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THE UNIVERSITY OF HONG KONG

AN EMPIRICAL STUDY OF THE EFFECT OF LAND SALES ON HOUSING 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

TSUI KA YAN

HONG KONG

APRIL 2008

Declaration

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

Signed : _____

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Date : 10th April, 2008

Abstract

During the period 1991-2005, Hong Kong has experienced the remarkable fluctuations in housing prices. These fluctuations might be accounted by exogenous events happened, in particular, Asian Financial Crisis in 1997 and Severe Acute Respiratory Syndrome (SARS) in 2003. In order to reduce the fluctuations, one of the means Hong Kong government uses is to control the land supply for housing through land sales.

It has been alleged that the high housing prices is resulted from the insufficient amount of land disposed by the government through land sales. Therefore, the primary objective of this study is to investigate the effect of land sales on the housing prices. Although previous researches concerning the land supply and housing prices in Hong Kong are not scanty, they were already carried out a few years ago. The changes in land and housing policies, alterations of land sale mechanism, fluctuations of economic situations and the outbreaks of exogenous events over the period of 1991-2005 are not all taken into accounts in the previous researches. Hence, it is worthwhile to examine the effect of land supply again.

A housing demand model is then developed to investigate the effect of land sales on housing prices statistically. The empirical analysis suggests that the volume of land area sold brings a negative effect on housing prices but this effect is not realized simultaneously but with a time lag. A change in the quantity of land sales alters the expectation of the market towards the future housing price appreciation and such expectation capitalizes into current housing price.

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All errors that may appear in this dissertation are mine.

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Chapter 1 - Introduction

1.1 Background

Hong Kong has experienced remarkable fluctuations in housing prices from 1991 to 2005. With reference to the statistics from Rating and Valuation Department, the fluctuations might be accounted by the exogenous events happened. In particular, the Asian Financial Crisis in 1997 and the Severe Acute Respiratory Syndrome (SARS) in 2003 were the most significant ones. These exogenous events stroke Hong Kong's property prices drastically, especially the occurrence of SARS when the property prices almost plunged to the level back of 1991. In order to mitigate the fluctuations, one of the means Hong Kong government uses was to control the land supply for housing through land sales.

No matter before or after the return of the sovereignty of Hong Kong to the People's Republic of China, Hong Kong's government owns all land in territory virtually and has the exclusive control on land disposal. By the signing of the Sino-British Joint Declaration, the British Hong Kong government was constrained to grant a maximum of 50 hectares of land a year until 30 June 1997. This land disposal limit was said to be a constraint to land supply. After the handover of Hong Kong, this land quota has been removed and scheduled land auctions were to be held as usual until November 2002, with a nine-month halt from June 1998. Nevertheless, a new mechanism called Application List System (ALS) has been introduced and worked with scheduled land auction concurrently since 1999. After the outbreak of SARS, the government resumed land sale in January 2004 and the traditional scheduled land auction was replaced by the Application List System completely. After that, the new system was modified in 2005 as it was alleged to be difficult for developers to trigger interested sites for public auction.

In economic theory, housing prices are determined by the housing demand and supply. With the increasing number of households in Hong Kong, the demand for housing becomes greater and greater. However, the amount of land for housing is limited and in turn the housing supply does so. With reference to the statistics concerning the numbers of households and housing units at year end in Hong Kong (Table 1.1), the numbers of housing units is larger than those of households. It appears that there should be no shortage of housing and the residential property prices should be below the equilibrium price according to traditional economic theory. The fluctuations of housing prices are very likely related to the effect of speculation activities in the property market that certainly cannot be neglected.

Year	Number of Households ('000)	Number of housing units ('000)
1991	1,601.9	1,681
1992	1,633.5	1,745
1993	1,677.7	1,779
1994	1,729.1	1,822
1995	1,783.0	1,884
1996	1,864.5	1,933
1997	1,922.8	1,962
1998	1,961.5	2,004
1999	1,998.9	2,041
2000	2,037.0	2,115
2001	2,064.0	2,224
2002	2,103.3	2,269
2003	2,127.1	2,332
2004	2,165.9	2,372
2005	2,195.1	2,408

Table 1.1: Numbers of households and total housing units (both public and private housings) at year end in Hong Kong, 1991-2005.

Source: Figures of the number of households and number of housing units from *Hong Kong Annual Digest of Statistics*; Census and Statistics Department, HKSAR Government.

Although there have been some researches that analyze the effect of land supply of land sales on housing prices and their relationship with the case study in Hong Kong, the researches were carried out several years ago already and had not included the recent changes in land and housing policies. Moreover, the effects of exogenous events happened in latest ten years in land and housing supply had not yet been taken into consideration. This study attempts to test the gradual housing price adjustment and to examine the effect of land sales on private housing prices derived from previous researches.

1.2 Objectives

The main themes of the current research are to examine, both theoretically and empirically, the impact of land sale on private residential property prices in Hong Kong and the role of government towards land supply in Hong Kong. The following objectives are pursued:

- To review the situations of the land and housing market in Hong Kong over the period 1991-2005;
- To identify the major determinants of private housing property prices in Hong Kong; and
- To examine the effect of land sales and in turn land supply on private housing prices formation.

1.3 Hypotheses

There are two hypotheses in this study. They are:

- Land sales have significant negative effect on housing prices; and
- Gradual price adjustment exists between the land supply and housing prices.

1.4 Framework

First of all, a literature review on theoretical background of housing prices determination will be illustrated as the foundations for discussion, Followed by the review of land policy and housing market in Hong Kong from 1991 to 2005. This review provides an elementary base for understanding the peculiarities of the land and housing markets of Hong Kong.

The variables to be tested will be selected based on the ideas suggested from the previous studies and the situations in Hong Kong. A regression analysis will be used for constructing a housing demand model so as to determine and analyze the determinants. In the model, prices for private housing will be the dependent variable and some demographic and economic indicators will be used as explanatory independent variables. By using quarterly data over the period 1991- 2005, the model will be tested empirically. Significant variables will then be analyzed and investigated in detail on its effect on land prices. At the end, conclusions on findings and limitations of study will be drawn.

This study is divided into eight chapters. This chapter, Chapter 1, is the introduction. It describes the background, objectives and framework of this study.

Chapter 2 will be a literature review. Previous academic research studies concerning land sales, land supply and housing prices will be illustrated. The meaning and sources of land supply, the effect of land sales on land supply, the relationship

between land supply and housing prices, the role of government in land and housing markets, and the determinants of housing prices will be reviewed literately in this chapter.

Chapter 3 will be a review on land policy and housing market of Hong Kong from 1991 to 2005. It will demonstrate the how the government intervention, housing price crisis and the exogenous shocks affect the land and/ or housing markets.

Chapter 4 will be an overview of the housing behaviour in Hong Kong. Demographic and economic factors and government land supply from land sales will be provided.

Chapter 5 will be the methodology employed in this study. The regression analysis will be described and the general development of the housing demand model will be outlined also.

Chapter 6 will present an overview of the empirical model of housing demand. The explanatory variables to be tested will be specified and justified first. Follow up by the identification of the expected signs of coefficients of the explanatory variables and finally data and sources for the variables will be stated.

Chapter 7 will display the empirical results and provide analysis of the results. It will further illustrate the implications of the findings.

Chapter 8 will be the concluding chapter. It summarizes the main observations and findings in this study. The limitations of this study and suggestion on further researches will be also provided in this chapter.

Chapter 2 - Literature Review

2.1 Meaning of Land Supply

In several previous researches studying the effects of land supply on housing prices in Hong Kong, the meaning of land supply is different and in turn there are some differences in their interpretations on the effects.

The model for housing demand in the study of Peng and Wheaton (1994) defines land supply as the rate of recent land sales to examine the impacts of restrictiveness of land supply on the housing prices. This means an increase or a decrease in the amount of land sales recently. When examining the trend in the booming market, there may not be many problems to in this definition. However, it is difficult to measure as the characteristics of the land sold, such as the quality of land, locations and types of use, should be kept constant.

Tse (1998) employs the site area of the residential land for public land auction in both urban areas and the New Territories, as well as the total allowed floor area, which is calculated by the area of the sites supplied by public land auction and tender times the plat ratio of each site, to find out the relationship between land supply and housing prices. Besides, Ho and Ganesan (1998) use land supply in terms of gross floor area for private residential development to explore the effect of land supply on residential housing prices. This shows these two studies have considered the characteristics of land supply in Hong Kong that there is a “volume” concept and in turn making the site area not exactly equal to the actual developable area. With a low plot ratio, a large site area may have smaller developable area than a small site area with a high plot ratio, and vice versa. As a result, the inclusion of plot ratio is important to land supply.

Hui et al. (2000) include both the land supply through public land auction and tender, and the estimated land supply planned by the government separately for studying the impact of the restrictions on land supply on the housing prices in private sector. The land supply means the absolute area of land supplied by auction and tender while the estimated land supply means the future land supply planned by the government. This involves an expectation effect of how a foreseeable shortage or surplus in the supply of land in the future would influence current housing prices.

In Hui (2004) , land supply is interpreted as the land supplied by the government through public land auction and tender, and by private developers through lease modification and exchange to investigate the effects of land supply and lease conditions on the housing market. However, as this dissertation focuses on the effect of land supply through land auction and tender on the housing prices, the impact of lease conditions and exchange is not examined in the first place.

2.2 Effect of Land Sales on Land Supply

Land sale is broadly interpreted as the land disposed by the government through public land auction and tender, which will be explained further in the next chapter. Peng and Wheaton (1994) and Tse (1998) concur that a reduction in land sales would result in an expected decrease in the land supply overall. The less the land sales, the smaller the land supply in terms of developable gross floor area is. However, since there is a presence of plot ratio, less land sale may not result in less developable gross floor area if the sites have larger plot ratio, and vice versa. However, in general, there is a positive relationship between land sales and the land supply.

2.3 Land Supply and Housing Prices

2.3.1 Impact of the government land supply on housing prices

Previous studies have examined the impact of land supply and land sales on private housing prices. In substance, there is no consensus about the effect of land supply on housing prices, but there are two sides on the result of the studies. The first one is that there is causality between the restrictive land supply and housing prices. Nevertheless, the second one is that land supply and private housing prices have no relationship in between.

Peng and Wheaton (1994) hold that housing prices have a positive relationship with the degree of restrictiveness in land supply. The first explanation is that as the construction of housing takes time, the stock of housing is unable to keep pace with the demand and subsequently housing prices increase. Another explanation is that when new land sales are reduced, a decrease in long-run land supply is appeared to be expected. Consequently, people will pay a higher rent for housing and land. Such an anticipated higher future rents are to be capitalized into higher current housing prices.

The empirical results found by Peng and Wheaton (1994) is that a reduction in land sales has a direct effect on housing prices but has no direct effect on the production of new housing units, consisting with the approach of equilibrium 'expectation'. In other words, a rise in housing prices is caused by the expectation to higher rents in future but not the shortage of new housing completion. The same study also suggests that a reduction in land supply from land sales does not generally affect the housing production as the construction density is less restrictive. It concludes that housing prices are affected by market expectation directly while the construction density is affected by price signals, including previous real housing prices and the change in real housing prices.

The result of the study of Hui et al. (2000) also suggests that the restrictions on land sales would affect the housing prices and about one year is needed for the market to

capitalize the anticipated higher future rents into higher current housing prices, the same findings as Peng and Wheaton (1994) . The analysis of Hui et al. (2000) suggests that the fluctuations of housing prices may cause the immediate actions taken by the government, for example on land disposal, so as to regulate the market.

Eve et al. (1992) recognize that the amount of land supply for new residential development will influence the housing prices as long as the supply is responsive to the changes in demand and price for housing. They also find that housing prices can be affected by the land supply to a greater extent in the medium and long terms rather than in the short term. While short term is identified as a period of less than 2 years, the medium and long terms are identified as 2 to 5 years and over 5 years respectively.

Eve et al. (1992) further explain that in the short term, housing prices are basically determined by the housing demand as the total stock of housing available cannot be varied significantly and rapidly. Due to different demand for different types and locations of housing, housing prices vary and in turn, this affects the amount that developers are willing to pay for the residential land, the quantity of land supply, the quantity of the construction of new housing stock, and the location and types of new housing constructed. Additionally, a short term price movements can be affected by stimulating speculative demand. Because of the expectations towards an increase in future prices, developers would tend to keep the land and housing off the market for future use, the variation of price can be intensified.

On the other hand, according to Eve et al. (1992) , since the land supply is not fixed and relatively flexible in the medium and long terms, land supply can have more impacts on the housing prices. Moreover, the impacts of land supply is greater on the total housing stock in long term than the short and medium ones as there is more scope for land supply to make a response for a longer period of time. Eve et al. (1992) also state

that the restrictive amount of land supply can affect the price of newly constructed housing.

Besides, the findings of Hui (2004) , agreeing with Peng and Wheaton (1994) and Eve et al. (1992) , shows a significant negative relationship between lagged land sales and housing prices. A reduction in land sales, meaning a reduction in land supply, would cause an increase in housing prices with the capitalization of the expectation of higher rent into the current housing prices. Hence, again, the realization of such effect would not be an immediate one but take approximate one year.

Although Tse (1998) also agrees that the number of new completions may not be affected by new land supply directly, in his study, the causality between the total allowed floor area[1] supplied and real housing prices is rejected at all conventional levels of significance. This implies that no cause and effect relationship is in between land supply and housing prices. Tse (1998) further explains the result is mainly because of the land-banking behaviour of the developers. The size of land banks held by the developers depends on the changes in market interest rates. When market interest rates rise, the land banks of the developers tend to decrease. As, according to Neutze (1987) , higher interest rates imply higher discount rates, the developers would prefer to develop earlier.

Besides Tse (1998), the result of Lai and Wang (1999) also shows the insignificant positive relationship between the housing supply and land supplied by the government due to the existence of land bank of the developers. This means that the number of housing supplied by the developers is independent of the quantity of land supplied by the government and therefore government land supply and housing prices would not have significant relationship in between.

[1] In Tse (1998) study, $FS_t=\Sigma q_{ti}LS_{ti}$ where FS_t represents the total allowed floor areas, q_{ti} is the plot ratio and LS_{ti} is the land supplied by the government.

It is noted that Peng and Wheaton (1994) , Tse (1998) , Ho and Ganesan (1998), Lai and Wang (1999) , Hui et al.(2000) and Hui (2004) study based on the case of Hong Kong and all of them use the local information to carry out the empirical studies. Nevertheless, the latest investigated period of these studies is merely up to 1998, which has been a long distance from today already. Since Hong Kong has experienced exogenous events and its economic environment has fluctuated much during the recent fifteen years, it is worthwhile exploring the relationship between land supplied by the government and the housing prices anew.

2.3.2 Impact of other land supply on housing prices

While Peng and Wheaton (1994) and Tse (1998) have different views on the impact of land supply on the housing prices, both of them assume that land supply represents the land supplied by the government. This means that they have only considered the land disposed by the government through land sales but not all other sources of land supply in their studies. Actually, the government land supply only accounts for about 30 percent on average in terms of land value in all land transactions from 1985 to 2001. (Li, 2006) Obviously, there should be other form of land supply in the private land market.

Tse (1998) also notes that the land disposed by the government only accounts for a small proportion of the development needs of Hong Kong. Furthermore, another more significant source of land supply is redevelopment of the land from the land banks of the private developers, implying lease modifications and land exchanges, which are considered as a land supply from the sector other than public land market, i.e. the private land market. Redevelopment has accounted for more than half of the new housing units from private land market.

Hui et al.(2000) also find that it is significant for the impact of the lease modification and land exchange on the housing prices being more immediate than the restriction on land sales. Hui (2004) concurs with Tse (1998) that other than land auctions and tender, lease modifications and land exchanges are the major means to supply land for housing. Hui (2004) finds that lease modifications and land exchanges show a significant impact on housing prices, with a two-year time lag. He indicates that there is a negative relationship between the existence of development conditions in lease and housing supply. Thus, with the modification of lease conditions, housing supply would increase as the development conditions are eased. As housing supply is negatively correlated to the housing prices and the modification of lease conditions can raise housing supply, modifying lease conditions can positively influence the housing prices.

2.4 Role of Government in Land Supply and Housing Markets

The government in Hong Kong is the owner of all land over the whole territory, except for the land parcel at St. John's Cathedral. The government can intervene with the supply of land in terms of quantity, development density and uses so as to meet the future demand.

Because of the enactment of the Sino-British Declaration, land supply in Hong Kong was restricted from 1984 to 1994. In order to provide sufficient housing units, the planning tools implemented by the government played an important role for increasing the development intensity of the existing land for residential.(Chiu, 2007)

Before the handover of Hong Kong to the People's Republic of China, the British Hong Kong government claimed to practice the economic policy with 'minimum intervention but maximum support' (Ng and Tang, 1999), or called 'positive non-interventionism' or laissez-faire (Tsang, 2006). In reality, the government has played an

important role as "an owner of a factor of production (land)", according to Schiffer (1991) , that it has strictly controlled over the land supply by land disposal. Besides, the government has acted as a land-use planner and major 'developers' in the territory. (Ng and Tang, 1999)

Hui et al. (2000) state that the government often revised its land sale policies with respect to the outlook of the market. For instance, when the housing market is booming, the government probably release more land for land sales and vice versa.

Nevertheless, after Mr. Donald Tsang has been the Chief Executive of the HKSAR since 2005, the economic strategy of the government taken has been modified. The role of the government towards the property market has changed from a major housing builder and seller of public housing to the 'Big Market, Small Government' economic strategy. The land sale mechanism was also changed from the traditional regular land sale to the Application List System. This proves that the government desires to allow the market to decide the amount of land should be supplied as the new mechanism is demand-driven. (Li, 2004) This also demonstrates that the changing from the role of the government as an active targeting supplier to the role of subjecting to the market demand of property developers. (Dai, 2004)

Chiu (2007) indicates that even though the major source of land supply is redevelopment[2], the government still acts as a monopoly supplier of new land and the largest single land supplier. As a result, the government always plays a critical role to directly regulate the land supply and indirectly control the housing prices by adjusting its land supply.

