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Other Contributor(s)	University of Hong Kong
Author(s)	Chan, Tin-lai, Mike; 陳天禮
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The University of Hong Kong

AN EMPIRICAL STUDY OF PROXIMITY EFFECT OF COMPREHENSIVE COMMERCIAL DEVELOPMENT ON ADJACENT PRIVATE RESIDENTIAL PROPERTY PRICE

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF REAL ESTATE AND CONSTRUCTION IN CANDIDACY FOR THE DEGREE OF BACHELOR OF SCIENCE IN SURVEYING

By

Chan Tin Lai Mike

Hong Kong

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Declaration

I declare that this dissertation represents my own words, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or any other institution for a degree, diploma or other qualification.

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Abstract

This dissertation aims to discover the proximity effect of a comprehensive commercial development on the adjacent private residential property prices. In Hong Kong, large commercial development is usually supported with retail and convenient transportation facilities and these can be defined as amenities which increase residential satisfaction. Hence, the author first assumed that locating at a smaller distance to the development will generate an increase in property price.

The case study chosen in this dissertation is the Cyber-Port development locating in Pok Fu Lam, Hong Kong. Due to the limited residential buildings situated next to the development, only the Baguio Villa is chosen as the residential properties under investigation. 946 transaction records were obtained from the whole private residential estate and two empirical analyses were carried out to test such proximity effect.

The findings indicate that proximity effect of the comprehensive development on property price is significantly positive after the completion of the project. The results suggested that the existence of new amenities due to the new development is a significant factor affecting the property price of residential properties. This study thus provides us with more understanding of the residential choice in Hong Kong. It also suggested that in consumers' eyes, the provision of new transportation and entertainment facilities will contribute to a higher amenity level of that property.

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Introduction

1.1 Background

As a city develops, population is generated and the demand for land and public services increases so as to accompany the citizens. This is also the case in Hong Kong where the population has nearly reached seven million and its population density has reached 6407(ppl/km^2)[1], being the place with the third highest population density in the world. Further more, the stock of permanent residential flats has also increased from 1933 to 2460 (thousands)[2] from 1996 to 2006. These show the increasing demand for residential housing in Hong Kong and this great demand in housing has attracted many researchers to investigate in the residential choice of citizens in this territory.

Residential housing acting as an enclosure for human activities is an essential component in every individual's life. It is an economic good where its value is affected by many different factors and most of these factors could be grouped into either locational, structural or neighborhood traits. These traits eventually affect the residential choice of consumers. Since this study aims to find out the proximity effect of a commercial development on adjacent property price, the main focusing area will be on the locational traits of a property.

To start with, it is not difficult to notice there is an observable phenomenon in the real world that the location traits of a property are a dominating factor which will greatly

[1] United Nations World Population Prospects (2004)
[2] Hong Kong Housing Authority (2006)

influence residential choice and its residential housing value. The term locational trait is defined as something associated with the locational characteristics of the property. The locational characteristics of a property can either affect property values in a positive or negative manner. For example, a property with a higher accessibility to economic and social facilities such as the CBD will usually have a higher residential value. And if the property is situated near the highway or railway line, it will have a lower residential value due to negative externality of noise.

In this study, the accessibility to amenities will be studied. In the past, the relationship between accessibility to desirable facilities or amenities and property prices is a common study area for scholars. But in fact the accessibility being investigated is in terms of travel distance but not in terms of walking distance. There has not been much research done in the past to investigate the effect of commercial development locating directly adjacent to residential properties on property prices except for Crafts (1998).

This study aims to follow the footsteps of Crafts (1998) which is to find out whether there are any effects on property prices due to adjacent commercial development. The impact on residential choice represented by the property prices throughout the different stages of the project will be investigated by using scientific methods instead of subject judgment obtained from questionnaires.

1.2 Objectives

The objectives of this research include:

- To review the literature on the choice of living in Hong Kong and the effect of proximity to amenities on property prices.
- To examine how a large scale commercial project (in this case, the Cyber-Port development) affects the adjacent residential property price throughout the whole development period.
- To discuss the implications of the results obtained.

1.3 Methodology

The development of the Cyber-Port has introduced new amenities to the surrounding areas and this may have caused some shocked impact on the property prices of the surroundings residential areas. The existence of this impact on property price can be proved or quantify by means of empirical models such as the hedonic pricing model established by Rosen (1974) or the repeat sales model established by Bailey, Muth and Nourse (1963).

The impact on adjacent property prices caused by the new development will be analyzed through studying the changes in the implicit prices of the residential properties, in this case, the properties of Baguio Villa during the announcement, construction and completion stages.

Transaction data of Baguio Villa will be collected from a database source and through conducting site visits, hence the quality of the data can be assured. The required statistics for interpretation could then be generated by a statistical program E-views, and a clear picture of the impact of Cyber-port on adjacent property prices can be seen.

1.4 Structure of the study

This section will briefly introduce the whole outline of the study. There are totally 7 chapters and 4 appendices in this dissertation.

Chapter 2 of this study will give a review on some relevant past literatures. These past literatures form the foundation of the study since the hypothesis is derived from them. Also, by reviewing the empirical studies on topics relating to property price, a suitable, useful and similar methodology can be adopted which will strengthen the reliability of the outcomes in this study.

Chapter 3 of the study will give a background study of the target development Cyber-port. The location of the development, the historical development of the site and the facilities of the development will be introduced to give the reader a better understanding of that neighborhood in Hong Kong and this case study.

Chapter 4 of the study will give a background study of the target residential property estate Baguio Villa, such as the number of units and the irregularity of the estate. Similar to Chapter 3, this chapter could give the reader a better understanding of the study.

Chapter 5 of the study will be the methodology of the study. The details of the type of analysis method used will be introduced. Also, the details of the hedonic pricing model such as the criteria of choosing the suitable types of variables, the data collection process, the expectation of the results as well as the way to interpret the statistical results will be discussed in detail so as to elaborate the rationale of this study.

Chapter 6 will presents the results of the two models used in this study. The statistical results will be interpreted and will be compared with the expected results given in the previous chapter. Then, some implications of this study will be discussed.

Chapter 7 will be the last chapter of this study which reviews the whole process of the study starting from the point of hypothesis development. Then, there will be a conclusion for the findings of this study. This study will end after the part stating the limitation of this study and the areas for further study.

For appendices 1 and 2, they will include the statistical details of the regression model for the repeat sales analysis. For appendix 3, it will include the photos of Cyber-port throughout the whole investigation timeline and also the photos of the residential estate Baguio Villa. For appendix 4, it will include a brief comparison between this study and Crafts(1998). The details of Crafts study will be introduced in the literature review.

Chapter 2
Literature Review

2.1 Introduction

Housing property can be regarded as one of the most valuable assets for home owners in Hong Kong due to the expensive cost of owning it. With such a large population compared to its small land area[3], the nature of housing property in Hong Kong which comprises of high rise development structures (large scale private/public estates) differs greatly from those of other countries (detached and semi-detached houses). Real estate is extremely important in many aspects. Firstly, as capital gain is not taxable in Hong Kong, housing properties are frequently used as a shelter together as an investment tool by home owners. On the other hand, real estate is also important to Hong Kong's economy and banking sector as many of the large listed companies are developers[4] and over 50% of loans made by banks are to the real estate sector. All these issues reflect that the housing market in Hong Kong is complex which has attracted series of researches done on different aspects relating to this field in the past.

The aim of this dissertation is to investigate the effects of the Cyber-port development to a large private residential estate in Pok Fu Lam. In this chapter, literatures focusing on the living environment in Hong Kong, the hedonic pricing model, the repeat sales model, the determinants of housing property price and other related literatures will be reviewed and some of them will be used as references to this study.

[3] Hong Kong's total land area is 1104km^2 according to Census and Statistics Department, HKSAR
[4] Cheung Kong Holdings, Sun Hung Kai Properties, Henderson Land and Swire Properties Ltd etc

2.2 The choice of living in Hong Kong

This part relates to Hong Kong residents' taste of living. It is essential to discover the choice of living by home buyers when deciding whether an attribute will influence their willingness to pay for a property. As this dissertation is concerned with the accessibility of commercial and community facilities brought by Cyber-port to its neighborhood, studies related to it will be reviewed.

2.2.1 Development of large scale private residential estate in Hong Kong

In Hong Kong, the emergence of large scale residential developments starting from the 1960's have greatly changed the style and quality in living of residents. Lee (1987) studied the development of large scale residential estates in Hong Kong and mentioned that the dense urban form and the development of large private residential estates in Hong Kong could be explained by the changing mode of production within the territory during the late 1950's and early 1960's. The economic transformation[5] during that time led to an increase in numbers of factories' operators, professionals and traders. Also, there was an increase on average wages of the workers. The result was that the number of middle class rose significantly, combining with the influences of foreign culture and ideas, there was a changed in their choice of living. They have a greater desire to live in higher quality housing at that time.

To capture this demand from the middle incomers, the first large scale private residential estate Mei Foo Sun Chuen was built in Lai Chi Kok of Kowloon in stages during 1965 to

[5] In the early days, Hong Kong specialized on entreport trade due to its geographical advantage It successfully transformed its core industry from entreport trade into export-oriented manufacturing industry during the early 60's.

1978. Mei Foo Sun Chuen is a symbol of early development of private estates. It is capable of being self-contained that cinemas, shopping centres and recreational open spaces could be found within the estates.

Since then more of these large scale residential development were built to cope with the demand from the rising middle class. As comprehensive large scale residential development generally [6] provides more community, commercial, transportation and recreational facilities, the demand of large scale development from the public actually reflected the increasing demand for greater accessibility to community facilities.

Huang (1996) established the willingness of home owners to live in estate-type housing, by including a variable "Estate" in his study to model the influence on property price due to the various amenities inherent in estate type development. According to him, premium is paid for the housing estate flats but not in single block developments. It is because estate type development allows careful overall planning to deal with combination of block relationships, views, flat size, pedestrian movement, provision of facilities and landscaped space.

2.2.2 Amenity concept

Community facilities can be regarded as a kind of tangible amenity which enhanced the attractiveness of a housing estate. Therefore, before talking about the essential of community facilities, it is important to understand the concept of amenity.

[6] Not all private residential estates are equipped with advanced provision of facilities, for example, Baguio Villa and Nam Fung Sun Cheun provides only limited provisions in facilities.

Amenity can be anything which provides tangible or intangible benefits to a property which affects household satisfaction. Edward (1954) defined amenities as something contributing to a pleasant living conditions. Amenities yield utility. Although it could not be trade directly in the market and there is no observable price label on the amenity, it affects the choice of individual consumers. Similar to other goods, the consumer's marginal willingness to pay for amenities depends on whether there are any close substitutes, the consumer's income or the tastes of the consumers for example, the household formation (Diamond and Trolley, 1982).

Diamond and Trolley (1982)'s study focused on locational amenities which they mentioned that such may affects the personal security and health, leisure time, housing quality, child quality, and the opportunity facing the household for market consumptions activities. They defined amenity as locational-specific. In this sense, a good can only be defined as an amenity if both the demand and supply side of that good in the market are location-specific. On the other hand, the enjoyment of amenity is non-excludable. For example, the enjoyment of good air quality, views or local public services can be viewed as amenities as they are location-specific and their consumption can only be varied by moving into another location.

Homogeneous units at a price independent to the location for example food or steel are not classified as amenities. Usually there is a human agent behind who supplies the amenities of a given location except for those[7] produced by the God. But with the rapid development in technology, they could also be altered[8] nowadays.

[7] Examples are the natural weather, views and water routes
[8] Examples are Global warming due to the pollution and reclamation for extra land spaces.

Amenity can be something originally existing in nature; it could also be supplied by the government such as the construction of highways, hospitals and recreational areas in a particular location. The rise of the demand for better quality living has affected the value being placed on residential amenities. Nowadays, it is often the developer's job to meet the consumer's demand in providing these amenities including club-houses, sports facilities or cycle tracks within the estate.

As amenity yields utility, the existence of amenity will directly affect property values. Holcomb (1981) studying the urban renewal of a city pointed out that an absent of amenities will limit investment on properties which may constrain the growth of property values. In general, amenities can be categorized into tangible and intangible. Parks, swimming pools, clubhouse facilities, shopping centre and accessibility to CBD can be regarded as some kind of tangible amenities. On the other hand, views, low crime rates and orientation could serve as intangible amenities.

Many of the past researches focus on environmental amenity in their study. Most of them are positively correlated with property price. Nicholls and Crompto, (2005) evaluated the amenity effects of greenways, open space and Polasky and Adams (2000) evaluated the amenity effects of urban wetland on property prices. In their study, they also point out that the distance or the proximity to the amenity is an important factor to consider when we evaluate amenity effects. This is easy to understand as accessibly to the amenities directly affects the level of enjoyment of these amenities. It is surprising that in (Edward L. Ullman, 1954), it states that "Climate" in a region is also regarded as an environmental amenity which could accelerate the growth of population in that region by attracting immigration from adjacent states.

2.2.3 The need for facilities in self-containment residential unit

To valuate a property, not only the interior quality of the property is considered but also the service facilities provided within the residential area as supplement. Kain and Quigley (1970) illustrated the complexity of the housing market which a large amount of residential services were consumed by households. He specified that in the purchasing of housing, families jointly purchase a wide variety of services at a particular location which includes the accessibility to employment, a neighborhood environment and other diverse collection of public and quasipublic services. It is important that certain kind of community facilities should be included in housing estates and it does contribute to a pleasant living environment.

There was never a lack of commercial and community facilities within public housing estates in Hong Kong. Fung (1995) mentioned that the facilities planning in public housing estates have added colours to the living of the residents. The centralized retail and dispersed community facilities create a comfortable and pleasant environment physically and visually which also creates a sense of belong from the residents to the estates. Self-containment of each living unit is defined by him as the basic requirement for creating an acceptable living standard it enhances social interaction among members.

Different kinds of daily need services and facilities should be provided within the estate or neighborhood. Mak (2004) studied the benefits of modern high rise density and residential development in Hong Kong. He specified that if there is an absent of supporting services like daily food shopping, household goods, grocery, laundry shops,

locksmith, repair and renovation specialists, restaurants etc, residents of a community would need to travel to other places to satisfy their daily needs causing inconvenience.

He also mentioned that in the modern development concept which is the creation of Comprehensive development zones (CDA) a mix development of commercial, retail and residential is allowed which provides sufficient recreational facilities to the residents in that area could make the development "self-sustaining". This enhances economies of scale by mixing employment, residential, recreation and commercial in the same space. Also it will create a vibrant and lively atmosphere which could retain residents to stay within the site promoting a reduction on the time and cost of travel.

The application of this concept can be observed from different large scale residential estates in Hong Kong such as Kornhill, Tai Koo Shing and Han Fa Chuen which the estates are supported by different commercial facilities[9] . They all are capable of becoming "self-supporting" and thus are residential estates of high reputation on Hong Kong Island.

Facilities serving daily needs are also important to create housing satisfaction. Liu (1999) studied the factors on both physical and social levels in determining the major factors contributing to housing satisfaction which affect the residential satisfaction of a chosen sample in a residential area in Hong Kong. By regression analysis, she identified the major factors affecting the satisfaction of residents. The most worth noting thing is the convenience of location which represented the ease of accessing recreational and transportation facilities is one of the major factor which led to housing satisfaction. Liu

[9] Kornhill is supported by Jusco, Tai Koo Shing is supported by Tai Koo Plaza and Han Fa Chuen is supported by Han Fa Sun Shing.

(1999) suggested that developers should be aware of these indicators of satisfaction during the planning of these housing estates.

Besides developers, town planners also take an important role in satisfying the need of the residents. Talen (2003) studied "neighborhood" as services provider, addressed that planners should "promote settlement patterns which priority should be given to increasing accessibility between humans, their place of working and also the services they require." Accessibility is defined as the ease with which a resident can reach a given destination and ease is measured as the walking distance to a given destinations that are neighborhood in scale. He also urges that the physical design of cities and neighborhood affects the quality of life which in particular, affecting the access to facilities of the poor, children and those immobile.

2.2.4 Amenities as a way to create sense of community

Amenities, besides fulfilling physical satisfaction, are also important to the community life of the residents. The quality of a resident's community life is often determined by the ability of the living environment in creation of sense of community to the residents. Sense of community is define by McMillan and Chavis (1986) as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together." Thus, social interaction between the members in a community plays an important role in creation of sense of community. Kim and Kaplan (2003) also categorized sense of community into four domains- attachment, identity, social interaction and pedestrianism which communications among neighbors are essential in creating the four domains.

The availability of facilities enhances more social interaction among the residents in a community. Past research has examined the relationship between accessibility to local amenities such as shopping centers and parks, with the creation of a sense of community. Berry (1985) and Brower (1996) suggested that if a community has necessary services within the easy walking distances of the residents, a sense of community may be sensed. Bernick and Cervero (1997) on the other hand suggested that the efficiency of public transportation, i.e. whether workplaces and other community centers are reachable by public transportation, also enhances the creation of sense of community.

2.3 Studies on the relationship between distance to amenities and property prices

The previous section indicates that the existences of social and economical facilities are essential in creating a desirable living environment and it greatly affects residential choice of homebuyers. The distance to these facilities is very important when considering how well these facilities can be enjoyed by the residents as it affects the accessibility of these facilities. Past studies have shown that a good accessibility to desirable facilities will impose a positive impact on property prices.

2.3.1 Proximity to Shopping Centres

In modern days, shops providing different services and products are centrally localized in shopping centers. The accessibility to shopping centers determines whether an individual could easily obtain the demand services or products and thus affects the value of property prices.

Hung (1997) studied the effect of proximity to regional shopping centre on property prices in Tuen Mun New Town. In his study, he confirmed that the proximity effect of a regional shopping centre has a significant effect on modifying the property price. The time cost to travel to shopping centre increases as the distance between the property and the shopping centre increases. This increases in time cost to shopping centers will decreases the attractiveness of property and hence it could be reflected in the lower property price. This decrease in property prices was modeled inside his hedonic price model. A strong limitation in his study was that he assumed the LRT travel time as the reference of distance to the shopping centre hence there is a out of expectation result for the S30 variable as another faster way of transportation mini-bus is available there.

2.3.2 Proximity to transportation facilities

The existences of transportation facilities such as the Mass Transit Railway (MTR) station are likely to produce a positive effect on property prices as they can provide an effective way of transportation and thus shorten the time need to travel to other places.

