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THE EFFECT OF BEAM PLUS CERTIFICATION ON PROPERTY PRICE IN HONG KONG

Eddie C. M. HUI [a,*], **Cheuk-kin TSE** [a], **Ka-hung YU** [a]

[a] *Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong, China*

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ABSTRACT. In response to the public's increasing awareness of sustainable development, the construction industry has introduced "green" buildings which emphasize better environmental performance. However, as a building's environmental performance is difficult to discern for laymen, different green building certifications have been established for evaluations in this regard. This study evaluates whether there exists a price premium for living space in buildings certified with BEAM Plus. The findings show that the prices of flats in BEAM Plus-certified buildings are 4.4% higher than those in non-registered buildings, and that housing units in buildings with an "unclassified" rating are transacted at a discount of 5.9%. Nevertheless, if homebuyers mistake an "unclassified" building for a non-registered building, due to the non-disclosure of the "unclassified" result by developers, the price premium of BEAM Plus certification becomes higher (6.2%). Regardless, the price premium is much lower than those on the office sector. The reasons behind such differences can be attributed to the disparities in the tangible and intangible benefits associated with green living space and green office space. Policy implications with reference to Hong Kong's GFA concession policy are then discussed.

KEYWORDS: Hong Kong; Green building certification; BEAM Plus; Residential property price

SUPPLEMENTARY MATERIAL associated with this article can be found, in the online version, at https://doi.org/10.3846/1648715X.2017.1409290

1. INTRODUCTION

As the notion of sustainable development has become increasingly popular since the early 1990s (Gibbs *et al.* 1996), more customers have placed a higher degree of importance on environmental protection than on economic growth (Mainieri *et al.* 1997). As a result, the demand for goods and services with lower environmental costs has soared. To put it differently, there exists a willing-to-pay (WTP) premium for these products over regular products. In response, companies in various business sectors have begun to take environmental considerations into account in their business operations (Berry, Rondinelli 1998), as well as production and marketing plans (see Hawken 1993; Stigson 1998; Gonzalez-Benito, J., Gonzalez-Benito, O. 2005). This results in an expanding market for eco-friendly products (and services) on a global scale (Fuerst, McAllister 2011).

Such emphasis on the preservation of the environment has generated an even more profound impact to the practices of the construction industry, given the environmental impact incurred in the daily operation of buildings. Hong Kong's electricity consumption has been gradually rising in the last decade (Fig. 1). In 2014, the vast majority of electricity was used for the operation of either commercial buildings or residential buildings (Fig. 2), in particular on space conditioning (Fig. 3). The soaring electricity consumption has serious implications on the environment, in that electricity generation alone contributed to over 68% of all greenhouse gas emissions in Hong Kong in 2013, according to the Environmental Protection Department. Based upon these statistics, it is reasonable to say that, should buildings be more energy efficient, greenhouse gas emissions in Hong Kong could be significantly reduced. In view of this development, the concept of "green buildings", which emphasizes eco-friendly building design and higher efficiency in the use of energy, water, and other resources, has been preached as the blueprint of sustainable development, and used as one of the major marketing tools for development projects in Hong Kong.

* Corresponding author. E-mail: bscmhui@polyu.edu.hk

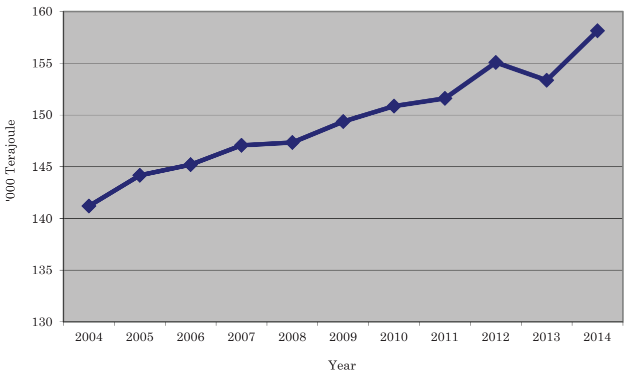

Fig. 1. Hong Kong's total electricity consumption, 2004–2014 (Census and Statistics Department 2016)

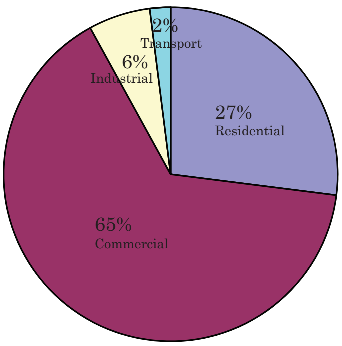

Fig. 2. Hong Kong's Electricity Consumption by Sector in 2014 (Census and Statistics Department 2016)

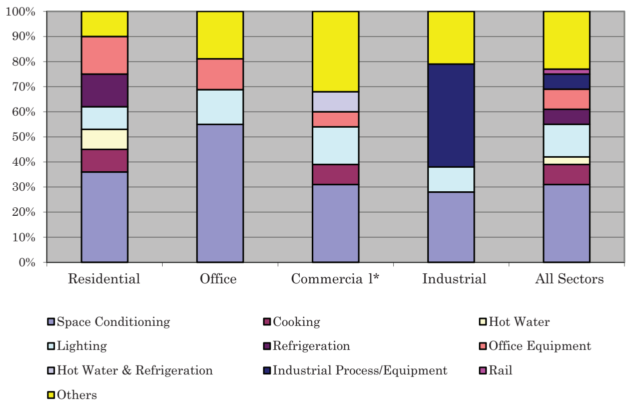

Fig. 3. Electricity End-uses by Sector in 2014 (Census and Statistics Department 2016)
* Including the Office Sector

The use of "green buildings" as a marketing tool suggests that, similar to other eco-friendly products and services, there is demand for buildings with eco-friendly design and/or features which provide additional benefits for occupiers, and reduce holding costs and risk premium for investors. In other words, the risk-adjusted returns for green properties are higher than regular properties, in turn proffering a price signal that encourages the supply of more green buildings (Fuerst, McAllister 2011). While some of the eco-friendly elements in buildings marketed as "green" are easily observable, such as the availability of open space and greenery, better landscape, and more innovative designs, the environmental performance of these buildings (for instance, in areas such as energy consumption, water consumption, sound insulation, indoor air quality, among others), on the other hand, is much more difficult to discern (i.e. the cost of obtaining the necessary information to assess the environmental performance of individual buildings is too high) for occupiers and investors. This is even more complicated for "green" development projects which are still at or before the construction phase. Without the necessary information for evaluating a building's environmental performance, how could potential stakeholders value this attribute? In view of this issue, many voluntary green building certification systems, with the aim to assess the energy efficiency of buildings, have been established since the 1990s (Kotchen 2006). These systems serve as a standardized, universally-recognized and much more cost-effective way to identify quality and efficient buildings (Chegut *et al.* 2014).

