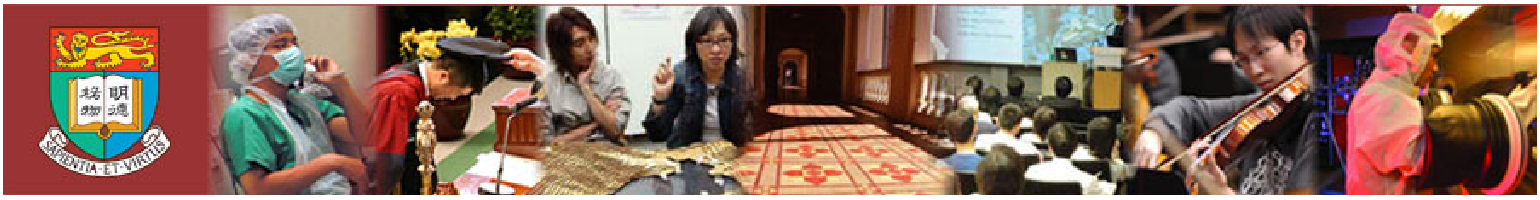

THE UNIVERSITY OF HONG KONG

AN EMPIRICAL STUDY OF THE IMPACT OF NEWLY CONSTURCTED RAILWAY LINES ON NEARBY RESIDENTIAL PROPERTY PRICES IN HONG KONG

A DISSERTATION SUBMITTED TO
THE FACULTY OF ARCHITECTURE
IN CANDIDACY FOR THE DEGREE OF
BACHELOR OF SCIENCE IN SURVEYING

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION

BY

CHEUNG PO CHING

HONG KONG

APRIL 2004

DECLARATION

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

Signed: ___________________________________

Name: _______Cheung Po Ching______________

Date: _______15th April 2004________________

ABSTRACT

There are endless amount of factors affecting property prices. Past literature has shown that, one of the factors: transportation infrastructure, in general affects property prices positively. This dissertation examines empirically whether such impact is positive, for four recently constructed railway lines in Hong Kong: the West Rail, the Ma On Shan Rail, the Tseung Kwan O Line and the Tung Chung Line, using the hedonic pricing model. Three development stages of a railway: the post-announcement stage, the construction stage, and the operation stage are investigated.

The results indicate that, in terms of the decrease in price gradient along the railway, as well as the increase in the value of proximity to the stations, the impacts were generally significant. Such impacts had sometimes occurred as early as during the announcement stage of the railway. Exceptional cases where there had been insignificant impact could mainly be attributed to poor market conditions or over supply of residential units. These results offer insight for future researchers to study and predict the impact of future railway lines on property prices, for railway companies to plan their future projects, for developers and investors to make appropriate decisions and property valuers to achieve higher accuracy in valuations.

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Chapter 1: INTRODUCTION

1.1 Background

Transportation infrastructure plays a vital role in the development of a city. Besides improving the accessibility and convenience of citizens, it also enhances the value of nearby land and properties, stimulating economic and real estate growth. Transportation infrastructure is thus important for continued land, social and economic development.

Railway infrastructure and new towns in Hong Kong

Hong Kong people are relatively time conscious. They prefer to go from one place to another within the shortest possible time. Among the various modes of mass transport, railways are relatively popular due to their efficiency, short time of travel and waiting time. In Hong Kong, railways account for more than 30% of daily domestic passenger travel. (Highways Department, 2001)

Indeed, there is a need to maintain well-managed and effective mass transport systems in Hong Kong, as Hong Kong is well known to be a densely populated city. The population in mid-2003 was approximately 6.8 million, in a total land mass of 1,100 square kilometres, of which only less than 22% was developed land. The majority of Hong Kong citizens live in Hong Kong Island and in Kowloon, having respective population densities of 16,290 and 43,220 persons per square kilometre in June 2002. (Census and Statistics Department, 2004) This density exerts an immense pressure necessitating the development of new towns, such as Ma On Shan and Tseung Kwan O in the New Territories, which is of much lower population density (3,640 persons per sq. km) to accommodate the ever increasing population.

The idea of new towns in Hong Kong dates back to 1959, when Tsuen Wan was designated as the first self-contained new town. (Ma, 1996) The influx of immigrants from Mainland China since the Second World War resulted in rapid growth of population in Hong Kong. This placed a great demand on land to provide housing, employment and community facilities. (Tsang, 2003) In response to this, the New Towns Programme in 1973 identified three new towns: Tsuen Wan, Tuen Mun and Shatin for comprehensive planning, in order to provide housing for 1.8 million people. (Territory Development Department, 2004)

The number of new towns has expanded to nine so as to cope with the increasing population. The total design population of the nine new towns has now increased to 4.1 million. The nine new towns are Tsuen Wan, Tuen Mun, Shatin, Tai Po, Fanling/Sheung Shui, Yuen Long, Tin Shui Wai, Tseung Kwan O and the latest one Tung Chung. (Territory Development Department, 2004) They can be classified into four generations:

Generation	New Towns
First	Tsuen Wan, Shatin, Tuen Mun
Second	Tai Po, Yuen Long, Sheung Shui/Fanling
Third	Tin Shui Wai, Tseung Kwan O
Fourth	Tung Chung

Compiled from:
1. Hills and Yeh, 1983
2. Leung, 2000

Table 1: The four generations of New Towns in Hong Kong

Source: Territory Development Department (2004) *New Town and Rural Township.* [online] Hong Kong, Territory Development Department. Available from: http://www.info.gov.hk/tdd/towns/index.htm [Accessed 11-2-2004]

Figure 1: The location of new towns in Hong Kong

According to the Territory Development Department (1994, 2004), by early 2004, the nine new towns have been developed to various stages. For the three new towns that comprise the first generation, development is almost completed. For example, Shatin has developed from a rural township in 1976 to a modern city today that houses population of approximately 640,000. The development of its extension, Ma On Shan, has been progressing since 1981.

The second generation of new towns, that started to develop from the late 1970s, has progressed to advanced stages. For example in Yuen Long, the present population is around 211,000, and is expected to reach 287,000 upon full development. Its status as the regional centre of the North Western New Territories is much strengthened by the newly constructed KCR West Rail. (Territory Development Department, 2004)

The remaining new towns, in third and fourth generations, are still in the active construction stage. The development of Tseung Kwan O, for example, was divided into three phases. After completing the first two phases, that include the districts of Po Lam, Hang Hau and the Town Centre North, the development of Tiu Keng Leng and Pak Sing Kok, comprising the final phase, is still in progress. (Territory Development Department, 2004)

In parallel to the rapid new town development, there is a demand for infrastructure investment to provide citizens with satisfactory levels of transportation convenience. According to the Territory Development Department (1994), the original Kowloon Canton Railway Corporation (KCRC) railway line, now known as the KCR East Rail, has provided an important means of access for citizens in new towns such as Shatin, Tai Po and Sheung Shui/Fanling, and after its electrification and double-decking, substantially improved the growth of these new towns as more and more new residents moved in.

Highways and tunnels were also constructed to shorten the travelling time between new towns and the urban areas. For example, the New Territories Circular Road, the Tuen Mun Highway, the Shing Mun Tunnel and the Tseung Kwan O Tunnel.

In Hong Kong, one of the goals of new town planning and development is ‘self-containment’, which means that new towns can satisfy the basic needs of its inhabitants in terms of housing, employment, recreation and other community facilities, that lessens the dependence of a new town on the existing urban districts. If the degree of self-containment is high, then there is less demand for travel to other new towns or to the urban area. (Territory Development Department, 1994) However, the Hong Kong new towns, according to Ma (1996), have failed to achieve this goal. Taking Tuen Mun as an example, the Tuen Mun Road and Castle Peak Road were at one time the only means for commuting to other districts. (Tsang, 2003) It was envisaged that the Tuen Mun Road could enable Tuen Mun residents to reach Tsuen Wan in less than half and hour, and with the completion of the Tsuen Wan by-pass, Kowloon and Hong Kong could be reached within an hour. (Territory Development Department, 1987) This has been proven wrong by severe traffic congestion on the Tuen Mun Road during the past two decades. A survey carried out by Tsang (2003) indicated that Tuen Mun residents perceived that the transportation system provided for them was much less adequate when compared to those for Tseung Kwan O and Tai Po residents. Their degree of satisfaction considering factors like accessibility by mass transport, variety of transportation provision, as well as time and money costs, was also lower than the residents in the two other new towns. This situation could well be improved by the opening of the West Rail by KCRC, brought into full operation in December 2003.

Impact on real estate properties by railway infrastructure

Besides the degree of convenience and satisfaction, the availability of transportation has a beneficial effect on the price of nearby real estate properties. There is a vast amount of literature examining such effects in various countries. (Bajic,1983; Chen et al., 1998; Craig et al., 1998; Henneberry, 1998) In Hong Kong, there are very few studies investigating the impact of railway infrastructure on nearby property prices. In one study, So (1998) investigated the impact of the 'saving of time travel' due to the Tung Chung Line constructed by Mass Transit Railway Corporation (MTRC), which was brought into operation in mid-1998. The study found that property prices in Tsing Yi, which had been the lowest compared with other new town districts like Shatin and Tseung Kwan O, had become the highest by 1997-98, despite the sharp decline in overall real estate prices during this period. This suggests that the prices of residential properties adjacent to major transportation infrastructure enjoy a marginal benefit over other residential properties in the market, i.e. they perform better than the overall trend of the residential property market in Hong Kong. (So, 1998) However, this particular study failed to take many other housing attributes, such as floor area and building age, into account in assessing the variation in property prices. Also, other stages in the development of the Tung Chung Line, such as the period after the announcement that the new line was to be constructed (referred hereafter as the 'post-announcement stage') and during the actual construction stage, were not considered.

A further study by So (2000) examined the impact of a railway from a different angle: the value of proximity[1] of residential properties to railway stations. Residential properties near five stations on the MTR Tsuen Wan Line were studied, based on their transaction records of sales between 1992 and 1999. It was found that properties nearer to the stations commanded a higher price than those further away. However, , this study investigated the value of proximity only in the stage when the Tsuen Wan Line was already under operation. Any changes in the value of proximity during the post-announcement stage and during its construction stage were not investigated.

This present dissertation makes use of the hedonic price model, which takes into account the various attributes (e.g. floor area, floor level and building age) of each property to investigate the impact of railway lines in three distinct stages: the period after the announcement to construct the new railway (i.e. the post-announcement stage); the construction stage; and the operation stage. Two aspects of residential

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[1] In this dissertation, the 'value of proximity' refers to the extra price a property nearer to a station can command over another which is further away.

prices, which are the variation in price gradient along the railway line and the change in value of proximity to the railway stations are investigated. The railway lines studied are the four most recently constructed railway lines in Hong Kong.

1.2 Objectives

As suggested by the study of So (1998), there is a marginal benefit in the prices of residential properties provided with railway infrastructure than those which are not. In this dissertation, the marginal benefit is reflected by the ‘real price’, which is obtained by deflating the actual transacted price with appropriate price indices so as to eliminate the market fluctuations. The remaining variations in real prices then represent effect of all other factors, from which it is possible to study more easily how the prices are affected by the railway lines.

To investigate the impact of railway lines in detail, two aspects are looked into. Firstly, the value of proximity to the stations is likely to be increased as a railway line enters from one development stage to the next. Secondly, the price gradient along the railway line is likely to be reduced as the railway line proceeds to a new development stage. The price gradient refers to the magnitude of the difference in price level between two districts: a ‘remote district’ and a ‘near district’, the former having a longer distance to the central business district (CBD).

Hence the two main objectives of this dissertation are:

1. To test the hypothesis that, throughout either one of the three stages: during the post-announcement stage, during the construction stage and during operation, the price gradient along the railway decreases,
2. To test the hypothesis that, throughout either one of the three stages: during the post-announcement stage, during the construction stage and during operation, the value of proximity to the stations increases,

1.3 Methodology and scope of study

The effects of new railway lines on residential prices are quantified using the hedonic price model proposed by Rosen (1974), which statistically generates the implicit prices of various attributes of a property. By studying the change in the implicit prices of the proximity of properties to the nearest railway station (i.e. value of proximity), and the change in price gradient between two districts with different distances to the CBD, during different phases of the railway construction, the comparison on the effects by different railways is carried out. The explanation the results, as well as the recommendation and generalization of such impacts are derived from theories from relevant literature, and interviews with professionals of surveying firms.

Four railways are chosen as subject railways for this dissertation: 1)West Rail by the KCRC, 2)Ma On Shan Rail by the KCRC, 3)Tseung Kwan O Line by the MTRC, and 4)Tung Chung Line by the MTRC. The selected railways for the study are either newly constructed or under construction at the time of this research, and they were all designated to provide railway services to residents living in each of four new towns: 1)Tuen Mun, 2)Shatin, 3)Tseung Kwan O and 4)Tung Chung.

It has been generally accepted that after a railway is brought into full operation, the properties nearby will enjoy higher prices. However, it is also believed that the effect of a railway on property prices could be apparent at an earlier stage, for example after the announcement of a future construction of a new railway in a district, and during the construction of the railway. The impact of the railways in these three stages by the four abovementioned railways is the focus of this study.

The three periods of impact, namely: after the annoucement of construction and before construction; during construction; and during operation for the four railways in this study are:

	After announcement	**During construction**	**During operation**
West Rail	10/1997 – 10/1998	10/1998 – 12/2003	12/2003 onwards
Ma On Shan Rail	3/1999 – 2/2001	2/2001 – mid 2004	mid 2004 onwards
Tseung Kwan O Line	9/1996 – 4/1999	4/1999 – 8/2002	8/2002 onwards
Tung Chung Line	1/1992 – 11/1994	11/1994 – 6/1998	6/1998 onwards

Compiled from:
1. Mass Transit Railway Corporation, *Annual Report: Various issues*, Hong Kong: Mass Transit Railway Corporation.
2. Mass Transit Railway Corporation, *Press Release*, Hong Kong: Mass Transit Railway Corporation.
3. Kowloon-Canton Railway Corporation, *Annual Report: Various issues*, Hong Kong: Kowloon-Canton Railway Corporation.

Table 2: The different time phases of the planning and construction of the four subject railways

1.4 Benefit of study

The findings of this dissertation can provide empirical evidence on the impacts of the railway lines on the residential property market. Such evidence offers benefit for the Government and the railway companies to develop their future transport plans and strategies to suit the needs of the citizens and the community. Based on these findings, property developers and investors can to plan their future investments more wisely, and property valuers can to take various factors, especially railway infrastructure, into account during their valuations of real estate properties for achieving higher accuracy. Insight is also provided to researchers to predict the potential impact of future railway lines on the property market.

1.5 Organization

The organization of the dissertation is as follows. Chapter 1 explains the background, objectives, methodology and scope of the study, and also an outline of its organization. Chapter 2 provides a literature review, comprising the economic theory regarding the relationship between land value and location, and the impact of transportation. Empirical findings of past studies of transportation and property prices are discussed, which would shed light onto the construction of the hedonic price model to be used in this dissertation. In chapter 3, descriptions of the 4 subject railways: West Rail, Ma On Shan Rail, Tseung Kwan O Line and Tung Chung Line are given. In particular, the important dates of these railways are identified. The hedonic price model employed in the study is discussed in Chapter 4, with the various variables used, method of data and information collection, method of results interpretation explained. Chapter 5 presents the summaries and details of the empirical results, and their interpretation. A comparative study is the subject of Chapter 6, which critically examines the different results of the estimations of the hedonic equations for the railways, in response to the objectives of this dissertation.

Chapter 7 concludes the dissertation, with a number of limitations and area of further study discussed.

Chapter 2: LITERATURE REVIEW

2.1 Land price, location and their relationship

The relationship between land price and location was first found from the study of agricultural land at the beginning of the nineteenth century. Ricardo (1817) identified that under market mechanism, the rent of a piece of land is based on its advantage over the least productive. In other words, the higher the productivity, the more rent would be received by the landlord, and hence higher will be the value or price of the land. It was also recognized that, since it incurs lower costs for the producer to transport the produce of a farmland near to the market than one which is further away, such advantage would accrue to the landlord, such that the rent becomes higher. (Ricardo, 1817)

As argued by Hurd (1903), "since value depends on… rent, and rent on location, and location on convenience, and convenience on nearness, we may eliminate the intermediate steps and say that land value depends on nearness."

Marshall (1916) defined situation value as the sum of money values of the situation advantages of a site. The market price of a land will be the sum of its situation value and its agricultural rent. Potential users of the land will bid for the land according to their respective location advantages, and theoretically, market competition will ensure that the land goes to the highest bidder. (Marshall, 1916)

By Haig (1926), the site rental and transportation cost for a piece of land are complementary and their sum is known as the ‘cost of friction’. Under constant cost of friction, we can regard site rentals as the charge imposed for using of the land due to saving in transportation cost which makes the use of land possible. (Hurd, 1903) By this token, site rentals could also be regarded as charges for the use of a site with due comparatively low transportation cost.

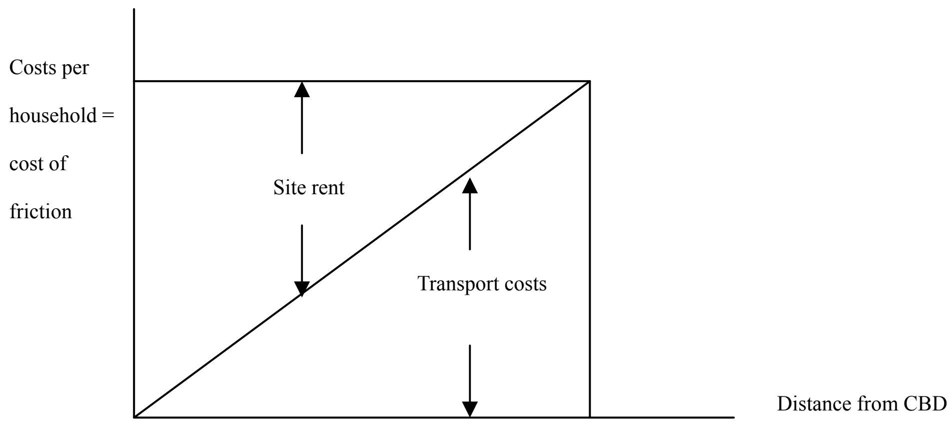

Figure 2: Variation of site rent and transportation costs with distance from Central business district (CBD) under constant cost of friction

From figure 2, the difference in site rentals between two locations is equal to the difference in transportation costs. The sum of site values and transportation costs is constant throughout the city and is equal to the maximum annual outlay for transportation which occurs among those families living at the rim of the city where the rent would be zero. (Alcaly, 1976)

Regard the city as a single line, the situation would simply be as in figure 2. However, considering a two-dimensional space, the city would become a circular area, with which the cost of friction are represented by the area of the cylinder which rises above the city to a height which is equal to the maximum expenditure on transportation. The site value alone is represented by the area of the cone which can be embedded in the cylinder.