For example, Choy et al (2007) estimated real estate prices from a Hong Kong perspective. By employing a hedonic pricing model, they concluded that a property lying closer to the mass transit railway station will command a price premium. Other transportation facilities such as bus stops or minibus stop will also yield premium to property prices as suggested by Tse and Ganesan (1996).

2.3.3 Proximity to Green features

The existences of green environmental features such as parks and forests are likely to produce a positive effect on property prices as they can provide screening and pollution control. Also, the distance to green features will affect the enhancement in value due to these features.

For example, Tyrvainen and Miettienen (1999) valued the implicitly non-priced urban forest amenities. In the study, by using the hedonic pricing model, they found out that for one kilometer increase in distance to the nearest forested area, there will be an average 5.9 percent decrease in the market price of the dwellings. Mahan et al (2000) estimated the value of wetland amenities in the Portland, Oregon, metropolitan area using the hedonic price model. They found out that by reducing the distance to the nearest wetland by 1,000 feet, an increased in property value by $436 was experienced.

2.4 Empirical model used in this study

In this study, to test the hypothesis, two empirical models will be introduced. They are the hedonic pricing model and the repeat sales model.

2.4.1 Hedonic Pricing Model

In this dissertation, the author would like to investigate the benefits which Cyberport have brought to the nearby properties. The properties nearby are actually composed of these additional benefits (improved transportation, provision of open areas, and proximity to

shopping centre) together with other housing traits. All of these housing traits are regarded as determinants of the property price. In the past, many previous researchers have developed different models to explain the change in property prices due to different housing traits. In their researches, they tried to identify different housing traits and they also tried to quantify them in their study by expressing its influence on property prices.

For example, Liisa and Antti (2000), Littik (2000) and Mahan, Polasky and Adams (2000) have developed models to value the environment amenities provided by parks, forest, open space and wetland. Also, Mok (1995), Mok et.al (1995) and Tse and Love (2000) have developed models to investigate the impact of different housing attributes to property prices in Hong Kong. The most common model they used in their researches papers is the Hedonic Pricing Model (HPM) developed by Rosen (1974) which it will again be used in this dissertation to determine Cyberport's influence to property price nearby.

The Hedonic pricing model is one of the most popular statistical models used to quantify the determinants of property prices. Chau (2003) has pointed out that this model is better than the mono-centric model developed by Alonso (1964) in determining property prices, as the fundamental results of the mono-centric model explained that the spatial distribution of land and housing prices are solely determined by the transportation costs to the Central Business District. In fact, housing price is not only a function of its proximity to the CBD but is actually a function of the different characteristics possesses by the property. Tse and Love (2000) and Chau (2003) both comment that " Housing property is a multi-dimensional commodity which is characterized by its durability, heterogeneity and spatial fixity." In this sense, Chau (2003) suggested that the hedonic pricing model

was thus more suitability introduced to model this differentiation of prices between properties.

The word "Hedonic" explained by Chau (2003) refers to the satisfaction deriving from the consumption of a good. The hedonic pricing model was first developed by Rosen (1974) based on the consumer theory. In Rosen's research he pointed out that a class of differentiated product is completely described by a vector of measured characteristics. This vector of measured characteristics (housing traits or attributes of property) yields consumer's utility and hence the consumer's value of a property. He defined Hedonic prices as the "implicit" prices of attributes and are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them. (Rosen, 1974).

In reality, consumers could not purchase individual characteristics alone. They could only purchase a package of characteristics possess by a single commodity. Hence the demand for a commodity is based on the attributes which it possesses. Similarly, housing prices are affected by the housing characteristics which it possesses. The total payment observed in the housing market is viewed as reflecting the sum of payments made from individual attributes in each implicit market (Linneman, 1982). Through implicit market models, the price of housing can be specify through a hedonic price function which the total payment of housing (V) can be expressed as a function of the vector of location specific triats (Z)

$$V=f(Z)$$

The hedonic pricing model thus provides a way to model the "implicit" but not the "explicit" price of each characteristic by regressing the price of the property to its characteristics or specific traits. It is a technique which helps to identify the influence on price of one factor among others (Henneberry 1998).

Linneman (1982) criticized the superb simplicity of the bid-rent residential location model developed by Alonso (1964). He mentioned that exclusive concentration upon access is a major shortcoming of the model. Then he demonstrated Rosen's model by a non-housing market example. Suppose a researcher at a supermarket is observing grocery shoppers with different bundles of grocery items due to different family size, income and other factors. If the researcher want to know the price of a 7-oz can of beans but he could not look at the price tag, he could still find out the price of it if he knows the total expenditures on grocery items (G). The total expenditures on grocery items is just the sum of all possible grocery items of Pi times the quantity of the items consumed Xi.

$$G=\sum_{I=1}^{N} PiXi$$

If the researcher can observe all of the quantity consumed (Xi), then the price of the 7 oz can of beans is simply the change in total grocery payments brought about by adding one 7 oz can of beans and holding the rest of the grocery items constant. Mathematically, this mean the partial derivative of G respect to X_{7oz} .

$$\delta G/\delta_{7oz}=P_{7oz}$$

By combining the two equations above and differentiating the hedonic function with respect to the item, the price of any items could be found. This example indicated an important nature of hedonic function. It measures only the prices but not the supply or demand functions.

The next question will be "What are the most common and important housing attributes included in previous researches?" In principle, Griliches, Z. (1971) suggested that during the construction of a hedonic price research, all relevant characteristics relating to the determination of market price should be considered and included. But in reality, this is impossible as there would be difficulty in obtaining all the relevant information in a good quality of all properties. On the other hand as suggested by Butler (1982), introducing too many characteristics could lead to the problem of muti-collinearity.

Thus, Butler (1982) suggested that only those attributes that are costly to produce and yield utility should be considered in the model. The housing attributes can be classified into three categories. They are the location(L), structural(S) and neighborhood(N) traits. Powe.et.al (1995) further categorizes the wide range of housing attributes into:

1. Structural characteristics including plot size, number of rooms, garage space, central heating, structural integrity: etc
2. Local socioeconomic and public sector characteristics including employment rate, racial composition, social conditions, wage differentials, quality of schools, local taxes etc.
3. Environmental and neighborhood characteristics including landscape, wildlife, tree cover, air quality, noise and water frontage etc.

4. Locational or accessibility characteristics including access to shopping centres, mainline rail links, major roads, urban centres etc.
5. Property rights or legal constraints regulating the use of the property

Thus according to Powe.et.al (1995), property prices can be empirically specified as:

$$Ph_0 = f(AM_i + ENV_i + Q_i + S_i + SE_i + Y_i)$$

Where PH_0 = the transaction price of the house

AM_i = a vector of local amenities(accessibility and locational variables)

ENV_i = a vector of the environmental amenities in the vicinity of the ith property

Q_i = the quarter of the year in which the ith property was purchased

S_i = a vector of the structural characteristics of the ith property

SE_i = a vector of variables describing the social-economic characteristics of the Ward containing the ith property

Y_i = the year in which the ith property was purchased

By this regression technique, the "implicit" price for each housing attributes, no matter the attribute is quantitative or qualitative in nature, can be derived from the regression coefficients while holding the other factors constant (Chau , 2003).

2.4.2 Repeat sales method

Since the accuracy of the result obtained from the hedonic pricing model is determine by the quality of the data obtained, the price index construction method will also be used to reaffirm the result.

Observing the change of different property prices indexes is a common method used during property price analysis. The most compromising index construction method as suggested by Palmquist, (1979) is the repeat sales model. The repeat sales method was first established by Bailey et.al. (1963) and was later refined by Palmquist (1979, 1982) and Case et al. (1987, 1989). By measuring the price of the same property in different period of time, the method captures the change in price between two or more sales of the same property. It could control the characteristics for different properties and hence it can be called as a "constant" quality price index.

There is one important assumption that should be noted before the construction of the repeat sales index. In the model, it is assumed that the property characteristics and their implicit prices do not change between the two points of transaction. (Chau et.al, 2003, Dombrow, 1997)

Similar to the hedonic pricing model, the construction of repeat sales index involve the use of the regression technique to estimate some unknown parameters. But unlike the hedonic pricing model, this approach eliminates the need of specifying the correct housing attributes or functional form. For the applicably of this method, since Hong Kong has a long history of high property transaction rate, many pairs of transaction pairs

could be generated in a short time and hence it becomes a desirable method for establishing a housing index.

The repeat sales method has a few shortcomings. Firstly, by discarding a large number of transaction will results in an insufficient use of data inside the repeat sales model (Case et al., 1991). Secondly, a sample selection basis may exist during the construction of the index (Meese et. al, 1997). Lastly, the negative age effect on property prices still exists but sometimes it is being ignored (Muth and Nourse, 1963).

The repeat sales method has practical applications in property price analysis and is sometimes used as a supplement to the hedonic pricing model. For example, Chau et. al. (2003) estimated the value enhancement effects of refurbishment. In the study, the repeat-sales approach is adopted as a cross-check for the results of the hedonic pricing model. Chau et. al. (2003) also stated the advantage of this approach is that the unchanged property attributes can be omitted so that the problem of arbitrarily defined sea views is avoided. The shortcoming of the hedonic pricing model could then be eliminated.

2.5 Property price determinants

Property price are affected by many factors and they can be group either as microeconomics or macroeconomics factor.

2.5.1 Mircroeconomics factors

According to Butler (1982), the major determinants of property values can be categorized into three types, they are the Location, Structural and Neighbourhood attributes.

2.5.1.1 Location attributes

The location or its accessibility to social and commercial facilities is one of the major factors to be considered during the purchase of a property. On the completions of new residential development, the first consideration for potential buyers is whether the location conveniences them or not. The developer will also advertise their development by amplifying the convenience of the supporting transportation system. In considering whether the location is convenient or not, the major thing to look at is its accessibility to the Central business district (CBD).

Many theories were developed, in the context of urban land economics in the last two centuries about property locations and land rent such as Ricardo (1817), Von Thunen (1826), Haig (1924), Ratcliff (1949) and Alonso (1964).

Most of the theories developed before the 19th century concentrated on the land rent of agricultural land as it was an agriculture society at that time. Thunen (1826) specified the concept of land rent and arrangement for agricultural land. Given the assumptions made in his research, he gave a conclusion that "concentric rings of regular formation will formed in the plain of the isolated state[10] around the town". Four rings are formed around

[10] "Isolated state" means the absence of external influences and the state is self sufficient

the market which different agricultural production will be carried out in each ring concerning the balance of transportation cost, commuting time, land rent and profit which maximize market efficiency of the different production activities.

Alonso (1964) focused on the relations of land values and land uses on agricultural, business and residential land and introduced the bid-rent[11] theory. He defined an individual who wishes to buy some land to live upon as "economic man" who he will wish to maximize his satisfaction by consuming goods he likes and avoiding those he dislikes. By mathematical derivation, he derived bid price curves of a individual which is a set of prices for land which he could pay at different distances from the centre of the city while a constant level of satisfaction could be enjoyed and he also recognized the importance of having a trade off between "commuting cost" which simply means transportation and time cost to travel to the CBD and "land rent or value". Land rent should be lower for places far from the city centre to offset the time and transportation cost. This is also true for business firm that the price of land should be lowered so as to compensate the loss in sales and increased operating costs of outward movement from the centre. (Alonso 1964)

Alonso (1964) also mentioned the effect of transportation improvement will have two effects. First it makes commuting easier and decreases the commuting time. Secondly it could make the commuting cost cheaper. These two effects will reduce the slope of the bid price curve. Having a more gently sloped bid-price curve will lowered the land price in the centre of a city and increasing the land price at the periphery of a city. This is

[11] Bid-rent simply means the value a consumer is willing to pay for different locations and distances from the CBD.

obvious as reducing transportation time and cost could help the individual living far from the centre to derive the same satisfaction than before the improvement is made. Although the theory developed by Alonso is quite straightforward and easy to understand, Schiller (2001) suggested that it is very complex to calculate the trade-off between transportation cost and land rent when different members in a household have different commuting cost.

Numerous of studies about the influence of transportation time and mode to property price were published in the past. Tse and Ganesan (1996) investigated effect on the property price due to the presence of different modes of public transportation services. He divided the impacts of transportation into four expects:

1. The availability of transport
2. “Commuting cost”
3. Travel time
4. Convenience of transport

They claimed that Hong Kong is heavily populated in a small area with concentrated economic activities in the CBD and limited road space, all of these will make up congestion which discourages the extensive use of private cars. Thus there is a high demand for public transportation from the citizen compared to other countries. They also pointed out that the usual approach of hedonic pricing model fails to control the difference in both structural and neighborhood quality. To solve that they choose a sample in Quarry Bay with similar location characteristics and income group which minimize the difference in both structural and neighborhood quality. They found out that

Minibus and MTR seems to be the most important mode of transportation to middle income people.

Craig et.al. (1998) investigated the effect of proximity to water and rail access on the value of antebellum farms. They found out that with access to navigable river and rail access, the values of farmland is enhanced and they concluded that substantial economic gain could be yield by having a better transportation system.

Chau and Ng (1998) explored the effects of improvement in public transportation to residential property price gradient. The public transportation improvement being investigated was the electrification of Kowloon Canton Railway provided by former KCRC[12]. The modernization of the railway system increased the operating capacity and also minimized the transportation time from sub-urban to urban areas. By examining the relative changes in transaction prices between Tai Po and Sha Tin during the investigation period, they concluded that the improvement in transportation shortens the commuting time needed to CBD between the two areas and thus reduced the price gradient between the two places.

Instead of just concerning the accessibility to facilities, Chau (2003), Mok et.al (1995) and Benson et.al. (1998) suggested that views of the property is also related to the location characteristics of the property and can be regarded as the location attributes of the property. Due to the urban form and high rise development nature in Hong Kong, the view of a flat is important in determining property prices. Even property developers allocate larger floor area for those flats having better views (Lai, 2007). By this, they

[12] KCRC and MTR were merged on 2nd December, 2007

could earn more profit as the unit price for flats with good view is higher than those without one.

Many researches were done in the past confirming that the presence of a good view will add value to a property. Rodriquez and Sirmans (1994) explained the importance of accurate valuing the "view" amenity by appraisers during the estimation of property values since little guidance was provided in the past of how to adjust property values for having a view. The views of lakes or golf courses were examined. By using multiple regression technique, they discovered that a good view will add 8% to the value of the house.

Inserting a generic view variable is not always appropriate as suggested by Benson et al (1998). They studied the effects of a variety of views to property price in a single family residential market. Data of property prices in Bellingham, Washington were collected. To deal with the quality of different views, the views were classified as full, superior partial, good partial and poor partial. The premium of Ocean, Lake and snow-covered views to dwellings prices were investigated. By using a log-linear regression model in their research, they found out that the quality of views will affect the premium a added to the dwellings. A full, superior, good and poor partial ocean views will add 58.8%, 30.8%, 29.4% and 8.2% premium to dwelling prices respectively.

Most of the researches using HPM to investigate property prices in Hong Kong were similar to (Mok et. al. 1995) which imported seaview as one of the independent variable. It is becoming a common knowledge in Hong Kong that flats with a seaview will be more expensive than one without it. Researchers in Hong Kong started to focus on the impact

of other kind of views to property prices. For example, Tse and Love (2000) studied the cemetery view as a source of negative externality to properties nearby. The results suggested that cemetery view will exert negative effect on property price.

2.5.1.2 Structural attributes

The structural attribute is related to the physical characteristics of a property. It is a group of factors which is property-specific. Comparing to location and neighborhood attributes, structural attributes have a closer relationship with the residents as residents have a direct and exclusive enjoyment of these attributes. Common structural attributes include number of rooms, floor area (GFA or salable area), existence of garage, basement and carparks, floor level, structural quality including the quality of the fixtures and the outlook of the building and clubhouse facilities provided within the housing estate.

In Hong Kong, the dense urban form made most of the residential buildings as muti-storey buildings except for village houses situated in the New Territories. The most common structural attributes included in the empirical studies in Hong Kong are the age of the property, the floor area either in salable floor area or Gross floor area form and the floor level of the property. These attributes are also very commonly included in studies from all around the world.

It is common that a flat with a larger area will sale at a higher price as buyer is always willing to pay more for more spaces enjoyed. This positive relationship has been proved by many studies such as (Mok, 1995; Do and Grudnitski, 1995; Carroll, Clauretie & Jenson 1996) etc. However, a negative relationship between Gross Floor Area and selling

price was found in (Mok et. al. 1995). They explained the result that sometimes it might be a pricing strategy that the price per square foot for bigger flat is smaller than that of the smaller flat. Due to the different in characteristics and different area of concern of property in foreign countries, some features relating to the floor area of a property such as number of bathrooms, number of bedrooms and lot area were also being investigated. For example, in (Kaufman and Cloutier 2006), increasing of lot size, number of bathrooms and bedrooms will increase the residential property value.

Other literatures relating to other structural attributes such as the presence of garage, fireplace or tile roof will not be reviewed here as it do not relate much to this study.

Another major structural attribute being considered is the age of the property. Most of the researches suggested that building age is negatively correlated to property price (Kaufman and Cloutier, 2006; Huges and Sirmans, 1992; Mok et.al. 1995; Chau et.al 2004). It is due to the deterioration or obsolescence effect of the property as time goes by. Chau (2003) suggested that more cost is incur for the frequent maintenance and repair action of older properties which make them less valuable.

A flat with a higher floor level possesses a better view, air quality and a minimum impact of nuisance from road traffic. So flats with increasing floor level will sale at a higher price (Mok et.al. 1995).

2.5.3 Neighborhood attributes

Neighborhood attributes refer to the neighborhood environment of the property. Since individuals could not totally isolate themselves from the neighbourhood, these types of attributes will affect the pricing of flats by consumers.

The importance of neighborhood attributes was raised by Linneman (1980) which in his study, he found out that 15 to 50 percent of the standard deviation in site valuation is caused by neighborhood attributes while for those with the same structural characteristic, as much as 100 percent of the differential in valuation is caused by neighborhood attributes. Many researches have been done on different aspects relating to neighborhood attributes on property prices such as proximity to undesired facilities (Do, Wilbur and Short, 1994), environmental goods (Correll et. al. 1978) and nuisance from airport (Mieszkowski and Saper 1978)

Li (2005) focuses on the study in the field of behavior economics. He tried to investigate the neighborhood effect or simply the externalities exerted on a property which may affect the property prices of that property. The negatives externalities chosen in his study was the presence of public/subsidized near private housing estates. He suggested that the negative effects due to the presence of a public housing scheme may not physically be observed unlike the pollution emitting from factories in industrial zoning, but in psychological sense, people do sometimes feel dislike for having such a neighborhood environment. By using the hedonic pricing model, he concluded that there existed a negative effect to property prices brought about by the public housing scheme.

