and hedonic regression results, mixed use buildings subsamples for the office and retail sectors. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

stronger Governance emphasis in the retail market. These results suggest that tenant WTP for sustainable buildings is not uniform and varies significantly based on the types of tenant and the ESG dimension that they prioritise. Furthermore, our temporal analysis suggests that that the alignment between environmental performance and corporate leasing decisions may have become an increasingly significant consideration among office tenants and retailers.

With the increasing focus on ESG, the desire among tenants for sustainable buildings could intensify, serving as a favourable market factor that propels the advancement of the sustainable construction and retrofit agenda. This also implies that office markets are likely to see increased polarisation, with high demand for sustainable, high-performance buildings and a declining appeal for substandard properties. In contrast, the retail sector

Table 15. Hedonic rent regressions with different BREEAM ratings, office and retail samples.

	Office		Retail	
	(1) PSM	(2) 2SLS	(3) PSM	(4) 2SLS
BREEAM_excellent above	.101***	.0896***	− .0852	.13
	(.0116)	(.0145)	(.086)	(.109)
BREEAM_very good	.0749***	.0757***	− .0302	.157
	(.00979)	(.0107)	(.0813)	(.119)
BREEAM_good	.0425*	.0386	.185	.459***
	(.0235)	(.0248)	(.155)	(.164)
BREEAM_pass	.0609	.0706*		
	(.0376)	(.0425)		
NIA	2.6e-08	5.6e-09	9.8e-08	− 1.8e-07
	(3.2e-08)	(3.4e-08)	(1.6e-07)	(2.2e-07)
stories	− .00162***	− .00117*	− .0115***	.00817
	(.00062)	(.00064)	(.00446)	(.00813)
Parking	7.9e-05**	8.8e-05***	7.2e-05	− .00023
	(3.1e-05)	(3.2e-05)	(.00012)	(.0002)
Lifts	.0221**	.0308**	− 8.8e-05	− .112
	(.0112)	(.0122)	(.0603)	(.0876)
Age	− .00199***	− .0019***	.00094	− .00032
	(.00023)	(.00024)	(.00113)	(.00179)
Age^2	6.2e-06***	5.9e-06***	1.1e-07	5.3e-06
	(1.0e-06)	(9.5e-07)	(6.8e-06)	(8.5e-06)
size	− 4.0e-07**	− 6.8e-07**	− 6.4e-05***	− 1.5e-05
	(1.9e-07)	(3.2e-07)	(7.7e-06)	(1.4e-05)
$size^2$	2.3e-13	4.9e-13	5.7e-10***	2.6e-10**
	(1.9e-13)	(3.1e-13)	(8.4e-11)	(1.1e-10)
floor	.0127***	.0127***	.0375**	− .00676
	(.00093)	(.00098)	(.0168)	(.0219)
lnterm	.123***	.186***	.017	− 2.07***
	(.00881)	(.0523)	(.0539)	(.51)
FRI	− .0035	− .0106	.0132	.00638
	(.00664)	(.00767)	(.0519)	(.0771)
Break	− .0186***	− .0313**	− .127**	− .0133
	(.00655)	(.0135)	(.0579)	(.0794)
newlease	.0232**	.018	− .023	.41***
	(.0116)	(.0134)	(.0715)	(.15)
headlease	.0267***	.0153	.0564	.325*
	(.00914)	(.0141)	(.0875)	(.179)
Rentfree	− .00633***	− .0072***	− .00861***	.014*
	(.00035)	(.00076)	(.00331)	(.00766)
Constant	2.84***	2.57***	5.27***	15.3***
	(.0972)	(.267)	(.814)	(2.63)
Submarket	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Geocodes	Yes	Yes	Yes	Yes
Construction materials	Yes	Yes	Yes	Yes
CoStar rating	Yes	Yes	Yes	Yes
PSM	Yes	Yes	Yes	Yes
N	18204	16141	5079	4650
R squared	0.5929	0.5921	0.2305	.
Wu-Hausman/score test		2.2568 ($p = 0.1330$)		122.351 ($p = 0.0000$)
Durbin-Wu/Robust regression F test		1.2883 ($p = 0.2564$)		37.587 ($p = 0.0000$)

Hedonic regression results. Dependent variable: lnR. Each column in each panel represents one separate regression. Standard errors are reported below the coefficients. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

may require additional incentives or policy interventions to promote sustainability, given the lack of significant rent premiums for BREEAM-certified spaces. Property owners and managers should consider tenant ESG profiles when designing and marketing sustainable properties to attract premium tenants and align with broader sustainability goals.

This study contributes to the ongoing discussion on ESG considerations in real estate by demonstrating that tenants' ESG agendas can shape their building choices and rent negotiations. Although commercial real estate markets exhibit considerable heterogeneity, the maturity of the market and the presence of major corporations in London render the demand for green buildings in relation to occupiers' ESG considerations comparable to other similar international cities. The findings of this study may reflect broader trends and provide a basis for further comparative research.

We acknowledge that, with the use of ESG scores, our empirical approach provides insights into the behaviour of listed companies but limits our ability to generalise these findings to non-listed tenants, as they typically do not disclose ESG/CSR information. Future studies could improve this analysis by including more detailed ESG data and exploring alternative metrics that capture the ESG/CSR practices of private companies. In addition to BREEAM certification, other measures can capture aspects of digital infrastructure and wellbeing features. Incorporating these would allow for a more comprehensive assessment of the ESG dimensions of the built environment. Additionally, further research could investigate the impact of ESG factors on the dynamics between landlords and tenants.

Notes

1. The regulation stipulates that from April 2018, it becomes unlawful to rent out properties with an EPC rating below grade E in England or Wales. From April 2023 onwards, the policy was extended to continuing leases affecting all rented properties rated F or G.
2. The retail sample is over shorter period due to the small number of observations in the early years.
3. If a tenant occupies multiple floors, we use the highest floor.
4. Now part of the London Stock Exchange Group (LSEG).
5. These refer to the number of lease transactions in which tenants' Refinitiv ESG scores can be identified.
6. The average ESG scores are not used in our regression models.
7. We also use ESG scores of matched tenants in our sample, the overall trends among the scores are similar to those in Figure 1.
8. For example, the number of organisations who are signatories of the United Nations Principles for Responsible Investment (UNPRI) continues to grow. Corporations listed on the London Stock Exchange are required to report their levels of greenhouse gas emissions (GHG) based on the 'Quoted companies GHG reporting' issued in 2013. Chinese firms have been required to disclose environmental information according to the Environmental Information Disclosure Act issued by the Chinese Government in 2008. In 2012, Mexico passed the Climate Change law, which sets requirements for mandatory emission measurement and reporting. Companies in the European Union (EU) started adapting to the EU Non-Financial Reporting Directive issued in 2014.
9. Excluding the size and the height of the building, as the floor space and floor level of the lease are included.
10. The only inconsistency appears to be with variable *newlease* in the 2SLS specification.

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Statements and declarations

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