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Green Premium: What is the Implied Prognosis for Sustainability?

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ABSTRACT

Economic considerations underpin almost every decision to determine social priorities. It is not surprising then that sustainability has fast become, among other things, economic advocacy. This has led to a proliferation of studies to establish the provenance of a green premium to provide impetus for sustainable real estate development to drive the sustainability agenda. The extant literature is replete with studies that conclude that green buildings, which are a proxy for sustainable real estate, command a green premium, notwithstanding disagreement about the size of the green premium. We revisit the green premium debate by analyzing Building Research Establishment Environmental Assessment Method (BREEAM) certified office buildings (a proxy for green buildings) in the Greater London area to ascertain the prevalence of a green premium and to answer the following questions: is the premium truly green (green-magic)? What prognosis does the green premium provide for sustainability? The study uses quantitative analysis (a hedonic model to analyze 2,842 CoStar transaction data points from 2008 to 2018 inclusive) and psychographic analysis based on primary data from a questionnaire survey of approximately 450 BREEAM certified building owners and occupiers in the Greater London area to address the research questions. The preliminary results of the hedonic model analysis show that BREEAM certification commands a rental and price premium of 4.3% and 22.3% respectively. Furthermore, the results reveal that a higher certification level generally generates a higher premium while certified buildings in outer zones generate a higher premium than those in the CBD. In addition, the results of both the quantitative and psychographic analyses imply that the premium is more a novelty premium than green-magic. This portends a dismal prognosis for sustainability and warns that sustainability cannot be won on purely economic grounds. Finally, the results of the psychographic analyses show that there is no meeting of minds (*consensus ad idem*) between investors in green office buildings on one side and green office space users (tenants) on the other. The results of the study could be of interest to London green office building market participants, researchers, practitioners, and sustainability adherents.

KEYWORDS

BREEAM certification; green premium; sustainability; prognosis

Economic considerations underpin almost every decision to determine social priorities. In consonance with Keynes' belief that "the love of money is the cancer of all economies" (Skidelsky, 1992, p. xix), the love of economics appears to have become the cancer of sustainability. Even before the Brundtland Commission's report (WCED, 1987), Mahapatra (1984) analyzes investors' incentives for sustainability and concludes that investors are economically rational rather than ethical. It is not surprising then that notwithstanding sustainability's survival imperativeness, sustainability has fast become, among

other things, economic advocacy in total disregard of the Ecologist (1960) observation that:

The principal defect of the industrial way of life with its ethos of expansion is that it is not sustainable ... We can be certain, however, that sooner or later it will end (only the precise time and circumstances are in doubt) and it will do so in one of two ways: either against our will, in a succession of famines, epidemics, social crises and wars; or because we want it to—because we wish to create a society which will not impose hardship and cruelty upon our children—in a succession of thoughtful, humane and measured changes.

The enchantment with economics has led to a proliferation of studies to establish the provenance

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of a green premium to provide impetus for sustainable real estate development to drive the sustainability agenda. The extant literature is replete with studies that conclude that green buildings, which are a proxy for sustainable real estate, command a green premium notwithstanding disagreements about the size of the green premium (e.g., Fuerst et al., 2017; Kim et al., 2017; Oyedokun, 2017; Sayce et al., 2010). Moreover, most of the past studies have predominantly focused on *if* there is a green premium for certified office buildings (e.g., Chegut et al., 2011; Fuerst & McAllister, 2011a, 2011b; Kim et al., 2017). The decisive factors for the green premium are under-researched. We therefore revisit the green premium debate by analyzing Building Research Establishment Environmental Assessment Method (BREEAM) certified office buildings (a proxy for green buildings) in the Greater London area to ascertain the prevalence of a green premium and to answer the following questions: is the premium truly green (green-magic)? What prognosis does the green premium provide for sustainability?

Answering the above research questions would be of special significance to a city like London given its global and financial importance. The focus on London differentiates this study from the extant literature, which focuses on the United Kingdom as a whole. Thus, this study is aimed at ascertaining a green premium for BREEAM certified office buildings in Greater London and, if such a premium exists, to ascertain whether it is green-magic.

Underneath the veneer of the preceding objectives is, in our view, a more important objective of attempting to analyze and opine about what all these (green premium, if affirmed, and the reliance on an economic argument and the market to drive sustainability) prognosticate about sustainability. This is the stark difference between this paper and the existing literature. The literature deals with green rental and price premia, the savings in operating expenses attributable to green features, and the cap rate discount (averaging 0.46%) for green buildings (see Leskinen et al., 2020), while this paper goes beyond a comparative analysis of green and brown office buildings to subject the green rental and price premia to incremental analysis to ascertain the implication(s) of the premia for sustainability—this is new to the literature on the impact of green certification on property values. The essence

of this is to find out if an investor whose objective is to receive a Target Rate of Return (TRR)—also known as hurdle rate, discount rate, or required rate of return (RRR)—of $x\%$ will achieve their objective by paying the green sale price premium to receive the green rental premium. We posit that reliance on the green premium with its concomitant market economy to drive sustainability would exacerbate the sustainability problem for the near future generations to portend a gloomy prognosis for sustainability as a whole.

The rest of the paper proceeds as follows: The next section provides a brief review of the relevant literature. This is followed by data sourcing and management after which the results of the data analysis are presented and discussed. The last section is devoted to concluding remarks.

Literature Review

The urgency emanating from the awareness of global warming and an ominous impending but fast approaching environmental catastrophe has given rise to various schemes/programs to drive green advocacy. One such program buoying the green revolution is the emergence of worldwide rating systems such as BREEAM in the United Kingdom, Leadership in Energy and Environmental Design (LEED) and ENERGY STAR in the United States, Green Globes and Green Mark in Singapore, BOMA-Best in Canada, Green Star in Australia, and High Environmental Quality (HQE) in France. These rating systems are meant to encourage environmentally and socially responsible building practices by awarding “badges” for buildings’ varying degrees of “green,” as well as differentiating green from non-green (“brown” hereafter) buildings. Thus, the rating systems are helping to promote a built environment that balances economic and social forces against the environmental imperatives of resource conservation and renewal for the world of tomorrow. Whether strict compliance with the rating systems, i.e., every new building meriting and being awarded the highest level of green certification, equates to sustainability is debatable as it is nowhere claimed that such an achievement can balance the ensuing economic and social effects against the environmental imperatives of both resource conservation and more significantly ecological renewal for future

generations. If this is a tenable proposition, one may postulate from the outset the ability to debate anything emanating from green certification, which is symbolic of green buildings, amounting to sustainability. However, since green premiums are predicated upon the perceived and/or actual benefits of green buildings, it is worth briefly discussing the benefits of green buildings.