The effects of urban renewal projects to property price are also being frequently investigated. Lai et. al. (2007) used the cross-sectional inter-temporal analysis to identify the changes in the price gradient originating from an important CDA zone before and after the completion of the redevelopment project. A price gradient simply means the differentials of property prices between properties and a steeper price gradient represent a larger differential of property prices between the properties. By applying the hedonic pricing model, the effects of CDA zoning on the price gradient can be investigated as all other heterogeneous housing attributes such as age, floor level and size can be controlled. The author propose a hypothesis that the CDA zoning upon redevelopment should provide positive externalities to nearby properties which could be reflected by a steeper price gradient between properties have different distances to the CDA zone. Insignificant results were obtained. They concluded that the zoning or redevelopment system has not contributed much to the welfare of the neighborhood.

2.5.2 Marcroeconomics factor

Property price is affected by both macroeconomic and microeconomic factors. Macroeconomics is defined by the Cambridge Dictionary as *the study of financial systems at a national level*. Macroeconomic determinants of property price are actually the factors affecting the whole property market movement. In concise, these types of factors are likely to affect the demand and supply of properties which affects the whole market trend. Some important macroeconomic factors include interest rates, inflation rates, households' income and other demographic factors.

2.5.2.1 Interest rates

Fisher (1930) defined the *rate of interest* as the bridge or link between income and capital. *It is the per cent of premium paid on money at one date in terms of money to be in hand one year later*. It can be said as the cost for early available of future cash.

The purchasing of real estate involves a large sum of capital. Most of the home owners need to finance their purchase by making mortgage with banks. Interest rate acting as the cost of financing is important in determining the mortgage rate which affects the demand of home buyers.

Peek and Wilcox (1991) studying the determinants of single-family housing prices provided empirical evidence in the United States indicating that real interest rate is an important housing price determinant. Real housing prices will usually decline when the real interest rate increase and vice versa. The reason is when the interest rate goes up; it will lead to an increase in mortgage payments. The amount of mortgage payments affects the demand of buyers in the market and hence the property price. The volatility of Interest rates will also flourish alternative method of home financing (Quigley, 1987).

2.5.2.2 Household income

Household income constrains the choice of living such as the flat size, quality and location. It also affects the affordability of household to repay the mortgage loans made during home purchases. Demand in housing usually increases when real income increase.

2.5.2.3 Population

Housing is an essentials providing shelter for peoples and families. A higher population will lead to a higher demand on housing. An increase in population can be represented by the increasing number of households. Peek and Wilcox (1991) specified that *the greater the number of households, the greater the demand for houses.*

2.5.2.4 Demographic factors

Typical demographic factors include age, marital status, nationality, sex and household sizes. Different groups of people with different household formation will have different demand and affordability on purchasing properties. Hence it is an important factor in considering the demand of housing.

2.5.2.5 Government policy and intervention

Land in Hong Kong is scarce[13] due to the restrictive supply of land by the government's policy. The effect of such system is observable. Research has shown that restrictive in supply of land have caused higher housing prices (Peng and Wheaton, 1994).

Also, Hong Kong's government could further control the housing supply by providing low-cost public housing (i.e "85000" policy). Thus, the government in Hong Kong plays an extremely important role in affecting the supply of the market.

[13] Actually there is still up to about 80 percent undeveloped land in Hong Kong.But due to the restriction in land supply, the land is often defined as 'scare'.

2.6 Related literatures

In this part, other literatures relating to the area of study in this paper will be reviewed. These include literatures about the expectation effects of improvement in amenity, the construction nuisance effects on property price and the impacts of large development projects on property prices.

2.6.1 Expectation effects

The construction of large projects last for years before its completion. Some typical examples were the West Rails and the Western Harbor Tunnel projects. It took about 7 years for the West Rail project to go through the announcement and construction stage and it took about 4 years for the construction of the Western Harbor Tunnel. These projects increase the accessibility of residents in that area and decreases the commuting cost needed to other places. The effect of improvement in amenities by these projects will not be actually reflected in property price at the time the project is completed; it should appear once the project is announced. Yiu and Wong, (2004) specified that "*since the planning, design and construction of infrastructure usually take a very long time, it is plausible to posit that the effects on price should appear well before the completion of the project.*" He also explained that buyers will evaluate property prices based on rational expectation under market competition. The information which will be evaluated by the buyers includes the expectation of future improvement in transportation due to the projects. In his study, he concluded that there exists a rational expectation effect of improvement in transportation reflected by the increase in property prices well before the completion of the project. Chau and Ng (1998) also supported the idea that improvement in transportation should be reflected in property price well before the operation of the railway.

2.6.2 Construction nuisance

Construction work does not only produce the building or infrastructure, a by-product of construction work, for example the noise from foundation piling and the air pollution formed by dust and sand during the operation of large machines are also produced. These can be regarded as construction nuisance which is undesirable to residents nearby.

Henneberry (1998) studied on the effect of the South Yorkshire Supertram on housing price in Sheffield. He proposed that the tram will not offer much gain in accessibility to the residents there as the transportation system was already mature. The results showed that there was a detrimental effect on property prices after the announcement of tram lines projects and the effect was disappeared on completion of the project. He argued that during the time between the anticipation and construction stage of the project, there were expectations of disruption during the building of the system which caused the negative impact on property price. At the time of his study, there wasn't enough evaluation data on property price at the completion stage of the tram; he suggested that the long term effect of this project can be further examined in the future.

Instead of construction nuisance, other nuisance factors such as those caused by railway and road traffic were also frequently being investigated.

"*Railway population represents a source of nuisance to many people; especially that living near the tracks, and is likely to have adverse effects on human health*." (Poon, 1978) Flat proximity to railway will be subjected to noise, air and visual pollution thus providing them an undesirable living environment which may impose a detrimental effect on property prices.

Strand and Bagnes (2001) studied the relationship between the property price and proximity to railroads. Through the hedonic pricing model and a muti-attribute utility investigation of real estate agents' evaluation, they found out that there were strong effects on property prices for those flats proximity to railroad lines at less than 100 meters from the lines. Doubling the distance from the railroad within 100 meter bound, the property price is increased by 10 percent.

Road traffic is another concern in assessing noise impact. It can be separated into two main types. The first type is the traffic noise arising from roads or street and the second type is the traffic noise generated from the highways. Usually, most people will concern more on the noise generated on highways as the speed of the traffic is higher on highways which increases the level of traffic noise generated. There were a few attempts in the past to model the effect of highway nuisance to property prices (Palmquist 1990; Taylor et. al. 1982). All of their findings gave rise to the same conclusion that proximate to highways or expressways have a negative effect on property price.

2.6.3 Impact of commercial development on adjacent property prices – Crafts (1998)

Crafts (1998) carried out a comparative analysis in New England to investigate the effect of commercial development on neighborhood property prices. The commercial development is a shopping centre which lies on the west of a group of hill side residential. Through the comparative analysis of property and land value, no differentiation in values is observed between the properties with and without commercial influences, a minor difference in value reflect discrepancies in building sizes or amenities, such as the present

of a garage or a fireplace. He concluded that there was no commercial influence on property with residential value less than 100,000.

In his study, he assumed that commercial development will exert a negative impact on adjacent neighborhood. This is the case in foreign countries since the people there enjoy a quiet environment more than the convenience gain from locating closely to amenities like a shopping centre in Crafts study. In Hong Kong, this may not be the case due to the difference in residential choice of people. This study is similar to the study of Crafts and in fact, the author is following the footsteps of Crafts in studying the influence of commercial development on adjacent property prices. In this study, a more systematic and scientific method with a larger data sample will be used to test Crafts proposition.

A brief comparison of the situation between this study and Crafts (1998) is presented in Appendix IV.

2.7 Contribution of literatures

This chapter reviews some of the academic works relating to the study area of this dissertation. It provides some information on the attributes which may affect the consumers' willingness to pay for a property. Also, the hedonic pricing model is introduced and this model will be used in the later part of this dissertation to investigate the effects of Cyber-port on nearby property prices.

Chapter 3
Background information (Cyber-port)

3.1 Introduction

The word "cyber" means "involving, using or relating to computers, especially the internet"[14]. It is an internet-related prefixes which could combined to large number of existing words forming new words relating to the internet. Cyber-port is also a new word formed by the prefix "cyber" and can be defined as a port gathering internet-related talents. It was designed as an electronic-port providing office spaces for information technology and multimedia services as to cope with the demands of the related industries in the near future. In this chapter, a brief background introduction of the Cyber-Port project will be given.

3.1.1 Location of Cyber-Port

Cyber-port is located at Telegraph Bay, Pok Fu Lam. Telegraph Bay is formerly named as Tai Hau Wan and is located between Sandy Bay and Waterfall Bay in the Southern Destrict, south-west side of Hong Kong.

[14] Meaning adopted from Cambridge online dictionary: http://dictionary.cambridge.org

Fig.1 The location of Cyber-Port
Source: www.Cyberport.com.hk

3.1.2 The condition of the site before the year 1999

Mr Donald Tsang, in his 1999-2000 financial budget speech first proposed the development of Cyber-port. Cyber-port is located on a 24 hectare land at Telegraph Bay. Part of the site is obtained from reclamation during the late 80's to early 90's and it was first proposed to be developed into a residential area. Telegraph Bay possesses a high quality landscape with wooded valleys slopes and an armored sea frontage. After the reclamation of the site, there was no early development on the land due to the lack of infrastructure such as water supply, sewerage and drainage. There wasn't any road access to the reclaimed site either. The development of the site is further restrained by the Pok Fu Lam Moratorium leaving the site highly vegetated before the development of Cyber-port. As Pok Fu Lam Moratorium had played an important part in the land use development in this area, it will be introduced in the next part.

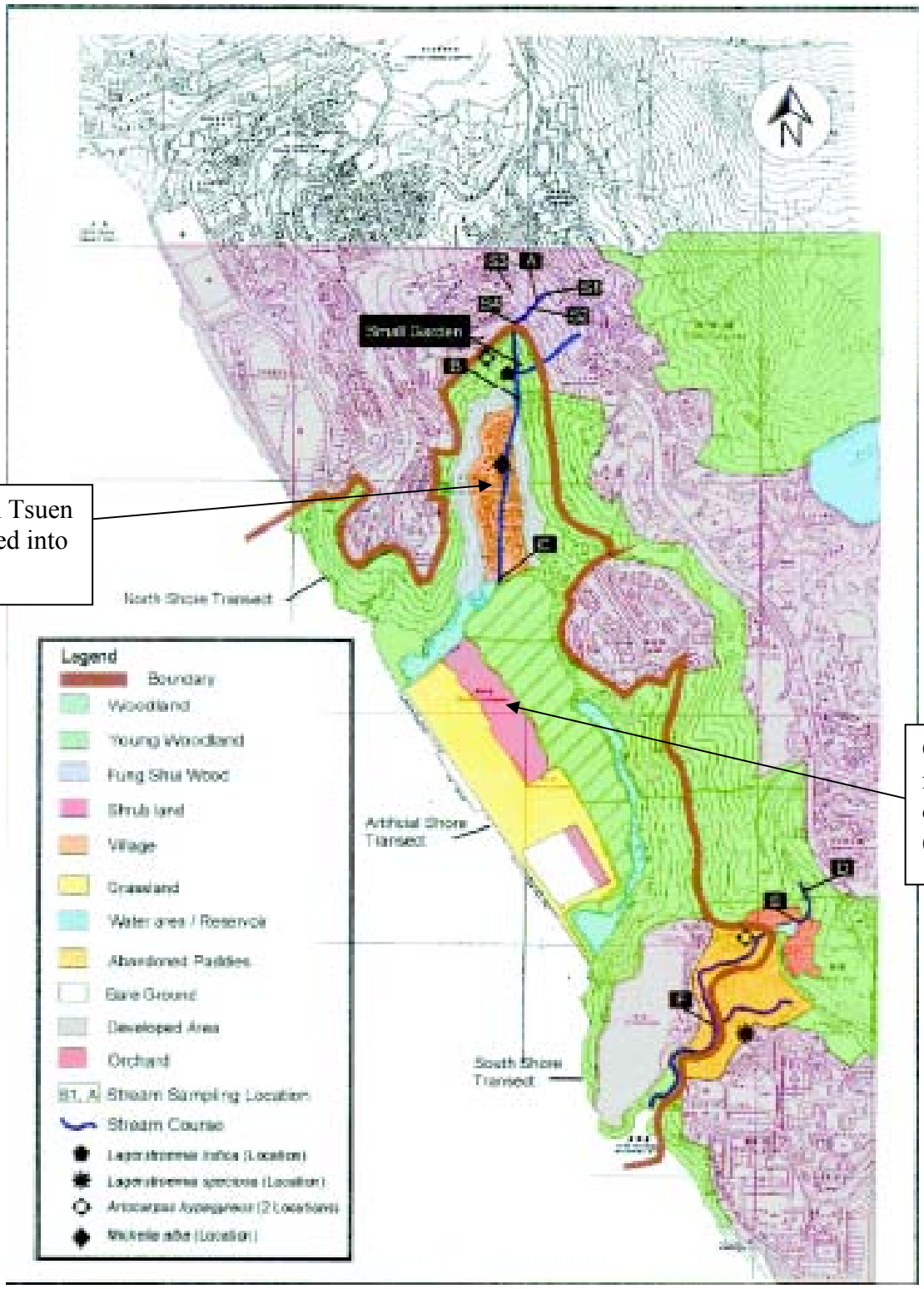

Fig.2 Habitat Map in Telegraph Bay before year 1999
Source:Territory Development Department, Hong Kong (1999)

3.1.3 Pok Fu Lam Moratorium

In 1972, the Executive Authorities introduced the Pok Fu Lam Moratorium. The measure prohibited the granting of new leases for land or modification to the existing lease which may result in an increase amount of traffic in this area until transport infrastructure had been improved sufficiently. Two large development projects[15] were carried out in between 1985-2000 in this area which has raised the question whether if this moratorium still exists. In the Pok Fu Lam Moratorium Review conducted by the Planning Department in 1999, the officials explained that the traffic generated by the project will be absorbed by the spare traffic capacity upon the completion of the major road and junction improvement works in 2003 prior to the opening of route 7, a route which has not been constructed until now. They also mentioned the traffic impact assessment carried out for this development has also showed that the new development will not bring adverse effects to the current transportation situation in the area. All of these become the evidence for the government to process a relaxation of the Moratorium which was highly controversial.

3.1.4 Land use zoning of the site

Before the rezoning of the site to Other Specific Use annotated" Cyber-port", the site consists of different types of zoning which was incompatible with the proposed development. To carry on with the proposed development, rezoning was therefore needed. On 9/4/1999, the Town Planning Board approved the request for the amendment to the Approved Pok Fu Lam Outline Zoning Plan No. S/H10/6 from "Residential (Group B)",

[15] In 1985, the relaxation of the moratorium to permit the construction of new public housing -Wah Kwai Estate and in 1999, the commencement of the Cyber-port Project.

"Residential (Group C)", " Residential (Group C) 5", "government, Institution or Community", "Grenn Belt", "Open Space," and "road" to "Other Specified Uses" annotated "Cyber-port", "Residential (Group C)", "Government, Institution or Community", "Open Space" and " Road". Since then, concerns have been raised by the public of the rezoning in different aspects of the project and several objections have been made to the Town Planning Board. Most of the objections focused on the environmental impact of the Route 7, other objections included the traffic impact brought by this project and the destruction of the existing views enjoyed by the residential development nearby.

Case No:	Objection aspects	Decision:
O/S/H10/(7-1,7-7,7,10,7-11,7-12,7-13)	Environmental impact of Route 7 design and construction	Not Upheld
O/SH10/7-2	Traffic and environmental impact of the project.	Not Upheld
O/SH10/7-4	Traffic, land disposal, open space provision and existing view for the existing residential developments	Not Upheld

Table.1 Objections made due to the rezoning of Cyber-Port site
.Source: Town Planning Board 2007.

These rezoning objections reflected the concern of the residents living in that area of the undesirable impact which may be brought by the new development.

3.1.5 Origin of Cyber-port

The aim for the development of Cyber-port is to provide the essential infrastructure to form a strategic cluster of information services companies to support other financial

services in the modern electronic age. The government was also determined to put Hong Kong as a leading role in the IT industry. (HKSAR,1999)[16]

The project comprised an office/commercial portion together with an ancillary residential portion. The statement issued from the Information Technology and Broadcasting Bureau (ITBB) "*Also, before any surplus from the sale of the residential development is shared, $200 million will be put into a Development Fund for the maintenance and refurbishment of the Cyber-port"* explained the reason for including a residential portion inside the project was to generate the revenue needed to successfully drive the project.

The construction and development of the Cyber-port project was led by the PCCW, a company listed in the Hong Kong Stock of Exchange. The company was solely responsible for the design, construction and marketing of the project without going through the public tender processes which attracted much dissatisfaction from the public and other large developers. Although the government once again reiterated the project was focused on the "IT" infrastructure portion instead of the residential portion, the outcome proved that rental business of Cyber-port's offices was not performing as well as the performance of the sales of Bel-Air.

3.1.6 The services and facilities provided within Cyber-Port

According to the website of Cyber-port[17], Cyber-port comprises:

[16] Hong Kong Government, (04.99). Information Technology and Broadcasting Bureau . Retrieved January 11, 2000 from the World Wide Web: http://www.info.gov.hk/itbb/cyberport/index.htm.

[17] www.cyberport.com.hk

- 95,000 m^2 Grade A intelligent office spaces for IT or related services company.
- A 27,000 m^2 retail and entertainment centre named the Arcade
- A 170 room five star hotel named Le Meridien cyber-port hotel.
- Hi-technology shared facilities such as iResource Centre, Digital Media Centre and cyberport Conference and Exhibition Centre

3.1.7 Completion time for various parts of the projects

Excluding the residential portion of the project, Cyber-port project was divided into four phases. The four phases were made up of four office buildings which are named as Cyber-port 1, 2, 3 and 4 together with a five star hotel and a retail and entertainment complex. The completion date[18] for the four phases are summarizes as follows:

1. Phase IA (Cyber-port 1): Completed in November 2002 to provide a total of 15,400 sq m office space
2. Phase IB (part of Cyber-port 3): Completed in August 2002 to provide 1,500 sq m office space and accommodate the Cyber-port Visitor Centre (which was officially opened on 27 June 2003)
3. Phase I (Cyber-port 2): completed in April 2002 to provide a total of 18000 sq m office space.
4. Phase II (part of Cyber-port 3): Completed in Feburary 2003 to provide 20,100 sq m office space and part of shared facilities.
5. Phase III (remaining part of Cyber-port 3): completed in April 2004 to provide 31,900 sq m office space and part of the share facilities

[18] The information was obtained from the Progress Report of the Cyber-port Project published by the Information Technology and Broadcasting Panel

6. Phase IV (cyber-port 4): completed in late 2004 to provide a 3 storey office building with 7700 sq m.
7. The Arcade which is a 27000 sq m specially designed complex providing themed education, entertainment and retail services were opened in late 2004. the Cyber port hotel (Le Meridien Hotel) was opened on 20, April 2004 to provide 173 rooms.

