

## BUYERS' PROPERTY ASSET PURCHASE DECISIONS: AN EMPIRICAL STUDY ON THE HIGH-END RESIDENTIAL PROPERTY MARKET IN HONG KONG

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**ABSTRACT.** Demand for luxury housing units from the upper and upper-middle income groups in Hong Kong has been increasing over the last few years. As the market cannot satisfy demand, some prospective buyers have turned their attention to “special” housing units. This research paper attempts to investigate buyers’ preferences for two types of “special” units, namely *duplex units* and *adjoining flats*. The study investigates the price premiums paid by the buyers, and examines the effects of these special units on property price. The study employs two hedonic price models: one measuring the buyers’ preference on duplex units and the other one measuring buyers’ preference on adjoining flats. The results show that buyers are willing to pay a larger premium for special residential units: HK\$588/ft<sup>2</sup> more for a duplex unit and HK\$934/ft<sup>2</sup> more for an adjoining property unit, respectively. Furthermore, a relatively larger premium is found for adjoining flats compared to duplex units. This implies that a property unit, purchased as an adjoining flat can add more value to the property price (in terms of \$ per sq. ft.) compared with being a duplex unit.

**KEYWORDS:** Property market; Duplex unit; Adjoining flat; Property price; Hong Kong

### 1. INTRODUCTION

Even though the housing affordability issue in Hong Kong has been a serious problem, especially among many low and medium income households, there has been an increasing demand for luxury housing units by the upper middle and high income households over the last few years. With the rising aspirations of this sector in society, along with increasing national income (and per capita income), there is an increasing demand for so-called “special” housing units (i.e. *duplex units* and *adjoining flats*). As the market cannot satisfy demand, some prospective buyers have turned their attention to these types of “special” housing units, for some as a way of getting into the market, for others as a way of increasing their investment and diversification into this type of asset. The main reason for this significant increase in demand for special units is the existence of the wealth effect and the limited supply of these units in the property market (Fong

2009). The wealth effect is defined as “...an increase in spending or consumption that accompanies an increase in wealth, or merely a perceived increase in wealth.” (Pigou 1943). According to Cheung *et al.* (2004), property equity has dominated the wealth portfolio of typical middle-class Hong Kong residents for a long time. Buying “bricks and mortar”, i.e. property, has been viewed as one of the safest stores of wealth as well as investment, according to Chinese tradition. These special housing units, in particular (i.e. duplex units and adjoining flats), are regarded as high quality durable investment goods as well as consumer goods. It is clear that people in Hong Kong have begun, on one hand, to appreciate the characteristics of these property units in terms of prestige value and potential for asset appreciation, and, on the other hand, to embrace green living (Jayantha, Wan 2012). Hence, these special housing units are in high demand in the local property market.

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In response to this increasing demand, developers have begun to add some special units into their new housing projects, and most of them are in the form of penthouses<sup>1</sup>. Early examples of property developments incorporating penthouses include Royal Ascot in Shatin, and more recent designs include 'Manhattan Hill' in Lai Chi Kok, 'The Masterpiece' in Tsim Sha Tsui, 'The Brand' in Yuen Long, and 'Festival City' in Shatin. According to both local property agents such as Centaline Property Agency (2009) and Ricacorp Properties Limited (2011) and consultants like Dudley Surveyors Limited (2010), although the demand for these special units is rapidly increasing, the supply is still limited. This may be due to various reasons: including a lack of a clear understanding of the preferences of potential buyers (i.e. which type of units they prefer). As these types of units are relatively new to the market, developers may be a bit reluctant to invest to the fullest in this niche until they are more certain of what potential buyers really prefer.

Some developers may have doubts about their cost-effectiveness, especially as the cost of constructing them is comparatively higher than for standard units. For example, a construction cost premium of approximately 5–20% is associated with green construction (Gomez 2008). In this context, it is very important for suppliers or developers to have a clear understanding of the needs of potential buyers in order to make efficient investment decisions to supply these units to satisfy the market demand. Specifically, it is necessary to find out which type of unit (duplex unit or adjoining flat) is more desirable and for which the potential buyers are willing to pay extra. The preferences of the buyers can be reflected by the market values of the duplex unit and adjoining flat, *ceteris paribus*. On the other hand, the inclusion of these special units (i.e. duplex unit and adjoining flat) in the development will bring value enhancement to the *other* units in the building that may lead to appreciation of the property values of those units as well. It is therefore also important to understand and evaluate the effect of these special units on the property price of the whole development, if any.

Thus, three vital questions needed to be addressed in realization of satisfying the market demand for this particular sub-housing market: (i) "Are potential property buyers ready to pay more

for these special units or buildings?"; (ii) "Which type of unit is more preferred by the potential buyers?"; and (iii) "How are these residential buildings with special units priced and valued in the market?". This is the threshold for the research.

The present study analyzes the buyers' preference between duplex units and adjoining flats through investigating the premiums paid by the buyers for these two types of special flat designs. The study also attempts to examine the relationship between these special units and the general property prices in these residential buildings. Thus, "Duplex unit" and "Adjoining flat" are taken as special units in the study. This research paper would enrich the housing literature significantly, as studies that investigate these special units are rare in the literature. According to the authors' knowledge, this study is the first in Hong Kong to analyze this particular niche of the housing market comprehensively. The findings of this research will be of great interest to private property developers, investors in the property market as well as scholars in Hong Kong and elsewhere. The present study provides valuable insights into our current knowledge about the housing market in general, and the market sentiments of the demand for these less explored special housing units (sub-housing market) in particular.

The paper is structured as follows. The following section (Section 2) reviews the existing studies in the area of housing market literature, with special reference to wealth and income effects on housing, whilst Section 3 provides the theoretical framework for a Hedonic Price Model (HPM) of residential property development. Section 4 discusses empirical estimates of the tested model, and the study concludes in Section 5 with a summary and some suggestions for future research.

## 2. LITERATURE REVIEW OF ECONOMIC FACTORS LINKED TO REAL PROPERTY ASSET PURCHASE DECISIONS

The demand for housing or housing consumption is influenced by many factors in any economic system. There is a significant body of studies that investigates various aspects of housing consumption available in the literature across the globe (e.g. Yu 2004; Huang 2003a, 2003b; Huang, Clark 2002; Clark, Drever 2000; Fu *et al.* 2000; Li 2000a, 2000b; Zhang 1999; Logan *et al.* 1998, 1999; Bian *et al.* 1997; Myers, Baer 1996; Clark *et al.* 1994; Deurloo *et al.* 1994; Myers, Choi 1992; Davies, Pickles 1985). These studies can be broadly di-

<sup>1</sup> According to *Dictionary of Architecture and Building Construction* (2008), a penthouse is an apartment or suite of rooms at the top of a high-rise building.

vided into two main categories in terms of their perspectives.

The first perspective is mainly driven by economic factors, with the main emphasis being the underlying market factors, whilst the second approach is dominated by demographic characteristics and life-cycle events. The literature review of the present paper is limited to the economic perspective as the other approach is not in line with its focus. According to this economic perspective, households, being rational thinkers, always try to maximize consumption / satisfaction within a given budget (Arnott 1987). They believe income, wealth, and house prices as the most significant determinants of housing demand behaviour (e.g. Mayer, Englehardt 1996; Henderson, Ioannides 1987, 1985; Deurloo *et al.* 1987; Plaut 1987; Kendig 1984; McCarthy 1976).

Of these three factors, wealth and income effects have been the most significant factors that influence housing consumption. The wealth effect is an increase in spending or consumption that accompanies an increase in wealth, or merely a perceived increase in wealth (Pigou 1943). Total wealth can influence decisions on purchasing real estate wealth on one hand, while on the other, real estate assets (wealth) can increase consumption. Indeed, according to the life-cycle hypothesis of Ando and Modigliani (1963), consumption is significantly dependent on total wealth, which includes housing and real estate assets (physical assets) as well as human and other financial assets. Recently, Benjamin *et al.* (2004) estimated a consumption function for real estate and financial wealth, and concluded that real estate wealth has a greater influence on consumption compared to financial wealth. It was found that an extra dollar of real estate wealth can increase consumption by 8 cents compared to only 2 cents of financial wealth. These findings are also in line with the findings of Case *et al.* (2001). They found that the elasticity of consumption with respect to housing wealth is 0.06 compared to 0.03 from wealth stock. Hurst and Stafford (2002) also find increases in housing wealth leads to positive marginal propensities to consume. However, the link between housing wealth and consumption is not always supported by empirical data. Some researchers find that housing wealth has either no effect or only a limited effect on consumption. For example, Hoynes and McFadden (1997) and Elliot (1980) mention that housing wealth has only a little impact on consumption, while Engelhardt (1996) finds almost no effect on consumption.