In addition, green certifications proffer other benefits for different stakeholders. For owners (developers) and occupiers, buildings certified with green labels help improve business productivity, enhance company image, and reduce occupancy costs. For investors, certified buildings usually incur higher rents, lower holding costs, and lower risk premium (see Fuerst, McAllister 2008, 2011; Aroul, Hansz 2012). With these certifications, stakeholders may find it much easier to assess a building's green features, as price/rental premiums for certified buildings essentially represent the occupiers' (and investors') WTP for "green" buildings with more sustainable designs, innovative building materials, better environmental performance as well as lower operating costs, they provide the signals critical for the allocations of resources (that is, demand for and supply of green buildings) (Fuerst, McAllister 2011; Chegut *et al.* 2014). Nevertheless, the development of green buildings is not necessarily a viable option for some developers, due to higher construction costs. According to the estimates in a number of studies (Kats 2003, 2006; Morrison Hershfield 2005; Berry 2007), the additional cost amounts to around 2% (see *Supplementary Material* (SM), SM1.1).

In Hong Kong, BEAM Plus is one of those green building certifications. Compatible with internationally-renowned green building certifications such as LEED and BREEAM (SM1.2), the original intent of BEAM Plus was to be a voluntary scheme for the assessment of buildings' environmental performance. It received a major boost in its credibility (and popularity) in April 2011 when the Buildings Department (BD) introduced a policy (PNAP APP–151) with the specific goal to foster a quality and sustainable built environment. Under this policy, new developments with "desirable green features and/or amenity features, as well as non-mandatory (or non-essential) plant rooms and services" are granted with concessions as much as 10% of a development's total gross floor area (GFA) (SM 1.3). According to this document, two of the pre-requisites for the GFA concessions are related to BEAM Plus (SM1.4): 1) An official letter issued by the HKGBC in which the "satisfactory completion of project registration application for BEAM Plus certification" is acknowledged; and 2) The result of the project's Provisional Assessment under BEAM Plus (Buildings Department 2011) (SM1.5).

Since the introduction of this policy, the number of registrations under BEAM Plus has skyrocketed. Before April 2011 (SM1.6), only 30 projects had been registered for environmental performance assessments under BEAM Plus. By early May 2016, 808 development projects have been registered, of which 340 are residential development projects, according to the Hong Kong Green Building Council (HKGBC). While the noticeable increase in the number of registrations for BEAM Plus assessments since the introduction of the GFA concession scheme is encouraging, what is required to obtain the 10% GFA concession, besides a development's compliance with the SBD guidelines, is only an BEAM Plus assessment "result" regardless of rating. The question as to whether the official endorsement of BEAM Plus actually encourages sustainable development, or is simply a loophole to be exploited by developers to obtain additional profits, thus, arises. In response to this question, this paper aims to evaluate the relationship between BEAM Plus certification and the price of flats.

Prior to the discussion of the literature relating to the relationship between green labels and price/rental levels of properties, the following section first provides some background information concerning BEAM Plus.

2. A BRIEF DESCRIPTION OF THE BEAM PLUS CERTIFICATION

The origin of BEAM Plus should be dated back to December 1996, when the Hong Kong Building Environmental Assessment Method (HK-BEAM) was first launched by the Real Estate Developers Association of Hong Kong (REDA). HK-BEAM, comprising one version for new buildings (Version 1/96) and another version for existing office buildings (Version 2/96), was a voluntary scheme largely based upon the United Kingdom Building Research Establishment's BREEAM. Then, a version of HK-BEAM specifically for new high-rise buildings was introduced in 1999 (Version 3/99). In the earlier days of the HK-BEAM, however, different problems regarding the scheme's implementation had arisen. In order to tackle these problems as well as to cover a broader range of building types and sustainability issues, updated versions of the HK-BEAM (i.e. 4/04 and 5/04), were published in 2005 after a series of extensive reviews in 2003–2004 (Lee, Burnett 2008). Later, in light of increasingly prominent global issues such as climate change and global warming, a revised assessment scheme named BEAM Plus was launched in November 2009, and was subsequently updated on two occasions, first in August 2010 (Version 1.1) and then in November 2012 (Version 1.2) (SM2.1).

According to the BEAM Society (2012: 3), the objectives of the BEAM Plus assessment tool are to improve the quality of buildings in Hong Kong, to stimulate demand for sustainable buildings, to recognize improvements in performance and minimize false claims, to proffer a set of environmental performance standards which are comprehensive enough for developers and owners alike, to reduce the life-cycle impact of buildings on the environment, and to make certain that environmental considerations are taken into account at the design and planning stages.

In the assessment under BEAM Plus for new buildings (Version 1.2), a variety of components are considered: 1) demolition planning, 2) design, 3) construction and commissioning of a building. A total of 128 credits (SM2.2) are obtainable for new buildings in 93 criteria (SM2.3) within six aspects of a building's environmental performance: Site Aspects (SA), Material Aspects (MA), Energy Use (EU), Water Use (WU), Indoor Environmental Quality (IEQ), and Innovations and Additions (IA) (SM2.4). As seen in Table 1, the focus of the BEAM Plus assessment is on a building's energy use, especially in terms of its ability to reduce CO2

Table 1. Weightings of different environmental-related aspects in the overall grade of BEAM Plus certification Version 1.2

Environmental aspects	Weighting for new buildings (in %)	Number of criteria
Site aspects (SA)	25	20
Material aspects (MA)	8	16
Energy use (EU)	35	18
Water use (WU)	12	7
Indoor environmental quality (IEQ)	20	32
Innovations and additions (IA)	N.A[1].	3

Source: BEAM Society.

Table 2. Threshold scores for obtaining award classifications under BEAM Plus

Grade(s)	Overall credit obtained	SA	EU	IEQ	IA	Classification
Platinum	75%	70%			3 credits	Excellent
Gold	65%	60%			2 credits	Very good
Silver	55%	50%			1 credit	Good
Bronze	40%	40%			–	Above average

Source: BEAM Society.

emissions (15–20 credits, depending on whether the alternative route is followed). Interestingly, despite the importance of energy use in the assessment, the aspect with the most criteria is the building's indoor environmental quality.

BEAM Plus assessments can be conducted at either the pre-design phase, the design stage, or the construction phase, by independent BEAM assessors engaged by BEAM Society. In other words, since certifications can be obtained prior to the operations phase, the building's design figures and predicted environmental performance, rather than its actual performance figures, are the major determinants. The overall assessment grade is determined based on three elements a registered development obtains: 1) the amount of credits (in percentage) in the Provisional Assessment and/or in the Final Assessment; 2) the minimum percentage of credits for the SA, EU, and IEQ categories; and 3) the minimum number of credits for the IA category (Table 2). There are five ratings which reflect a registered project's overall assessment grade: Platinum, Gold, Silver, Bronze, and Unclassified (SM2.5), of which the first four are regarded as "award classifications" (i.e. certified).

3. LITERATURE REVIEW

The earliest studies on the price/rental effects of green building certifications have primarily focused on LEED and ENERGY STAR in the U.S. office sector (Miller *et al.* 2008; Fuerst, McAllister 2008, 2009, 2011; Eichholtz *et al.* 2008, 2009, 2010, 2013; Murray 2008; Pivo, Fisher 2009; Wiley *et al.* 2010; Reichardt *et al.* 2012). There have also been a handful of investigations on the effect of either BREEAM on the U.K.'s office market (Chegut *et al.* 2014) or EPC on the European office market (Kok, Jennen 2012). All these studies have reached similar conclusions, in that space in certified buildings carry a price/rental premium over non-certified buildings, and that space in buildings with a higher rating under a particular green building certification is more expensive than that in buildings with a lower rating.