Benefits of Green Buildings

According to the literature, the benefits of green buildings include government subsidies, tax reliefs, and reduced regulatory barriers (McAllister, 2014); total or partial tax exemption, low interest loans, an increase of the Floor-to-Density ratio (Alker et al., 2014; Gou et al., 2013; Olubunmi et al., 2016; VanderDoes, 2008), energy cost savings (Kats et al., 2003), lower staff turnover and higher productivity gains by tenants (Addae-Dapaah & Chieh, 2011), goodwill benefits (Devine & Kok, 2015; Eichholtz et al., 2013) and marketing benefits (Lützkendorf & Lorenz, 2011; Reichardt et al., 2012). However, some of these benefits have been debated by other researchers. For example, Scofield (2009) shows that certified office buildings in New York at the time consistently underperformed (i.e., used more energy) than conventional office buildings in the area. Xie et al. (2017) replicate Scofield (2009) by citing Newsham et al. (2009) to the effect that 28%–35% of LEED's certified buildings use more energy than conventional ones. This is another verification of the Jevon Paradox (the Rebound Theory in economics which is being hotly contested—e.g., Giampietro & Mayumi, 2018) which states that “in the long term, an increase in efficiency in resource use will generate an increase in resource consumption rather than a decrease” (Giampietro & Mayumi, 2018, p. 1). Furthermore, Giampietro and Mayumi (2018, p. 1) conclude that “sustainability cannot be achieved by technological innovations alone, but requires a continuous process of institutional and behavioral adjustment.” This is a stark and timely reminder that energy efficiency, instead of reducing utility consumption cost through lowering total utility consumption to beget a rental/sale premium, could increase utility consumption cost through increased total utility consumption to engender rental/sale discount.

McAllister (2014) claims that tenants only profit from energy cost saving sustainable features if there is a net rental lease (triple net in the United States). However, net or gross lease should not, theoretically at least, affect the lessee or the lessor if both parties are informed. According to the International Valuation Standards Committee (IVSC), “market rent is the estimated amount for which a property would be leased on the valuation date between a willing lessor and a willing lessee on appropriate lease terms in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion” (IVSC, 2017, p. 21; RICS, 2019, p. 10). This implies that market rent satisfies the Greek's concept of “Corrective Justice” (see Sewall, 1901) whereby neither party to a transaction wins or loses. Therefore, if any party to the lease of a green building wins/loses by virtue of the lease being net or gross market rent, it could be due to one party over-reaching the other (an over-reaching premium) and not necessarily a function of cost savings attributable to green features (green premium). Alternatively, where the rent, net or gross, is market rent as defined above, any advantage gained by either party to the lease could most probably be attributable to skillful management over and above what pertains to the market (i.e., the average market management skills). If that is the case, the ensuing gain/premium may be correctly termed skillful management gain/premium, which increases investment value (i.e., investment worth in the United Kingdom) not necessarily market value. However, this trend of argument will not be explored further to avoid distracting attention from the focus of the paper, which is the implied prognosis of the green premium.

Similarly, lower staff turnover and productivity gains have been controverted by Addae-Dapaah and Chieh (2011), Lützkendorf and Lorenz (2011) and Oyedokun (2017) while marketing benefits have been discounted by Dixon et al. (2009). Notwithstanding the pros and cons of the benefits of green buildings, green buildings may incur higher cost than conventional buildings. Therefore, the net impact of the benefits and cost may be of much interest to investors and users of green buildings. Despite the assertion by the World Green Building Council (WGBC) (2013) that green buildings

can be delivered at a price comparable to conventional buildings, several studies (e.g., Dwaikat & Ali, 2016; Fuerst & McAllister, 2011b) argue otherwise. Fuerst and McAllister (2011b) claim that there is a construction cost premium of around 2% due to certification. Dwaikat and Ali (2016) find that the cost premium for green buildings ranged between -0.4% and 21% for 12 of 13 sampled projects for their study. Only 5 out of the 13 projects had a cost premium of 0% to 5%. The 13th project even had a cost premium of 46%. Given the foregoing discourse, do green office buildings command a premium?

Is There a Green Premium?

There are limited studies on the impact of environmental certification on the value of office buildings in the United Kingdom (Kim et al., 2017; Sayce et al., 2010). According to Sayce et al. (2010) there is no link between sustainability features of a property and a higher rent or sales price. The authors argue that the green premium is more an expectation than a fact. Similarly, Kim et al. (2017) state that a certification has a relatively small effect on a building's rental/price premium. However, Bond and Devine (2016) argue that environmental certification of a building commands a 4% premium. Moreover, Oyedokun (2017) claims that there is a growing consensus that buildings with an environmental certification generate a higher financial return than non-certified buildings. This is replicated by Leskinen et al. (2020) who document, among other benefits, that green certified commercial buildings command an average yield discount of 0.46%. It must be noted that the yield discount is relative to the average yield of brown buildings. For example, if brown commercial buildings attract a yield of 4%, the relative yield for green certified commercial buildings will be 3.54% (i.e., 4%–0.46%). It does not necessarily mean that if an investor buys a green certified commercial building at an entry yield of 3.54%, the property can be sold at an exit yield of 3.08% (i.e., a discount of 0.46% on the entry yield). If the exit yield were to be lower than the entry yield by the 0.46% discount, paying the green price premium could make economic sense. However, according to Ling and Archer (2005), the exit yield for a fully rented commercial property is conventionally estimated at between 0.25% and 0.75% above the entry yield.

Addae-Dapaah and Chieh (2011) admit the existence of a premium but argue that it is not possible to allocate the green premium solely to the certification of a property. Similarly, Fuerst and Van de Wetering (2015) find it difficult to determine if green certification is really the driving force behind an occupier's renting decision, pointing out other factors that could be decisive. According to Kim et al. (2017) the rental premium of green buildings is also driven by traditional attributes such as the building's age, size, class, and number of stories. The fact that sustainably-built buildings are usually newer, larger, taller, and of a better quality than conventionally-built buildings could explain the presumption of green buildings generating a premium. Fuerst et al. (2017) provide a different explanation for the premium for certified buildings. The authors attribute the observed price premium for certified space to eco-investors' over-bidding strategy which results in a price premium of 5% compared to non-certified buildings. So then, is the greater London green office building premium, if it exists, green-magic? What prognosis does the green premium provide for sustainability? Before answering these questions, we provide a brief description of BREEAM as BREEAM certification is used as a proxy for green office buildings.

BREEAM Certification

The Building Research Establishment (BRE) introduced BREEAM certification in the United Kingdom in 1990—the first in the world. It has since become one of the world's two most prominent eco-assessment systems, second only to its American successor LEED. The scheme evaluates environmental and social features of buildings to award credits for nine assessment features plus innovation which are weighted to provide the overall rating scores (Table 1) on which the five ratings (Table 2) are based.

Every newly built U.K. government building is mandated to meet the BREEAM "Excellent" standard while all refurbished buildings have to meet the BREEAM "Very Good" standard (Fuerst & van de Wetering, 2015). The main aims of BREEAM Certification are:

1. To mitigate the life cycle impact of buildings on the environment
2. To enable buildings to be recognized according to their environmental benefits

Table 1. BREEAM credit scores and weightage.

Assessment Features	Available Credit	Weight	Max Section Score
Management	22	0.12	12
Health & Well-being	10	0.15	15
Energy	30	0.15	15
Transport	9	0.09	9
Water	9	0.07	7
Materials	12	0.135	13.5
Waste	7	0.085	8.5
Land Use & Ecology	10	0.10	10
Pollution	13	0.10	10
Innovation	10	0.10	10
Max Achievable BREEAM Score			110

Note. Based on BREEAM (2014) Table 6.

- To provide a credible environmental label for buildings
- To stimulate demand for sustainable buildings

BREAAM has become symbolic of green buildings and has been used in the literature as a basis for evaluating the impact of “green” on property values especially in the United Kingdom and Europe.