Hui (2004) says that the government uses the restriction on land supply as one of the indirect methods to intervene the housing market in Hong Kong. As a result, the

[2] Chiu (2007) finds that in the case of 1993, the redevelopment accounted for 87 per cent of land for residential and commercial uses, excluding redevelopment sites with unrestricted leases not requiring lease modification or land exchange.

government is suggested to focus its policy on planning and be aware of the impact brought by the policy so as to achieve a stable housing market in the long term, in the study of Hui and Ho (2002) . For instance, if there is a foreseeable demand for housing, the government should make its planning application more efficient in order to increase the areas for residential use and permissible development density for meeting the demand in the future.

Hui et al. (2000) state that to speed up the redevelopment process, the existing planning and development processes have been reviewed for simplifying the procedures and assisting developers to meet the requirements of relevant departments when considering planning applications.

For several decades, one of the goals of the Hong Kong government wants to achieve is to provide sufficient housing for its citizens. As a result, the government also acts as a housing supplier since 1978.

For many years, the government has provided public housing for low income residents in order to abate the economic imbalance. (Hong, 2007) Apart from the public housing for rent, public housing for sale and subsidies for encouraging residents to purchase their own flats help the ownership rate increasing from about 25 percent in 1978 to about 54 percent in 2005, with reference to *Hong Kong Annual Digest of Statistics*. The contribution of the government's housing policy certainly cannot be blotted out.

However, the government decided that from 2003 onwards, except for a limited number of unsold and returned Home Ownership Scheme (HOS) and Private Sector Participation Schemes (PSPS) flats, the production and sale of HOS and PSPS flats ceased indefinitely. This act aims to minimize the government intervention in the housing market. Nevertheless, in the early 2006, the government made a decision to sell the surplus HOS flats starting from 2007 to 2009, divided into two phrasing. The phrasing

arrangement aims at preventing the sale of one large batch of flats and minimizing the impact of the reinstatement of sale of HOS flats on the private housing market. (Hong Kong Yearbook, 2006) This is consistent with the approach of "Big Market, Small Government".

Other than influencing the housing market directly by constructing public housing, the government controls the land supply can help stabilizing the housing market and improving the affordability of housing. Chiu (2007) finds the empirical evidence of Hong Kong that the economic environment affects the land supply to a greater extent than the shaping of market outcomes. Besides, Chiu (2007) suggests that the alternative measures for stimulating housing supply should be considered though the government chooses to tackle the housing problem by adjusting land sales.

2.5 Determinants of Housing Prices

For the development of a housing market model in previous studies, different determinants are included. To conclude, there are several fundamental determinants that should be incorporated based on the regression models for housing market in Hong Kong Peng and Wheaton (1994), Hui et al. (2000) and Hui (2004).

2.5.1 Demographic Characteristics

Demand and supply of housing are important determinants of housing prices. Housing demand is strongly affected by speculative activity. (Tse et al., 1999) However, the total housing demand does not merely include the investment demand for housing. It is common to think that the existence of human beings would generate demand for housing since a place for accommodation is actually a basic need for men. Therefore,

according to Tse et al. (1999), "Housing demand refers to the take-up figures in respect of flats which represent the net increase in the number of units occupied.

In the traditional economic view on the law of demand and supply, when housing demand increases, the housing prices should increase, by keeping the housing supply constant. However, the research result in Mankiw and Weil (1989) suggest the opposite view by examining the housing price behaviour in the United States. They find that the housing demand and the real housing prices are negatively related.

2.5.1.1 Population

Hui (2004) states the increasing population in Hong Kong can illustrate the demand for the housing. An increase in population implies a rise in housing demand. The result of study of Hui (2004) finds that population shows significant strong positive correlation with housing prices with two-years lagged land supply. This means that the larger the population size, the larger the housing demand and in turn the higher the housing prices. This result is contradicted to that of Mankiw and Weil (1989).

2.5.1.2 Household Formation

Although the housing demand can be reflected by the population, this may not explain the change in housing demand in Hong Kong adequately. Since the household formation is more rapid than the growth of population in Hong Kong, the explanatory power of pure demographic change to the change in demand for housing is not sufficient. As a result, Peng and Wheaton (1994) uses potential households instead of population as the proxy. By using potential households, the effect of both demographic factors and

other socio-economic factors on household formation can be captured so that household formation and housing prices can be jointly estimated.

The study of Peng and Wheaton (1994) resulted that the ratio of housing stock per potential household has a negative relationship with the housing prices. When the number of households increases, the housing prices would decrease. Nevertheless, this negative relationship is only significant in the case with two-year lagged land sales.

2.5.2 Income

Household income always associates with housing demand. With higher income, household would be more willing and capable to pay for housing. (Hui, 2004) Thus, the demand for housing would be increase and so do the housing prices. Furthermore, Peng and Wheaton (1994) finds that the demand for housing in Hong Kong is more income elastic and price inelastic. This means that households consider more their income as the most important determinant than the housing prices. Peng and Wheaton (1994) show that the household income has a significant positive effect on housing prices.

Hui et al. (2000) and Hui (2004) both include median household income as the proxy for household income. The result of Hui et al. (2000) shows there is a significant positive relationship between the household income and housing prices in all cases of no lagged, one-year and two-year lagged land sales. Dissimilarly, Hui (2004) discovers that the household income influences the housing prices significantly with two-year lagged land supply.

2.5.3 Interest Rates

According to Wong et al. (2003) , the findings of Harris (1989) shows that real interest rate is a factor influencing the housing prices. Tse (1996b) suggests that there is a negative relationship between real interest rate and housing prices. Wong et al. (2003) explained that interest rate would affect the price for a property and in turn affect burden of debt payments of the owners. The higher the interest rates, the less the money available from the property, the greater the burden for the owners is. Therefore, interest rate is actually a nominal cost of housing.

Wong et al. (2003) demonstrates that the housing prices rise when the interest rate falls from 1981 to 2001, in the overall terms. Nevertheless, it is interesting that the effect of interest rate on housing prices differs for the periods before and after 1997. A significant inverse relationship between market interest rate and housing prices is observed in the study over the period 1981-1997 since a positive impact of low interest rates is shown in this period. Conversely, a significant positive relationship between interest rate and housing prices is observed in Wong et al. (2003) in the post-1997 period. A decrease in nominal interest rate leads to a decrease in housing prices and this effect is greater for the post-1997 period rather than for the pre-1997 period. The result demonstrated that from 1998 to 2001, housing prices were no longer stimulated by the falling market interest rate, ceteris paribus.

In Peng and Wheaton (1994), the prevailing long-term interest rate or mortgage rate is used for the proxy of interest rate. Yet, Peng and Wheaton (1994) combines the effect of interest rate and price appreciation and thus the pure relationship between the interest rate and housing prices is not examined. The study finds that the cost of housing is significantly and negatively related to the housing prices. This result is consistent with that in Wong et al. (2003) over the pre-1997 period.

2.5.4 Price Appreciation

Housing prices is influenced by macroeconomics and other exogenous factors. Wong et al. (2005) states that the expected housing price is affected jointly by the changes in existing housing prices and the expectation of the economic conditions, such as the price appreciation. Especially for a weak economy, macroeconomic conditions are significant to the formation of price expectations. This tends to consistent with the rational expectation model.

To influence the housing price in the demand side, Tse et al. (1999) suggest that the expectations of consumers about the price appreciation and inflation play an important role. Wong et al. (2003) also concur that expected inflation or deflation can influence the demand for housing. When there is an anticipated inflation, the housing prices would raise, keeping other things being equal.

Peng and Wheaton (1994) suggest that consumers will look back at the recent rates of price appreciation in order to speculate about the future price appreciation. They further show the expectation of higher future housing rents to be capitalized into higher current housing prices. This means that the recent rate of price appreciation has a positive effect on the current housing prices. Apart from the capitalization of the expectation, Ho and Wong (2006) state an increase in price appreciation can raise the incentive and ability for homeowners to transact their flats as such a price appreciation can boost confidence.

In addition, Phillips (1988) demonstrated that an increase in the housing price reflects the future housing price appreciation. As a result, the rate of price appreciation and the current housing price has a mutually positive relationship. It becomes a cycle that when the recent rate of price appreciation increases, the current housing prices are expected to increase and further the future housing price appreciation is expected to rise.

According to Lai and Wang (1999) , the past two decades from 1997, one of the features of Hong Kong housing market is the high average price appreciation rate, which is among the highest in the world. This can provide an explanation for the high housing price in Hong Kong in the aspect of rate of price appreciation.

2.5.5 Housing Stocks

The housing stock is not only consumption good but a durable asset that can be employed to provide a flow of consumption services in the future. Therefore, the demand for housing represents the demand for consumption as well as an investment good. (Lai and Wang, 1999) Housing supply has a characteristic of inelastic in short term owning to the construction lag. (Hui et al., 2000)

2.5.5.1 Private Housing Stock

Lai and Wang (1999) indicates that the completion of new private housing units is fluctuated as the private developers decide whether to construct the housing units depending on the market conditions and outlook. It appears that the developers would increase their housing supply at the peak season and vice versa so as to maximize the selling price and their profit.

It is common to indicate that when there is a fall in private housing supply, the housing prices would rise. However, with reference to the empirical findings of Hui et al. (2000) , the effect of housing supply restrictions on housing prices is weak and insignificant.

2.5.5.2 Public Housing Stock

Lai and Wang (1999) states the construction of public housing aims at ensuring sufficient housing for all low income households at affordable prices and rents, as well as meeting the demand for home ownership. Up till now, the public housing accounts for about half of the total housing stock. Hui et al. (2000) also agree that the provision of affordable housing for low-income households is a responsibility of the government.

Hui et al. (2000) state the public housing is seen to be a substitute of private housing by public. Thus, if the public housing supply increases, the demand for private housing would decrease and so does the private housing prices. Nevertheless, the findings of Hui et al. (2000) shows the relationship between the supply of public housing and housing prices is fluctuated and inconsistent. Therefore, the public housing supply would not have any concrete relationship with the private housing prices.

2.5.6 Land Supply

Apart from land sales of the government, there are still other sources of land supply such as lease modification and exchange, which are included in Hui et al. (2000) and Hui (2004) to examine the impact of land supply on the housing prices. Nevertheless, in this study, as the effect of land sales on the housing prices is to be investigated, only the literatures concerning the land supply from public auctions and tenders is focused.

2.5.6.1 Public Auctions and Tenders

Peng and Wheaton (1994) indicates that due to the government control over land supply, land supply decreases leading to higher current housing prices as the capitalization of the expectation of higher future rents. The negative impact of land

supply by the government on housing prices is shown to be significant in all the cases having one-, two- and three-year lagged land sales, reflected from the empirical result of Peng and Wheaton (1994). But, the case with two-year has the best goodness of fit of the model. This implies that the effect of land sales on housing prices realizes for about two years.

Similarly, Hui et al. (2000) and Hui (2004)also suggest that the restriction of land sales has influence on the housing prices but it needs to realize the effect after about one-year time. This means that the reduction in land sales would increase the housing prices directly due to the expectation of future high rent which have to take about one-year time to realize the effect.

All the results of Peng and Wheaton (1994), Hui et al. (2000) and Hui (2004) show that the effect of the current government land supply on the housing prices is positive. However, this may imply the realization of the effect of the government policy that, for instance, when there is an upsurge in the housing prices, the government would increase the quantity of land sold in order to cool down the overheated housing market.

On the other hand, the empirical result of Tse (1998) is different from that of the above studies. Tse (1998) significantly displays that the land supply has no Granger-causality to the housing prices in Hong Kong as the existence of the land banks of the private developers and the large contribution of the redevelopment to the total land supply.

2.5.7 Gradual Price Adjustment

Traditionally, the housing demand model is assumed to be stock-flow, which means the housing prices would instantly adjust to be equal to the housing demand with the existing stock. Nevertheless, the instant adjustment could only occur if the market is

perfectly efficient, which is absolutely not the case for the reality. As a result, with the empirical analyses, DiPasquale and Wheaton (1991) and Peng and Wheaton (1994) suggest the housing prices would adjust gradually instead of simultaneously in response to shocks.

According to DiPasquale and Wheaton (1991) , when consumers develop their expectations by 'looking backward' at previous price movement together with 'rational' forward looking forecasts, the gradual price adjustment strongly holds. As such expectations have to take time to realize the effect on market, the price adjust mechanism, proposed by DiPasquale and Wheaton (1991) , demonstrates the effects of slow market clearing and the inefficiency of the market.

Chapter 3 - Review on Land Policy and Housing Market of Hong Kong

3.1 Government Intervention in Land and Housing Markets

3.1.1 Land Tenure System

Under the Treaty of Nanking in 1842, Hong Kong Island was ceded to the British government. After that, the British further acquired Kowloon (south of Boundary Street) and Stonecutters Island under the First Treaty of Peking in 1860 and the New Territories was leased to the British government for 99 years from 1 July 1898 under the Second Treaty of Peking. The British Hong Kong Government was the sole owner holding freehold interest over all lands in Hong Kong except a parcel of land at St. John's Cathedral.(Li, 2004) This land parcel is given a freehold privilege with a condition that the land use remains for the purpose of a church.

As the leases on Hong Kong expired on 30 June 1997, the Sino-British Joint Declaration was signed to solve the disputes which might arise. Li (2004) says under the Declaration, after the turnover of the sovereignty of Hong Kong, the existing leasehold system would continue to adopt. Annex III of the Declaration was particularly drafted to solve the disputes concerning land leases. This means that although the sovereignty of Hong Kong had been turned over to the People's Republic of China, the government of the Hong Kong Special Administrative Region (HKSAR) continues to adopt the previous land tenure system as the sole owner of all lands in the HKSAR.(Hui and Soo, 2002)

Under the land tenure system, the Government has special powers in regulating the uses of land by determining when and how much new land will be put on the market together with the uses allowed on this land.(Peng and Wheaton, 1994)

According to the Lands Department of the HKSAR (2005), after 1898, leases in the urban areas of Hong Kong Island and Kowloon having the terms of 75, 99 or 999 years were standardized to a term of 75 years and were renewable at a re-assessed annual rent under the provisions of the old Crown Leases Ordinance. Besides, leases for land in the New Territories and New Kowloon were normally sold for the residue of a term of years less three days from 1 July, 1898, thus they will expire three days before the expiry of land lease of Hong Kong to the British government. With the provisions of Annex III to the Joint Declaration, leases for normal land granted throughout the whole territory from 27 May, 2985 to 30 June, 1997, they were expired not later than 30 June, 2047. They were granted at a premium and nominal rental until 30 June, 1997 and after which date, an annual rent charged would be three percent of rateable value of the property. Under the provisions of the Joint Declaration, leases expiring before 30 June 1997, except short term tenancies and leases for special purposes, might be extended to 2047 also.

Every lease term requires a premium in lump sum and an annual rent. The amount of premium attached to every land lease is roughly the land value. As most leases are transferable, land market can be interpreted as a land lease market.

Overall, due to colonial history of Hong Kong, it has a rather peculiar land tenure system. It helps the Government of the HKSAR to be the sole owner of the territory effectively.

3.1.2 Land Policy

As the Government of the HKSAR virtually owns all lands in Hong Kong, under the leasehold system, land sales in Hong Kong is generally referred to the sales of leases of Government lands to the public sector by public auction or tender. This is totally different from the land sales, under a freehold system, which actually sells a parcel of

land to someone.(Li, 2004) In order to control to the development on land, leases are usually imposed different lease conditions including general and special conditions. The most common lease conditions are total gross floor area, maximum site coverage, maximum plot ratio, maximum building height and maximum number of stories. (Hui and Soo, 2002) These conditions not only help the government to control the space development effectively but also hold back room for design and creation simultaneously.

3.1.2.1 Methods for Land Disposal

The administration of the land, including land sales, is responsible by the Lands Department. Government lands in Hong Kong can be disposed by means of public auction, tender and private treaty grant.

The major land is disposed by auction while the land for very specialized use, like petrol filling stations, or with complex development conditions as the Government requires certain public facilities to be included in the scheme. For tender, before making a bid, developers are allowed to have more time to design the scheme.

Land disposed by means of private treaty grant is mainly for public utility companies and non-profit-making organization. Public utility companies are required to pay a premium, which is usually assessed by assuming an equivalent industrial land value for the location, and also to the actual gross floor area can be developed due to their commercial principle. Non-profit-making organizations such as schools, hospital or welfare facilities are usually required to pay a heavily subsidized premium or even nil. Nevertheless, land is disposed to commercial profit-making organization by private treaty grant. For example, the air space development rights above the Mass Transit Railway stations are granted to developers. Besides, there is land disposed to the Hong Kong

Housing Authority and Hong Kong Housing Society for HOS, Sandwich Class and PSPS. (Nissim, 1998)

3.1.2.2 Changes in Land Sale Mechanism

The auction and tender are carried out publicly and everyone can participate in them. Nevertheless, the methods of carrying out public auction had some changes, from traditional scheduled land auction to Application List System for land sale, after the Asian Financial Crisis.

Before the mid of 1998, the land sales programme for that year would be firstly issued at the beginning of each financial year and the details of the sales would be shown. Land sales were regularly held regardless economic and political fluctuations.

