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RESEARCH ARTICLE

Different grades and different green premiums: a cross sectional analysis of a green certification scheme

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ABSTRACT

Green certification is often hailed as an effective means of resolving information asymmetry by providing prospective buyers with credible proof of a property's level of quantitative sustainability performance. These certification schemes are also considered as providing the credible identification labels needed to generate a market premium. This study analysed whether different market premiums (financial implications) exist across different ratings of the HK-BEAM certification scheme. The paper used hedonic price model (HPM) to evaluate the influence of green certification rating levels on residential property prices in Hong Kong. The results indicate, on average, that HK-BEAM certification increases price values by between 5.3% and 6.7%. Most importantly, the results indicate that significant price premium differences exist across the different ratings available for HK-BEAM certified buildings. The findings provide strong proof of the existence of a premium across ratings.

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Introduction

Globally, buildings (both residential and commercial) contribute significantly towards energy consumption, reaching 20% to 40% in developed countries alone, and exceeding contributions from other major sectors, such as industrial and transportation (Pérez-Lombard, Ortiz, & Pout, 2008). Because of this, environmental authorities across the globe have introduced green certification schemes as technical instruments to assess and evaluate the environmental impact of buildings on one hand, and encourage the development of green buildings on the other hand (Bernardi, Carlucci, Cornaro, & Bohne, 2017). Notable examples of green certification systems adopted around the world include; Building Research Establishment Environmental Assessment Method (BREEAM) in the United Kingdom, Leadership in Energy and Environmental Design (LEED) in the United States, the Haute Qualité Environnementale or HQE (High Quality Environmental standard) in France and Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan (Bernardi et al., 2017; BREEAM, 2015; U.S. Green Building Council, 2015). Since green buildings can bring a large amount of benefits to building occupants and developers, given the possibility that this would

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become a catalyst to influence property prices. It has been revealed in the literature that green buildings can enhance residential property prices (Chegut, Eichholtz, & Kok, 2014; ; Fuerst & McAllister, 2009; Kats, 2003; Wadu & Sze Man, 2013; Wing Chau, Kei Wong, & Yim Yiu, 2004). For instance, Chan et al. (2009) highlighted the government economic and advocatory incentives as significant drivers for investing in green buildings. In Europe, Porumb et al. (2020) noted that green office buildings sold at higher prices than non-green buildings. Also, Tolliver, Keeley, and Managi (2019) suggested the importance of a rapidly growing green bonds market in achieving the Paris Agreement and United Nation's Sustainable Development Goals (SDGs). Previous studies mainly compared the difference in property prices between certified and non-certified buildings rather than buildings with different green certification ratings.

Building contributions towards greenhouse gas emissions in Hong Kong is alarming, accounting for approximately 70% of the total emission but the Hong Kong government has initiated various policy measures to attain sustainable development and low-carbon living (see Wong, San Chan, & Wadu, 2016). Studies within the context of Hong Kong have examined energy use assessment of HK-BEAM (Hong Kong – Building Environmental Assessment Method), BREEAM and LEED (Lee & Burnett, 2008). In the context of Hong Kong, Tam, Hao, and Zeng (2012) examined that green buildings can improve the economic and social issues in the Hong Kong construction industry. Tam, Fung, and Chan (2014) also estimated the efficacy of the proposed Gross Floor Area (GFA) concession policy which allowed green and amenity features exempted from GFA. Wadu and Sze Man (2013) investigated the impact of green features on residential building prices. Gou and Lau (2014) analysed different green building certification systems at international (LEED, BREEAM, CASBEE), national (China Green Building Rating System) and local Hong Kong (BEAM-Plus) level. Hui, Tse, and Yu (2017) recent study only evaluated the effects of BEAM-Plus certification on property prices in Hong Kong. However, no study was conducted to compare the impact of different green certification schemes, that is, HK-BEAM Plus's Platinum, Gold, Silver, and Bronze on residential property prices in Hong Kong. Lack of empirical evidence on the impact of green certification schemes can lead to lack of essential insights into facilitating strategies to determine reasonable and profitable prices for residential properties. This study, therefore, examines the price premium brought by different levels of HK-BEAM-Plus scheme on residential property prices. The main hypothesis of the present study is to examine whether there is a positive relationship between property prices and the level of green certification of residential buildings in Hong Kong.