Methodology

The study uses quantitative and psychographic analyses. The quantitative analysis employs hedonic modeling to analyze market rental and sales data to explore and answer the research questions. However, correct specification of the hedonic relationship requires researchers to identify both the correct list of independent variables and the true functional forms (Linneman, 1980). Given that correct specification of the hedonic relationships requires the inclusion of all the property’s value-bearing attributes in the model which creates a collinearity problem (overfitting) to reduce the precision of parameter estimates while the omission of important traits (underfitting) on the basis of multicollinearity ensures that both the standard errors and hedonic coefficients of the remaining traits are biased (Consumer Reports, 1996), it is worth noting Taylor and Wilson’s (1964) statement that “to seek perfect specification for quantitative analysis of human behavior is to seek the stars. Earth bound creatures must be content with approximate correct specification.” However, robustness checks are required to ensure compliance with the hedonic model’s requirements. Therefore, 13 property variables in Table 3, which fall under the five broad categories of factors that affect property prices (structural features, neighborhood attributes, facility attributes, locational factors,

Table 2. BREEAM rating.

	Pass	≥ 30%
	Good	≥ 45%
	Very Good	≥ 55%
	Excellent	≥ 70%
	Outstanding	≥ 85%

Note. From BRE Global (2011).

time-related attributes, and environmental amenity) are used in the analyses.

The current literature is discordant about the choice of the correct hedonic functional form. Therefore, using linear and logarithmic functional forms in market analysis is not uncommon. Colwell et al. (1985) test their hypotheses on six functional forms (Linear, Semi-Log, Exponential, Log-Linear, Inverse, and Inverse-Inverse). The Log Linear Model is selected because of the ease in interpreting the regression coefficient while its log likelihood at the 95% level of confidence is not significantly different from the maximum log likelihood given by other models. Similarly, Des Rosiers et al. (1996) demonstrate that all tested functional forms (Linear, Semi-Log, Log-Linear, and Inverse models) yield satisfactory results although the best performance is obtained using either a log-linear or the inverse model.

Data: Hedonic Model

Both rental and sales data for 2,842 (out of a population of 3,157) freehold and long leasehold (99+ years unexpired term) office properties in Greater London were extracted from the CoStar database in June and July 2018 for the study. While the sale data cover the period 01/01/2008 to 10/01/2018, the rental data were the most current annual data at the time of the study in 2018. The ten-year sales and current rental data sample periods are constrained by data availability. Of the 2,842 office properties, only 221 are BREEAM certified. Apart from the available 221 BREEAM certified office buildings which were included in the study, the sample of 2621 brown rental and sales data were selected on the following bases to

Table 3. Definition of variables for hedonic models.

Variables	Codes	Types	Description
<i>Dependent variables</i>			
Rental	LOG_RP	Numeric	Rental per SF
Last Sales Price	LOG_PRICE	Numeric	Sales price per SF
<i>Independent variables</i>			
Age	AGE	Numeric	Years since built
Size	SF	Numeric	Total square feet
Location	ZONE	Dummy Variable	1 – Zone 1 0 – Zone 2–6
Number of Floors	FLOORS	Numeric	Number of Floors
BREEAM Certification	BREEAM	Dummy Variable	1 – BREEAM certified 0 – uncertified
CoStar Rating	COSTAR	Numeric	1 (worst quality) to 5 (best quality)
Closest Transit Station	CLOSEST_TRANSIT	Numeric	Miles to closest transit station
Percent Leased	PERCENT_LEASED	Numeric	Percentage of the building that is leased
Typical floor size	TYPFLOORSF	Numeric	Typical floor size
LOcated out of town	OUT_OF_TOWN	Dummy Variable	0 – located in town 1 – located out of town
Located on a high street	HIGHSTREET	Dummy Variable	0 – not located on a high street 1 – located on a high street
renovated in the last 10 years	RENOVATED	Dummy Variable	0 – not renovated in the last 10 years 1 – renovated in the last 10 years
LAST sale Date*	LAST_SALE_DATE	Dummy Variable	0 – transacted 2008–2018 Except 2008, the reference category

Note. *Only used in models for price premium. It shows the last date on which the property was sold.

ensure as close comparability as possible with the 221 BREEAM certified office buildings.

1. These sampled offices are located on the same streets in the 32 London Boroughs and have all the required variables data for the hedonic model (Table 3).
2. The rental and sales data for each of the sampled office buildings relate to the same building as pertains to the certified buildings.
3. The rental for each sample must not be less/greater than £20/£150 per ft² while the sale price must not be less/greater than £100,000/£1,700,000,000. Similarly, the rentable area must not be smaller/larger than 500/1,000,000 ft². These were necessary to accommodate the inclusion of all the 221 certified buildings in the sample given the small sample size.

The certification classification for the 221 buildings is the following: Pass (2); Good (5); Very Good (110); Excellent (99); and Outstanding (5).

Empirical Model

The following fundamental semi-log hedonic model (Equation (1)) is used to analyze the rental and sales price data:

$$\ln P_i = \alpha_i + \beta x_i + \varphi Z_i + \varepsilon_i, \quad (1)$$

where the dependent variable is the natural logarithm of the selling price or rental of the sampled office properties and α_i and ε are the constant and error terms respectively. X_i is the vector of the explanatory physical and locational characteristics of the properties while Z_i is a vector of time-related variables. β and φ are the respective vectors of the parameters to be estimated.

The variables in Table 3 are analyzed through the adjusted hedonic rental (Equation (2)) and sales price (Equation (3)) models:

$$\begin{aligned} \ln \text{Rent} = & \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} + \beta_3 \text{Location} \\ & + \beta_4 \text{Floors} + \beta_5 \text{BREEAM Certification} \\ & + \beta_6 \text{CoStar Rating} \\ & + \beta_7 \text{Closest Transit Station} \\ & + \beta_8 \text{Percent Leased} \\ & + \beta_9 \text{Typical Floor Size} \\ & + \beta_{10} \text{Located out of Town} \\ & + \beta_{11} \text{Located on a High Street} \\ & + \beta_{12} \text{Renovated in the last 10 Years} + \varepsilon_i \end{aligned} \quad (2)$$

$$\begin{aligned} \ln \text{Price} = & \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Size} \\ & + \beta_3 \text{Location} + \beta_4 \text{Floors} \\ & + \beta_5 \text{BREEAM Certification} \end{aligned}$$

$$\begin{aligned}
& + \beta_6 \text{CoStar Rating} + \beta_7 \text{Closest Transit Station} \\
& + \beta_8 \text{Percent Leased} + \beta_9 \text{Typical Floor Size} \\
& + \beta_{10} \text{Located out of Town} \\
& + \beta_{11} \text{Located on a High Street} \\
& + \beta_{12} \text{Renovated in the last 10 Years} \\
& + \beta_{13} \text{Last Sale Date} + \varepsilon_i
\end{aligned} \tag{3}$$

The log transformation of the dependent variables reduces the non-normality of the raw sales and rental dataset as well as heteroskedasticity. The variable of interest in Equation (2) and Equation (3) is β_5 BREEAM Certification.

Six models of Equation (1) are estimated:

- *Model 1*: Uses the rental data to assess the overall (Greater London) rental premium (if any) attributable to BREEAM certification.
- *Model 2*: Uses the sales data to compute the overall (Greater London) price premium (if any) attributable to BREEAM certification. A comparison of Models 1 and 2 would reveal the consistency between the two premia and any implied implications thereof.
- *Model 3*: Investigates the rental premia for different BREEAM Certified tiered buildings in Greater London. This will give insight into the logic of the premia allocation.
- *Model 4*: Investigates the price premia for different BREEAM Certified tiered buildings in Greater London. This will give insight into the logic of the premia allocation. If the premia are green-magic there should be logical allocation among the tiers.
- *Model 5* and *Model 6*: Deal respectively with rental and price premia for BREEAM Certification by zones. If the premia are green-magic they should not make any significant difference by zone.

