



Development of price models for architectural and environmental quality for residential developments in Hong Kong



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ABSTRACT

Factors affecting a residential unit's price are always of interest to homebuyers and building developers, especially in a city like Hong Kong which is known for expensive housing. Literature review indicates that the governing factors can be categorized into architectural and environmental attributes. Among different methods commonly used for pricing, the hedonic price approach is viewed as the most suitable. However, the successful use of this method requires that homebuyers know and choose the attributes. Whilst choosing architectural attributes are not a problem for homebuyers, the same does not apply to environmental attributes. Previous studies by the authors have proposed some simple indicators for quantifying the environmental attributes. Based upon the developed performance indicators and the transaction records of two representative housing estates (Royal Ascot = RA and City One Shatin = COS), details of the properties, including transaction prices, architectural particulars and environmental characteristics were numerically transformed for the hedonic price analysis. The analysis results revealed that the willingness to pay (percentage of house price in parenthesis) for architectural and environmental attributes was HK\$302.3/ft² (5.8%) and HK\$886.8/ft² (28.2%), respectively, for RA and HK\$1672.7/ft² (31.9%) and HK\$111.5/ft² (3.5%) for COS. It was found that elasticity of substitution (ES) of environmental attributes contributed 3.4–13.3% of the property price, compared to 0.6–5.5% for architectural attributes.

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Introduction

A residential property's market value is determined by combinations of site-specific and property-specific characteristics. Site-specific characteristics, described by site locations and availability of amenities in close vicinity, are often set by the town planning group (HKPSG, 2011), which is a constraint beyond the control of site planners and architects. Property-specific characteristics, on the contrary, are not stipulated in local codes and regulations; site planners and architects are generally allowed to design the construction the way they deem proper (EPD, 2006; JPN1, 2001; JPN2, 2002; PNAP, 2013). These characteristics, contributed by architectural and environmental attributes, therefore, vary significantly in different residential units.

Hong Kong people spend a large amount of their income on housing. According to the global house-price indicators published in "The Economist" in 2011, Hong Kong tops the world in residential property prices. Results of the 2009/2010 household expenditure

survey also showed that the weight of expenditure Hong Kong people incur on housing was the highest among expenses under all heads, accounting for over 32% of the total household expenditure. Thus the influence of a residential property's characteristics on its market value is of particular importance to Hong Kong people when making home buying decisions, and on the contrary, to building developers when making investment decisions.

Over the years, several studies have investigated the influence of different factors on residential property prices. Harris (1989), Krashinsky and Milne (1987) and Tse (1996) found that economic conditions play a significant role in property price increases. Many others have found that government policies on town planning (Sagalyn & Sternlieb, 1973) land supply (Hannah, Kim, & Mills, 1993) and tax system (Bramley, 1993) affect property prices significantly. However, economic and government policies impact the residential property market as a whole only, while market value of individual residential units is affected more by site-specific characteristics. Some studies have examined influence of individual property-specific features also. However, little seems to have been done for investigating the relative and combined influence of different property-specific characteristics.

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In the context of impact of different property-specific characteristics on market value, the willingness to pay (WTP) (Banfi, Farsi, Filippini, & Jakob, 2005; Jim & Chen, 2006; Kim, Phipps, & Anselin, 2003; Okoko, 2004) and elasticity of substitution (ES) concepts (Ahmad, Choi, & Ko, 2013; Hannah et al., 1993; Pryce, 1999) are often adopted in relevant research. In this study, the hedonic price method is adopted for determining the market value of each property-specific attribute. However, use of the hedonic price method requires development of performance indicators that are known to homebuyers. This is less of a problem for architectural attributes which can easily be understood by homebuyers but is a problem in case of environmental attributes. Accordingly, a series of studies has been done by the authors for developing performance indicators for quantifying a residential unit's environmental qualities (Fung & Lee, 2011, 2012, 2014). Through the use of the hedonic price method, the marginal WTP and ES for each architectural and environmental attribute are determined for the information of homebuyers and building developers.

Factors affecting residential property prices

That economic and government policies affect the residential property market as a whole has been documented widely; that an individual residential property's market price is affected by combinations of site-specific and property-specific factors also is indicated by studies reviewed below.