Literature review

Green buildings and green certifications

Given the significant environmental issues, we are currently confronted with, taking steps to protect our environment is becoming more compelling and necessary (Chan, 2013). Thus, the idea of green building appeared alongside numerous environmental policies to contribute to reducing impacts to the environment through reductions in energy usage, water usage, and minimising environmental disturbances from the building site. A green building, also known as a sustainable building, is designed and built using resource-efficient methods and materials, or one that considers the occupants, construction workers, the general public, or future generations (Landman, 1999). Although the idea of green building is a relatively new solution to the challenges that arise in the construction sector (Balaban & de Oliveira, 2017), green buildings have proliferated as a network of state, nongovernmental, and private players seeking to address the environmental and human health effects of a building's whole life cycle, from construction to demolition (Matisoff, Noonan, & Flowers, 2016). Subsequently, environmental economists and lawmakers have paid more attention to green building over the last decade. While general definition of green buildings is uncommon in the literature, building resource productivity and minimising the effect of buildings on human health and the environment are prioritised by researchers and organisations (Matisoff et al., 2016). Green buildings aim to reduce environmental effects by reducing energy and water use and mitigating environmental disruptions caused by the construction site. Green buildings, by extension, seek to promote human health through the construction of sustainable indoor environments (Allen et al., 2015). The U.S. Environmental Protection Agency (2014, p. 1) defined green building as "the practice of increasing the efficiency with which buildings and their site use and harvest energy, water, and materials; and protecting and restoring human health and the environment, throughout the building life-cycle". As a result, a growing number of building industry regulations have been adopted in the United States and other nations to increase energy efficiency and lower the environmental impact of the structure or site. Green buildings are backed by a set of rules, including both voluntary and mandatory programs, that impact the building's entire life cycle, from design and construction to operation and deconstruction. Green buildings and associated policies have two associated economic rationales: to allow firms to internalise externalities (Kingsley, 2008) and promote a public good's private provision (Kotchen, 2006).

Urban built environment is a policy area in which effective strategies and activities will reap important human and environmental benefits and buildings, among other aspects of the urban built environment, deserve special recognition due to their important contribution to environmental and health concerns (Balaban & de Oliveira, 2017). There are several performance benefits of green buildings that result from more effective and safe operations (Matisoff et al., 2016). Green building co-benefits strategy tackles climate change issues while still solving particular urban challenges or assisting in achieving specific growth goals (de Oliveira, 2013). The strategy appears as a win–win strategy or a way of achieving several outcomes with a single program. While one of the outcomes is unquestionably lowered GHG emissions, others will range from increased air quality or health conditions in cities to economic gains and savings (Balaban & de Oliveira, 2017). The concept of green building has brought about reduction in impact of construction pollution on the environment as well as improved ecological benefits (Chen & Luo, 2020). Green buildings, when compared to conventional buildings, have longer lifecycles, lower maintenance and operational costs, lower water and energy bills, can attract higher rents, and have lower turnover (Ampratwum, Agyekum, Adinyira, & Duah, 2019). Ries, Bilec, Gokhan, and Needy (2006) study suggested that green construction can provide significant economic benefits through improved employee productivity, health and safety, saving from energy, maintenance, and operational costs. Green buildings can also offer additional advantages to their owners, such as acting as a hedge against atmospheric, regulatory, or other environmental risks (Matisoff et al., 2016). In the context of Hong Kong, green building is a practice of reducing the environmental impact of buildings on the environment which is achieved by planning throughout the building lifecycle, optimising resource efficiency, and reducing waste and pollution (Hong Kong Green Building Council, 2015).

