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Review Article

Green premium as a driver of green-labelled commercial buildings in the developing countries: Lessons from the UK and US

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Abstract

Evidence continues to emerge that green-labelled buildings achieve a higher financial return than conventional buildings, both in terms of rent and sale price (referred to as the green premium in the literature). Consequently, the green premium is considered as a potential driver of investment in labelled buildings. However, it is not clear to what extent investors' expectation of a green premium can help to stimulate the development of green buildings in the developing countries. This study, therefore, assesses the available evidence, as well as trends of property development in the UK and US, as countries with significant concentrations of green-labelled office buildings. The study raises issues that should be considered in adopting the existing empirical findings and presents recommendations for the development of a viable green property market in developing countries.

Keywords: Developing countries; Green building; Green premium; Property market; Sustainability

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1. Introduction

As concerns about global warming persist, global energy consumption and carbon emissions continue to gain the attention of the international community. Commercial properties constitute a key source of environmental concern, not only in terms of energy consumption but also in terms of location and accessibility (Leishman et al., 2012; Simons et al., 2009). Consequently, various local and international green building certification schemes have been established to ensure buildings are designed, built and operated so that they impact minimally on the environment (Roderick et al., 2009). These schemes are mainly designed to provide the labels of identification required to create a market premium and speed up the adoption of green buildings (Reed et al., 2009).

The Building Research Establishment Environmental Assessment Method (BREEAM) was the first green building accreditation scheme, established in the UK, in 1990. Other schemes followed, most of which have been developed based on similar rating criteria as those employed under BREEAM. In North America, the primary scheme being used is Leadership in Environmental and Energy Design (LEED) which was set up in 1994. Other notable examples are Green Star in Australia, HQE in France and Green Star in South Africa. There are also well-established green building labels in the United Arab Emirates, such as the Estidama (Abu Dhabi), the Dubai Municipality Green Building Regulations and Specifications, the ARZ Building Rating System (Lebanon); and the Global Sustainability Assessment System (Qatar) (Issa and Al Abbar, 2015). Although the initial adoption of green buildings has been more prominent in the larger cities, interest has also continued to grow among stakeholders in the developing countries (UN-HABITAT, 2010). There is now a record demand for green buildings globally due to their performance against the triple bottom line of sustainability.

In support of this, there is an emerging consensus that green-labelled buildings achieve a higher financial return than conventional buildings. This has been promoted as what is referred to as the green premium, in the literature (Chegut et al., 2014; Dermisi, 2009; Fuerst and van de Wetering, 2015; Miller et al., 2008; Newell et al., 2014). Although the existence of a green premium is still the subject of an ongoing debate, the notion has continued to gain increasing popularity and acceptance (McAllister, 2012). The introduction of green building labels and the resulting green premium message have ramifications for the real estate market, especially in terms of property development, investment and pricing (Jones, 2013). Based on the underlying principles of property investment, a valid proof that supports the existence of a green premium would be a key motivator for the development of labelled buildings. Confirmation of the green premium is thus an essential prerequisite for the development of the market for green buildings (DiPasquale and Wheaton, 1992; Ball et al., 1998).

In Africa, the green premium message has also continued to gain acceptance. South Africa is ahead of any other country in the continent in terms of green building adoption. With the introduction of Green Star by the Green Building Council of South Africa, the number of certified buildings has continued to rise (Nurick et al., 2015). Kenya is also gradually adopting green building practices, but the country still relies on a foreign certification scheme (Kanyaura and Obino, 2015). Although Nigeria is yet to establish a green building council and has not yet developed or adopted a green building label, analysts are already advocating for the incorporation of green building features in real estate valuations (Ajibola, 2015; Babawale and Oyalowo, 2011). In the absence of a local rating tool, the Nigerian commercial property market is already witnessing the development of buildings certified under international schemes. Arguably, all these factors point to an increasing acceptance of the green premium message by investors and developers alike and potentially, the evolution of a green property market in the country (Oliyide, 2014). Although the lack of a green building standard constitutes a significant challenge to a reliable green building valuation in most of the developing countries, the incorporation of green building certification and the associated impact on market value in valuation is gradually becoming inevitable (Ajibola, 2015; Nurick et al., 2015).

This paper, therefore, reviews available evidence with the aim of assessing the impact of a green premium as a driver of investment in green buildings. The review will lead to recommendations on how to stimulate relevant stakeholders towards the creation of a sustainable market for green buildings in the developing countries. The study starts by reviewing essential factors in developing a sustainable property market, with a view to providing evidence on the financial return as a potential driver of property investment. This is then followed by examining the rationale as to why the green buildings should have higher market values than conventional buildings. Real property valuation and the use of the hedonic pricing model is also discussed, followed by a review of studies on the impact of green building certification on the financial performance of buildings. Through this review, key issues are identified and discussed with respect to the efficacy of a green premium in driving a sustainable market for green buildings.

2. Essentials of a sustainable property market

Generally, a market is any arrangement that facilitates the exchange of goods between willing sellers and willing buyers (Baker, 2007). While a market can be defined geographically in terms of location or place, this needs not be a prerequisite for a complete transaction to take place. Rather, what matters is the ability of the parties involved to engage in an effective process that would lead to goods exchanging hands. The irrelevance of the physical space for the operation of markets is even more applicable to the real property market setting, in which the goods being traded are not really tangible but invisible interest or right to own, receive income or occupy (Keogh and D'Arcy, 1999). Nevertheless, like other markets, the real property market is also guided by price mechanisms and forces of demand and supply, although its efficiency is largely undermined by the peculiar nature of real property as an asset (Dunse et al., 2010).

Real properties are generally heterogeneous, as no two units can be exactly identical. Unlike other commodities, real properties tend to differ in physical attributes, location, orientation, overall quality and in terms of the interests subsisting in them (Dunse and Jones, 1998). These peculiar characteristics of real properties combine to shape the nature of the real estate market. Among other attributes, the real estate market is localized, due to the relative fixity of landed properties (Brounen and Jennen, 2009). Thus, infrequent transactions and a lack of full information can sometimes make the property market monopolistic (Mansfield, 1991). In addition, the property market is highly subject to government regulations and interventions, due to the need to protect the well-being of the relevant stakeholders (Zhu, 1997). All these factors hinder the efficiency of the real property market.