In the context of Hong Kong, there is a significant positive relationship between wealth and real estate assets. As mentioned earlier, it is common that Hong Kong people tend to accumulate wealth mainly through acquiring real estate assets. For example, Cheung *et al.* (2004) mention that real estate assets dominate the wealth portfolio of a typical middle-class Hong Kong resident. Chiang and Ganesan (1996) state that during 1984–1995 period, direct real estate investment outperformed property stock investment in terms of risk and return in Hong Kong. It is clear that people in Hong Kong tend to purchase real estate assets (housing) as an investment as well as consumption goods. More important, those special housing units with special features would be targeted more, since they are regarded as properties with a greater potential in appreciation of the value. As homebuyers are normally rational thinkers, they are willing to pay more for desirable housing attributes (Mok *et al.* 1995).

The income generated from such ownership of property assets also is considered not only as a significant determinant of housing consumption, but also as a factor that can promote better quality housing consumption. Zarin and Bujang (1999) mentions that higher income often encourages upgrading to better quality housing. With higher income, housing affordability improves significantly and covers the occupancy costs including initial payment and the mortgage repayment. Increasing incomes may also enhance the ability and expectation of the growing middle and upper class groups of people to achieve higher expectations in the standard of living (Zarin, Bujang 1999), which would eventually have a positive impact on higher quality housing consumption such as condominiums (special units).

In economics, superior goods are a commodity such that consumption of them would have a higher rise of the wealth effect compared to normal goods, due to the higher positive income elasticity (Lam 2007). Special units such as duplex units, adjoining flats, flats with a garden, flats with a roof area, and combinations of the above, etc., doubtlessly can be regarded as superior goods because of their uniqueness, compared to typical flats, which are “normal” goods in nature. Therefore, special units may have a higher increase in demand among upper middle and upper income households as compared with conventional ones

In addition to the upgrading of housing quality, under conditions of asset appreciation, buyers tend to acquire special units as they are more unique

with special attributes and with a limited supply, so the appreciation potential of those properties is higher (Centaline Property Agency 2009). This is very much in line with Chow (2008), Head of Research at Ricacorp Properties Limited. According to him, with a low market interest rate, low recovery in total wealth and the stock market, the property market becomes more active and reliable. In particular, special units, with high appreciation potential, are the best choices to potential buyers. Transactions of special units have become more active and the number of transactions has risen significantly over the last 4 years (Ricacorp Properties Limited 2011). Sharing the same view, Dudley Surveyors Limited (2010) observe that the increasing demand, together with the supply shortage of large units in the property market eventually resulted in some owners altering their flats into adjoining flats or duplex units. These views from the local property agents share similar opinions which suggest that there is an increasing demand for these special units, for instance duplex units and adjoining flats, in the Hong Kong property market.

### 2.1. Housing attributes and prices

Property price is a function of a bundle of various attributes: physical (structural) attributes, environmental attributes and neighbourhood (location-al) attributes. Tse (2002) classifies these attributes into two main categories: utility-bearing attributes (i.e. structural characteristics of the property, location of the site, and recreational facilities); and the neighbourhood characteristics (amenities such as views, provision of parks; and the presence of schools and community services). There is a significant body of research studies that investigate the effect of these attributes on housing price. For example, the effects of structural attributes such as the size of the flat, floor level of the unit, age of the building, existence of balconies, number of bedrooms and bathrooms have been extensively investigated by researchers (e.g. Selim 2008; Choy et al. 2007; Chau et al. 2004; Chau et al. 2003; Tse 2002; So et al. 1997; Mok et al. 1995). Thus, there is a broad consensus in the literature of the effects of these attributes on property prices.

Effects of the neighbourhood environment on property prices have also been extensively investigated in the literature. Impact of neighbourhood attributes such as accessibility to work and CBD, distance to railway stations and improvements in transportation on residential properties have been studied by many scholars (e.g. Yiu, Wong 2005;

Tse 2002; So et al. 1997; Mok et al. 1995). Effects of neighbourhood amenities such as presence of a landscaped garden, private swimming pool, club house, gymnasium, various sports facilities and shopping centres on housing property prices have also been studied in the literature (e.g. Bolitzer, Netusil 2000; Tyrväinen, Miettinen 2000). Impacts of these amenities have been found to be positive on property prices.

Orientation and the view from the premises are factors that have also been investigated extensively in the property market. These attributes have been considered very important in buying properties, specifically in Hong Kong. Possessing a sea view yields more satisfaction to the end-users and hence commands a higher transaction price (Choy et al. 2007; Benson et al. 1998; Mok et al. 1995).

However, in the literature not a single comprehensive study has been carried out to investigate the market for these special housing units, in particular, the effects of special units on the property price in Hong Kong. A decade ago, Cheung et al. (2004) examined the popularity of residential units by means of a repeated sales pattern. By employing *event history analysis*, they found that duplex units had a negative / uncorrelated relationship with transaction intensity. This indicated that owners were less likely to sell these prestigious units and so they were inactive in second-hand property transactions. However, they just used the duplex unit as an independent variable in their study and did not investigate the effect of a class of special units (duplex or adjoining units) on the property price or the buyers' preference. Thus, there has been very little attempt to analyze and understand the buyers' preference, in terms of willingness to pay, on these newly developed special units in residential buildings. Until this study this very important gap in the literature – investigation of the effect of special units on housing property price and the willingness to pay for these special units in Hong Kong – has been largely ignored in the literature for some reason. Specifically, in view of the wealth effect and increasing desire of the upper and upper middle income groups towards high quality and standard housing, it is important to carry out a study to fill this gap in the literature.

### 2.2. Definitions of a “duplex unit” and an “adjoining flat”

Penthouses have become one of the most common forms of special units in the property market in Hong Kong. According to *Dictionary of Architec-*

ture and Building Construction (Davies, Jokiniemi 2008), a penthouse is an apartment or suite of rooms at the top of a high-rise building. Nearly all of the recently developed residential developments / estates have incorporated the penthouse design, either in the form of a duplex unit, or as an adjoining flat, or a mix of the two.

In this same reputable source, a duplex unit means a dwelling of more than one storey within a large residential block, with its own private internal vertical circulation. The definition of a duplex unit is generally accepted as a single residential unit which spreads over two floors and is connected by an indoor staircase. On the other hand, a proper definition of an adjoining flat has not been found in the literature. In this paper, an *adjoining flat* refers to a single residential unit which constitutes the whole or nearly the whole of the size of two adjacent units (as viewed on plan directly below or above in the typical floors). Thus, an adjoining flat is defined as a single residential unit that combines two or more typical units and has a large floor area. This usually refers to the penthouse on the top floor of a residential block with an extremely large flat size (i.e. occupying the whole storey).

### 3. METHODOLOGY

The study aims to investigate the buyers' preference for special housing units (duplex units and adjoining flats) and to examine the effects of these special housing units on property prices. The study employs two hedonic price models (HPM) to achieve these objectives: one measuring the buyers' preference on duplex units (Model 1); and the other one measuring buyers' preference on adjoining flats (Model 2). Two models are employed because there are no examples of these two structures (both duplex units and adjoining flats) co-existing in the same residential building in Hong Kong.