The aim of green ranking or certification schemes is to provide individuals with an awareness of the labels that express a building's sustainability attributes (Rattan, 2015). Green certification is a rating tool to indicate the level of environmental friendliness of real estate properties (Abdullah, Nur, & Mohd, 2017). Green building certification is not new for many developing nations, such as the United Kingdom, the United States, Canada, Australia, and Japan, depending on their adopted times. The availability of numerous green building rating tools indicates a movement underway to construct more green buildings that minimise environmental effects, maximize social benefits, and improve economic returns. Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), CASBEE, Green Star, Green Mark, and Green Globe are examples of green building assessment tools. Within Hong Kong, the three main private certification and environmental information schemes are Hong Kong Building Environmental Assessment Method (HK-BEAM) – by the HKBEAM Society Limited BEAM Plus – by the HKBEAM Society Limited, and Green Building Award – by the Hong Kong Green Building Council (Wadu Mesthrige & Chan, 2019). While HK-BEAM is certification is by far the dominant scheme in Hong Kong, and BEAM Plus, being a revamped version of HK-BEAM widened the coverage of issues, further defining the quality and sustainability of building features (BEAM Society Limited, 2012). Building certification is carried out according to particular requirements that consider the most critical aspects of sustainable buildings, including ecological eciency, effective water storage, pollution prevention, and environmental sustainability for building users (Plebankiewicz, Juszczyk, & Kozik, 2019).

Green buildings, including those subject to verification by appropriate entities issuing green certificates, can become the solution to high-energy consumption problems (Plebankiewicz et al., 2019). Previous studies have found empirical evidence of financial benefits for building owners. According to Eichholtz, Kok, and Yonder (2012), real estate investment trusts (REITs) with a higher percentage of LEED-certified properties in their portfolio have higher valuation and lower price uncertainty than REITs with a lower percentage of LEED-certified properties in their portfolio. Study by Deng and Wu (2013) in Singapore revealed that Green Mark–certified properties command a 9.9% premium in the resale market but only a 4.4% premium in the initial transaction, implying that green certification can minimise information asymmetries in the resale market. According to Chegut et al. (2014), buildings in the United Kingdom that are certified using the BRE Environmental Assessment Method rent for longer periods of time and at a 28% premium. Green certification indirectly aids people in evaluating the benefits of green building versus non-certified buildings (Ampratwum et al., 2019). Green certification systems further provide guidelines to measure, improve, certify, benchmark and label the lifecycle sustainability and performance of a project (Cheng & Venkataraman, 2012). Furthermore, reducing dependence on volatile-priced inputs such as water and energy will minimise a firm's risk exposure (Jackson, 2010). For instance, Kahn and Kok (2014) demonstrate that climate-related shocks increase the premium for green-certified homes in California. Deng, Li, and Quigley (2012) indicate that when environmental standards were tightened, investments in Singapore's GreenMark certification for sustainable buildings paid off. In practice, three categories of green building certification programs can be distinguished. The first of these are mandatory energy certificates, in which the measurement is limited to the building's energy efficiency – often belong to residential buildings. The second category is voluntary ecological certificates, the most common of which are issued by the LEED and BREEAM schemes. These certifications mostly apply to commercial properties, and the purpose of the assessment encompasses the building's general ecological features, which is possible due to the comparatively broad number of assessment requirements. Voluntary comprehensive certification programs, which have only been adopted in a few countries, are the third category. The appraisal, which mostly applies to residential buildings and homes, is very extensive in scope, encompassing more than just environmental issues. Voluntary building certification programs decrease the costs of gathering information about a building and credibly validate the environmental performance of a building by utilising a third-party certifier. According to Matisoff et al. (2016), participants in voluntary green building projects such as LEED partake in costly private activities to generate public products (for example, use sustainably sourced building construction materials) and to certify structural changes that minimise running costs (i.e. improved energy efficiency).