Data: Psychographic Analyses

The data for this were collected through a questionnaire survey to the owners (investors) and occupants/tenants (space users) of the 221 BREEAM certified office buildings to solicit relevant information to ascertain the main drivers of the green premium. The questions for the survey were posed in a neutral way to avoid biasing the participants'

answers. Two slightly different questionnaires were sent to the owners and the tenants of the 221 buildings via a self-created Google Docs survey. First the owners and tenants were asked to rank on a Likert scale of 1 (most important) to 5 (least important) the relative importance of different factors that drive their decision to purchase or rent office space. The second question is about the relative importance (on a Likert scale as above) of factors related to a BREEAM certification. These results are analyzed through a Friedman test, which scales the treatments from most to least important (Theodorsson-Norheim, 1987). The third question was posed to find out whether building tenants and investors found tangible (e.g., higher rent, lower utility costs) or intangible (e.g., image gain, less environmental impact) benefits of a green building more important. Respondents could answer this question by simply ticking boxes but were asked to explain their answers with brief comments.

The tenants' questionnaire had two additional questions. The fourth question solicited information on whether they had a net or a gross rental lease agreement. The last question sought information on how the rental for their BREEAM certified office space/building compares to a conventional building. The survey was conducted over a period of two weeks in July. Out of 450 questionnaires sent to respondents, only ten tenants and nine owners returned fully completed questionnaire forms.

Incremental Analysis of Green Premia (If Any)

If the results of the hedonic models confirm the existence of green premia, the premia will be examined through incremental analyses and the application of models for real value, equivalent yield and equated yield approaches which have been extensively discussed by Baum et al. (1996), Baum and Crosby (2007), Brown (1984), Fraser (1985), Crosby (1983, 1986), Crosby et al. (1997), French (1997), Sykes (1981), Wyatt (2007) and most recently by Ataguba and Tinufa (2015). The essence of these analyses is to answer the following research question: what prognosis does a green premium provide for sustainability? First, we rely on the hedonic model results to calculate the incremental cost (green price premium) and benefit (green rental premium) for investing in London green office

properties. Second, we express the incremental green rent as a ratio of the incremental green price to get an incremental all-risks green yield (cap rate). It must be highlighted that the incremental analyses solely and directly focus on the green transaction. What we are trying to ascertain is whether an investor who pays the incremental price (green price premium) to receive the incremental rent (green rental premium) will achieve their investment objective proxied by the investor's TRR. TRR can be estimated through CAPM, the Gordon Model and/or the Bond-yield-plus-risk-premium approach (Daves et al., 2004). We use a variant of the Bond-yield-plus-risk-premium approach (i.e., Gilt-yield-plus-risk-premium, see Fraser, 1985; Wyatt, 2007) to calculate the TRR. The risk-free rate (3.91%) component of the TRR is the average 30-year gilt yield over 20 years based on figures from the Debt Management Office downloaded on December 30, 2018 from www.dmo.gov.uk/data. A risk-premium of 3% was added to this to arrive at a TRR of 6.91. This is a very conservative TRR as according to Beck (2018), the Target IRRs for the four real estate investment types are the following: Core (6%–10%), Core Plus (9%–13%), Value Add (14%–20%), and Opportunistic (greater than 20%).

The incremental green yield implies that the incremental green rental income must grow at a certain rate annually for the investor to achieve the TRR. We use the following equations to ascertain the growth rate implicit in the incremental all-risks green yield (cap rate) (see Wyatt, 2007). Ataguba and Tinufa (2015) provide a review of the equations.

$$y = r - r \left\{ \frac{(1 + g)^p - 1}{(1 + r)^p - 1} \right\} \quad (4)$$

Solving for g , Equation (4) becomes:

$$g = \left\{ \frac{(r - y)(1 + r)^p + y}{r} \right\}^{1/p} - 1 \quad (5)$$

where g is the implied growth rate of the green rental premium to be calculated, r is the TRR, y is the incremental all-risks green yield, and p is the rent review period assuming it is five years which complies with market norm. Given that we are dealing with freehold and long leasehold properties, the equation is evaluated over perpetuity. If the implied growth rate is achievable, that will be good news as it will motivate investors to patronize certified

(Green) buildings to boost the sustainability agenda. Alternatively, if the implied growth rate is not achievable, investors will be put off Green buildings, implying that reliance on the green premium to push the green agenda forbodes danger for sustainability.

Results

Descriptive Statistics

The descriptive statistics for the raw data and transformed log data are presented in Table 4. The transformed log values are included to balance the stark differences between certified and brown office buildings especially in relation to price per square foot which presents an anomalous situation where the average price per square foot for brown office buildings is higher (£2245.19) than certified office buildings (£1397.47). The anomaly could be due to the differences in skewness and kurtosis between certified and brown office buildings. The transformed log values for "Certified" (6.86) and "Brown" (6.39) restore normality. Moreover, the median price per square foot (recorded at the bottom of Table 4) for "Certified" and "Brown" is £894.57 and £619.89 respectively. In contrast to price, the average rental per square foot for "Certified" (£61.69) is significantly higher than "Brown" (£46.92). The median rental per square foot follows a similar trend: £59 and £46 for "Certified" and "Brown" respectively. Another anomaly relates to percentage leased (occupancy ratio) where "Brown" records a higher figure (96.85 Raw/4.55 Log) than "Certified" (96.69 Raw/4.16 Log). Note also that log transformation did not improve the skewness and kurtosis for "% Leased." The results for the remaining variables are in consonance with expectation—"Certified" is bigger, taller, and lower in size, height, and age. The stark differences between "Certified" and "Brown" epitomizes the extreme difficulty in attempting to value a "Certified" property in the midst of "Brown" buildings. Given the anomalous Brown mean price/ft², we will discuss the implied prognosis of the green premium (Table 6), if any, for sustainability on the basis of both Brown mean and median rental and price/ft².

Table 4. Descriptive statistics.

	Rent £/Ft ² Raw Log	Price £/Ft ² Raw Log	Size (Ft ²) Raw Log	% Leased Raw Log	Number of Floors Raw Log	Age Raw Log
Overall Sample						
Mean	48.07	2179.27	45471	96.84	6.28	73.87
	3.80	6.43	9.73	4.55	1.70	3.90
Std. Deviation	18.41	8782.79	83844	11.60	3.68	64.67
	0.39	1.37	1.42	0.32	0.52	1.00
Skewness	0.849	12.19	4.31	-4.82	3.62	1.33
	-0.18	0.27	0.12	-18.70	-0.29	-0.57
Kurtosis	1.52	198.17	25.25	26	28.15	1.50
	-0.57	1.75	-0.39	484.95	1.00	0.19
Observations	2842	2842	2842	2842	2842	2842
Certified						
Mean	61.69	1397.47	136,175	96.69	9.39	40.63
	4.07	6.86	11.34	4.16	2.12	3.06
Std. Deviation	19.82	1846.90	143942	10.13	5.79	49.12
	0.32	0.81	1.01	0.13	0.47	1.22
Skewness	1.93	6.04	2.22	-3.53	3.79	1.93
	-0.29	0.30	-0.05	-3.99	0.39	-0.05
Kurtosis	3.21	51.94	6.42	12.45	21.54	3.75
	1.09	0.77	-0.56	16.77	2.15	-0.80
Observations	221	221	221	221	221	221
Brown						
Mean	46.92	2245.19	37823	96.85	6.02	76.67
	3.78	6.39	9.60	4.55	1.67	3.97
Std. Deviation	17.82	9126.97	71627.63	11.72	3.31	65.05
	0.39	1.40	1.37	0.33	0.51	0.95
Skewness	0.80	11.76	4.86	-4.88	3.13	1.31
	-0.16	0.31	0.14	-18.28	-0.37	-0.52
Kurtosis	1.17	183.73	32.82	26.51	22.70	1.41
	-0.62	1.68	-0.29	459.36	0.90	0.12
Observations	2621	2621	2621	2621	2621	2621

Note. This table presents the descriptive statistics for the raw data and their corresponding transformed log values to provide a balanced view of the data and to resolve any anomalies created by the raw data.