In choosing a residence purely for consumption, a person will weigh the costs of friction involved with his other wants, as well as his resources, and fits into his scale of consumption. (Haig, 1926) Alonso (1965) proposed a bid rent curve model which shows the various rents an individual is able and willing to pay at various distances, under a constant level of utility.[2] As rent is a proxy for the price or value, the bid rent curve is a good indicator of how the land value varies with its distance from the city

[2] This model is subjected to several assumptions including: 1) the city is located on a featureless plain, 2) consisting a central business district (CBD) with all job locations and 3) a surrounding ring containing all residences. All households are assumed to have 4) identical utility functions and 5) identical incomes to spend on housing rentals, commuting costs and consumption goods.

center. “A consumer, given his income and his pattern of tastes, will seek to balance the costs and bother of commuting against the advantages of cheaper land with increasing distance form the center of the city and the satisfaction of more space for living.” (Alonso, 1960) Equality of income implies that in equilibrium the land market would adjust to provide equal utility levels, meaning that total expenditure on consumption goods is the same. Thus the expenditure spent on rent and transport costs to CBD will be constant. (Coulson and Engle, 1987) Then, there is a trade-off between land price and transportation cost: as transport costs increase with distance, rent must decrease. This renders the bid rent curve showing relationship between price and distance from CBD to be negatively-sloped. (Alonso, 1965).

“Along any bid rent curve, the price the individual will bid for land will decrease with distance form the center at a rate just sufficient to produce an income effect which will balance to his satisfaction the increased costs of commuting and the bother of a long trip… The higher curves obviously yield less satisfaction because a higher price is implied so that, at any given location the individual will be able to afford less land and other goods.” (Alonso, 1960)

Besides residential land use, according to Alonso (1960), other land uses such as agriculture and various businesses all has their respective bid rent curves. Such curves represent the amount the business manager is willing to pay the landlord as rent, under a given amount of profit. Thus sometimes they are called isoprofit curves. The higher the curve, the lower the profit, obviously due to more money spent on purchasing or paying rent for the land. Along the same curve, the manager will be indifferent as to wherever he is to operate his business.

Thus as in figure 3, we have a family of negatively sloped bid rent curves for a manager of any business and a residence purchaser. The higher the curve, the lower is the profit or satisfaction, and vice versa.

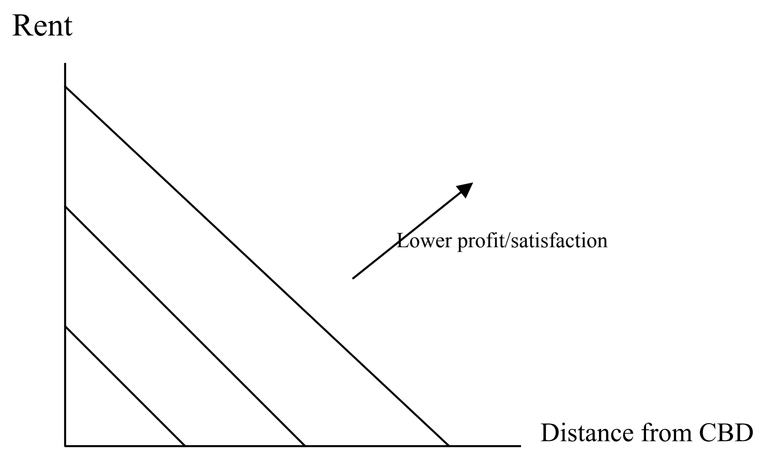

Figure 3: A family of negatively sloped bid rent curves of different levels of satisfaction / profit

While the level of the bid rent curve is decided by the satisfaction or profit, the steepness of a bid rent curve represents how sensitive a business or a resident is to a change in location. By market competition, the highest bidder obtains a land. Hence as depicted from figure 4, "if the curves of the business firms are steeper then those of residences, and the residential curves steeper than the agricultural, there will be business at the center of the city, surrounded by residences, and these will be surrounded by agriculture." (Alonso, 1960)

Fig 4

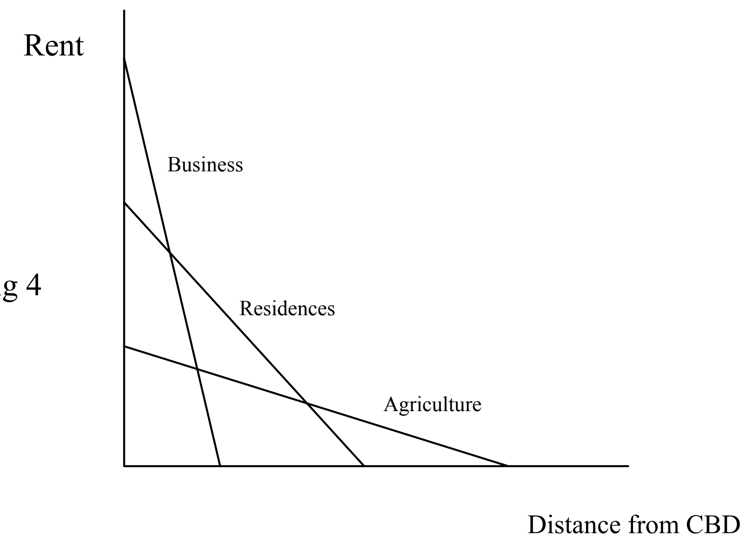

Figure 4: The possible pattern of land uses determined by bid rent curves of business, residences and agriculture

Concluding from the above literature:

1) At the city center, business are located, surrounded by residences, and agricultural zones are at the periphery;

2) Land value is higher for the land nearer to the city center.

2.2 Effect of transportation on property prices

As discussed in the previous section, better accessibility means higher land value. But how exactly does transportation affect the land value? We can first imagine the transportation costs as zero across the whole city, with the only transport system as a magic carpet which can transport all objects to and fro each point of the city without any cost and time. In such a scenario, all activities would be uniformly distributed as there is no benefit to be located near the city center for resources.

But how about when transportation cost is existent? Other factors remaining the same, obviously an improvement in transportation will reduce the cost of friction defined by Haig, thus the better the transportation, the less the friction. If we assume that the transportation improvement is uniform, and the demand for both transportation and land to be inelastic with respect to their costs, the land values will fall. (Alcaly, 1976)

Consider the bid rent of curve of the entire population as shown in figure 5. If the relationship between land values and distance from CBD is shown by AB, then after the introduction of or improvement of the transportation, the bid rent curve will be

A’B, a less steeper line, indicating a decrease in land value proportional to the decrease in transportation costs.

If the elasticity of demand for travel is introduced, the initial fall in land values will induce the purchase of more land, which requires an expansion in the city’s area. (Alcaly, 1976) The bid rent curve will shift upward in a parallel fashion, to A’’B. The combined effects are that, the land value near to the CBD, which is the land between O and D, is decreased due the transportation improvement, but for further land beyond D, the value is increased.

Fig 5

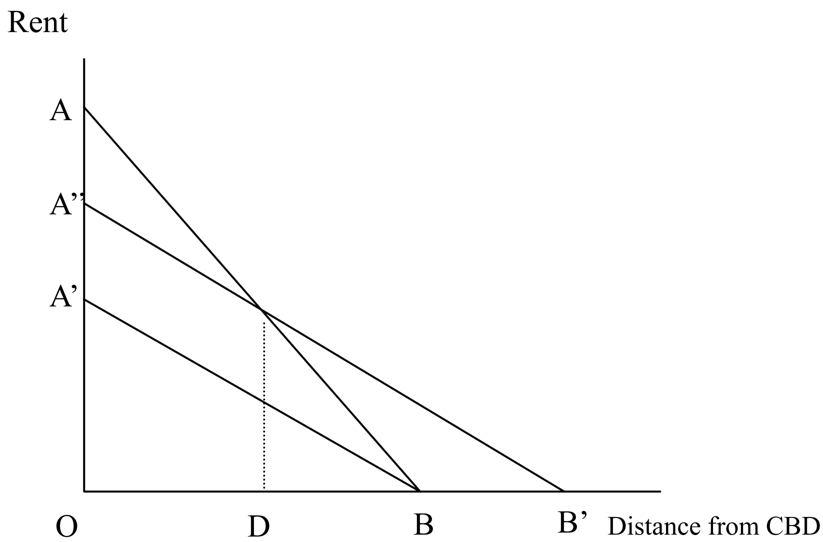

Figure 5: The effect on the aggregate bid-rent curve by transportation improvement

The effect on the aggregate land value depends on the elasticity of the demand of land. Consider the aggregate demand curve for the entire population as in a standard demand and supply diagram in figure 6. The transportation improvement induces an expansion in the size of the occupied land (Alcaly, 1976), represented by the shift of supply curve from S to S'. Aggregate land value increases/decreases if the demand of land is elastic/inelastic, as can be seen by comparing the areas ABCO and A'B'C'O.

Fig 6

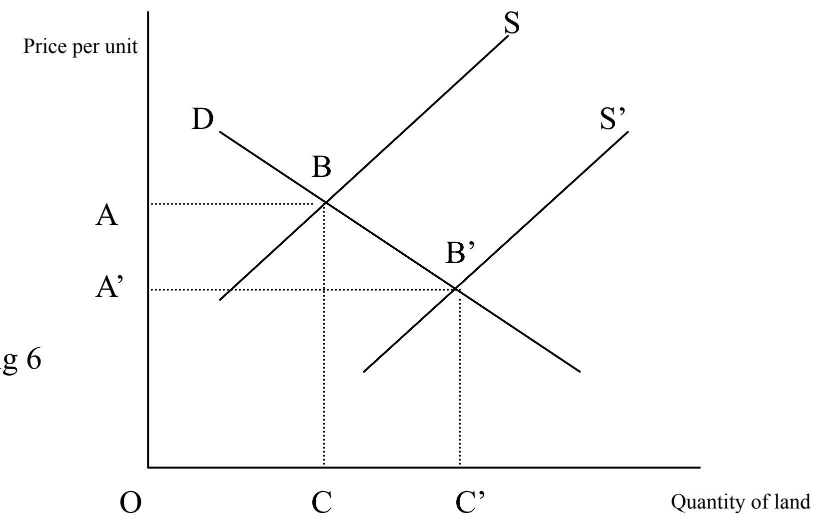

Figure 6: The effect on land value due to transportation improvement

Thus as long as the elasticity of demand for land is not zero, a transportation improvement will tend to produce an increase of land value at the periphery and a decrease in the value of land at the center, with the net effect depending of the demand elasticity. (Alcaly, 1976) However, Vickrey (1963) noted that at the center, the value might actually increase if there is a sufficiently large increase in the demand for land at the center at the same time that the aggregate size of the city is increasing. This could happen when the planning, finance and industry concentrates around the CBD, and in this case the city may experience an increase in land values at both the center and the periphery.

2.3 Empirical studies on transportation

So et al. (1996) suggested that the impacts of transportation on property prices are in 4 major aspects: its availability, costs, travel time, its degree of convenience. Accessibility is closely related to transportation.

An efficient and effective mode of transport could have a positive effect on the property price. (Henneberry, 1998) A change in transportation can be regarded as a change in locational attributes that serve as proxy for accessibility to employment centres, and the capitalization of such accessibility into housing prices can be identified by hedonic equations. (Bajic, 1983)

Chen et al. (1998) argued that the impact on land prices due to proximity to transportation system could be twofold. Accessibility can increase property prices as discussed above, but it may decrease property price as well due to nuisance effects or negative externality, which include adverse effect due to noise and air pollution, disruption, increased crime rate etc.

Henneberry (1998) pointed out that "value changes, when substantial enough, will trigger property investment decisions, resulting in intensification or change in land use. Thus the property market acts as the conduit through which the economic and social impacts of changes in accessibility are transmitted to the built environment." However, a change in land use, or re-shaping of urban land pattern can only arise in areas with available land and demand for space if, according to Gatzlaff and Smith (1993), many favourable factors such as public investment and incentives, coordination of land-use policies are present.

From the past literature concerning this issue, it had been identified that an establishment of a new mode of transport could bring very diverse effect on the property prices.

Announcement of the introduction of a new mode of transport

Gatzlaff and Smith (1993) examined the impact on Miami residential prices by the announcement of the Miami Metrorail construction. There was a negative effect on overall prices of residential properties in the north of the Miami CBD, and the nearer a property is to a future station, the lower will be its price. This was probably due to expectation of congestion and increased crime rate. However in the south of the CBD, a mild increase in overall price level was detected, and an increased price due to nearness to station was detected. This could be due to the economically viable areas south of the CBD that support land use changes and increase in price. But on average, the effect of announcement was weak. It was therefore concluded that the Metrorail had a limited effect on property prices, perhaps owing to Miami's decentralized city structure and dominance of automobiles. (Gatzlaff and Smith, 1993)

McDonald and Osuji (1995) studied the appreciation in residential land prices near the future Midway Line in Chicago, after its scheme of construction was announced. It was shown that there was an increase of 17% in prices within one-half mile of the station sites. This implied that the land market had begun to adjust well before the facilities were put into operation.

The study by Henneberry (1998) investigated the effect of announcement to build the Supertram in Sheffield. A negative impact in residential price level was observed, which was possibly owing to the expectations of disruption during the building of the system. Hence, the people's expectation about the potential advantage brought by a future railway may not be able to compensate for the worry for the disutility generated during and after the construction stage.

Operation of a new mode of transport/Improvement of an old type of transport

The works by Bajic (1983), Craig et al. (1998), Henneberry (1998), Chau and Ng (1998) all looked into whether a transport investment can promote land value or price. It was found that apart from the study by Henneberry, all concerned countries or districts experienced a significant change in the price after the new mode of transport start to operate.

The empirical study of Bajic (1983) strongly suggested that the benefit for commuters due to the new Spadina subway system was capitalized into housing prices in proximity with the subway line. Craig et al. (1998) found out that on average, transport access, which included canal, navigable river or railroad, yielded substantial economic gains, and as a result increased the price and value of the land.

An improvement of the effectiveness and convenience of a railway system as a result of electrification, according to Chau and Ng (1998), had reduced the price gradient along the railway line, but such an effect took place gradually. This means that the relative price level needed time to reach a steady state. In the study of Henneberry (1998), the house prices near the Supertram failed to indicate a significant rise within four months' time after the full opening of the system. However, the negative impact due to the anticipated disruption disappeared, and it could be foreseen that the benefits brought by the Supertram will be reflected in the appreciation of the house prices in the next several years.

A significantly inverse relationship was demonstrated between distance from a metro station and rent. (Banjamin and Sirmans, 1994) So (2000) argued that for each metre closer to the nearest MTR station, there will be a 0.05% rise in property price. Such findings are consistent with the views of Hurd (1903), Haig (1926), Alonso(1965) and Alcaly (1976) that nearness or accessibility promote land prices.

However, Poon (1978) discovered just the opposite. Railway externalities brought adverse effect on residential property prices. In particular, railway pollution was a major nuisance to people in Canada, and this was even more serious for those living near the railway tracks.

From the above review, we can see that transport investment can bring both positive and negative effect on property prices. As So (2000) suggested, the impact of a transport system depends on the local situation and the quality of the mode of transport. Or as Henneberry (1998) put forward, “the type of rail technology, the extensiveness of a system and the character of the urban environment within which it is developed affect the system’s impact.”

2.4 Hedonic pricing analysis

The bid price model by Alonso was subjected to criticism that, besides accessibility other key factors such as income of residents, structural attributes and site attributes were overlooked. Yet they all could have significant effect on land value. (Linneman, 1982) Actually, Alonso’s model is based on several assumptions that are unlikely to be the real case. For instance, it was criticized as having decreasing applicability since city structure no longer has a single CBD (Yeates, 1965). Multiple CBD will create “lumps” of the bid price curve to reflect the dispersed centers for economic activity. Other major sources of the lumps include geography, government regulation, social and cultural impacts. (Lusht, 1997)

Apparently, there are many factors other than transportation and accessibility to CBD which will affect the price of a property. To cater such the numerous factors, the hedonic pricing model was extensively applied. It was first proposed by Rosen (1974), who considered every property is sold as a bundle or package of implicit characteristics (or attributes). Each characteristic has its implicit price determined by consumers’ valuation, and their sum will be the price of the property.

In order words, in using this model, we first have to identify several attributes of the property, which could be the building age, floor level, distance from transport nodes, time of transaction etc. to be the independent variables. We then use a regression technique to obtain a regressed linear equation, whose coefficients correspond to the implicit prices of the attributes. The sign of a coefficient is positive(negative) if the attribute is good(bad). (Freeman, 1993) We can thus have a clear idea of the degree of impact the attributes have on the price of the property.

The application of the hedonic price analysis in the field of real estate has been common. In particular, hedonic analysis would be suitable for quantifying impact of a mode of transportation since it identifies its the redistributional effects. (Bajic, 1983)

One of the major challenges of employing the model is to select relatively homogeneous samples in order to minimize the effect of attributes we do not consider in the hedonic equation, and this could result in a very restricted amount of acceptable data. Alternatively, we can choose to include independent variables to represent such attributes in our equation. However, in this case, a large sample size will be needed to have an accurate estimation. (Chau and Ng, 1998)

Furthermore, we have to choose proper variables reflecting the regional and cultural attributes of the country or district where we are studying. It is thus important to first investigate the market structure and carry out necessary adjustment to the reality of the county or district before carrying out the hedonic analysis. (Huh and Kwak, 1997)

The functional form of the market price of a property is, according to Mok et al.(1995) to be $P = f(L, S, N)$, where L, S, N are the locational, structural and neighborhood attributes respectively. However, the function does not necessarily need to be linear. The best-fit functional form could be semi-log, log-linear, or any other flexible forms as determined by the Box-Cox (1964) transformation. Freeman (1993) declared that the functional form reflects the hedonic price structure of different markets, and any form of function is plausible.

However, the implicit prices of the attributes are the results of the demand and supply of the market. So the functional form for the hedonic equation cannot be determined theoretically, rather, it is determined empirically. (Craig et al., 1998) Usually, either we 1) use the Maximum Likelihood Estimation technique to find out the optimal model, and choose one of the special case models (linear, semi-log or log-linear etc.) which best approximates the optimal model, as done by Chau and Ng (1998), or 2) we simply choose one of the special case models with the highest coefficient of determination (R^2). (So et al., 1996)

Many of the past studies used the log-linear or semi-log form, since they can provide information about the elasticities or percentage change in price induced by a change in the independent variables.

2.5 Factors affecting property prices

There were many other factors besides transportation which may also significantly affect property prices. Using the categorization by Mok et al. (1995), the various factors considered by past studies are generalized as follows:

Locational attributes

As discussed in previous sections, distance from or time to travel to CBD and distance from or time to access to nearest transport system are important locational attributes of a property.

Structural attributes

There are numerous structural attributes of a property. The more common ones include the gross floor area, age, floor level, view, presence of facilities such as carparks or driveway.

It is straightforward to realize that larger properties command a higher total price from the purchaser, since more area of floor spaces are purchased. But for the price per unit floor area, according to the study of Mok et al (1995) on apartment units in North Point, the larger the size of the property, the lower will be the unit price. This means that the total prize of will usually increase at a decreasing rate with each additional unit of floor area. However, this is not the case in Seoul of Korea by the study of Huh and Kwak (1997), where the unit rate was positively affected by an increase in floor area. It seems that relationship should be derived empirically rather than theoretically.

Mok et al (1995) also suggested that the higher the floor level of a property, the higher will be the price of it, chiefly due to a better view of the outdoor environment a higher unit can provide. Another finding is that the older of a property, the lower will be its price. Obviously, it is because people will normally prefer brand new units, and older properties incur more problems in defects and maintenance.