BEAM plus green certification in Hong Kong

Before delving into the literature on the relationship between green labels and property price/rental prices, this section contains some context information on BEAM Plus in Hong Kong. According to the BEAM Society Limited (2012), the goals of the BEAM Plus appraisal tool are to increase the quality of buildings in Hong Kong, to promote demand for sustainable buildings, to recognise changes in efficiency and reduce false statements, and to include a set of environmental performance criteria that are rigorous enough for developers and owners. BEAM Plus can be traced back to December 1996, when the Real Estate Developers Association (REDA) of Hong Kong first introduced the HK-BEAM. HK-BEAM was a voluntary scheme based on the United Kingdom BREEAM, with one variant for new buildings and another for existing office buildings. Then, in 1999, a version of HK-BEAM designed specifically for modern high-rise buildings was released. Subsequently, other versions have been released as necessary revisions took place over time (Hui et al., 2017). Independent BEAM assessors engaged by BEAM Society can perform BEAM Plus tests during the pre-design, design, or construction phases. Buildings are graded on four different levels of ratings concerning HK-BEAM Plus (Platinum, Gold, Silver and Bronze). These ratings are focused on a variety of issues related to the environmental efficiency of the house, from reduction of CO2 emissions, to building use guides and green leases, and innovation. For instance, if a project does not achieve the threshold scores for bronze grades, it will be rated as "unclassified" (BEAM Society Limited, 2012). Similarly, if the performance of a building meets the pre-defined criterion of BEAM Plus, credits will be awarded to the building accordingly (Ho et al., 2013). As of May 2018, the total number of registered BEAM Plus projects is 1061, while assessed BEAM Plus projects amount to 566 (Hong Kong Green Building Council, 2018). It is noted that among all assessed buildings, 247 (43.6%) are residential buildings, accounting for the highest percentage among different building types (Hong Kong Green Building Council, 2018).

Relationship between green certification and residential property prices

Several studies have shown that green certification has a favorable impact on house values and leases, for example, Fesselmeyer (2018), Deng et al. (2012), Kahn and Kok (2014), and Eichholtz, Kok, and Quigley (2010). Fesselmeyer (2018) discoverered that green certification raises the price per square meter by around 3% in Singapore. The sudy further found that the impact is greatest for marginally green buildings, which are likely to be the developments whose greenness is less apparent to buyers and for which certification is more necessary. Energy-efficient buildings are one of the most effective approaches to mitigating carbon emissions and this can be achieved in Hong Kong by adopting energy-saving guidelines for space coolers, refrigerators, water heaters and washing machines (Jing et al., 2017). Therefore, Hong Kong, as a service economy with no large energy-intensive sectors, must focus heavily on the promotion of green buildings to lead to major cuts in carbon emissions (Gou, Lau, & Prasad, 2013). The study by Gou et al. (2013) unveiled the relationship between energy use and carbon emissions by developing techniques to introduce a cost-reduction and carbon-saving scheme for Hong Kong's residential buildings in accordance with the government green building guidelines. Although there is a misperception about the higher costs of green buildings (Kats, Alevantis, Berman, Mills, & Perlman, 2003), the cost of producing green buildings is decreasing due to richer expertise of green construction and economies of scale hence, the construction cost of green buildings should not be significantly higher than the one with a non-green configuration (Yau, 2012). It has been revealed in the literature that there is significant savings in operation and maintenance costs of green buildings (Weerasinghe & Ramachandra, 2018). Also Chegut, Eichholtz, and Kok (2019) showed that the total marginal cost of green-labelled buildings is lower than the value premium reported in the literature.

Green certification ratings can influence property prices. It was found in the literature that investors will likely be attracted to green-certified buildings if they will see more benefits over conventional properties (Kuiken, 2009). The investments in green-certified real estate developments have measurable benefits, such as low resource utilisation at the construction process, low operating cost with energy efficiency, low greenhouse gas emissions, improved indoor environmental quality, increased employee productivity and positive impacts on the image of the tenants (Gabay, Meir, Schwartz, & Werzberger, 2014; Liu, Guo, & Hu, 2014; Park, Yoon, & Kim, 2017). Therefore, tenants should be willing to pay more on rent for green-certified buildings compared to the conventional buildings (Eichholtz et al., 2010). In the context of Hong Kong, green-certified buildings with HK-BEAM and HK-GBC assessment schemes have upgraded the quality of the buildings and therefore the property prices were increased between 3.46% and 6.61% while sales price premium increased by 8.3% (Wadu & Sze Man, 2013).

Research methodology

Hedonic Price Model (HPM)

Different researchers have used HPMs to examine the effects of various housing attributes on property prices. Such attributes include; property management (Hui, Ting Lau, & Hayat Khan, 2011), land-use policies (Song & Knaap, 2004), urban redevelopment (Ki & Wadu, 2010), transportation (Atkinson-Palombo, 2010; Bartholomew & Ewing, 2011;

Duncan, 2011), urbanism (Tu & Eppli, 2001), sports amenities (Tu, 2005), architectural design (Plaut & Uzulena, 2005), historic monuments (Ahlfeldt & Maennig, 2008) and green features (Wadu & Sze Man, 2013). HMP can analyse implicit relationships between the commodity and its characteristics (Freeman, 1979). It is pointed out by Hui et al. (2011) that the model is location-specific, hence it is not used to generalise the effects of a certain characteristic across different regions. The present study focuses on the effect of the green certification level on the property prices in Hong Kong, which targeted at a specific location. Therefore, the HPM would be a suitable tool for investigating the relationships.