Median price for All Sample/Certified/Brown is £650.11/£894.57/£619.89.

Median rent for All Sample/Certified/Brown is £47/£59/£46.

Hedonic Models 1 and 2: Aggregate Green Premium

The results for Models 1 and 2 are presented in Table 5. The adjusted R² of 0.459 and 0.455 imply that the predictor variables account for 45.9% and 45.5% of the variance in the criteria variables for Models 1 and 2 respectively. These levels of explanatory power are deemed to be acceptable by the existing literature (see Fuerst & McAllister, 2011b; Fuerst & Van de Wetering, 2015). The significant F-Value (*p*-value of 0.000, Table 5) also implies that the models are correctly specified to provide credible results. Furthermore, the results of independence, multicollinearity, and homoscedasticity tests satisfy the assumptions of multiple regression. Therefore we can safely proceed to focus on the variable of interest, BREEAM, to discuss whether the premium is green-magic and thereafter evaluate what it may mean for sustainability.

According to the results in Table 5, five and ten predictor variables are respectively statistically significant at the conventional levels of significance

(0.01, 0.05, and 0.10) in explaining the variance of the dependent variables in Models 1 and 2. The variable of interest, BREEAM, is statistically significant at the 0.01 level of significance in both models. The results of Model 1 show that green office buildings in Greater London command a green rental premium of 4.3% compared to their "brown" counterparts. This translates into an additional mean/median rental of £2.02/£1.98 per square foot. This premium is relatively infinitesimal relative to previous findings ranging from 19.7% to 26% reported in the literature (see Chegut et al., 2014; Fuerst & van de Wetering, 2015). The huge difference in the green rental premium may be due to the fact that this study focuses on Greater London which accounts for 480 of the 1108 BREEAM certified office buildings (about 36.82%) while the existing literature predominantly deals with BREEAM certified office buildings in the whole of the United Kingdom. The green premium of only 4.3% is in consonance with Chegut et al. (2011) that the clustering of green buildings leads to decreased green rental and sales price premium.

Table 5. Models 1 and 2 regression results.

Model 1 – Results For Rental Analysis					Model 2 – Results For Price Analysis				
Sig F-Test	0.000				0.000				
Adjusted R ²	0.459				0.455				
Observations	2842				2842				
Independent Variable	β	P-Value	P-Value (Glejser Test)	VIF	β	P-Value	P-Value (Glejser Test)	VIF	
CONSTANT	1.683	0.000***	0.010		6.329	0.000***	0.000		
ZONE	-0.065	0.000***	0.563	1.195	-0.070	0.000***	0.063	1.196	
BREEM	0.043	0.000***	0.403	1.132	0.223	0.000***	0.333	1.133	
AGE	0.000	0.000***	0.140	1.219	0.003	0.000***	0.499	1.225	
SF	0.000	0.595	0.057	1.671	-0.000	0.000***	0.116	1.672	
FLOORS	0.011	0.000***	0.140	1.697	0.060	0.000***	0.000	1.697	
CLOSEST_TRANSIT	0.000	0.980	0.002	1.071	-0.017	0.351	0.480	1.072	
PERCENT_LEASED	0.000	0.406	0.605	1.009	0.001	0.461	0.183	1.009	
COSTAR	0.006	0.054*	0.071	1.480	0.048	0.028**	0.548	1.481	
OUT_OF_TOWN	-0.014	0.688	0.307	1.006	0.169	0.340	0.292	1.006	
HIGHSTREET	0.013	0.472	0.176	1.020	0.059	0.012**	0.083	1.020	
RENOVATED	0.002	0.737	0.583	1.018	0.122	0.000***	0.027	1.018	
TYPFLOORSF	0.000	0.379	0.622	1.426	0.000	0.028**	0.410	1.426	
LAST_SALE_DATE	N/A		N/A						
2009					-0.017	0.442	0.480	2.390	
2010					-0.021	0.390	0.490	3.177	
2011					-0.024	0.340	0.497	4.038	
2012					-0.002	0.941	0.366	3.627	
2013					0.112	0.000***	0.095	3.841	
2014					0.117	0.000***	0.275	4.108	
2015					0.205	0.000***	0.377	4.262	
2016					0.164	0.000***	0.767	3.834	
2017					0.161	0.000***	0.456	4.139	
2018					-0.003	0.845	0.000		

Note. *** denotes significance at the 0.01; ** and * denote significance at the 0.05 and 0.10 levels respectively. Durbin-Watson Test: Model 1 = 1.713 and Model 2 = 2.028.

Table 6. Implied rental growth analysis.

Type of Green Effect	Target Required Return (%)				
	6.91	8.5	10	12	15
PANEL A: Implied Annual Rental Growth Rate Relative to Green Effect on Price					
Green Mean Rental Premium	6.56	8.16	9.66	11.68	14.69
Green Median Rental Premium	5.62	7.25	8.78	10.82	13.88
Panel B: Implied Annual Rental Growth Rate/Historical Annual Rental Growth Rate Gap (Median basis bracketed)**					
CoStar Data – 3.07% p.a. rental growth rate over 16.8 years to 2Q19	3.49 (2.55)	5.09 (4.18)	6.59 (5.71)	8.51 (7.75)	11.62 (8.55)
Colliers Data* – 1.61% p.a. rental growth rate over 18.5 years to 2Q19	4.94 (4.01)	6.54 (5.64)	8.05 (7.17)	10.06 (9.21)	13.08 (12.27)
MSCI Global London Office Rental – 2.88% p.a. rental growth rate over 38 years to End 2018	3.67 (2.74)	5.62 (4.37)	6.78 (5.90)	8.79 (7.94)	11.81 (11.00)

Note. The table displays the implicit rental growth (based on incremental Green mean/median rental premium of £2.02/ft²/£1.98ft²) relative to assumed Target Required Return (TRR) given the incremental Green mean/median price premium of £500.68/ft²/£138.24/ft². The gap between the implicit annual growth rate and the actual historic average growth rates based on data from CoStar, Colliers, and MSCI Global are also displayed in Panel B of this table. Data cover office properties in the West End, City, and Southbank

*Based on the average rental data for West End, City, and Southbank office sub-markets.

** The gap is obtained from deducting the annual historical growth rate from the corresponding Green mean/median premium.