A more beautiful view from the property gives more pleasure to its occupants, and this should improve the price of the property. Ho (1999) carried out a comprehensive study on the impact of view on the property prices in a number of Hong Kong estates. It was shown that a view of a sea, a river, or a racecourse are favourable attributes which gives higher prices to a property, where as a reclamation project adjacent to the property results in a negative effect.

Neighborhood attributes

This is mainly concerned with surrounding environment or the provision of facilities and amenities nearby the property. Proximity to schools, hospitals and green belts could bring significant effect to the property prices. In general, such nearness to the amenities implies that transportation costs for using them could be lowered, and higher property prices will result.

Huh and Kwak (1997) empirically suggested that, famous schools positively affect the price of nearby units, but for green belts and hospitals, the effect is negative. Such negative effects was explained by that fact that being placed in a same zone as green belt, the development potential of the land is hindered, and the resale value of the property will be low. And for the hospital, it will generate substantial traffic nearby, causing disturbance for the residents, making the property less attractive to live in.

Other factors

There are certain factors that could not be characterized into any of the three above. For example, Chau, Ma and Ho (2001) considered certain floor numbers of a high rise building such as 8th floor, 18th floor etc. to be "lucky" units, since in Cantonese their floor numbers are pronounced as if it means "prosperous" and "wealthy", thus due to superstitious results or show-off effects, they are considered to command a premium in property price during a market boom, but such premium should be reduced during market downturn. An empirical study on the transactions in Taikoo Shing has confirmed such proposition.

Chau, Ng and Hung (2001) investigated the effect of a Hong Kong developer's goodwill on the prices of the apartment units they developed. It was found that purchasers were at least willing to offer 7% premium in the unit prices for this goodwill. Hence, valuers should consider the reputation of a developer during their valuation. Also, a good brand name was suggested to be investment which can bring profit in the long run.

Chapter 3: THE SUBJECT RAILWAYS

In this chapter, important facts of the four subject railways of this dissertation, 1) the West Rail, 2) the Ma On Shan Rail, 3) the Tseung Kwan O Line and 4) the Tung Chung Line are provided. In particular, the important dates representing different milestones of the railways are identified.

3.1 The West Rail

The population of Hong Kong's North West New Territories was growing rapidly from 600,000 in 1991 to nearly 900,000 by 1996, and was anticipated to rise further to 1.3 million by 2006. In order to improve the provision of transport for this expanding population, in December 1995, KCRC submitted the preliminary proposal of the construction of the West Rail project to the Government for consideration. Consultation, discussion and review had been carried out throughout 1996. (Kowloon-Canton Railway Corporation, 1997)

The proposed alignment, which extended from Yen Chow Street in West Kowloon via Tsuen Wan, Yuen Long to Tuen Mun was adopted by the Government in

December 1996, and the Government announced that the project should proceed to the preliminary design stage. Such a decision has ended months of uncertainty surrounding the project, as KCRC was given the clear mandate to proceed with the proposed passenger line of the West Rail. On 3rd October 1997, the West Rail was Gazetted to officially establish its alignment. (Kowloon-Canton Railway Corporation, 1998)

After a series of technical studies, tendering for the design work and design-and-build contracts started from August 1997 and November 1997 respectively. By September 1998, the Executive Council endorsed the draft Project Agreement between KCRC and the Government, so that their respective obligations in terms of the West Rail's financing, design, construction and financing were set out. Eventually, the groundbreaking ceremony held on 26th October 1998 marked the beginning of the construction of the West Rail. (Kowloon-Canton Railway Corporation, 1999)

After 5 years of construction, the Rail was brought into full operation on 20th December 2003. It is a 30.5 kilometers long railway comprising nine stations. Nam Cheong station in Sham Shui Po and Tuen Mun station in Tuen Mun are the termini of WR. Mei Foo, Tsuen Wan West, Kam Sheung Road, Yuen Long, Long Ping, Tin Shui

Wai, Siu Hong are the 7 intermediate stations. Nam Cheong and Mei Foo are the respective interchanges with the MTR Tung Chung Line and Tsuen Wan Line. Currently, the time taken for a full journey on West Rail is about 30 minutes. (Highways Department, 2004)

Compiled from: Highways Department (2004) *Existing Rail Lines:- West Rail*. [online] Hong Kong: Highways Department. Available from: http://www.hyd.gov.hk/road/rail/existing/wr.htm [accessed 31-3-2004]

Figure 7: The route map of the West Rail

3.2 The Ma On Shan Rail

The Ma On Shan Rail was planned as an extension of the KCR East Rail. By 2011, the population along its alignment is expected to grow over by about 50% to 800,000 from 540,000 in 1996, leading to a substantial increase in transport demand that could overload the existing road network. The Ma On Shan Rail was therefore planned for providing an efficient means of shuttle service between Ma On Shan at one end and the Tai Wai station of East Rail at the other. (Kowloon-Canton Railway Corporation, 1998)

After KCRC submitted the proposal of the Ma On Shan Rail to the Government, in December 1997, the Government approved in principle the proposed alignment. KCRC then submitted a detailed proposal to the Government for further discussion. Eventually, the project was Gazetted in March 1999, when the plan of construction was formally announced. (Kowloon-Canton Railway Corporation, 2000)

Groundbreaking for the Ma On Shan Rail project took place at Tai Wai on 12 February 2001, which marked the commencement of construction. It was scheduled for full operation in mid-2004. (Kowloon-Canton Railway Corporation, 2002)

This 11.4 kilometres long railway will consist of nine stations, located within short walking distance from large residential developments. A terminus will be the Tai Wai station, which will also be the interchange with the KCR East Rail, and the terminus at the other end will be the Wu Kai Sha station. The 7 intermediate stations are Che Kung Temple, Sha Tin Wai, City One, Shek Mun, Tai Shui Hang, Hang On, and Ma On Shan. When it opens in 2004, the Ma On Shan Rail will run a four-car train every 2.5 minutes during peak hours. (Highways Department, 2004)

Source: Highways Department (2004) *Committed Rail Projects:- Ma On Shan to Tai Wai Rail Link.* [online] Hong Kong: Highways Department. Available from: http://www.hyd.gov.hk/road/rail/committed/mos.htm [accessed 31-3-2004]
Figure 8: The route map of the Ma On Shan Rail

3.3 The Tseung Kwan O Line

In Railway Development Strategy 1994, the Tseung Kwan O Extension was listed as priority projects. In light of this, in 1995, the Government invited MTRC to submit proposal for its construction. (Mass Transit Railway Corporation, 1996) Initial proposals, indicating the likely form of the extensions have been discussed with the Government in the same year. In order to meet the projected passenger demand in Tseung Kwan O, a revised proposal was agreed with the Government in February

1996, with other formal submissions, incorporating transport, engineering, development and financing details made at the same time. 5 new stations were to be constructed, namely, Yau Tong, Tiu Keng Leng, Tseung Kwan O, Hang Hau and Po Lam. It was predicted that the future Tseung Kwan O Line could serve up to 520,000 people living the district of Tseung Kwan O. The Gazette date of the Line was 26th September 1997. (Mass Transit Railway Corporation, 1998)

After agreeing with the Government, the project went into the detailed design stage. It was decided to have the Line bifurcated to serve the Southern part of Tseung Kwan O in addition to the northern point, which extended to Po Lam. Detailed design was then brought underway. The formal project agreement was signed between MTRC and the Government in November 1998. The commencement date of the construction was on 24th April 1999. (Mass Transit Railway Corporation, 2000)

The Tseung Kwan O Line was brought into full operation since 18 August 2002. Besides the 5 originally decided stations from Yau Tong to Po Lam, the current Line consists of 2 more stations: North Point and Quarry Bay which were originally stations of the Island Line, both have become interchanges between the Tseung Kwan O Line and the Island Line. On the other hand, Yau Tong and Tiu Keng Leng are the interchanges with the Kwun Tong Line, and Tiu Keng Leng station has become the new terminus of the Kwun Tong Line. (Highways Department, 2004)

Source: Highways Department (2004) *Existing Rail:- Tseung Kwan O Line.* [online] Hong Kong: Highways Department. Available from: http://www.hyd.gov.hk/road/rail/existing/tkol.htm [accessed 31-3-2004]

Figure 9: The route map of the Tseung Kwan O Line

3.4 The Tung Chung Line

In 1990, the Government intended to build a new airport in Chek Lap Kok, and began negotiation with MTRC about the construction of a possible airport railway system. On 2nd January 1992, MTRC agreed in principle the terms of the design, construction, financing and operation of the new railway system. The alignment of the system was also decided. (Mass Transit Railway Corporation, 1993)

According to the agreed alignment, the airport railway system was to comprise two separate rail services interlinked on common tracks: a passenger link to Hong Kong's new airport, the Airport Express Line and a domestic service, the Tung Chung Line serving Northern Lantau, Western Kowloon and Central in Hong Kong Island. MTRC had envisaged that the Tung Chung Line would offer substantial relief to the Nathan Road section of the existing MTR Tsuen Wan Line. The detailed design work was substantially completed at the end of 1993. It was planned that the major construction contracts were to be awarded upon the formalization of the Railway Agreement with the Hong Kong Government. However, since the Chinese Government has not yet declared their support to finance the project by the end of 1993, the award of contracts, had to be postponed beyond 1993. (Mass Transit Railway Corporation, 1994)

After the achievement of the Sino-British Agreement and the Hong Kong Government's confirmation of equity support in November 1994, the MTRC's commitment to construction was confirmed. 19 main contracts were soon awarded and the construction work of Tung Chung Line started on 21st November 1994. (Mass Transit Railway Corporation, 1995)

Civil and engineering works for the railways were substantially completed in 1997. Service of the Tung Chung Line and the Airport Express Line commenced on 22 June 1998 and 6 July 1998 respectively. (Mass Transit Railway Corporation, 1999)

After its completion, the Tung Chung Line consisted of 4 intermediate stations: Kowloon, Olympic, Lai King and Tsing Yi between 2 terminal stations: Hong Kong and Tung Chung. Hong Kong Station was an interchange with Central Station on Tsuen Wan Line and Island Line. Lai King was the interchange with the Tsuen Wan Line, and Kowloon and Tsing Yi are interchanges with the Airport Express Line. Tung Chung Line has a total length of 31.1 kilometres. (Highways Department, 2004)

Source: Highways Department (2004) *Existing Rail Lines :- Tung Chung Line* [online] Hong Kong: Highways Department. Available from: http://www.hyd.gov.hk/road/rail/existing/tcl.htm [accessed 31-3-2004]

Figure 10: The route map of the Tung Chung Line

By the end of 2003, when the West Rail started its operation, a new station: Nam Cheong was constructed as an interchange between the West Rail and the Tung Chung Line.

3.5 Critical dates of the subject railways

After introducing the subject railways, it is worthwhile to identify and emphasize the critical dates for each of them, according to the dates when its alignment was announced, its construction was commenced and its operation was started.

<u>Announcement date</u>

It is possible for the public to aware of a future railway as early as during the process of its feasibility studies. However, when its future alignment is confirmed, the exact locations of the stations will be known among people. Therefore, in this dissertation the 'announcement date' of a railway is the date when the plan of construction is formally announced and the alignment established, either by Gazette or the official declaration of the railway alignment.

Based on the information provided in the sections 3.1 to 3.4, the announcement dates adopted for each railway are as follows:

Railway	Announcement Date
West Rail	3rd October 1997
Ma On Shan Rail	1st March 1999
Tseung Kwan O Line	26th September 1997
Tung Chung Line	2nd January 1992

Table 3: The announcement dates of subject railways

Construction date

Apparently, it is the date where the physical work of the construction of a railway is started. Such dates are again provided in sections 3.1 to 3.4. In particular, for West Rail and Ma On Shan Rail, they are the dates when the groundbreaking work was commenced.

Railway	Costruction Date
West Rail	26th October 1998
Ma On Shan Rail	12th February 2001
Tseung Kwan O Line	24th April 1999
Tung Chung Line	21st November 1994

Table 4: The construction dates of subject railways

Operation date

This is the date when a railway line is brought into service. These are also found in the information provided in section 3.1 to 3.4.

Railway	Announcement Date
West Rail	20th December 2003
Tseung Kwan O Line	18th August 2002
Tung Chung Line	22nd June 1998

Table 5: The operation dates of subject railways

By identifying these critical dates, it becomes very clear that at any particular point of time, whether a subject railway was officially announced of its alignment, was under construction or has already brought into full operation. This enables the testing of the hedonic equations, which are to be discussed in detail in the following chapter.

Chapter 4: THE MODEL

4.1 Targets of study

The objective of this dissertation is to investigate the impact of four newly constructed railway lines on prices of nearby residential properties. Such impact could arise in one of or in all three stages, namely, after the announcement of the alignment of the railway line, during its construction, and finally after the line starts to operate. The four target railways are, the West Rail, the Ma On Shan Rail, the Tseung Kwan O Line, and the Tung Chung Line.

In order to examine whether the railway lines had affected nearby property prices, two aspects are looked into. Firstly, due to the reduction in transportation cost due to the new railway, the price gradient along the railway line is likely be reduced, due to a diminished relative advantage of travel of a ‘near district’- an area closer to the CBD, over a ‘remote district’. Secondly, the proximity of a residential property to a railway station may also attract purchasers to pay a premium, since this implies higher convenience of travel.

As mentioned, these two types of impacts could arise in one of or in all of the three stages as described below.

Announcement stage

Even before the actual construction of a railway line has begun, if a person is well aware of a plan of the future railway after the official announcement of its alignment, he could be attracted to purchase a residential property located near future stations. Although the he cannot enjoy the benefit of the railway immediately, there could well be a “hope value” of the property that there will be a future betterment of living there in terms of lower costs of transportation. If the information of the plan of future construction is widespread enough, more people could be interested to be property purchasers, and hence the overall demand of residential properties in that district could increase significantly. This may give rise to an enhancement of residential property prices after the announcement.

Construction stage

When the railway station is under construction, people are assured that they will have an additional choice of a convenient and efficient transport mode in the future. This advantage could be capitalized into real estate prices, so the prices of residential properties near the station under construction could be enhanced. On the contrary, the possible disruption such as visual intrusion, view obstruction and noise production due to the construction of the site could detriment the property prices. The actual effects of construction of the subject railway lines are yet to be determined from the findings of this dissertation.

Operation stage

When the construction of a railway line is completed and is put into full operation, the residents near the stations can enjoy the immediate benefit of improved comfort of travel, reduction in commuting time and cost. Again, such satisfaction could be reflected from a rise in the prices of residential properties near the operating stations.

However, it could be possible that there is a high increase right after the announcement, but not in the later stages, because the public may have already been well informed and have digested the news of transportation improvement during the construction or operation of the railway. On the other hand, the public may wait until the actual efficiency and effectiveness of the railway is proven after its operation, resulting in an insignificant change in property prices in the announcement and construction stage. There are many other possibilities when the price enhancement can arise. The exact stage when the nearby properties react most actively to the railway investment is one of the interests of this dissertation.

Hence, there are two hypotheses to be tested in this dissertation:

1. The price gradient along the railway will diminish, either when the alignment of the railway line is announced, it is under construction, or brought into operation;
2. The value of proximity to the station will increase, either when the alignment of the railway line is announced, it is under construction, or brought into operation.

To test the two hypotheses, it is necessary to investigate whether the impact impacts of the four subject railway lines in the three stages are significant. Such impacts are to be quantified using the hedonic price model, which is to be discussed in detail in the subsequent section.

4.2 Hedonic price model

The rise of the idea of hedonic price model dates back to Court (1939), who considered the word 'hedonic' as a description of the weightings of relative importance of various components of a good, which are in turn determined by the components' usefulness and desirability. But it was Rosen (1974) who formalized the hedonic price function of a good as a joint envelope of a family of value-functions of buyers, and a family of offer-functions of sellers. The hedonic function reflects the set of market clearing prices associated with bundles of housing characteristics, attributes or traits, and hence the function and its associated partial derivatives are the locus of points which supply of the traits equal to their demands.

If housing is considered to be composed of a variety of residence site attributes, then the hedonic model is a vector of these attributes, where the demand for each are carried out through implicit markets, that assemble the so-called housing market. (Linneman, 1982) The hedonic model could be written in mathematical term as:

$$\mathbf{V} = f(\mathbf{Z})$$

Where V, as the price of the housing unit is expressed as a function of housing attributes, which are specified as components of the vector **Z**. The partial derivative of the price with respect each attributes, according to Rosen (1974), is the implicit market clearing price of that particular attribute.

If the hedonic relationship partially reflect pricing strategies, it will be difficult to identify the buyers' preferences. However, this is not a severe problem in the case of real estate properties, as the buyers' preferences will dominate due to relatively durable nature of properties, and the stable and decentralized supply of housing units. (Muellbauer, 1974)

The above equation, according to Linneman (1982), although cannot be measured with perfect accuracy, in practice, it can be satisfactorily estimated by information of data available. One of the most commonly used approaches is the ordinary least square (OLS) regression technique, which generates an equation analogous to the hedonic price function that minimizes the residual sum of square of the differences between the actual and forecasted value based on the equation obtained. Such a regression technique will be adopted in this dissertation, as it is simple to master using computer programmes.

A correct specification of the functional form is crucial for obtaining an accurate estimate of the relationship between the price and the property attributes. (Linneman, 1980) Many functional forms besides the linear form are plausible, such as polynomial and logarithmic function, but usually linear should be used as a first attempt before other more complicated forms are tested.

In the case of properties, linear or semi-logarithmic forms are most commonly employed. By assuming a linear relationship, the hedonic equation is in the form:

$$P = b_0 + b_1Z_1 + b_2Z_2 + \ldots + b_nZ_n + M$$

or equivalently

$$P = b_o + \sum_{i=1}^{n} b_iz_i + M$$

Where P = price of the property
b_0 = constant term
b_i = regression coefficients of the attribute z_i
M = error term

The partial derivative with respect to the ith attribute, $\partial P/\partial z_i$, and hence its implicit price, as suggested by Rosen (1974), in the linear functional form, equals to the regression coefficient b_i estimated, since

$$\partial P/\partial z_i = b_i$$

If other functional forms are used, the regression coefficients will have other implications. For example, if assume a semi-logarithmic function:

$$\ln P = b_o + \sum_{i=1}^{n} b_i z_i + M$$

Then the coefficient b_i will be equal to $1/P \times \partial P/\partial z_i$, which represents the percentage change in the price P with respect to each unit increase in the attribute z_i. Say if the coefficient equals to 0.05, then each unit of addition of the ith attribute will lead to an 5% increase in the price of the good.

Semi-logarithmic function is used in this dissertation, because this function form is conventional for analyzing real estate properties, easily interpretable and often produces the best fit when subjected to a Box-Cox algorithm. (Galster and Williams, 1994)

Interpretation of statistics

After the estimation of the equations, several statistics and coefficients are generated, including the t-statistics and coefficient of each variable, the coefficient of determination and F-statistic for the equation. They are discussed as follows.

t – statistic

Before the coefficient of an attribute could be considered, its t-statistic must be looked at for considering whether it is statistically significant. It is a relative measure of the average effect of an attribute has on the dependent variable when compared to the degree of variability of the factor in the sample. It is calculated by the formula

$$t = b_i/Sb_i$$

A higher value of t implies that the value of the coefficient b_i is more likely to be different from zero, and hence the effect of the ith attribute on the dependent variable is more significant. This means that the attribute is more likely to influence the value of the dependent variable.