To investigate the relationship between green certification ratings and residential property prices, the following semi-log form of HPM was used in this paper. The housing price was used in natural logs and regressed against a set of logs. The model contains 10 variables under three broad categories, that is, locational, structural and environmental attributes, which capture all required determinants of property values in the context of high-rise high-density environment. Among various determinants that have been used in hedonic price models in the Hong Kong HPM literature (e.g. Wadu Mesthrige & Chan, 2019; Wadu Mesthrige, Wong, & Yuk, 2018), 10 important determinants are selected for the current study. Besides, other studies (based on HPM) have used these key variables in their studies. For example, floor area, age, flat size, views, distance to MTR (Hewitt & Hewitt, 2012; Seo, Golub, & Kuby, 2014; Wong, Chau, Yau, & Cheung, 2011; Yan, Delmelle, & Duncan, 2012).

$$Ln(P)_i = \beta_0 + \beta_1 Ln(AGE)_i + \beta_2 Ln(SA)_i + \beta_3 Ln(LVL)_i + \beta_4 ({}^{SV}/_{MV})_i + \beta_5 (BV)_i + \beta_6 Ln(MTR)_i + \beta_7 (EAST)_i + \beta_8 (SOUTH)_i + \beta_9 (WEST)_i + \beta_{10} (BEAM)_i +$$

where, $Ln(P)$ ***represents the residential property price in natural logarithm;*** $\beta_1 \ldots \beta_9$ ***represents the coefficients to be estimated;*** β_0 ***denotes the constant term; and*** ε_i ***connotes the stochastic term. LnP measures Transaction price, LnAGE represents Structural building age, LnSA is for Saleable area, LnLVL indicates Floor level, LnMTR is Locational accessibility to MTR, LnSV is Sea view, LnMV is Mountain view, BV is Building view, LnEAST, SOUTH, WEST is Orientation, LnBEAMP, BEAMG, BEAMS, BEAMB are Environmental BEAM Plus certification i.e. Platinum (P), Gold (G), Silver (S), Bronze (B).Selection of Data***

The property prices are obtained from the Economic Property Research Centre Limited, with the sale and purchase records agreement. The transaction period is from 2009 to 2015. There are two reasons why this period is chosen for the analysis: (i) this is the most suitable period as 2009/2010 is the year in which BEAM Plus Version 1.1 was launched; and (ii) this period easily avoid the effect of 2008 Global Financial crisis on property values. It is noted that the transaction prices obtained are nominal prices, which were converted to their corresponding real prices with the same base year. According to their class, the prices were deflated to the base year of 1990 using the private domestic price indices published by the Ratings and Valuation Department. In this study, the neighbourhood attributes such as nearby facilities and amenities are not considered because the selected buildings are all located in the same area and that they have similar accessibility to various amenities.