#### 3.1. Hedonic price model (HPM)

The price of a housing unit can be regressed as a function of a set of housing attributes: structural, locational (neighbourhood) and environmental attributes. These main attributes normally consist of smaller attributes (i.e. size and floor area of the house, view, location, transport etc.), making housing a heterogeneous good (Sirmans *et al.* 2005). The HPM is an ideal analytical tool to analyze a non-homogeneous commodity in relation to its attributes. The HPM allows the total value of the

property to be broken down into individual attributes; while it also helps us to identify and analyze the effects of these individual attributes separately (Hui *et al.* 2011). The ability to analyze and interpret the implicit relationships between the commodity as a whole (here, residential property) and its characteristic sub-variables is the main strength of HPM (Freeman 1979). The HPM is also an ideal tool to estimate marginal willingness to pay, as it has the ability to approximate marginal implicit prices of various property attributes. In the present study, therefore, the HPM is used to evaluate the buyers' preference (willingness to pay) for special housing units (duplex units and adjoining flats) and to analyze the effects of these special housing units on residential property price.

Though the residential property price is influenced by a wide variety of attributes, after a careful consideration eleven property attributes (variables) were chosen that can significantly influence residential property price and may also not be directly controlled by the special housing units. The eleven variables included in the model represent all the three main housing attributes, namely structural, locational and environmental factors.

The study proposes following two HPM models:

Model 1 (*Duplex unit*)

$$\text{Price}_i^D = \beta_0 + \beta_1(\text{FlatSize})_i + \beta_2(\text{FlatRoof})_i + \beta_3(\text{Age})_i + \beta_4(\text{Floor})_i + \beta_5(\text{Orient})_i + \beta_6(\text{ViewHw})_i + \beta_7(\text{ViewMount})_i + \beta_8(\text{ViewSea})_i + \beta_9(\text{DUPLEX}) + \varepsilon_i,$$

Model 2 (*Adjoining flat*)

$$\text{Price}_i^A = \beta_0 + \beta_1(\text{FlatSize})_i + \beta_2(\text{FlatRoof})_i + \beta_3(\text{Age})_i + \beta_4(\text{FloorSq})_i + \beta_5(\text{Floor})_i + \beta_6(\text{Orient})_i + \beta_7(\text{ViewOpen})_i + \beta_8(\text{ViewMount})_i + \beta_9(\text{ViewSea})_i + \beta_{10}(\text{Mount})_i + \beta_{11}(\text{ADJOIN})_i + \varepsilon_i,$$

where, dependent variable 'Price' represents the real residential property price,  $\beta_1 \dots \beta_9$  (model 1) and  $\beta_1 \dots \beta_{11}$  (model 2) are the coefficients of variables;  $\beta_0$  is the constant term and  $\varepsilon_i$  the error term. Table 1 reports all the necessary details of the variables used in the two models.

#### 3.2. Selection of data

To investigate buyers' preference for duplex units and adjoining flats (and their impact on property prices), the transaction records of residential properties from three large-scale housing estates (Heng Fa Chuen, South Horizons and Chi Fu Fa Yuen) in Hong Kong were used in the analysis.

The purpose of having two models is threefold. *Firstly*, Model 1 is to evaluate the buyers' preference on duplex units (how much premium they are willing to pay); whilst Model 2 is to evaluate

Table 1. The property attributes and their expected relationship with price

Attributes	Abbreviation	Characteristics	Definition	Expected sign (+/-)
Structural (physical)	Price	Transaction price	Selling price of the property in HK\$/ft <sup>2</sup>	/
	FlatSize	Floor area	Saleable area (excluding flat roof area) of the unit in sq. ft.	+
	FlatRoof	Roof area	Flat roof area of the unit in sq.ft.	+
	AGE	Age of the unit	Age of the building in year at the transaction date	-
	Floor	Floor level	Number of floors above the ground <sup>2</sup>	+
Location & environment	Orient	Orientation of the unit	1 if the unit is facing the west, southwest and northwest direction; 0 if facing other directions	-
	ViewHw	Facing highway/railway	1 if the unit is facing the a highway/railways; 0 otherwise	-
	ViewOpen	Facing open space	1 if the unit is facing an open space or a view with no obstruction; 0 otherwise	+
	ViewMount	Facing mountain	1 if the unit is facing a mountain view; 0 otherwise	+
Structural (special)	ViewSea	Facing sea	1 if the unit is facing a sea view; 0 otherwise	+
	DUPLEX	Duplex unit	1 if the flat is a duplex unit; 0 otherwise	+
	ADJOIN	Adjoining flat	1 if the unit is an adjoining flat; 0 otherwise	+

buyers' preference on adjoining flats. *Secondly*, we can make a comparison between these two special units in terms of premiums that potential buyers are willing to pay. *Thirdly*, we can also evaluate the effects of these special units on property price, separately, if any.

#### Model 1 (duplex unit)

A total of 711 property transactions<sup>3</sup> were collected from a renowned and large private residential estate, Heng Fa Chuen housing estate. Among them 279 (39%) property transactions are sales of duplex units whilst the rest (432: 61%) are without duplex units. Heng Fa Chuen is located at 100 Shing Tai Road, Chai Wan.

The development was completed in 1989 with a total of 48 blocks. It contains 6,504 flats ranging in size from 556 to 990 square feet for typical units and 1,021 to 1,292 square feet for duplex units, respectively, in term of saleable area. All of the 20 blocks are located on top of the podium in which 17 blocks are 14-storey height and the remaining 3 blocks are 13-storey height. The other 28 blocks contain 18 stories. This development provides normal units in lower floors and duplex units on the top floors, which are the 19-20/F, among 26 blocks each with 8 units in one storey (MTRC Ltd. 2011).

<sup>2</sup> It refers to the adjusted floor level of a residential flat. Adjusted floor level is the number of storeys that the flat located on above ground level which may be different from the floor level stated in the sales brochure as developments may omit unlucky number (i.e. 4, 14, 24, etc.).

<sup>3</sup> Duplicated and outlying transactions including transactions with car parking space and transactions with extremely high or low transaction prices have been eliminated from the data set.

Figure 1 shows the distribution of the blocks with and without duplex units in the estate.

Transaction data of 16/F to 19/F were gathered from 27 blocks which contained 26 blocks of buildings with duplex units. The development can be conveniently accessed by MTR, bus, and minibus. The accessibility to the Heng Fa Chuen MTR Station is similar for all 27 blocks, being not more than 5 minutes from the MTR station. According to Tse (2002), any railway station located within 10 minutes<sup>4</sup> walking distance from a housing unit may not have a significant effect on the price of the housing unit. It is therefore assumed that there is no significant difference on the house prices of the selected samples that is caused by difference in accessibility to the transport. In addition, the amenities and recreational facilities such as car parks, clubhouse, swimming pool, children playground, and shopping mall and sport courts are shared by all the residents of all the blocks in the estate. As all these residential developments also comprise other facilities such as club-houses etc., it is not necessary to incorporate those attributes to the model.

#### Model 2 (Adjoining flats)

A total of 687 property transactions were used for the model. These were collected from two large scale residential estates, (in which 376 transactions are from South Horizons in Aberdeen and 311 transactions are from Chi Fu Fa Yuen in Pok Fu Lam. Among them 180 (26%) property transactions are sales of adjoining flats (whilst the rest;

<sup>4</sup> The average waiting time for a public bus or cab was approximately 10 minutes.



Fig. 1. Distribution of the blocks with and without duplex units in Heng Fa Chuen

Source: Google Maps.

74% are without adjoining flat). Both of these developments provide small to large size residential units and some of them are adjoining flats.

South Horizons was completed in 1995 with a total of 34 towers ranging in height from 25 to 42 storeys. It comprises 9,812 residential units ranging in size from 631 to 1,121 square feet for typical units and 1,107 to 1,630 square feet for adjoining flats, respectively, in term of saleable area and occupies 1.67 million square feet site area (Hutchison Whampoa Limited 2011). This development

provides normal units on typical floors and adjoining flats on the top floors in 18 towers with 4 towers having 4 units and remaining 14 towers having 2 units. Figure 2 shows the distribution of blocks with and without adjoining flats in the estate. Transaction records were collected for the top two floors of the 18 blocks containing adjoining flats. Their occupation permits were issued between 22<sup>th</sup> November, 1991 and 2<sup>nd</sup> February, 1994. All of the selected properties are with either a building view or a sea view.