The residential portion of the Cyber-port project was constructed in phases from 2004 to 2007.

3.2 New facilities provided by the Cyber-port development

The development of Cyber-port improves the amenity enjoyment level in the area. These new amenities can be sorted into three main types.

1. Improvement of transportation system
2. Leisure facilities in the area
3. Creation of a small community in the area

3.2.1 Transportation facilities derived from Cyber-port Project

Telegraph bay was originally without any direct transportation connecting to the urban. To satisfy the demand of transportation needs from the users of the four stages office buildings, a five-star hotel and a retail entertainment complex, an improvement in transportation was therefore needed.

The opening of the public bus terminus for use on 3 April 2002 marked the first improvement in transportation in that area. Some new bus services were introduced on the same date and there is also a taxi stand inside the bus terminal.

Bus number:	**M49**	**73**
Bus Fare:	$5.0	$5.8
Destination:	Central	Stanley
Bus company:	New World	Citybus
Operating time	6 a.m to 12 p.m	8 05 a.m to 11.45 p.m

Table.2 New bus-stop introduced in Cyber-Port on 3rd April, 2002

Since then more bus routes to different places were introduced to satisfy the needs of working groups. Green minibuses were also introduced to serve for this area. Also, with the opening of the Northern Access Road in July, 2004 linking Cyber-port to Sandy Bay accelerated the introduction of new transportation routes.

Bus number:	**970**	**107P**	**40**	**73P**
Bus Fare:	*$10.6*	*$10.6*	*$5.3*	*$3.0*
Destination:	*To/from Cyber-port* *From/to So Uk Estate*	*From Cyber-port to Laguna Verde*	*Morning:* *Wan Chai to Cyber-port only* *Evening:* *Cyber-port to Wan Chai only*	*Aberdeen to Cyber-port only*
Bus company:	*New world*	*KMB*	*Citybus*	*Citybus*
Operating time:	*Every day: 6:30 a.m to 0:30 a.m*		*Morning: 8, 8:30a.m* *Evening : 6:06p.m*	*Mon to Sat Morning: 7:40, 7:50*

Table.3 Other bus routes introduced in later stages of Cyber-Port development

Fig.3 Bus routes to Cyber-port
Source: www.cyberport.com.hk

Minibus Number:	**69**	**69X**	**69A**	**58**	**10B**
Minibus Fare:	*$10*	*$ 8.5*	*$4.0*	*$3.7*	*NA*
Destination:	*Quarry Bay*	*Causeway Bay*	*Aberdeen*	*Aberdeen/Sai Wan*	*Central/sandy Bay circular line*
Operating time:	*From cyber-port: 6:30 a.m to 10:30p.m To cyber-port 7:00 a.m to 11:00 p.m*	*From cyber-port: 6:30 a.m to 11:30p.m To cyber-port 7:00 a.m to 12:00 Mid*	*From cyber-port: 10:00a.m To 5:00p.m*	*6:00a.m to 11:30p.m*	

Table.4 Minibus routes to Cyber-port
Source: www.cyberport.com.hk

Fig.4 Minibus routes to Cyber-port
Source: www.cyberport.com.hk

Cyber-port also provides 760 parking spaces for Cyber-port tenants and visitors. A chartered ferry service running between Cyber-port and North Point/Central was commenced in December 2003.

These provisions removed the limitations of transportation choice in that area providing convenience to local residents. The increasing leasing rate of the office portion of this project drives the need of more efficient transportation mode in the future. There were also rumors telling that the MTR southern line are planning to include a stop named the Cyber-port within the development which give rise to a higher expectation of growth in this area.

3.2.2 Shopping centre- the Arcade

The arcade, with an area of 27000 square meters is located in the centre of the residential and commercial portion of the project. It provides a relaxing shopping destination for the visitors, residents at the southern district and workers. It combines advanced technology, showcase retail, entertainment (cinema), dinning (food court and restaurants) and exhibition in a single interface. Its attractive design has attracted series of awards. It was also named as the "Most Innovative Interior Design for a Retail Development" at the first annual retail future projects awards.

The Arcade provides food and beverage facilities such as Starbucks, Hk Brew House and Oh sushi & Tappas together with a food court. On the other hand, it also provides other up-market shopping opportunities for the visitors such as WiseKids, a shop providing kid's clothes and toys. For entertainment, there is also a cinema situated inside the Arcade

allowing the residents of Bel-Air and Baguio Villa to enjoy films in a comfortable way. Banks within the Arcade such as HSBC and Wing Hang Bank provides banking services to the locals.

3.2.3 Provisions of Recreational facilities

The project emphasizes the "Campus like Environment" concept which aims to keep extensive green areas within the development. Cycle tracks linking all main Cyber-port facilities with bicycle parking spaces will be provided. Also seating areas and a nice sea front park were built for people working there to relax themselves. These recreational facilities could also be enjoyed by the residents of nearby development.

3.2.4 Entertainment functions held in Cyber-port

The development of Cyber-port creates more social interaction between family members and neighborhoods. Many functions were held inside Cyber-port during different festivals entertaining the residents and visitors of all age. Recently, the Cyber-port Christmas Fun land was held in during Christmas entertaining the visitors. Computer games expo and other dancing or singing performance were also held in the past.

3.3 Construction nuisance caused by the project

One of the side effects of the Cyber-port project was the involvement of large infrastructure construction work. Undesired impacts were brought to the neighbourhood during the construction stage. In this part, noise and air quality impact on the vicinity of the study area during the construction stage of the project will be discussed.

An Environmental Impact Assessment (EIA) [19]of the project was prepared to provide information on the nature of environmental impacts which are likely to arise within the construction stage and beyond the completion stage. According to the EIA report, dust impact is likely to arise from the following activities:

- Advance works for Telegraph Bay Development, including earth works and surcharging on the reclamation areas
- Main construction works for Telegraph Bay Development, including access road works, civil works and superstructure construction
- Route 7 construction within Telegraph Bay Area (Not constructed)

The assessment has shown that the development is likely to have caused excessive dust levels at the identified Air Sensitive Receivers (ASRs)[20] during the site clearance and foundation work. This will have a detrimental impact on the neighbourhood environment.

Noise generated from the construction activities and on-site vehicle movements also affects the living environment of residents nearby. Some activities which may induce noise impact include:

- Advance work including vertical drain installations and earthwork/surcharging
- Main construction works including jetty/ quay construction, civil works and building construction works, G/IC construction.

[19]The Environmental Impact Assessment (EIA) process together with the environmental permit are required under the Environmental Impact Assessment Ordinance in order to avoid, control and minimize the impact of the proposed project to the environment. The potential side effects and constraints of the development will also be identified within the EIA study.

[20] ASR (19) represent the sensitive receivers located at Baguio Villa in the report

In the assessment, the Predicted Noise Levels (PNL) at Lower Baguio Villas exceeds the assessment criteria during the construction stage. It is likely that the noise impact will affect the living of residents there.

The construction nuisance above would likely to affect the choice of homebuyers during the construction stage of the project. This will be reflected by the property price.

Chapter 4
Background information (Baguio Villa)

4.1 Profiles of the Southern district

This study targets Cyber-port together with Baguio Villa, both of them situated in the Southern District on Hong Kong Island. The Southern District covers an area of 4000 hectares and is the largest district on Hong Kong Island. The Western part of the Southern Districts covers the coastal area from Po Fu Lam through Wah Fu, Tin Wan, Wong Chuk Hang, Aberdeen and Au Lei Chau while the eastern part covers Stanley and Shek O.

Many large public housing estates are situated in this district which accommodates more than 113000 people. The district has a slow growth in population during the past 20 years from 237888 to 275162 which accounts for 4% of the total population in Hong Kong. It also has the lowest population density on Hong Kong Island. Most of the population in the district is situated in Ap Lei Chau and Aberdeen due to the extensive development of public and private housing such as Lei Tung Estate and South Horizons in that area.

At the present, there is no Mass Transit Railway services serving the citizens in the South District. The citizens there mostly rely on the Buses and minibus services through the Aberdeen Tunnel to Central or Causeway Bay. For the Pok Fu Lam area, there is even less transportation choice for the residents there. The government also noticed the problem of congestion and that the roads system there could not support a sudden increase in traffic thus the Pok Fu Lam Moratorium was implemented in 1972.

4.2 Background for Baguio Villa

Baguio Villa is a famous private luxury residential estate located in Pok Fu Lam, Hong Kong. The estate supply more than 1000 units making it become one of the four largest private residential estates[21] in the area. The population[22] for the Upper Baguio Villa and Lower Baguio Villa are 3165 and 2750 respectively.

The large volume of property transaction allows the estate to become one of the estates which its transaction data were used for computing the "Price Indices for selected popular residential developments" produce by the Rating and Valuation Department in HKSAR. Baguio Villa is divided into Upper Baguio Villa[23] and Lower Baguio Villa. Both the Upper and Lower Baguio Villa enjoy similar facilities except for that the Lower Baguio Villa has a provision of a Park'N shop while Upper Baguio does not. The information of the estate is summarizes in the table below.

[21] The other three private residential estates include Chi Fu Fa Yuen, Bel Air and Pok Fu Lam Garden
[22] According to the statistics of the By-census conducted by the Census Department, HKSAR in 2001
[23] Upper Baguio Villa (碧瑤灣) is located at 555 Victoria road while Lower Baguio Villa(碧瑤灣) is located at 550 Victoria Road, Po Fu Lam.

	Upper Baguio Villa	Lower Baguio Villa
No of blocks:	9	24
No of units:	900	635
No of floors:	25	10-30
GFA	1020-1520	1590-2700
Facilities:	2 tennis court with swimming pool and children's play area	1 tennis court with a small swimming pool and a private garden, park'n shop
Carpark:	Each flat is attached to one carpark	Each flat is attached to one carpark
Age:	29	29-33

Table.5 Summary of the characteristics Baguio Villa

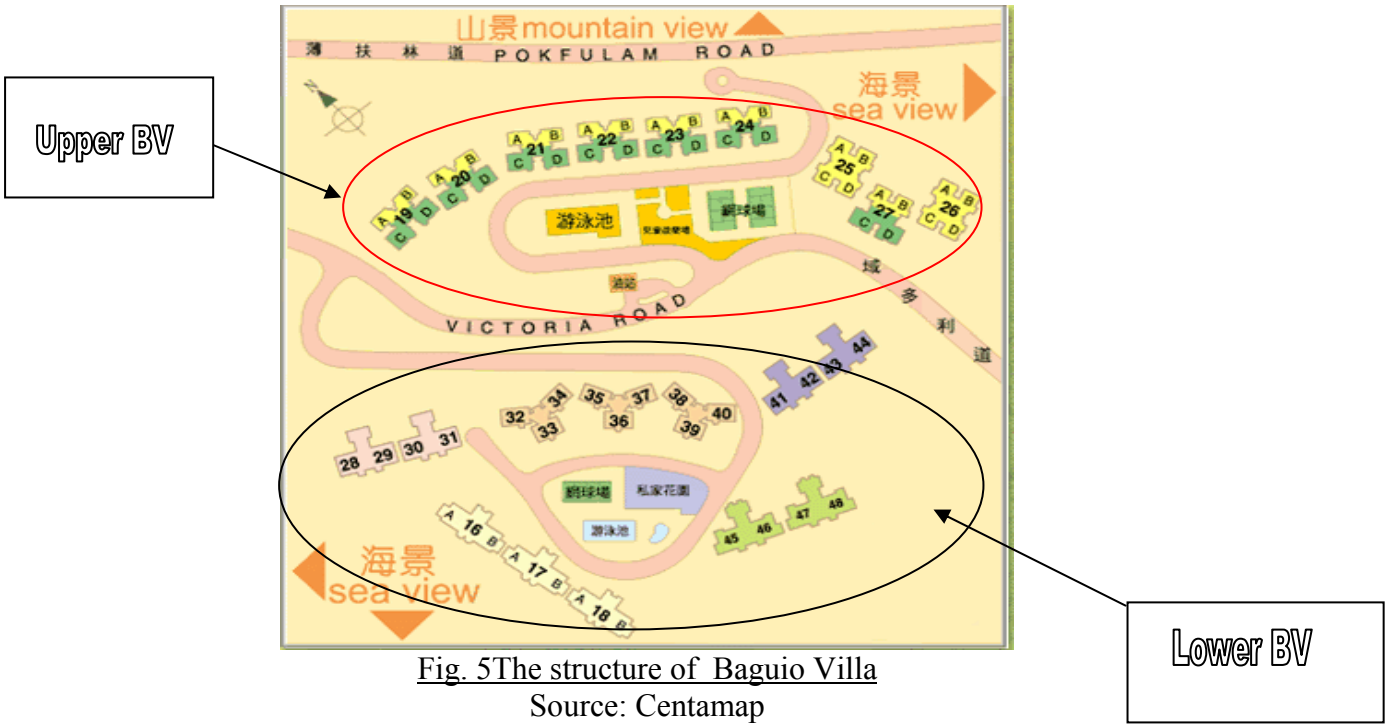

Fig. 5The structure of Baguio Villa
Source: Centamap

Generally, Lower Baguio Villa has similar age with upper Baguio Villa. As they have a completely different building layout in terms of building design and outlook, it makes the whole estate "irregular" in structure. In terms of location indifference, the two estates are separated by the Victoria Road. There is a minibuses service provided for the exchange

flow of passenger from the Lower/Upper Baguio Villa which $1 dollar is charged for every ride.

For transportation, there are two minibus routes in service. The Minibus No.8[24] terminus is located in Lower Baguio Villa while the No 28[25] minibus terminus is located in the upper Baguio Villa. Each line circulates through the two portion of the estate. In between the two portion of the estate, there is also a bus station with Bus M47 in service. The Bus starts from Wah Fu to Central passing through Kennedy Town.

4.3 Interaction between Baguio Villa and Cyber-port

The residents of Baguio Villa can easily assess to Cyber-port to enjoy its facilities through a security gate located at Lower Baguio Villa. A short walk of about five minutes is needed for the residents of Lower Baguio Villa to reach the Cyber Centre in Cyber-port. For the residents of the Upper Baguio Villa, they need to walk down the slope to the Victoria Road and then again down a slope to the Lower Baguio Villa before arriving to Cyber-port. It takes about 10 to 15 minutes and more effort for them to arrive at Cyber-port.

[24] To Central with a fare $7.5 and $5.5 charged for those stopping near Queens's Mary Hospital
[25] To Causeway Bay with a fare $8.0 and $5.5 charged for those stopping near Queens's Mary Hospital.

Fig.6 Interaction of Cyber-Port and Baguio Villa
Source: Centamap

Chapter 5
Methodology

5.1 Introduction

In this dissertation, the author would like to model and quantify the effects of a commercial development project, the Cyber-port on the property prices nearby. Two methods are introduced to quantify the effect and they are the hedonic pricing model and the repeat sales model.

5.2 Regression analysis

As mentioned in chapter two, housing is composed of locational attributes, structural attributes and neighborhood attributes. It is a muti-dimensional commodity which is characterized by its durability, heterogeneity and spatial fixity (Tse and Love, 2000). Thus it is important that all the other factors not being investigated are held constant. Otherwise accurate results of the effects under investigation could not be truly obtained from the study.

The regression analysis will be adopted in this study to investigate the effects of Cyber-port on residential property prices. Regression analysis is commonly used in many different disciplines such as education, political science and economics. By obtaining suitable data, it allows us to analysis relationship (Kahane 2001). One of the applications of regression analysis is the Hedonic Pricing Model. It is a product of (Rosen, 1974)

which deals with the implicit prices of the characteristics of property. The model will be adopted in this study.

In the following part, details about the hedonic pricing model, the techniques of the model and the way to interpret the results will be introduced.

5.2.1 Applicable of regression analysis to this study

Each housing property is unique due to the different locational, structural and neighborhood attributes which it carries. Consumers are always interested in relating the prices of housing commodity to its characteristics such as the gross floor area, floor level or even the facilities within the clubhouse of the housing estate. It is important that when examining the effect of one attribute, all the other attributes should be held constant. As Hedonic pricing model provides a way to let us examine the effect of certain attribute by holding other factors constant, thus this model is applicable in this study.

5.3 The use of Hedonic pricing model

As mentioned in Chapter two, hedonic pricing model as an application of regression analysis will be used in this study. Hedonic prices is defined by Rosen (1974) as "the implicit prices of attributes and are revealed to economic agents from observed prices of differential products and the specific amounts of characteristics associated with them." Hedonic pricing model thus helps to quantify the relationship between property prices to its housing traits or attributes.

5.3.1 Structure of Hedonic Pricing equation

According to Bulter (1982), housing traits can be categorized into 3 domains:

- Location traits (L) including the distance to Central Business District, the view of the property, the accessibility to community and commercial facilities.
- Structural traits (S) including the physical characteristics of the property such as the age of the buildings, the gross floor area of the property and the virtual height of the flat which is represented by the floor level.
- Neighborhood traits (N) including the neighborhood characteristics of the property such as the services provided by the neighborhood and the approximate to schools or church.

These traits can not be separately purchased; the buyers could only buy a bundle of characteristics possessed by the property. So the property price can be expressed as a function:

$$P= f (S, L, N)$$

Assuming a linear relationship between the property price (P) and its characteristic traits (S,L and N), the equation can be further expressed as follows:

$$P= a_0 + \sum a_i S_i + \sum b_j L_j + \sum c_k N_k + \epsilon$$

Where P = Property price of an individual property unit

a_0 = constant term

S_i = Variable representing the structural traits of the property

L_i = Variable represent the locational traits of the property

N_k = Variable represent the neighborhood traits of the property

a_i , b_j , c_k = Regression coefficients of the corresponding independent variables

ϵ = Stochastic or error term

These regression coefficients can be obtained by differentiating the equation with respect to the different traits,

$$\Delta P/\Delta S_i = a_i$$

$$\Delta P/\Delta L_j = b_j$$

$$\Delta P/\Delta N_k = c_k$$

The interpretation of these regression coefficients will be explained in the later part of this chapter. In order to compute the regression coefficients, the Ordinary Least Square technique is used.