Furthermore, Clark (2013) claims that the green premium decreases by 1.5% when certified buildings are clustered in one area. According to Fuerst and van de Wetering (2015), green buildings have “vintage” advantage over “brown” buildings in markets where eco-labeled buildings are a novelty for being new to the market. This “vintage” advantage inflates their rental and/or sales price premium far above what it would be in saturated markets such as London. This may indicate a future lack of desire to invest in green buildings if economics, predicated

on the green premium, is the main driver of investment in green buildings as the premium could totally disappear in the near future when the market is saturated with green buildings, especially if the COVID-19 pandemic leads to a general fall in demand for offices in crowded central London. This does not bode well for sustainability that is predominantly buttressed in economics.

The situation is different and subtly complicated when we turn to the green sale price premium of 22.3% which falls within the 14.7% to 26% range in

the literature (see Chegut et al., 2014). The 22.3% amount to a mean/median green price premium of about £500.64/£138.24 per square foot. Before subjecting the green rental and price premia to further examination through incremental analysis, it is worth noting a few things about other coefficients in Table 5. The positive sign for “Age” is either expected or unexpected depending on whether the age of a building is considered as positively or negatively correlated to its value (see Fuerst & McAllister, 2011a for a discussion on the issue). It must be noted that from a valuation point of view, it is the effective age, not nominal age, that is of significance to value. In contrast, the negative sign for “Zone” means that green office buildings outside Zone 1 suffer a statistically significant loss in green rental/price premium of 6.5%/7.0% respectively.

Results of Incremental Analyses

To understand the implications of these mean/median incremental figures of £2.02/£1.98 green rental and £500.64/£138.24 green sale price premia for sustainability, we use Equation (5)—repeated below for easy reference—for the incremental analyses of the premia. The incremental rental and price provide a yield of 0.40% (i.e., 2.02/500.68). We can then calculate the implied growth rate using Equation (5):

$$g = \left\{ \frac{(r - y)(1 + r)^p + y}{r} \right\}^{1/p} - 1 \quad (5)$$

where g is the implied growth rate to be calculated; r is the TRR (6.91%); y is the all-risks yield (0.40%) (i.e., cap rate); and p is the rent review period assuming it is five years. Given that we are dealing with freehold and long leasehold properties, the equation is evaluated over perpetuity. Substituting the figures for the variables in Equation (5), we get

$$g = \left\{ \frac{(0.0691 - 0.0040)(1 + 0.0691)^5 + 0.0040}{0.0691} \right\}^{1/5} - 1$$

$$g = (1.3737)^{1/5} - 1$$

$$g = 1.0656 - 1, \text{ or } 6.56\%$$

This implies that the incremental mean rental (green premium) of £2.02 per square foot will require an average 6.56% per annum growth in income (compounded at each review) for an

investor to achieve the TRR of 6.91%. An analysis based on the incremental median rental and price yield of 1.43% (i.e., 1.98/138.24) results in a required average annual income growth of 5.62%. A higher TRR would need an even higher implied growth rate as shown by Table 6.

Table 6 presents the implied annual growth in income required to achieve different TRRs. The results in Table 6 show that the implied annual growth in income required to achieve the various TRRs is difficult to achieve given the Implied-Historical annual rental growth gap (Table 6, Panel B). On the basis of MSCI Global London Office Rental data which cover the longest period (see Table 6), the “Gap” ranges from 2.74% for 6.91% TRR to 11.00% for 15% TRR on the basis of median incremental rental premium. The “Gap” increases slightly on the basis of mean incremental rental analysis, i.e., green rental/price premia (see Table 6). This does not bode well for sustainability.

We continue the incremental analysis by exploring the financial implications of the green premium as presented in Table 7. The analysis assumes a standard office building of 100,000 ft² (about 9,300 m²) and a constant payment mortgage over 20 years at 4.5% p.a. interest rate compounding monthly and 1% points. The 4.5% per annum interest rate comprises 1.5% (12-year average LIBOR) plus 3% risk premium based on a market practice of LIBOR plus 1.2%–4.5% risk premium. Panel A simplifies the analysis by assuming the same interest rate for all sizes of mortgage loans while Panel B varies the mortgage interest rate to reflect the varying exposure risks related to the quantum of loan amount. The bracketed figures under Column 6 of Table 7 (Panel A) signify savings as the BREEAM Good rating paradoxically caused price diminution (see Table 8) and therefore a lower mortgage relative to the standard office building. All the mortgage figures are payments (outflows) and therefore should be construed as negative (cost).

It can be seen from the highlighted figures in Table 7 that the marginal cost (in terms of mortgage payment) attributable to the additional mortgage (IMMP) considerably exceeds the green rental premium (GRP). The disconnect between green rental premium and the green price premium implies that the green price premium is a function of overly optimistic market expectation and therefore may be

correctly termed “expectational” premium. The preceding statement is supported by Table 8 which shows that the rental premium for the BREEAM Outstanding rating is 6.3% compared to the corresponding price premium of 33.2%. Whatever be the cause of the disconnect, the incremental analysis shows that investing in BREEAM certified office buildings is not economically and financially advisable. Another worry is how long investors can hold such investments given an incremental monthly loss ranging from £185,122 to £352,845 (Panel A) and £207,780 to £418,175 (Panel B). This is not good news for sustainability as it portends troubled times for the green office market in the immediate future to give sustainability a “bad name” among developers and investors.

Given these results, it is doubtful whether investors will be able to sell these green office blocks (bought at inflated prices) in the future when green becomes the norm. Furthermore, the ramifications of the COVID-19 pandemic are likely to make it extremely difficult to sell these office blocks for the price at which they were bought. This implies that the unrealistic market expectation of the green premium could cause the market to implode. Thus, reliance on such unrealistic market expectation to boost the sustainability agenda could lead to trouble for sustainability.

It could be argued that the above analyses relate to the secondary (not the primary) office market. It is absolutely true that the analyses relate to the secondary office market as they are based on the last sale (not the first sale) data. However, given the inextricably intertwined nature of both the primary and secondary office markets, the woes of the secondary market resonate in the primary market to provide support for conclusion(s) based on the secondary market.

Regression Results for Models 3 and 4: Premia For BREEAM Ratings

The results for Models 3 and 4 are presented in Table 8. The adjusted R^2 , 0.460 and 0.455 as well as the F-test (p -Value of 0.000) respectively attest to the correct specification of the models. The results clearly show that the different ratings of BREEAM certification command a premium. However, some of the premia are not statistically significant from zero. The BREEAM rental premia for Very Good (0.039), Excellent (0.057), and Outstanding (0.063)

ratings are logical although the premium for the Outstanding rating is not statistically significant. However, the results for Good and Pass ratings exhibit illogical allocation of premia as the premium for the Pass (lower) rating (−0.026) is higher than that for the Good (higher) rating (−0.095) albeit both being negative and statistically insignificant. The BREEAM sale price premia for Pass (0.163) and Good (−0.083) ratings continue the same pattern of illogical allocation of premia. It may also be noted that the BREEAM sale price premium for the Very Good rating (0.256) is higher than that of the Excellent rating (0.205) to provide further evidence of illogical allocation of premium to some tiers to cast doubt on the “purity” of the premia and making it difficult to attribute the premia to green-magic. The relatively high price premium for the Outstanding rating may be due to the fact that all of the BREEAM Outstanding-rated buildings (only 5) are located in Zone 1 and generate a sales price per square foot which is twice as much as the preceding certification level. BREEAM Excellent- and Very Good-rated buildings on the other hand are located throughout all six zones. Another reason for the high premium generated by the Outstanding level could be that there are only five buildings in the Greater London area with Outstanding certification. The high premium may therefore be a function of the buildings being a “rare” breed—a scarcity or an “aura” premium rather than a green-magic premium. Another fascinating feature of the BREEAM premia in Table 7 is the chasm between the rental premia and the price premia which reinforces the phenomenal and unachievable implied growth rate embedded in the all-risk yield (see Table 6).