Nevertheless, the land sale programme was temporarily halted due to a drastic decline in property prices resulted from the outbreak of Asian Financial Crisis of 1997. (Lai et al., 2005) Under the pressure from real estate developers created by the decline in property pries, the government announced that the land sale programme would be temporary halted for nine months, from June 1998 to March 1999, in order to try to stabilize property prices and in turn to retain market confidence. The government consistently determined how much land it would sell and the reserve prices of the land were. However, this halt of land sale programme likely to reflect the indetermination of the government with its land policies. Facing this serious crisis, it seemed that the government was uncertain of the ability of its land policies to control the land supply and land prices. (Fu, 2000)

After the nine months halt of the land sale programme, a new mechanism for public land auction, which is known as the Application List System, was introduced in March 1999. Under this system, Lands Department would publish a list of sites available

for leasing for the coming year for application. It is necessary for those interested parties to submit the application which indicate the 'minimum price', known as trigger price, that they are prepared to bid for a specific site. The Department will accept the trigger price as if it is not less than the reserve price, which is not announced, indicated by the government. If the Department accepts the price, the applicant will be notified the intended method of sale, i.e. auction or tender, and when the sale will be held. Then it is required that the within fourteen days, the applicant signs the Agreement for Auction or the Agreement for Tender to bid for the site at the offered trigger price. Simultaneously, the applicant is required to pay a deposit which is specified in the Application List. After the Agreement and deposit are received from the applicant, advertisement or gazettes and distribution of the land sale documents will be arranged by the Department.

The successful party can purchase the land at the trigger price unless there is a higher bid offered during the auction that the site will sell the highest bidder. (Chiu, 2007) On the other hand, if the site cannot be sold at the trigger price or above in the public auction, the government will withdraw the site so that sites on the Application List will not be sold at pathetic price. (Li, 2006)

For the period from March 1999 to December 2003, the land sale programme comprised a detailed programme for scheduled land auctions or tenders, and the new Application List System. The government introduced the Application List System to aim at minimizing the negative effect of public land auction by sealing market sentiment and enhancing the flexibility in land supply by providing more choices in land sale. (Li, 2004)

There was the second halt temporarily from November 2002 till December 2003 due to Suen's Nine Measures for rescuing the property market.[3] One of the measures stated was to stop all scheduled land auctions, to cancel the remaining two land auctions

[3] On 13 November 2002, Mr. Michael Ming-yeung Suen, the Secretary for Housing, Planning and Lands delivered a statement on housing policy at the Legislative Council, which was coined as the Suen's Nine Measures.

in that financial year and to suspend the Application List System until the end of 2003. Afterward, the supply of new land will only be triggered from the Application List in order to restore the public confidence to the property market. Thereafter, the land sale reinstated in 2004 and the scheduled auctions had been replaced by the Application List System completely. (Ching, 2006)

Ching (2006) thought that the advantage of the Application List System over scheduled auctions is that the former allowed land supply to be market-driven while the later did not provide that flexibility. Li (2004) also stated it was widely believed that the new land sale system was a positive measure as the land supply was decided market by the demand-driven mechanism. The adoption of the Application List System was a strategic movement of the government to stabilize land prices. (Yu and Wong, 2007) Besides, Dai (2004) the change of the land sale mechanism implies that the government transforms its role from an active targeting supplier to that subject to the market demand of the developers. Peterson (2006) also agrees that the government has changed its role from the supplier of land for a pre-announced amount, that the locations were designated for development and advised by planners, to a more inactive role, which tend to follow the market demand and supply as the government disposes land only in response to the requests of the developers at acceptable prices.[4]

3.1.2.3 Lease Modification

As time passes, the environment may change and the economic structure of a particular area may be altered. Some lease conditions for development control may be out

[4] Ching (2006) states the Application List System was modified in 2005. The trigger price was adjusted to be as low as 80 percent of the reserve price.

of time. In order to fit in with current situation, lease conditions can be applied for alteration, i.e. lease modification.

Hui (2004) indicated that other than having land auction and tender, lease modification and exchange are the major channel to supply land for housing in Hong Kong. Lease modification is a government policy considering the modification of old lease conditions which severely restrict the development permitted on a lot in order to redevelop the lot with current town planning requirements, such as building height and development intensity. A premium, equal to the difference between the land value of the development before and after the lease modification, is levied for any granted modification. (Nissim, 1998) Therefore, if a government lessee of a lot wants to develop it with different conditions that existing permitted, it is required to have a permanent modification or a temporary variation of the conditions.(Li, 2006)

Year	Public Land Market Value (HK$ million)	Overall Land Market Value (HK$ million)	Share (%)
1991	7,425	41,072	18.1%
1992	9,954	58,225	17.1%
1993	15,880	81,791	19.4%
1994	14,521	80,977	17.9%
1995	18,642	49,656	37.5%
1996	17,400	38,098	45.7%
1997	42,893	93,750	45.8%
1998	15,073	24,311	62.0%
1999	9,566	35,670	26.8%
2000	15,813	19,921	79.4%
2001	3,023	22,964	13.2%
		Average:	34.8%

Table 3.1: Share of the Public Land Market in the Overall Land Market in Hong Kong (in terms of value), 1991-2001

Source: L.H. Li, (2006), *Development Appraisal of Land in Hong Kong*, Hong Kong: Chinese University Press. (Li, 2006)

Other than the government land supply, urban renewal organized by developers can occupy more than 60 percent of the land supply in terms of value, on average. (Table 3.1) This implies that the land supply from the government is insufficient when compared to the land supplied from the private sector by means of assembly of land, carried out by private developers. In order to cope with the sizable housing demand in Hong Kong, it is important for developers to have an alternative way to get more land supply - redevelopment. Lease modification thus plays a vital role in facilitating urban redevelopment. It allows private owners to convert obsolete and underused buildings to more environmentally and socially desirable developments. (Land supply in HK, 2005)

In addition, lease modification has an important function in the property market. It can facilitate redevelopment and maximize the use of land. The significance of land premium amount is to help determining the lease modification and redevelopment outcome. (HKIS, 2003) Since developers make the application for lease modification responding to the market demand and supply mechanism, this flexibility in the land management system is not only beneficial for developers but also to the whole society.

3.1.3 Sino-British Joint Declaration

The British Government and Government of People's Republic of China signed the Sino-British Joint Declaration in 1984. There are eight clauses in Annex III exclusively concerning land leases exclusively of Hong Kong in the transition period before the handover so as to deal with the question of land leases. One of the clauses stated that "the total amount of new land to be granted … shall be limited to 50 hectares a year (excluding land to be granted to the Hong Kong Housing Authority for public rental housing) from the entry into force of the Joint Declaration (27 May 1985) until 30 June 1997". (Nissim, 1998) Therefore, the land supply of the transition period was deemed to

be constrained by this 50-hectare quota. Nissim (1998) believes that the signing of the Joint Declaration contributed to stop a severe slump in the property market in Hong Kong during 1981 to 1984.

To cope with the increase in property prices in the period of 1995 to 1997 and the demand for housing, the Land Commission agreed that more residential land, especially for those with higher density, were disposed. This phenomenon shows that there was a weakness for the 50-hectare quota policy as the land quota was in terms of land area rather than permitted gross floor area , was believed by both Nissim (1998) and Hui and Soo (2002). Nevertheless, as lease modification was not included in the 50-hectare quota to supply land, it played a significant role for supply land for new development.

After the transfer of sovereignty of Hong Kong to the People's Republic of China, all land in Hong Kong is still held by the HKSAR government and the former leasehold system in Hong Kong is used continuously for fifty years, at least. There has been no more the explicit quota of land supply thereafter.

From the above, it designates that political consideration is one of the significant factors to affect the government policy of land disposal. Particularly for the Sino-British Joint Declaration which altered the government policy on land supply, trimmed down the flexibility of land supply to response to the property market in Hong Kong during the transition period before the handover.

3.1.4 Urban Redevelopment

Apart from government land sale, redevelopment is another important source for land supply in Hong Kong, especially for the urban areas. Nevertheless, according to Hui and Soo (2002) , the HKSAR government has realized that the number of land sites which are suitable for housing and have opportunities for redevelopment are becoming

rare, since 1997. In addition, the difficulty of assembling a developable site is increasing owning to the multiple ownerships and thus it becomes more and more difficult to proceed a redevelopment.

In order to facilitate the urban renewal process in terms of speed in the urban areas, the government decided to establish a Land Development Corporation in 1987. Owning to the enactment of the Land Development Corporation Ordinance 1987, the Land Development Corporation (LDC) was set up in January 1988. The LDC was responsible for initiating and facilitating urban renewal by surrendering existing property and assembling land through negotiation. (Li, 2006)

In mid-2001, a new legal and institutional framework, the Urban Renewal Authority (URA), has been set up to replace the LDC to expedite urban renewal. The URA aims at implementing the Urban Renewal Strategy (URS), which emphasizes a people- oriented approach, of the government, to improve the quality of life of residents in the urban areas. Two hundred urban redevelopment projects and twenty-five uncompleted projects of the LDC are included in a twenty-year comprehensive urban renewal programme implemented by the URA. The projects include the redevelopment of dilapidated buildings, the rehabilitation of older buildings and the preservation of buildings having historical, cultural or architectural interest. (Li, 2006)

Actually, lease modification involved in redevelopment incurs a high transaction cost. In addition, redevelopment itself incurs high negotiation costs of transferring the land rights from owners of properties to developers discourage investors from initiating redevelopment projects. (Hong et al., 1998) Hence, the costs for a redevelopment project are considerably large. In the private market, since private developers cannot force individual owners to sell their properties, the owners, especially for the last group of owners in the existing building, usually demand for exceedingly unreasonable price.

However, this cost is not accounted in the redevelopment scheme that the Lands Department will not normally consider when assessing the land premium amount. Therefore, it is not feasible for developers to drag on purchasing old properties for redevelopment when the market is sluggish. The gazette of the Land (Compulsory Sale for Redevelopment) Ordinance in 1999 was the first response to this problem made by the government.

Under the Land (Compulsory Sale for Redevelopment) Ordinance, persons who own (except mortgagee) not less than 90 percent of the undivided shares in a lot are allowed to make an application to the Lands Tribunal for an order to sell all of the undivided shares in the lot for the purposes of the redevelopment of the lot. This ordinance facilitates and speeds up the process of redevelopment carried out by private parties. As a result, the existence of this ordinance reduces the degree of difficulty of acquiring shares of buildings for redevelopment.

3.1.5 Public Housing

Besides controlling over land supply of Hong Kong, the government plays an important role in housing by supplying public housing at low cost. According to Hong Kong Annual Digest of Statistics, public Housing includes public rental housing flats, which comprise rental flats of the Housing Authority (HA) and the Hong Kong Housing Society (HS), and HA subsidized sales housing flats, including HOS flats, PSPS flats and Buy or Rent Option (BRO) or Mortgage Subsidy Scheme (MSS) flats.

Year	Total population*	Population in Public Housing	Percentage
1991	5,752,000	2,760,960	48.0%
1992	5,800,500	2,900,500	50.0%
1993	5,901,000	2,950,500	50.0%
1994	6,035,400	3,017,500	50.0%
1995	6,156,100	3,139,560	51.0%
1996	6,435,500	3,218,000	50.0%
1997	6,489,300	3,179,610	49.0%
1998	6,543,700	3,206,560	49.0%
1999	6,606,500	3,369,300	51.0%
2000	6,665,000	3,399,150	51.0%
2001	6,714,300	3,289,860	49.0%
2002	6,744,100	3,304,560	49.0%
2003	6,730,800	3,365,500	50.0%
2004	6,783,500	3,324,160	49.0%
2005	6,813,200	3,270,240	48.0%

* Mid-year figures

Table 3.2: Number of Population living in Public Housing in Hong Kong, 1991-2005

Sources: 1. Figures for total population from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

2. Figures for population in public housing from *Graphic Presentation on Housing Statistics 2007*. Hong Kong Housing Authority, HKSAR.

Since 1978, the government has already provided more than 390,000 flats for sale and 710,000 flats for rental in 2006.[5] As indicated in Table 3.2, the government has supplied low-cost accommodation for about half of population in Hong Kong. The percentage of the population was accommodated in public housing was just fluctuating slightly between 48 percent and 51 percent over the recent fifteen years. This may imply

[5] According to the Hong Kong Annual Digest of Statistics 2007, the stock of public rental housing is 716,900 while that of subsidized sale flats is 391,700.

that the government is successful to provide accommodation below the market price to meet the demand for low-cost housing. At the same time, it seems that the equilibrium of demand for and supply of public housing is almost achieved.

Reviewing the past fifteen years, the percentage of public housing stock to total housing stock was swinging a little. From the share of public housing stock to the total one shown in Table 3.3, besides private housing, public housing accounts for a significant component in the Hong Kong property market during the recent fifteen years. It is observed that the stock of public housing dropped in 2002 only due to the housing policy proposed by Mr. Suen Ming-Yeung Michael in 2002, i.e. Suen's Nine Measures which stated that the production and sale of the HOS flats would be ceased. In addition, it was because of a special high demolition rate for public permanent housing in 2002.

Between the year of 1987 and 2002, the government involvement in property market was relatively great in the housing policy, especially in the aspect of housing provision. The role of government was not only a land supplier but also a housing builder and seller. For instance, the HOS and the PSPS of the Housing Authority was detruded. (Yung, 2007)

After experiencing the Asian Financial Crisis, the economy and the property market had suffered and undergone significant changes. Due to the decline of property price, a serious overlapping situation took place between the Subsidized Housing Schemes carried out by the government and private housing. In turn, the room for development of private housing was directly affected. (Suen et al., 2003) After considering the market changed in recent years, the government determined to withdraw it previous role as a direct provider and to minimize the intervention to the private residential market. Meanwhile, the government facilitated qualified families to become home owners by offering more flexible and well tested means of loans. From 2003

onwards, except for a limited number of unsold and returned HOS and PSPS flats, the production and sale of HOS and PSPS flats ceased indefinitely. (Hong Kong Yearbook 2002)

Year	Total Housing Stock*	Stock of Public Housing #	Percentage
1991	1,780,950	797,000	44.75%
1992	1,834,700	827,000	45.08%
1993	1,890,050	832,000	44.02%
1994	1,938,300	870,000	44.88%
1995	1,992,300	880,000	44.17%
1996	2,015,500	904,000	44.85%
1997	2,054,350	922,000	44.88%
1998	2,093,300	947,000	45.24%
1999	2,154,350	969,000	44.98%
2000	2,233,900	1,016,000	45.48%
2001	2,288,250	1,071,000	46.80%
2002	2,346,650	1,049,000	44.70%
2003	2,381,400	1,074,000	45.10%
2004	2,422,650	1,085,000	44.79%
2005	2,471,200	1,096,000	44.35%

* Temporary housing is included and village housing is excluded.

Public Rental Housing (PRH) flats and Subsidized sales housing flats are included.

Table 3.3: Number of Public Housing Units in Hong Kong, 1991-2005.

Source: 1. Figures for total housing stock from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

2. Figures for stock of public housing from *Graphic Presentation on Housing Statistics 2007*. Hong Kong Housing Authority, HKSAR.

Year	Households in Public Housing	Stock of Public Housing #	Percentage
1991	1,601,900	797,000	49.75%
1992	1,633,500	827,000	50.63%
1993	1,677,700	832,000	49.59%
1994	1,729,100	870,000	50.32%
1995	1,783,000	880,000	49.36%
1996	1,864,500	904,000	48.48%
1997	1,922,800	922,000	47.95%
1998	1,961,500	947,000	48.28%
1999	1,998,900	969,000	48.48%
2000	2,037,000	1,016,000	49.88%
2001	2,064,000	1,071,000	51.89%
2002	2,103,300	1,049,000	49.87%
2003	2,127,100	1,074,000	50.49%
2004	2,165,900	1,085,000	50.09%
2005	2,195,100	1,096,000	49.93%

Public Rental Housing (PRH) flats and Subsidized sales housing flats are included.

Table 3.4: Number of households living in Public Housing in Hong Kong, 1991-2005

Source: 1. Figures for stock of public housing from *Graphic Presentation on Housing Statistics 2007*. Hong Kong Housing Authority, HKSAR.

2. Figures for households in public housing from *Quarterly Report on General Household Survey*. Census and Statistics Department, HKSAR.

With the degree of sharing almost equal to one[6] and negligible vacancy, the stock of public housing represents the number of households living in the public sector. There was around 50 percent of the total households in Hong Kong was accommodated in public housing throughout the past fifteen years with minor fluctuations. By comparing

[6] With reference to the statistics of *Hong Kong Annual Digest of Statistics*, the ratio of households to occupied units in the public sector was less than 1.02 throughout the past fifteen years.

Tables 3.3 and 3.4, it is observed that the proportion of households living in public housing was larger than that of population, except for the year from 1995 to 2001.

Since public and private housing are almost substitutes, the contribution of public housing is that its stock reduces the demand for private housing. With subsidies provided by the government, the competitiveness of public housing is considerably high. There has always been a long waiting list for public rental housing. By 2007, the waiting list was over 100,000 households. This reveals that the demand for public housing is larger than the supply of that.

In this context, it is understood that the demand for private housing is mainly derived from those who are not satisfied the qualifications of applicants of public housing. Therefore, an increase in the proportion of households living in public housing means a decrease in the number of households seeking housing in the private residential market. During the past fifteen years, the percentage of households living in public housing fluctuated slightly. It is noted that the continuous decline from 1994 to 1997 was mainly due to the economic boom while the continuous increase from 1998 to 2001was because of the economic recession after the Asian Financial Crisis broke out in October 1997. Besides, since the outbreak of Severe Acute Respiratory Syndrome (SARS) in April 2003 negatively affected the economic condition in Hong Kong, the percentage of households living in public housing rose in that year.

3.2 Housing Prices Crisis

Since 1991, residential property prices, in both nominal and real terms, in Hong Kong had experienced considerable fluctuations. Accordingly, in Figure 3.1, the residential property prices in Hong Kong were highly volatile during the whole period. The housing prices were generally continuously rising for the period from 1991 to

October 1997. According to Tse (1996) , the dramatic increase in housing prices in 1991 was mainly due to the expected rising inflation, stimulated by the decreasing interest rates. Nevertheless, the rising residential property prices had taken brief knocks.