5.3.2 Ordinary Least Squares (OLS) technique

In carrying out a regression analysis, the major job is to find the equation of a line which it fits the data best as it is not possible for a human eye to observe the best fitted line from a group of data. To achieve this, the Ordinary Least Square technique is introduced.

Ordinary Least Squares (OLS) technique aims to estimate the true but unobservable function by a regression equation which tries to minimize the residual sum of squares[26] so as to obtain a best fitted line.

$$\text{Dependent variable (D)} = b_0 + \sum b_i X_{ij} + r_j$$

Where b_i is the OLS estimator of the true unobservable coefficient of the independent variable X_i and r_j is the residual

OLS is a good estimator for estimating the true but unobservable coefficient as it has some desirable properties if certain assumptions are held. The estimated coefficients under the OLS technique are generally unbiased, most accurate and consistent.

5.3.3 Choice of functional form

Choosing a suitable functional form in a model is as important as choosing the suitable variables to be included in a model. Inconsistent estimates may result due to the incorrect

[26] The sum of the squares of the difference between the actual and the forecast values of the dependent variable (D), sum of squares is used as to avoid the cancellation of positive errors with negative errors.

choice made on a functional form (Goodman, 1978). Linneman (1980) discovered that 86% of the overestimation obtained in his study is due to the misspecification of the functional form. A good functional form will correctly specify the relationship between the dependent and independent variable. In deciding which functional form is the most suitable, two situations will arises which are:

- When there is no a priori information is available, or
- When a prior knowledge can be logically deducted

If there is no priori information available, then try and error based on empirical observations should be carried out. Assuming a linear function as the first attempt is a standard procedure when deducing the correct functional form. If the linear function fails, then more flexible functional form such as the polynomial function and Box-Cox transformation can be used.

When there is priori knowledge which can be logically deducted, the procedures in choosing the correct functional form will be much easier by just simply following the functional forms adopted in the past. For example, building height and cost are hypothesized to be J-shaped and project cashflow forecast is hypothesis as S-shaped.

There was little guidance provided in the past on how to choose the correct functional form for the hedonic pricing theory (Bulter 1982). It was often difficult to predict the correct relationship between the bundles of variables.

The semi-log model will be employed in this study as it is the most popular specification for hedonic pricing model in the past.

5.3.4 Types of variables

Independent variables can be qualitative or quantitative in nature. Quantitative variables are variables which are usually measurable and take values over a continuous range. For example, size of the flat, age of the building and floor level. Sometimes, qualitative variables will also be introduced to measure immeasurable attributes such as the possession of a sea-view and the existence of certain facilities etc. The qualitative variable, namely the dummy variables are used.

5.3.4.1 Dummy variables

Dummy variables usually take the value of 0 or 1. For example, taking the structure of the regression equation as:

$$Y_i = b_0 + \sum a_i S_i + \sum b_j L_j + \sum c_k N_k + d_1 X_i + r_i$$

Taking the possession of a seaview as an example, if Y_i represents the property price of a property and X_i is a dummy variable to differential the property with or without a seaview, then:

If it possesses a seaview, then $X_i=1$

If it does not possess a seaview then $X_i = 0$

5.4 Study target

This study aims at investigating the effects of proximity to Cyber-port on property prices during different stages of the project. Overall speaking, the project can be divided into three stages, the announcement stage, the construction stage and the completion stage. The duration for each period of the project is listed out as follows:

Period	Duration
1.Announcement	From 3/3/1999 to 15/9/1999
2.Construction	From 16/9/1999 to 31/5/2004
3.Completion	From 1/6/2004 to 31/5/2005

Table.6 Period under investigation

The announcement date started when Mr. Donald Tsang gave his financial report speech which inside his speech he mentioned the proposed development of Cyber-port project. This period ends at the time when the site clearance and foundation work commenced.

The construction period started at the commencement of the construction work. As mentioned in Chapter 3, the project was actually consisted of different phases. The date 31/5/2004 is chosen as the completion date since most of the major construction work had ceased after this time and also most of the facilities such as the Arcade and the new transportation route were in used after this time.

As the index obtained from the University of Hong Kong started from 1991 to 2005 the investigation period for the completion stage ends at 31/5/2005.

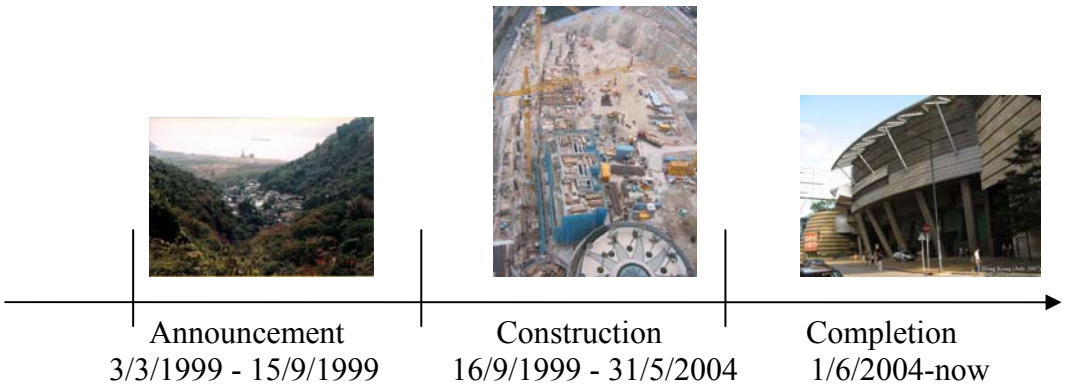

Fig.7 Investigation period timeline

The investigation area for this study is a famous private residential estate namely the Baguio Villa locating next to Cyber-port.

Fig.8 Area for investigation
Source: Centamap

The left hand side of the Victoria Road refers to Lower Baguio Villa while the right hand side refers to Upper Baguio Villa. As mentioned in chapter 3, Cyber-port provides a variety of services to residents nearby such as the provision of cinemas, restaurants, new

transportation routes and open recreational spaces for holding different functions. Due to the difference in accessibility to Cyber-port between lower and upper Baguio Villa, the enjoyment level of these new services will be different and hence the following hypothesis is derived.

5.4.1 Hypothesis

> *"Cyber-port has brought improvement in amenities level in the surroundings, as accessibility is a factor in determining the level of enjoyment over these new amenities, the closer to Cyber-port, the stronger increase in property prices should be experienced."*

5.5 Source of data

The required transaction data in this study could be obtained from the EPRC system. The system holds the transaction data for most of the residential properties transacted after 1992. The data in the database is extracted from the transaction record in the Land Registry which makes it reliable for use.

The information provided in the EPRC system for properties transactions includes the price of transaction, the date of transaction, the floor level, the gross floor area and also the date of occupation permit for the properties. Other kinds of required information such as the view of the property are not provided. To obtain these kinds of data, site visits together with map observations were carried out.

5.6 Criteria in choosing the variables

Emphasis should be put on "how" to choose the correct variables inside the model. It is an important issue during the construction of the model as misspecification of variables will generate undesirable outcome. There are two situations which misspecification may results.

1. An irrelevant independent variable is included in the model representing over-specification and ;
2. a relevant independent variable is omitted representing under-specification

Over-specification gives estimated independent variables that are both unbiased and consistent while under-specification will cause bias and the estimated coefficient will be inconsistent.

To avoid the problem of misspecification, independent variables should be carefully chosen. Butler (1982) suggested that the hedonic pricing model should include a small number of key variables that are costly to produce and which yield utility. All key relevant variables should be included to avoid under-specification. There are three main types of relevant independent variables in housing price model which will be included in this study, they are summarize in the following model.

Variable Symbol	Description of its meaning	
RP	Real property transaction price	
AGE	Age of the building	Structural attributes
SIZE	Gross floor area of the property	
$SIZE^2$	Square term of SIZE	

FL	Floor level of the property	
FSV	Full seaview	Locational attributes
PSV	Partial seaview	
FSNV	No seaview but facing the seashore	
LOWER_BV	Location Dummy	
AN	Announcement dummy	Time dummies
CON	Construction dummy	
COM	Completion dummy	
AN_LOW	Interaction dummy	Effects of Cyber-port on price gradient
CON_LOW		
COM_LOW		

Table.7 Descriptions on variables included inside the model

5.6.1 Dependent variable

RP-Real property price

The dependent variable in the model is the Real property price (RP) instead of the nominal property price. In Hong Kong, as the market situations or trend are different in different time periods, there will be a time-effect exerted on the transaction data. Some of the causes of this time-effect include the changes in the interest rates, inflation rates, political and economic environment etc. If the time-effect is not taken into account, bias and incorrect results will be obtained. The market situation in Hong Kong is very volatile,

large changes occur not only yearly but also monthly. To deal with this effect, time adjustment is needed.

To take into account the time effect exerted on the transaction price, the nominal property prices will be deflated into real transaction prices by using the corresponding price indices obtained from the Department of Real estate and Construction. The price indices chosen in this study is the University of Hong Kong Island Real Estate index for sub-region Po Fu Lam. The Real Property Price is obtained by the following formula:

$$RPRICE = NPRICE_t \times 100 / INDEX_t$$

Where RPRICE = Real Property Price

NPRICE= Nominal Property Price

INDEX = Price Index

The deflated property price obtained is based on the same price level in year 1991, thus the time effect can be eliminated.

The main reason for choosing this index instead of the property price index from the Rating and Valuation Department as property price deflator is to the concern on the inaccuracies of the price index obtained from the Rating and Valuation department. The index produced by RVD pictures the fluctuation of price levels for the whole territory which does not account for specific sub-region. As this study focuses only on one large private residential estate in Pok Fu Lam, the price index produced by RVD will certainly be less efficient in eliminating the time effect of this estate.

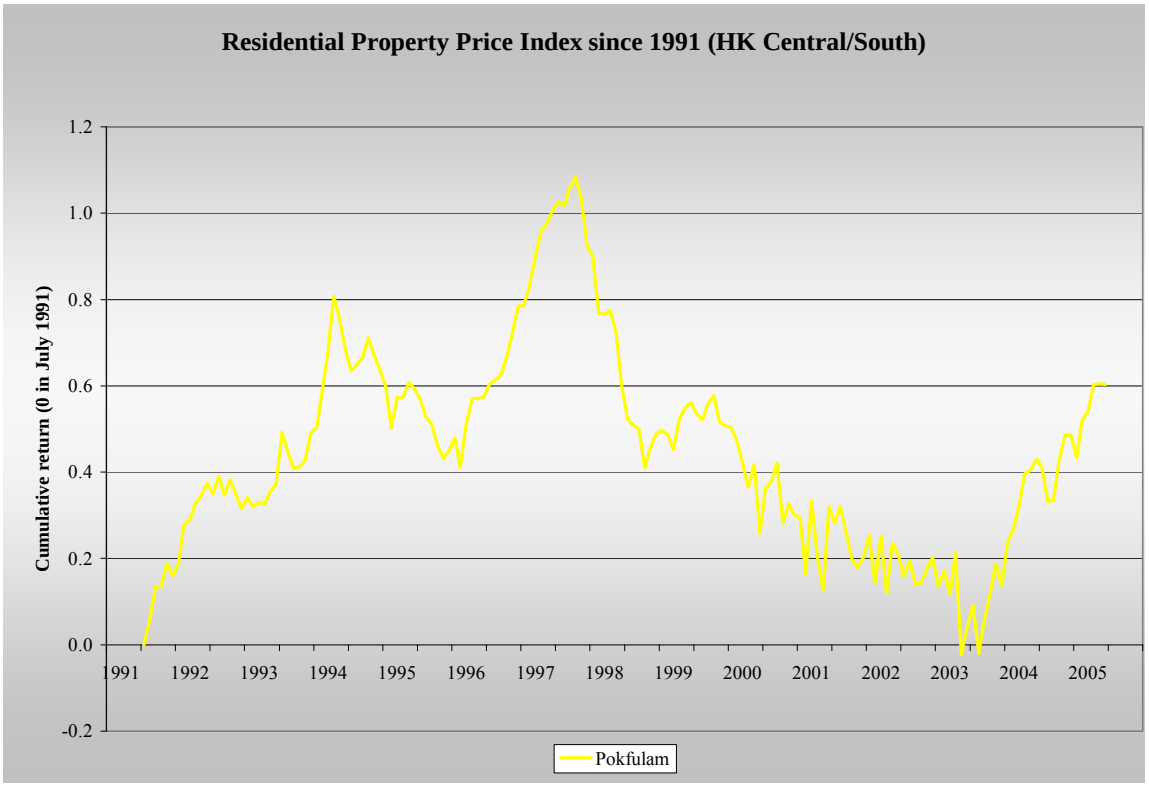

Fig.9 Residential price index for Pok Fu Lam region in Hong Kong

(Source: Department of Real Estate and Construction, HKU)

5.6.2 Independent Quantitative Variable

AGE (AGE of the property)

The independent variable (AGE) in this model represents the age of the building at the time of transaction. It is calculated as the number of months between the transaction date and the date of issuance of the occupation permit, a date representing the whole completion of the building.

As time goes by, buildings will deteriorate. The value of the building will also decrease. It is expected that a negative relationship will exist between the age of the building and the property price. So a negative sign of the coefficient is expected.

SIZE (Gross Floor Area)

The independent variable SIZE is one of the structural attribute included inside the model. It refers to the gross floor area of the property. The definition of "Gross floor area" can be found inside the Building Ordinance (Cap 123F) stating "the area contained within the external walls of the building measured at each floor level (including any floor below the level of the balcony (including the thickness of the sides thereof), and the thickness of the external walls of the building." Other area measured unit such as the saleable area or usable floor area will not be used since all the properties inside the investigation area have similar usable floor area ratio and also the data presented in GFA is easier to obtain. A positive coefficient is expected to be shown as people will be willing to pay for additional amount for extra floor area. The square term of GFA will also be included to model the non-linear effect of increasing GFA.

FL (Floor Level)

Floor level is simply the number of storeys above ground level which the property is located. It reflects the virtual height of the property. With the special urban form which Hong Kong enjoys, high-rise residential development could be found everywhere. People are willing to pay a higher price for flats situated in upper floors. The reason is flats with higher floor level could enjoy a more spectacular view than the ones in the lower floors.

Also, roads situated near the development which traffic nuisance is more likely to affect the flats with lower floor levels. Thus, it is expected that the property price will increase with floor levels.

FSV (Full sea view)

This dummy variable represents whether a flat possessed of a full sea view. The dummy variable will be equal to one if the flat has a sea view and will be equal to zero if it does not. Past researches have confirmed the positive relationship between the possession of a sea view and property prices. Having a sea view represents having a more desire living environment. The expected sign of this variable is positive.

PSV (Partial sea view)

As suggested by Benson et al (1998), inserting a generic view variable is not always appropriate, so this independent variable (PSV) differentiates the properties which have different quality of sea view. If the property possesses a partial sea view, then the dummy variable will be one and if it does not, it will becomes zero. It is expected that the coefficient of this independent variable will be positive but the positive effect of this will be lower than the one which possesses a full seaview.

FSNV (Facing sea with no sea view)

This variable represents the property which does not have a seaview but facing the seashore. It is expected that without the blockage of sunlight and the wind by the

mountain, a higher residential satisfaction can be gained from living in these flats rather than those facing the mountain. So it is expected that this coefficient will be positive in sign but with a value lower than the above two view variables.

LOWER_BV (Location dummy for Lower Baguio Villas)

This dummy variable represents the location which the sample falls into. As this study focuses on the price gradient between the lower Baguio Villa and upper Baguio Villa during the different stages of Cyber-port project, it is necessary to differentiate the sample into two groups. If the property is situated inside lower Baguio Villa, the dummy variable will be equal to one and if the property is situated within upper Baguio Villa, then the dummy variable will be zero.

Dummy variable	Properties located within Block 16-18 and 28-44	Properties located within Block 19-27
LOWER_BV	1	0

Table.8 The value of the location variable LOW-BV for different property

Upper Baguio Villa and Lower Baguio Villa combine together to form the whole private residential estate Baguio Villa and it makes the whole estate irregular in terms of different aspects.

- Firstly, the structural design and layout is quite different for the two parts of the estate. Upper Baguio Villa is constructed in a horizontal pattern which the building lies from the east to the west. The directions of the flats are either to the west or to the east. While the buildings in Lower Baguio Villa were constructed in

an irregular and congested pattern. As some of the flats have parts of their flats facing others, the degree of privacy enjoyment is lower in Lower Baguio Villa. Also this decreases the enjoyment of openness and poorer ventilation within the estate results.

- Secondly, Upper Baguio Villa is not surrounded by roads while Lower Baguio Villa is. The Victoria Road is just approximate to Lower Baguio Villa which the bedrooms in Lower Baguio Villa are directly facing it. Also, Upper Baguio Villa is located on a higher land level with slopes and trees blocking the noise from the Pok Fu Lam Road. There is a less harmful effect to the residents there due to the traffic noise from the minibus and private cars.
- Lastly, there is a pedestrian corridor at the Upper Baguio Villa next to the entrance of each block of buildings. It creates pedestrian movement and providing a space for the residents to carry out exercise.

Accounting for all of the features mentioned above, it is expected that the coefficient of this location dummy variable will be negative. This means buyers have are more willing to pay more for the property located in Upper Baguio Villa rather than Lower Baguio Villa.

Time dummy (AN/CON/COM)

This study concerns the impact of different stages of the Cyber-port project. The three stages of the project include the announcement, construction and the completion stage. Three dummy variable (AN/CON/COM) representing the three stages of the project will be included in the model for investigation.

Announcement (AN)

The time dummy (AN) represents the transactions done during the announcement period (from 3/3/1999 to 9/9/1999). A value of 1 represents the transaction is done within this period and 0 is assigned when the transaction falls out of this period.

Construction (CON)

This time dummy (CON) represents the transactions made during the construction period (from 9/9/1999 to 31/5/2004). A value of 1 represents the transaction is done within this period and 0 is assigned when the transaction falls out of this period.

Completion (COM)

The time dummy (COM) represents the transactions made after completion of the project (from 31/5/2004 until now). A value of 1 represents the transaction is done within this period and 0 is assigned when the transaction falls out of this period.