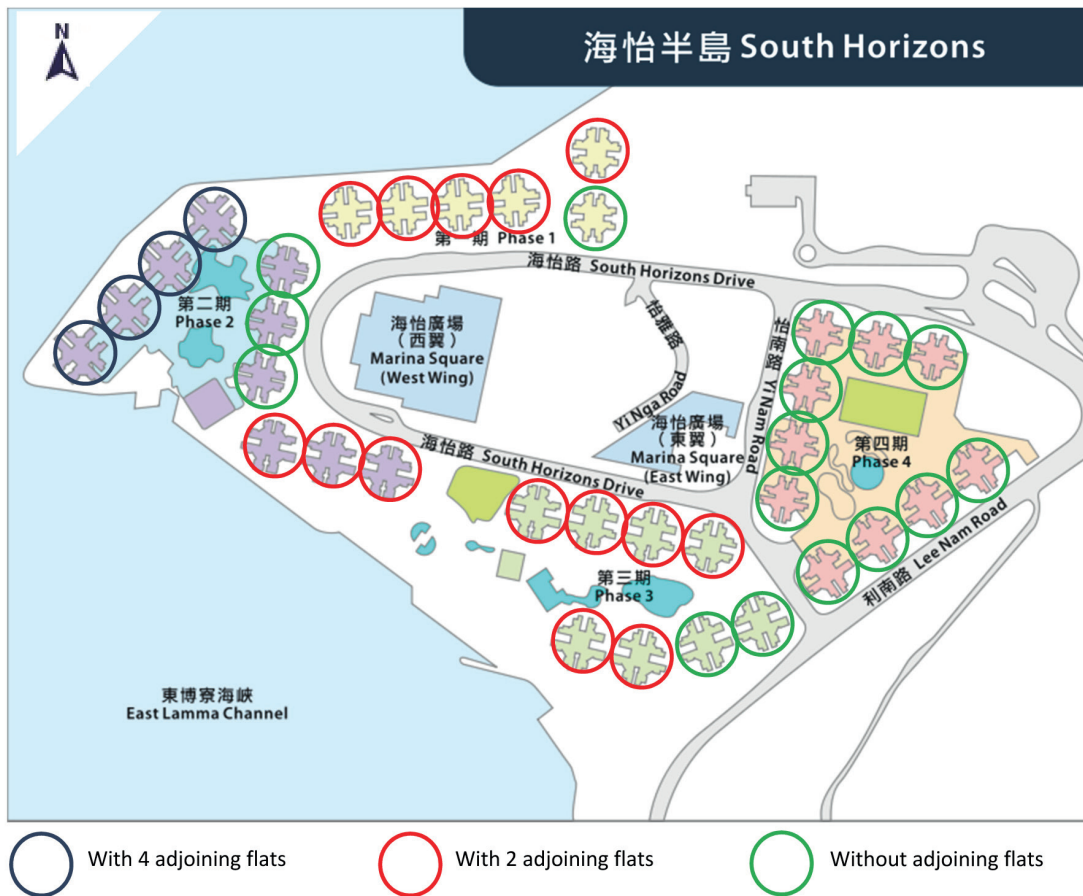


Fig. 2. Distribution of the blocks with and without adjoining flats in South Horizons  
 Source: Wikipedia. Retrieved from [http://zh.wikipedia.org/wiki/File:South\\_Horizons\\_Map.svg](http://zh.wikipedia.org/wiki/File:South_Horizons_Map.svg)

Chi Fu Fa Yuen is located at Pok Fu Lam in Hong Kong Island and has a total of 20 blocks (excluding Yar Chee Villas) each with 27 storeys. It comprises 4,240 residential units ranging in size from 518 to 1,270 square feet of saleable area. This development provides normal units on typical floors and adjoining flats on the top floors in all 20 blocks having 4 units each. Figure 3 demonstrates the distribution of the blocks in the estate. Transaction data of 26/F to 27/F were gathered from all the 20 blocks which containing adjoining flats. Most of the selected properties possess either a building view or a mountain view, and the others enjoy an open view. Both developments provide recreational facilities like swimming pool, residents club, children playground, sports courts and other facilities such as car parks and commercial /shopping complexes that are shared by the all the residents in both estates.

The two residential estates (South Horizons and Chi Fu Fa Yuen) are also located in the same school networks for both primary and secondary schools in Hong Kong, (School network 18 and Southern District, respectively). In addition,

they are close to each other, both situated in the Southern District, which is far from the city centre. Besides, no MTR stations are currently available<sup>5</sup> near either development, so the degree of accessibility is the same. Non-special housing unit equivalents were also chosen from the same market segments in both models in order to cancel out the difference in geographical characteristics.

There are four reasons for selecting these private housing developments for the study: (i) comparable household income group, (ii) comparable distance between properties and the MTR station, (iii) similar neighbourhood amenities (i.e. swimming pools, parks and sports centers) in all three developments; and (iv) all these residential developments are with club-houses and other amenities. Thus, the study does not need to include those attributes to the models. This may cancel out the effects, if any, caused by micro-level facilities such as transportation in the analytical model.

<sup>5</sup> A new MTR station, namely South Horizons, are now under construction on the MTR South Island Line East Section and is scheduled to be completed in 2014.





Fig. 3. Distribution of the blocks in Chi Fu Fa Yuen

Source: Google Maps.

### 3.3. Data sources

Both models draw upon data from all three residential schemes, comprising both small scale and large scale housing units; with the unit sizes ranging from 518 sq. ft. to 1630 sq. ft. of saleable area. The number of property transaction records employed in model 1 is 711 and 687 in model 2. The data was collected within the period 1<sup>st</sup> January, 1992 to 30<sup>th</sup> November, 2011. The transaction price is defined in the study as the transacted price of a residential flat per saleable area (excluding flat roof area) in terms of Hong Kong Dollars. The transacted price is the selling price of the premise registered with the Land Registry of the HKSAR. Since property transactions do not take place concurrently, transacted prices are adjusted

to eliminate the time effects by using the Monthly Residential Property Price Index<sup>6</sup> issued by the Rating and Valuation Department, according to the classes<sup>7</sup>.

The transaction records and property information including the considerations, saleable areas,

<sup>6</sup> For transactions took place during 1992, Quarterly Residential Property Price Index is used due to the unavailability of data from the Rating and Valuation department.

<sup>7</sup> According to the Rating and Valuation Department (2011), private domestic units can be divided with reference to their saleable areas as follows:

- Class A – saleable area less than 40 m<sup>2</sup>
- Class B – saleable area of 40 m<sup>2</sup> to 69.9 m<sup>2</sup>
- Class C – saleable area of 70 m<sup>2</sup> to 99.9 m<sup>2</sup>
- Class D – saleable area of 100 m<sup>2</sup> to 159.9 m<sup>2</sup>
- Class E – saleable area of 160 m<sup>2</sup> or above

aspects of the properties, date of occupation of the building, etc. were obtained from Economic Property Research Centre (EPRC) Limited and cross checked with Centadata, which is established by Centaline Property Agency. EPRC provides a database that records all the registered property transaction in the Land Registry since 1991 in Hong Kong. The data provided in Centadata is based on the registered property transactions in the Government Land Registry. When necessary, a land search was obtained from the Land Registry for verification and supplementary purposes. Other property information is obtained through various government departments and site investigation. Location, geographical and neighbourhood information of the selected buildings are gathered from the GeoInfo Map powered by the Lands Department. Floor plans of some of the selected properties were collected from the *Building Records Access and Viewing On-line* (BRAVO) System established by the Buildings Department. The building management information employed in this research was obtained from the *Database of Private Buildings in Hong Kong* provided by the Home Affairs Department. Recreational facilities associated with the chosen residential developments were verified through property agents' and developers' websites. Site investigation was also conducted to identify the views, accessibilities, etc. of the properties.