The process of property market development is documented in the literature. Jones and Watkins (1996) assessed the success of British urban policy initiatives in terms of their ability to engender the emergence of a sustainable property market. Defining a sustainable market as that which is created to meet the long-term desires of the consumers, the study presented a three-stage model of a sustainable market development process, as summarized in Table 1. In line with this model, Jones (2009) notes from the investment market viewpoint that institutional property investors played a significant role in developing the British office parks into a fully-grown investment market, given their overwhelming contribution when compared to other investors. Thus, for a new property investment market to thrive, institutional investors must be willing not only to invest but also to bear the perceived risk that inherently characterises the initial stage of the emerging market.

Ball et al. (1998) conceive the real property market as consisting of several interrelated markets. Notable among these are markets for property use, financial assets, development and land, all of which are guided by the forces of demand and supply to ensure a constant state of equilibrium. These markets are interrelated, as depicted through the 4-Quadrant model (Fig. 1) developed by Dipasquale and Wheaton (1992). The model presents, in a most simplified manner, how the real estate market functions. Basically, the model incorporates two markets, namely the market for the use of built stock and the market for real property as an asset (Lambiri and Rovolis, 2014).

In the northeast (NE) quadrant, rent is determined in the user market through the interaction between demand and supply. At equilibrium, the quantity of space demanded is equal to the quantity of space supplied. However, demand is a function of rent and a host of other macroeconomic factors. Thus, an increase in demand for space is possible, even at an unchanging rent level, referred to as a shift in demand. The northwest (NW) quadrant represents the part of the asset market where price is determined by the interaction between rent and capitalisation rate. Increase in rent at an unchanging capitalisation rate translates into a higher property price in the asset market.

Table 1
Stages of sustainable real property market development.

Stage	Characteristics
Introduction	• There are new and few developments • Specialist investors dominate, there is little or no profit • Yields are high due to very high perceived risk • Low prices compared to established markets
Growth	• Rapid market acceptance and increase in number of developers • Increase in the size of property stock, due to more institutional investment • Perceived risk is still relatively high
Maturity	• Property is fully recognised as an investment form • Market becomes reasonably stable, predictable and accessible • Low yields due to low perceived risk • Market is able to withstand downturns in property cycle • Developers and investors become more confident

Source
Table compiled by the author, based on information obtained from Jones and Watkins (1996) and Jones (2009).

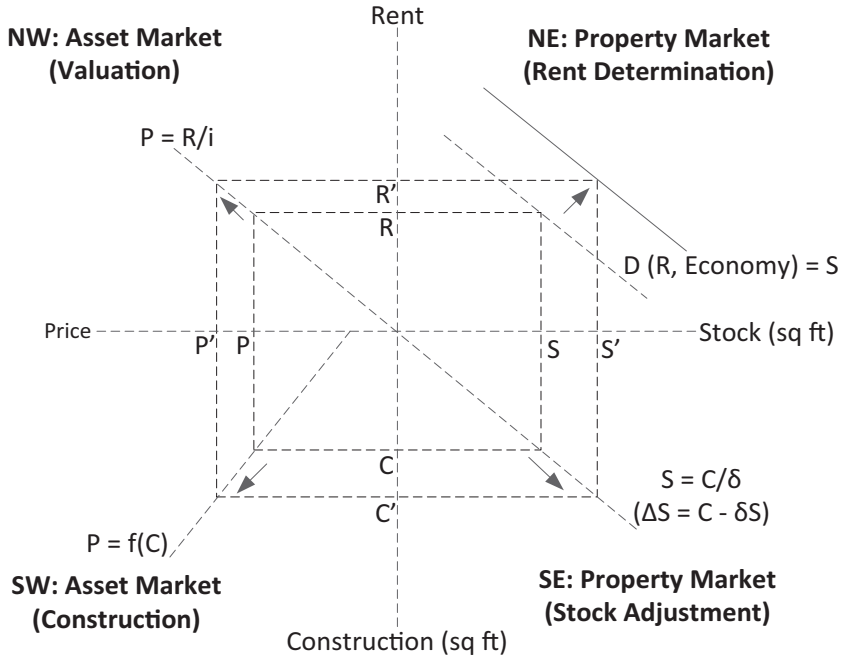

Fig. 1. The 4-Quadrant model by Dipasquale and Wheaton. **Source**: Dipasquale and Wheaton (1992).

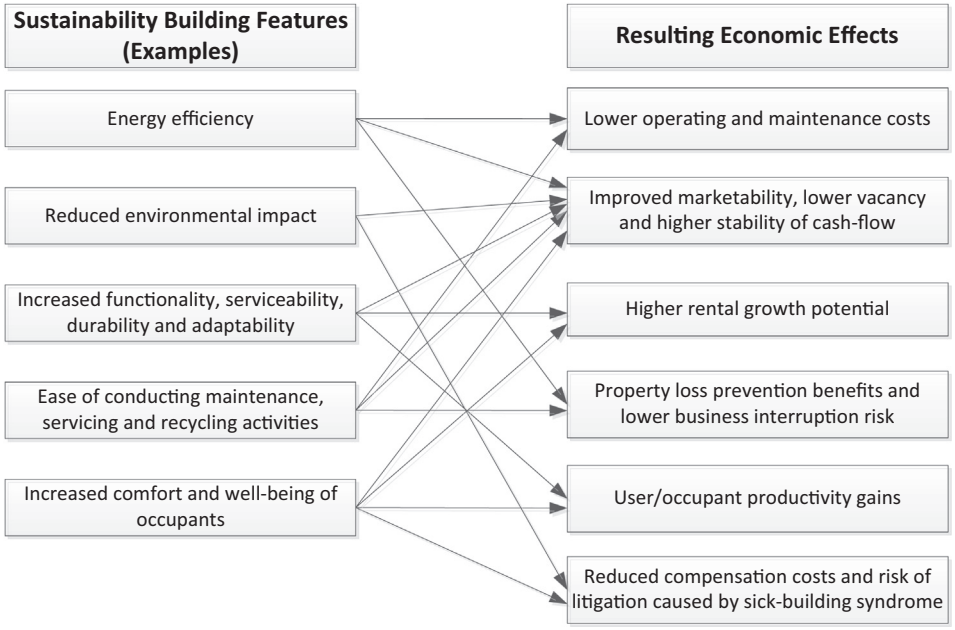

Fig. 2. Economic impact of sustainable building features. **Source**: Lorenz et al. (2007).