It can be seen from the formula that the value of the t-statistic is not always related to the magnitude of the coefficient. The attribute can exert a significant effect on the dependent variable (t-statistic being large) but the magnitude of the effect could be little. (the coefficient having a small value)

To test the degree of significance of an attribute, the t-test is carried out. The t-statistic obtained is compared with a critical value of t according to the desired significant level. This critical value of t is checked from the T-distribution under a degree of freedom (df), whose depends on the number of samples and the number of variables. The proposition that the dependent variable is not affected by the attribute will be refuted if

$$| t | > T_{1-p,\, df}$$

where $| t |$ = absolute value of t-statistic obtained from regression

p = desired probability that the coefficient equals to zero

df = degree of freedom

$T_{1-p,\, df}$ = critical t for a given p and df

The critical value will have a larger value if the desired probability p is lower, and hence it will be more difficult for the abovementioned proposition to be refuted. When the absolute value of calculated t-statistic is greater than the critical t for a 1% probability of "zero effect", then it can be said that the variable is significant "at the 1% level" or "at the 99% confidence level". Then, it can be concluded that this variable has an effect on the dependent variable.

Coefficient - b_i

After the significance of the ith attribute is verified by the t-test, it becomes meaningful to interpret its coefficient, b_i. It is the measure of the magnitude of impact of an attribute has on the price of the property. Since the logarithmic functional form is adopted in this dissertation, the coefficient of each attribute is equal to the percentage change in the price per unit increase in the attribute. The coefficient can have either positive or negative signs, which indicates whether the relation between the attribute and the price is positive or negative.

Coefficient of determination - R^2

The value of R^2 demonstrates the proportion of variation in the dependent variable that can be explained by the variation in the dependent variables. It is a measure of the goodness of fit or the explanatory power of the hedonic equation. It takes a value from 0 to 1. For example, if R^2 of an equation is 0.75, it implies that 75% of variation in the dependent variable could be attributed to the variation in the dependent variables, such as the gross floor area, floor level etc. In case of real estate properties, a high R^2 reflects the homogeneous nature of the property samples. (Chau and Ng, 1998)

F-statistic

The F-statistic represents the significance of the coefficient of determination, R^2. A high value the F-statistic obtained implies that some of the independent variables are significant and are able to explain the variation of the dependent variable. This will give extra evidence which supports the significance of the results.

4.3 Data collection

2 stations are chosen as target stations for each railway:

Subject railway	Stations
West Rail	Tuen Mun, Tsuen Wan West
Ma On Shan Rail	Ma On Shan, City One
Tseung Kwan O Line	Po Lam, Lam Tin
Tung Chung Line	Tsing Yi, Olympic

Table 6: The stations selected from subject railways for transaction data

These stations are chosen because they are surrounded by a high number of residential developments that had already been built before the construction of their respective railway lines. Although Lam Tin station is not on the Tseung Kwan O Line, other stations on the TKOL do not have enough transaction records spreading through the three periods. Lam Tin station is reasonably close to the Po Lam station, and it is surrounded by a number of housing blocks of Sceneway Garden. Hence Lam Tin station is a suitable control of Po Lam station.

The transactions in these estates had been very active. Hence, the effect of the three stages can be fully investigated by analyzing a large amount of transaction records. The names and exact locations of the selected residential developments near to each station are contained in Appendix 1.

The transaction records as well as the particulars of properties are obtained from the Economic Property Research Centre (EPRC). It is a databank containing details of most transactions of different types of properties in Hong Kong that has been registered in the Land Registry. The information provided includes the transacted price, date of transaction, date of issuance of occupation permit, gross floor area, saleable floor area and floor level of the transacted units. EPRC provides important information for estimating the hedonic equations in this dissertation.

The period that the transaction data is collected is from 1st January 1991 to 31st

October 2003. Although data from 1st November 2003 to 31st March 2004 is also available, the real property price within this period cannot be assessed accurately, because at the time of this study, only provisional price indices are available for this period from the Rating and Valuation Department. Unfortunately, at 31st October 2003, the construction of West Rail and Ma On Shan Rail was still underway. Therefore, it is unable to study the impact on property prices due to their operation in this dissertation.

4.4 The variables

According to Mok et al (1995) the hedonic equation of a property can be in the form: P(A) = f (L, S, N). Rosen (1974) also pointed out that in constructing a hedonic price model, all attributes that could determine the market price of the good, generating utilities to users and costly to produce should be included. It is true at more variables can improve the predictability of the model. However, as more variables are included in the hedonic equation, its complexity will also increase. According to Chau and Ng (1998), higher number of variables also implies that substantial data is required in order to estimate the equation. Chan (2002) suggested as there are virtually unlimited number of price determinants for properties, one practical solution is to include the attributes that are appropriate and crucial in order to preserve the explanatory power of the hedonic model. To sum up, it is essential to strike a balance between the accuracy and simplicity in constructing the model.

In this dissertation, the following independent variables are chosen for estimating several hedonic equations using the OLS regression techique:

Type	**Variables**
Structural attributes	GFA – Gross Floor Area FL – Floor level AGE – Age of the building
Locational attributes	DIST – Walking distance from nearest railway station TM, MOS, PL, TY – Location dummies
Time factors	AN – Announcement dummy CON – Construction dummy OP – Operation dummy
Interaction terms	AN * TM, AN * MOS, AN * PL, AN * TY CON * TM, CON * MOS, CON * PL, CON * TY OP * PL, OP * TY AN * DIST, CON * DIST, OP * DIST

Table 7: The independent variables employed in hedonic equations

These variables will be discussed in detail in the later part of this section.

The most important neighborhood variable, the view of a unit, is excluded in the hedonic equations for simplicity. The reason behind is that view of a unit is difficult to obtain from the EPRC, and is difficult to quantify. Moreover, the view factor may partly overlap with the floor level, since usually a unit in a higher floor number provides better view. Fortunately, view is not an important factor to be considered in this dissertation.

Dependent variable

<u>RPRICE – Real Price at 1999</u>

The real price of a residential property is obtained by deflating its actual transacted price by an appropriate residential price index published by the Rating and Valuation Department in the Hong Kong Property Review, which is issued annually. The real price is considered instead of the actual transacted price, because the prices of properties are always subject to the fluctuation of the real estate market. So by deflating the transacted price to the real price, the effect of time or inflation is eliminated, and the remaining differences in price must be due to factors other than the overall residential price level.

There are yearly, quarterly and monthly indices published in the Hong Kong Property Review. The property market in Hong Kong is very volatile. The change in the price level could be substantial even within a very short time frame. In order to minimize the bias resulted from using the indices, the time span of a particular index number should be as short as possible. Therefore, whenever possible, the monthly indices are used. When there are no monthly indices provided, the quarterly indices are employed as an alternative.

The Rating and Valuation Department published quarterly indices for the residential sector before 1993, and after that monthly indices were published instead. Therefore, for transactions from 1991-1992, quarterly indices are used, while for 1993 onwards, monthly indices are used. These indices are shown in Appendix 2.

Quantitative independent variable

<u>GFA – Gross Floor Area in square feet</u>

Studies by Benjamin and Sirmans (1996), Huh and Kwak (1997), Guntermann and Norrbin (1987) used number of rooms of a residential unit as a proxy of its size or area. However, in this study, the Gross Floor Area is used since it is a more accurate and reliable measure of the size of a unit, and the data is easily available from the EPRC.

Under the Buildings Ordinance (Cap.123), GFA is defined as "the area contained within the external walls of the building measured at each floor level, together with the area of each balcony in the building, which shall be calculated from the overall dimensions of the balcony and the thickness of the external walls of the building." Differ from the definition of Saleable Floor Area (SFA), which exclude all common areas, GFA include common areas in clubhouses, management offices and caretaker rooms. Therefore, in order to consider all the floor areas enjoyable by the property owner, GFA is incorporated into the hedonic equation.

Obviously, the larger the GFA, the more space that the purchaser can enjoy from owning the property. There, GFA is a favourable attribute for the purchaser and hence its expected sign is positive.

FL – Floor Level

It is defined here to be the floor number in which the property is situated. For example, if the property is at the 11^{th} floor, FL will take the value 11. In general, properties in higher floor levels are more preferable to purchasers. This is because the view of a higher unit is better, and higher units can enjoy a quieter environment. (Chau and Ng, 1998). Thus the higher the floor level, the high will be the real price of the property. Floor levels of properties are retrieved from the ERPC.

<u>AGE – the age of a building in days</u>

In this dissertation, the age of a property is calculated by the number of days between the date of issue of the Occupation Permit and the date of transaction of the unit. Both dates are contained in the transaction records in the EPRC. The issue of an occupation permit indicates the construction of a building is substantially completed, hence this date can be considered to be the birth of the building. It is obvious that as a building grows old, it will deteriorate, and becomes less attractive to purchasers. Extra maintenance fees have to be paid in order to uphold its appearance and conditions. Therefore, the age of a building will have a negative effect on the real price of a property.

<u>DIST – Distance from railway station in metres</u>

This variable is one of the major interests in this dissertation. It is defined here as the nearest walking distance from the property to a nearest railway station of a newly constructed railway, whether at the time of transaction the station was built or not. Such distance can be measured from the Outline Zoning Plans (OZPs) issued by the

Town Planning Board for the relevant districts. Another Hong Kong map[3] is used as a cross-reference to find out the precise locations of the properties.

Qualitative independent variables

Unlike quantitative variables, there are qualitative aspects of a property which no quantities are associated. In such a case, dummy variables are used. A dummy variable can take either a value of 0 or 1, depending on how the variable is defined.

<u>TM, MOS, PL, TY – location dummies</u>

In the equation for investigating the variation the price gradient, two stations of the railway linear considered. If a property is located near Tuen Mun station for the West Rail, Ma On Shan station for the Ma On Shan Rail, Po Lam station for the Tseung Kwan O Line, or Tsing Yi station for the Tung Chung Line, the location dummy will take a value of 1. Otherwise, it will be assigned a value of 0.

The purpose of including location dummies is to separate the transactions in a 'remote district' from those in 'near districts' - another district along the same railway

[3] Lands Department (2003), Hong Kong Guide 2003, Hong Kong: Lands Department.

line that is closer to the CBD. Its estimated coefficient reflects the premium that a purchaser is willing to pay to purchase a property in the 'remote district'. Its sign represents whether the premium is positive or negative.

<u>AN – Announcement dummy</u>

It will take a value of 1 if, at the date of the property's transaction, the plan to construct the concerned railway line has already been announced officially, but no construction work has commenced. For any transaction falling out of this period, the value of AN will be 0. For each of the railways, the period when AN is 1 is as follows:

West Rail – 3rd October 1997 to 25th October 1998
Ma On Shan Rail – 1st March 1999 to 11th February 2001
Tseung Kwan O Line – 26th September 1996 to 23rd April 1999
Tung Chung Line – 2nd January 1992 to 20th November 1994

<u>CON – Construction dummy</u>

It refers to the period when the construction of the railway is in progress. If the date of transaction falls into this period, the value of CON will be 1, otherwise it will be 0. The periods for the four railways are:

West Rail – 26th October 1998 to 31st October 2003
Ma On Shan Rail – 12th February 2001 to 31st October 2003

Tseung Kwan O Line – 24th April 1999 to 17th August 2002
Tung Chung Line – 21st November 1994 to 21st June 1998

OP – operation dummy

When the railway concerned has already started to operate at the date of transaction of the property, then OP will be assigned a value of 1. Otherwise it will be 0. The periods for Tseung Kwan O Line and Tung Chung Line are:

Tseung Kwan O Line – 18th August 1999 to 31st October 2003
Tung Chung Line – 22nd June 1998 to 31st October 2003

Interaction terms

It is the subject of this dissertation to examine the impact of railways on property values among different time phases of railways. To test whether there are any significant differences in the prices of properties and the value of railway station proximity among different time phases, interaction terms are employed in order to capture the change in implicit prices of two factors: price differential along the railway and ease of access to the nearest station.

AN- interaction terms: AN * TM, AN * MOS, AN * PL, AN * TY

These interaction terms expresses the change in property purchaser's preference to purchase residential units in 'remote districts' - Tuen Mun, Ma On Shan, Po Lam and Tsing Yi over those in 'near districts', during the announcement stage. If these terms are estimated to be significantly positive/negative, then it is very likely that such preference has increased/decreased during the announcement stage.

<u>CON – interaction terms: CON * TM, CON * MOS, CON * PL, CON * TY</u>

By the same token, these four interaction terms capture the change in premium that purchasers units in these four 'remote districts' during the construction stage of the railway line.

<u>OP- interaction terms: OP * PL, OP * TY</u>

Since the operation stage is only studied in the Tseung Kwan O Line and Tung Chung Line, only two interaction terms for the operation stage are considered. Again, these two terms indicates the variation in preference of purchasers to purchase property in 'remote districts' after the target railway has already begun its operation.

<u>-DIST interaction terms AN * DIST, CON * DIST, OP * DIST</u>

Another measure of the effect of the railway is to see whether the nearness to a station, expressed as the walking distance to the station, has undergone any change in implicit price before and after the critical dates of the railway. If the value of one of them is positive/negative, it is a strong suggestion that purchasers favour living further from/closer to the (future) railway station during the announcement, construction or operation stage.

4.5 Equations for this study

In each of the three stages that the railway line is likely to exert an impact, three equations will be estimated for each railway.

Price gradient effect

In order to study whether there is a change in the price gradient along the railway line, the following set of equations are estimated:

West Rail

Before and during announcement stage:

$$\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TM + b_{10}AN * TM$$

Before and during construction stage:

$\ln(RPRICE) = b_0 + b_1 GFA + b_2 GFA^2 + b_3 FL + b_4 FL^2 + b_5 AGE + b_6 AGE^2 + b_7 DIST + b_8 DIST^2 + b_9 TM + b_{10} CON * TM$

<u>Ma On Shan Rail:</u>

Before and during announcement stage:

$\ln(RPRICE) = b_0 + b_1 GFA + b_2 GFA^2 + b_3 FL + b_4 FL^2 + b_5 AGE + b_6 AGE^2 + b_7 DIST + b_8 DIST^2 + b_9 TM + b_{10} AN * CO$

Before and during construction stage:

$\ln(RPRICE) = b_0 + b_1 GFA + b_2 GFA^2 + b_3 FL + b_4 FL^2 + b_5 AGE + b_6 AGE^2 + b_7 DIST + b_8 DIST^2 + b_9 TM + b_{10} CON * CO$

<u>Tseung Kwan O Line:</u>

Before and during announcement stage:

$\ln(RPRICE) = b_0 + b_1 GFA + b_2 GFA^2 + b_3 FL + b_4 FL^2 + b_5 AGE + b_6 AGE^2 + b_7 DIST + b_8 DIST^2 + b_9 PL + b_{10} AN * PL$

Before and during construction stage:

$\ln(RPRICE) = b_0 + b_1 GFA + b_2 GFA^2 + b_3 FL + b_4 FL^2 + b_5 AGE + b_6 AGE^2 + b_7 DIST + b_8 DIST^2 + b_9 PL + b_{10} CON * PL$

Before and during operation Stage:

$\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9PL + b_{10}OP * PL$

Tung Chung Line:

Before and during announcement stage:

$\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TY + b_{10}AN * TY$

Before and during construction Stage:

$\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TY + b_{10}CON * TY$

Before and during operation Stage:

$\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TY + b_{10}OP * TY$

The significance and the coefficients of the AN-, CON- and OP- interaction terms of the equations are to provide evidence on whether there has been a variation in the price gradient.

Proximity effect

Besides the equation for price gradient, the following equations are to be estimated in each of the three stages for both the distant and near station. (for example, Tuen Mum and Tsuen Wan West for the West Rail)

Before and during announcement stage:

$$\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN * DIST$$

Before and during construction Stage:

$$\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON * DIST$$

Before and during operation Stage:

$$\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9OP + b_{10}OP * DIST$$

While the time dummies AN, CON and OP capture the overall price effect in a district, they should not be over emphasized because it is difficult to ascertain the railway announcement, construction and operation as the only change across the period. The -DIST interaction terms indicates the more focused variation in distance, or the proximity effect. The purpose of adding two equations for each stage is allow comparison between the distant and near stations about variation in distance effect when the railway enters into a new stage.[4]

Note that square terms including GFA^2, FL^2, AGE^2 and $DIST^2$ are added in order

[4] An exception is Lam Tin station, which is not a station along the Tseung Kwan O Line. However, it is used for studying the change in price gradient along the Tseung Kwan O Line.

to provide a more flexible functional form, so as to capture any diminishing or magnifying effect of the factors on the real price, and enhance the predictability of the equations. If the coefficient of the square term of a variable is opposite/same to that of its linear term, then the impact of the variable will be decreasing/increase as the value of the variable increases. For example, if GFA^2 is negative, the additional utility provided by an extra unit of floor area will diminish as more floor areas are offered. However, these are empirical issues for different equations.

Finally, the following summarizes the expected signs for the other controlling variables:

Variable	**Expected signs**
GFA	POSITIVE
GFA^2	UNKNOWN
FL	POSITIVE
FL^2	UNKNOWN
AGE	NEGATIVE
AGE^2	UNKNOWN
DIST	UNKNOWN
$DIST^2$	UNKNOWN

Table 8: Controlling variables and their expected signs

Chapter 5: THE EMPIRICAL RESULTS AND ANALYSIS

In this chapter, all the statistical results of the hedonic equation estimations are shown and discussed. The impacts of each railway line in different time phases are discussed one by one. In interpreting the results, the signs and magnitudes of the coefficients and their level of significance are studied.

It is founded that, although most of the behaviour of coefficients conform to what were expected, some divergent results are noted. Parts of the possible explanation will be provided in this chapter according to the data problem or local characteristics of where the transactions were located.

The subjects of this dissertation: change in price gradient between ‘near districts’ and ‘remote districts’ as well as the change in the implicit price of railway station proximity are interpreted at the end of discussion of each railway line. Further implications will be discussed in Chapter 6.

5.1 Impacts of the West Rail

1a: Announcement effect of the West Rail on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TM + b_{10}AN*TM$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001558	0.000112	13.90817	0.0000
GFA^2	1.18E-07	9.58E-08	1.228548	0.2193
FL**	0.007484	0.000449	16.66590	0.0000
FL^2**	-0.000114	1.21E-05	-9.440263	0.0000
AGE**	-4.88E-05	2.99E-06	-16.33302	0.0000
AGE^2**	5.70E-09	5.71E-10	9.976567	0.0000
DIST**	0.001675	8.82E-05	18.97874	0.0000
$DIST^2$**	-1.81E-06	9.81E-08	-18.51006	0.0000
TM**	**-0.492801**	**0.004259**	**-115.7054**	**0.0000**
AN*TM**	**0.102499**	**0.002535**	**40.43933**	**0.0000**
C**	13.11599	0.041960	312.5839	0.0000
Adjusted R-squared	0.841819	F-statistic		5434.616

Number of transactions included: 10211
**: significant at 1% level
* : significant at 5% level

The coefficient of TM is significantly negative, which indicates that properties in the Tsuen Wan West sample have a higher price than those in Tuen Mun. One of the major reasons is that Tuen Mun, being more remote that Tsuen Wan, require a higher transportation cost to travel to and from CBD. Therefore, the property prices are lower in Tuen Mun. This echoes with Alonso’s bid rent curve model that the land closer to the city center has higher prices than those in the periphery.