Interacting variable (AN_LOW, CON_LOW, COM_LOW)

These interacting variables were introduced to test the hypothesis in this study which is to examine whether the proximity to Cyber-port will have an effect on the price difference between Upper Baguio Villa and Lower Baguio Villa. These variables will test whether there is any significant difference between the two parts of the housing estate during different stages of the project. The sign of the coefficient shows the preference of buyers in choosing Upper Baguio Villa or Lower Baguio Villa. A positive sign means buyers would prefer more to buy a flat in the Lower Baguio Villa and vice versa.

It is expected that after the completion of the project, there will be a positive price gradient in between Lower Baguio Villa and Upper Baguio Villa. The coefficient of the interacting variable COM_LOW is expected to show a positive sign. While, it is difficult to predict the effect of the development to Baguio Villa in construction stage as it is hard to measure the balance between construction nuisances, the enjoyment of limited new amenities and the expectation effect for future enjoyment of amenities. Also, the price gradient in the announcement cannot be predicted in this stage.

The size of the effect during different stages of the project is represented by the value of the coefficient of these interacting variables respectively.

5.7 Equation for the study

This study will employ the Hedonic pricing model to test the proximate effect of Cyber-port. Taking into account all of the attributes of the property inside investigation, the hedonic pricing equation is specified as follows:

$$LN(RP)= a_0 + a_1AGE + a_2FLOOR + a_3GFA + a_4GFA^2 + a_5PSV + a_6FSV + a_7\ FSNV + a_8\ LOWER\_BV\ + a_9AN\_LOW + a_{10}CON\_LOW + a_{11}COM\_LOW$$

Where,

RP is the real transaction price

AGE is the age of the buildings

FLOOR is the floor level

GFA is the gross floor area of the property

FSV is the property which possesses a full sea view

PSF is the property which possesses a partial sea view

FSNV is the property facing the direction of the sea with no SV

LOWER_BV is the location dummy variable which is equals to one if the property is inside Lower Baguio Villa and zero otherwise

AN_LOW is the interacting variable which is equals to one if the property is transacted within the announcement period and is located in the Lower Baguio Villa and zero otherwise

CON_LOW is the interacting variable which is equals to one if the property is transacted within the construction period and is located in the Lower Baguio Villa and zero otherwise

COM_LOW is the interacting variable which is equals to one if the property is transacted after the construction period and is located in the Lower Baguio Villa and zero otherwise

The square term of SIZE is also added in the equation to test the linear functional form. If the results show the coefficient is statistically significant, we can said that the SIZE attributes is not increasing or decreasing linearly, or it can be said as increasing or decreasing in an increasing/decreasing way.

Independent variable	Expected sign of its coefficient
AGE	(-)
GFA	(+)
GFA^2	(?)
FLOOR	(+)
FSV	(+)
PSV	(+) but < coefficient of FSV
FSNV	(+)but< coefficient of PSV
LOW	(-)
AN_LOW	(?)
CON_LOW	(?)
COM_LOW	(+)

Table.9 Expected sign of the coefficient of the independent variables

5.8 Model interpretation and test statistics

In testing the hypothesis, the Hedonic regression model will be run through E-views. Then the results would be given by E-views through presenting some data in statistical terms. To clearly understand the results, it is necessary for us to understand the statistical meaning of each term such as the meaning of regression coefficient, the T-statistics, the F-statistics and coefficient of determination.

Regression coefficient (bi)

The regression coefficient (bi) measures the changes in the dependent variable associated with an unit change in the independent variable (Xi) holding all other factors constant. i.e. with other variables being equal, one unit change in Xi will cause C to change by bi units.

$$C=b_0+\sum b_i X_{ij}+ r_j$$

$$\partial C/\partial X_i \quad \text{for all i}$$

This coefficient only takes account of the magnitude of the effect of the independent variable but does not show the statistical significance of this effect. In linear regression model, the coefficient of the independent variables represents the change of the dependent variable due to an unit change of the independent variable but in a semi-log regression model, the coefficients of each independent variable actually represent the variation of the dependent variable in percentage terms due to an unit change of the independent variable.

The sign of the coefficient determines whether a positive or negative relationship exist between the dependent and independent variables. For example, it a negative coefficient is observed, it means that the dependent variable will decrease when there is an unit increase in a independent variable.

T statistics (ti)

T-statistics measures the "significance" of the effect of the independent variable Xi on the dependent variable C. The value of ti depends on the beta coefficient (bi) and the standard error of coefficient (Sbi)

$$t_i = b_i / Sb_i$$

Where Beta coefficient (bi) measure the relative importance of independent variables and Sb_i is the sample estimates of the standard deviation associated with the regression coefficient b_i, simply speaking, Sb_i measures the accuracy of b_i.

There is a critical t (tc) for a given significant level and degree of freedom. If the calculated t (ti) is higher than a critical (tc) at a given significance level and degree of freedom, then the regression coefficient bi is said to be significant at that significant level. When an independent variable is significant at the 5 % level, we can say that we are 95% sure that b_i is non-zero and the null-hypothesis can be rejected. Even we could not reject the null-hypothesis that $b_i = 0$, it does not mean b_i is zero and the corresponding independent variable exert no effect on the dependent variable, it only gives implications that we do not have enough evidence to prove that $b_i > 0$. (Ramanathan,1998)

So the larger the value of T_i, the higher the significance level thus the more accurate the estimate will be and the less likely that b_i will be equals to zero. It should be noted that t-statistics measures the statistical significance of the effects of the independent variables but not the strength of this effect.

Coefficient of determination R^2

The coefficient of determination (R^2) determined by regression residuals variation describes the proportion of variation in the dependent variable which could be explained by the variation in the independent variables. It is often used as a measure of goodness of fit. A higher R^2 is desirable. The coefficient of determination will increase as more independent variables are added to the regression equation and it will range from zero to one. For example, if R^2 is equals to 0.60, then we can say 60% of the changes in the dependent variable can be explained by the independent variables. Then the remaining 40% of the variation is unknown and can not be explained.

R^2 does not account for the number of degrees of freedom so it might not be a good measure of goodness of fit. (Roberts & Rubinfeld, 1998). Adjusted R^2 are then introduced to measure the proportion of variance (variation divided by degree of freedom) of the dependent variable explained by the variance of independent variables. For small degree of freedom such that there are a large number of independent variables relative to the sample size, the R^2 should be adjusted downward. The difference between R^2 and adjusted R^2 is small for degree of freedom >30.

P-values

P-value (probability value) provides additional information describing the exact significance level associated with a particular econometric result. (Roberts & Rubinfeld, 1998). A p-value < x% means the coefficient b_i :

- Is significant at the x%
- Is significant at the (1-x%) confidence level
- Has x% chance of being equal to zero
- Has less than x% chance that it would has no effect on the dependent variable

F-statistic (F k, N-k-1)

F statistics is used to test the null hypothesis that none of the independent variable helps to explain the variation of the dependent variable about its means.

$$\text{i.e. } b_i=0, \text{ for all } i \geq 1$$

5.9 Repeated sales analysis

Sometimes, it is hard to obtain the information relating to the characteristics of the properties under investigation. For example, without entering into the flat, it is hard to justify whether the property possesses a full or partial seaview. As the accuracy of the hedonic pricing model is determined by the quality of the data and the use of a correct functional form, another method which is the repeated sales analysis is chosen to reaffirm the results obtained from the hedonic pricing model. The rationale of this method will be introduced in this part.

5.9.1 Repeat sales methodology

A repeat sale is defined by (Chau, 2006) as more than one pair of transactions of the same property within the observation period. As the housing property in Hong Kong is one of the most frequently traded commodity, the use of repeat sales model is applicable since many pairs of transaction can be obtained even in a short time period, say 10 years. In a repeat sales model, it is assumed that the quality of the flat during the investigation period is the same. This implies that the difference in transaction price during different periods is due to pure price level changes. Chau (2006) briefly outlined the mathematical rationale of the repeat sales model.

Let R_t = the single period return of a portfolio of property assets from time t-1 to 1 and P_t be the portfolio price at time t. The gross return of the portfolio is the ratio of the portfolio price between the two time periods which is:

$$P_1/P_0=1+R_1 \text{ , } P_2/P_1=1+R_2 \text{ …….., } P_t/P_{t-1}= 1+R_t \quad (1)$$

This return captures the price change during different period before any deduction of transaction cost such as brokerage fees, legal fees or stamp duty. (Chau, 2006)

The price ratio from time 0 to t can then be expressed as:

$$P_t/P_0=(1+R_1)(1+R_2)(1+R_3)….(1+R_t) \text{ or } 1+cR_t \quad (2)$$

Where cR_t is the cumulative return of the property portfolio from time 0 to t, with $cR_0=0$

By (1) that for any two time period t_1, t_2 (where $T\geq t_2\geq t_1\geq 0$), the cumulative return is :

$$P_{t2}/P_{t1}=1+cR_{t2}/1+cR_{t1}\ (3)$$

Suppose that there are N properties, all of them have been transacted twice in the market between the time period 0 to T. Let t_1 be the time of first sale and t_2 be the time for the second sale, assume for any property I (I = 1, 2….N) the cumulative return between the first and second sales is formed by two multiplicative and uncorrelated components: which is the property market return and the idiosyncratic return, ϵ.

$$P_{t,t2}/P_{t,t1}= (1+cR_{t2}/1+cR_{t1}) \text{ x } \epsilon_t$$

If the repeat transactions span the whole period from time 0 to T, then (3) can be expressed in terms of a series of gross cumulative returns:

$$P_{i.t2}/P_{i,t1}=(1+cR_1)^{Di,1}\ (1+cR_2)^{Di,2}….(1+cR_T)^{Di,T}\ \epsilon_i$$

Where $D_{i.t}$ is a time indicator which equals to -1 if t is equal to t_1, +1 if t_2 and 0 if otherwise. Taking the natural logarithm of both sides and assuming that In ϵ_i is a random noise with zero mean and constant variance, it becomes a linear regression model which can be estimated by using the OLS technique.

$$\text{In}(P_{t,t2}/P_{t,t1})= \sum_{t=1}^{T} a_t \blacksquare D_{i,t} + \text{In}\epsilon_i$$

5.9.2 Applicable of repeat sales analysis to this study

In this dissertation, due to the insufficient number of transaction data available, quarterly housing index is constructed rather than the monthly housing index. In order to obtain one pair of transaction record from a particular property, the property should at least been transacted in the market twice. Two pairs of transaction record pair could be obtained if the property has been transacted three times and so on. The repeat sales index can be constructed by the regression function:

$$\ln(P_{t,t2}/P_{t,t1}) = \sum_{t=1}^{T} a_t \cdot D_{i,t} + \ln\epsilon_i$$

- Where the dependent variable is the natural logarithm of the ratio of the transaction price of the second sales ($P_{t,t2)}$ to the first sales of the repeat sales pair ($P_{t,t1)}$, $D_{i,t}$ is a series of time indicators which is equal to -1 at the time when the first sale took place, +1 at the time when the second sale took place and 0 for all other time periods. The coefficient a_t represents the index value which could be obtained by using the regression technique.

Two indexes will be constructed in this study. The first one is the index for the whole private residential estate Baguio Villa. The second index is the housing index for the Upper Baguio Villa. This two housing index basing on 1Q/1995 starting from 1995 to 2008 will be compared to each other to see whether there is any change in price level. The index of lower Baguio Villa is not constructed directly to compare to the index of Upper Baguio Villa since there are not enough number of pairs of sales available.

5.9.3 Data construction

Similar to the source of data for the hedonic pricing model, property transaction pair will be constructed by pairing up the property transaction data obtained from the EPRC. Once we obtained two transaction records which have the exactly same address are obtained, the two records can then be paired up to form a transaction pair.

Record No.	Address	GFA(sqm)	Transaction Price	Date of transaction
1	Flat A, 22/F XX Terrance	1000	$5M	1/2/2001
2	Flat A, 22/F XX Terrance	1000	$7M	1/2/2005

Record	No.	Address	1st sale	2nd sale	1st sale date	2nd sale date
1		Flat A, 22/F XX Terrance	$5M	$7M	1/2/2001	1/2/2005

Fig.10 The construction of repeat sales pair

In selecting the suitable transaction pair for the analysis, several repeat sales pair which greatly deviates from the market price trend was removed. These pairs are usually caused by data entry error in the EPRC database, non-arm's length transactions and special deals.

Also, transactions with transaction period difference lower than four month are excluded to reduce the problem of revision[27] (Chau, 2006).

5.9.4 Expected result

It is expected that the result of this analysis will be similar to the result obtained from the hedonic pricing model conducted. It means that the housing index for the Upper Baguio Villa will be above the index for the whole estate before 3/99 and the difference between the two indexes will be diminished after this time period due to the effect of proximity to Cyber-port amenities. As the magnitude of the effect is not yet known in this stage, it is hard to justify the position of the two different indexes after the announcement of the project.

[27] Previous indes values change as new transactions become avaliable

Chapter 6
Empirical results

6.1 Introduction

This chapter aims to present the empirical results of the two analysis described in Chapter 5. Then, an interpretation of the empirical results will be made. After presenting the result, implications related to the study will be given.

6.2 Hedonic pricing analysis

In this study, the author aims to find out the proximity effect of cyber-port on nearby property prices. In this part, the description of data and the empirical results for the hedonic pricing model will be presented.

6.2.1 Description of data

To carry out the investigation, a set of property transaction data is obtained from the private residential estate Baguio Villa. As the data is obtained from the same estate, most of the locational and neighborhood characteristics of the properties under investigation can be effectively controlled.

The transactions of the properties inside Baguio Villa from 1995 to 2005 were collected which give a database with 946 transaction record. **Some data were excluded from the database as those properties have experienced structural change (i.e. the seaview**

was blocked by the Cyber-port development) within the investigation timeline. The data used in this model are of high quality as they were carefully examined before being inputted into the program E-view from which the results were then generated. On the other hand, the time effect for the transaction price is eliminated more effectively by deflating the property price by the Repeated Sales Index for the Pok Fu Lam area produced by The University of Hong Kong instead of the index produced by the Rating and Valuation Department which the latter index may produces less accurate results as it is a territory index. Some statistical descriptions of the data used are shown in the following table.

Variable	Mean	Median	Maximum	Minimum	Std.Dev
AGE	259	254	377	196	42.32178
GFA	1445	1153	2700	1020	503.8501
FLOOR	14	15	31	1	7.533
LOWER_BV	0.241015	0	1	1	0.427926
PSV	0.068710	0	1	0	0.253095
SV	0.389006	0	1	0	0.487783
FSNV	0.121564	0	1	0	0.326955
AN_LOW	0.12685	0	1	0	0.111970
CON_LOW	0.057082	0	1	0	0.232123
COM_LOW	0.023256	0	1	0	0.150795
INPRICE	15.12558	15.08356	16.35559	13.25882	0.380399

Total no. of observations: 946

Table.10 Description statistics for the variables used in the model

After collection of the suitable property transaction data, they were inserted into the E-view program for the estimation of the unknown parameters (i.e. the coefficient of the independent variables). Some of the statistical information presented below which is already being introduced in the previous chapter will be interpreted.

6.2.2 Empirical result for the model

In this study, the effect of proximity to Cyber-port on nearby property price during the different stages of the project is investigated by employing the three interacting variables AN_LOW, CON_LOW and COM_LOW. The square term of GFA is added to capture the non-linear effect of this variable. Other square terms are not included as they are not statically significant. The results are presented in the following table.

Dependent variable: InPRICE

Method: Lease Square

Date: 01/03/2008 Time: 16:20

Sample: 1 946

Included Observations: 946

White Heteroskedasticity-consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.94918	0.146715	95.07642	0.0000
AGE	0.000142	0.000239	0.592590	0.5536
GFA	0.000797	0.000130	6.131138	0.0000***
GFA^2	-7.31E-08	3.24E-08	-2.255588	0.0243**
FLOOR	0.007300	0.001061	6.877429	0.0000***
LOWER_BV	-0.044765	0.042272	-1.058981	0.2899
PSV	0.107990	0.022778	4.741010	0.0000***
FSV	0.111928	0.021247	5.267882	0.0000***
FSNV	0.090775	0.027277	3.327868	0.0009***
AN_LOW	-0.003501	0.060683	-0.057688	0.9540
CON_LOW	-0.016831	0.031321	-0.537375	0.5911
COM_LOW	0.123146	0.036892	3.337998	0.0009***
R-squared	0.717864			
Adjusted R-squared	0.714542			
F-statistic	216.0423			
Prob(F-statistic)	0.000000			

* 10 per cent significance
** 5 per cent significance
*** 1 per cent significance

Table.11 The regression results for the hedonic pricing model

The regression equation of the hedonic pricing model is therefore:

LNPRICE = 13.94918 + 0.0001422AGE + 0.00730FLOOR + 0.00080GFA - 7.31211e-08GFA^2 - 0.04477LOWER - 0.00350AN_LOW - 0.01683CON_LOW + 0.12315COM_LOW + 0.11193SV + 0.09080FSNV + 0.10800PSV

The value of the adjusted R-square is 0.714542 (i.e. 71.5%) which means that the model could explain 71.5% of the change of the dependent variable (i.e. the natural logarithm of the transaction price). The explanation power of this model is quite high. The F-statistic of the model is high also at the value 216.0423 with Prob(F-statistic) < 0, so the null hypothesis that none of the independent variable helps to explain the variation of the dependent variable can be rejected.

Moreover, most of the estimated parameters of the independent variables are statistically significant and are of the expected sign and magnitude at the 1% and 5% significant level. The following table shows the actual sign of the estimated parameters with the expected sign of the coefficient.

Independent variable	Expected sign of coefficient	Actual sign of coefficient
AGE	(-)	(+)
GFA	(+)	(+)
GFA^2	(?)	(-)
FLOOR	(+)	(+)
FSV	(+)	(+)
PSV	(+) but< FSV	(+)<FSV
FSNV	(?) but < PSV	(+)<PSV
LOWER_BV	(-)	(-)
AN_LOW	(?)	(-)
CON_LOW	(?)	(-)
COM_LOW	(+)	(+)

Table.12 Expected results Vs Actual results

The only coefficient of the independent variable which deviates with the expected result is AGE. The coefficient of the variable AGE is shown positive with the value 0.000142 but not statically significant. This means that the increase in age of the properties will not lead to a decrease on property prices. This result does not match with the expected result that an increase in age will cause maintenance and an appearance problem which decreases the property price of the property. This can be explained by the similar age of the buildings under investigation. The buildings under investigation only have 2 to 3 years difference in age and thus the AGE effects between buildings may be so small that it could not be observed by the purchasers. Also both the Upper and Lower Baguio Villa are buildings over 30 years. The depreciation effect of the buildings on property price is limited.