It was until 2010 that researchers began to assess the price/rental impact of a variety of green building certifications in the housing sector. The following sections provide an overview of these studies by geographic location.

3.1. Asia

One of these schemes under study, within Asia, is Singapore's Green Mark Scheme. In a study by Addae-Dapaah and Chieh (2011), the authors find that the additional premium yielded via the certification of the Green Mark Scheme is about 9.61–27.74% (using sales data) and 5.47–6.82% (using survey data). Another investigation (Deng *et al.* 2012), meanwhile, reports that prices of residential buildings certified with the Green Mark Scheme are about 4–6% higher. A more recent study conducted by Deng and Wu (2014) find that,

[1] The IA category, comprising 1 regular credit and 5 bonus credits, is not included in the weighting for the overall grade.

on average, the price premium amounts to 4–5%. Specifically, living space in buildings which obtain a Platinum rating is sold at prices 11% higher than that in non-certified buildings, followed by Gold (5%) and Certified (1.6%). Another investigation by Heinzle *et al.* (2013) finds a lower price premium for properties with a Platinum rating (7.98%) but a higher price premium for certified properties (3.78%).

In Japan, it is reported that "green labels" carry a price premium of about 5% for new condominiums in Tokyo over those without them (Shimizu 2010), and that wealthier buyers are willing to pay a higher premium for these properties than other buyers (Fuerst, Shimizu 2016). By contrast, two investigations on the Japanese condominium market by Yoshida and Sugiura (2015) have reached opposite results, as the prices of eco-labelled condominiums are lower than non-certified ones. Yet, the authors find that, despite the price discount, the depreciation rates of eco-labelled condominiums are also lower, due to long-life designs and higher durability (SM3.1).

And lastly, in Hong Kong, Jayantha and Man (2013) find that a sale price premium ranging from 3.4% to 6.4% is generated for housing units in buildings certified with either HK-BEAM (the predecessor of BEAM Plus) issued by the BEAM Society or the Green Building Award issued by the HKGBC.

3.2. The United States

A number of recent investigations have focused on the impact of either LEED or Energy Star on prices of residential properties in different markets of the U.S., with varying results. While Bond and Devine (2016) identify a rental premium of 8.9% for LEED-certified residential properties, Couch *et al.* (2015) do not find a significant relationship between LEED certification and housing prices in Chicago, New York, Portland, and Seattle. For the effect of Energy Star certification on residential property price, Bruegge *et al.* (2016) find a premium ranging from 1.2–4.9% (subject to model specifications) for properties certified with Energy Star. Unlike the Singaporean housing market (Deng, Wu 2014), however, the price premium is much lower in the resale market (Bruegge *et al.* 2016). Walls *et al.* (2013) identify price premiums for homes certified with Energy Star in North Carolina, Austin, and Portland constructed between 1995 and 2006, but not for homes constructed afterwards. Rather, in accordance with the authors, the local certifications result in higher price premiums for both older and newer homes. Lastly, two separate studies on the California housing market have been conducted by Kok and Kahn (2012) and Kahn and Kok (2014). In their 2012 study, they find an average price premium of 9% for homes certified with LEED, ENERGY STAR, and/or the local Green Point Ratings programme. In their 2014 study, however, the resultant price premiums are noticeably smaller (2.1–3.9%).

3.3. Europe

In Continental Europe, numerous studies conducted in the last few years have mainly concentrated on the EPC and its impact on housing prices in different nations. In a report compiled by the European Commission (2013) (SM3.2), it is found that a unit change in the EPC rating results in housing price premiums of 8% in Greater Vienna, of 4% in France, and of 2.8% in Ireland. In the U.K. housing market, using houses with a D grade as base cases, Fuerst *et al.* (2015) report a 5% price premium for homes with either an A or B rating, 1.8% for those with a C rating, –0.7% for E-rated homes, –0.9% for those with an F rating, and –6% for G-rated homes. Likewise, a 12.8% price premium is found for either A-rated or B-rated homes in Wales, 3.5% for those with a C rating, –3.6% for E-rated homes, and –6.5% for those with an F rating (Fuerst *et al.* 2016). Hyland *et al.*'s (2013) investigation of the Irish housing market reveals that A-rated properties are about 9% more expensive in price, and 2% more costly in rent, than D-rated properties. Lastly, Brounen and Kok's (2011) investigation on The Netherland's housing market discover that, the average residential property prices are 3.7% higher if they are EPC-certified. Besides, the price premium of an A-grade property over a D-grade property is 10.2%.

3.4. Oceania

In Australia, a study conducted by the Australian Bureau of Statistics (2008) reveals that an additional 0.5 score on the energy rating scale provided a housing price premium of 1.23% in 2005 and 1.91% in 2006. Nonetheless, it is conceded in this study that the impact on price is not as prominent if the energy label and the energy efficiency characteristics of the house are included in the model as separate variables.

It is not difficult to discern the noticeably differences when it comes to the price (or rental) premium incurred by different green building certifications.

Table 3. Summary of previous studies on the impact of green certifications on property prices/rents