### 3.4. Statistical interpretations in the HPM

Empirical results of HPM (regression model) are generally interpreted and analyzed by using numerous simple statistical techniques (i.e.  $t$ -test,  $F$ -test and adjusted  $R^2$ ). Our HPM has eleven independent variables, and the  $t$ -test is used to test whether each parameter of a variable is significant or not. This is done by comparing the estimated  $t$ -value with the critical  $t$ -value. An independent variable is said to be significant if the absolute  $t$ -statistic for that coefficient of the variable is greater than the critical value. That implies that a particular variable has a significant impact on the dependent variable. Another important statistic in the regression model is the  $F$ -test, which reflects the overall performance of the model. The overall model is said to be performing well or is statistically highly significant if the estimated  $F$ -statistic is larger than the critical value. That means the independent variables included in the model jointly explain the dependent variable satisfactorily. Finally, the explanatory power of the model is evaluated through the adjusted  $R^2$  value that ranges from 0 to 1; and the greater the value of

it, the better the model. High values of  $R^2$  indicate that the independent variables selected, together substantially explain the behaviour of the dependent variable (meaning that no significant variables are missing).

Table 2. Summary of descriptive statistics (*Model 1*)

Variable	Mean	STD	Min	Max
Price	9010.88	1806.72	2177.00	15472.00
FlatSize	770.01	202.62	556.00	1229.00
FlatRoof	68.50	92.34	0.00	292.00
AGE	14.56	5.30	5.73	25.24
Floor	17.14	0.88	15.00	19.00

## 4. EMPIRICAL FINDINGS

### 4.1. Results of model 1 (Duplex unit)

Table 2 presents the descriptive statistics of the variables used in model 1. Empirically estimated coefficients and the explanatory power of the model along with statistical measures are presented in Table 3. All the employed independent variables (except *Orient*) are found to be highly significant at conventional levels and also bear the anticipated theoretical signs of variables. The adjusted  $R^2$  value of 0.745 indicates that around 75 percent of the total variation of residential property price can be described by the explanatory variables, and this is quite a high value. The estimated  $F$ -value of 231.95 ( $p$ -value is 0.000) also suggests that the set of explanatory variables chosen are jointly statistically significant and at least one of the independent variables is able to explain the variation of the property price in the model. Confidence interval levels (at 95%) were also tested for all the estimates of independent variables<sup>8</sup>. All the estimated coefficients are within the range of 95 % confidence level, confirming the reliability of the estimates.

The most relevant and significant variable in the study is DUPLEX, and as anticipated, it is found to be statistically highly significant. The estimated  $t$ -value of 2.408 and  $p$ -value 0.016 suggest that the variable DUPLEX is highly significant at 5 percent level. The coefficient of 588.54 of DUPLEX means a property being a duplex unit can add value and raise the property price by \$588.54/sq.ft. To put it differently, potential buyers are ready to pay \$588.54 more per square feet for a duplex property unit than for a normal/typical unit. This tells us that if a residential building has duplex units, the value of the other units in the residential property increases significantly.

<sup>8</sup> Not reported in the text, but available upon request.

Table 3. Coefficients of the model 1 (*Duplex*)

Variable	Coefficient	<i>t</i> -statistic	Sig.
Constant	3465.965*	3.111	0.002
FlatSize	3.229*	5.414	0.000
FlatRoof	4.056*	3.734	0.000
AGE	-45.506*	-6.948	0.000
Floor	187.311*	2.843	0.005
Orient	-102.268	-1.367	0.172
ViewHw	-229.866**	-2.190	0.029
ViewMount	390.095**	2.511	0.012
ViewSea	1368.619*	8.530	0.000
DUPLEX	588.540**	2.408	0.016
Adj. <i>R</i> <sup>2</sup>	0.745		
<i>F</i> -value	231.950		

\*, \*\* indicate significant at 1% and 5% levels, respectively.

A duplex unit can enhance the living standard of the end user due to the protection of privacy among users through the separation of spaces into two floors. In addition, the property owner can enjoy the prestige value of the duplex unit because of the limited supply of these units in the market. The result shows that the quality of housing property in terms of prestige and living standard seems to be playing an important role in buyers' decisions on purchasing a property. As duplex units are now well recognized housing units with these attributes, potential property buyers may be willing to pay a premium for these special housing units that enhance their prestige level and living standard.

All the other explanatory variables (except Orient) incorporated into the model are also statistically significant. The coefficient of 3.229 of Flat-Size suggests a positive relationship between the saleable area (excluding flat roof area) and the property value per square feet. Buyers are willing to pay a higher price as they can enjoy a larger living space. It reveals that a property with a larger perimeter and larger living area naturally tend to appreciate more rapidly (Cebula 2009). The result is consistent with previous research works (e.g., Mok *et al.* 1995; So *et al.* 1997; Chau *et al.* 2003). Variable FlatRoof is also found to be highly significant (*t*-statistics of 3.734 and *p*-value of 0.000) with the coefficient of 4.056. This indicates that potential property buyers value a flat roof area as part of the property and are willing to pay \$4.056 for every 1 square foot of flat roof area. In other words, every 1 sq. ft. of flat roof area causes the property price (per saleable area) (excluding flat roof area) to increase by \$4.056. The positive relationship is obvious since the property price per saleable area by definition excludes the flat roof area. With a bigger flat roof size, the property

owner can enjoy a larger open space for leisure and recreational activities, for example barbecue, resting, feeding pets, etc. Hence, the purchasers are willing to pay a premium for the added benefit of a flat roof area.

The negative coefficient of age (-45.506) implies a negative correlation between building age and property price (per square feet) with a rate of \$45.506/sq. ft. per year. The estimate is significant at 5% level with *t*-statistics of -6.948 and *p*-value of 0.000. This finding is consistent with Mok *et al.* (1995) and Choy *et al.* (2007) and Coulson and Lahr (2005). The age of a building is expected to link negatively with the property value as the building structure deteriorates physically with time. Potential buyers obviously pay only lower prices for older buildings as structural defects are generally found in aged properties requiring significant maintenance, so buyers pay only lower prices.

The coefficient of Floor has a positive sign with a value of 187.311, which means that the higher the floor level of the property is located, the higher the property price per square feet with a rate of \$187.311. for each successive floor level. The result is significant at 5% level with *t*-statistics of 2.843 and *p*-value of 0.005. This suggests that the buyers are willing to pay more (\$187.31 per square foot) for a unit at higher level to enjoy the better view and the cleaner air. Generally, higher level units enjoy cleaner air and better view, and fewer mosquitoes, compared with properties located at lower floor levels and this is totally true in Hong Kong. The result is in line with previous researchers such as Mok *et al.* (1995), So *et al.* (1997) and Chau *et al.* (2003).

Property buyers treat 'orientation' as a key factor when purchasing a property in Hong Kong. The reason being that the West direction is normally considered as the worst orientation because units facing West would be a lot warmer in summer, whilst on the other hand; units facing South direction would enjoy a better ventilation (airflow) and better natural lighting. However, the results do not support this view. The variable Orient is found to be insignificant even though it bears the expected negative sign. This suggests that buyers do not take orientation into serious considerations in purchasing properties. The reason may be partly because some blocks in selected residential estates, for instance Heng Fa Chuen, are surrounded by other blocks of building or mountain and thus have a less exposure to excessive sunlight. The obstruction of sunlight may somehow reduce the negative impact on some of the units.

The view factor is another significant element in Hong Kong that influences purchasing decision of a property (see for example, Mok *et al.* 1995). Sea view is considered as the best, followed by the mountain view for many property buyers whilst units having high-way view or obstruction with adjacent buildings and structures are considered negatively. Findings of the model support this view. The negative coefficient ( $-229.866$ ) of ViewHw indicates that the possession of a highway or railway view lowers the property price (per sq. ft.) significantly. The result is significant at 5% level with  $t$ -statistics of  $-2.190$  and  $p$ -value of  $0.029$ . It is obvious that traffic noise and air pollution arising from the highway or railway cause an undesirable living environment to the end user leading to discounts in the property value. This finding is also in line with previous works (e.g., Nelson 1982; Theebe 2004; Brandt, Maennig 2011). On the other hand, the positive coefficient of ViewMount suggests that possession of a mountain view enhances property price (per square foot). It is obvious that the tenants would appreciate a mountain view (compared to a highway or buildings view) as it is pleasing to have a green view to the eye of the end user, and hence they are willing to pay a higher price for such properties. The most appreciated view by the buyers is the sea view; and, this is very clearly reflected through the result. Highly significant positive coefficient ( $1358.619$ ) of ViewSea indicates that the possession of a sea view would increase the property price dramatically, by  $\$1358.619/\text{sq.ft.}$  Potential buyers would be willing to pay a larger premium if the unit possesses a sea view as the sea view can yield more satisfaction to the end users with a better living environment. The estimate is significant result at 1% level with  $t$ -statistics of  $8.530$  and  $p$ -value of  $0.000$ . This finding is also consistent with previous studies (e.g., Mok *et al.* 1995; Choy *et al.* 2007).