The coefficient of the variable GFA is positive with the value 0.000797 and significant at the 1% level. This means that the property price will increase with an increase in the Gross Floor Area. This matches the expectation that the buyers are willing to pay for the enjoyment of the extra floor space.

The coefficient of the variable GFA^2 is negative and is significant at the 5% level. It means that the increase in size of the properties increase the property price at a decreasing rate.

The coefficient of Floor is positive with the value of 0.007300 and it is significant at the 1% significance level. This means that an increase in one floor level will increase the property price by 0.73%. This matches with the expectation that the purchasers are willing to pay a premium for living at a greater height. They could be explained by that the flat with greater height could enjoy a more superior seaview. On the other hand, a minimization of nuisance receiving from the street traffic can be achieved by living at a greater height from the ground level.

The coefficient of FSV is positive with a value of 0.111928 and a significant level at 1% level. This means that a flat possessing a full seaview can attract purchasers to pay 11.1% premium comparing with the flat which are facing the mountain. This matches the expectation that purchasers are willing to pay more for a flat having a seaview. Due to the high population density in Hong Kong, lots of tall buildings are built up. The views from the flats are often blocked by the surrounding buildings. A “good” view such as seaview thus become an very important housing attribute which increases the amenity level of the property enjoyed by the homebuyers.

The coefficient of PSV is positive with a value of 0.107990 and it is significant at the 1% level. This means that a flat possessing a partial seaview can attract purchasers to pay for 10.8% premium comparing to the flats facing the mountain. This matches the expectation that purchasers are willing to pay more for a flat even if it does not possess a seaview but a partial seaview. The magnitude of the effect of a partial seaview is smaller than the effect of having a full seaview as reflected by the size of the coefficient. This match the expectation that the housing attribute (full seaview) has a higher amenity level than a partial seaview.

The coefficient of FSNV is also positive with the value 0.090775 and it is significant at the 1% level. This means that a flat facing the sea but with no seaview can attract purchasers to pay for 9.08% premium comparing to the flats facing the mountain. This means that the purchasers are willing to pay more for a flat even if it does not possess a seaview but facing the sea. The effect of facing to the sea is smaller than the effect of having a full seaview or a partial seaview as reflected by the size of the coefficient.

The coefficient of LOWER_BV is negative with a value of -0.044765 but it is shown not significant at even the 10% significance level. This means although the sign of the coefficient is same as our expectation, we can not prove this coefficient is significantly different from zero. This result reflected the rather similar property prices between lower and upper Baguio Villa before the announcement of the Cyber-port development in 1999.

The following three interacting independent variables are employed to test the hypothesis of this research; they are AN_LOW, CON_LOW and COM_LOW respectively. Positive

sign will be shown if there is a preference for the purchasers to choose to buy a flat at Lower Baguio Villa instead of Upper Baguio Villa during the three time period.

The coefficient of AN_LOW is negative with the value -0.003501 but it is not shown as statically significant even at the 10% significance level. This means that during the announcement period, there is no effect of proximity of Cyber-port in affecting the preference of the purchasers in choosing Lower Baguio Villa over Upper Baguio Villa. This can be explained by the relatively short time period between the announcement period and construction period. The purchasers are not aware of the types of amenities which they could enjoy after the completion of the project as lack of certainty of the information of the project was provided to the general public.

The coefficient CON_LOW is negative with the value -0.016831 but it is not shown statically significant at even the 10% significance level. This means that during the construction period, there is no evidence to prove that there exists a positive or negative effect of proximity to Cyber-port in affecting the preference of the purchasers choosing Lower Baguio Villa over Upper Baguio Villa. But by comparing the significance level and the value of the negative coefficient of AN_LOW and CO_LOW, we can roughly see there is a greater detrimental effect on property price of Lower Baguio Villa during the construction period. This can be explained that although some of the facilities such as the new transportation routes were in used before the whole completion of the project, these new amenities were outweigh by the negative effect brought about by the construction activities described in Chapter 3.

The coefficient of COM_LOW is positive with the value 0.123146 and it is also statistically significant at the 1% significance level. This means that after the completion of the project, there is a preference for the purchasers to choose Lower Baguio Villa over Upper Baguio Villa. After the completion of the project, most of the construction works have ceased and other facilities such as the new shopping centre named the Arcade, the cinema, the restaurants and transportation routes were in used. The advantage taken by Lower Baguio Villa of proximity to these new facilities was reflected inside the property price of the flats. This confirms the hypothesis of this research which is:

> *"Cyber-port has brought improvement in amenities level in the surroundings, as accessibility is a factor in determining the level of enjoyment over these new amenities, the closer to Cyber-port, the stronger increase in property prices should be experienced."*

6.3 Repeat sales analysis

There are a numbers of factors which may cause the inaccuracies of the results obtained from a hedonic pricing model such as the quality of the data[28], the suitable use of an accurate price index as price deflator and the correct choice of a suitable functional form for the model. So to avoid the inaccuracies of the model due to the above factors, another analysis, which is by the creation of two housing price index is adopted to reaffirm the result obtained in the hedonic pricing model.

[28] In Wong & Yiu (2003), they specified the advantage of this approach is to avoid the problem of arbitrarily defined sea views which it may affects the quality of the data obtained.

6.3.1 Description of data for the repeat sales analysis

Following the method and criteria described in Chapter 4, two repeat sales index were constructed, one for the whole private residential estate Baguio Villa (namely Index 1) and another one for the Upper Baguio Villa (namely Index 2). For Index 1, it was created based on 474 pairs of transaction pairs. For Index 2, it was created based on 363 pairs of transaction pairs. Due to the limited number of transaction pairs obtained, the two indexes are created as quarterly indexes. The base of the two indexes is set as 100 at the 1st Quarter of 1995. Also, the price index is normalized at Q1/95. The statistical information for the indexes created is included in the Appendix 1&2.

6.3.2 Empirical results for the repeat sales model.

The following graph shows the price index 1 (in blue colour) and 2 (in pink colour). The regression statistics for the creation of the two indexes are provided in the Appendix 1 and 2.

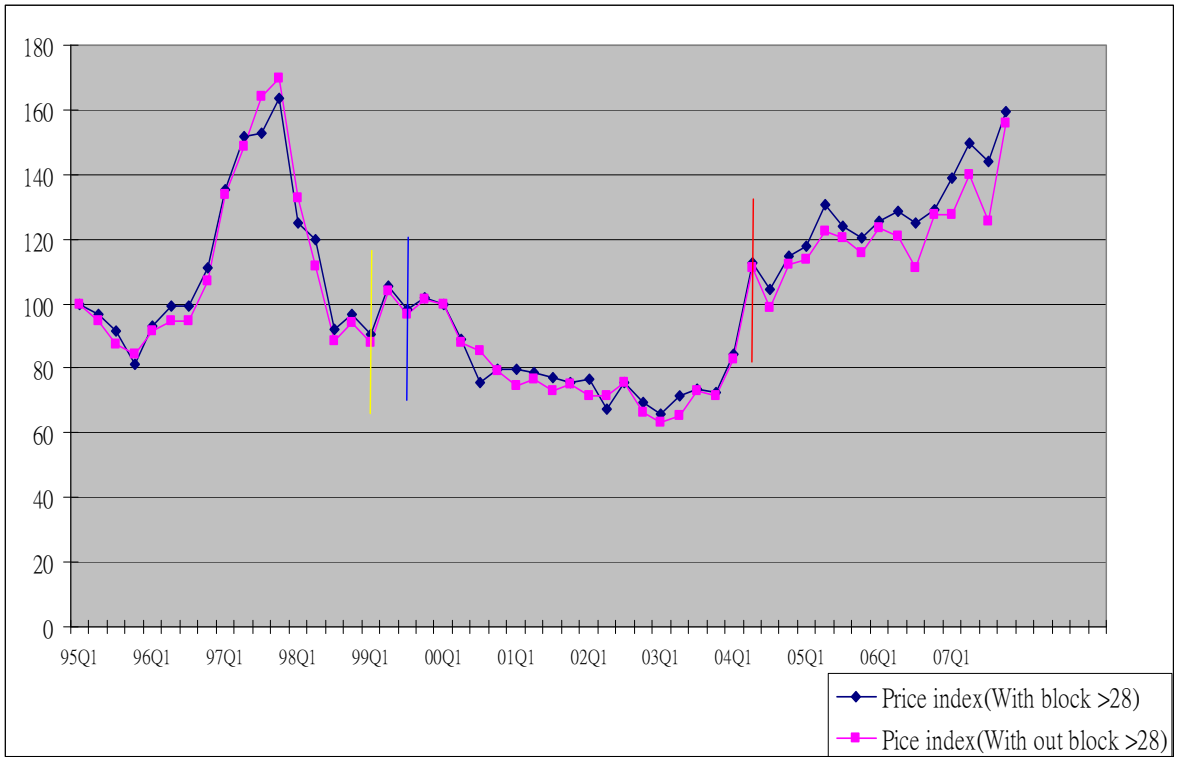

Fig.11 Repeat sales indexes for the whole Baguio Villa and Upper Baguio Villa

The blue line is the price index for the whole Baguio Villa and the pink line represents the price index for the Upper Baguio Villa.

The yellow, blue and red line shows the starting of the announcement, construction and completion period respectively. There are few observations drawn from the graph above and it is summarized as follow:

- From the start to the yellow line, the two lines are nearly identical
- In between the yellow and blue line, the two line is nearly identical
- In between the yellow and red line, the two line is nearly identical, but there is a rough trend that the blue line is above the pink line
- The blue line is over the pink line for all the period after the starting of the red line

Before the announcement of the Cyber-port project, both the Upper and the whole Baguio Villa were at a similar property price level. After the announcement but before the construction period, they also have an identical price level trend. These match the result obtained in the Hedonic Pricing Analysis. At the construction stage, it is hard to differentiate whether which one is at a higher price level for the whole period, but roughly, the blue line started to climb above the pink line. At the completion stage, there exists a trend that the whole estate has a higher price level than the Upper Baguio Villa which means that Lower Baguio Villa is at a higher price level than Upper Baguio Villa at this stage. This fits the results of the hedonic pricing model and hence the hypothesis of this dissertation is once again confirmed.

6.4 Implication of the result

In Hong Kong, flat land with prime location is scarce. Local private developers and even the government of the HKSAR which regarded it as a "public developer" always tends to fully utilize the use of the land in this territory. To achieve this, private developers would always ask for a higher percentage of site coverage and a larger number of plot ratio through planning applications. Also, the government through setting the terms in the land lease and town planning can utilize the use of the land so as to achieve a balance between the economical and social factors.

Besides the consideration of maximizing the use of the land, private developers and the town planners surely understand the need for other external supporting facilities to support the running of certain kind of development. For example, shopping centre is always an essential element included in a residential development to support the daily

needs of the residents. New transportation routes and transport terminal are also important for this kind of development. As suggested in the previous section, residential satisfaction of a household is affected by the amenity level of that property. These facilities acting as amenities would contribute to different kind of residential satisfaction and eventually lead to a higher property price of surroundings.

Distance is an essential factor which affects the enjoyment level of different kind of amenities and hence affecting the enhancement of property price by these amenities. A series of researches have already been reviewed in Chapter 2 which suggested the existence of an important relationship between distance to amenities and property price. But then a question may be raised "Is it always true that being in a short distance to facilities is always desirable?" Lack of research has been done to give an answer to this question. Except for Crafts (1998) where he challenged this question by proposing that in walking distance, a commercial development may has a detrimental effect to neighborhood property price. To conclude, no such effect was found by him.

In this study, the author followed the footsteps of Crafts (1998) by carrying out an empirical analysis to test the effect of proximity (i.e. in walking distance) to commercial properties on adjacent property price. The Cyber-port development was used as a case study to test such effect. The result showed that there exists a positive effect on property price by living near to the commercial development and it answered the question raised above.

The positive result give rises to two important implications, one on the general public side and one on the government side.

For the government side, as the new comprehensive development could enhance the property value in the surroundings, the land value of the surroundings are boosted and the government could raise more revenue from the land auction of the surrounding land after the completion of the development. In fact, the government has chosen to finance the government-owned development by allowing a private developer to develop a part of the site as residential buildings – the Bel-Air. It is hard to justify whether this decision of financing is correct or not but more revenue might be obtained to finance the project if that part of the land is auctioned after the completion of the Cyber-port portion.

For the general public, some rezoning objections were raised by the citizens living in that area concerning the environmental impact which the development may bring about during the different stages of the project. In fact from the empirical result shown, living near the development will experience an increase in property price rather than a decrease. This means that the amenity level increases rather then decrease after the completion of the project. This suggested that the convenience gained due to proximity to facilities is probably a more important consideration than the harmful effect due to the exposure of undesirable nuisance prior or after the project during the purchasing of the property. This gives us a clearer idea of the residential choice of Hong Kong people.

Chapter 7
Conclusion

7.1 Introduction

This chapter aims to give a brief summary on the whole process of the study. Firstly, there will be a part summarizing the findings, after that there will be a brief discussion on the limitation of this research which may accounts for the inaccuracy of the model. At the end, there will be a section about the areas for future studies derived from this research.

7.2 Review of research

This section gives a short review on the whole dissertation construction process including the remarkable results obtained from the empirical analysis.

"Time is the essence" **-** A platitude frequently used by businessman located around the world especially in financial centers such as New York and Hong Kong. Time has become an important resource for most people since the changing in mode of production in the past two to three centuries.

Unlike the mode of living in the past which most of the people obtained their daily needs such as food from the farms they owned situated next to their house, advancement in technology has brought these daily goods to a central place called shopping centre or supermarket. The distance between shopping centers and residential properties thus affects the time needed for people to travel from their home to those places.

Also, human beings begin to work in offices and earn bank notes instead of working on farms for food. These offices are usually located in the Central Business district which is not cheap to live in and thus many new transportation modes has been developed which served to satisfy the workers' need. The distance between this transportation modes stations and residential properties thus also affects the time needed for people to travel from their home to those work places.

As the amount of time resources employed by human to reach these facilities forms a critical part of time spent in their daily lives, it could easily affect their residential satisfaction. After deep thinking, the author wondered whether this sort of effect on residential satisfaction could be fully reflected on property prices. In a special occasion, the author noticed the irregularity of the private residential estate, Baguio Villa which is situated near a recent comprehensive development Cyber-Port. This provided a good chance for the author to carry out a study on the time-residential satisfaction (indicated by the increase in property price) relationship. It also let us to discover whether a negative effect due to the adjacent commercial development as proposed by Crafts (1998) does exist or not.

The research objective is to examine the impacts of new amenities on adjacent property prices. After the development of the hypothesis, it was first tested in a hedonic pricing model by using 946 property transaction data from Baguio Villa, Pok Fu Lam within the timeline 1995-2005. The result confirmed the hypothesis and suggested that property situated nearer to Cyber-Port has experienced a greater increase in property price level after the completion of the project.

Since the result obtained from the hedonic pricing model is subject to dozens of assumptions and which it may constrain the accuracy of the result, another approach which is the construction of repeat sales index is introduced as supplement to reaffirm the result. From the observation of the difference between the two indexes being constructed, the hypothesis is once again confirmed.

7.3 Limitation of Research

Although empirical analysis has been carried out with the expected result obtained, this study may not be comprehensive enough to conclude the effect of proximity to amenities on property price due to some limitations involved. It will be discussed in this section.

7.3.1 Limitation on the Data Samples used

Through out the whole investigation timeline (from 1995 to 2005), only 946 data were collected and included inside the research database. This number of data used maybe less than enough for carrying out a representative or reliable analysis. Also, there is only a few data collected within the announcement and construction period of the project which may affect the result of the coefficient of the two interacting variable. This problem is unavoidable since only the private residential estate Baguio Villa is adjacent to Cyber-port which allows the continuation of this research. Other residential buildings are located far away from the development; at least, not in walking distance and therefore they are not suitable to be included in the study.

The limited number of data obtained also affects the accuracy of the repeat sales indexes created for the analysis. A quarterly index was plotted instead of monthly index since not enough transaction pairs were obtained for each month. As the real estate market in Hong Kong is very volatile, the price level for a short period says even within one to two months will be quite different. These may cause inaccuracy when comparing the two indexes.

7.3.2 Assumptions made in the analysis

Due to the limited time and other resources, a complicated research methodology is avoided. To simplify the whole analysis process, assumptions were made throughout the progress of the work and some of the assumptions are summarized below:

- The assumptions of hedonic pricing model such as (i.e. The correctiveness of the functional forms used and that the dependent variable can be expressed as a combination of several unknown factors)

- By discarding the property transaction data with potential blockage of seaview, there are no other structural change of property within the investigation period.

- The assumptions made during the construction of the repeat sales indexes

7.4 Areas for future studies

As mentioned in the previous section, the numbers of data collected in this study may not be large enough to produce a consolidate conclusion on whether proximity to large comprehensive commercial development will generate an increase in property price. Thus, the research can be carried out again in the near future in other district such as the APM in Kwun Tong. As more residential buildings are situated within that area, a larger sample could be obtained and hence generating a more representative result.

On the other hand, the effect of proximity to other kinds of facilities such as churches, schools, flower markets and even offices has not been deeply investigated in Hong Kong. Many researches in this area have been done in the past by the westerners. It maybe quite interesting to compare those results obtained in Hong Kong with other countries since the high-rise compact housing development nature of Hong Kong is quite unique and so the residential choice of homebuyers here maybe different to those in foreign countries.

Instead of carrying out empirical analysis to investigate the effect on property price due to the proximity to amenities, qualitative approach can be adopted in the future to test the residential satisfaction of citizens in the period before and after the construction of a new development. This could let us understand more about the factors affecting their residential choice and how they weigh the value of environmental amenities and other types of amenities.