The southwest (SW) quadrant is the second part of the asset market, where construction of new assets is determined. Given the price of real estate assets from the NW quadrant, a line down to the replacement cost curve and then horizontally to the construction axis determines the level of new construction. In the southeast (SE) quadrant, the annual flow of new construction is converted into a long-run stock of real estate space.

While it is not clear which causes the other, due to the effect of stock availability on demand (Healey, 1992), real property supply through new development or refurbishment will not be viable if demand is insufficient. As demonstrated through the 4-Quadrant model (by the dashed line), an increase in demand is required against static supply to drive rent upward from R to R'. This, in turn, causes the price to increase from P to P'. The rent that would translate into a higher price has to be high enough, as significant building stock can only be added to the market when the price rises above its replacement cost (Ball et al., 1998). Given the fact that the real estate market is a market for

productive space as well as the market for an investment asset (Keogh and D'Arcy, 1999), investors and occupiers are thus crucial stakeholders in the real estate market. Jones (2013) notes that, while increased demand, high occupier satisfaction, and regular leases must be maintained in the occupier market, the volume of investment must also be on a rising trend for a mature market to evolve. The investment and the occupier segments of the real property market must always relate in engendering the right financial return for viable property development activities.

3. Why should green buildings have higher market values?

There are plenty of claims regarding the benefits of green buildings, but quantifying them empirically has been very difficult. Based on the three fundamental pillars of sustainability, green buildings should be environmentally, socially and economically beneficial (Abolore, 2012; Falkenbach et al., 2010). However, whether the benefits of green buildings would translate to increased market values depends on who enjoys them (Gabe and Rehm, 2014; Sayce et al., 2009). Compared to conventional buildings, green buildings use less resources throughout their life (Aye et al., 2000), are more energy and water efficient (Maller et al., 2012) and have high indoor air quality and reduced environmental impact (Addae-Dapaah et al., 2010). As demonstrated in Fig. 2, all these features translate into economic benefits to both occupiers and investors.

Occupiers enjoy reduced employee sick leave, lower energy and operational costs, improved employee recruitment and retention capability, and enhanced environmental corporate social responsibility (Singh et al., 2010; Smith and Pitt, 2011; WGBC, 2014.). If occupiers have the assurance of achieving these benefits, the chances are that they would be willing to pay more to occupy green buildings (Addae-Dapaah et al., 2010). However, this may not be automatically the case, for a number of reasons. In the commercial property market, space is considered as one out of many input factors that are competing for the limited resources of corporate organizations. For occupiers, demand for space is a derived demand, which usually makes occupancy satisfaction more important to occupiers than the quest to merely occupy a green-labelled building. Occupiers are mostly concerned with profit maximisation and, in doing so, they may occasionally sacrifice the benefits of occupying labelled buildings in favour of financial profitability.

Ideally, the occupancy benefits should make the occupiers willing to pay more to occupy green buildings. However, this appears not to be the case, as there is no convincing evidence that occupiers readily pay a premium for green-labelled buildings. In addition, there are still concerns on how the occupancy benefits are quantified for the purpose of valuation (Jones, 2013). The methods for assessing benefits of green buildings, especially those that relate to employee productivity, generally rely on conjecture and surveys of occupiers' personal opinions (see Nieuwenhuis et al., 2014; Singh et al., 2010; Smith and Pitt, 2011). Because most of the benefits relate to employee well-being, it is generally difficult to detach the health or productivity benefits that emanate from occupying green buildings from those brought about by personal hygiene or lifestyle, for example. Moreover, it is also not clear whether green building as a term, is clearly understood by the occupiers. For illustration, there is still confusion as to whether a green building means a building with certification or a building with many indoor potted plants and outdoor green landscape (Nieuwenhuis et al., 2014). All these uncertainties make it difficult to ascertain if the prices of green buildings are directly related to the benefits occupiers expect to derive from green buildings.

Investors also benefit from the higher occupancy and rental rates, lower maintenance costs, improved marketability, and reduced obsolescence that green buildings offer (Bartlett and Howard, 2000; Miller et al., 2008; Zuo and Zhao, 2014). Higher occupancy rate implies higher effective rental income, which would invariably raise the property's net operating income for the owner (Fuerst and McAllister, 2009). Improved marketability either in terms of letting or sale, also has an impact on the investment performance of real properties (Nurick et al., 2015). Green buildings are promoted generally as easy-to-market properties because market stakeholders have become more environmentally conscious and socially responsible now than ever (Levy and Peterson, 2013; van de Wetering and Wyatt, 2011). Given all these benefits, it is expected that green-labelled buildings should command a higher financial return than non-labelled buildings (Cajias and Piazolo, 2013; Fuerst and van de Wetering, 2015).

4. Real property valuation and the use of hedonic pricing models

Real property valuation is the process of estimating the market value or the most likely selling price of properties (Baum and Crosby, 2008). It is concerned with the identification, analysis, and quantification of the impact of various property-specific and market-related factors that affect value (Dunse and Jones, 1998). Arguably, the market comparison method should be the simplest and most accurate approach to valuation, as it uses evidence from recent market transactions in estimating values of properties (see Scarrett (2008) for full descriptions of valuation methods). However, this would only be true provided the comparable properties are numerous and are similar in all aspects to the property whose value is unknown. As these conditions are usually difficult to achieve, the concern of valuers has been that of adjusting the influence of significant determinants of property value to allow for the heterogeneous nature of real property (Smith and Huang, 1995). To achieve this, valuers have resorted to the use of the hedonic pricing model (HPM). The technique can be applied to a series

of property values, together with their associated characteristics, to identify and quantify the significant determinants of value (Dunse and Jones, 1998).