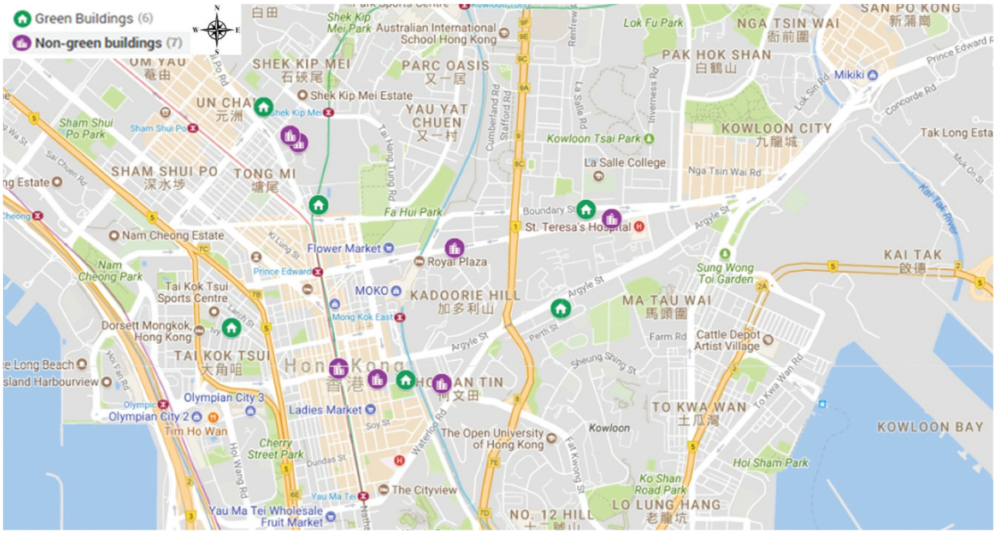

Figure 1. The study area and geographic distribution of the sample properties in Kowloon.

The selected buildings are all situated in the Kowloon Peninsula around Mong Kok East Station (Figure 1). In the model, six private residential buildings with various BEAM Plus certifications, from silver to platinum, are selected in the analysis. Seven non-certified comparables are also selected for comparison purposes. By selecting residential buildings from the same market segment, the effect of neighbourhood facilities, such as shopping centers, transportation and public amenities are deemed negligible. At the same time, all the selected residential buildings are relatively high-end ones targeting higher income groups, making the comparison more accurate because the class and quality of the buildings may affect property prices. For a comprenhensive investigation, the 14,768 transaction records of residential properties certified with green certifications and without green certifications were collected. Of which, 9,257 transactions are from properties are green certified, and 5511 tranasctions are non-certified comparables. Non-comparables (property units without certifications) were chosen from properties 150-m radius from green-certified properties. They are also with similar property attributes as that of green certified selected in the study including their age.

Results and discussion

The definition and measurement of the variables employed in the HPM are shown in (Table 1), while the descriptive statistics of the variables used in the model are presented in (Tables 2a and 2b). The results of the empirical HPM model are presented in, all the HPM' estimates were corrected for heteroscedasticity using White's heteroscedasticity consistent standard errors. Accordingly, the variance inflation factor (VIF) test was employed to correct the model's multicollinearity problem. The VIF results were found to be varying from 1.089 to 2.28 (mean VIF is 1.68), which clearly shows

Table 1. Description of variables.

Attributes	Abbreviation	Definition	Expected sign
	$Ln(RP)_{it}$	Real transaction price of property *i* at time t (HK$ million)	/-
Structural	$Ln(AGE)_i$	Age of property *i* (difference between the date of the issue of the occupation permit and the date of the transaction t (in months)	+
			+
	$Ln(SA)_i$	Saleable floor area (sq. ft) of the unit *i*–in log form	+
	$Ln(LVL)_i$	Floor level on which the unit *i* is located – in log form	+-
Location	**View**	Dummy: 1 if the unit enjoys a sea view; 0 if otherwise	+
	SV	Dummy: 1 if the unit has mountain view; 0 if otherwise	+-
	MV	Dummy: 1 if the unit has building view; 0 if otherwise	+
	BV	Dummy: 1 if the unit is facing the east direction, 0 otherwise	TBE
	Orientation	Dummy: 1 if the unit is facing the south direction, 0 otherwise	
	EAST	Dummy: 1 if the unit is facing the west direction, 0 otherwise	
	SOUTH		
	WEST		
Transoprt	Ln*(MTR)*	The distance between property *i* and the centre of the MTR station (in metres – long-form)	
Green Certification	BEAM	1 if the property is BEAM certified; 0 otherwise	

Note: TBE: to be estimated

Table 2a. Descriptive statistics of BEAM plus model.