Author(s)	Country	Sector	Green building certification(s) studied	Data source(s)	Sample size	Findings
Australian Bureau of Statistics (2008)	Australia	Commercial	Energy Rating	The ACT Planning and Land Management Agency	5,104	Price premium per additional 0.5 score: 1.23% (2005); 1.91% (2006)
Miller *et al.* (2008)	U.S.	Commercial	LEED/ES	CoStar	927	Price premium: 9.94% (LEED); 5.76% (ES)
Fuerst and McAllister (2008)	U.S.	Commercial	LEED/ES	CoStar	3,257 (sales) 3,626 (rental)	Price premium: 10% (ES); 31% (LEED)
Eichholtz *et al.* (2008)	U.S.	Commercial	LEED/ES	CoStar	8,182	Average rental premium: 1.9–2.6%
Fuerst and McAllister (2009)	U.S.	Commercial	LEED/ES	CoStar	10,970	Price premium: 35% (LEED); 31% (ES) Rental premium: 6% (LEED/ES)
Eichholtz *et al.* (2009)	U.S.	Commercial	LEED/ES	CoStar	11,100	Price premium: 16% Rental premium: 3%
Pivo and Fisher (2009)	U.S.	Commercial	ES	NCREIF	46,000	Price premium: 13.5% Rental premium: 4.8%
Chegut *et al.* (2010)	U.K.	Residential	EcoHomes	Real Capital Analytics (RCA) database and CoStar FOCUS database	4,417 (sales) 26,118 (rental)	Price premium: 8% Rental premium: 16–20%
Shimizu (2010)	Japan	Residential	"Green" Labels	MRC database and transaction price database owned by Recruit Co., Ltd	82,270	Price premium: 5%
Wiley *et al.* (2010)	U.S.	Commercial	LEED/ES	CoStar	7,308	Rental premium: 15.2–17.3% (LEED); 7.3–8.9% (ES)
Addae-Dapaah and Chieh (2011)	Singapore	Residential	Green Mark Scheme	Real estate information system (REALIS)	13,899	Price premium: 9.61–27.74% (sales data); 5.47–6.82% (survey data)
Brounen and Kok (2011)	The Netherlands	Residential	EPC	The Dutch Association of Realtors(NVM)	177,318	Price premium: 3.7% A-grade property 10.2% more expensive than a D-grade property
Dermisi and McDonald (2011)	U.S.	Commercial	LEED/ES	Zeller Reality Group & MB Real Estate Market Reports	222	Price premium: 23% (LEED)
Fuerst and McAllister (2011)	U.S.	Commercial	LEED/ES	CoStar	9,806 (sales) 18,519 (rental)	Price premium: 25% (LEED); 26% (ES) Rental premium: 5% (LEED); 4% (ES)
Deng *et al.* (2012)	Singapore	Residential	Green Mark Scheme	Real Estate Information System (REALIS)	74,278	Price premium: 4%
Kok and Jennen (2012)	The Netherlands	Commercial	EPC	CBRE, DTZ Zadelhoff, and Jones Lang LaSalle,	1,100	D-rated properties 6.5% lower in price than higher-rated properties
Kok and Kahn (2012)	U.S.	Residential	LEED/ES/Green Point Ratings Programme	DataQuick	1,609,879	Price premium: 9%
Reichardt *et al.* (2012)	U.S.	Commercial	LEED/ES	CoStar	9,442	Rental premium: 2.9% (LEED); 2.5% (ES)
European Commission (2013)	Various European Nations	Residential	EPC	Daft.ie, Konstantin Kholodilin (DIW), Notaires de France, the Department of Communities and Local Government, Landmark and Land Registry	2,323 (Austria) 26,000 (Belgium) 3,400 (France) 48,000 (Ireland)	Price premium: 8% (Greater Vienna), 4% (France), 2.8% (Ireland) Rental Premium: 4% (Greater Vienna), 1.4% (Ireland)

(Continued)

Author(s)	Country	Sector	Green building certification(s) studied	Data source(s)	Sample size	Findings
(Continued)						
Hyland *et al.* (2013)	Ireland	Residential	EPC	Daft.ie	15,060 (sales) 20,825 (rental)	A-rated properties 9% (2%) more costly in price (rent) than D-rated properties
Heinzle *et al.* (2013)	Singapore	Residential	Green Mark Scheme	Survey Interview	62	Price premium: Platinum (7.98%), Certified (3.78%)
Walls *et al.* (2013)	U.S.	Residential	ES	Real Estate Multiple Listing Services (MLS)	171,087	Price premiums for houses built between 1995 and 2006, but not for newly-built homes.
Jayantha and Man (2013)	Hong Kong	Residential	HK-BEAM/ HK-GBC Award	Economic Property Research Centre (EPRC)	4,206	Price premium: 3.4–6.4%
Chegut *et al.* (2014)	U.K.	Commercial	BREEAM	CoStar FOCUS and Estates Gazette Interactive	1,149 (sales) 2,103 (rental)	Price premium: 19.7% Rental premium: 14.7%
Deng and Wu (2014)	Singapore	Residential	Green Mark Scheme	Real Estate Information System (REALIS)	35,730	Price premium: Platinum (11%), Gold (5%), Certified (1.6%).
Kahn and Kok (2014)	U.S.	Residential	LEED/ES/Green Point Ratings Programme	DataQuick	1,609,879	Price premium: 2.1–3.9%
Couch *et al.* (2015)	U.S.	Residential	LEED	CoStar	136	No significant (positive) relationship between LEED certification and housing prices
Fuerst *et al.* (2015)	U.K.	Residential	EPC	Calnea Analytic	325,950	Price premium: 5% (A/B), 1.8% (C), –0.7% (E), –0.9% (F), –6% (G)
Hui *et al.* (2015)	China	Commercial	LEED	One of the co-authors	59 buildings	Rental premium: 12.8%
Yoshida and Sugiura (2015)	Japan	Residential	"Green" Labels	Transaction Price Information Service (TPIS)	41,560	Properties with green labels sold at discount.
Bond and Devine (2016)	U.S.	Residential	LEED	NCREIF	1,589	Rental premium: 8.9%
Bruegge *et al.* (2016)	U.S.	Residential	ES	Alachua County Property Appraiser's Office	5,528	Price premium: 1.2–4.9%
Fuerst *et al.* (2016)	Wales	Residential	EPC	The Land Registry house price index for Wales	62,464	Price premium: 12.8% (A/B), 3.5% (C), –3.6% (E), –6.5% (F).

A number of possible reasons behind such disparities can be identified: 1) the assessment scope of the green building certification (i.e. energy-only assessment vs. multi-attribute assessment); 2) the type of buildings studied (i.e. commercial vs. residential); 3) the differences in the selection of building- and region-specific control variables; 4) the nature of the green building certification (i.e. international vs. domestic); 5) the full sample size; 6) the control sample size; 7) omitted variables such as design quality, building quality, orientation, and cultural factors such as Feng Shui; and 8) public access to information regarding a development's actual rating in its green building assessment. Within the context of BEAM Plus, previous studies on it (and HK-BEAM) have mostly focused on comparisons of assessment criteria (with BREEAM, LEED, and others; see SM1.2). There, unfortunately, have been no studies on the price effect of BEAM Plus on properties, be they residential or commercial (SM3.3). This paper, therefore, is the first study to investigate how BEAM Plus affects residential property prices. Based upon the findings in previous studies (Table 3), this paper will test two hypotheses. The first hypothesis is that BEAM Plus certification generates additional price premium for properties. By contrast, the second hypothesis, grounded on the findings in Kok and Jennen (2012) and Fuerst *et al.* (2015, 2016), is that a housing unit located in a building with a lower rating (i.e. "unclassified" rating under BEAM Plus) would be transacted at a discount.

In view of BEAM Plus's popularity in Hong Kong (Chen, Ng 2016), an investigation in this regard, we believe, would provide references to developers and investors. In this light, this study aims to fill this particular gap in the literature. In the next section, the data sample and research methodology are to be discussed.

4. DATA SAMPLE AND METHODOLOGY

The Sham Shui Po – Cheung Sha Wan District (located in northwestern Kowloon) is selected for this investigation. As one of the earliest developed urban areas in Hong Kong, this district now has a mixture of old residential buildings and new developments (due to urban renewal). As such, the district has many registered developments, active market transactions, and comprehensive transportation networks.

A total of 646 transactions of housing units in sixteen private residential developments located in this district, between February 2012 and December 2014, are analyzed (see Fig. 4). Of these sixteen residential developments (SM4.1) selected for this study, five of which have been registered to BEAM Plus (and four assessed) (Table 4). It should be noted that, since the selected residential developments are all located in the same district in which recreational facilities, school zone, and transportation network are common features, it is thus not necessary to include these factors in the model.