In real estate economics, it is used to deal with the problems associated with researching a good that is heterogeneous, which makes it suitable for property valuation (Fuerst and van de Wetering, 2015). A typical HPM is presented in Equation I, where the market price, P, of a property, is a function of the property's attributes, x and the error term, e.

$$P = f(x_1, x_2, x_3, x_4 \ldots\ldots x_n, e) \quad (1)$$

As useful as the HPM is, it has a number of shortcomings. The model assumes equilibrium throughout the property market and no interrelationship between the price of property attributes (Dunse and Jones, 1998). The implication of these two assumptions is that the implicit price that is placed on an additional property attribute is equal across all submarkets and property types. However, this is unrealistic, as buyers or occupiers attach different importance to property attributes. The implicit price of property attributes, therefore, tends to be valued differently by each buyer or occupier. Another shortcoming of HPM relates to the fact that the price of properties is a function of the combined influence of all property attributes, such that one attribute may not impact significantly on price if separated from other attributes. Real properties come in bundles containing structural and locational attributes (Fuerst and McAllister, 2011a) and since these cannot be bought separately, the implicit price of each attribute cannot be observed. Although different statistical adjustments have been developed to overcome these shortcomings, the reliability of such HPMs depends on the knowledge of the analyst.

In addition, the amount of data required to develop a reliable HPM is very large (Benjamin et al., 2004). This makes the methodology almost impracticable in emerging markets. The relatively long lifespan of buildings and infrequent transactions means that modelling HPMs tends to be based on small samples. It is should be mentioned that a fundamental prerequisite in using HPM is that occupiers must have prior knowledge of the potential positive and negative impacts that are associated with real property features. Occupiers must know beforehand, about the potential benefit of key building features before they can be expected to place value on them. However, in reality, occupiers often do not discover most benefits until after they have started to occupy properties. The last and probably the most important shortcoming is the inability of HPM to fully capture the reasons behind the rents or prices paid for properties. Arguably, the method estimates willingness to pay (Fuerst and van de Wetering, 2015) but clearly not the 'reason for paying'. When occupiers are unaware of the relationship between building attributes and the benefits they can provide, the implicit prices of such building attributes cannot be said to be reflected in the property values.

5. Valuation of green premium

The estimation of the green premium is mostly carried out through the HPM. This is due largely to the potential of the method to identify the effect of the individual building attributes on property value (Muldavin, 2008). The study by Miller et al. (2008) is one of the earliest to use the HPM for green premium estimation. Using a sample of Class A office buildings which were quite similar to labelled buildings, as comparable, the study found sales price premiums of 9% and 6% for LEED-certified and Energy Star (ES)-rated buildings respectively, although at statistically insignificant levels. Dermisi (2009) found that ES designation increased both the assessed and market values of properties substantially. Moreover, the study found that LEED-Existing Building (LEED-EB) designation at the Gold level had a strong positive effect on assessed value, while at the Silver level, it had similar effects on both the assessed and market values. Specifically, LEED-EB Silver has been associated with about 118% increase in asset value compared to other LEED properties (Dermisi, 2009).

Similarly, Wiley et al. (2010) found a rental premium ranging between 7.3 and 8.9% for buildings that were ES-rated and a premium of 15.2 to 17.3% for buildings with LEED certification. In monetary value, the green premium was estimated at \$30/ft^2 and \$129/ft^2 for ES and LEED buildings respectively. Fuerst and McAllister (2011a) reported rental premiums of approximately 4% and 5% for ES and LEED certified buildings respectively. Kok et al. (2012) found that LEED-certified buildings had a rental premium of approximately 7% compared to non-certified buildings. They also found that when a building had multiple green credentials (LEED and ES), it commanded an additional rental premium, although with a marginal difference when compared to only one certification. Das and Wiley (2014) estimated stationary premiums of 16.4% and 10.6% for ES-rated and LEED-certified buildings respectively.

Attempts have also been made to assess the development of premiums over time, in order to test the potential impact of the property cycle on the financial performance of green buildings. Using a panel data set, Reichardt et al. (2012) found that over the period under consideration, ES-rated and LEED-certified buildings achieved rent premiums of 2.5% and 2.9% respectively. Das et al. (2011) examined the rental rate dynamics of green commercial office properties in the San Francisco and Washington DC metropolitan areas. The study matched the list of commercial office properties certified by the US Green Building Council (USGBC) in the two areas with property-level temporal and non-temporal data derived from USGBC and CoStar between 2007 and 2010. Similarly to previous studies, the study found that green office buildings enjoyed rental premiums over comparable non-green buildings. The study also reported that the premiums are dynamic and counter-cyclical. Gripne et al. (2012) found that LEED

buildings command higher rent premiums than ES-rated buildings. In monetary terms, LEED-certified buildings achieved \$3.54 per ft^2, while ES-rated buildings achieved a rental rate of \$2.87 per ft^2.

Empirical studies on the impact of ecolabels on values of commercial offices are relatively limited in the UK, despite a wealth of anecdotal evidence (Sayce et al., 2010). Fuerst and McAllister (2011b) used data on 708 commercial property assets held by the Investment Property Databank UK and found no evidence to suggest that BREEAM and EPC ratings have any significant effect on market rents and prices of properties. The study by Chegut et al. (2014) was perhaps the first known to find statistically significant premiums for BREEAM-certified buildings in the UK, although the data used was mainly for City of London. The study found that BREEAM certification resulted in premiums of 19.7% and 14.7% in terms of rent and sale prices respectively, relative to non-certified buildings in the same neighbourhood. The study by Fuerst and van de Wetering (2015) is the latest in the UK to report a higher financial performance for labelled buildings. The study found that BREEAM-rated buildings commanded rental premiums ranging from 23 to 26%, compared to the non-rated buildings. These results are in line with many previous studies that used similar data from the US, where rental and sale price premiums were found for commercial buildings with LEED and Energy Star rating. The other hedonic studies that support the existence of the green premium include those by Deng et al. (2012), Kok and Jennen (2012), Newell et al. (2014), Pivo and Fisher (2008) and Yoshida and Sugiura (2010). From the green premium studies reviewed here, it appears that labelled buildings consistently outperform their non-labelled counterparts.