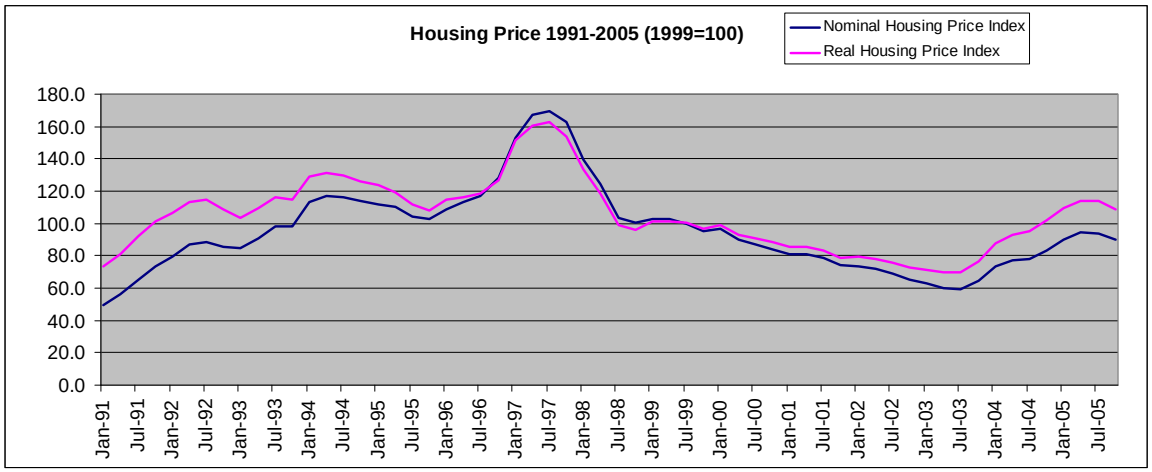

Figure 3.1: Historical Movements of Housing Prices, 1991-2005

Source: Figures for housing price index from *Hong Kong Property Review*. Rating and Valuation Department, HKSAR.

From 1991 to 1993, the housing prices had increased over 100 percent in three years and about 20 percent in the first quarter of 1994. The sudden boost in housing price in the first quarter of 1994 was due to the subsequent increase in interest rates in Hong Kong following the decision of rising in interest rate in the United States, causing the property market boom. In turn, the government introduced several preventive measures in 1994 in order to halt the land speculation, with reference to the escalating land price since 1989. (Li, 2006) It is observed that there had been a remarkable decrease in housing prices for almost 20 percent from second half of 1994 to 1995 which implies that the government measures towards lowering the housing prices were effective.

After that, the residential property prices shot up again in the late 1996 and reached a peak until October 1997. Xiao and Tan (2007) suggest that the changes in speculative bubble is an important force behind the large fluctuations of housing prices

during 1990s. By October 1998, the housing price declined sharply by about 45 percent already from the 1997 peak in one year time only due to the Asian Financial Crisis, as there was a prolonged collapsing speculative bubble. When the property market was depressed after 1997, Hong Kong economy suffered one of the worst and longest recessions in its history. (Gerlach and Peng, 2004)

Although there was a mini-recovery in the property market because of the speculative investment activities in the luxury residential sector from mid-1998 to mid-1999, it failed to keep the effects in long term. Worries of the public towards the economic outlook had contributed to sluggish residential property markets in Hong Kong for several periods after the outbreak of Asian Financial Crisis. (Wong et al., 2005) For example, the dot. com bubble burst in 2000 and thus confidence of investors were damaged and uncertainties clouded both Hong Kong stock and property markets gradually over the next two years. The 911 Incident happened in the United States even worsened the situation.

The outbreak of SARS in the early 2003 brought the residential property prices reaching the lowest point in the recent ten years. After SARS was over, both Hong Kong economy and the property market had experienced a tangible recovery from July 2003 to April 2005. During this period, the government introduced a series of policies, including the Individual Visit Scheme, the CEPA Agreement Establishment and Harbour Fest 2003, so as to stimulate the local economy. There was a little setback of the residential property prices amidst the recovery process of the property market.

3.3 Exogenous Shocks and Housing Prices

Within the recent fifteen years, there were two major shocks to the real estate industry, namely Asian Financial Crisis in 1997 and Severe Acute Respiratory Syndrome

(SARS) in 2003. They were mainly exogenous in sense that they were generated outside Hong Kong. Moreover, they had an immediate effect of increasing uncertainty and thus had an impact on property prices and transactions. (Lai et al., 2005) In this chapter, the impacts of the exogenous shocks on housing market in Hong Kong in terms of private housing prices.

3.3.1 Asian Financial Crisis (1997)

With the depreciation of the Thai Baht, the Asian Financial Crisis originated on 2 July 1997. According to Tse and Webb (2004) , when the Thai cabinet decided to float its currency so as to avoid a government default on public debt. Lai et al. (2005) states that syndicated international speculators stormed the Hong Kong dollar and the Hong Kong government raised interest rates overnight by 300 percent by reaction on 23 October 1997. This sudden rise in interest rate triggered a slump in the stock and property markets.

Li (2006) says the residential property prices suffered a great fall substantially, just within a short period of twelve month since the peak in July 1997. Many individuals got burned in their investments and their confidence to the market was lost. Moreover, the demand for sale and purchase of housing units fell about a half in 1998 from the peak level in 1997.[7] Besides, as the value of most properties was not sufficient to cover the outstanding mortgages for them, the one who bought property in the mid-1990s most likely became a 'negative assets' holder. Since 1997, the unemployment and bankruptcy rates have increased and the general price level has decreased. (Li, 2000)

[7] Li (2006) states the number of agreements for sale and purchase of building units fell 46% in 1998 against the corresponding peak level in 1997.

Although some developers blamed the '85,000-flat policy'[8], yet, it has not been proven that there is a relationship between the policy and the shrink in property prices, together with the Asian Financial Crisis in the late 1997.

From the regression result from Lai et al. (2005) , the effect of the Asian Financial Crisis on price levels of residential properties was negative and there is an average obvious drop in the price levels of properties before and after the crisis.[9] It is significant to prove that the Asian Financial Crisis has a negative correlation with the property prices.

3.3.2 Severe Acute Respiratory Syndrome (SARS) (2003)

SARS broke out in Hong Kong under the atmosphere of increasing unemployment and declining housing prices in March 2003. It attacked Hong Kong until June in the same year when the World Health Organization declared that Hong Kong has been SARS free.

According to Roback (1982) , the anticipated changes in the life quality can have contribution to the changes housing prices and in turn should be capitalized into the housing prices. As a result, since the occurrence of SARS brought Hong Kong an adverse anticipated change in the general life quality, especially for the residential estates in which residents were found to suffer from SARS, negative changes in housing prices had been capitalized.

[8] The '85,000-flat policy' was announced by the Chief Executive of the new HKSAR government that 85,000 housing units per year would be ensured to be produced so as to prevent further increases in property prices. According to Housing Bureau, this policy was generally welcomed by the public. However, many Hong Kong people blamed the '85,000-flat policy' when the property prices began to fall in the late 1997.

[9] Lai et al. (2005) finds that the price levels of units in Mei Foo Sun Chuen was negative and the average difference in the price levels of two similar units before and after the crisis is 12%.

The findings of Wong (2004) illustrates several effects of SARS on the housing prices. He finds that there was a fall in transaction volume for the whole territory and affected estates. Wong (2004) further indicates that for those residential buildings which were claimed to have residents suffered from SARS have a more significant fall in housing prices than those which were confirmed to be affected by SARS by the Department of Health. For the further away the residential estates being located from the city centre, the less the transaction volume being affected. Moreover, it is found from the result that for the more expensive residential estates, the more severe decrease in housing prices suffered.

In addition, according to Lai et al. (2005), the volume of primary transactions has been decreased by 12 percent over the SARS period. The local property market was struck by the epidemic of SARS. Lai et al. (2005) also state that Amoy Gardens in Ngau Tau Kok became the hardest-hit area, followed by the Telford Garden in Kowloon Bay and Laguna City in Kwun Tong. From the result found in Lai et al. (2005) , the outbreak of SARS had a negative correlation with the housing prices. Nevertheless, this result was not consistent for all housing estates but only Amoy Gardens experienced a significant adverse impact.[10]

In short, either in the case of the outbreak of the Asian Financial Crisis or SARS, their impacts on the housing prices are adverse and distinct.

[10] In Lai et al. (2005), only Amoy Gardens, Laguna City and Mei Foo Sun Chuen are tested in the regression model.

Chapter 4 - Housing Market Behaviour in Hong Kong

During the past fifteen years, it is observed that there had been remarkable fluctuations in housing prices, which are basically determined by both housing demand and supply that are also affected by a number of socio-economic factors. In order to facilitate the development of a housing market model for the housing demand, the characteristics of the factors and their relationships with housing price movements should be identified.

4.1 Demographic and Household Characteristics

Over the past fifteen years, the social and demographic structures of the population in Hong Kong had certain changes and in turn these changes have significant implications on the demand for residential properties. There are a number of demographic variables that affect the demand for residential properties, namely population growth, home ownership and most importantly, the household formation.

4.1.1 Population Growth

The population of Hong Kong has increased by about 20 percent in the previous fifteen years as shown in Table 6. With low birth rate and death rate, the natural growth rate of population was keeping at about 0.2 to 0.3 percent. Therefore, the major attribution of the population growth was the immigrants, mainly coming from China for joining their families.[11]

[11] By 2005, according to Hong Kong Annual Digest of Statistics, the number of new arrivals from the Mainland of China holding one-way permit was 55,106 while the natural population growth was 18,268.

From 1991 to 2005, the number of households increased at an average rate of 2.46 percent while the population growth rate was less than 1.3 percent. With a decreasing trend in the average household size and a growing population, it is common to conclude that the rate of household formation is uprising. This aspect will be explored in the following.

Year	Mid-Year Population	Percentage Change	Number of Households	Percentage Change	Average Household Size
1991	5,752,000	---	1,601,900	---	3.5
1992	5,800,500	0.84%	1,633,500	1.97%	3.4
1993	5,901,000	1.73%	1,677,700	2.71%	3.5
1994	6,035,400	2.28%	1,729,100	3.06%	3.4
1995	6,156,100	2.00%	1,783,000	3.12%	3.4
1996	6,435,500	4.54%	1,864,500	4.57%	3.4
1997	6,489,300	0.84%	1,922,800	3.13%	3.3
1998	6,543,700	0.84%	1,961,500	2.01%	3.3
1999	6,606,500	0.96%	1,998,900	1.91%	3.3
2000	6,665,000	0.89%	2,037,000	1.91%	3.3
2001	6,714,300	0.74%	2,064,000	1.33%	3.2
2002	6,744,100	0.44%	2,103,300	1.90%	3.1
2003	6,730,800	-0.20%	2,127,100	1.13%	3.1
2004	6,783,500	0.78%	2,165,900	1.82%	3.0
2005	6,813,200	0.44%	2,195,100	1.35%	3.0

Table 4.1: Population, Number of Households and Household size, 1991-2005

Source: Figures for mid-year population, number of households and average household size from *Hong Kong Annual Digest of Statistics*, Census and Statistics Department, HKSAR.

4.1.2 Average Household Size

It can be observed from Table 4.1 that from 1991 to 2005, the average size for domestic households had decreased from 3.5 to 3.0 persons per household. This indicates the changing of social patterns that shifting from extended to nuclear families together with a growing tendency for working youths to live independently. These thus account for a 37 percent increase during the past fifteen years. The decline in average household size can be seen as a reason behind the growing rate of household formation.

Year	Percentage of Households (%)			
	1 person	2 – 3 persons	4 – 5 persons	6 or over
1991	13.0	36.6	39.2	11.2
1992	12.8	37.5	39.3	10.4
1993	13.0	37.9	39.4	9.7
1994	13.0	38.0	39.6	9.4
1995	12.8	38.2	40.5	8.5
1996	13.0	39.5	39.6	7.9
1997	13.7	39.9	39.1	7.3
1998	13.8	40.3	38.9	7.0
1999	13.4	41.2	38.7	6.7
2000	13.3	41.9	38.4	6.4
2001	13.2	42.7	38.0	6.1
2002	14.1	43.6	37.0	5.3
2003	14.1	44.6	36.1	5.2
2004	14.2	46.0	35.2	4.6
2005	14.8	46.1	34.5	4.6

Table 4.2: Percentage of Households by Size, 1991-2005

Source: *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

As illustrated in Table 4.2, the percentage of households comprised 1 to 3 persons was increasing while that comprised 4 persons or more was moving in an opposite direction. These are probably due to the increasing tendency for young couples to move out to form their own families rather than to live with their preceding generation, the effectiveness of families planning and high cost of living in Hong Kong. As a result, there is an increasing trend that the number of households will increase but with a decreasing household size.

4.1.3 Household Formation

According to Peng and Wheaton (1994) , the household formation in Hong Kong is far more rapid than the population growth. Accordingly, Table 6, showing the percentage changes of population and that of households, also empirically indicates the same phenomenon as Peng and Wheaton (1994). Since the number of households in Hong Kong is increasing, the demand for housing certainly becomes stronger. The trend of household formation is that there is an increase in number of households, which can be attributed to the population growth, and a decline in average household size.

4.1.4 Home Ownership

As indicated in Figure 4.1, showing the percentage of households that have home ownership in Hong Kong between 1991 and 2005, there was a trend of shifting from renters to home owners for households in Hong Kong. This contributed to the increasing demand for private residential properties. However, it is noted that the percentage of households owning private housing had become rather stable from 2003 to 2005, ranging

from 53 to 55 percent. Nevertheless, the trend of actual number of households owning private housing would be increasing as the number of households is in fact rising.

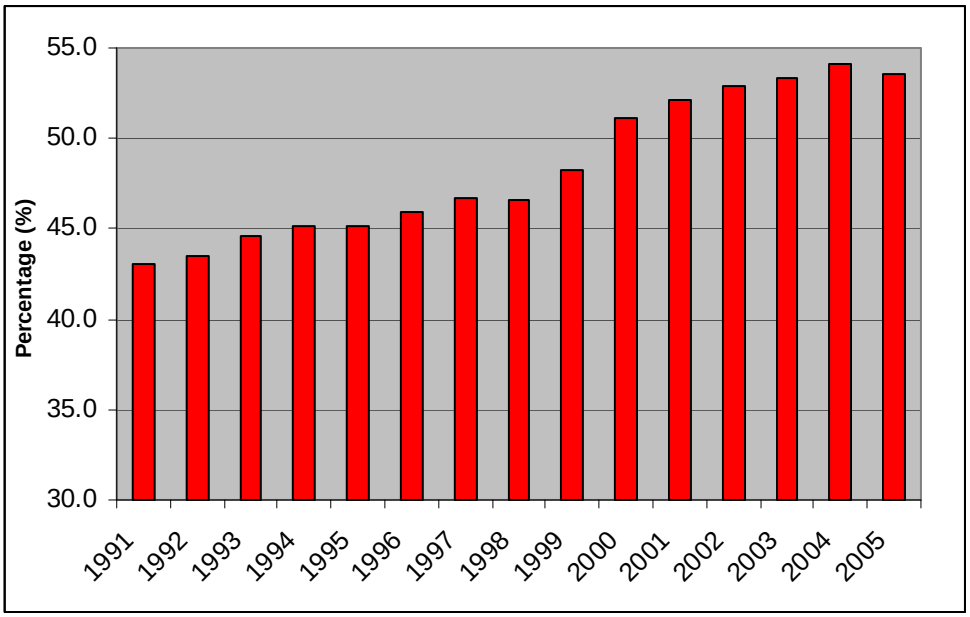

Figure 4.1: Percentage of Home ownership of Households, 1991-2005

Source: *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

Even though home ownership has been promoted by the government for the past three decades, the demand for private residential market has not been remarkably reduced as the home ownership scheme provided by the government occupies merely a minor part of the total housing stock.[12]

[12] According to Hong Kong Annual Digest of Statistics, the percentage of home ownership scheme housing to the total housing stock was 16.1 while the percentage of private domestic housing accounted for 54.4 in 2005.

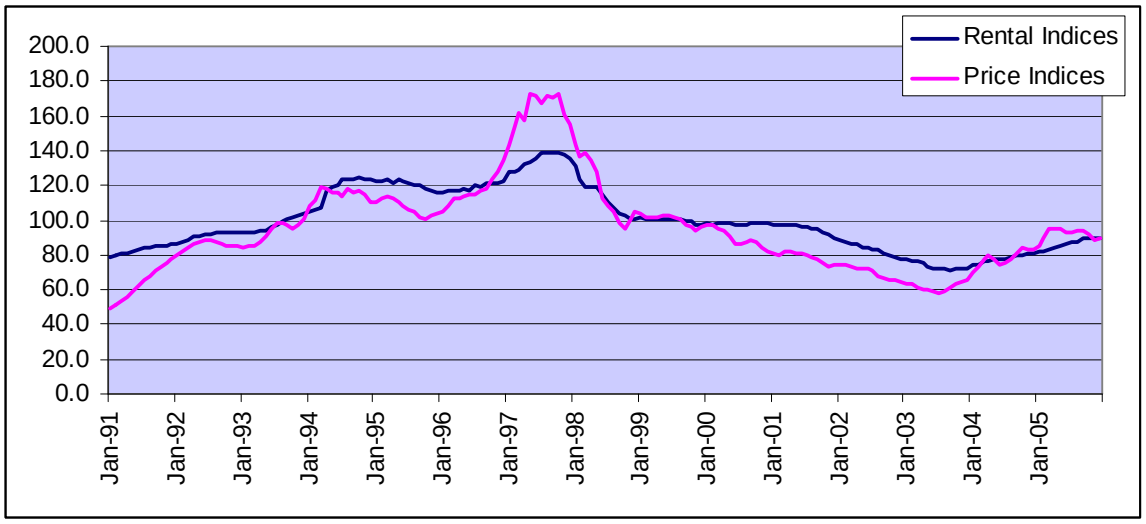

Figure 4.2: Residential Prices and Rentals, 1991-2005

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

As indicated above, other than for ownership, the household demand for residential properties is also for investment purpose. Most of the time, residential properties are viewed as durable investment assets. From Figure 4.2, it is observed that the price indices for private residential properties were boosting faster than the rental indices from 1991 to the October 1997, where it reached its peak. The escalating price indices imply that the demand for purchasing residential properties was great as individuals purchase properties for investment. After that, due to the subsequent effect brought from the Asian Financial Crisis, the price indices dropped more drastically than the rental indices. Since it was foreseeable that the property price would not go back to the peak level, it was not feasible to hold residential properties because of their 'negative' value. Therefore, individuals were more preferable to renting properties for accommodation rather than buying, resulting a rather stable rental indices for private domestic residential for few years. After the Hong Kong economy and property market experienced a trough due to the influence of SARS in the early 2003, it then underwent a recovery from the mid 2003 to the early 2005. The price indices became overriding the

rental indices again owning to better and optimistic expectation and greater confidence towards the outlook of Hong Kong, in turn.