The whole debate about the green premium would benefit from a benefit-cost analyses. The problem is obtaining realistic and reliable cost figures. Doan et al. (2017) argue that there is an increase in capital cost of 0.15% to receive a lower BREEAM rating, 0.2% to receive a Very Good rating, 0.8% to receive the Excellent standard, and 9.8% to reach the BREEAM Outstanding level. Abdul and Quartermaine (2014) on the other hand argue that the cost premium for buildings targeting higher BREEAM ratings is typically less than 2%. Dwaikat and Ali (2016) state that there is a cost premium of 0% to 4% for green office buildings while Chegut et al. (2015) have found a cost premium of 6.5% for BREEAM certified buildings in the United

Table 7. Financial implications of a green premium.

B Rating	Standard*	Outstanding	Excellent	Very Good	Good	Pass
PANEL A: Same Interest Rate Regardless of Size of Incremental Loan						
Value	224,519,000	299,059,308	270,545,395	281,995,864	205,883,923	261,115,597
L/V (80%)	179,615,200	239,247,446	216,436,316	225,596,691	164,707,138	208,892,478
Points (1%)	1,796,152	2,392,474	2,164,363	2,255,967	1,647,071	2,088,925
Net Mortgage	177,819,048	236,854,972	214,271,953	223,340,724	163,060,067	206,803,553
INM		59,035,924	36,452,905	45,521,676	(14,758,981)	28,984,605
MMP	1,136,334	1,513,597	1,369,283	1,427,236	1,042,019	1,321,557
IMMP		377,263	232,949	290,902	(94,315)	185,223
GRP		24,418	22,093	15,116	(368)	(101)
IMMP-GRP		352,845	210,856	275,786	(93,947)	185,122
PVA _{240,0.0391/12}		58,685,390	35,069,695	45,868,891	(15,625,321)	30,789,601
Marginal Cost		4.62%	4.62%	4.62%	4.62%	4.62%
PANEL B: Analysis Based on Differential Mortgage Rates Relative to Size of Mortgage						
M Rate	4.5%	5%	4.75	4.75	Same as A	4.7
MMP	1,136,334	1,578,927	1,398,663	1,457,859	Same as A	1,344,215
IMMP		442,593	262,329	321,525	Same as A	207,881
Rent		24,418	22,093	15,116	Same as A	(101)
IMMP-GRP		418,175	240,236	306,409	Same as A	207,780
PVA _{240,0.0391/12}		69,551,114	39,956,194	50,962,127		34,558,093
Marginal Cost		5.12%	4.87%	4.87%	Same as A	4.82%

Note. The figures in this table show the financial implications of green premiums assuming a constant payment mortgage over 20 years at 4.5% p.a. interest rate compounding monthly and 1% points. Panel A simplifies the analysis by assuming 4.5% p.a. interest rate regardless of the size of the amount borrowed while Panel B adjusts the interest rate to reflect lenders' exposure risk relative to quantum of loan, holding all other things constant.

INM = Incremental net mortgage, i.e., difference between standard office mortgage and green office mortgage

MMP = Monthly mortgage payment

IMMP = Incremental monthly mortgage payment, i.e., difference between standard office MMP and green office MMP

GRP = Green rental premium

* = Standard signifies "brown" office building. The value of the other categories = [Value of Standard × (1 + i)]

where i is the respective green premium.

PVA = Present value of annuities resulting from IMMP-GRP over 240 months at 3.91%/12. 3.91% is the 30-yr

Gilt yield for 20 years.

Kingdom. Seyis et al. (2015) claim that besides the tangible costs captured in these cost premia by the literature, there are some hidden costs such as higher design efforts or additional time spent on redesigning the building. According to Chegut et al. (2015) green-certified buildings take approximately 11% longer to complete. Another forgotten cost element is extra financing costs involved in the whole process that is not included in the analyses. The extra mortgage financing costs attributable to the various BREEAM ratings have been analyzed and presented in Table 7. If we capitalize the monthly incremental mortgage payment at 3.91% per annum long-dated gilt yield for 20 years over the mortgage period (20 years), the incremental mortgage payments range from £30,789,601/£58,685,390 (BREEAM "Pass" rating) to £34,558,093/£69,551,114 (BREEAM "Outstanding" rating) for results presented in Panels A and B respectively of Table 7. The marginal cost of borrowing the extra required funding could neutralize every premium.

Regression Results for Zones (Models 5 and 6)

The results for Models 5 and 6 are presented in Tables 9 and 10. Out of the 221 BREEAM certified office buildings constituting the sample, 194 are

found in Zones 1–3. Zone 1 has a rental premium of 3.7% and a sales price premium of 24.1%. Zone 2 provides a statistically insignificant rental premium but a statistically significant sales price premium of 32.5% to once again demonstrate the disconnect between the rental and price premia. Zone 3 generates a rental premium of 11.8% and a sales price premium of 38.1%. The wide gaps between the rental premium and the price premium are syndromic of a price bubble which is troublesome for sustainability. Furthermore, it is evident from Table 10 that the sales premia increase as one moves from Zones 1 through 3, dips in Zone 4, but picks up again in Zones 5 and 6 with Zone 5 registering the highest BREEAM sale price premium of 0.421 followed by Zone 3 (0.381), Zone 6 (0.376), Zone 1 (0.241), and Zone 4 (0.030). The relative "glut" of BREEAM certified office buildings in Zone 1 leads to a saturated market to reduce the green premium. Chegut et al. (2011) conclude that the higher the competition in green building markets, the more the rental and sales price premia of certified buildings decrease. Conversely, the small sample of BREEAM certified buildings outside Zone 1 creates a "vintage" advantage to inflate both rental and price premia (Fuerst & van de Wetering, 2015). Once again, the evidence

Table 8. Models 3 and 4 regression results: BREEAM ratings' premia.

	Model 3 – Results for Rental Analysis		Model 4 – Results for Sales Price Analysis	
Sig F-Test		0.000		0.000
Adjusted R ²		0.460		0.455
Observations		2842		2842
Independent Variable	β	P-Value	β	P-Value
CONSTANT	1.682	0.000***	6.320	0.000***
ZONE	−0.065	0.000***	−0.070	0.000***
AGE	0.000	0.000***	0.000	0.386
SF	−0.000	0.523	0.000	0.000***
FLOORS	0.011	0.000***	0.060	0.000***
CLOSEST_TRANSIT	0.000	0.981	−0.018	0.318
PERCENT_LEASED	0.000	0.439	−0.001	0.457
COSTAR	0.006	0.047**	0.048	0.002***
OUT_OF_TOWN	−0.014	0.696	0.168	0.342
HIGHSTREET	−0.006	0.208	0.062	0.009***
RENOVATED	0.002	0.695	0.124	0.000***
TYPFLOORSF	0.000	0.367	0.000	0.027**
LAST_SALE_DATE	N/A	N/A	0.184	0.000***
BREEAM OUTSTANDING	0.063	0.265	0.332	0.001***
BREEAM EXCELLENT	0.057	0.000***	0.205	0.000***
BREEAM VERY GOOD	0.039	0.003***	0.256	0.000***
BREEAM GOOD	−0.095	0.143	−0.083	0.563
BREEAM PASS	−0.026	0.768	0.163	0.211

Note. *** denotes significance at the 0.01 level; ** denotes significance at the 0.05 level.