1b: Announcement effect of Tuen Mun station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001043	0.000108	9.634169	0.0000
GFA^2**	5.87E-07	9.31E-08	6.306693	0.0000
FL**	0.006960	0.000476	14.60821	0.0000
FL^2**	-0.000106	1.34E-05	-7.938781	0.0000
AGE**	-4.54E-05	2.92E-06	-15.55595	0.0000
AGE^2**	4.78E-09	5.50E-10	8.693991	0.0000
DIST**	**0.001308**	**9.34E-05**	**13.99717**	**0.0000**
$DIST^2$**	**-1.35E-06**	**1.02E-07**	**-13.18756**	**0.0000**
AN**	**0.134838**	**0.010215**	**13.20028**	**0.0000**
AN*DIST**	**-6.86E-05**	**2.19E-05**	**-3.130040**	**0.0018**
C	12.82953	0.042054	305.0721	0.0000
Adjusted R-squared	0.765806	F-statistic		3040.759

Number of transactions included: 9297
**: significant at 1% level
* : significant at 5% level

In this equation, all the significance and coefficient signs of controlling variables GFA, FL and AGE match with expectation. The coefficient of DIST is positive, which means the estates nearer to the future Tuen Mun station commanded a lower price than those further away before the announcement of the station's construction. This is probably because that Tuen Mun station was to be built next to the Tuen Mun industrial area, where there was a higher level of pollution. Purchasers were urged to choose estates further away from the industrial area and hence the future Tuen Mun station.

1c: Announcement effect of Tsuen Wan West station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.006277	0.001196	5.249069	0.0000
GFA^2**	-3.99E-06	9.35E-07	-4.266225	0.0000
FL**	0.014931	0.001727	8.644835	0.0000
FL^2**	-0.000269	3.65E-05	-7.363959	0.0000
AGE	**-2.57E-05**	**3.91E-05**	**-0.656022**	**0.5120**
AGE^2	**-4.37E-09**	**1.28E-08**	**-0.342121**	**0.7323**
DIST**	**0.006972**	**0.000433**	**16.11458**	**0.0000**
$DIST^2$**	**-9.60E-06**	**5.42E-07**	**-17.70400**	**0.0000**
AN	**-0.035946**	**0.044914**	**-0.800322**	**0.4237**
AN*DIST	**8.70E-05**	**0.000107**	**0.811850**	**0.4171**
C**	10.89145	0.355505	30.63657	0.0000
Adjusted R-squared	0.685606	F-statistic		200.1002

Number of transactions included: 914
**: significant at 1% level
* : significant at 5% level

Although there are numerous residential estates in Tsuen Wan, only three of them are chosen as they are reasonably close to the Tsuen Wan West station, while others are either too distant or in close proximity to the existing Tsuen Wan MTR station. As a result, only 914 transaction records are available for estimating this equation.

The scenario in Tsuen Wan West is worthy of more discussion. The significantly positive coefficient of DIST means that before the announcement of the Tsuen Wan West station construction, people preferred living further away from the future station.

This could be attributed to the fact that, Clague Garden Estate, which is the closest to the Tsuen Wan West station among the sample estates, is also the closest to the Tsuen Wan Road that involves heavy traffic, hence there was disturbing noise the residents living there. The two other estates, Tsuen Wan Plaza is closer to the city center where more facilities and shopping centers which are available and the Waterside Garden is in close proximity to Tsuen Wan Park and Tsuen Wan Riviera Park, which provides pleasure and enjoyable views for residents. All these render the coefficient of DIST to be positive.

The insignificance of AGE can be comprehended by the inadequacy of data. Since only 914 transactions records are available, the variations in ln(RPRICE) are mostly captured by other variables. There is simply not enough remaining variation that could be explained by the AGE variable.

1d: Construction effect of the West Rail on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TM + b_{10}CON*TM$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002246	0.000176	12.73699	0.0000
GFA^2**	-5.41E-07	1.53E-07	-3.536677	0.0004
FL**	0.007077	0.000656	10.78081	0.0000
FL^2**	-0.000106	1.75E-05	-6.066241	0.0000
AGE**	-4.83E-05	5.28E-06	-9.144869	0.0000
AGE^2**	7.23E-09	6.56E-10	11.01085	0.0000
DIST**	0.002255	8.04E-05	28.03261	0.0000
$DIST^2$**	-2.39E-06	9.18E-08	-26.01278	0.0000
TM**	**-0.363322**	**0.006525**	**-55.68549**	**0.0000**
CON*TM**	**-0.031330**	**0.004074**	**-7.690565**	**0.0000**
C**	12.62977	0.057515	219.5901	0.0000
Adjusted R-squared	0.655543	F-statistic		1995.275

Number of transactions included: 10480

**: significant at 1% level

* : significant at 5% level

In this equation, all coefficients are significant and 1% level. Same as equation 1a, the coefficient of TM is still significantly negative, but is of a lower absolute magnitude (0.36) than that in equation 1a (0.49).

1e: Construction effect of Tuen Mun Station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001603	0.000174	9.188647	0.0000
GFA^2	3.54E-08	1.52E-07	0.233118	0.8157
FL**	0.006757	0.000721	9.374359	0.0000
FL^2**	-0.000104	2.03E-05	-5.142319	0.0000
AGE**	**-5.32E-05**	**5.16E-06**	**-10.31649**	**0.0000**
AGE^2**	**8.06E-09**	**6.28E-10**	**12.84448**	**0.0000**
DIST**	**0.001654**	**0.000131**	**12.64906**	**0.0000**
$DIST^2$**	**-1.74E-06**	**1.41E-07**	**-12.35382**	**0.0000**
CON**	**-0.051620**	**0.015066**	**-3.426202**	**0.0006**
CON*DIST	**4.72E-05**	**3.19E-05**	**1.478990**	**0.1392**
C**	12.57288	0.065048	193.2849	0.0000
Adjusted R-squared	0.516701	F-statistic		980.6274

Number of transactions included: 9164
**: significant at 1% level
* : significant at 5% level

Again, most coefficients of this equation are significant. The signs of the coefficients of GFA, FL, AGE and DIST do not differ from that in equation 1b.

1f: Construction effect of Tsuen Wan West station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.004836	0.000776	6.230183	0.0000
GFA^2**	-2.95E-06	6.40E-07	-4.607771	0.0000
FL**	0.009804	0.002324	4.218589	0.0000
FL^2**	-0.000147	5.01E-05	-2.933512	0.0034
AGE	**0.000113**	**7.76E-05**	**1.460715**	**0.1443**
AGE^2	**-1.71E-08**	**1.00E-08**	**-1.707259**	**0.0880**
DIST**	**0.006787**	**0.000373**	**18.20140**	**0.0000**
$DIST^2$**	**-8.92E-06**	**4.62E-07**	**-19.33456**	**0.0000**
CON**	**0.303107**	**0.058181**	**5.209684**	**0.0000**
CON*DIST**	**-0.000937**	**0.000160**	**-5.863596**	**0.0000**
C**	11.13237	0.279933	39.76792	0.0000
Adjusted R-squared	0.605224	F-statistic		202.6000

Number of transactions included: 1316
**: significant at 1% level
* : significant at 5% level

Again, due to same reasons discussed in equation 1c, the DIST coefficient is positive and the AGE coefficient is insignificant. For GFA, FL and DIST coefficients, their signs are the same as those in equation 1c.

Discussion of the impacts of the West Rail

Change in price gradient

Equation 1a: AN*TM coefficient significant and positive

Equation 1d: CON*TM coefficient significant and negative

As discussed in equation 1a and 1d, purchasers are willing to pay premium for properties in Tsuen Wan West over those in Tuen Mun. However, since AN * TM is positive, the locational disadvantage of Tuen Mun compared to Tsuen Wan diminished after the announcement of the West Rail construction.

On the other hand, as CON * TM in equation 1d is negative, the real price premium of Tsuen Wan increased again after the construction of West Rail has started. However, the increase was of a much smaller magnitude (3%) than the reduction in the announcement stage (10%), thus probably it was simply a market adjustment.

Change in value of station proximity

Equation 1b: AN*DIST coefficient significant and negative

Equation 1c: AN*DIST coefficient insignificant

Equation 1e: CON*DIST coefficient insignificant

Equation 1f: CON*DIST coefficient significant and negative

It is observed that the overall real price level in Tuen Mun has been enhanced after the announcement of the construction of Tuen Mun station, as interpreted from the positive AN coefficient in equation 1b. However, this could be due to other unknown events occurring during this period. As demonstrated by the negative AN*DIST coefficient in equation 1b, there was an increasing preference to live closer to the future Tuen Mun station after its construction was announced. But for Tsuen Wan West station, it is shown from equation 1c that both the average real price level and the proximity effect of properties to future construction of Tsuen Wan West station were not significantly affected by the announcement.

Unlike the announcement effect, from equation 1e, the overall real price level in Tuen Mun has dropped after the construction of the Tuen Mun station has started (negative CON coefficient). Also, as CON*DIST is insignificant, there is no evidence of any re-distributional effect of residents to live close to Tuen Mun station. On the contrary, from equation 1f, the average price effect of construction of the Tsuen Wan West station is positive, and the nearness to the constructing station started to attract purchasers.

5.2 Impact of the Ma On Shan Rail

2a: Announcement effect of the Ma On Shan Rail on price gradient

Equation: $\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9MOS + b_{10}AN*MOS$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002528	1.47E-05	172.3276	0.0000
GFA^2**	-7.25E-07	8.19E-09	-88.59096	0.0000
FL**	0.007839	0.000317	24.71353	0.0000
FL^2**	-0.000111	8.24E-06	-13.49369	0.0000
AGE**	-8.34E-05	2.26E-06	-36.88591	0.0000
AGE^2**	9.66E-09	2.81E-10	34.38914	0.0000
DIST**	0.000415	1.70E-05	24.39241	0.0000
$DIST^2$**	-4.64E-07	2.20E-08	-21.05585	0.0000
MOS**	**0.119170**	**0.005204**	**22.90161**	**0.0000**
AN*MOS**	**0.047759**	**0.003040**	**15.70811**	**0.0000**
C**	13.18114	0.009343	1410.808	0.0000
Adjusted R-squared	0.915067	F-statistic		24185.26

Number of transactions included: 22448
**: significant at 1% level
* : significant at 5% level

The coefficient of MOS is significantly positive. This suggests that, despite being less accessible, the units in Ma On Shan attract a premium over those in City One Shatin. According to Mr. Cliff Tse of JonesLang LaSalle, the reasons for this are the less dense housing density, more advanced facilities and better air quality in Ma On Shan, which entail the units in Ma On Shan being to be more attractive than those in City One.

2b: Announcement effect of Ma On Shan station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002357	2.08E-05	113.0828	0.0000
GFA^{2**}	-5.96E-07	1.19E-08	-50.13783	0.0000
FL**	0.006468	0.000372	17.38691	0.0000
FL^{2**}	-8.23E-05	9.09E-06	-9.052734	0.0000
AGE**	-4.28E-05	4.25E-06	-10.07123	0.0000
AGE^{2**}	-1.20E-08	1.97E-09	-6.098921	0.0000
DIST**	**-0.000337**	**2.37E-05**	**-14.23100**	**0.0000**
DIST^{2**}	**1.03E-06**	**4.19E-08**	**24.65396**	**0.0000**
AN**	**0.075545**	**0.004446**	**16.99221**	**0.0000**
AN*DIST**	**-7.08E-05**	**1.78E-05**	**-3.979240**	**0.0001**
C**	13.40627	0.009748	1375.315	0.0000
Adjusted R-squared	0.912985	F-statistic		13822.51

Number of transactions included: 13174
**: significant at 1% level
* : significant at 5% level

The estimated coefficients of GFA, FL and AGE attain expected signs and level of significance. As DIST coefficient is negative, people prefer living close to the position of the future Ma On Shan station even before its construction was announced. This is expected since most amenities such as shopping centers of Ma On Shan are located very close to the position of the future railway station.

2c: Announcement effect of City One station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002575	1.92E-05	134.4083	0.0000
GFA^2**	-7.69E-07	1.05E-08	-72.99880	0.0000
FL**	0.010490	0.000591	17.74948	0.0000
FL^2**	-0.000184	1.78E-05	-10.33190	0.0000
AGE**	-5.38E-05	1.42E-05	-3.803596	0.0001
AGE^2**	9.78E-09	1.45E-09	6.747190	0.0000
DIST**	**0.001295**	**5.29E-05**	**24.49804**	**0.0000**
$DIST^2$**	**-1.45E-06**	**5.52E-08**	**-26.20020**	**0.0000**
AN	**-0.019423**	**0.010921**	**-1.778507**	**0.0754**
AN*DIST**	**-0.000143**	**2.15E-05**	**-6.649483**	**0.0000**
C**	12.85047	0.037318	344.3523	0.0000
Adjusted R-squared	0.882058	F-statistic		6936.037

Number of transactions included: 9274
**: significant at 1% level
* : significant at 5% level

It is observed that the DIST coefficient is positive, which suggests before the announcement, people prefer living away from the location where the new City One station would be constructed. This could be explained by the geographic nature of City One Shatin and Belair Gardens. The blocks away from the station are less packed together, and are in proximity to amenities such as shopping centers and swimming pools. The residents living in such housing blocks can enjoy a more spacious view and enjoy better access to such amenities.

2d: Construction effect of the Ma On Shan Rail on price gradient

Equation: $ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9MOS + b_{10}CON*MOS$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002373	3.09E-05	76.88303	0.0000
GFA^2**	-6.71E-07	1.71E-08	-39.19395	0.0000
FL**	0.007479	0.000682	10.96353	0.0000
FL^2**	-0.000106	1.79E-05	-5.919189	0.0000
AGE**	-0.000112	5.10E-06	-22.03824	0.0000
AGE^2**	1.22E-08	5.07E-10	23.96801	0.0000
DIST**	0.000463	3.40E-05	13.63675	0.0000
$DIST^2$**	-6.02E-07	4.43E-08	-13.57449	0.0000
MOS**	**0.183617**	**0.011672**	**15.73154**	**0.0000**
CON*MOS**	**0.032344**	**0.005662**	**5.712757**	**0.0000**
C**	13.28664	0.023800	558.2589	0.0000
Adjusted R-squared	0.854588	F-statistic		5695.818

Number of transactions included: 9691
**: significant at 1% level
* : significant at 5% level

Similar to equation 2a, all the coefficients obtain their desired signs and level of significance.

2e: Construction effect of Ma On Shan station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002115	4.75E-05	44.52240	0.0000
GFA^2**	-4.95E-07	2.76E-08	-17.92954	0.0000
FL**	0.004986	0.000836	5.963474	0.0000
FL^2*	-6.07E-05	2.06E-05	-2.939994	0.0033
AGE**	-9.73E-05	1.00E-05	-9.728961	0.0000
AGE^2**	8.23E-09	2.59E-09	3.177025	0.0015
DIST**	**-0.000254**	**5.38E-05**	**-4.716398**	**0.0000**
$DIST^2$**	**8.04E-07**	**8.93E-08**	**9.006061**	**0.0000**
CON**	**0.042386**	**0.008131**	**5.213155**	**0.0000**
CON*DIST	**-3.65E-05**	**3.15E-05**	**-1.158524**	**0.2467**
C**	13.62061	0.023747	573.5605	0.0000
Adjusted R-squared	0.845081	F-statistic		3185.087

Number of transactions included: 5838
**: significant at 1% level
* : significant at 5% level

The signs and significance of the GFA, FL, AGE and DIST are the same as those in equation 2b.

2f: Construction effect of City One station

Equation: $\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002479	4.19E-05	59.20536	0.0000
GFA^2**	-7.41E-07	2.23E-08	-33.23337	0.0000
FL**	0.009399	0.001314	7.151032	0.0000
FL^2**	-0.000140	4.00E-05	-3.494828	0.0005
AGE	**-7.67E-05**	**4.06E-05**	**-1.888721**	**0.0590**
AGE^2**	**1.10E-08**	**3.27E-09**	**3.378543**	**0.0007**
DIST**	**0.001124**	**0.000109**	**10.31388**	**0.0000**
$DIST^2$**	**-1.34E-06**	**1.10E-07**	**-12.14833**	**0.0000**
CON	**-0.019739**	**0.018862**	**-1.046500**	**0.2954**
CON*DIST	**-5.10E-05**	**3.57E-05**	**-1.428656**	**0.1532**
C**	12.95448	0.130064	99.60057	0.0000
Adjusted R-squared	0.792918	F-statistic		1475.928

Number of transactions included: 3853
**: significant at 1% level
* : significant at 5% level

The AGE factor is only significant at 10% level, not at 5% level. This is because that in the sample of transactions, the blocks of City One Shatin and Belair Garden were already more than 15 old. The rate of obsolescence had decreased to a very low value when the buildings reach such an age, rendering the AGE factor less significant than expected.

Discussion of the impacts of the Ma On Shan Rail

Change in price premium

Equation 2a: AN*MOS coefficient significant and positive

Equation 2d: CON*MOS coefficient significant and positive

The results of equation 2a and 2d imply that both the announcement and actual construction of Ma On Shan Rail had enlarged the real price premium of Ma On Shan residential units over those in City One.

Change in value of station proximity

Equation 2b: AN*DIST coefficient significant and negative

Equation 2c: AN*DIST coefficient significant and negative

Equation 2e: CON*DIST coefficient insignificant

Equation 2f: CON*DIST coefficient insignificant

For Ma On Shan station, it appears that the price level in Ma On Shan has been enhanced by both its announcement and construction, as demonstrated by the significantly positive CON coefficients in equation 2b and 2e. But the behaviours of

AN*DIST in equation 2b and CON*DIST in equation 2e entail that, for the proximity effects, there is only a variation in the announcement stage but not in the construction stage. The same applied to City One station.

5.3 Impacts of the Tseung Kwan O Line

<u>3a: Announcement effect of the Tseung Kwan O Line on price gradient</u>

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9PL + b_{10}AN*PL$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001983	4.56E-05	43.46837	0.0000
GFA^2**	-4.21E-07	3.13E-08	-13.46199	0.0000
FL**	0.005516	0.000314	17.58326	0.0000
FL^2**	-4.99E-05	7.43E-06	-6.718753	0.0000
AGE**	-5.89E-05	4.30E-06	-13.70639	0.0000
AGE^2**	3.82E-08	1.64E-09	23.35670	0.0000
DIST**	-0.000197	3.55E-05	-5.553176	0.0000
$DIST^2$**	-3.87E-07	7.03E-08	-5.508613	0.0000
PL**	**-0.106847**	**0.009140**	**-11.68968**	**0.0000**
AN*PL**	**-0.091844**	**0.005159**	**-17.80126**	**0.0000**
C**	13.73843	0.017280	795.0624	0.0000
Adjusted R-squared	0.886574	F-statistic		8731.080

Number of transactions included: 11170
**: significant at 1% level
* : significant at 5% level

The coefficients of GFA, FL and AGE are of expected significance and signs. PL coefficient is significantly negative. This implies that before the plan of Tseung Kwan O Line construction, purchasers preferred to buy properties in Lam Tin instead of those in Po Lam. This is mainly because Lam Tin is closer to the CBD than Tseung Kwan O. Moreover, before the construction of Tseung Kwan O Line, Lam Tin was already supplied with MTR services. Therefore, Lam Tin was much more accessible before the Tseung Kwan O Line is introduced.