Table 4. Status of the sixteen selected residential developments concerning BEAM Plus certification

Name of development	BEAM Plus certification status
Beacon Lodge	Not registered
Court Regence	Not registered
Gardenia	Not registered
Hey Home	Not registered
High Point	Provisional Gold
High Park	Provisional Sliver
High One	Provision Bronze
High One Grand	Registered but not assessed
Maison Rose	Not registered
Milan Place	Not registered
One Madison	Not registered
One New York	Not registered
The Met Delight	Provisional unclassified
The Prominence	Not registered
Sorentino	Not registered
Vista	Not registered

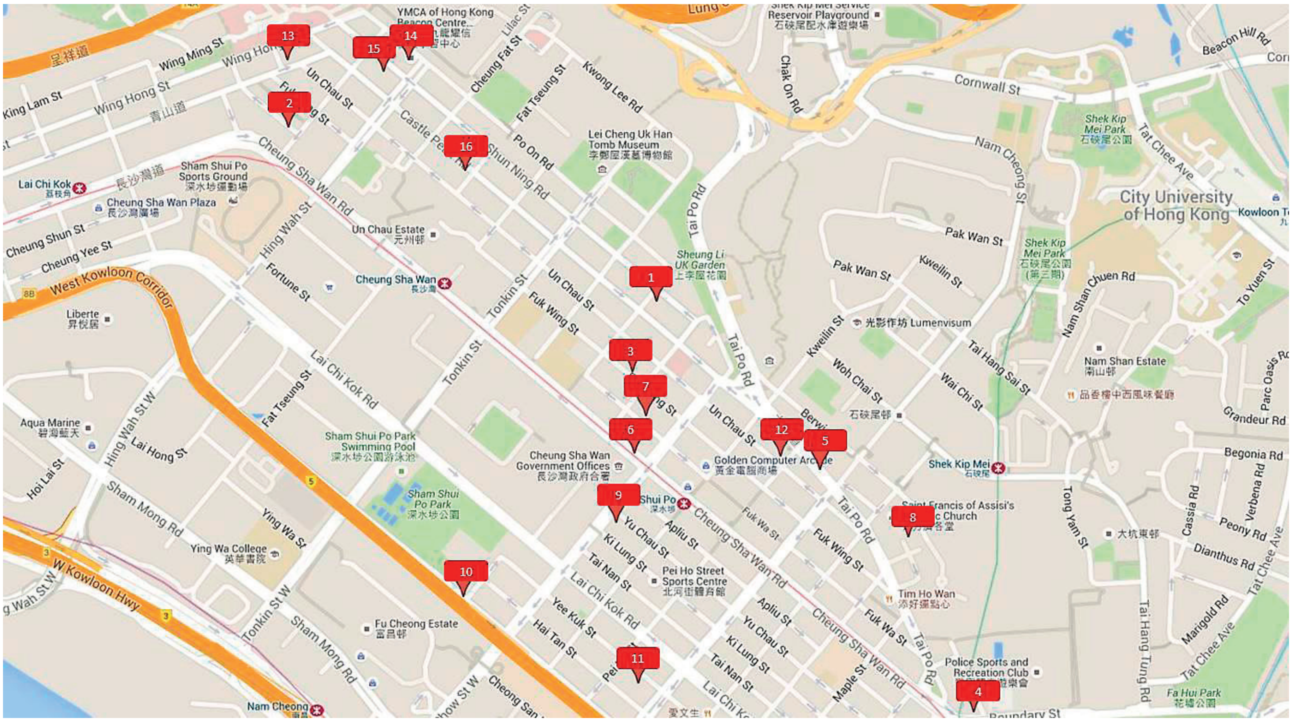

Fig. 4. Location of development in Sham Shui Po – Cheung Sha Wan district (Google Map 2015)

Notes: 1 (The Met Delight), 2 (High One), 3 (High One Grand), 4 (High Park), 5 (High Point), 6 (Maison Rose), 7 (Vista), 8 (Gardenia), 9 (Milan Place), 10 (The Prominence), 11 (Hey Home), 12 (Court Regence), 13 (One New York), 14 (Beacon Lodge), 15 (Sorentino), and 16 (One Madison).

Of the 646 housing units in the data sample used for this study, 54.3% of them are presale flats and the remaining 45.7% are occupied flats. As seen in Table 5, for the full sample, the transaction price of the housing units in the sample ranges from 2.2 million HKD to 9.13 million HKD, with an average of approximately 4.65 million HKD. The majority of them were transacted at more than 4 million HKD (60.1%). The average floor area of these flats is 359.6 sq. ft, with the smallest housing unit at 193 sq. ft. and the largest flat at 717 sq. ft. More than 60% of the

Table 5. Descriptive statistics of residential units in the sample

	Full sample	Pre-sale flats	Occupied flats
Transaction price (in HKD)			
3 million or less	8.2	0.9	16.9
3.01–4 million	31.7	24.5	40.2
More than 4 million	60.1	74.6	42.9
Maximum (in million HKD)	9.13	9.13	8.70
Minimum (in million HKD)	2.20	2.90	2.20
Mean (in million HKD)	4.65	4.96	4.28
Standard deviation (in million HKD)	1.42	1.37	1.79
Floor area (in square feet)			
200 or less	3.9	7.1	0
201–400	63.8	68.1	58.8
401–600	29.2	24.8	34.5
More than 601	3.1	0	6.8
Maximum	717	577	717
Minimum	193	193	241
Mean	359.61	331.32	393.16
Standard deviation	114.73	96.08	125.66
Floor level			
1^{st}–10^{th}	30.1	29.3	31.1
11^{th}–20^{th}	35.2	38.8	31.1
21^{st}–30^{th}	28.7	30.5	26.7
31^{st}–40^{th}	4.2	1.4	7.4
41^{st} or higher	1.7	0	3.7
Maximum	45	33	45
Minimum	3	3	3
Mean	17.2	16.4	18.1
Standard deviation	8.76	7.60	9.89
Age of Building			
5 years or less	N.A.		69.6
6–10 years			27.7
More than 10 years			2.7
Maximum			11
Minimum			0
Mean			4.71
Standard deviation			2.41
Other characteristics			
Accessibility to MTR station	62.1	76.6	44.9
Located in Cheung Sha Wan	8.4	4.6	12.8
BEAM Plus certification			
Assessed	42.2	77.8	0
Provisional Platinum rating	0	0	0
Provisional Gold rating	8.7	16.0	0
Provisional Silver rating	2.5	4.6	0
Provisional Bronze rating	18.4	33.9	0
Unclassified	12.7	23.4	0
Registered but not assessed	12.1	22.2	0

sampled residential flats are within 201–400 sq. ft. The highest flat in the sample is on the 45^{th} floor whereas the lowest one is on the 3th floor. On average, the floor level of the residential units is 17.2, and more than 65% of them are on the 20^{th} floor or lower. In addition, 62.1% of all flats in the data sample are within 5-minute walking distance to the MTR station, and less than 10% of them are located in Cheung Sha Wan. Lastly, 53.3% of the flats in the sample are located in buildings which have been registered under BEAM Plus, and 42.2% of them in already-assessed buildings.