	BEAM Plus vs Non-certified Buildings				BEAM Plus Platinum vs Non-certified Buildings			
Variable	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
LnP	2.08	0.687	0.74	4.42	2.14	0.714	0.74	4.66
LnAGE	0.42	0.408	0.00	1.39	0.59	0.366	0.00	1.39
LnSA	6.15	0.532	5.37	7.76	6.19	0.561	4.85	8.35
LnLVL	2.73	0.549	1.10	3.66	2.77	0.526	0.69	3.66
LnMTR	2.16	0.386	1.61	3.09	2.12	0.306	1.61	3.09
EAST	0.47	0.499	0.00	1.00	0.54	0.499	0.00	1.00
SOUTH	0.16	0.363	0.00	1.00	0.12	0.330	0.00	1.00
WEST	0.25	0.434	0.00	1.00	0.24	0.425	0.00	1.00
MV	0.10	0.300	0.00	1.00	0.13	0.331	0.00	1.00
BV	0.89	0.300	0.00	1.00	0.87	0.331	0.00	1.00
BEAM	0.44	0.497	0.00	1.00	0.25	0.431	0.00	1.00

the model used in the research is free multicollinearity problem. According to Neter et al., (1989), the VIF test rule is 10, and the present research result is far below that.

All the variables for BEAM Plus certified and non-certified buildings are statistically significant (see Table 3). Among the variables, the proximity to MTR stations and the southern orientation is found to be statistically insignificant. The adjusted R^2 value of the model is 0.933, implying that the selected independent variables can explain 93.3% of the variations in residential property prices. The F-value of the model is 1839.089, which is higher than the critical value, showing the explanatory power of the model. In consistence with the expectation, the variable of BEAM Plus certification is highly significant, with a positive coefficient and t-value of 7.783. The coefficient is 0.064, reflecting that residential properties with BEAM Plus certification have a property value of 6.61% higher than non-certified buildings which means that buyers are willing to pay a 6.61% premium for the BEAM Plus certification for these properties.

It was observed that when compared to non-certified buildings, buildings with BEAM Plus certification generally show a positive relationship with property prices. The study found that buyers are willing to pay premium for different BEAM Plus ratings than

Table 2b. Descriptive statistics of BEAM plus model.

	BEAM Plus Gold vs Non-certified Buildings				BEAM Plus Silver vs Non-certified Buildings			
Variable	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
LnP	1.94	0.724	0.74	4.42	2.09	0.750	0.74	4.42
LnAGE	0.48	0.451	0.00	1.39	0.48	0.447	0.00	1.39
LnSA	6.07	0.541	5.37	7.76	6.16	0.558	5.29	7.84
LnLVL	2.72	0.588	1.10	3.66	2.76	0.573	0.69	3.66
LnMTR	2.19	0.259	1.61	3.09	2.10	0.436	1.10	3.09
EAST	0.46	0.498	0.00	1.00	0.56	0.497	0.00	1.00
SOUTH	0.23	0.421	0.00	1.00	0.17	0.372	0.00	1.00
WEST	0.14	0.347	0.00	1.00	0.16	0.371	0.00	1.00
MV	0.12	0.328	0.00	1.00	0.16	0.366	0.00	1.00
BV	0.88	0.328	0.00	1.00	0.84	0.366	0.00	1.00
BEAM	0.27	0.444	0.00	1.00	0.17	0.378	0.00	1.00

properties without certification. For example, premium brought by different levels of ratings is positive, overall BEAM Plus (6.61%), Platinum (6.93%), Gold (6.08%), Silver (5.44%). However, there is no premium noted for the Bronze rating. It was hypothesised that the higher the BEAM Plus rating, the higher premium it can bring to the residential property. The results show consistency with the hypothesis, in which the premium of buildings with BEAM Plus platinum certification is higher than those with gold certification, followed by properties with silver certification. These results aligns with earlier studies conducted in other countries. For instance, Gilmer (1989) observed a positive impact of energy labels in the US market. Also, Australian Bureau of Statistics (2008) found that house price increased by 1.9%in 2006 for each increase in efficiency scale. Cajias and Piazolo (2013) study in Germany revealed that 1% improvement in energy efficiency increased rents by 0.08% and market value of the property by 0.45%. Kahn and Kok (2014) found that green buildings attracted 9% price premium in the USA, Yuan, Ma, Zuo, and Mu (2016) found certified green buildings in Japan received a price premium of approximately 5.5%. Similarly, in Ireland, energy rated properties received premium of 9.3% (Hyland et al., 2013), 6.3% in Netherland (Chegut et al., 2016) and 3.5% in Romania (Taltavull, Anghel, & Ciora, 2017).