3b: Announcement effect of Po Lam station

Equation: $\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002451	5.85E-05	41.93321	0.0000
GFA^2**	-6.92E-07	3.90E-08	-17.77355	0.0000
FL**	0.005360	0.000682	7.865164	0.0000
FL^2**	-5.56E-05	1.46E-05	-3.818396	0.0001
AGE**	-3.43E-05	7.71E-06	-4.445219	0.0000
AGE^2**	-3.85E-08	5.68E-09	-6.773290	0.0000
DIST**	**-0.006158**	**0.000752**	**-8.188026**	**0.0000**
$DIST^2$**	**6.95E-06**	**9.00E-07**	**7.720609**	**0.0000**
AN**	**-0.325675**	**0.040031**	**-8.135577**	**0.0000**
AN*DIST**	**0.000789**	**9.04E-05**	**8.723849**	**0.0000**
C**	14.63196	0.159698	91.62260	0.0000
Adjusted R-squared	0.760959	F-statistic		956.9717

Number of transactions included: 3004
**: significant at 1% level
* : significant at 5% level

All the variables give expected signs with 1% level of significance. It is observed that DIST coefficient is negative, probably due to the amenities and bus stations that had existed very near to the future Po Lam station.

3c: Construction effect of the Tseung Kwan O Line on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9PL + b_{10}CON*PL$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001173	8.79E-05	13.33838	0.0000
GFA^2	9.71E-08	6.12E-08	1.586388	0.1127
FL**	0.003543	0.000408	8.679856	0.0000
FL^2	7.81E-07	9.63E-06	0.081086	0.9354
AGE	-4.53E-06	5.22E-06	-0.867240	0.3858
AGE^2**	-1.97E-08	1.25E-09	-15.76420	0.0000
DIST**	-0.000227	4.82E-05	-4.699620	0.0000
$DIST^2$	-3.33E-08	9.96E-08	-0.333924	0.7384
PL**	**-0.297926**	**0.009120**	**-32.66719**	**0.0000**
CON*PL**	**0.019498**	**0.004012**	**4.860069**	**0.0000**
C**	14.13163	0.032600	433.4814	0.0000
Adjusted R-squared	0.789308	F-statistic		4203.554

Number of transactions included: 11219
**: significant at 1% level
* : significant at 5% level

There is still a positive price premium of Lam Tin residential properties over those in Po Lam before the construction of TKO Line, as indicated by the negative and significant PL coefficient.

3d: Construction effect of Po Lam station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001604	9.02E-05	17.79072	0.0000
GFA^2**	-2.47E-07	6.36E-08	-3.881241	0.0001
FL**	0.002463	0.000447	5.507352	0.0000
FL^2	1.63E-05	1.02E-05	1.592607	0.1113
AGE**	**2.24E-05**	**5.97E-06**	**3.761299**	**0.0002**
AGE^2**	**-4.23E-08**	**3.26E-09**	**-12.98113**	**0.0000**
DIST	**-0.000118**	**6.20E-05**	**-1.895201**	**0.0581**
$DIST^2$*	**-2.81E-07**	**1.24E-07**	**-2.271207**	**0.0232**
CON	**0.017702**	**0.010095**	**1.753578**	**0.0795**
CON*DIST	**-2.09E-05**	**0.000118**	**-0.176795**	**0.8597**
C**	13.71773	0.031597	434.1516	0.0000
Adjusted R-squared	0.757544	F-statistic		2450.003

Number of transactions included: 8623
**: significant at 1% level
* : significant at 5% level

In this equation, transaction data of Metrocity Phase I, II and III are included, whose completion are at 1994, 1996 and 1999 respectively. Therefore, some of the transactions are presale records. In general, presale prices are lower than the prices transacted immediately after the building completion since the risk associated with incomplete buildings are higher. This results in the significant and positive AGE coefficient.

3e: Operation effect of the Tseung Kwan O Line on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9PL + b_{10}OP*PL$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001313	0.000153	8.589559	0.0000
GFA^2	-4.45E-08	1.03E-07	-0.433343	0.6648
FL**	0.002889	0.000932	3.101409	0.0019
FL^2	9.36E-06	2.17E-05	0.430373	0.6669
AGE**	-5.85E-05	9.62E-06	-6.076848	0.0000
AGE^2	-1.89E-09	2.37E-09	-0.801035	0.4232
DIST*	-0.000265	0.000117	-2.266430	0.0235
$DIST^2$	2.77E-08	2.36E-07	0.117187	0.9067
PL**	**-0.251620**	**0.020556**	**-12.24076**	**0.0000**
OP*PL**	**0.042635**	**0.012660**	**3.367696**	**0.0008**
C**	14.10891	0.062964	224.0801	0.0000
Adjusted R-squared	0.621026	F-statistic		671.7207

Number of transactions included: 4094
**: significant at 1% level
* : significant at 5% level

Again the PL coefficient is negative, so purchasers still preferred Lam Tin properties instead of those in Po Lam during the construction of TKO Line.

3f: Operation effect of Po Lam station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9OP + b_{10}OP*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.001468	0.000195	7.521007	0.0000
GFA^2	-1.98E-07	1.35E-07	-1.466596	0.1426
FL	0.001447	0.000947	1.528550	0.1265
FL^2	3.42E-05	2.15E-05	1.593086	0.1112
AGE**	-6.80E-05	1.24E-05	-5.470465	0.0000
AGE^2	-1.38E-10	5.25E-09	-0.026297	0.9790
DIST	**-4.62E-06**	**0.000127**	**-0.036415**	**0.9710**
$DIST^2$	**-4.49E-07**	**2.53E-07**	**-1.773267**	**0.0763**
OP**	**0.047184**	**0.017273**	**2.731686**	**0.0063**
OP*DIST	**-1.17E-05**	**7.57E-05**	**-0.154690**	**0.8771**
C**	13.82859	0.070676	195.6621	0.0000
Adjusted R-squared	0.680211	F-statistic		660.3905

Number of transactions included: 3101
**: significant at 1% level
* : significant at 5% level

The FL coefficient is insignificant. The explanation is as follows. Transaction data from 1999 to 2003 are employed for estimating this equation. In this period, the high-rise residential blocks in the Po Lam district were already very intensively distributed. Hence the marginal benefit of living in higher floors is minimal, as higher floors do not necessarily means a better view for the purchasers.

Discussion of the impacts of the Tseung Kwan O Line

Change in price gradient

Equation 3a: AN*PL coefficient significant and negative

Equation 3c: CON*PL coefficient significant and positive

Equation 3e: OP*PL coefficient significant and positive

Unlike the cases in West Rail and Ma On Shan Rail, the real price gradient between Lam Tin and Po Lam has been enlarged after the plan to construct TKOL was announced. The positive effect of TKOL was not apparent until the construction and operation stage, when the price gradient had diminished.

Change in proximity effect

Equation 3b: AN*DIST coefficient significant and positive

Equation 3d: CON*DIST insignificant

Equation 3f: OP*DIST insignificant

After the announcement of Po Lam station construction, the proximity to future station was unsatisfactory for property purchasers. Also, there is no evidence that living close to the Po Lam station bear any advantage in the construction and operation stages.

However, the OP coefficient in equation 3f is significant and positive. It suggests that the average real price level in Po Lam district is increased after the TKO Line started to operate.

5.4 Impacts of the Tung Chung Line

4a: Announcement effect of the Tung Chung Line on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TY + b_{10}AN*TY$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002468	7.95E-05	31.06346	0.0000
GFA^2**	-6.76E-07	6.64E-08	-10.18477	0.0000
FL**	0.008370	0.000569	14.69742	0.0000
FL^2**	-0.000151	1.44E-05	-10.47105	0.0000
AGE**	-5.38E-05	5.32E-06	-10.10899	0.0000
AGE^2**	-6.87E-09	1.41E-09	-4.883712	0.0000
DIST**	0.000666	0.000206	3.239397	0.0012
$DIST^2$**	-5.68E-07	1.36E-07	-4.169401	0.0000
TY**	**-0.236076**	**0.005822**	**-40.54938**	**0.0000**
AN*TY**	**-0.048183**	**0.004090**	**-11.78194**	**0.0000**
C**	13.20715	0.079009	167.1594	0.0000
Adjusted R-squared	0.806914	F-statistic		1969.327

Number of transactions included: 4711
**: significant at 1% level
* : significant at 5% level

The coefficient of TY is significantly negative, which suggests that residential units in Tsing Yi are of lower prices than those in Tai Kok Tsui (the neighborhood of the Olympic station) before the announcement of the plan to construct the Tung Chung Line. The reason is, once more, the relatively convenient transport and higher accessibility of Tai Kok Tsui than in Tsing Yi.

4b: Announcement effect of Tsing Yi station

Equation: $\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN+ b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	-0.001599	0.000594	-2.692551	0.0071
GFA^2**	2.88E-06	5.37E-07	5.357697	0.0000
FL**	0.006204	0.000648	9.581122	0.0000
FL^2**	-9.80E-05	1.60E-05	-6.137961	0.0000
AGE**	-0.000199	1.59E-05	-12.50668	0.0000
AGE^2**	4.12E-08	5.30E-09	7.777146	0.0000
DIST	**-0.000605**	**0.000387**	**-1.562847**	**0.1182**
$DIST^2$	**1.33E-07**	**2.56E-07**	**0.521320**	**0.6022**
AN**	**-0.266006**	**0.044109**	**-6.030621**	**0.0000**
AN*DIST	**5.10E-05**	**5.54E-05**	**0.920191**	**0.3577**
C**	14.75863	0.186837	78.99187	0.0000
Adjusted R-squared	0.682144	F-statistic		750.1945

Number of transactions included: 3492
**: significant at 1% level
* : significant at 5% level

The signs and significance of GFA, FL and AGE coefficients conform to the expectation. The DIST coefficient, being insignificant, demonstrated that there was no preference to live close to the future position of Tsing Yi station before the announcement of constructing Tsing Yi station.

4c: Announcement effect of Olympic station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9AN + b_{10}AN*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.003152	8.12E-05	38.80411	0.0000
GFA^2**	-1.04E-06	6.05E-08	-17.22360	0.0000
FL**	0.005537	0.001450	3.819724	0.0001
FL^2	5.10E-05	5.54E-05	0.920191	0.3577
AGE**	-0.000182	1.26E-05	-14.45927	0.0000
AGE^2**	1.75E-08	2.29E-09	7.639296	0.0000
DIST**	**-0.001437**	**0.000327**	**-4.396774**	**0.0000**
$DIST^2$**	**1.06E-06**	**2.29E-07**	**4.615923**	**0.0000**
AN	**-0.046595**	**0.030838**	**-1.510958**	**0.1311**
AN*DIST	**3.37E-05**	**3.61E-05**	**0.933687**	**0.3507**
C**	13.67863	0.122227	111.9114	0.0000
Adjusted R-squared	0.935659	F-statistic		1772.252

Number of transactions included: 1219

**: significant at 1% level

* : significant at 5% level

The GFA, FL and AGE coefficients are also consistent with expectation.

4d: Construction effect of the Tung Chung Line on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TY + b_{10}CON*TY$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002888	6.20E-05	46.56543	0.0000
GFA^2**	-9.05E-07	5.20E-08	-17.39761	0.0000
FL**	0.009519	0.000471	20.19308	0.0000
FL^2**	-0.000175	1.18E-05	-14.82502	0.0000
AGE**	-9.65E-05	4.07E-06	-23.71284	0.0000
AGE^2**	9.74E-09	7.94E-10	12.26114	0.0000
DIST**	0.002362	0.000152	15.57792	0.0000
$DIST^2$**	-1.62E-06	1.02E-07	-15.88619	0.0000
TY**	**-0.276751**	**0.004664**	**-59.33752**	**0.0000**
CON*TY**	**0.192548**	**0.003499**	**55.03517**	**0.0000**
C**	12.37610	0.057813	214.0697	0.0000
Adjusted R-squared	0.778794	F-statistic		3016.101

Number of transactions included: 8565

**: significant at 1% level

* : significant at 5% level

As in equation 4a, there was still a price premium of Tai Kok Tsui properties over those in Tsing Yi during the announcement stage, since TY coefficient is significantly negative.

4e: Construction effect of Tsing Yi Station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.006085	0.000315	19.28808	0.0000
GFA^2**	-3.91E-06	2.87E-07	-13.62358	0.0000
FL**	0.007086	0.000492	14.40384	0.0000
FL^2**	-0.000114	1.21E-05	-9.449194	0.0000
AGE**	-0.000158	9.24E-06	-17.06195	0.0000
AGE^2**	4.01E-08	1.91E-09	20.96885	0.0000
DIST**	**-0.000778**	**0.000281**	**-2.768646**	**0.0056**
$DIST^2$*	**4.07E-07**	**1.84E-07**	**2.206146**	**0.0274**
CON**	**0.236420**	**0.029822**	**7.927831**	**0.0000**
CON*DIST**	**-0.000470**	**3.99E-05**	**-11.78628**	**0.0000**
C**	12.51157	0.121738	102.7748	0.0000
Adjusted R-squared	0.710205	F-statistic		1639.797

Number of transactions included: 6688
**: significant at 1% level
* : significant at 5% level

The coefficients of GFA, FL and AGE are of same signs and similar level of significance as those in equation 4b.

4f: Construction effect on Olympic station

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9CON + b_{10}CON*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.003067	6.89E-05	44.51538	0.0000
GFA^2**	-9.38E-07	4.92E-08	-19.06745	0.0000
FL**	0.010053	0.001298	7.744059	0.0000
FL^2	-9.03E-05	5.09E-05	-1.774249	0.0762
AGE**	-0.000151	6.64E-06	-22.74180	0.0000
AGE^2**	1.30E-08	8.99E-10	14.50449	0.0000
DIST	**-0.000367**	**0.000244**	**-1.508468**	**0.1316**
$DIST^2$	**3.20E-07**	**1.69E-07**	**1.898941**	**0.0577**
CON*	**-0.035885**	**0.015865**	**-2.261927**	**0.0238**
CON*DIST	**2.68E-05**	**2.07E-05**	**1.295936**	**0.1952**
C	13.25991	0.094201	140.7626	0.0000
Adjusted R-squared	0.926689	F-statistic		2372.377

Number of transactions included: 1877

**: significant at 1% level

* : significant at 5% level

4g. Operation effect of Tung Chung Line on price gradient

Equation: $\ln(RPRICE) = b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9TY + b_{10}OP*TY$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.002612	8.05E-05	32.43787	0.0000
GFA^2**	-7.41E-07	6.86E-08	-10.79319	0.0000
FL**	0.011044	0.000603	18.31150	0.0000
FL^2**	-0.000198	1.51E-05	-13.08861	0.0000
AGE**	4.05E-05	6.39E-06	6.338847	0.0000
AGE^2**	-8.33E-09	7.34E-10	-11.34384	0.0000
DIST**	-0.001612	0.000157	-10.24359	0.0000
$DIST^2$**	1.14E-06	1.08E-07	10.51748	0.0000
TY**	**-0.044983**	**0.006629**	**-6.786121**	**0.0000**
OP*TY	**0.008656**	**0.004854**	**1.783180**	**0.0746**
C**	12.47917	0.060804	205.2360	0.0000
Adjusted R-squared	0.682670	F-statistic		2015.039

Number of transactions included: 9363
**: significant at 1% level
* : significant at 5% level

4h: Operation effect of Tsing Yi station

Equation: $\ln(RPRICE) = b_0 + b_1 GFA + b_2 GFA^2 + b_3 FL + b_4 FL^2 + b_5 AGE + b_6 AGE^2 + b_7 DIST + b_8 DIST^2 + b_9 OP + b_{10} OP*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.005261	0.000371	14.19552	0.0000
GFA^2**	-3.26E-06	3.37E-07	-9.671778	0.0000
FL**	0.009123	0.000595	15.32976	0.0000
FL^2**	-0.000156	1.47E-05	-10.60648	0.0000
AGE**	0.000218	1.15E-05	18.98892	0.0000
AGE^2**	-2.70E-08	1.43E-09	-18.80507	0.0000
DIST**	**-0.001654**	**0.000315**	**-5.246499**	**0.0000**
$DIST^2$**	**1.27E-06**	**2.07E-07**	**6.130177**	**0.0000**
OP**	**0.226415**	**0.032634**	**6.937993**	**0.0000**
OP*DIST**	**-0.000389**	**4.39E-05**	**-8.852974**	**0.0000**
C**	12.52193	0.140928	88.85348	0.0000
Adjusted R-squared	0.559283	F-statistic		983.7373

Number of transactions included: 7745

**: significant at 1% level

* : significant at 5% level

The positive coefficient of the AGE variable could be explained by during the period from 1994-1997 where the data are collected for the construction stage of the Tsing Yi station, the large shopping center, Maritime Square was built, and there is an improved utility for the Tsing Yi residents. The rate of obsolescence of the residential buildings was being overhauled by the increasing prospect of satisfaction.

4i: Operation effect of Olympic station

Equation: $\ln(RPRICE)= b_0 + b_1GFA + b_2GFA^2 + b_3FL + b_4FL^2 + b_5AGE + b_6AGE^2 + b_7DIST + b_8DIST^2 + b_9OP+ b_{10}OP*DIST$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA**	0.003048	0.000146	20.81227	0.0000
GFA^2**	-8.86E-07	9.77E-08	-9.060069	0.0000
FL**	0.010025	0.002788	3.595680	0.0003
FL^2	-6.20E-05	0.000121	-0.513334	0.6078
AGE**	-8.48E-05	1.56E-05	-5.440060	0.0000
AGE^2	2.36E-09	1.45E-09	1.631427	0.1030
DIST	**1.37E-05**	**0.000363**	**0.037812**	**0.9698**
$DIST^2$	**-1.24E-08**	**2.54E-07**	**-0.048857**	**0.9610**
OP	**0.043081**	**0.029239**	**1.473389**	**0.1408**
OP*DIST	**5.19E-05**	**3.96E-05**	**1.312525**	**0.1895**
C**	13.07738	0.165763	78.89199	0.0000
Adjusted R-squared	0.741195	F-statistic		464.0953

Number of transactions included: 1618
**: significant at 1% level
* : significant at 5% level

The signs and significant level of GFA, FL and AGE level are the same as equation 4c and 4f.

Discussion of the impacts of Tung Chung Line

Change in price gradient

Equation 4a: AN*TY coefficient significant and negative

Equation 4d: CON*TY coefficient significant and positive

Equation 4g: OP*TY coefficient insignificant

For the announcement effect on price gradient, the phenomenon in Tseung Kwan O Line is also observed in Tung Chung Line, that is, the real price premium of properties in Tai Kok Tsui over those Tsing Yi has been increased. However, this increase in the real price differential (4%) has been more than offset during the construction stage, due to a greater amount of decrease in real price differential (19%). However, such differential did not vary much after the operation of TC Line.