As for the pre-sale housing units and the occupied housing units in the sample, the transaction price of the pre-sale flats is higher than that of the completed flats. Almost three quarters of all pre-sale flats were sold at more than 4 million HKD, while only 42.9% of the occupied flats were transacted at the same price range. By contrast, the average size of the pre-sale flats is smaller than that of the occupied flats. While close to 70% of pre-sale flats in the data sample are 201–400 sq. ft., the percentage of occupied flats with similar floor area is less than 60%. Also, the mean floor level of the pre-sale flats is slightly lower than that of the occupied flats as well. The average age of the occupied flats is 4.7 years, with the oldest being 11 years old and the newest only occupied for less than half a year. A much larger proportion of pre-sale flats in the data sample are within 5-minute walking distance to the MTR station, compared to the occupied flats, while a larger percentage of occupied flats are located in Cheung Sha Wan. Regarding BEAM Plus certification, however, it should be noted that all of the BEAM-Plus-registered flats in the sample are pre-sale. 78% of these flats are located in buildings that have already been assessed under BEAM Plus, and the highest proportion of them are within buildings certified with a Provisional Bronze rating.

As this study concerning the price impact of BEAM Plus certification on residential flats in Hong Kong, relevant data which captures the structural attributes, neighborhood attributes, and BEAM Plus certification attributes is required. The data comes from three sources. The first source is the property transaction database compiled from the Economic Property Research Centre (EPRC), in which all property transactions recorded by the Hong Kong Land Registry since 1991 are available. In these records, information concerning the structural attributes and neighborhood attributes of the transacted properties, such as transaction price, floor area, floor level, name/age/address of the building in which the sampled housing flat is located, is provided. Nevertheless, it should be noted that, though critical, some elements of these transacted housing units are not included in the EPRC database, for instance the quality of building and design quality.

The second source of data is the Rating & Valuation Department (RVD). As noted in the paragraph above, only the transaction price at the time when a housing unit was sold is included in the transaction records within the EPRC database. However, if this raw price data is incorporated into the empirical model, the property price trends over time would be overlooked, and the results would likely be distorted. To take this property price trend into consideration, the raw price data is needed to be adjusted with reference to Hong Kong's residential housing price trends over time. Thus, the RVD's property price index (SM4.2) is used for the computation of the adjusted transaction price of the sampled housing units.

Most importantly, for information about the sampled buildings' status with reference to BEAM Plus certification (or registration) we rely on two sources: 1) the BEAM Society and 2) the HKGBC. While the former generally provides technical information concerning BEAM Plus itself, the latter's official website proffers other important information such as the most updated BEAM Plus certification/registration statistics by sector (and the status of registered buildings).

As for the methodology, the hedonic price model is used. The conceptual framework behind this model is derived from Rosen's (1974) framework in which a variety of products are differentiated and their utility-bearing attributes valued. Within the context of housing, Malpezzi (2002) points out that the hedonic equations can decompose the value of housing into measurable prices and quantities, and that the resultant regression coefficients may be transferred into the implicit prices of various housing attributes.

Regarding the variables required for this investigation, the dependent variable in the model is the per square metre transaction price of the sampled housing units, adjusted with respect to the general property price indices when a housing unit was transacted. It should be noted that, the model follows a semi-log specification, in that the (adjusted) per square metre transaction price in natural log form (LnPPSM) is also deployed. The reason behind such a specification is twofold. First, the interpretation of the results is more straightforward, as the price premium generated from the selected attributes becomes a percentage. And second, the use of LnPPSM takes the possible non-linear relationships between the dependent variable and the explanatory variables into consideration, and minimizes the potential problem as a result of heteroskedasticity (Sirmans *et al.* 2005) (SM4.3).

As for the explanatory variables, according to Sirmans *et al.* (2005), the price of the house is a function of its physical characteristics and other external factors. In this paper, various factors that have been widely adopted in previous studies are to be included in hedonic equations, which fall into three categories – structural attributes, neighborhood attributes, and the green building certification attribute.

For the structural attributes, three explanatory variables are included. The first one is a housing unit's usable floor area (AREA). While it is self-evident that a larger housing unit is sold at a higher price than a smaller housing unit with similar characteristics, it is not necessarily true that their respective per unit prices are identical. The statistics provided by the Rating and Valuation Department reveal that the per square metre price of larger housing units is noticeably higher than that of smaller housing units. In view of this, it is hypothesized that there is a positive relationship between the size of a housing unit and its (per square metre) transaction price. Then, the age of the building (AGE) in which the sampled housing unit is located is another explanatory variable. Nevertheless, as the sample contains pre-sale flats, this factor cannot simply be incorporated into the hedonic model as a numerical variable. Instead, to take the pre-sale effect into consideration, three separate binary variables are introduced to take into account the age differences between the sampled properties: 1) 5 years or less; 2) 6–10 years; and 3) more than 10 years. Flats within newer buildings, with a lesser extent of wear and tear (and depreciations), are usually more costly than similar flats located in older buildings. As a result, a negative relationship between a flat's transaction price and the age of the building where it is located is hypothesized. The third structural attribute concerns the floor level of the housing unit. Four binary variables are introduced (i.e. 11^{th}–20^{th} Floor, 21^{st}–30^{th} Floor, 31^{st}–40^{th} Floor, and 41^{st} Floor or above). A housing unit on a higher floor level is expected to be transacted at a higher price due to 1) better views and 2) lower proximity to road(s) where adverse effects, such as noise and air pollutions, are incurred. Therefore, the hypothesis is that floor level is positively related with transaction price.

In addition to the structural attributes, two neighborhood attributes are taken into consideration as well. The first attribute is a dummy variable (MTR) which separates a flat which is within 5 minutes walking distance to an MTR station ("1") from others ("0"). As proximity to an MTR station suggests better accessibility to public transportation, a positive relationship between a flat's transaction price and this variable is expected to be found. The other neighborhood attribute relates to the location of the sampled housing unit. As the 16 housing developments included in the sample are scattered across the Sham Shui Po-Cheung Sha Wan District, with some closer to Sham Shui Po MTR station and the others closer to Cheung Sha Wan MTR station. A binary dummy variable (NSSP) is thus required to separate these two groups of housing developments, since Cheung Sha Wan was developed later than Sham Shui Po. "1" is assigned to housing units located in Cheung Sha Wan and "0" is assigned to those located in Sham Shui Po; and given the development timing of these two areas, the hypothesis is that NSSP and property price are positively correlated.