All these physical and locational attributes have been well documented in the literature with regard to the housing price. For example, floor area of the unit (Cebula 2009; Neill *et al.* 2007;

Table 4. Summary of descriptive statistics (*Model 2*)

Variable	Mean	STD	Min	Max
Price	8852.52	2555.75	3608.00	21426.00
FlatSize	852.41	295.64	518.00	1654.00
FlatRoof	100.01	177.25	0.00	541.00
AGE	14.17	8.55	0.00	32.58
AgeSq	273.88	269.01	0.00	1061.51
Floor	32.85	6.57	0.25	42.00

Sirmans *et al.* 2005; Coulson, Lahr 2005; Chau *et al.* 2003; So *et al.* 1997; Mok *et al.* 1995), age (Choy *et al.* 2007; Neill *et al.* 2007; Coulson, Lahr 2005; Sirmans *et al.* 2005; Mok *et al.* 1995), floor (Jayantha, Wan 2012; Chau *et al.* 2003; So *et al.* 1997; Mok *et al.* 1995), orientation (Jayantha, Wan 2012), view (Brandt, Maennig 2011; Theebe 2004; Mok *et al.* 1995; Nelson 1982).

#### 4.2. Results of model 2 (Adjoining flat)

Descriptive statistics of the data series for the model are summarized in Table 4. The empirical estimates of variables of the model 2, including  $t$ -statistics and other measures are shown in Table 5. The adjusted  $R^2$  ( $0.81$ ) suggest that 81 percent of the total variation of housing price (for saleable area) can be explained by the attributes of the model, meaning that it has a very high explanatory power. Again, as in model 1, all the explanatory variables (excluding Orient) are found to be significant at conventional levels. The  $F$ -statistic value of  $266.09$  indicates that the overall model performs very well and all the selected explanatory variables are jointly statistically significant.

The main emphasis of the model is on ADJOIN, which represents the special housing units (adjoining flats). As in model 1, it is found that variable ADJOIN (special unit) is highly significant and bears the expected positive sign. The estimated coefficient of ADJOIN is  $934.079$ , which is much larger than (estimates for DUPLEX) that of in model 1. The  $t$ -statistic ( $2.513$ ) along with  $0.012$  of corresponding  $p$ -value indicates that the ADJOIN variable is highly significant. Thus this variable

Table 5. Coefficients of the model 1 (*Adjoining*)

Variable	Coefficient	$t$ -statistic	Sig.
Constant	1786.530*	1.854	0.064
FlatSize	2.690*	5.376	0.000
FlatRoof	4.469*	4.442	0.000
AGE	$-56.700^*$	$-2.833$	0.005
AgeSq	1.538*	2.618	0.009
Floor	110.119*	4.763	0.000
Orient	$-101.477$	$-0.999$	0.318
ViewOpen	596.154*	3.226	0.001
ViewMount	338.198**	1.977	0.048
ViewSea	1040.848*	6.207	0.000
ADJOIN	934.079*	2.513	0.012
Adj. $R^2$	0.810		
$F$ -value	266.086		

\*, \*\* indicate significant at 1% and 5% level, respectively.

exerts a strong positive impact on residential property price. The coefficient of 934.079 suggests that a property being an adjoining flat can add value and raise the property price by \$934.079 per square feet. Put differently, potential buyers are willing to pay \$934.079 more per square feet if it is an adjoining property unit. This means if a residential building is with adjoining flats, the value of the other normal units in the residential property also increases significantly. Adjoining flats by their nature improve the living standard of the end user due to a wider view and extensive enlargement of floor spaces. In addition, great prestige feeling value that potential buyers have living in such a unit encourages them to pay extra money for the property being an adjoining flat. This finding is in line with the results obtained from model 1. The findings of both models indicate that potential property purchasers value special units (Duplex units and Adjoining flats) and are ready to pay an extra amount of money for them. This is very much in line with findings of some of the previous studies. For example, Cebula (2009), Coulson and Lahr (2005) and Sirmans *et al.* (2005) find out that desirable internal luxury housing attributes such as courtyards, number of bedrooms and bathrooms, stories in structure, garage car spaces, square footage, the presence of a deck, a pool/hot-tub, etc. are positively related with the real housing price. These special units (Duplex units and Adjoining flats) possess all these housing attributes. Similar to model 1, all the other variables (except *Orient*), are also found to be highly significant, implying the fitness of the model.

#### 4.3. Difference in magnitudes of price effect between Model 1 and Model 2

In an attempt to compare these two models, the magnitudes of price effects between these two cases are analyzed in this section. Models 1 and 2 clearly indicate that potential buyers value special units (Duplex units and Adjoining flats) and are ready to pay a premium for them. Both models also show that special units exert a clear positive impact on property price.

The empirical results summarized in Table 6 clearly show that the coefficients of special units in

Table 6. Comparison of coefficients of special units (*Duplex and Adjoining*)

	Coefficient	<i>t</i> -statistic	Sig.
Model 1 (Duplex)	588.540	2.408	0.016
Model 2 (Adjoining)	934.079	2.513	0.012

both models are highly significant. This suggests that potential property buyers are happy to pay an extra amount over and above typical units (a premium) for special units: duplex units and adjoining flats. Potential buyers normally tend to appreciate and value a better living environment, and hence are willing to pay a higher premium for these units. However, the magnitude of coefficient of ADJOIN is much larger than that in DUPLEX: 588.054 and 934.079, respectively. That means potential buyers are willing to pay a higher premium for adjoining flats compared to duplex units: a premium of HK\$934/ft<sup>2</sup> compared to HK\$588/ft<sup>2</sup>. In other words, a property being an adjoining flat can add more value (i.e. HK\$346/ft<sup>2</sup>) to the property price compared with being a duplex unit. The result indicates that buyers prefer an adjoining flat than duplex unit. It can be therefore concluded from the empirical results that an adjoining flat has a greater positive impact on the property price and is more preferred by homeowners in Hong Kong compared with duplex unit. This situation could be explained this way.

Though duplex units enhance the prestige image and provide a house-like feeling for the owners, it also has some disadvantages for the users. Duplex units normally comprise of two stories with a stair case, and staircase occupied some floor spaces of the unit. However, adjoining flats do not have this disadvantage. Also, older people may not feel safe in climbing stairs, so adjoining floor space would be safer and preferable. On the other hand, adjoining flats enhance the floor space usage and also possess a broader view. Thus, investors specially consider adjoining flats as a good investment.

## 5. SUMMARY AND CONCLUSIONS

The study aimed to investigate the buyers' preference for special housing units (duplex units and adjoining flats), and to examine the effects of these special housing units on property prices. This research issue was investigated by adopting two models (cases). The empirical results suggest that special units can add value and raise the property price significantly. Potential buyers are willing to pay HK\$588/ft<sup>2</sup> and HK\$934/ft<sup>2</sup> more for a duplex unit and an adjoining property unit, respectively. In other words, the findings suggest that potential buyers are willing to pay a larger premium for special housing units. For example, one may be willing to pay HK\$ 588,000 (model 1) and HK\$ 934,000 (model 2) more on a duplex unit and

adjoining flat, respectively, with floor area of 1000 square feet. The results also suggest that potential buyers are willing to pay a higher premium for adjoining flats compared to duplex units. In other words, a property being an adjoining flat can add more value (i.e. HK\$346/ft<sup>2</sup>) to the property price compared with it being a duplex unit. This also means if a residential building is with both types of special units (duplex and adjoining flats), the value of the other normal units in the residential property also increases significantly.