6. Issues in green premium hedonic estimation

So far, this review has demonstrated that good financial return is crucial in stimulating real property development activity and for the creation of a sustainable market. It has also shown that green buildings achieve higher financial performance than conventional buildings, due to an array of benefits they offer to the occupiers and the investors. What is not clear is whether the so-called green premium is helping to drive the market for green buildings, especially in the markets where developing to a green standard has almost become the norm. In addressing this issue, it is necessary to examine the methodology used for estimating the green premium. Given its acceptability, the HPM is the principal method for this purpose, as it allows valuers to quantify the impact of each building feature on the overall property values. In fact, the technique is considered more advanced than other methods such as case study and peer building selection (Muldavin, 2008).

However, the HPM is not entirely without flaws with regard to the green premium estimation (McAllister, 2012). One of the major drawbacks associated with the use of the model is the difficulty attached to matching green-certified buildings with other buildings that have almost exactly the same characteristics except for being green-certified. While using the HPM may help to control for some of these characteristics, it does not capture all discrepancies to make the method entirely error-free (Blumberg, 2012). Apart from the general shortcomings of HPMs presented earlier in this review, there are other noticeable shortcomings inherent in the use of an HPM for estimating a green premium. These are particular shortcomings that question the credibility of the conclusions of the hedonic studies with respect to green premiums. The main issues of concern are presented in the subsections that follow.

6.1. Sample size

The relatively small sample size used in the green premium hedonic studies constitutes a huge challenge to the credibility of such studies. In many of the studies, the number of green buildings is usually smaller compared to a usually much larger sample of conventional buildings. McAllister (2012) notes that "in studies involving commercial real estate assets, sample sizes have been small with typically hundreds of environmentally certified assets being compared to thousands of conventional assets" (p. 2). For instance, the study by Chegut et al. (2014) is based on a sample of 1149 lease transactions which included 64 BREEAM-certified leases and a sales transaction sample of 2103 observations, including 68 BREEAM-certified transactions. For the two datasets, labelled buildings represented only 6% and 3% of the overall building sample. It seems that this indicates a high level of lop-sidedness in the sample distribution, with relatively too few green buildings.

A similar study by Newell et al. (2014) conducted in Australia, used a sample of 23 Green Star-rated buildings, representing 6% of the total sample of 366 buildings. Kok and Jennen (2012) based their study on 1072 rental transactions consisting of both green buildings (EPC of A, B or C) and non-green buildings (EPC of D, E, F or G) while Fuerst and McAllister (2011b) used a sample of 226 office buildings. The study by Dermisi, (2009) was based on a sample of 351 LEED buildings drawn from 36 states. Miller et al. (2008) carried out a national study, based on 580 LEED and 643 ES buildings, while in another national study, Fuerst and McAllister (2011a) used 127 LEED and 559 Energy Star buildings. Gripne et al. (2012) cited limited data sets from existing programmes and industry databases as a major constraint to the ability of their study to establish verifiable higher financial performance for labelled buildings. Looking through all these studies, it is glaringly evident that sample size constitutes a major factor that undermines the accuracy of the HPM in the context of green premium estimation.

6.2. Uniqueness of green buildings

Green buildings are quite unique and different from non-labelled buildings, even when the latter are designed to high specifications. Robinson and Sanderford (2015) applied a propensity scoring methodology to predict the status of buildings, with a view to determining if green buildings are the same as other premium buildings in the market. The study found little statistical evidence that building attributes are good predictors of whether or not a building is certified. The study concluded that green buildings as a group do not share common characteristics with buildings that, for other reasons, generate premium rent in the market. The study is in line with the caveat commonly stated in hedonic studies that green buildings are quite unique and, thus, it may be difficult to compare them with conventional buildings for the purpose of green premium estimation. As found by Chegut et al. (2014), green buildings are mostly newer, taller, bigger in size and tend to be further away from train stations and motorways. Kok and Jennen (2012) also found that green buildings tend to have better overall building quality. These descriptions confirm that green buildings are very distinct from non-green buildings (Fuerst and Mcallister, 2009). Corroborating, Fuerst and van de Wetering (2015) concluded that the green premium reported in their study "may not be fully attributable to certification alone since there may be a difference in design specifications between BREEAM-rated buildings and non-BREEAM buildings with similar higher standards" (p. 205). Based on these findings, green premium estimation through market comparative analysis may be inevitably difficult.

6.3. Timing of transaction

As found in the studies reviewed, it is evident that the timing of the transaction evidence used in hedonic estimations has a significant effect on the reliability of the result. Fuerst and van de Wetering (2015) reported that the premium that the BREEAM-rated sample achieved over the non-BREEAM sample varied with time. This was estimated at 28% in 2007, 23% in 2008, 29% in 2009 and 30% in 2010. Earlier, the green premium has been found to be related to property cycles. It tends to be positive when the market is down but substantially falls when the market is booming (Das et al., 2011). Furthermore, when green-labelled buildings are still new in the market, they enjoy a certain vintage advantage that can inflate their premium far above what it would have been (Fuerst and van de Wetering, 2015). A similar finding is also reported in the study by Chegut et al. (2014), in which rents and transaction prices of stand-alone green buildings were found to be higher than those of labelled buildings located in neighbourhoods with a significant concentration of green buildings. Thus, the general state of the economy and the extent to which a (sub)market had been saturated with green buildings will determine whether a labelled building will command a premium or not.

6.4. Green label may not be a significant factor in renting decisions

To confirm the existence of a green premium, it is important to identify the factors considered by occupiers in determining how much to pay for a particular green building. There must be convincing evidence that the green label, as an umbrella description of green building features, is considered as a significant factor in renting decisions. Unfortunately, the HPM is incapable of revealing the motive underlying the rents paid by occupiers. Green premium studies that have applied the HPM acknowledge this by usually stating that factors other than green label may influence rental rates (Austin, 2012; Goering, 2009; Gripne et al., 2012). Fuerst and van de Wetering (2015) state categorically that several factors may account for the existence of the green premiums found in their study. The authors note that certain companies may want to pay a premium to occupy environmentally friendly buildings to follow their internal corporate policies or to align their business model with the space that they occupy. From this evidence, it is difficult to ascertain if green certification is really important to the occupiers, considering that there are other factors occupiers take into account when taking their renting decisions.