4.1.5 Investment Demand

Apart from the demand created by the basic need of households, investment demand also plays a significant role in affecting the housing demand and housing prices. Tse et al. (1999) state that in the early 1990s, the investment demand for residential properties was extremely strong, which reflects the continuous rapid inflation and declining nominal interest rates. Moreover, Ho and Wong (2006) suggest an increase in residential property prices allows homeowners to trade their homes for better ones and thus it tends to drive up transactions.

Tse et al. (1999) further indicate that it has been increasingly viewed that purchasing residential properties is a favourable investment for hedging against inflation. Besides, demand for residential properties can be strongly affected by speculative activity. Thus, household demand for residential properties is mainly for owner-occupied and investment. Moreover, residential properties are viewed as investment assets. (Tse, 1996a) This means the household demand for housing is the sum of housing demand and investment demand for housing.

According to Tse et al. (1999) , the investment demand for housing can be capitalized into the housing prices. The higher the investment demand for housing, the higher the level of housing prices is. Besides, the expectations of the continuous rapid inflation and decrease in nominal interest rates would probably lead to a strong investment demand. Tse et al. (1999) further state that the investment demand for housing is possible to have a sudden crash owning to the exogenous variations, such as

political incident, stock market crisis and government intervention. Nevertheless, the demand for housing changes would be due to the changes in housing prices basically.

4.2 Economic Factors

The most fundamental factors affecting the housing price are the demand and supply in the housing market in Hong Kong. Considering the housing demand, it is mainly influenced by income growth, interest rates, inflation and employment condition.

4.2.1 Income Growth

Income is a vital factor affecting the demand for housing. Level of income reflects how much purchasing power of an individual has. The higher the level of income, the greater the purchasing power and in turn, the demand for housing increases, and vice versa. Therefore, it is expected that the residential property prices will increase with the overall level of income.

Over the past fifteen years, both nominal and real household incomes have fluctuations, as illustrated in Table 4.3. The nominal income was increasing at an annual rate of 4 percent while the real one was at rate of 2.39 percent between 1991 and 2005. As a result, the effect of high inflation rate in Hong Kong is observed.

Year	Median Monthly Household Income	
	At current price (HKD)	At constant price in 1991* (HKD)
1991	10,000	10,000
1992	11,700	10,635
1993	13,000	10,874
1994	15,000	11,781
1995	16,000	12,075
1996	17,600	12,557
1997	19,000	12,823
1998	18,000	12,052
1999	17,500	12,269
2000	18,000	13,095
2001	18,000	13,347
2002	16,500	12,677
2003	15,500	12,690
2004	15,500	13,146
2005	16,000	13,584

Table 4.3: Median Monthly Household Income in Hong Kong, 1991-2005

Source: *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

4.2.2 Housing Prices and Household Income

The percentage changes in real housing prices and real income, which is measured by median household income at constant price in 2005, are shown in Figure 4.3. It is observed that an increase in real income growth rate tends to induce an upward movement in real housing prices with about one year time lag. This means that when there is a rise in real income growth, people would expect there will be a continuous surge in real income in long run and therefore purchasing residential properties are encouraged and demand for residential properties rises then.

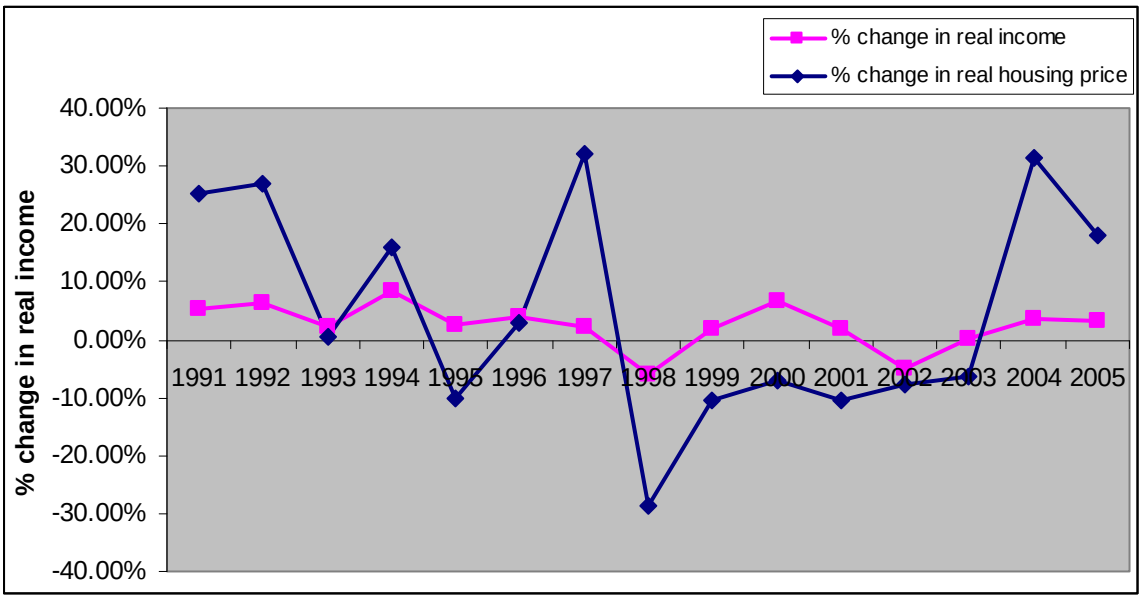

Figure 4.3: Changes in Real Income and Real Housing Prices, 1991-2005

Sources: 1. Figures for housing prices from Rating and Valuation Department, HKSAR.

2. Figures for median household income from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

With reference to Figure 4.3, there is a gap between the growth of real income and real housing prices. This implies that it becomes unaffordable to own residential properties for those households who are not qualified to be allocated to public housing. However, between 1991 and 1997, the prices and transactions of private residential were increasing and reached the peak in 1997. On the other hand, even though the percentage growth of real income is greater than that of real housing prices, it does not imply the demand for residential properties is greater, for example, the property prices and transactions of private residential were still remain a low level from 1998 to 2003. Therefore, the effect of the outlook of economic condition should be greater than the growth of real income on housing prices. This also indicates that the individuals purchased housing owning to the investment purpose rather than the consumption purpose.

4.2.3 Interest Rates and Inflation

Housing prices are affected by the interest rate and inflation rate. In Hong Kong private residential market, most purchasers use mortgages for financing. In theory, the higher the real interest rate, the higher the cost of borrowing and thus the incentive of potential property buyers is reduced. Conversely, a decrease in real interest rate makes the financing of properties less costly and makes housing more affordable. Therefore, it is expected that there is a negative relationship between interest rate and the demand for residential properties.

According to Tse (1996) , a declining real interest rate tends to stimulate housing prices. Harris (1989) also indicates that when there is a decline in interest rates, housing prices are appreciating. Besides, Harris (1989) suggests that housing purchasers tend to respond to declining real costs rather than rising nominal costs. Tse (1999) states when there is inflation, more investors participate in the property market as they expect the property prices will continuously appreciate.

Year	Best Lending Rate#	Inflation Rate*	Real Interest Rate^
1991	9.41%	11.29%	-1.69%
1992	7.33%	9.58%	-2.06%
1993	6.50%	8.74%	-2.06%
1994	7.26%	8.87%	-1.48%
1995	8.95%	9.01%	-0.06%
1996	8.52%	6.27%	2.12%
1997	8.83%	5.90%	2.76%
1998	9.94%	2.83%	6.91%
1999	8.50%	-3.96%	12.97%
2000	9.22%	-3.76%	13.49%
2001	7.00%	-1.58%	8.73%
2002	5.11%	-3.12%	8.49%
2003	5.00%	-2.54%	7.74%
2004	5.02%	-0.40%	5.44%
2005	6.11%	0.91%	5.16%

Table 4.4: Interest Rates and Inflation Rates in Hong Kong, 1991-2005

Source: Data are derived from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

Notes: # Best lending rate is used as nominal interest rate.

***** Percentage change in the composite consumer price index.

^ Real interest rate = [(1+nominal interest rate)/(1+inflation rate)]-1

The real interest rates shown in Table 4.4 are derived from the nominal interest rates and inflation rates. The figures of real interest rates were fluctuating and appeared to be negative in the early 1990s as the inflation rate is larger than the nominal interest rate. Tse (1996) indicates that residential property was seen as a type of favourable investments to hedge against inflation during the early 1990s.

Nevertheless, after the Asian Financial Crisis, the real interest rates increased sharply for 3 years. The real interest rates then decreased steadily in the next few years.

However, an increase in interest rates is found to have clearly dampening effects on residential property market transactions. (Ho and Wong, 2006)

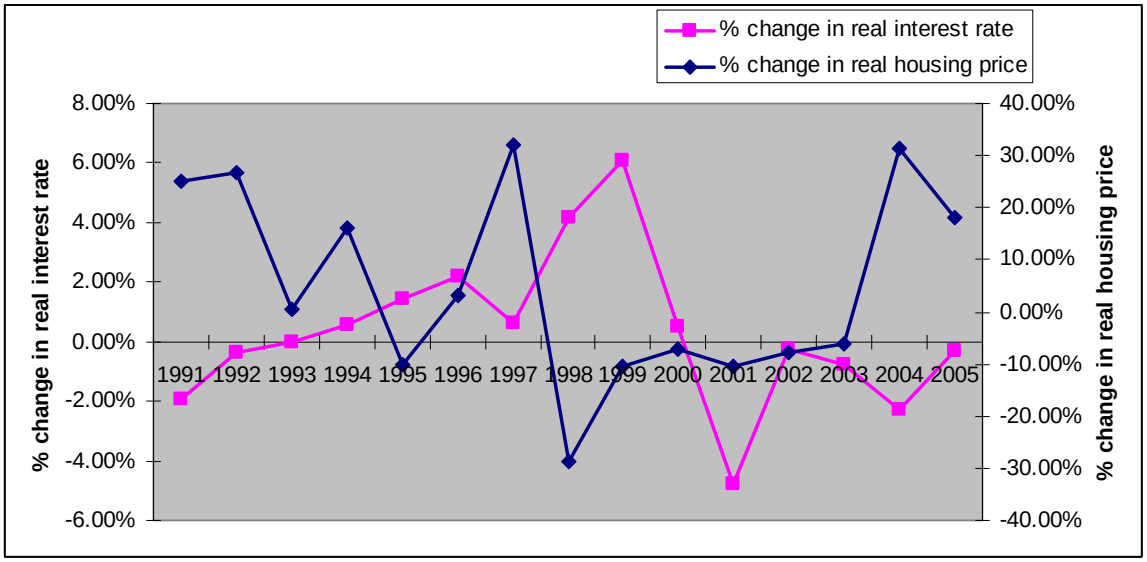

Figure 4.4: Real Interest Rates and Real Housing Prices

Source: 1. Real interest rates derived from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

2. Real housing prices derived from *Hong Kong Property Review*. Rating and Valuation Department, HKSAR.

Indicating in Figure 4.4, the real interest rates moved in an opposite direction from housing prices between 1991 and 2005. Before 1997, the real interest rates were rather low and thereby causing the boosting of housing prices. Oppositely, after the Asian Financial Crisis, the real interest rate climbed up but the housing price went down. The investment environment became less favourable and thus housing prices sluggish. Nevertheless, the situation has got better since 2004 when the real interest rates fell again.

4.2.4 Unemployment

As financing residential properties usually require foreseeable stable income, employment is able to affect the demand for residential properties significantly. According to Yiu and Hui (2005) , previous studies have found that unemployment has a negative effect on housing prices. Unemployment may bring two effects to the property markets in broad terms, income uncertainty effect and financial constraint effect. These two effects are actually associated with and inter-related to each other. Carroll (1994) indicates that when consumers face greater uncertainty in income, they will have lower consumption.

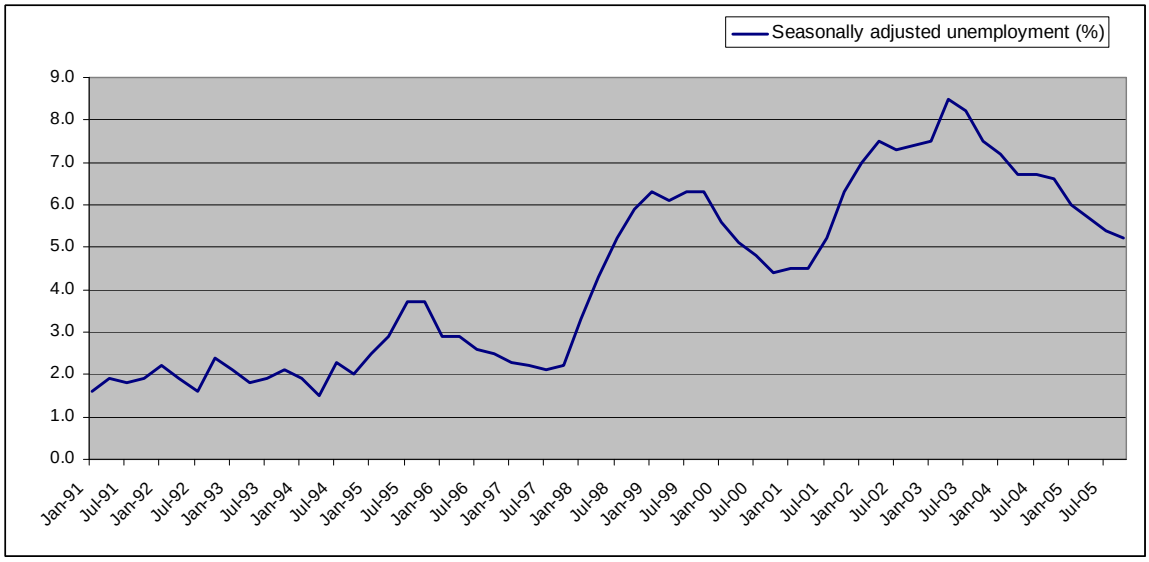

Figure 4.5: Seasonally Adjusted Unemployment Rate in Hong Kong, 1991-2005

Source: Figures of seasonally adjusted unemployment rate from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

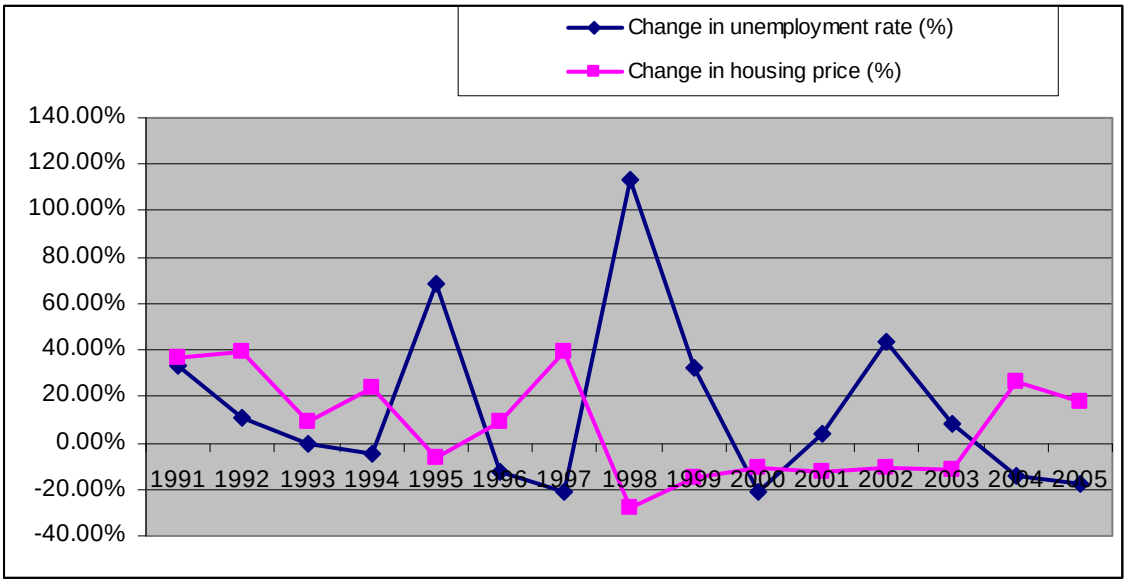

Figure 4.6: Changes in Adjusted Unemployment Rate and Housing Price in Hong Kong, 1991-2005

Sources: 1. Figures for adjusted unemployment rate from *Hong Kong Annual Digest of Statistics*. Census and Statistics Department, HKSAR.