The findings can be used to draw several conclusions. First, special units, and in particular, *adjoining flats*, can be seen as a good marketing prospect for property developers. As more and more buyers now tend to embrace quality sustainable housing attributes, these special units will enhance the marketability of their portfolios. These special units with good quality and a healthy living environment make potential buyers pay more for these special units that in turn increases the seller's profit margins. Thus, increasingly, developers may tend to incorporate special units into their new developments.

Second, these special housing units are also attractive to the potential buyers in the secondary property market. For example, these special residential buildings with special units with green features may be the de-facto standard for refurbished as well as for brand new properties in the future. These units, enhancing the feeling of an environmentally- friendly lifestyle, provide a better and attractive icon to the property in the mind of the potential home buyers. Therefore, this can significantly improve their competitiveness (over the others) and their marketability, commanding a better price for the property, in the second-hand market.

These findings prompt some important implications. For policy decision makers, in particular for homebuilders, the findings of this research may help to better understand market needs for upper and high income categories and the strength of the market to exploit the tastes of these special units with special environmental concerns in investment decisions. Although developers have to spend more for constructing special units, they recognize that increasing public awareness of these special units with sustainability attributes is indeed a business opportunity for them.

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## REFERENCES

- Ando, A.; Modigliani, F. 1963. The "life-cycle" hypothesis of saving: aggregate implications and tests, *American Economic Review* 53(1): 55–84.
- Arnott, R. 1987. Economic theory and housing, in Mills, E. S. (Ed.). *Handbook regional and urban economics*, vol. 2: Urban economics. Amsterdam: Elsevier.
- Benjamin, J. D.; Chinloy, P.; Jug, G. D. 2004. Real estate versus financial wealth in consumption, *Journal of Real Estate Finance and Economics* 29(3): 341–354. <http://dx.doi.org/10.1023/B:REAL.0000036677.42950.98>
- Benson, E. D.; Hansen, J. L.; Schwartz, A. L. Jr.; Smersh, G. T. 1998. Pricing residential amenities: the value of a view, *Journal of Real Estate Finance and Economics* 16(1): 55–73. <http://dx.doi.org/10.1023/A:1007785315925>
- Bian, Y.; Logan, J.; Lu, H. 1997. Working units and the co modification of housing: observations on the transition to a market economy with Chinese characteristics, *Social Sciences in China* 18(4): 28–35.
- Bolitzer, B.; Netusil, N. R. 2000. The impact of open spaces on property values in Portland, Oregon, *Journal of Environment Management* 59: 185–193. <http://dx.doi.org/10.1006/jema.2000.0351>
- Brandt, S.; Maennig, W. 2011. Road noise exposure and residential property prices: evidence from Hamburg, *Transportation Research Part D: Transport and Environment* 16(1): 23–30. <http://dx.doi.org/10.1016/j.trd.2010.07.008>
- Case, K. E.; Quigley, J. M.; Shiller, R. J. 2001. Comparing wealth effects: the stock market versus the housing market, *Working paper* 8606. Cambridge MA: National Bureau of Economic Research.
- Cebula, R. J. 2009. The hedonic pricing model applied to the housing market of the city of Savannah and its Savannah historic landmark district, *The Review of Regional Studies* 39(1): 9–22.
- Centaline Property Agency. 2009. [Online]. Available at: <http://hk.centanet.com/icms/template.aspx?series=222 &article=21241> [accessed 22 November 2011]
- Chau, K. W.; Leung, A. Y. T.; Yiu, E. C. Y.; Wong, K. S. K. 2003. Estimating the value enhancement effects of refurbishment, *Property Management* 21(1/2): 13–19. <http://dx.doi.org/10.1108/02632770310460504>
- Chau, K. W.; Wong, S. K.; Yiu, C. Y. 2004. The value of provision of a balcony in apartments in Hong Kong, *Property Management* 22(3/4): 250–266. <http://dx.doi.org/10.1108/02637470410545020>
- Cheung, U. S. L.; Yau, K. K. W.; Hui, Y. V. 2004. The effects of attributes on the repeat sales pattern of residential property in Hong Kong, *Journal of Real*

- Estate Finance and Economics* 29(3): 321–329. <http://dx.doi.org/10.1023/B:REAL.0000036676.76741.90>
- Chiang, Y. H.; Ganesan, S. 1996. Property investment in Hong Kong, *Journal of Real Estate Portfolio Management* 2: 141–158.
- Chow, P. M. K. 2008. *Ricacorp Properties Limited* [online]. Available at: <http://www.hk-pub.com/forum/thread-1347704-1-35.html> [accessed 22 November 2011]
- Choy, L. H. T.; Mak, S. W. K.; Ho, W. K. O. 2007. Modeling Hong Kong real estate prices, *Journal of Housing and the Built Environment* 22: 359–368. <http://dx.doi.org/10.1007/s10901-007-9089-2>
- Clark, W. A. V.; Deurloo, M. C.; Dieleman, F. M. 1994. Tenure changes in the context of micro-level family and macro-level economics shifts, *Urban Studies* 31(1): 137–154. <http://dx.doi.org/10.1080/00420989420080081>
- Clark, W. A. V.; Drever, A. 2000. Residential mobility in a constrained market: implications for ethnic population in Germany, *Environment and Planning A* 32: 833–846. <http://dx.doi.org/10.1068/a3222>
- Coulson, N. E.; Lahr, M. L. 2005. Gracing the land of Elvis and Beale street: historic designation and property values in Memphis, *Real Estate Economics* 33(3): 487–507. <http://dx.doi.org/10.1111/j.1540-6229.2005.00127.x>
- Davies, N.; Jokiniemi, E. 2008. *Dictionary of architecture and building construction*. Oxford: Elsevier Ltd.
- Davies, R. B.; Pickles, A. R. 1985. A panel study of life-cycle effects in residential mobility, *Geographical Analysis* 7: 199–216. <http://dx.doi.org/10.1111/j.1538-4632.1985.tb00841.x>
- Deurloo, M. C.; Clark, W. A. V.; Dieleman, F. M. 1994. The move to housing ownership in temporal and regional contexts, *Environment and Planning A* 26: 1659–1670. <http://dx.doi.org/10.1068/a261659>
- Deurloo, M. C.; Dieleman, F. M.; Clark, W. A. V. 1987. Tenure choice in Dutch housing market, *Environment and Planning A* 19: 763–781. <http://dx.doi.org/10.1068/a190763>
- Dudley Surveyors Limited. 2010. [Online]. Available at: [http://blog.yahoo.com/\\_XZJPFQTEFIDTTJK5VXPCZHMWNY/articles/102396](http://blog.yahoo.com/_XZJPFQTEFIDTTJK5VXPCZHMWNY/articles/102396) [accessed 22 November 2011]
- Elliott, J. W. 1980. Wealth and wealth proxies in a permanent income model, *Quarterly Journal of Economics* 95: 509–535. <http://dx.doi.org/10.2307/1885091>
- Engelhardt, G. V. 1996. House prices and home owner saving behavior, *Regional Science and Urban Economics* 26: 313–336. [http://dx.doi.org/10.1016/0166-0462\(95\)02118-3](http://dx.doi.org/10.1016/0166-0462(95)02118-3)
- Fong, P. K. M. 2009. Press release by Centaline Property Ltd. [online]. Available at: <http://hk.centanet.com/icms/print.aspx?series=226&article=21638> [accessed 22 November 2011]
- Freeman, A. M. 1979. The hedonic price approach to measuring demand for neighbourhood characteristics, in Segal, D. (Ed.). *Studies in urban economics*. New York: Academic Press, 52–77.
- Fu, Y.; Tse, D. K.; Zhou, N. 2000. Housing choice behaviour in urban workers in China's transition to a housing market, *Journal of Urban Economics* 47(1): 61–87. <http://dx.doi.org/10.1006/juec.1999.2133>
- Gomez, S. 2008. *Is the client willing to pay to occupy a greener building?*, CB Richard Ellis (May 2008).
- Henderson, J. V.; Ioannides, Y. M. 1985. Tenure choice and the demand for housing, *Economica* 53: 231–246. <http://dx.doi.org/10.2307/2553951>
- Henderson, J. V.; Ioannides, Y. M. 1987. Owner occupancy: investment vs consumption demand, *Journal of Urban Economics* 21: 228–241. [http://dx.doi.org/10.1016/0094-1190\(87\)90016-7](http://dx.doi.org/10.1016/0094-1190(87)90016-7)
- Hoynes, H. W.; McFadden, D. L. 1997. The impact of demographics on housing and nonhousing wealth in the United States, in Hurd, M. D.; Naohiro, Y. (Ed.). *The economic effects of aging in the US and Japan*. Chicago: University of Chicago Press for NBER, 153–194.
- Huang, Y. 2003a. A room of one's own: housing consumption and residential crowding in transitional urban China, *Environment and Planning A* 35: 591–614. <http://dx.doi.org/10.1068/a35119>
- Huang, Y. 2003b. Renters' housing behavior in transitional urban China, *Housing Studies* 18(1): 103–126. <http://dx.doi.org/10.1080/0267303032000076867>
- Huang, Y.; Clark, W. A. V. 2002. Housing tenure choice in transitional urban China: a multilevel analysis, *Urban Studies* 39: 7–32. <http://dx.doi.org/10.1080/00420980220099041>
- Hui, E. C. M.; Lau, H. T.; Khan, H. T. 2011. Effect of property management on property price: a case study in HK, *Facilities* 29(11/12): 459–471. <http://dx.doi.org/10.1108/026327711111157132>
- Hurst, E.; Stafford, F. 2002. *Home is where the equity is: liquidity constraints, refinancing and consumption*, Mimeo, University of Chicago.
- Hutchison Whampoa Limited. 2011. *South horizons* [online]. Available at: [http://www.hutchison-whampoa.com/eng/property/property\\_development/hk.htm](http://www.hutchison-whampoa.com/eng/property/property_development/hk.htm) [accessed 28 November 2011]
- Jayantha, W. M.; Wan, S. M. 2012. Effect of green labelling on residential property price: a case study in Hong Kong, *Journal of Facilities Management* 11(1): 31–51. <http://dx.doi.org/10.1108/14725961311301457>
- Kendig, H. L. 1984. Housing careers, life cycle and residential mobility: implications for the housing market, *Urban Studies* 21: 271–283. <http://dx.doi.org/10.1080/00420988420080541>
- Lam, P. L. 2007. *Advanced level macroeconomics*. 5<sup>th</sup> ed. Macmillan New Asia Publishers Limited.
- Li, S. 2000a. Housing consumption in urban China: a comparative study of Beijing and Guangzhou, *Environment and Planning A* 32: 1115–1134. <http://dx.doi.org/10.1068/a32145>
- Li, S. 2000b. The housing market and tenure decision in Chinese cities: a multivariate analysis of the case of Guangzhou, *Housing Studies* 15: 213–236. <http://dx.doi.org/10.1080/02673030082360>
- Logan, J. R.; Bian, Y.; Bian, F. 1999. Housing inequality in urban China in the 1990s, *International Journal of Urban and Regional Research* 23(1): 7–26. <http://dx.doi.org/10.1111/1468-2427.00176>