7. Growth of the green office market

Examining the growth of the green office market both in the UK and the US provides a basis for evaluating the impact of almost a universally accepted green premium message. These two mature real property markets offer the right platform to assess the economics of green buildings with a view to uncovering the potential impact of a green premium on the supply of green buildings. As mentioned earlier, BREEAM was introduced in the UK in 1990 as the world's first green building certification scheme, followed later by Energy Star and LEED which were introduced in the US in 1992 and 1998 respectively. These are the leading international green building standards, especially in the commercial property market. Since their establishment, the green commercial property markets of the two countries have grown significantly. Notwithstanding, labelled buildings are yet to become a significant segment in the urban property markets.

The study by Oyedokun et al. (2015) is the most recent to document the penetration of green office buildings in the UK. The empirical study examined the spatial growth of green (BREEAM certified) offices, which provided a platform to challenge the perceived industry wisdom that the establishment of a green premium is the key to green building development. Using CoStar data on BREEAM office buildings, the study found that the initial adoption of green offices was slow, but there had been a dramatic rise in green

building supply at the peak of the past decade's development boom, which occurred in 2008 and in the immediate years that followed. Given the state of the market, the authors noted that market acceptance of the importance of greenness was still in the melting pot, with limited market transactions since 2008, as evident in the number of green office buildings in the market at the time of the analysis. The study further reported that green offices represented only 2.7% of office buildings and 12% of total space in the market. Moreover, most of the green offices were in the principal cities, with the largest concentration in London. It was concluded that up to the time of the study, the growth of the UK green office sector was inconsistent with the green premium development model (Oyedokun et al., 2015).

The Green Building Adoption Index issued by CBRE is an annual report that tracks the spatial growth of green buildings across the US (CBRE, 2015). According to the 2015 edition of the report, which was based on the data available up to the end of the fourth quarter of 2014, only about 13% of the commercial building stock in the US had either the Energy Star label, LEED certification, or both. In terms of floor space, the certified stock was approximately 40% of the market, but the proportion of buildings certified under Energy Star fell from 10.8% in 2013 to 9.7% across the 30 largest markets in the US (CBRE, 2015). A significant gap between the large and the small office buildings in terms of sustainability certification was also reported, with the former found to have a higher tendency to be green-certified. The report concluded that the uptake of green building practices in the 30 largest US cities continued to be significant, although at a decelerating growth rate. However, quoting from the report:

> *"this does not imply that buildings are starting to perform worse than before. Rather, it reflects the fact that only a certain fraction of the building stock can obtain a sustainability or energy-efficiency certification. And perhaps it also indicates that the fraction that can seek certification has now done so. The most sophisticated owners with the most high-profile buildings in Tier 1 markets have pursued and achieved certification*" (CBRE, 2015, p. 4).

The findings of this report point to a diminishing financial motivation for further expansion of the green building sector. The concern for the achievement of the green agenda would, therefore, focus on drivers for future developments and perhaps more fundamentally, on retrofitting the existing non-labelled buildings. Based on these two reports and the discussions in the preceding sections, the green premium appears not to be a significant explanatory factor for green building development as currently being experienced in the UK and the US to date. Rather, issues that border on corporate social responsibility and energy efficiency legislation seem to have been the main drivers. In summary, the trend of green building development to a large extent, questions the green premium as a potential driver of the development of green commercial buildings.

8. Concluding remarks

This study reviewed relevant literature to assess the potential of the green premium as a driver of the market for green buildings. It sought to provide an answer to the question on whether the green premium is responsible for the green building development to date. A significant finding of this review is that the green premium message has almost become universally accepted, with the same idea being promoted as the driver of green-labelled commercial properties. However, after examining the growth of the green building sector, both in the UK and the USA, it became clear that green premium does not provide an independent explanation for the rapid development of green buildings experienced to date. There are, however, lessons to take on board as the struggle for the development of a sustainable market for green buildings continues.

To start with, it is not possible to talk about a green premium if there are no green building standards. In the markets where a green premium may potentially exist, there is usually a green building certification scheme in operation. As this is generally absent in most developing economies, it may be difficult to adopt findings of the green premium hedonic studies in the developing countries. A giant stride for any developing country will be to establish or adopt a green building certification scheme. This is the starting point for the development of market for green-labelled buildings, since the label serves as a means of distinguishing buildings according to their level of greenness. The green label is also useful for valuation purposes, as it provides a benchmark for comparative analysis. In the absence of a label, valuers would inevitably rely on their personal experiences in factoring the impact of green building features into valuations. Apparently, this is not ideal in a globalised property market. Comparing the values of green-labelled buildings in different countries for potential investment would be possible if there were rating tools designed for such comparative analysis (Nurick et al., 2015). Green certification schemes help in creating the initial awareness required to kick-start a market, and governments should provide the right framework for their operation (Ntshwene et al., 2014).

Furthermore, the review has demonstrated that seeking for a green premium as a motivation for green building development may not lead to the development of a sustainable market. Rather than seeking for a green premium, property investors and developers must first be committed to promoting the green agenda through their activities, even when doing so may involve uncertainties. This brings out the role of professionals, including real estate appraisers, who should take up the responsibility of creating awareness about the benefits of green buildings. In creating a sustainable market for green buildings, government, developers, investors, and occupiers must all be fully aware of the benefits that such buildings offer. No doubt, a thorough awareness of the benefits of green buildings would help in motivating governments to create a green building

council and establish a green building certification scheme. Whereas occupiers would only pay more to occupy green buildings when they are convinced of the occupancy benefits that such buildings offer, developers and investors would only be motivated to invest when they accept that it makes financial sense to invest. Therefore, continual efforts must be made to demonstrate the benefits of green buildings.

References

Abolore, A.A., 2012. Comparative study of environmental sustainability in building construction in Nigeria and Malaysia. J. Emerg. Trends Econ. Manage. Sci. 3 (6), 951–961.

Addae-Dapaah, K., Wai, T.K., Bin, M.J., Foo, Y., 2010. Indoor air quality and office property value. J. Sustain. Real Estate 2 (1), 91–115.

Ajibola, M.O., 2015. Valuing green buildings in Nigeria: issues and challenges. Covenant J. Res. Built Environ. 3 (1), 1–10.

Austin, G.W., 2012. Sustainability and income-producing property valuation: North American status and recommended procedures. J. Sustain. Real Estate 4 (1), 78–122.