2. Figures for housing price index from *Hong Kong Property Review*. Rating and Valuation Department, HKSAR.

In Figure 4.5, it is observed that the unemployment rate remained a low level but started escalating from 1998. Though there was a fall of the unemployment rate in 2000, it rose again and reached the peak in 2003 when Hong Kong experienced SARS. In Figure 4.6, the historical statistics support that there is a negatively relationship between unemployment and housing prices. Hui and Yiu (2003) further explained that owning to the rising unemployment rate, uncertainty over the ability to repay mortgage loans is developed and thus both income uncertainty and financial constraints are reflected.

It is not only the unemployment affects the housing prices in one way, but also there is bidirectional causality between housing price and employment, according to the test result in Ho and Wong (2006) . Due to the decline in property values, domestic consumption and domestic investment drop and thus affect employment negatively. In

turn, employment declines further and hurts property values in a vicious circle. (Ho and Wong, 2006) Therefore, in order to know the economic condition of Hong Kong, unemployment rate is one of the important economic indictors.

4.3 Land Supply of the Government Land Sales

The total area of land sold and the developable gross floor area of residential land supplied by the government through public auction and tender from 1991 to 2005 are shown in Figure 4.7. The developable gross floor area is always greater than the area of sites and this shows the presence of plot ratio. With the 50-hectare quota policy brought by the Sino-British Joint Declaration, the plot ratios of the land sold are rather higher for the early 1990s. Since the population and number of households keep rising, the demand for housing is keen. To cope with this keen housing demand, the government put land with higher plot ratios so as to provide larger developable gross floor area to construct more housing units.

After the implementation of the Application List System for government land sales in 1999, private developers have to trigger the land if they are interested in it. Particularly for 2002, 2004 and 2005, the average plot ratios of the land are over 5.4, even higher than that in the early 1990s. As the new land sale mechanism is demand-driven, this shows that developable gross floor area is in a great demand for constructing more housing units. It is observed that the amount of residential land sold in 2003 is zero due to the Suen's Nine Measures for rescuing the sluggish property market.

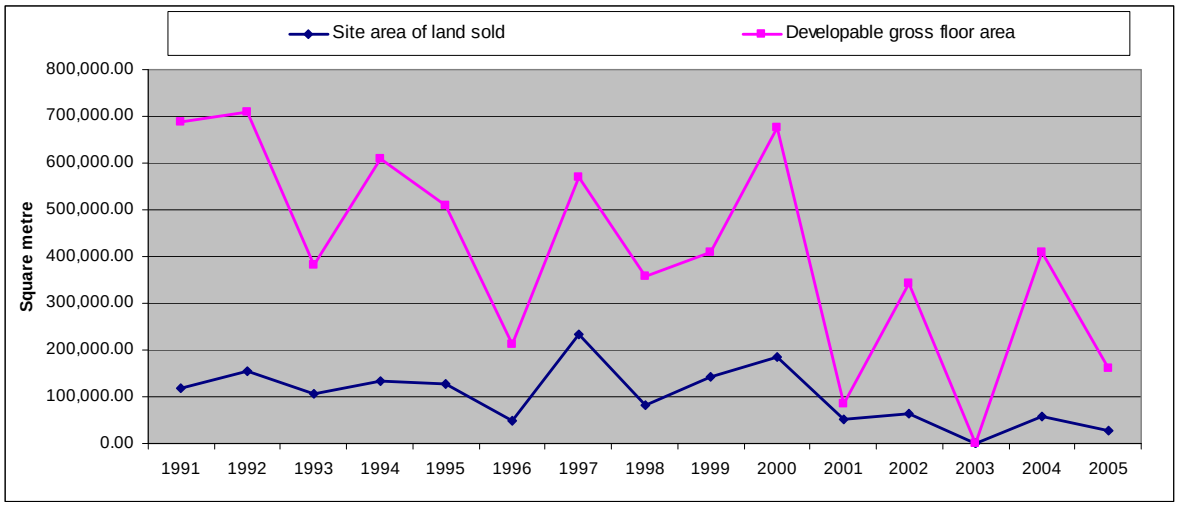

Figure 4.7: Total Site Area and Developable Gross Floor Area# of Residential land supplied by the HKSAR Government through Public Auction and Tender, 1991-2005

#: Developable gross floor area=Actual area of land sold × Respective plot ratio of the land.

Sources: 1. Total area of residential land from Land Sale Records, Lands Department, HKSAR Government.

2. Figures for actual area of land sold from Land Sale Records, Lands Department, HKSAR Government.
3. Figures for plot ratio from Statutory Planning Portal, Town Planning Board, HKSAR Government.

Figure 4.8 shows the total site area of land sold and site area of residential land sold through public auctions and tenders of the government. The amount of land supplied through government land sale is always below 320,000 square meters from 1991 to 2005, except the one in 1996 as a site with 605,242 square meters for the use of river trade terminal. Before the introduction of the Application List System in 1999, on average, about half of the land disposed by the government through public auction and tender is for residential use, excluding 1996. However, after the new mechanism introduced, about 75 percent of the total land disposed by the government land sale is for residential use,

excluding 2003 in which there was no residential land disposed. All these indicate the great demand for the land with residential use.

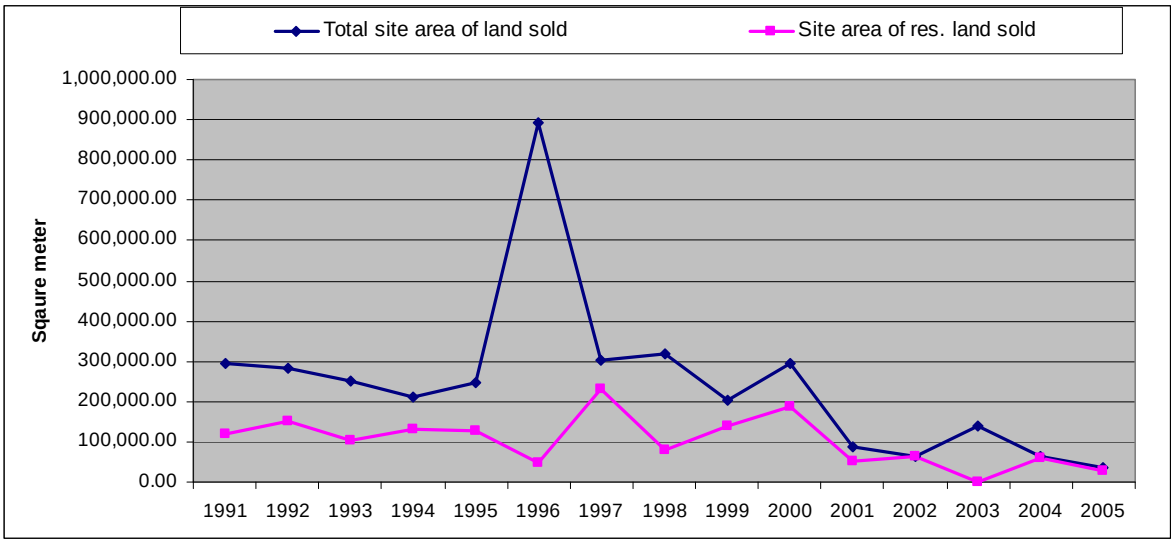

Figure 4.8: Total Site Area of Land Sold and Site Area of Residential Land Sold through Public Auctions and Tenders by the HKSAR Government, 1991-2005

Source: 1. Figures for total area of land sold from Land Sale Records, Lands Department, HKSAR Government.

2. Figures for area of residential land sold from Land Sale Records, Lands Department, HKSAR Government.

Figure 4.9 displays the area of residential land sold and the change in real housing prices over the period from 1991 to 2005. It is observed that about 90 percent of the figures show a positive relationship between the area of residential land disposed and the change in housing prices. This may indicate the government intervention over the housing market that the government would probably dispose more residential land when housing prices increase so as to cool down the overheated market.

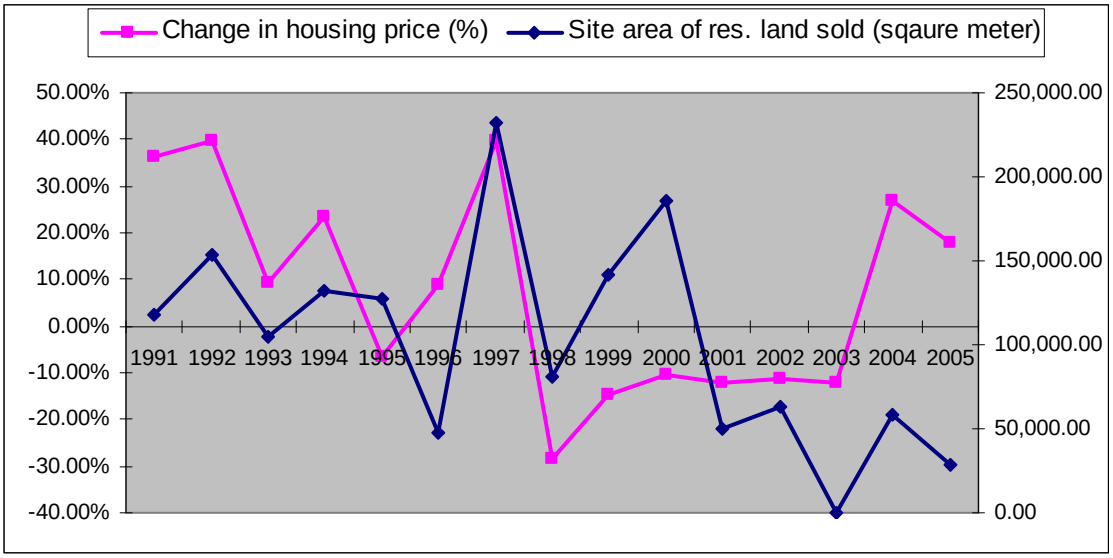

Figure 4.9: Area of Residential Land Sold and Change in Housing Prices, 1991-2005

Source: 1. Figures for area of residential land sold from Land Sale Records, Lands Department, HKSAR Government.

2. Figures for housing price index from *Hong Kong Property Review*. Rating and Valuation Department, HKSAR.

Chapter 5 - Methodology

5.1 Regression Analysis

The result of the study lies on the testing of predictive variables by using a statistical model. In order to investigate the relationship among variables, one of the most efficient ways is to perform a regression analysis. Besides, by analyzing the data, a hypothesized model can be confirmed or refuted. Achen (1982) states, *"... the strength of ordinary regression is its great resilience. As the consistency theorem shows, if the researcher sets up the problem correctly, regression will tend to the right answer under any reasonable practical circumstances, even if a great many of the classical postulates are violated."*

According to Chatterjee et al. (2000) , the relationship is expressed in form of an equation or model that connects a dependent variable and one or more explanatory or predictor variables. Therefore, in the current study, a single-equation econometric function for housing prices is modelled by Ordinary Least Squares (OLS) technique.

In this study, the dependent variable is housing price which is denoted as P_t and the explanatory variables are denoted as $X_1, X_2, ..., X_n$ where n denotes the number of predictor variables. The relationship between P_t and $X_1, X_2, ..., X_n$ can be approximated by the linear regression model that shown in the following.

$$P_t = \beta_0 + \beta_1 X_1 + \beta_0 X_2 + ... + \beta_0 X_n + \varepsilon$$

β_0 , β_1 , …, β_n are the regression parameters or coefficients as the unknown constants that are estimated from data while ε is the stochastic error term.

In order to analyze and interpret the result of the model, the following information must be estimated and recognized.

5.1.1 Regression coefficient

β_0 is the constant coefficient which is the value of P_t when $X_1 = X_2, = ... = X_n = 0$. β_j , where $j=1,2, ..., n$, is called partial regression coefficient. It can be interpreted as the change in P_t when X_j changes for one unit, keeping all other explanatory variables constant. However, the value of β_j does not equal to the degree of change. The partial regression coefficient can also represent the contribution of an explanatory variable to the dependent variable, after adjusting other explanatory variables. As the explanatory variables are assumed to be unrelated in theory but may not be in reality, it may not be possible to vary one of them and keep the others constant simultaneously in practice.

5.1.2 T-statistics

T-statistics is used to test the significance of the effect of each explanatory variable on the dependent variable. It can represent the likelihood that the statement "the dependent variable is affected by an explanatory variable" is true. The larger the value of t-statistics, the more significant the explanatory variable is and the more accurate the estimate is. However, significance does not mean the magnitude of the effect of an explanatory variable on the dependent variable as an explanatory variable can be very significant but it effect on the dependent variable can be very small.

5.1.3 P-value

P-value, which is the chance that the estimated coefficient is equal to zero, usually associates with the t-statistics. The smaller the p-value, the more significant the estimated regression coefficient is.

5.1.4 Coefficient of determination

R-square (R^2) is known as goodness-of-fit index as it represents the proportion of the total variability in the dependent variable that is accounted for by the explanatory variables. Adjusted R-square (adjusted R^2) can be viewed as a modification of R-square. It is a measure of the proportion of variance, which is variation divided by degree of freedom, of the dependent variable explained by the explanatory variables. The range of the value of R^2 is from 0 to 1 while that of adjusted R^2 can be negative and always be less than or equal to the value of R^2. The more the R^2 approaches to 1, the larger the part that the explanatory variables account for the variation in the dependent variable. When the number of observations is small and the number of explanatory variables is large, there will be a greater difference between R^2 and adjusted R^2.

Since an increase in the value of R^2 is more dependent on the increasing number of explanatory variables added to the model, regardless whether their coefficients are significant or not, adjusted R^2 of the model will be interpreted in this dissertation as its value is not affected by the number of variables added.

In order to perform the linear regression analysis, a statistical tool called SPSS is used. By analyzing the data collected in this way, the relationship between the housing price and each explanatory variable and the effect of all explanatory variables on the housing price can be shown.

5.2 Development of Model

The empirical analysis of the current study is mainly based on the housing price determinants of the housing demand equations which are reviewed in Chapter 2. Housing price (P_t) will be the dependent variable that will be regressed against with several explanatory variables. Most of the explanatory variables in the model are chosen lying on previous research of Peng and Wheaton (1994) which study the relationship between housing price and land supplied by the government. Except for an explanatory variable of the unemployment rate, it is chosen to be included in the model with reference to Yiu and Hui (2005) which demonstrate the impact of unemployment rate on the housing prices in Hong Kong. Reviewing the past fifteen years, the economic condition has many fluctuations. For example, after the Asian Financial Crisis in 1997, many companies closed down and this contributed to the upsurge of the unemployment rate for two to three years. Moreover, as mentioned in the literature review in Chapter 2, income is considered to be a determinant of housing prices. Besides, as explained in Chapter 4 that the high unemployment rate brings an expectation that there would be uncertainties in future income stream and financial constraints. Therefore, the unemployment rate is included in the model in this study.

The model begins with the demand function in form of the linear regression equation. All variables in the model relate to the housing prices either directly or indirectly by reflecting the demand for housing according to the concept of demand in Economics. For those variables that can not be measured directly, they will be represented by proxies which are highly correlate with the variables.

As Peng and Wheaton (1994) find that there is a gradual adjustment in the housing prices, time lag effects will be included for the variables of housing price and land sale in the model. Therefore, both current and lagged changes will be tested. It is

assumed that the current housing prices would partly depend on the prices observed in the previous year. In addition, time lags will be given to land sales so as to realize the effect of the explanatory variables on the housing prices. By adding different lagged variables into the regression model, the best fitting model which gives the highest adjusted R^2 can be determined.

After getting the result from regression model, the significant variables will be explained. Their signs will be identified in order to investigate the effects on the housing prices and also to see whether they conform to the initial expectations.

Chapter 6 - Empirical Model

6.1 Specification of Model

The model adopted for this study was based on the housing demand equation developed by Peng and Wheaton (1994), which is successful in explaining the housing price movement in the case of Hong Kong.[13] However, there is a modification for the model by including one more specific factor, unemployment rate (U) which is seasonally adjusted, as an economic factor influencing the demand for housing.

The housing demand equation is in form of a function that provides an interaction between the number of households and other explanatory variables determining the housing demand.

Total stock of housing units (TSTK) is considered as the sum of stock of public housing (STK_p) and private housing (STK_v). With negligible sharing of housing and near-zero vacancy, the number of households allocating to the public housing would be equivalent to the stock of public housing. Peng and Wheaton (1994) define F as the formation rate of actual private market households to those potential households that have not been allocated to the public housing. In equilibrium, the number of actual households that are not housed in the public sector ($H\text{-}STK_p$), where H is total number of households, equaling to the demand for the private housing, must equal to the existing private stock, as illustrated in equation (1).

$$(H\text{-}STK_p)F = STK_v = TSTK - STK_p \quad (1)$$

F can be illustrated in form of a function of the equilibrium annual housing rental price (R), income (Y), and the cost of other goods and services (P_z).

$$F = f\,(R, Y, P_z) \quad (2)$$

[13] In the best performing equation of the model, the value of R^2 is 0.97.