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Appendix I Repeat sales index for Upper Baguio Villa

Robust Regression Output: Dependent Variable = lnprice							
Regression Statistics							
R-Squared	0.818272				F statistic =	98.14398	
Adjusted R-Squared	0.789148				Prob > F =	1.000000	
Standard Error	0.173950						
Number of Obs	363				Mean (lnprice) =	0.083102	
					Std Dev (lnprice) =	0.369571	
	Coefficients	Standard Error	t stat	p > |t|	Lower 95%	Upper 95%	
Intercept (95Q1)	0	N/A	N/A	N/A	N/A	N/A	100
95Q2	-0.056608	0.043725	-1.29464	0.195446	-0.142306	0.029091	94.49649
95Q3	-0.135203	0.061951	-2.18243	0.029078	-0.256625	-0.013782	87.35383
95Q4	-0.171303	0.048816	-3.50912	0.000450	-0.266981	-0.075624	84.25663

Appendix I Repeat sales index for Upper Baguio Villa

96Q1	-0.086746	0.045494	-1.90676	0.056552	-0.175912	0.002420	91.69103
96Q2	-0.057049	0.042973	-1.32756	0.184323	-0.141274	0.027176	94.45478
96Q3	-0.053657	0.060079	-0.89312	0.371792	-0.171409	0.064094	94.77568
96Q4	0.067988	0.041011	1.65781	0.097355	-0.012392	0.148368	107.0353
97Q1	0.289149	0.041215	7.01565	0.000000	0.208369	0.369928	133.529
97Q2	0.396655	0.049133	8.07311	0.000000	0.300356	0.492954	148.6843
97Q3	0.496339	0.072302	6.86478	0.000000	0.354629	0.638049	164.2696
97Q4	0.529362	0.042360	12.49672	0.000000	0.446338	0.612386	169.7849
98Q1	0.284719	0.053194	5.35250	0.000000	0.180461	0.388976	132.9388
98Q2	0.111631	0.055180	2.02304	0.043070	0.003480	0.219781	111.81
98Q3	-0.124691	0.051397	-2.42604	0.015265	-0.225427	-0.023955	88.27697
98Q4	-0.062187	0.055641	-1.11764	0.263722	-0.171241	0.046868	93.97075
99Q1	-0.127858	0.088223	-1.44927	0.147263	-0.300771	0.045055	87.99781
99Q2	0.039103	0.048610	0.80443	0.421146	-0.056170	0.134377	103.9878
99Q3	-0.035625	0.049506	-0.71961	0.471767	-0.132655	0.061405	96.50022
99Q4	0.011671	0.125663	0.09288	0.926002	-0.234624	0.257966	101.1739

Appendix I Repeat sales index for Upper Baguio Villa

00Q1	-0.002278	0.044398	-0.05130	0.959086	-0.089295	0.084740	99.7725
00Q2	-0.128755	0.057765	-2.22893	0.025818	-0.241972	-0.015537	87.91897
00Q3	-0.157541	0.085891	-1.83419	0.066625	-0.325885	0.010802	85.42416
00Q4	-0.232598	0.048462	-4.79959	0.000002	-0.327583	-0.137614	79.24717
01Q1	-0.294984	0.051879	-5.68595	0.000000	-0.396666	-0.193302	74.45437
01Q2	-0.267287	0.090683	-2.94748	0.003204	-0.445023	-0.089551	76.54533
01Q3	-0.314735	0.062055	-5.07191	0.000000	-0.436360	-0.193111	72.99821
01Q4	-0.288840	0.052335	-5.51904	0.000000	-0.391415	-0.186265	74.9132
02Q1	-0.338224	0.046155	-7.32803	0.000000	-0.428686	-0.247762	71.30357
02Q2	-0.336545	0.059925	-5.61610	0.000000	-0.453996	-0.219094	71.42339
02Q3	-0.281129	0.051666	-5.44123	0.000000	-0.382393	-0.179865	75.49311
02Q4	-0.411326	0.056470	-7.28395	0.000000	-0.522006	-0.300647	66.27705
03Q1	-0.456700	0.051836	-8.81057	0.000000	-0.558296	-0.355105	63.33701
03Q2	-0.426317	0.045656	-9.33753	0.000000	-0.515801	-0.336832	65.29096
03Q3	-0.314967	0.103256	-3.05035	0.002286	-0.517345	-0.112589	72.98128
03Q4	-0.333296	0.044101	-7.55751	0.000000	-0.419733	-0.246859	71.65582

Appendix I Repeat sales index for Upper Baguio Villa

04Q1	-0.188772	0.043792	-4.31068	0.000016	-0.274603	-0.102942	82.79749
04Q2	0.105853	0.142811	0.74121	0.458566	-0.174052	0.385758	111.1658
04Q3	-0.010214	0.053275	-0.19173	0.847955	-0.114632	0.094203	98.98376
04Q4	0.114247	0.070976	1.60966	0.107472	-0.024863	0.253357	112.1029
05Q1	0.126143	0.043138	2.92415	0.003454	0.041594	0.210693	113.4445
05Q2	0.202057	0.042301	4.77662	0.000002	0.119148	0.284966	122.3918
05Q3	0.184228	0.049104	3.75178	0.000176	0.087985	0.280470	120.229
05Q4	0.144521	0.051945	2.78217	0.005400	0.042710	0.246332	115.5486
06Q1	0.210382	0.045741	4.59944	0.000004	0.120732	0.300032	123.4149
06Q2	0.190675	0.054566	3.49441	0.000475	0.083728	0.297622	121.0066
06Q3	0.104039	0.088570	1.17466	0.240131	-0.069554	0.277632	110.9644
06Q4	0.244956	0.064214	3.81467	0.000136	0.119098	0.370813	127.7564
07Q1	0.242084	0.097589	2.48065	0.013114	0.050813	0.433355	127.3901
07Q2	0.335288	0.049328	6.79709	0.000000	0.238607	0.431970	139.8344
07Q3	0.226689	0.094982	2.38665	0.017003	0.040527	0.412850	125.4439
07Q4	0.442557	0.061823	7.15844	0.000000	0.321386	0.563727	155.6682

Appendix II Repeat sales index for Whole Baguio Villa

Robust Regression Output: Dependent Variable = lnprice							
Regression Statistics							
R-Squared	0.777305				F statistic =	103.3370	
Adjusted R-Squared	0.750982				Prob > F =	1.000000	
Standard Error	0.193596						
Number of Obs	474				Mean (lnprice) =	0.085828	
					Std Dev (lnprice) =	0.378322	
	Coefficients	Standard Error	t stat	p > |t|	Lower 95%	Upper 95%	Price index
Intercept	0	N/A	N/A	N/A	N/A	N/A	100
95Q2	-0.033634	0.036054	-0.93286	0.350890	-0.104299	0.037032	96.69254473
95Q3	-0.089102	0.047018	-1.89505	0.058086	-0.181256	0.003052	91.47523528
95Q4	-0.209780	0.049961	-4.19886	0.000027	-0.307702	-0.111858	81.07627525

Appendix II Repeat sales index for Whole Baguio Villa

96Q1	-0.070584	0.037491	-1.88271	0.059740	-0.144065	0.002896	93.18490546
96Q2	-0.008649	0.043742	-0.19773	0.843258	-0.094381	0.077083	99.13883628
96Q3	-0.007783	0.045652	-0.17048	0.864632	-0.097260	0.081694	99.22473393
96Q4	0.105830	0.033451	3.16376	0.001557	0.040268	0.171393	111.1633077
97Q1	0.302617	0.036385	8.31709	0.000000	0.231304	0.373930	135.3396066
97Q2	0.418330	0.039408	10.61529	0.000000	0.341091	0.495569	151.9421948
97Q3	0.422331	0.070818	5.96360	0.000000	0.283530	0.561133	152.551394
97Q4	0.492481	0.044173	11.14904	0.000000	0.405905	0.579058	163.6371765
98Q1	0.221116	0.053231	4.15386	0.000033	0.116784	0.325448	124.7468042
98Q2	0.180024	0.045070	3.99435	0.000065	0.091689	0.268358	119.7245553
98Q3	-0.082970	0.051489	-1.61140	0.107093	-0.183887	0.017947	92.03790998
98Q4	-0.034872	0.046952	-0.74271	0.457657	-0.126896	0.057153	96.57292034
99Q1	-0.100293	0.083108	-1.20678	0.227518	-0.263182	0.062596	90.45722963
99Q2	0.053836	0.042314	1.27229	0.203269	-0.029098	0.136769	105.5311227
99Q3	-0.019545	0.063627	-0.30718	0.758709	-0.144251	0.105162	98.0645064
99Q4	0.016254	0.095138	0.17084	0.864347	-0.170214	0.202722	101.6386551

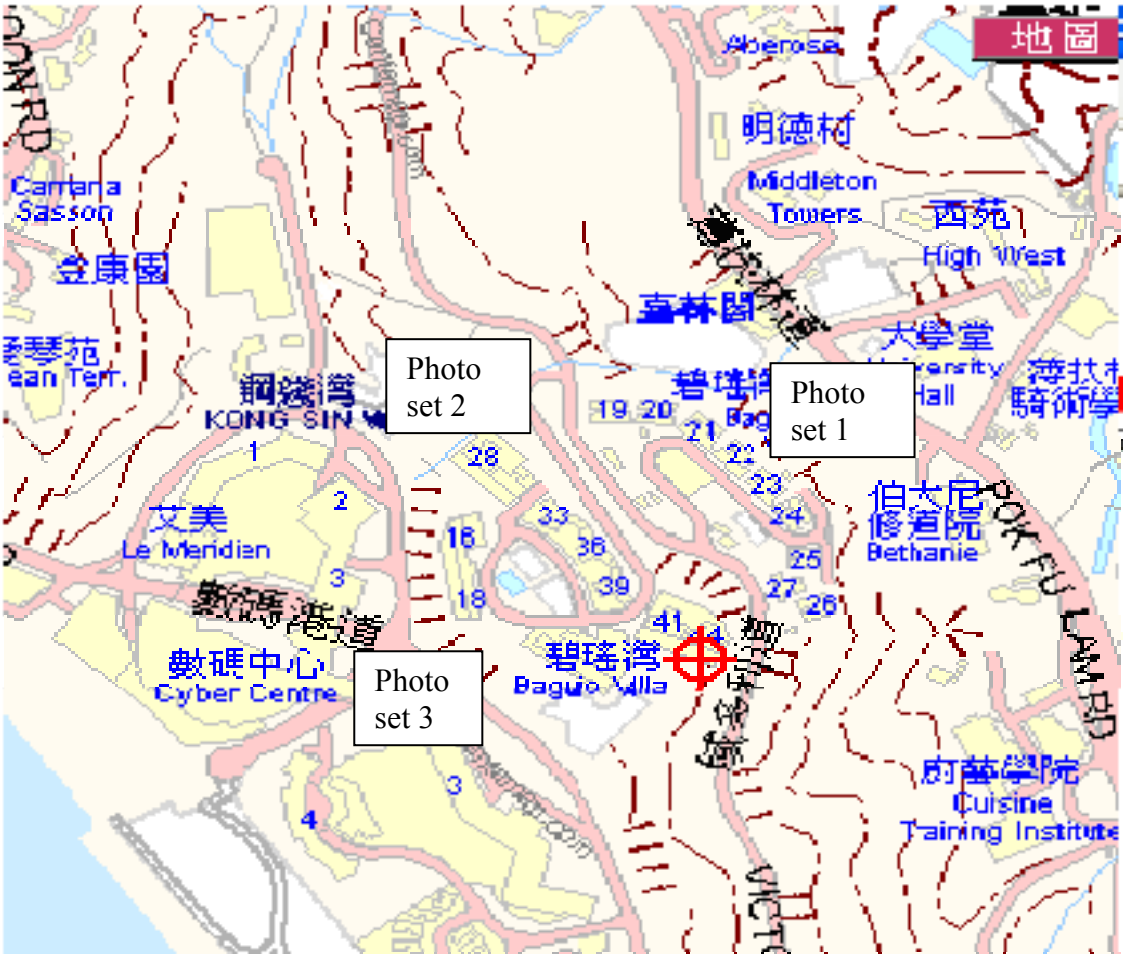
Appendix II Repeat sales index for Whole Baguio Villa

00Q1	-0.001690	0.037717	-0.04480	0.964268	-0.075613	0.072234	99.83117571
00Q2	-0.115040	0.046350	-2.48196	0.013066	-0.205885	-0.024195	89.13304543
00Q3	-0.281190	0.128198	-2.19341	0.028278	-0.532452	-0.029927	75.48850321
00Q4	-0.223561	0.036958	-6.04900	0.000000	-0.295998	-0.151124	79.96659145
01Q1	-0.225035	0.039395	-5.71222	0.000000	-0.302248	-0.147821	79.8488292
01Q2	-0.237080	0.072680	-3.26197	0.001106	-0.379531	-0.094630	78.89278981
01Q3	-0.262129	0.049412	-5.30495	0.000000	-0.358975	-0.165283	76.94118395
01Q4	-0.279026	0.042513	-6.56327	0.000000	-0.362350	-0.195701	75.6520539
02Q1	-0.263329	0.042623	-6.17812	0.000000	-0.346869	-0.179790	76.84887385
02Q2	-0.396149	0.110002	-3.60129	0.000317	-0.611749	-0.180549	67.29064086
02Q3	-0.276878	0.034393	-8.05042	0.000000	-0.344287	-0.209469	75.81470496
02Q4	-0.363040	0.048984	-7.41143	0.000000	-0.459046	-0.267033	69.55587783
03Q1	-0.422002	0.052889	-7.97898	0.000000	-0.525664	-0.318341	65.57324038
03Q2	-0.335030	0.078990	-4.24142	0.000022	-0.489847	-0.180212	71.53167846
03Q3	-0.306210	0.102343	-2.99199	0.002772	-0.506800	-0.105621	73.62317704
03Q4	-0.322287	0.038833	-8.29927	0.000000	-0.398398	-0.246175	72.44905663

Appendix II Repeat sales index for Whole Baguio Villa

04Q1	-0.167591	0.035470	-4.72492	0.000002	-0.237110	-0.098072	84.56997974
04Q2	0.119143	0.141888	0.83970	0.401077	-0.158952	0.397239	112.6531394
04Q3	0.044446	0.056607	0.78517	0.432354	-0.066502	0.155394	104.544883
04Q4	0.135562	0.055430	2.44567	0.014459	0.026922	0.244202	114.5180269
05Q1	0.161416	0.035544	4.54135	0.000006	0.091751	0.231080	117.517317
05Q2	0.267292	0.060804	4.39595	0.000011	0.148118	0.386466	130.6422319
05Q3	0.215515	0.038882	5.54274	0.000000	0.139307	0.291723	124.0500656
05Q4	0.185367	0.042111	4.40188	0.000011	0.102831	0.267903	120.3659919
06Q1	0.228381	0.046899	4.86968	0.000001	0.136462	0.320301	125.6564351
06Q2	0.250013	0.045321	5.51655	0.000000	0.161187	0.338840	128.4042344
06Q3	0.224637	0.081529	2.75529	0.005864	0.064843	0.384432	125.1868442
06Q4	0.253553	0.049829	5.08844	0.000000	0.155889	0.351216	128.859522
07Q1	0.327124	0.064490	5.07251	0.000000	0.200727	0.453522	138.697383
07Q2	0.402391	0.043706	9.20676	0.000000	0.316729	0.488053	149.5396144
07Q3	0.364587	0.071416	5.10513	0.000000	0.224615	0.504560	143.991932
07Q4	0.465669	0.060760	7.66401	0.000000	0.346580	0.584757	159.3079066

Appendix III Photos of Baguio Villa and Cyber-Port



There will be 3 photo set in this appendix.

Photo set 1 --Upper Baguio Villa

Photo set 2 –Lower Baguio Villa

Photo set 3 –Cyber-Port development throughout the different stages

Photo set 1 – Upper Baguio Villa

The outlook of Upper Baguio Villa

The corridor

The view from the lower floors

The view from the lower floors

Photo set 2 – Lower Baguio Villa

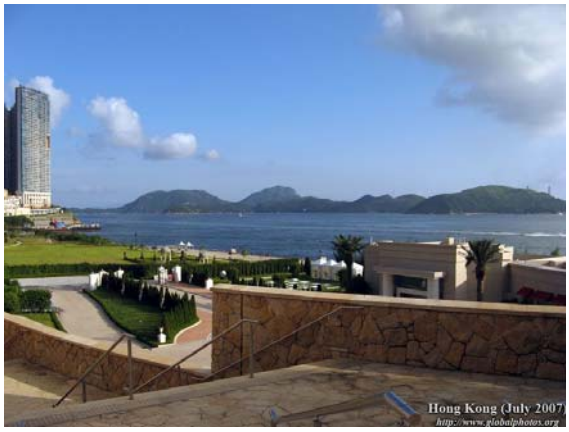
The back view of lower Baguio Villa

Block 16-18 (Data excluded from the model since potential seaview blockage)

Partial seaview

Access staircase to Cyber-Port

Photo set 3 – Cyber-Port



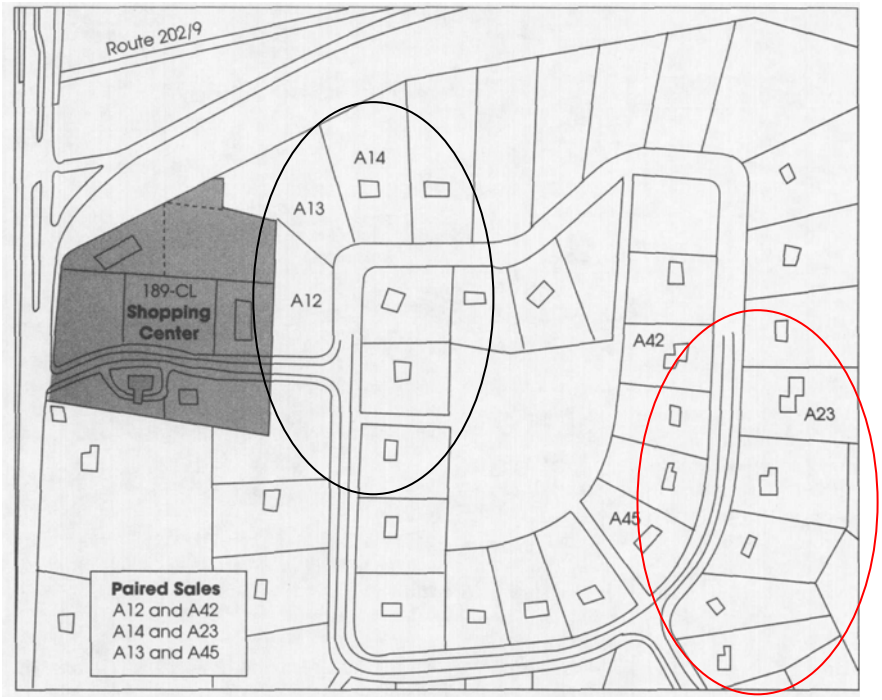
Seashore Corridor

Telegraph Bay before 1999

Bus terminal

The Arcade

Appendix IV
Comparison between this study and Crafts (1998)



BLACK- Properties adjacent to commercial development

RED - Properties buffered by a slope