- Logan, J.; Bian, F.; Bian, Y. 1998. Tradition and change in the urban Chinese family: the case of living arrangements, *Social Forces* 76: 852–882. <http://dx.doi.org/10.1093/sf/76.3.851>
- Mass Transit Railway Corporation Limited (MTRC Ltd.). 2011. *Heng Fa Chuen* [online]. Available at: [http://www.mtr.com.hk/eng/properties/urban\\_lines\\_hengfachuen.html](http://www.mtr.com.hk/eng/properties/urban_lines_hengfachuen.html) [accessed 27 November 2011]
- Mayer, C. J.; Englehardt, G. V. 1996. Gifts, downpayments, and housing affordability, *Journal of Housing Research* 7(1): 59–77.
- McCarthy, K. 1976. The household life cycle and housing choices, *Papers of the Regional Science Association* 37: 55–80. <http://dx.doi.org/10.1007/BF01941422>
- Mok, H. M. K.; Chan, P. P. K.; Cho, Y. S. 1995. A hedonic price model for private properties in Hong Kong, *Journal of Real Estate Finance and Economics* 10: 37–48. <http://dx.doi.org/10.1007/BF01099610>
- Myers, D.; Baer, W. C. 1996. The changing problem of overcrowded housing, *Journal of American Planning Association* 62(1): 66–84. <http://dx.doi.org/10.1080/01944369608975671>
- Myers, D.; Choi, S. Y. 1992. Growing in overcrowded housing: a comparison of the states, *Applied Demography* 57: 1–4.
- Neill, H. R.; David, H. M.; Djeto, D. A. 2007. Estimating the effect of air quality: spatial versus traditional hedonic price models, *Southern Economic Journal* 73(4): 1088–1111. <http://dx.doi.org/10.2307/20111943>
- Nelson, J. P. 1982. Highway noise and property values, *Journal of Transport Economics and Policy*: 117–138.
- Pigou, A. C. 1943. The classical stationary state, *Economic Journal* 53: 343–351. <http://dx.doi.org/10.2307/2226394>
- Plaut, S. E. 1987. The timing of housing tenure transition, *Journal of Urban Economics* 21: 312–322. [http://dx.doi.org/10.1016/0094-1190\(87\)90005-2](http://dx.doi.org/10.1016/0094-1190(87)90005-2)
- Rating and Valuation Department. 2011. *Monthly residential property price index* [online]. Available at: <http://www.rvd.gov.hk/en/publications/pro-review.htm> [accessed 5 February 2012]
- Ricacorp Properties Limited. 2011. [Online]. Available at: <http://www.ricacorp.com/cms/template.aspx?series=15&article=44527> [accessed 22 November 2012]
- Selim, S. 2008. Determinants of house prices in Turkey: a hedonic regression model, *Doğuş Üniversitesi Dergisi* 9(1): 65–76.
- Sirmans, G. S.; Macpherson, D. A.; Zietz, E. N. 2005. The composition of hedonic pricing models, *Journal of Real Estate Literature* 13(1): 1–14.
- So, H. M.; Tse, R. Y. C.; Ganesan, S. 1997. Estimating the influence of transport on house prices: evidence from Hong Kong, *Journal of Property Valuation & Investment* 15(1): 40–47. <http://dx.doi.org/10.1108/14635789710163793>
- Theebe, M. A. 2004. Planes, trains, and automobiles: the impact of traffic noise on house prices, *Journal of Real Estate Finance and Economics* 28(2/3): 209–234. <http://dx.doi.org/10.1023/B:REAL.0000011154.92682.4b>
- Tse, R. Y. C. 2002. Estimating neighbourhood effects in house price: towards a new hedonic model approach, *Urban Studies* 39(7): 1165–1180. <http://dx.doi.org/10.1080/00420980220135545>
- Tyrväinen, L.; Miettinen, A. 2000. Property prices and urban forest amenities, *Journal of Environment and Economic Management* 39: 205–223. <http://dx.doi.org/10.1006/jeem.1999.1097>
- Yiu, C. Y.; Wong, S. K. 2005. The effects of expected transport improvements on housing prices, *Urban Studies* 42(1): 113–125. <http://dx.doi.org/10.1080=0042098042000309720>
- Yu, Z. 2004. Heterogeneity and dynamics in China's emerging urban housing market: two sides of success story from the late 1990s, *Habitat International* 30(2): 277–304. <http://dx.doi.org/10.1080/0042098042000309720>
- Zarin, H. A.; Bujang, A. A. 1999. Factors influencing demand for condominium in Johor Bahru, Malaysia, in *International Real Estate Society Conference 1999 (IRESC '99)*, 26–30 January 1999, Mandarin Oriental, Kuala Lumpur.
- Zhang, Z. Q. 1999. The impact of housing privatization in China, *Environment and Planning B: Planning and Design* 26: 593–604. <http://dx.doi.org/10.1068/b260593>