Change in value of station proximity

Equation 4b: AN*DIST coefficient insignificant

Equation 4c: AN*DIST coefficient insignificant

Equation 4e: CON*DIST coefficient significant and negative

Equation 4f: CON*DIST coefficient insignificant

Equation 4h: OP*DIST coefficient significant and negative

Equation 4i: OP*DIST coefficient insignificant

From results in equation 4b, 4e and 4h, the units closer to Tsing Yi station had started to command premium over those further away since the construction stage, and to an even higher degree after TC Line began its operation. But the results of equations 4c, 4f and 4i show that the proximity effect has not been varied significantly for the Olympic station throughout its announcement, construction and operation stage.

Chapter 6: IMPLICATIONS FROM THE FINDINGS

In this chapter, a detailed explanation and comparison of impacts of the four subject railways on nearby property prices is carried out.

6.1 Impact of railways

Change in price gradient

Firstly, although occurring in varying stages, all the subject railways had demonstrated an apparent price impact in terms of a change in real price gradient between the 'near' and 'remote' districts. There are increases in preference to purchase properties in the 'remote districts' for all the four railway lines. Thus, except for the Ma On Shan Rail, where the 'remote district': Ma On Shan had a higher average real price level than that of the 'near district', which is City One, the price gradient along the railway line were reduced. These results reinforce the findings of Chau and Ng (1998). Also, it is shown that the first hypothesis of this dissertation: the price gradient will be diminished by the railway when its alignment is announced, is under construction or brought into operation, cannot be refuted.

Mr. Cliff Tse of JonesLang LaSalle suggested that, such changes in the price differential are not surprising. People definitely consider saving in transportation costs as an advantage, and thus they often prefer buying properties in the 'near' districts before there is any news of the railway line construction. However, when there is a new railway line provided, their preference can change drastically. Railways in Hong Kong are often regarded as a quicker means of transport than road transport, and the risks of accidents and congestion are lower. Therefore, there will be a reduction in transportation costs in living in such 'remote districts'. The preference on purchasing properties in 'remote districts' will become higher, and the purchasers are willing to pay extra for these properties.

Change in value of station proximity

Apart from Po Lam station of Tseung Kwan O Line and Olympic station of Tung Chung Line, all the subject stations have demonstrated a higher enhancement in the real price of properties nearer to them, compared to those further away. The implication is that, for most of the stations, there is a growing preference to live closer to the station as the railway lines enter into a new time phase. Therefore, the second hypothesis: the value of proximity to railway stations increases as the railway line is announced of its alignment, under construction or brought into operation, cannot be refuted.

Obviously, the advantage of station proximity is the convenience of access to the station. If a property is located further away from the station, it will incur extra time of walking to or taking another mode of transport to reach the station. Hence there should be a higher property price enhancement of properties in close proximity to the station.

Moreover, from the property purchasers' perspective, the construction works of the railway lines in Hong Kong are rather pollution free. Property prices are seldom adversely affected during the railway construction since negative externality due to noise and visual intrusion are minimal. For example, like the Tseung Kwan O Line and Tung Chung, the noise impact are not serious as either the rails are constructed underground or there are sound insulators installed for the tracks, which greatly reduced the potential sound disturbance for the residents.

Mr. Yu Kam-fung of CB Richard Ellis suggested that the impact of railway will be significant only if the railway is important and can offer high benefit to the residents. For the residential properties around Olympic station, there was no significant price enhancement. The reasons are that the properties in the sample are quite far away (more than 300 metres) from Olympic station. More importantly, the estates are already provided with various kinds of transport such as franchised buses and mini-buses, and the Prince Edward MTR station is within 500 meters walking distance as well. The benefit brought by introducing the Tung Chung Line was not substantial enough to trigger a great enhancement in the prices of the subject properties.

As a comparison, Mr. Cliff Tse pointed out an example: the sample of transactions in Tuen Mun used in the hedonic equations estimations, where there has been very little alternatives for the residents living there other than the Tuen Mun Road to travel to other districts in Kowloon and Hong Kong Island. The risk of traffic congestion and delay is very high. Therefore the property prices were stimulated significantly due to the announcement of West Rail construction.

6.2 Timing of impacts

From the findings, it is suggested that the enhancement of property prices can occur once the plan to construct the railway is announced. This is supported from the findings on West Rail and Ma On Shan Rail, where both the price gradient and value of station proximity were affected since the announcement stage. And for the Tung Chung Line, the price gradient along it started to diminish when its construction was underway.

Mr. Tse suggested that the Hong Kong property market is rather sentimental. While purchasing properties, people are quite willing to speculate on any favourable events and are ready to offer premium for good news, even if there is no immediate benefit. Thus, it is not totally surprising that the property prices were positively affected by the railway lines well before it is actually constructed or even brought into operation.

However, when the “excitement” caused by the railway has cooled down, it is more likely to for the price to stop rising. For example, for Tuen Mun station and City One, the price enhancement of nearby properties was no longer evident during the construction stage.

To sum up, in the context of the information-sensitive Hong Kong property market, it is not necessary to have any existing benefit in buying a property. Once there is a possibility that there will be certain enjoyment in the future, he or she is still willing to offer a price premium for the property.

6.3 Factors masking the impacts

Condition of property market in the district

It can be observed from the results of Tsuen Wan West station that, the value of station proximity did not rise until the station was under construction. Mr. Tse suggested that during 1996-1997 when the real estate market was booming, a large number of investors had been speculating on the properties in Tsuen Wan, due to the positive prospect of the new airport and Tsing Ma Bridge construction. The announcement stage of the West Rail: October 1997 to October 1998, coincides with the burst of the economic bubble. As the properties in Tsuen Wan was over-speculated, they are more severely penalized than other districts during the downturn of the market. Thus, the news of the announcement failed to drive the prices of Tsuen Wan property prices upward. Fortunately, after the dramatic decrease in prices during the announcement stage, proximity started to manifest its importance in the construction stage, when the market became more settled.

Over construction of residential units

Tseung Kwan O is well known of the abundant supply of residential units. In the past decade, there had been massive construction of housing units in Tseung Kwan O. For Po Lam, Metrocity City (Phast I, II and III) is a large housing estate, and its construction has vastly increased the amount of housing stock in the district. Mr. Albert So of the Albert So Surveyor's Limited claimed that the oversupply of new building in Po Lam has dragged down the market price of second-hand housing units. As the units in new residential blocks are more favourable substitutes for the second-hand older residential units, as the Asian Financial Crisis has exerted its adverse impact since 1999, the older units in Tseung Kwan O suffered even more severe reduction in price. All these render the good news of the TKO construction immaterial.

This was why the positive influence of the TKO Line was not apparent until its operation, when there had been no new site construction in Po Lam. The fluctuating nature of the property market in that district has vanished, and the properties began to absorb the value adding benefit of TKO Line. Mr. Tse predicted that, from the high amount of passengers of TKO Line since its operation, this railway line should be quite influential to nearby property valuers in the near future.

Chapter 7: CONCLUSION

7.1 Summary of findings

The subject of this dissertation is the impact of railway infrastructure on nearby property prices. By reviewing past literature, it can be concluded that the effects of new railway lines have been generally positive.

In order to provide empirical evidence in the context of Hong Kong, the effects of four most recent railway infrastructure projects: West Rail, Ma On Shan Rail, Tseung Kwan O Line and Tung Chung Line on nearby residential property prices, are rigorously investigated by the use of the hedonic pricing model. A total of 27 hedonic equations were estimated, in which a variety of housing attributes such as floor level and building age are recognised so as to determine how the price gradient along a railway line and the value of proximity to railway stations are affected by the subject railways during each of three distinct stages: the post-announcement stage, during actual construction and during operation.

The objectives of estimating the hedonic equations is to test the validity of two hypotheses: 1) the price gradient along the railway diminishes, 2) the value of station proximity increases, when the railway line has its alignment announced, starts to be constructed or brought into operation. From the empirical results, both hypotheses cannot be refuted. The implications are that in most cases, the price gradient will be reduced, and the value of station proximity will be enhanced by the introduction of the railway line.

It is also discovered from the findings of that, in many cases the two types of effects had occurred much earlier than the time when the railways ever start their operation. For instance, West Rail and Ma On Shan Rail had both enhanced the prices of nearby residential units once the plans of construction had been announced. The preference to purchase properties in the ‘remote districts’ had also increased during the post-announcement stage.

However, the significance and magnitudes of such enhancement depends on the nature of the district concerned. There could be no enhancement if the conditions are not favourable. For example, the real price level in Tseung Kwan O, which has been continuously oversupplied with new residential buildings, did not reflect much increase until the Tseung Kwan O Line started to operate. The real price level in

Tsuen Wan West was not enhanced during the post-announcement stage, as in this period, the properties in Tsuen Wan was suffering from a recession after the excessive speculation activities between 1996 and 1997, and the railway only started to result an increase in nearby residential prices during the construction stage.

Moreover, whether a railway line or a new transportation can influence property prices depends mainly on whether its introduction offers substantial benefits for the residents. For example, for the Olympic station of Tung Chung Line, the benefit provided for the older estates in this study was minimal since there are many alternative transport modes available.

The lessons learnt from the empirical results are that, whether there will be a positive effect on the property prices is contingent on the degree of benefit the railway brings to the public at large. The Government and the railway companies should take this into account during their planning of infrastructure projects, because a new railway should not always be expected to promote nearby property prices.

If there is indeed a positive impact on prices, then it should be apparent even before a railway is actually constructed or brought into operation, it is advisable for property valuers to take this into account when valuing a property. Developers and property investors should consider this in their investment decisions.

7.2 Limitations of study

In this dissertation, in studying the impacts of railways, time intervals are used as proxies to distinguish whether the railways' construction has been announced, commenced and the operation has begun or not. However, it is highly probable that exogenous factors other than matters concerning the railway line have occurred across different time frames. Such factors, like economic climate, housing construction, environmental and demographic changes could exert their impacts on the prices as well. Therefore, the pure impact of railways as discussed in this dissertation may be contaminated by such factors. Unfortunately, it is very difficult to isolate such factors, so it is required to resort to qualitative analyses to complement such deficiencies.

For Tung Chung Line, the time span for sampling transactions before the announcement at 1992 is one year, which is too low for achieving high accuracy. And for certain housing estates such as those surrounding Tsuen Wan West, the amount of data is not substantial enough. Therefore, a few variables cannot arrive at signs and significance as expected.

7.3 Area for further research

Due to the time of this dissertation, the influences of Ma On Shan Rail and West Rail during their operation were not studied. It would be an interesting area for future study after they have operated for a few years. Also, since the impact of railway lines to some newly constructed residential developments, such as the Olympian City are investigated, further research can be carried out to examine such an impact.

Moreover, the hedonic equations suggested by this dissertation could be used for empirical studies of impacts due to future railway lines, in terms of the effect on price gradient and value of station proximity. These equations can serve as a basis for a predictive model to anticipate the impacts of the railway lines on property prices during the planning of transportation infrastructure.

Including this dissertation, most past literature focused on the influence of various transport modes on residential property prices. It is worthwhile to expand the interest to other property types, such as retail properties. It will provide insights for shopping centers developers for determining rents, and for property valuers to arrive at more accurate valuations.

Finally, other types of amenities such as parks and shopping centers can also affect nearby property prices. Their impacts of nearby property prices in their announcement, construction and operation stage are worthwhile for future analyses.

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Appendix 1 – Selected residential developments for transaction data

West Rail

	Tuen Mun station	Tsuen Wan West station
Selected Developments	Eldo Court Hong Lai Garden Kam Wah Garden New Town Mansion Tai Hing Gardens Trend Plaza Tuen Mun Plaza Waldorf Garden	Clague Garden Estate Tsuen Wan Plaza Waterside Plaza

Ma On Shan Rail

	Ma On Shan station	City One station
Selected Developments	Bayshore Tower Ma On Shan Centre Sunshine City Villa Athena Villa Oceania The Waterside	Belair Gardens City One Shatin

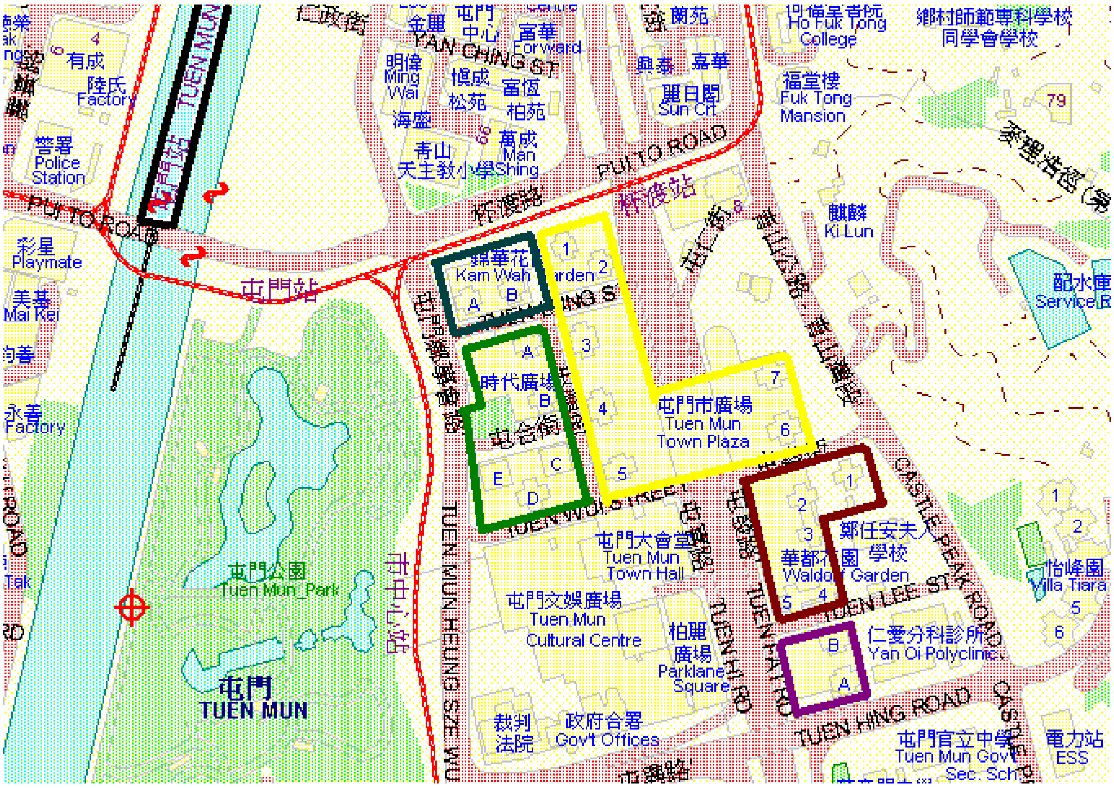
Tseung Kwan O Line

	Po Lam station	Lam Tin station
Selected Developments	Finery Park MetroCity Well On Garden	Sceneway Garden

Tung Chung Line

	Tsing Yi station	Olympic station
Selected Developments	Greenfield Garden Tsing Yi Garden	Fu Tor Loy Sun Chuen Greenfield Garden Hoi Hong Garden June Garden

Tuen Mun Station (1)



Map Scale: 1:6000

Tuen Mun Station

Kam Wah Garden

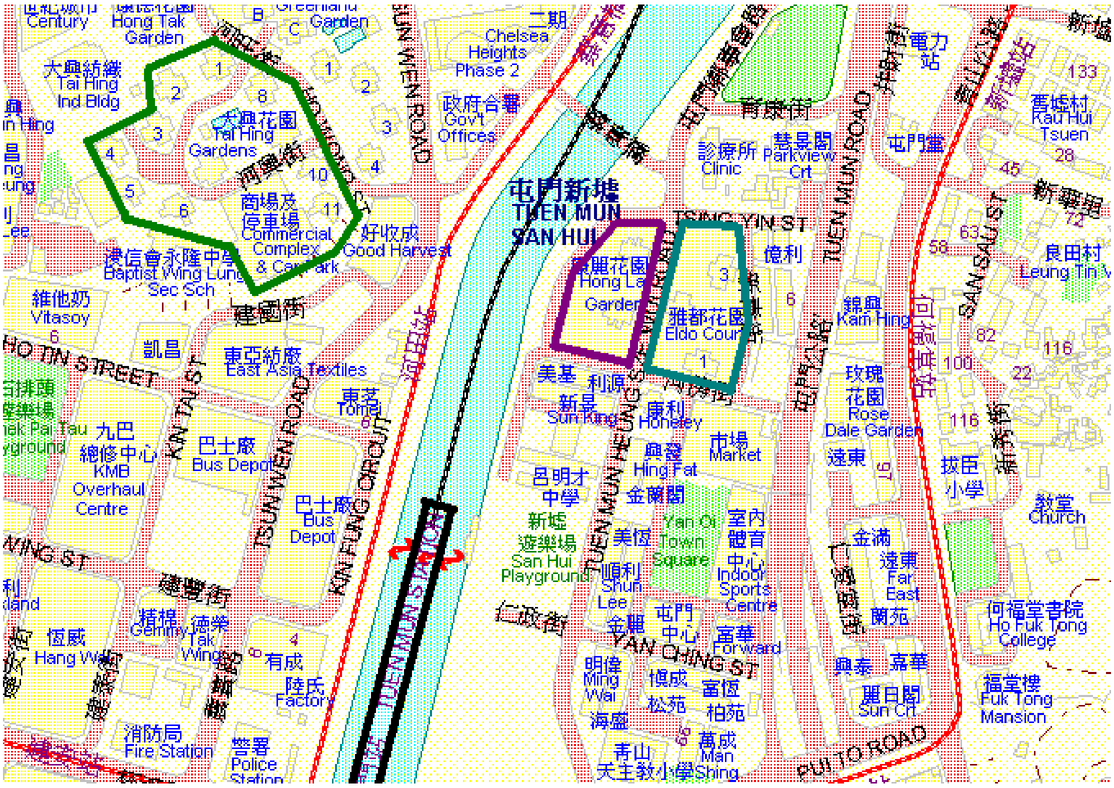
New Town Mansion

Trend Plaza

Tuen Mun Plaza

Waldorf Garden

Tuen Mun Station (2)