The results of the HPM model show that green features are considered in the decision to purchase a property. BEAM Plus certification is a well-established green labelling system in Hong Kong, reflecting the level of the greenness of properties. Buildings with BEAM Plus certification are likely to have more green elements and be more resource-efficient. This has become an environmental attribute attracting people to buy properties with BEAM Plus certification. When choosing a property, potential buyers give structural and locational attributes higher priorities since it is directly related to their convenience and enjoyment. For example, flats at a higher level would have a better view, while flats closer to public transport facilities can save occupants' traveling time. On the other hand, the public may not have comprehensive knowledge of the benefits of green buildings. They may understand that green buildings usually have more green features like green walls, but not other benefits like energy and cost savings, across different ratings of green certification. Thus, the level of green certification is not likely to be a primary concern to them, hence, the environmental attribute of BEAM Plus rating is given lower priority, when compared to structural and locational attributes. Selected buildings for this study are relatively high-end ones,

Table 3. Coefficient BEAM plus model.

Variable	BEAM Plus vs Non-certified Buildings		BEAM Plus Platinum vs Non-certified Buildings		BEAM Plus Gold vs Non-certified Buildings		BEAM Plus Silver vs Non-certified Buildings	
	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Constant	−5.319	0.000	−4.874	0.000	−5.799	0.000	−5.228	0.000
LnAGE	−0.025	0.002	−0.031	0.001	−0.033	0.010	−0.042	0.000
LnSA	0.937	0.000	0.889	0.000	0.974	0.000	0.887	0.000
LnLVL	0.021	0.011	0.025	0.012	0.000	0.999	0.010	0.311
LnMTR	0.015	0.090	0.020	0.172	−0.009	0.525	0.029	0.009
EAST	0.078	0.000	−0.149	0.000	−0.064	0.000	−0.125	0.000
SOUTH	0.005	0.639	−0.036	0.008	−0.014	0.286	−0.023	0.115
WEST	−0.026	0.035	−0.076	0.000	0.006	0.652	−0.058	0.000
BV	−0.026	0.002	−0.011	0.308	−0.055	0.000	−0.022	0.038
BEAM	0.064	0.000	0.067	0.000	0.059	0.000	0.053	0.000
Adjusted R^2	0.933	-	0.931	-	0.952	-	0.950	-
F-value	1839.089	-	1277.909	-	1244.130	-	1389.486	-

targeting the middle class and the higher income group, therefore, it is assumed that the occupants would be more aware of the quality of life and they may have more knowledge of the benefits of green buildings. As a result, the BEAM Plus certification gives them an incentive to pay more for a better quality of life, and certified buildings have higher values than non-certified ones.

Conclusions

This research, using a Hedonic Price Model, investigates the effect of green certification, in particular the HK_BEAM Plus rating, on residential property price. The empirical results revealed that a residential building having HK-BEAM certification (HK-BEAM Plus) increases the property price, on average, by 6.61%. The results further reveals that the effect of green certification varies across different levels of green rating. Accordingly, the effect of Platinum, Gold and Silver on residential property price are 6.93%, 6.08% and 5.44%, respectively. The empirical results suggest that potential buyers are willing to pay a premium for residential properties certified by green certifications. However, the premium varies across different levels of ratings.

It is possible to draw several important conclusions from these findings. Firstly, property developers can view green certification as a strong selling point for their residential properties. As people have begun to appreciate green living, the implementation of standard sustainability measures will certainly boost the marketability as well as the competitiveness of their portfolios. Secondly, the effect of green buildings will be limited to first-hand market, but it also has a significant impact on the second-hand property market. As green features provide buyers with variety of benefits (such as minimum wear and tear, depreciation and breakdowns, and low-cost of energy), having green features provide positive image to the property in the eye of the potential buyers. Findings may also bring a brand premium to green-certified buildings and increase property prices of green-certified buildings. In addition to economic benefits, environmental and social benefits of green certification can be gained for the project stakeholders and the whole society. The findings can inform property developers about the potentials inherent in green buildings. Some important implications triggered from the findings. From policy-makers' perspective, findings may shed light on the fact that market is able to capitalise on environmental features in properties in investment decisions. From developers point of view, there is skepticism about financial implications of current certification schemes in Hong Kong. The findings will further increase the people' awareness of the positive impacts of green buildings and green certification. The findings therefore may also help bring green attitudes of people towards a higher level.

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