Aye, L., Bamford, N., Charters, B., Robinson, J., 2000. Environmentally sustainable development: a life-cycle costing approach for a commercial office building in Melbourne Australia. Constr. Manage. Econ. 18 (8), 927–934.

Babawale, G.K., Oyalowo, B.A., 2011. Incorporating sustainability into real estate valuation: the perception of Nigerian valuers. J. Sustain. Dev. 4 (4), 236–248.

Baker, J.B., 2007. Market definition: an analytical overview. Artic. Law Rev. Other Acad. J. 74 (1), 129–173.

Ball, M., Lizieri, C., MacGregor, B.D., 1998. The Economics of Commercial Property Markets. Routledge, London.

Bartlett, E., Howard, N., 2000. Informing the decision makers on the cost and value of green building. Build. Res. Inf. 28 (5–6), 315–324.

Baum, A., Crosby, N., 2008. Principles of investment analysis. Property Investment Appraisal. Blackwell Publishing, Oxford, UK.

Benjamin, J.D., Guttery, R.S., Sirmans, C.F., 2004. Mass appraisal: an introduction to multiple regression analysis for real estate valuation. J. Real Estate Pract. Educ. 7 (1), 65–77.

Blumberg, D., 2012. LEED in the US commercial office market: market effects and the emergence of LEED for existing buildings. J. Sustain. Real Estate 4 (1), 23–47.

Brounen, D., Jennen, M., 2009. Local office rent dynamics. J. Real Estate Financ. Econ. 39 (4), 385–402.

Cajias, M., Piazolo, D., 2013. Green performs better: energy efficiency and financial return on buildings. J. Corp. Real Estate 15 (1), 53–72.

CBRE, 2015. National Green Building Adoption Index. Retrieved 1 December 2016, from http://www.cbre.com/~/media/files/corporate%20responsibility/green-building-adoption-index-2015.pdf?la=en.

Chegut, A., Eichholtz, P., Kok, N., 2014. Supply, demand and the value of green buildings. Urban Stud. 51 (1), 22–43.

Das, P., Tidwell, A., Ziobrowski, A., 2011. Dynamics of green rentals over market cycles: evidence from commercial office properties in San Francisco and Washington DC. J. Sustain. Real Estate 3 (1), 1–22.

Das, P., Wiley, J.A., 2014. Determinants of premia for energy-efficient design in the office market. J. Prop. Res. 31 (1), 64–86.

Deng, Y., Li, Z., Quigley, J.M., 2012. Economic returns to energy-efficient investments in the housing market: evidence from Singapore. Reg. Sci. Urban Econ. 42 (3), 506–515.

Dermisi, S.V., 2009. Effect of LEED ratings and levels on office property assessed and market values. J. Sustain. Real Estate 1 (1), 23–47.

DiPasquale, D., Wheaton, W.C., 1992. The markets for real estate assets and space: a conceptual framework. J. Am. Real Estate Urban Econ. Assoc. 20 (2), 181–198.

Dunse, N., Jones, C., 1998. A hedonic price model of office rents. J. Prop. Valuat. Invest. 16 (3), 297–312.

Dunse, N., Jones, C., White, M., 2010. Valuation accuracy and spatial variations in the efficiency of the property market. J. Eur. Real Estate Res. 3 (1), 24–45.

Falkenbach, H., Lindholm, A.-L., Schleich, H., 2010. Environmental sustainability: drivers for the real estate investor. J. Real Estate Lit. 18 (2), 203–223.

Fuerst, F., McAllister, P., 2011a. Green noise or green value? Measuring the effects of environmental certification on office values. Real Estate Econ. 39 (1), 45–69.

Fuerst, F., McAllister, P., 2011b. The impact of Energy Performance Certificates on the rental and capital values of commercial property assets. Energy Policy 39 (10), 6608–6614.

Fuerst, F., McAllister, P., 2009. An investigation of the effect of eco-labeling on office occupancy rates. J. Sustain. Real Estate 1 (1), 49–64.

Fuerst, F., van de Wetering, J., 2015. How does environmental efficiency impact on the rents of commercial offices in the UK?. J. Prop. Res. 32 (3) 193–216.

Gabe, J., Rehm, M., 2014. Do tenants pay energy efficiency rent premiums? J. Prop. Invest. Finance 32 (4), 333–351.

Goering, J., 2009. Sustainable real estate development: the dynamics of market penetration. J. Sustain. Real Estate 1 (1), 167–201.

Gripne, S., Martel, J.C., Lewandowski, B., 2012. A Market evaluation of Colorado's high-performance commercial buildings. J. Sustain. Real Estate 4 (1), 123–148.

Healey, P., 1992. An institutional model of the development process. J. Prop. Res. 9 (10), 33–44.

Issa, N.S.C., Al Abbar, S.D., 2015. Sustainability in the Middle East: achievements and challenges. Int. J. Sustain. Build. Technol. Urban Dev. 6 (1), 34–38.

Jones, C., 2009. Remaking the monopoly board: urban economic change and property investment. Urban Stud. 46 (11), 2363–2380.

Jones, C., 2013. Office Markets and Public Policy. John Wiley & Sons, Chichester.

Jones, C., Watkins, C., 1996. Urban regeneration and sustainable markets. Urban Stud. 33 (7), 1129–1140.

Kanyaura, V.N., Obino, M.S., 2015. An Assessment of the adoption of green building in Kenya: a case of green building society of Kenya. Int. J. Bus. Manage. Res. 1 (5), 31–42.

Keogh, G., D'Arcy, E., 1999. Property market efficiency: an institutional economics perspective. Urban Stud. 36 (13), 2401–2414.

Kok, N., Jennen, M., 2012. The impact of energy labels and accessibility on office rents. Energy Policy 46, 489–497.

Kok, N., Miller, N., Morris, P., 2012. The economics of green retrofits. J. Sustain. Real Estate 4 (1), 4–22.

Lambiri, D., Rovolis, A., 2014. Real estate, and housing markets. In Handbook of Regional Science. Springer Berlin Heidelberg. Retrieved 12 December 2016, from http://doi.org/10.1007/978-3-642-23430-9.

Leishman, C., Orr, A., Pellegrini-Masini, G., 2012. The impact of carbon emission reducing design features on office occupiers' choice of premises. Urban Stud. 49 (11), 2419–2437.