As the main focus of this investigation, the price effect of BEAM Plus certification is investigated through two dummy variables. The first variable is CERTIFED, which represents properties in registered buildings which have received an award classification under BEAM Plus (i.e. Gold, Silver, and Bronze). The hypothesis is that space in certified buildings is sold at a price premium over space in non-certified buildings. The second variable is UNCL, which represents properties in registered buildings which have received an "unclassified" rating under BEAM Plus (see SM2.5). Since the unclassified rating under BEAM Plus is equivalent to lower rating(s) (i.e. D or below) in the EPC. In view of the findings in Fuerst *et al.* (2015, 2016) and Kok and Jennen (2012) that prices of space in buildings with low ratings under EPC are lower than those in buildings with ratings higher than D, the hypothesis, hence, is that UNCL and transaction price are negatively related, as space in buildings that have obtained lower ratings in green certification scheme(s) is expected to be sold at a lower price. Nonetheless, with reference to the 8^{th} possible reason behind the varying level of price premiums incurred by green building certifications, unlike other nations in which systematic database which includes a building's rating in different green building certification(s) is available to the public, information concerning BEAM Plus certification (and registration) of individual property

Table 6. A summary of variables and their expected relationship with housing price

Attributes	Abbreviation	Definition	Relationship with property price (+/–)
Dependent variable			
	LnPPSM	Adjusted per square metre transaction price of the residential unit in HKD (in natural log form)	N/A
Explanatory variables			
Structural	AREA	Saleable area of the residential unit (in square metre)	+
	AGE	Age of the building when a flat was transacted, in three binary variables: 1) 5 years or less; 2) 6–10 years; and 3) more than 10 years	–
	FLOOR	Floor level of the housing unit, in four binary variables: 1) 11th–20th floor; 2) 21st–30th floor; 3) 31st–40th floor; and 4) 41st floor or above	+
Neighborhood	MTR	Binary variable; 1 if the flat is within 5 minutes walking distance (i.e. about 400 m) to either Sham Shui Po MTR station or Cheung Sha Wan MTR station; 0 otherwise	+
	NSSP	Binary variable; 1 if the flat is located in Cheung Sha Wan; 0 if the flat is located in Sham Shui Po	+
Green building certification	CERTIFIED	Binary variable; 1 if the flat is located in a building which has received an award classification under BEAM Plus (Gold/Silver/Bronze); 0 otherwise	+
	UNCL	Binary variable; 1 if the flat is located in a building which has obtained an unclassified rating under BEAM Plus; 0 otherwise	/

development(s) is only available in the HKGBC website. Meanwhile, property developers in Hong Kong tend to disclose the BEAM Plus rating(s) of their developments only when they are certified. The less-informed homebuyers, as a result, are likely to mistake a building with an (undisclosed) "unclassified" rating for a non-registered building[2]. Thus, two scenarios are introduced. The first scenario (Model 1) depicts the situation in which homebuyers are informed of the actual BEAM Plus assessment results of residential buildings (i.e. both CERTIFIED and UNCL included), while the second scenario (Model 2) depicts the situation in which homebuyers are not as informed, in that "unclassified" ratings are not disclosed by property developers (i.e. only CERTIFIED included) and that these buildings are (mistakenly) viewed as non-registered.

A description of the selected variables is provided in Table 6.

[2] For instance, there is no mention of BEAM Plus registration (nor rating) in available information provided by the developer of The Met Delight (which has obtained an unclassified rating).

The hedonic model, built upon the factors mentioned above, thus takes two slightly different forms, due to the two scenarios proposed for testing the price effect of BEAM Plus. The final model for the first scenario is shown as follows:

$$LnPPSM = c + b_1AREA + b_2AGE + b_3FLR + b_4MTR + b_5NNSP + b_6CERTIFIED + \varepsilon$$

whereas that for the second scenario takes the following form:

$$LnPPSM = c + b_1AREA + b_2AGE + b_3FLR + b_4MTR + b_5NNSP + b_6CERTIFIED + b_7UNCL + \varepsilon$$

5. EMPIRICAL FINDINGS AND ANALYSIS

The results of the four hedonic pricing models are illustrated in Table 7 below. The adjusted R-square of Model 1 is 0.800 while that of Model 2 is slightly lower (0.796). Regardless, both models are able to explain approximately 80% of the variance of the adjusted per square metre transaction price of the sampled housing flats. Hence, it is reasonable to conclude that the model's explanatory power is high. This is further supported by their respective

Table 7. The results from the hedonic pricing models

	Model 1	Model 2
Constant	12.110**	12.062**
BEAM Plus certification attributes		
CERTIFED	0.044**	0.062**
UNCL	–0.059**	
Structural attributes		
AREA	–0.005**	–0.005**
5 years or less	–0.185**	–0.157**
6 to 10 years	–0.238**	–0.203**
More than 10 years	–0.324**	–0.295**
11th to 20th floor	0.030**	0.031**
21st to 30th floor	0.090**	0.091**
31st to 40th floor	0.154**	0.153**
41st floor or above	0.199**	0.188**
Neighborhood attributes		
MTR	0.028**	0.051**
NSSP	0.242**	0.250**
N	646	
Adjusted R-square	0.800	0.796
F-statistic	216.095	229.644

Note: ** denotes significance at 1% level; and * at 5% level.

ANOVA test results, which indicate that the null hypothesis is rejected at 5% level for all four models, and that the models are considered statistically significant.

For Model 1, the findings first illustrate that BEAM Plus certification is statistically significant (within 1% level) in explaining the transaction price of the sampled properties. The coefficient is positive, which means that a housing unit located in a BEAM-Plus-certified building is transacted at a price about 4.4% higher than a similar housing unit located in a non-registered building. This is consistent with the literature, in that green building certification generates additional price premium for housing units. Model 1 also reports a statistically significant (within 1% level) relationship between UNCL and property price per square metre. The negative coefficient suggests that, holding other variables constant, a housing unit located in a building with an "unclassified" rating under BEAM Plus is sold at a discount of 5.9% when compared with similar housing units in non-registered buildings. This finding is consistent to those in recent studies on the EPC (Fuerst *et al.* 2015, 2016). Viewing these two findings together, it can be said that there exists a 10.3% difference in price between a housing unit in a certified building and a similar flat in a registered building with an "unclassified" rating.

As for the structural attributes, the findings indicate that a flat's saleable area has a significant relationship with it's (per square metre) transaction price. The coefficient suggests that, for every 1% increase in saleable floor area, a flat's (adjusted) transaction price per square metre would be 0.005% lower. Another factor found to be negatively related with transaction price is age. Using pre-sale flats as the base case, it is reported that the older the building in which a housing unit is located, the lower per square metre price it has. Specifically, the price per square metre of a housing unit in a building which has been completed for 5 years or less is 18.5% lower than that of a pre-sale housing unit. The discounts in price for housing units in buildings that are 6–10 years old and more than 10 years old are 23.8% and 32.4%, respectively. This is in line with the expectation in the relationship between property price and the age of residential buildings. By contrast, the floor level dummy variables are all positively related (significant at 1% level) in explaining the per square metre transaction price of the sampled housing units. Using flats on the 10th floor or below as the base case, it is found that flats are sold at prices approximately 3% (11th to 20th floor), 9% (21st to 30th floor), 15.4% (31st to 40th floor), and 19.9% (41st floor or above) higher. This is consistent with the expected relationship between floor level and property price.

Lastly, for the neighborhood attributes, the findings reveal that better accessibility, as expected, results in higher property prices, as a residential unit's proximity to MTR station (i.e. 5-minute walking distance) is found to incur a price premium of 2.8% when compared to others, controlling for the effects of other variables. The NSSP variable, likewise, is statistically significant within 1% level, in that a residential unit located in Cheung Sha Wan, is about 24.2% more costly than a similar flat located in Sham Shui Po, holding other variables constant.