Map Scale: 1:6000

Tuen Mun Station

Eldo Court

Hong Lai Garden

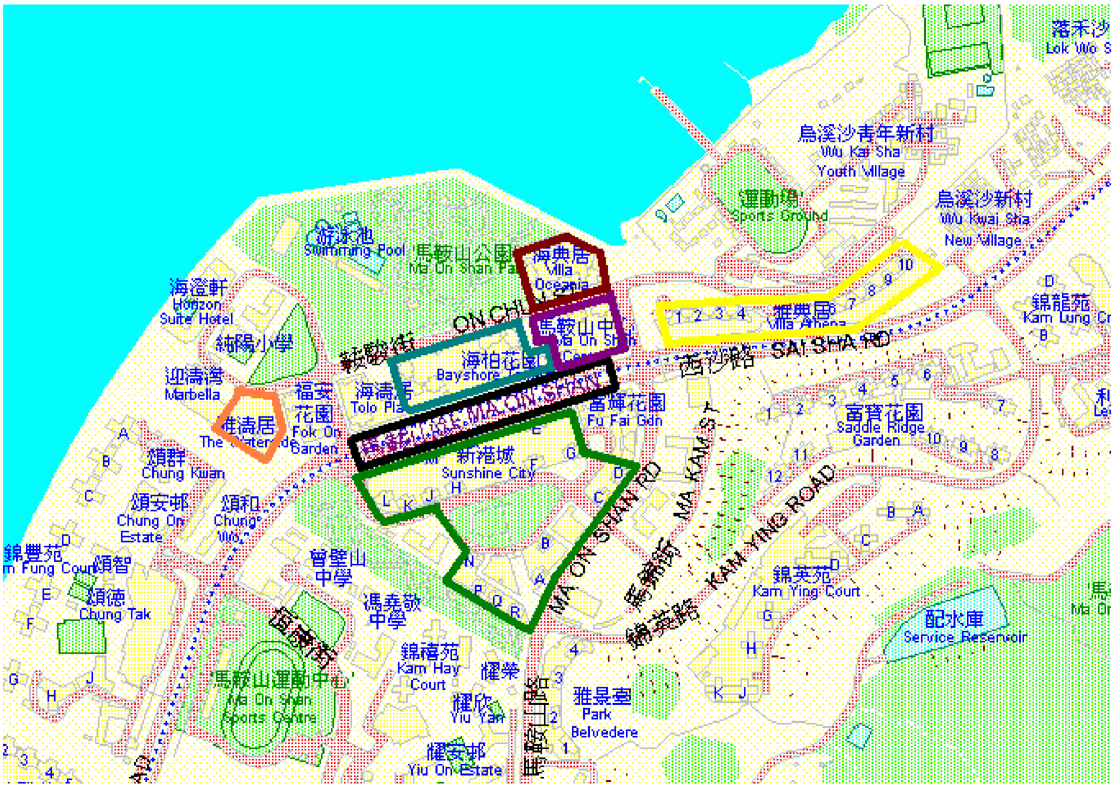
Tai Hing Gardens

Tsuen Wan West Station

Map Scale: 1:10000

Black line	Tsuen Wan West Station
Blue line	Clague Garden Estate
Purple line	Tsuen Wan Plaza
Green line	Waterside Plaza

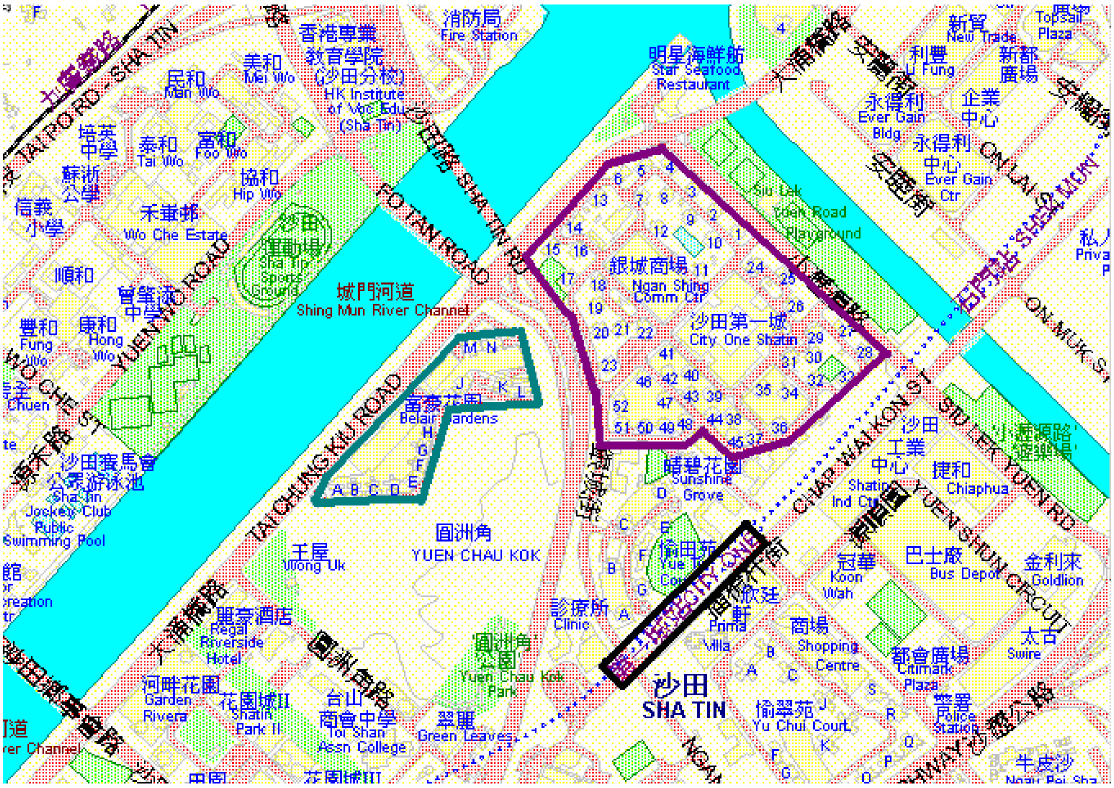
Ma On Shan Station



Map Scale: 1:10000

Black line	Ma On Shan Station
Navy line	Bayshore Tower
Purple line	Ma On Shan Centre
Green line	Sunshine City
Yellow line	Villa Athena
Maroon line	Villa Oceania
Orange line	The Waterside

City One Station



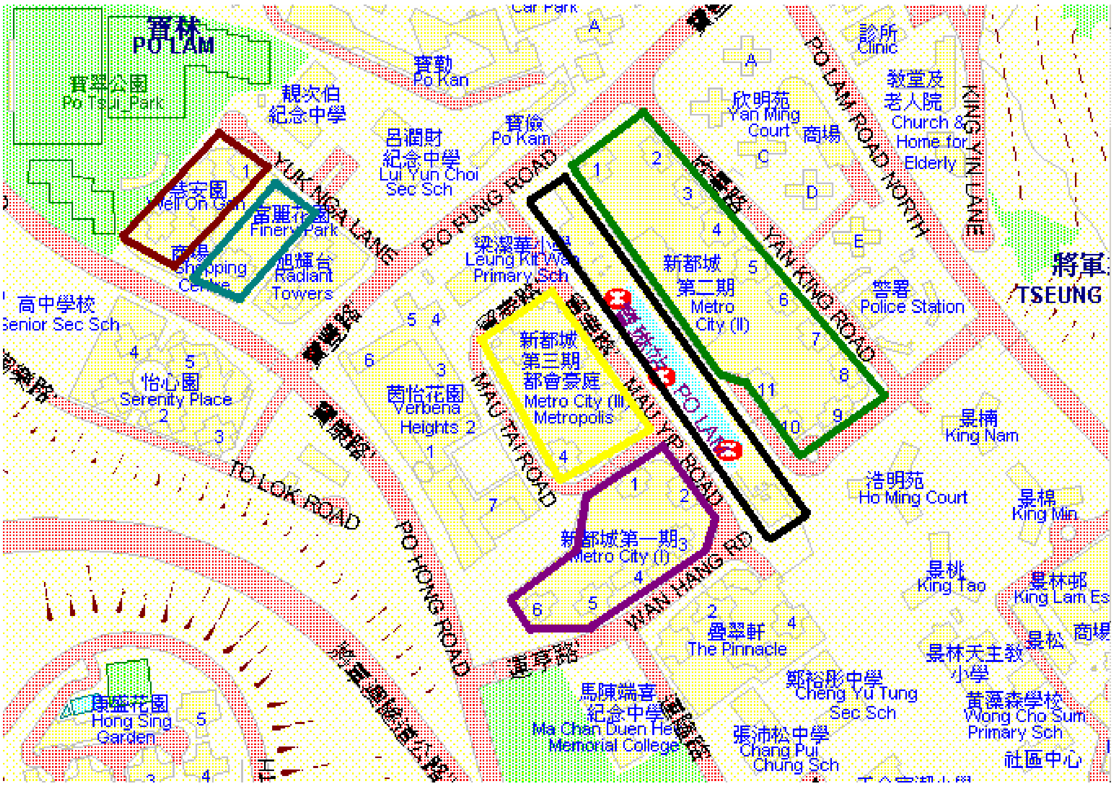
Map Scale: 1:10000

City One Station

Belair Gardens

City One Shatin

Po Lam Station

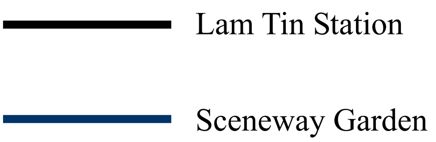


Scale: 1:6000

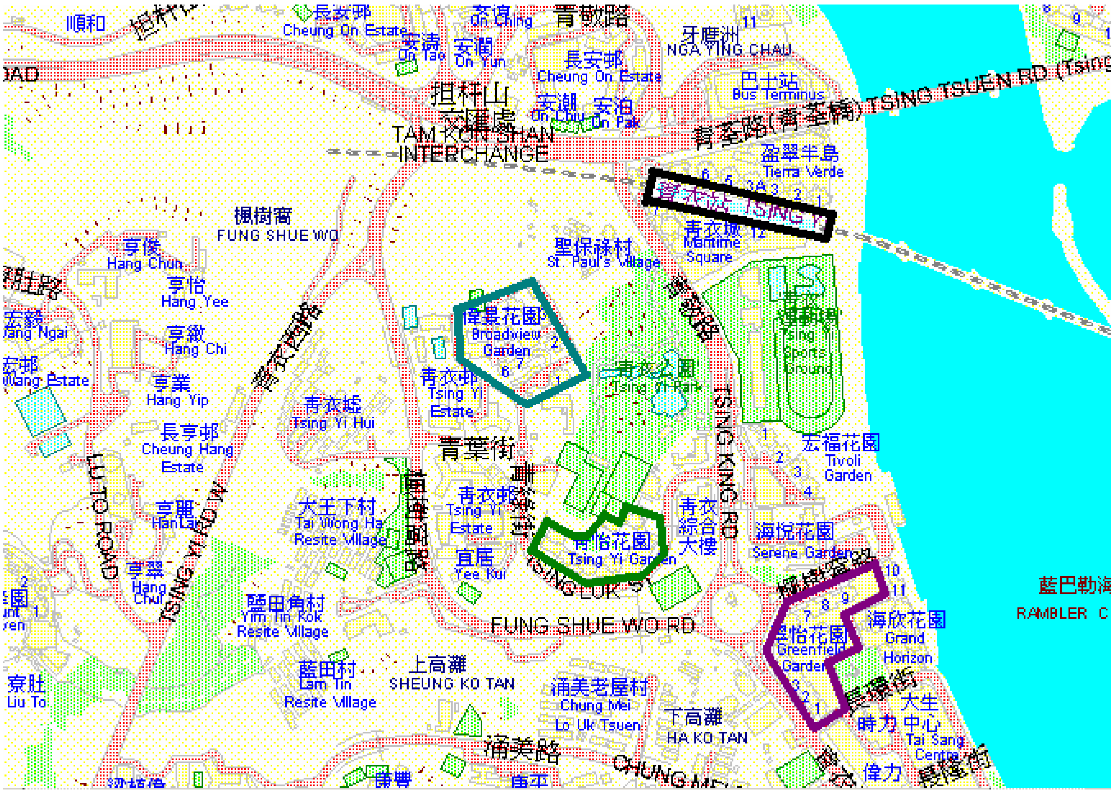
(black line)	Po Lam Station
(blue line)	Finery Park
(purple line)	Metro City Phase I
(green line)	Metro City Phase II
(yellow line)	Metro City Phase III
(dark red line)	Well ON Garden

Lam Tin Station

Scale: 1:4000



Ting Yi Station



Map Scale: 1:10000

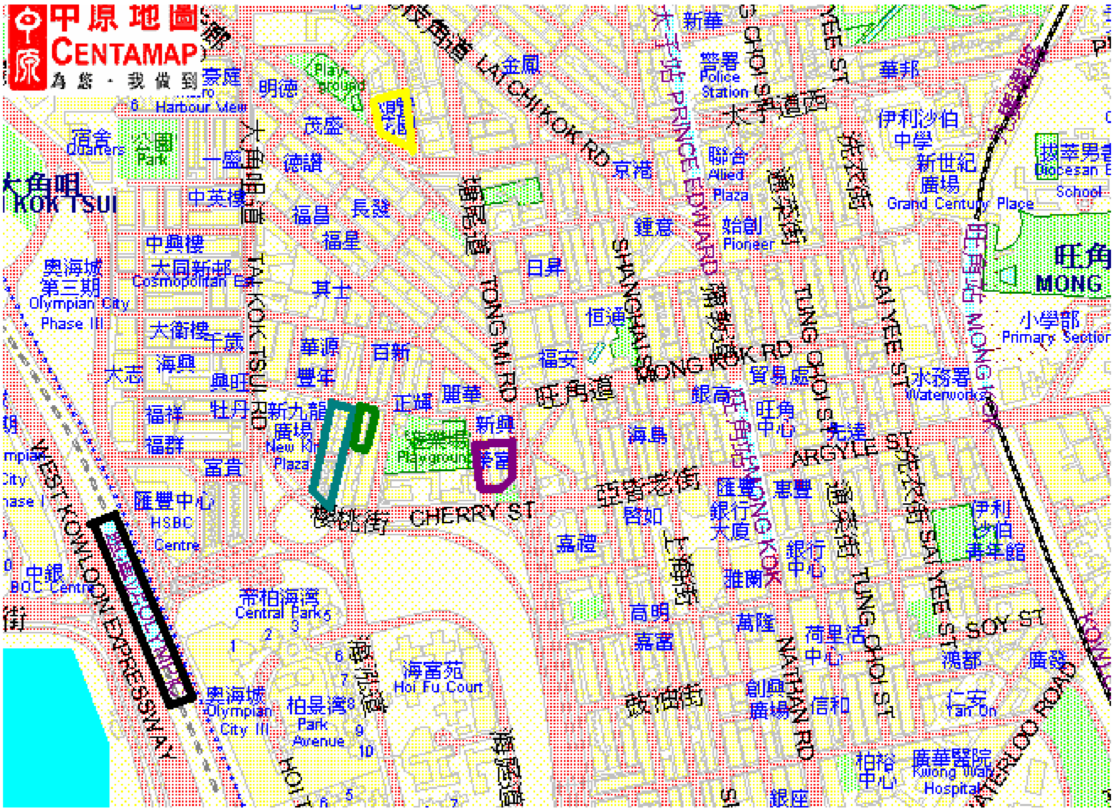
Tsing Yi Station

Broadview Garden

Greenfield Garden

Tsing Yi Garden

Olympic Station



Scale: 1:6000

- Olympic Station
- Fu Tor Loy Sun Chuen
- Greenfield Garden
- Hoi Hing Garden
- June Garden

Source: Centaline Agency Limited (2004) *Centamap* [Online] Hong Kong: Centaline Agency Limited. Available from:
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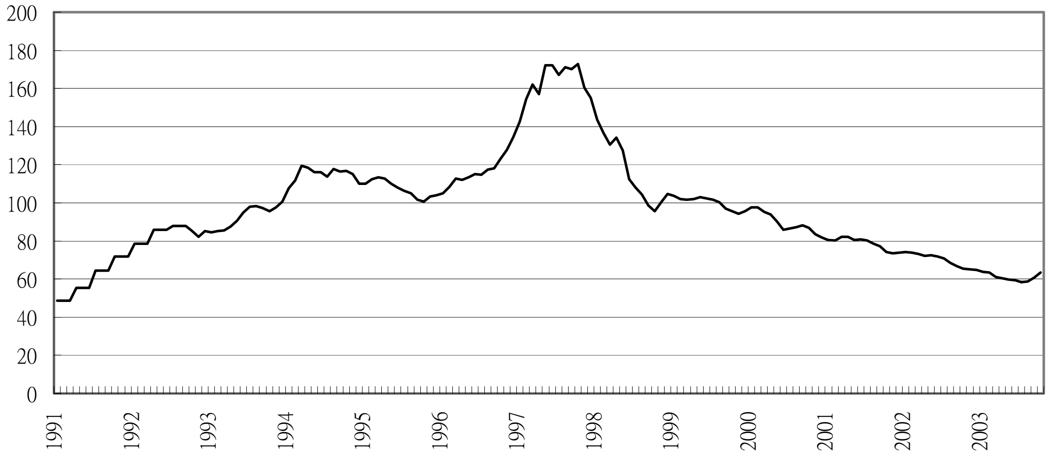
Appendix 2 – Price Indices of residential properties from 1991-2003



Quarterly Indices: 1991-1992

Year	Quarter	Index	Year	Quarter	Index
1991	1	48.7	1992	1	78.6
	2	55.4		2	86
	3	64.4		3	88
	4	71.9		4	85.2

Monthly indices: 1993-2003

Year	Month	Index	Year	Month	Index
1993	1	84.4	1996	1	105.2
	2	85.2		2	108.5
	3	85.7		3	112.8
	4	87.5		4	112.1
	5	90.7		5	113.5
	6	94.9		6	115
	7	98.1		7	114.6
	8	98.3		8	117.4
	9	97.3		9	118.2
	10	95.5		10	123.1
	11	97.8		11	128
	12	100.8		12	134.5
1994	1	107.7	1997	1	142.7
	2	111.6		2	154.3
	3	119.4		3	162.2
	4	118.4		4	157
	5	116		5	172.3
	6	116.1		6	172
	7	113.8		7	167.2
	8	117.7		8	171.1
	9	116.3		9	170.3
	10	116.8		10	172.9
	11	115.2		11	160.5
	12	110.1		12	155
1995	1	110	1998	1	143.7
	2	112.4		2	136.6
	3	113.3		3	130.7
	4	112.7		4	134.3
	5	110.1		5	127.6
	6	108.2		6	112.5
	7	106.4		7	108
	8	105		8	104.5
	9	101.6		9	98.5
	10	100.8		10	95.6
	11	103.2		11	100.3
	12	103.9		12	104.6

Year	Month	Index	Year	Month	Index
1999	1	103.8	2002	1	74.1
	2	102		2	73.9
	3	101.7		3	73.3
	4	102		4	72.3
	5	102.9		5	72.4
	6	102.3		6	71.9
	7	101.6		7	70.9
	8	100.5		8	68.3
	9	97.1		9	66.7
	10	95.8		10	65.4
	11	94.3		11	65.1
	12	95.7		12	64.8
2000	1	97.5	2003	1	63.6
	2	97.5		2	63.4
	3	95.3		3	61.2
	4	93.9		4	60.5
	5	90.3		5	59.7
	6	86		6	59.3
	7	86.6		7	58.4
	8	87.2		8	58.6
	9	88.2		9	60.9
	10	87		10	63.4
	11	83.7			
	12	81.8			
2001	1	80.7			
	2	80.2			
	3	82.1			
	4	82.2			
	5	80.5			
	6	80.9			
	7	80.2			
	8	78.5			
	9	77.2			
	10	74.1			
	11	73.6			
	12	73.8			

Source: Rating and Valuation Department, *Hong Kong Property Review: Various issues*, Hong Kong: Rating and Valuation Department.