Site-specific factors

Tse and Love (2000) stated that property price could be raised by availability of car park, shopping center and club house, etc. Hui, Chau, Pun, and Law (2007) found that the availability of a private club house within an estate increases the sale value of an apartment by about 3.5%. These findings explain why in the last few years, nearly all new residential estates have club houses and developers often use them as one of the key selling points. Moreover, Jud and Watt (1981) identified that districts with reputable schools have higher property value compared with other districts. Hui et al. (2007) further identified that each additional reputable secondary school located in the proximity of a property leads to an average of 0.1% increase in house price. Mok, Chan, and Cho (1995) pointed out those houses with good security provisions are viewed as more valuable.

Property-specific factors

Property-specific characteristics can be classified into architectural and environmental attributes. Environmental attributes, according to several building environmental assessment schemes (BEAM Interiors, 2008; BEAM Plus, 2010) can further be classified into occupant-specific and property-specific issues. The occupant-specific issues include thermal comfort, electromagnetic environment and indoor environmental quality (IEQ) management, which obviously do not affect property prices. Thus, as far as property price is concerned, only property-specific issues are considered. They include indoor air quality, quality of view and other health and safety related features such as natural ventilation, acoustic performance and daylight performance.

Architectural attributes

With regard to the influence of architectural attributes on property price in a high-density city like Hong Kong, Tse and Love (2000) revealed that floor area has a positive influence on property price. However, valuation of larger units does not increase proportionally with area of medium quality residential housing

because the demand for small units is relatively higher than large units since homebuyers cannot afford the higher property price.

Mok et al. (1995) illustrated that valuation of a property is most sensitive to changes in the age of a building and the floor level. They found that valuation of a property is inversely related to the age of the building and higher floors have a positive effect on price. Hui et al. (2007) conducted a similar research and found that a younger flat has a higher sale price than an older one, other attributes being identical. On average, it was observed that price goes up by 1.6% if a flat is a year younger; price decreases by 0.3% as one goes one floor down. This is somewhat consistent with the pricing strategy of developers as revealed from the sale price of the first hand residential properties markets.

Environmental attributes

Much literature has reviewed the effects of environmental attributes on property prices. The earliest work was carried out by Ridker and Henning (1967) to study the relation between indoor air quality (IAQ) and property prices in the St. Louis metropolitan area. They concluded that air pollution was a relatively significant factor in explaining residential property values. Harrison and Rubinfeld (1978) later estimated the marginal value of clean air for property prices in the Boston metropolitan area. It was found that the value of clean air was positive and the effect was positively correlated to household income. With regard to the effect of indoor particulate matter on property prices, Diamond (1980) and Li and Brown (1980) found a significantly negative effect. Chattopadhyay (1999) pointed out that residents in Chicago were willing to pay more for reducing exposure to pollution caused by air particulate (PM₁₀) and sulfur dioxide. A regression analysis by Kim et al. (2003) also showed that the marginal WTP for a 4% air quality improvement was about 1.4% of the mean house value. To conclude, people prefer a place with better IAQ despite a higher cost.

IAQ and natural ventilation performance are closely related. Chao, Tung, and Burnett (1997) studied the influence of different ventilation rates on indoor radon levels at 12 residential sites in Hong Kong. It was reported that the ratio of indoor to outdoor radon level was 46.5 when the ventilation rate was around 0.2 air changes per hour (ACH). However, when the ventilation rate was increased to higher than 3 ACH, the indoor radon level was close to the outdoor radon level. Murakami, Kato, Ooka, and Shiraiishi (2004) studied two residential building models with and without voids in buildings. The results indicated that the model with voids improves natural ventilation effectively and thus saves 2.8% of energy used for air-conditioning compared with the model without natural ventilation. Given the positive contribution of natural ventilation to energy usage and IAQ, better natural ventilation undoubtedly has an impact on the property value.

The acoustic environment of an indoor space is often associated with traffic noise, which has commonly been regarded as a negative externality that causes inevitable sufferance. The higher the traffic noise, the lower will be the property value. Nelson (1982) studied the impact of traffic noise by hedonic price method. The result was represented by a noise sensitivity depreciation index (NSDI) that relates the percentage depreciation in property price induced by each decibel (dB(A)) of noise above a threshold level. It was found that a house with a background noise level of 75 dB(A) was valued 8% less than a house with a noise level of 55 dB(A) and thus the corresponding NSDI was 0.4%. Wilhelmsson (2000) conducted a detailed study on the correlation between traffic noise and the value of single-family houses in Sweden. His empirical analysis found an average drop of 0.6% in property price for each increase in dB(A) or a total discount of 30% in price for a house in a noisy location compared to a house in a quiet zone.

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