Levy, D., Peterson, G., 2013. The effect of sustainability on commercial occupiers' building choice. J. Prop. Invest. Finance 31 (3), 267–284.

Lorenz, D.P., Truck, S., Lutzkendorf, T., 2007. Exploring the relationship between the sustainability of construction and market value: theoretical basics and initial empirical results from the residential property sector. Prop. Manage. 25 (2), 119–149.

Maller, C., Horne, R., Dalton, T., 2012. Green renovations: intersections of daily routines, housing aspirations and narratives of environmental sustainability. Housing Theory Soc. 29 (3), 255–275.

Mansfield, E., 1991. Microeconomics: Theory and Application, seventh ed. W.W. Norton & Company, New York.

McAllister, P.M., 2012. Studies of Price Effects of Eco-Labels in Real Estate Markets: An "off the record" record. Retrieved 12 December 2015, from https://www.reading.ac.uk/web/FILES/REP/Table_of_studies_(12).pdf.

Miller, N., Spivey, J., Florance, A., 2008. Does green pay off?. J. Real Estate Portf. Manage. 14 (4) 385–399.

Muldavin, S., 2008. Quantifying "green" value: assessing the applicability of the CoStar studies. Retrieved 14 October 2015, from http://www.greenbuildingfc.com/Home/ViewResearchDoc.aspx?id=34.

Newell, G., MacFarlane, J., Walker, R., 2014. Assessing energy rating premiums in the performance of green office buildings in Australia. J. Prop. Invest. Finance 32 (4), 352–370.

Nieuwenhuis, M., Knight, C., Postmes, T., Haslam, S.A., 2014. The relative benefits of green versus lean office space: three field experiments. J. Exp. Psychol. Appl. 20 (3), 199–214.

Ntshwene, K., Essah, E., Dixon, T., 2014. Investigating the level of awareness of building assessment tools in the construction industry of Botswana. In: 30th Annual ARCOM Conference, 1–3 Sept 2016, Portsmouth, U.K., pp. 23–32. Retrieved 14 June 2016, from http://centaur.reading.ac.uk/37716/.

Nurick, S., Le Jeune, K., Dawber, E., Flowers, R., Wilkinson, J., 2015. Incorporating green building features and initiatives into commercial property valuation authors. J. Sustain. Real Estate 7 (1), 21–40.

Oliyide, S., 2014. The evolution of green building in Nigeria: A myth or a reality. Retrieved 1 December 2016, from http://www.slideshare.net/amfacilities/the-evolution-of-green-buildings-in-nigeria.

Oyedokun, T., Jones, C., Dunse, N., 2015. The growth of the green office market in the UK. J. Eur. Real Estate Res. 8 (3), 267–284.

Pivo, G., Fisher, J.D., 2008. Investment Returns from Responsible Property Investments: Energy Efficient, Transit-oriented and Urban Regeneration Office Properties in the US from 1998–2007. Responsible Property Investing Center, Boston College, University of Arizona, Benecki Center for Real Estate Studies, and Indiana University, Working Paper WP-08-2.

Reed, R., Bilos, A., Wilkinson, S., 2009. International comparison of sustainable rating tools. J. Sustain. Real Estate 1 (1), 1–22.

Reichardt, A., Fuerst, F., Rottke, N., Zietz, J., 2012. Sustainable building certification and the rent premium: a panel data approach. J. Real Estate Res. 34 (1), 99–126.

Robinson, S.J., Sanderford, A.R., 2015. Green buildings: similar to other premium buildings? J. Econ. Real Estate Finance 52 (2), 99–116.

Roderick, Y., McEwan, D., Wheatley, C., Alonso, C., 2009. Comparison of energy performance assessment between LEED, BREEAM and Green Star. In: Eleventh International IBPSA Conference Glasgow, July 27–30, pp. 1167–1176.

Sayce, S., Sundberg, A., Clements, B., 2010. Is sustainability reflected in commercial property prices: an analysis of the evidence base, RICS Research. Report.

Sayce, S., Sundberg, A., Parnell, P., Cowling, E., 2009. Greening leases: do tenants in the United Kingdom want green leases? J. Retail Leis. Prop. 8 (4), 273–284.

Scarrett, D., 2008. Property Valuation: The Five Methods, second ed. Routledge, Abingdon.

Simons, R.A., Choi, E., Simons, D.M., 2009. The effect of state and city green policies on the market penetration of green commercial buildings. J. Sustain. Real Estate 1 (1), 139–166.

Singh, A., Syal, M., Grady, S.C., Korkmaz, S., 2010. Effects of green buildings on employee health and productivity. Am. J. Public Health 100 (9), 1665–1668.

Smith, A., Pitt, M., 2011. Sustainable workplaces and building user comfort and satisfaction. J. Corp. Real Estate 13 (3), 144–156.

Smith, V., Huang, J., 1995. Can markets value air quality? A meta-analysis of hedonic property value models. J. Polit. Econ. 103 (1), 209–227.

UN-HABITAT, 2010. Conference on Promoting Green Building Rating in Africa. Retrieved 1 December 2016, from http://mirror.unhabitat.org/categories.asp?catid=640.

Van de Wetering, J., Wyatt, P., 2011. Office sustainability occupier perceptions and implementation of policy. J. Eur. Real Estate Res. 4 (1), 29–47.

WGBC, 2014. Productivity in Offices: The next chapter for green building. Retrieved 1 December 2016, from http://www.ukgbc.org/resources/publication/health-wellbeing-and-productivity-offices-next-chapter-green-building.

Wiley, J., Benefield, J.D., Johnson, K.H., 2010. Green design and the market for commercial office space. J. Real Estate Finance Econ. 41 (2), 228–243.

Yoshida, J., Sugiura, A., 2010. Which "greenness" is valued? Evidence from green condominiums in Tokyo. Retrieved 1 December 2016, from http://ssrn.com/abstract=1636426.

Zhu, J., 1997. The effectiveness of public intervention in the property market. Urban Stud. 34 (4), 627–646.

Zuo, J., Zhao, Z.Y., 2014. Green building research-current status and future agenda: a review. Renew. Sustain. Energy Rev. 30, 271–281.