Assuming it is a perfect financial market, the annual housing rental price is equal to the equilibrium value of a price index for housing capital (P_h^*) times the opportunity cost of purchasing housing. The cost is dependent on the economic rate of depreciation (δ), the current mortgage rate (INT) and the expected rate of future housing price appreciation (EP).

$$R = P_h^*(\delta + INT - EP) \quad (3)$$

As mentioned in Chapter 2, the expected rate of future housing price appreciation can be relied on two approaches. One is to assume the expectations are base on certain current or past behaviour pattern in the market. Another one is to assume consumers have perfect market information and form their expectation rationally. Therefore, the expected rate of future housing price appreciation (EP) is assumed that the consumers will not only look backward to the recent rates of price appreciation (PA) so as to make speculation from the future price appreciation, but also look at the rate of recent land sales (LS) to adjust their expectation.

$$EP = g(PA, LS) \quad (4)$$

By combining the equations (1) to (4) above, we have

$$(H\text{-}STK_p)\ f(P_h^*[\delta + INT - g(PA, LS)], Y, P_z) = TSTK - STK_p = STK_v \quad (5)$$

The term ($H\text{-}STK_p$) represents the number of households that are not housed in public sector and desire to own a unit in the private market. By econometric version of equation (5), assume household formation function (*f*) is a linear function of income, house prices, annual capital costs, and land sales.

$$(\text{H-STK}_p)\ [\beta_0 + \beta_1 P^* + \beta_2\ (\text{INT} - \text{PA}) + \beta_3 \text{LS} + \beta_4 \text{Y}) = \text{TSTK-}\ \text{STK}_p = \text{STK}_v \qquad (6)$$

In equation (6), β_0 is a constant to represent δ, β_1 to β_4 are a set of coefficients and P^* is the equilibrium housing price in real terms. Derived from equation (6),

$$P^* = (1/\beta_1)[\text{STK}_v /(\text{H-STK}_p) - \beta_0 - \beta_2\ (\text{INT} - \text{PA}) - \beta_3 \text{LS} - \beta_4 \text{Y}] \qquad (7)$$

Traditionally, it is assumed that traditional economic theory assumes housing price adjust instantly to equate demand for housing with existing stock. However, empirical analyses of Whitehead (1974), Hadjimatheou (1976) and DiPasquale and Wheaton (1990) suggest that housing prices may adjust gradually with changes. To test the hypothesis, equation (8) is set and assumed that current housing prices (P_t) is dependent on both unobserved current equilibrium price (P_t^*) and the prices observed in the previous period (P_{t-1}). τ is denoted as the rate at which P_t converges to P_t^*.

$$P_t = \tau P_t^* + (1- \tau)\ P_{t-1} \qquad (8)$$

A complete price specification for empirical estimation can formed by combining equations (7) and (8),

$$P_t = (\tau/\beta_1)[\text{STK}_v /(\text{H-STK}_p) - \beta_0 - \beta_2\ (\text{INT} - \text{PA}) - \beta_3 \text{LS} - \beta_4 \text{Y}] + (1-\tau)\ P_{t-1}$$

$$P_t = \alpha_0 + \alpha_1[\text{STK}_v /(\text{H-STK}_p)] + \alpha_2\ (\text{INT} - \text{PA}) + \alpha_3 \text{LS} + \alpha_4 \text{Y} + \alpha_5\ P_{t-1} \qquad (9)$$

In equation (9), α_0 is denoted as a constant and α_1 to α_5 are as a set of regression coefficients associated with their explanatory variables respectively. Based on equation (9), unemployment rate is added as an independent variable to the housing price and it acts as an indicator of economic environment. Therefore, the equation for the estimates of housing price is

$$P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-1} + \alpha_6 LS. \quad (10)$$

As Peng and Wheaton (1994) carry out the empirical test by using annual data, however quarter data is used in this dissertation, the required equation is

$$P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4} + \alpha_6 LS. \quad (10)$$

The above housing demand econometric equation will be used to estimate the demand for private housing in Hong Kong. The model of this dissertation is based on the traditional stock-flow model with a lagged price variable so as to incorporate the realization of the market expectation.

6.2 Expected Signs of Coefficient of Independent Variables

After reviewing the previous literature and according to the situations in Hong Kong, several independent explanatory variables are chosen. All of them are expected to have significant effect on the housing prices. Before performing the regression analysis, the expected signs of the coefficient of the independent variables are identified in the following. The determination of the expected signs is based on the expectations on their effects on the private housing price. The expected signs of coefficients of all independent variables in the model are summarized in Table 6.1.

6.2.1 Ratio of Housing Stock per Potential Household in Private Market [STK_v /(H-STK_p) (α_1)]

There are three determinants to influence the ratio of housing stock per potential household in private market. They are the number of households, stock of private housing and stock of public housing. When the stock of public housing increases, the ratio increases too, by keeping the number of households and stock of private housing constant. As an increase in the stock of public housing, more households can be accommodated and in turn fewer households have to seek residence in the private market. Hence, the demand for purchasing private housing decreases and so do the private housing prices. Similarly, when the stock of private housing increases, the ratio would increase and eventually the private housing price would decrease, assuming the other two determinants to be unchanged. Besides, when the number of households increases and the other two determinants are keep constant, the ratio decreases and thus the demand for private housing rise and so does the private housing price.

As a result, the ratio of housing stock per potential household in the private housing market and the private housing prices are negatively related, and thus the expected sign of the coefficient of this explanatory variable is negative.

6.2.2 Income [Y (α_2)]

Income has a positive relationship with the housing demand. Higher income level, implying greater purchasing power, will stimulate the housing demand. As the demand for housing increases, the housing price rises. Thus, there is a positive relationship between income and housing prices and so the expected sign of the coefficient of income is positive.

6.2.3 Opportunity Cost of Purchasing Housing [INT-PA (α_3)]

The opportunity cost of purchasing housing is dependent on the interest or mortgage rate and recent rate of price appreciation. As people usually purchase properties through mortgage from banks, when the interest or mortgage rate is high, the cost of borrowing for households is high and in turn, the demand for housing will be lowered and so will the housing prices. The recent rate of price appreciation can be considered as the recent inflation rate. When there is a high inflation rate, people are more willing to invest in housing as they foresee the housing prices will rise.

Overall, when the opportunity cost of purchasing housing increases, the demand for housing decreases and thus housing price decreases. Therefore, the opportunity cost of purchasing housing has a negative impact on the housing prices and thus its expected sign of coefficient is negative.

6.2.4 Unemployment Rate [U(α_4)]

Unemployment rate can be an economic indicator of the economy. An increase in unemployment rate is likely to increase the uncertainty of future household income. This adversely affects the affordability of households to purchase housing and so does the demand for housing. Moreover, high unemployment rate is perceived to be a sign of weak economy. This lowers the confidence of households in real estate market and thus they will prefer not to spend on properties. As a result, a negative relationship exists between the unemployment rate and housing prices and so the expected sign of the coefficient of unemployment is negative.

6.2.5 Previous Observed Housing Price [P_{t-4} (α_6)]

The pervious housing price contributes to the people's expectation of the future housing price. When previous housing price is observed to be in a rising trend, people would expect the future price of housing will increase and thus people would prefer purchase housing now. So, the demand for housing increases and so does the housing price. The expected sign of coefficient of previous housing price is positive.

6.2.6 Land Supply [LS (α_7)]

From the result of Peng and Wheaton (1994), land disposed by the government through public auction and tender has a positive relationship with the housing supply, though it is not significant. An increase in land supply would raise the housing supply and so the housing price would decrease. As a result, the supply of housing and the housing prices are negatively related and its expected sign of coefficient is negative.

Moreover, it is widely documented that the housing market is not efficient apparently. As a result, the effect of land supply on the housing prices would not realize simultaneously. The effect of land sale on housing prices also would not be reflected in the market quickly but after some years. Therefore, lagged land supply variables are tested in the regression analyses to observe the inefficiency.

Variables	Denoted as	Expected signs of the coefficients
Ratio of housing stock per potential household in private market	STK_v /(H-STK_p)	-
Income	Y	+
Opportunity cost of purchasing housing	INT-PA	-
Unemployment rate	U	-
Previous observed housing price	P_{t-1}	+
Land supply	LS	-

Table 6.1: Expected Signs of Coefficients of the Explanatory Variables

6.3 Data and Sources

All the explanatory variables are collected from time series data of the first quarter 1991 to the forth quarter 2005. There are 60 quarterly observations in total. A summary of the definitions, method of data conversion and data source are shown in Table 6.2. For those data which is not available in quarter, monthly figures are adopted to adjust to quarter.

6.3.1 Housing Prices

To measure the dependent variable of housing prices, the private domestic price index from the *Hong Kong Property Review* of the Rating and Valuation Department of HKSAR Government is adopted in this dissertation. In order to eliminate the influence of inflation, housing prices are expressed in real terms which are adjusted by using the implicit price deflator of Gross Domestic Product.

6.3.2 Income

Income is measured by using the median household income. The data is available from the *Quarterly Report on General Household Survey* published by the Census and Statistics Department. Since the data for median household income before October 1999 is not available the survey, direct request for the required data is made to the Census and Statistics Department. The household income is also expressed in real terms and inflation-adjusted.

6.3.3 Ratio of Housing Stock per Potential Household

6.3.3.1 Private Housing Stock

The data for private housing stock is computed by subtracting the stock of public housing rental flats from the total stock of permanent housing. The data is available from the *Hong Kong Monthly Digest of Statistics* of the Census and Statistics Department.

6.3.3.2 Public Housing Stock

The data for public housing stock is obtained from the *Hong Kong Monthly Digest of Statistics* of the Census and Statistics Department. Although public housing includes Public Rental Housing (PRH), HOS and PSPS, only the latter two are incorporated. As the PRH is rented below the market housing price due to subsidies from the government, it is worried that there will be distortion in the analysis if the PRH is included.

6.3.3.3 Number of Households

The data for the number of households is got from the website of the Census and Statistics Department.

6.3.4 Opportunity Cost of Housing

6.3.4.1 Interest or Mortgage Rate

Hong Kong Inter-bank Offer Rate (HIBOR) is used as a proxy of the prevailing interest or mortgage rate. This data is obtained from the website of the Census and Statistics Department. Furthermore, it is inflation-adjusted to produce the real interest rate.

6.3.4.2 Recent Rate of Price Appreciation

The recent rate of price appreciation is represented by the change in Composite Consumer Price Indices (CPI). The data for CPI is available from the website of the Census and Statistics Department.

6.3.5 Unemployment Rate

The data for unemployment rate is got from the website of the Census and Statistics Department. The seasonally adjusted quarterly figures, which refer to the unemployment rate adjusted for seasonal variations, are adopted.

6.3.6 Previous Housing Prices

The source of data for previous housing prices is the same as the housing prices which is specified above. Private domestic price index is used to represent the previous housing prices from the *Hong Kong Property Review* of the Rating and Valuation Department of HKSAR Government. To minimize the effect of inflation, the previous housing prices are expressed in real terms which are adjusted by using the implicit price deflator of Gross Domestic Product. In addition, the previous housing price is the current housing price with 4-quarter lag.

6.3.7 Land Supply

The definition of land supply adopted in this dissertation is the permissible gross floor area of land disposed by land sales and tender for residential or commercial/ residential combined development. This is calculated by multiplying the site area of the land disposed and the respective permitted maximum plot ratio. Most of the data are

obtained from the land sale records of the Lands Department for the site area of the disposed land and the Outline Zoning Plans in Statutory Planning Portal of Town Planning Board for the plot ratio. Some plot ratios are not provided in the Schedule of Uses of the Plan, thus they are approximated according to the uses and heights of the buildings built on the land and the classes of the sites. For the commercial/ residential combined development, it is assumed that the percentage of residential development to the overall development is 80 percent.

Variables	Definition	Data Conversion	Data Source
Housing prices (P_t)	Private Domestic Price Index (1999=100)	Quarterly Private Domestic Price Index (Total), inflation-adjusted	Various Hong Kong Property Review, Rating and Valuation Department
Income (Y)	Household Income	Median household income, inflation-adjusted	Various Quarterly Report on General Household Survey and direct request, Census and Statistics Department
Private housing stock (STK_v)	Private housing stock	Private housing stock (Total)	Various Hong Kong Monthly Digest of Statistics, Census and Statistics Department
Public housing stock (STK_p)	Public housing stock	Public housing stock (includes HOS and PSPS only)	Various Hong Kong Monthly Digest of Statistics, Census and Statistics Department
Number of Households (H)	Total number of households	Total number of households	Website of the Census and Statistics Department
Interest or Mortgage rate (INT)	Real interest rate	Quarterly figures of 12-month HIBOR, inflation-adjusted	Website of the Census and Statistics Department
Recent rate of price appreciation (PA)	Composite Consumer Price Indices (CPI) (2005=100)	Change in Quarterly Composite Consumer Price Indices (CPI)	Website of the Census and Statistics Department
Unemployment Rate (U)	Unemployment Rate	Seasonally adjusted quarterly figures	Website of the Census and Statistics Department
Previous Housing Prices (P_{t-4})	Private Domestic Price Index (1999=100) with 4-quarter lag	Quarterly Private Domestic Price Index (Total), inflation-adjusted and with 4-quarter lag	Various Hong Kong Property Review, Rating and Valuation Department
Land supply (LS)	Permissible Gross Floor Area of land disposed by land sales and tender for residential or commercial/residential combined development	Site Area × Permitted maximum Plot Ratio	Land Sale Records, Lands Department and Statutory Planning Portal, Town Planning Board

Table 6.5: Summary of Definitions, Method of Data Conversion and Data Source for All Variables.

Chapter 7 - Empirical Results and Analysis

7.1 Empirical Results

The following housing demand equation is used in the regression model.

$$P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4} + \alpha_6 LS$$

There are total 6 cases to test the hypothesis of gradual price adjustment and the effect of land sales. Case 1 excludes the explanatory variables of previous housing prices and land supply while case 2 excludes land supply only. With the addition of previous housing prices in case 2, the effect of gradual price adjustment can be reflected and thus the hypothesis of gradual price adjustment can be tested. Besides, to capture the effect of construction lag, which is about two to three years, current land sales, 4-quarter, 8-quarter and 12-quarter lagged land sales are included in the model. From case 3 to case 6, different lags of land sales are introduced so as to examine their effects on the private housing prices. The equations are shown as below.

Case 1: $P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U$

Case 2: $P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4}$

Case 3: $P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4} + \alpha_6 LS$

Case 4: $P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4} + \alpha_6 LS_{t-4}$

Case 5: $P_t = \alpha_0 + \alpha_1[STK_v/(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4} + \alpha_6 LS_{t-8}$

Case 6: $P_t = \alpha_0 + \alpha_1[STK_v /(H\text{-}STK_p)] + \alpha_2 Y + \alpha_3(INT - PA) + \alpha_4 U + \alpha_5 P_{t-4} + \alpha_6 LS_{t-12}$

The coefficients of the variables in the equation are estimated by regression model shown in Table 7.1.

Independent Variable	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Constant	95.719	108.672	111.231	130.563	101.570	101.679
	(1.162)	(1.537)	(1.595)	(1.455)	(1.477)	(1.449)
Y	5.681×10^{-3}	5.368×10^{-3}	5.501×10^{-3}	5.591×10^{-3}	5.902×10^{-3}	5.678×10^{-3}
	(3.651)**	(4.017)**	(4.164)**	(4.805)**	(4.458)**	(4.232)**
$STK_v/(H\text{-}STK_p)$	-53.525	-96.843	-96.256	-92.570	-92.045	-91.954
	(-0.718)	(-1.498)	(-1.509)	(-1.422)	(-1.464)	(-1.434)
INT- PA	-49.154	-166.092	-149.042	-153.750	-143.393	-157.837
	(-0.639)	(-2.121)*	(-1.910)[a]	(-1.921)[a]	(-1.865)[a]	(-2.029)*
U	-762.079	-532.178	-593.696	-570.210	-608.234	-563.585
	(-7.602)**	(-5.339)**	(-5.609)**	(-5.160)**	(-5.866)**	(-5.570)**
P_{t-1}		0.438	0.426	0.432	0.429	0.439
		(4.557)**	(4.477)**	(4.464)**	(4.592)**	(4.615)**
LS			-9.80×10^{-6}			
			(-1.573)			
LS_{t-1}				-5.22×10^{-6}		
				(-0.809)		
LS_{t-2}					-1.17×10^{-5}	
					(-2.053)*	
LS_{t-3}						-7.84×10^{-6}
						(-1.423)
R^2	0.561	0. 683	0.697	0.687	0.706	0.695
Adjusted R^2	0.529	0.654	0.663	0.651	0.673	0.660
Standard error of the estimate	12.5839	10.7931	10.6488	10.8279	10.4856	10.6921

[a] significant at the 10% level ($p<0.1$), * significant at the 5% level ($p<0.05$), ** significant at the 1% level ($p<0.01$).

Figures in parentheses are t-statistics.

Table 7.1: Regression Estimates of Housing Prices
(1st Quarter of 1991 to 4th Quarter of 2005)

7.1.1 Analysis of Empirical Results

All coefficients of the explanatory variables carry the expected signs mentioned in Chapter 6. The best result is achieved in case 5 by incorporating Y, $STK_v/(H\text{-}STK_p)$, INT-PA, U, P_{t-1} and LS_{t-2}.

In case 1, the equation excludes the explanatory variables of lagged housing price and the land supply, i.e. permissible gross floor area. Only income (Y) and unemployment rate (U) are shown to be statistically significant at the 99 percent level of confidence while other explanatory variables are shown to be statistically insignificant. The adjusted R^2 is 0.529, which means that the explanatory variables included can explain 52.9 percent of the variations in housing prices.

Lagged housing price is included while land supply is excluded in the equation in case 2. From the result generated from the regression model, with the addition of the lagged housing price, the significance of all explanatory variables' coefficients have an improvement and also the value of adjusted R^2 has an obvious increase, i.e. the adjusted R^2 increases by 23.6 percent from 0.529 to 0.654. Therefore, the hypothesis of a gradual price adjustment cannot be rejected. This result is consistent with that of Peng and Wheaton (1994).

From case 3 to case 6, the effect of land sales on housing prices is examined. In case 3, the inclusion of current land sale improves the value of adjusted R^2 to a small extent only, i.e. from 0.654 to 0.663. This displays that the addition of current land sale enhances the explanatory power of the variables by 1.4 percent and this implies that the impact of current land sale is small. The coefficient of current land sale (LS_t) carries the expected negative sign, which is different from the result of Peng and Wheaton (1994), but both of them are shown to be insignificant statistically.