For Model 2, without UNCL as a control variable, the resultant transaction price premiums/discounts differ in all categories with the exception of floor area, even though their signs are identical. The findings show, first, that the coefficient for the CERTIFIED variable becomes noticeably higher, in that a housing unit in a BEAM-certified building is 6.2% more expensive than another flat with identical characteristics in a non-registered building.

Then, for the structural attributes, the negative price impact of a residential building's age is not as prominent as it is in Model 1. Using pre-sale housing units as the base case, the price discounts for flats located in older buildings are 15.7% (5 years old or less), 20.3% (6–10 years old), and 29.5% (more than 10 years old), respectively. By contrast, using flats on the 10^{th} floor or below as the base case, flats on lower floor levels (11^{th}–30^{th} floor) carry a slightly higher price premium compared to Model 1 (3.1–9.1%), whereas those on higher floor levels (31^{st} floor or above) result in slightly lower price premium (15.3–18.8%).

Lastly, for the neighborhood attributes, the resultant price premium for a flat with accessibility to either Sham Shui Po MTR station or Cheung Sha Wan MTR station, at 5.1%, is noticeably higher than that in Model 1 (2.8%). Also, a flat located in Cheung Sha Wan is, on average, sold at a per square metre price about 25% higher than a similar flat in Sham Shui Po, compared to 24.2% in Model 1.

6. CONCLUSION AND POLICY IMPLICATIONS

This study has evaluated the price effect of BEAM Plus certification on flats in sixteen residential developments within the Sham Shui Po – Cheung Sha Wan district. The findings first show that the prices of flats in BEAM Plus-certified buildings are 4.4% higher than those in non-registered buildings, and that flats in buildings with an "unclassified" rating under BEAM Plus are transacted at a discount of 5.9%. To put it differently, the price difference between a BEAM-Plus-certified flat and a similar flat in an "unclassified" building amounts to 10.3%. Nevertheless, this is only the case when homebuyers are informed of the actual status of a residential development with respect to its BEAM Plus assessment (including the "unclassified" rating). For less-informed homebuyers, however, since property developers only disclose information about a development's participation in BEAM Plus assessment when it is certified, it is very likely that these buyers would mistake an "unclassified" building for a non-registered building. Then, the price premium of BEAM Plus certification becomes higher (6.2%). In other words, the non-disclosure of BEAM Plus assessment results of "unclassified" buildings on the part of the developers would lead to over-valuation of price premium.

Regardless, considering the additional cost (2%) required for the construction of green buildings (Kats 2003, 2006; Morrison Hershfield 2005; Berry 2007), the price premium as a result of BEAM Plus certification suggests that developers may find it profitable, or at least financially viable, to "go green" in response to the market demand for green living space. From another perspective, the price premium obtained via BEAM Plus certification (4.4–6.2%, depending on model specifications) are generally on par with those found in the residential sector (Chegut *et al.* 2010; Shimizu 2010; Deng *et al.* 2012; Hyland *et al.* 2013; Jayantha, Man 2013; Brounen, Kok 2011; European Commission 2013; Heinzle *et al.* 2013; Deng, Wu 2014; Kahn, Kok 2014; Fuerst *et al.* 2015, 2016; Bond, Devine 2016; Bruegge *et al.* 2016), but much lower than those found in the office sector (Miller *et al.* 2008; Fuerst, McAllister 2008, 2009, 2011; Eichholtz *et al.* 2008, 2009, 2010, 2013; Murray 2008; Pivo, Fisher 2009; Wiley *et al.* 2010; Reichardt *et al.* 2012; Chegut *et al.* 2014; Kok, Jennen 2012). While some of the benefits are applicable to owners of residential space and of office space, such as higher rents (or returns), lower holding costs, and lower risk premium (see Fuerst, McAllister 2008, 2011; Aroul, Hansz 2012), the reason behind the disparities in price premium between the two sectors can be attributed to the differences in the tangible and intangible benefits associated with green living space and green office space. For the tangible benefits, approximately 55% of all electricity consumed in Hong Kong's office sector in 2014 was on space conditioning, compared to around 35% in the residential sector (Fig. 3). Therefore, the daily operating costs, in terms of electricity consumption, for office use are much larger than those for residential use. Operating in a building with better environmental performance would reduce the consumption of electricity, thus lowering operating costs for businesses. The improvement in energy costs for occupiers of living space in green buildings, in comparison, would not be as remarkable. For the intangible benefits, while the manufacturing sector can illustrate its commitment to sustainability by producing environmental-friendly products, such commitment is not as noticeable for non-manufacturing sectors. Therefore, one way to showcase this commitment, and thus boost corporate image, is to move their offices to green buildings. By contrast, even though buyers of green living space may take the "feel good" factor into consideration, this factor does not translate into business opportunities that an enhanced corporate image does.

The findings in this study have some implications regarding the GFA concession policy. This policy, on paper, provides some extra incentives for developers to build green residential buildings. Nevertheless, as a development project's actual rating is not considered in the Building Authority's decision to grant GFA concessions, as long as it has been assessed under BEAM Plus, this, hence, provides a loophole for some developers to exploit for additional profits, in that they could simply complete the registration and the provisional assessment under BEAM Plus in exchange for the GFA concessions, without necessarily committing themselves to the construction of buildings with better environmental performance[3]. In addition, such exploitations for additional floor space are in stark contrast with the original intent of the policy, which is to "foster a quality and sustainable built environment". In light of this, it is recommended that a review of this policy be conducted. In particular, rather than merely obtaining a "result" in the BEAM Plus assessment, the government may consider only granting GFA concessions only to BEAM-Plus-certified developments. Also, instead of a fixed cap at 10% of total GFA regardless of rating, the government may consider introducing a progressive rate, similar to Singapore's BCA GM GFA Scheme, for the amount of GFA concessions. Such an arrangement could provide extra incentives for the development of buildings with better environmental performance.

However, it should be noted that, as a much newer green building certification scheme compared to the likes of LEED and BREEAM (BEAM Plus Version 1.1 launched in 2010 and BEAM Plus Version 1.2 launched in 2012), not many residential developments had registered, much less assessed, under BEAM Plus by the end of the study period of this paper (December 2014). Hence, the sample size in this paper is inevitably much smaller than those in previous studies on green building certifications which were established much earlier. In addition, due to the innate limitations of the available datasets, some of the housing characteristics are inevitably omitted (such as design quality, building quality, orientation, etc.), which could impact the results. Despite these issues, the findings can still serve as a useful reference not only to the construction industry, but also to future research in BEAM Plus and in other domestic green building certifications, considering that BEAM Plus has been shown as highly compatible to the likes of LEED and BREEAM, and in some ways similar to other local green building certifications.

[3] In accordance with the HKGBC, of the 340 residential development projects that have registered to BEAM Plus by May 2016, 164 of them have been assessed. 44 (or 26.8%) of these assessed developments have only managed to obtain an unclassified rating. The overall percentage of non-certified developments under BEAM Plus is approximately 32% (see https://www.hkgbc.org.hk/eng/BEAMPlusStatistics.aspx).

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