(differential premium) implies that the premia are not green-magic as one would otherwise have expected in Zone 1, where the highest BREEAM Rating offices are, to command the highest premium.

Results of the Survey: Tenants

The majority of the tenant respondents to the survey (60%) said that location and rent are key factors when deciding to rent a building (see Table 11). Surprisingly, 40% of the respondents did not know what BREEAM was. It is not surprising then that some of them stated that BREEAM did not affect their decision. This might explain why 50% of them marked BREEAM certification as the least important factor when deciding to rent a building. The only two variables that are less important than BREEAM in their decision-making are the impact of marketing and the height of a building (see Table 9). These findings are contradictory to the results of the HPM, which show that the height of a building has a high explanatory power for the rental.

In answering the question as to why they chose to occupy a BREEAM certified building, the majority of participants stated that an expectation of lower rent was the decisive factor (see Table 12). This explains why 80% of the participants chose tangible benefits as more important than intangible benefits

when renting a green building. This outcome supports the findings of Oyedokun (2017), who claims that occupiers' main focus is profit maximization rather than occupying a green-labeled building. Other important factors for occupants are expected lower utility costs, lower environmental impact and image gain. About 70% of the tenants hold a gross rental contract. Even though most of the respondents chose a BREEAM certified building due to an expected lower rent, 70% of them did not know if they actually paid higher or lower rent compared to a conventional building. Only one participant stated that the rent of their BREEAM certified building was lower than conventional buildings. The main priority of the respondents is to rent low-priced space in a favorable location regardless of BREEAM certification.

Survey Results: Investors

According to investors, location and acquisition price are the two most decisive factors when deciding to invest in a building (Table 11). However, 50% of the investors rated BREEAM certification as an important factor in their decision-making process. The majority of the investors stated that it is due to tenant wishes rather than building regulations that it is no longer possible to develop an unsustainable building in Central London. This statement,

Table 9. Model 5: breeam rental premium by zone.

Independent Variables	β	p-Value
Zone 1	0.037	0.000***
Zone 2	0.001	0.960
Zone 3	0.118	0.008***
Zone 4	0.006	0.933
Zone 5	0.064	0.148
Zone 6	0.054	0.227

Note. *** denotes significance at the 0.01 level.

however, does not reflect the findings of the tenants' survey (see Table 11). Only one investor-respondent said that tenants are indifferent to whether a building is green or not. When asked what the most important factors were when buying a BREEAM certified building, the majority of the participants said that the expected higher rental and sales price were the most important factors. These results show how much the expectations of investors and tenants differ—tenants wish to lower their rental costs by occupying a certified building while investors aim to achieve higher rents through BREEAM certification (see Table 12). The tenants' and investors' responses to the survey are presented in Tables 11 and 12.

It is obvious from Table 11 that BREEAM certification (i.e., sustainability) does not have any compelling influence on either tenants' or investors' decision to rent and invest in office space. One major significant finding from the survey results is that both parties are diametrically opposed in their foremost rationale for choosing BREEAM certified office space. While tenants are primarily motivated by an expectation of relatively lower rent, investors are motivated by an expectation of relatively higher rent and sale price. This could explain the chasm between the green rental and price premia which is indicative of a dismal prognosis for the sustainability agenda as discussed earlier in this paper.

Conclusion

This study was done to ascertain the prevalence of a green premium to answer the following questions: is the premium truly green (green-magic)? What prognosis does a green premium provide for sustainability? The study uses quantitative analysis (hedonic models to analyze 2,842 CoStar transaction data from 2008 to 2018 inclusive) and psychographic analysis based on primary data from a questionnaire survey of approximately 450 BREEAM

Table 10. Model 6: breeam price premium by zone.

Independent Variables	β	p-Value
Zone 1	0.241	0.000***
Zone 2	0.325	0.000***
Zone 3	0.381	0.040**
Zone 4	0.030	0.895
Zone 5	0.421	0.079
Zone 6	0.376	0.001***

Note. *** denotes significance at the 0.01 level; ** denotes significance at the 0.05 level.

Table 11. Factors affecting tenant and investor choice of property.

Tenants		Investors	
Factor	Mean Rank	Factor	Mean Rank
Location	2.95	Location	2.38
Rental	3.95	Acquisition Price	2.56
Amenities & Facilities	4.45	Accessibility	2.88
Accessibility	4.60	Amenities & Facilities	4.50
Lease Structure & Terms	4.75	Building Design	5.56
Building Size	5.25	Building Size	6.50
Building Design	5.50	BREEAM Certification	7.19
BREEAM Certification	7.55	Developer Reputation	7.19
Building Height	8.00	Impact of Marketing	8.13
Impact of Marketing	8.00	Building Height	8.13

Note. The results of the Friedman Test (with 1 being the most important and 10 being the least important factor affecting tenants' and investors' decision to rent/purchase an office building) are presented in this table.

certified building owners and occupiers in the Greater London area to address the research questions. The results of the hedonic model analysis show that BREEAM certification commands a rental and price premium of 4.3% and 22.3% respectively. Furthermore, the results reveal that a higher certification level generally generates a higher premium while certified buildings in outer zones generate a higher premium than those in the CBD. However, a further examination of the green premia through incremental analysis (a method of analysis that is new to the extant literature on green certification and property values albeit being very well known in the investment literature) revealed that any investor with a TRR of 6.91% who pays the green price premium to receive the green rental premium will not achieve their objective as the annual green rental growth rate implicit in the green price premium is not achievable. The results of the incremental analyses which are supported by the results of the psychographic analyses imply that the premium is more a novelty premium or an unrealistic "expectation" premium (both ephemeral) than green-magic. This combined results of the incremental and psychographic analyses is a dismal prognosis for sustainability and warns that sustainability cannot be achieved on purely economic

Table 12. Factors affecting tenant and investor choice of BREEAM certified office buildings.

Tenants		Investors	
Factor	Mean Ranking	Factor	Mean Ranking
Lower Rent	2.75	Expected Higher Rental & Sales Price	3.94
Lower Utility Cost	3.45	Lower Utility Cost	4.44
Expected Lower Staff Turnover & Increased Productivity	3.85	Image Gain	4.44
Internal CSR Policies	4.35	Expected Lower Obsolescence	4.63
Marketing Reasons	4.50	Lower Environmental Impact	4.94
Image Gain	4.55	Marketing Reasons	5.06
Lower Environmental Impact	4.55	Expected Lower Vacancy Rate	5.63
		To Prevent Impact of Future Stricter Government Regulations	5.75

Note. The results of the Friedman's Rank Test (with 1 being the most important and 10 being the least important reason affecting tenants' and investors' decision to rent/purchase BREEAM Certified office building) are presented in this table.

grounds and thus should not be economic/market led. Finally, the results of the psychographic analyses show that there is no meeting of minds (*consensus ad idem*) between investors in green office buildings on one side and green office space users (tenants) on the other. The lack of *consensus ad idem* between investors and tenants could be problematic for sustainability as the two groups need to work together to ensure that the expected savings in utility costs are realized. Any serious disparity in the motives of the two groups will provide impetus to the rebound effect to offset any utility cost savings attendant to green office buildings. It is hoped that this paper will provoke more research, constructive discussion, and debate on the plausibility of achieving sustainability on the basis of economics for the benefit of humankind.

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