In case 4, one-year lagged land sale is included in the model but its coefficient is statistically insignificant also. Surprisingly, it does not improve the explanatory power of the model as the value of R^2 and adjusted R^2 drop. This is dissimilar with the result of Peng and Wheaton (1994), Hui et al. (2000) and Hui (2004), in which the regression results show increases in the value of R^2 and adjusted R^2 by replacing a variable of current land sale with one-year lagged land sale. This is due to the gradual price adjustment to the exogenous shocks is made less than 1 year, quicker than the result suggested by Peng and Wheaton (1994). As the economic environment of the study period of Peng and Wheaton (1994), Hui et al. (2000) and Hui (2004), and this dissertation is different, i.e. 1965-1990, 1978-1998, 1988-1998 and 1991-2005 respectively, the mindset of former consumers may be more conservative than now, the time used to adjust the expectation by consumers may be more than now.

The best result is modelled in case 5 as the goodness of fit of the model is the greatest, i.e. R^2 is 0.706 and adjusted R^2 is 0.673. The addition of two-year lagged land sale not only has a statistically significant coefficient but also improve the goodness of fit of the model. All coefficients of the explanatory variables except ratio of housing stock per potential household in private market and opportunity cost of purchasing housing are significant at 5 percent level. Carrying the expect sign of coefficient, the two-year lagged land sale is suggested to have a significant negative effect on the housing prices. This result is consistent with that of Peng and Wheaton (1994). The inclusion of three-year lagged land sale in case 6 is not statistically significant again despite it has the expected negative sign. Conforming to Peng and Wheaton (1994), the negative relationship between land sales and housing prices implies the restrictiveness of land in housing market.

7.1.1.1 Significant Variables

The significant explanatory variables in case 5, which is the best model among the six, will be explained.

Income (Y) obtains a regression coefficient of 5.902×10^{-3}, which means a percentage change in income of households would result in little effect on housing prices in a quarter time but this effect is significant statistically. As mentioned in previous chapter, with higher income level, households would have greater purchasing power and so the demand for housing increases and so does the housing prices.

Unemployment rate (U) displays a regression coefficient of -608.234, which is the largest among all the significant variables. This means that when there is one percent increase in unemployment rate, the housing price would decrease by 608.234 percent within one quarter, which is a substantial percentage change. With carrying the expected negative sign, the effect of unemployment rate on the housing prices is proven. When the unemployment rate increases, the income level of households reduces and so does the purchasing power of households. Additionally, the unemployment rate reflects the uncertainty of the economy. Thus, the demand for land would be lowered and in turn the housing prices would decrease.

Previous housing price (P_{t-4}) is significant and has a coefficient of 0.429, which means that one percent change in the last-year housing price would result in 0.429 percent change in the current housing price. When the housing price increased last year, it is expected that the current housing price would also increase at a modest rate, since consumers would anticipate a higher rent in the future and the future rent would be capitalized into a higher current housing price, in about 4 quarters time, i.e. 1 year.

Two-year lagged land sale (LS_{t-8}) is shown to be significant and it has a coefficient of -1.17×10^{-5}. It illustrates that a percentage change in the land supply from a

two-year lagged land sale would cause a minute percentage change in the housing prices. It is consistent with the result of Peng and Wheaton (1994) and it proves that apart from land sale held by the government, there are other sources of land supply such as lease modification. Although the effect of the two-year lagged land sale on the housing prices is minute, it is significant.

7.2 Implication of Findings

This study has investigated the impacts of the explanatory variables, including income, ratio of housing stock per potential household in private market, opportunity cost of purchasing housing, unemployment rate, previous housing price and current and lagged land sales. The empirical result is consistent with the theoretical analysis illustrated previously. As expected, in all cases, income of households and previous housing prices have significant positive impact while unemployment rate have significant negative effects. The hypothesis of gradual price adjustment is supported by the result of this regression model with empirical study in housing market of Hong Kong.

Furthermore, since the coefficient of P_{t-4} is 0.429, the estimated value of τ is 0.571. This means that the housing prices would move to approximately 57.1 percent of their long run equilibrium value in the first year following a shock. (DiPasquale and Wheaton, 1990) Compare to the result of Peng and Wheaton (1994), which shows a coefficient of 0.24, the rate of housing prices movement resulted in this study is higher than the former over two times. The faster movement of price adjustment may imply the improvement of inefficiency in the Hong Kong housing market. It is probably because of the difference in the economic environment and the mindset of consumers of the former and nowadays.

With the two-year lagged land sale and gradual price adjustment, the goodness of fit of the model is best, at 67.3 percent. Information of land sales varies the expectation of

future housing price appreciation with the adjustment of expectation at approximately two years. With reference to the regression result, the effect of land sale on housing prices is significant and negative with a two-year lag. This result is similar to that of Peng and Wheaton (1994). It indicates that when there is an increase in land supplied by land sale, a decrease in housing prices would occur after about two years. Apparently, the findings of this empirical study can provide further evidence on the observation of housing market inefficiency.

Although the findings of this dissertation are similar to that of Peng and Wheaton (1994) to a large extent, it should be noted that the period of time examined are absolutely different, without overlapping. Peng and Wheaton (1994) examine the period of 1975 to 1990, which is the phase of the economic development at a gallop and having a serious inflation in Hong Kong.[14] Both stock and property market boosted over this period, which is absolutely different to the period examined in this study, which experienced ups and downs in the economy.[15] This implies that even though the economy experiences at any position of the business cycle, the gradual price adjustment is still valid and has not been rejected. Similarly, the effect of land sale on housing prices would be realized in the market for approximately two years after shocks.

In accordance with the empirical results, as the effect of government land sales on the housing prices is minute, there should be other more important source for land supply, i.e. the lease modification and exchange, which has discussed in the previous chapters. To facilitate the land supply and housing supply to meet the market demand so as to obtain the equilibrium, the government should not only focus on the land sale policy to control the overall land supply in Hong Kong. On the other hand, since the overall land supply is

[14] The average of the inflation rate over the period of 1975 to 1990 is 8.4 percent. The highest inflation rate is 15.1 percent in 1980 while the lowest one is 3.5 percent in 1985.
[15] During the period of 1991 to 2005, the average inflation rate is 3.2, having the highest inflation rate that is 11.3 percent in 1991 and the lowest one that is -3.9 percent in 1999.

not only from the government land sales but also lease modification and exchange. As a result, the government can pay effort on improving the current mechanism to shorten the time consumed so that the land supply in terms of developable gross floor area can meet the market demand faster and more efficient.

Chapter 8 - Conclusion

Before the handover of Hong Kong in 1997, it was stipulated in the Sino-British Joint Declaration that the quantity of land disposal was limited to 50 hectares per annum and thus the total site area of land sales was constrained. Nevertheless, the Joint Declaration did not put a restriction on the use and intensity of the land to be disposed. In order to meet the keen housing demand, instead of disposing more land, the government chose to dispose the land with higher intensities. Therefore, even though the site area of land disposed was restricted, the land supply in terms of developable gross floor area is rather flexible so as to maintain housing supply.

The housing prices had reached the peak in the mid-1997 and soon after this, the Hong Kong experienced the Asian Financial Crisis in 1997, which were adversely affected Hong Kong economic and property market and brought a drastic drop in the housing prices. The housing prices still could not recover to the level before 1997 and was suffered a consistent fall for the few years afterwards. Besides, the outbreak of SARS in 2003 further brought down the housing price to the level nearly as low as that in 1991. From 1991 to 2003, the government had adjusted the amount of land disposed in the scheduled auctions or tenders so as to alleviate the fluctuations of housing prices.

By reviewing the land sale mechanism, several changes have been made for suiting the government approach of “Big market, Small Government” towards land and housing markets. The Application List System was first introduced in March 1999 and it ran with the scheduled land auctions or tenders. To rescue the sluggish property market, several measures had been implemented with the introduction of the Suen’s Nine Measures. One of the measures is a halt of government land sale from November 2002 to December 2003. After the reinstatement of land sale, the Application List System has

totally replaced the scheduled auctions and tenders. Therefore, the land sale mechanism is demand-driven in nature and with minimized government intervention to adjust the land supply by market forces.

As mentioned above, land supply in terms of total site area of land sales in fact underestimates the amount of actual land supply. Thus, the permissible developable gross floor area is employed in the regression model of this dissertation to investigate the effect of land sales on housing prices.

In accordance with the implementation of different land sale mechanisms over the period of 1991-2005, this study does not support that the actual land supply of the government has been affected by the amount of land disposed in terms of site area and by the mechanism of land sale. Furthermore, the empirical analysis in this study illustrates that the effect of land sales on housing prices is only significant with a two-year lagged land sales throughout the whole period although its effect is minute. This shows that no matter the conditions of economic and housing markets are, the land sales of government do not play a vital role to influence the housing prices in Hong Kong.

Moreover, the empirical result indicates that previous housing prices are significant to affect the housing prices and thus the gradual price adjustment has not been rejected. It suggests that a change in the land supply in land sales in terms of developable gross floor area affect housing prices negatively as the market expectations on future price appreciation changed. A reduction in developable gross floor area of land sales would lead to an anticipated higher future rent which is capitalized into higher housing prices, according to the rational expectation theory. Such a capitalization takes for about four quarters.

Additionally, the regression model provides empirical evidence that housing prices in Hong Kong are mainly determined by demographic and economic factors. The

effects of household formation and household income on housing prices are positive while that of unemployment rate and two-year lagged land sale are negative. The statistically significance of two-year lagged land sale and gradual price adjustment imply the inefficiency of Hong Kong property market.

8.1 Limitations of Study

As the percentage of residential development in the commercial/ residential combined development is unavailable, it is assumed the percentage of residential development in the commercial/ residential combined development is 80 percent. Thus, the permissible developable gross floor area is calculated by multiplying the site area, plot ratio and 80 percent. However, such percentage may not be 80 percent for all the commercial/ residential combined development. As a result, the permissible developable gross floor area may not be very accurate and may have small alteration of the empirical results.

Besides, this study investigate the effect of land supply of land sales on housing prices assuming all new housing units are sold after their completion. The empirical analysis of the two-year lagged land sales, which obtains the best goodness of fit, indicates that the length of time normally takes for construction and sale of housing units from the land auctions or tenders, without the pre-sale activities. However, developers are allowed to sell housing units of their development projects before the completion and the practice of pre-sale is quite common in Hong Kong. Therefore, pre-sale activities affect the validity of the empirical results.

8.2 Future Area for Research

In this dissertation, the regression model only takes the fundamental economic and demographic determinants into account to explore the effect of land sales on the housing prices. There must be other factors that have not been included in the regression equation and thus further investigation can be made.

In addition, further study can be done on investigating how the pre-sale activities of developers can affect the effect of land sales on the housing prices and what the government can regulate the pre-sale arrangement so as to mitigate the fluctuations in housing prices.

References

Bilingual Laws Information System.

Available at: http://www.legislation.gov.hk/eng/home.htm. [assessed on 24 February, 2008]

Achen, C. H. (1982) *Interpreting and Using Regression,* Newbury Park, C.A., Sage Publications.

Carroll, C. D. (1994) How does Future Income affect Current Consumption? *Quarterly Journal of Economics,* 109 (1)**,** p.111-147.

Census and Statistics Department. (1991-2005) *General Household Surveys*, Hong Kong: Government Printer.

Census and Statistics Department. (1991-2005) *Hong Kong Monthly Digest of Statistics*, Hong Kong: Government Printer.

Census and Statistics Department. (1991-2005) *Hong Kong Annual Digest of Statistics*, Hong Kong: Government Printer.

Chan, H. K. (1996) Land Supply Restriction in Hong Kong's Housing Market. Department of Surveying. Hong Kong, The University of Hong Kong.

Chatterjee, S., Hadi, A. S. and Price, B. (2000) *Regression Analysis by Example,* New York, A Wiley-Interscience Publication.

Ching, S. (2006) Unlocking the Winner's Curse in the Application List System Content.

Available at: http://www.tdctrade.com/econforum/hkcer/hkcer060301.htm.

[assessed on 29 April 2007.]

Chiu, R. L. H. (2007) Planning, Land and Affordable Housing in Hong Kong. *Housing Studies,* 22**,** 63-81.

Dai, D. H. (2004) Resumption of the Application List System and its Impacts. Available at: http://www.tdctrade.com/econforum/boc/boc040101.htm. [assessed on 22 January 2008]

Dipasquale, D. and Wheaton, W. C. (1991) *Housing Market Dynamics and the Future of Housing Prices,* Cambridge, Massachusets Institute of Technology Centre for Real Estate Development.

Eve, G., Planning Research Programme (Great Britain), University of Cambridge. Department of Land Economy and Department of the Environment. (1992) *The Relationship between House Prices and Land Supply,* London, H.M.S.O.

Fu, Y. M. (2000) *Hong Kong : Overcoming Financial Risks of Growing Real Estate Credit,* Armonk, N.Y. ; London, M.E. Sharpe.

Fung Tung. Housing Conference 1996. Available at: http://sc.housingauthority.gov.hk/gb/www.housingauthority.gov.hk/housconf/dhspeech.htm [assessed on 29 February 2008]

Gerlach, S. and Peng, W. (2004) Banking Lending and Property Prices in Hong Kong. Discussion Paper No. 4797, CEPR.

Hadjimatheou, G. (1976) *Housing and Mortgage Markets*. London, Saxon House.

Harris, J. C. (1989) The Effect of Real rates of Interest on Housing Prices. *Journal of Real Estate Finance and Economics,* 2 (1)**,** p.47-60.

Ho, W. K. O. and Ganesan, S. (1998) On Land Supply and the Price of Residential Housing. *Nethelands. Journal of Housing and the Built Environment,* 13**,** p.439-452.

Ho, L.S. and Wong, G. W. C. (2006) Privatization of Public Housing: Did it cause the 1998 Recession in Hong Kong? *Economic Policy,* 24 (2)**,** p.262-273.

Hong Kong Institute of Surveyors. (2003) *Expediting Urban Redevelopment through Innovative Land Policy*. Hong Kong, The Hong Kong Institute of Surveyors.

Hong Kong Yearbook 2002. Hong Kong, HKSAR. [Online] Available at: www.yearbook.gov.hk. [assessed on 29 February 2008]

Hong, L. (2007) Cheap housing can narrow Hong Kong wealth gap. *China Daily.* People's Republic of China.

Hong, Y. H., Lam, A. H. S. and Lincoln Institute of Land Policy. (1998) *Opportunities and risks of capturing land values under Hong Kong's leasehold system,* Cambridge, Mass., Lincoln Institute of Land Policy.

Hui, E. C. M. (2004) An Empirical Study of the Effects of Land Supply and Lease Conditions on the Housing Market: A Case of Hong Kong. *Property Management,* 22 (2)**,** p.127-154.

Hui, E. C. M., Chan, A. P. C., Wong, F. K. W., Wong, A. K. C. and Leung, B. Y. P. (2000) *The Supply of Land for Housing in Hong Kong,* Hong Kong, Department of Building and Real Estate, Hong Kong Polytechnic University.

Hui, E. C. M. and Ho, V. S. M. (2002) Does the Planning System Affect Housing Prices? Theory and With Evidence from Hong Kong. *Habitat International,* 27 (3)**,** p.339-359.

Hui, E. C. M. and Soo, J. A. (2002) Development Conditions and Supply of Housing: Evidence from Hong Kong. *Journal of Urban Planning and Development,* 128 (3)**,** p.105-138.

Hui, E. C. M. and Yiu, C. Y. (2003) Market Dynamics of Private Residential Real Estate Price - An Empirical Test in Hong Kong. *Journal of Financial Management of Property and Construction,* 8**,** p.155-165.

Lai, L. W. C., Chau, K. W., Ho, D. C. W. and Lin, V. Y. Y. (2005) Impact of Political Incidents, Financial Crises, and Severe Acute Respiratory Syndrome on Hong Kong Property Buyers. *Planning and Design 2006,* 33 (3)**,** p.413-433.

Lai, N. and Wang, K. (1999) Land Supply Restrictions, Developer Strategies and Housing Policies: The Case in Hong Kong. *International Real Estate Review,* 2 (1)**,** p.143-159.

Li, K. W. (2000) An Economic Analysis of the pre- and post-1997 Hong Kong. Hong Kong, Department of Economics and Finance and APEC Study Centre, Faculty of Business, City University.

Li, L. H. (2004) Real Estate Cycle and Government Behaviour in Hong Kong. In Aveline, N. and Li, L. H. eds. *Property markets and land policies in Northeast Asia : the case of five cities : Tokyo, Seoul, Shanghai, Taipei and Hong Kong.* Tokyo [Hong Kong], Maison Franco-Japonaise ; Centre for Real Estate and Urban Economics, The University of Hong Kong.

Li, L. H. (2006) *Development Appraisal of Land in Hong Kong,* Hong Kong, Chinese University Press.

Mankiw, N. G. & WEIL, D. (1989) The Baby Boom, the Baby Bust, and the Housing Market. *Regional Science and Urban Economics,* 19 (2)**,** p.235-258.

Neutze, M. (1987) The Supply of Land for a Particular Use. *Urban Studies,* 24 (5)**,** p.379-388.

Ng, M. K. and Tang, W. S. (1999) Land-use Planning in 'One Countrym Two Systems': Hong Kong, Guangzhou and Shenzhen. *International Planning Studies,* 4 (1)**,** p.7-27.

Nissim, R. (1998) *Land administration and practice in Hong Kong,* Hong Kong, Hong Kong University Press.

Peng, R. and Wheaton, W. C. (1994) Effects of Restrictive Land Supply on Housing in Hong Kong: An Econometric Analysis. *Journal of Housing Research,* 5 (2)**,** p.263-291.

Perterson, G. E. (2006) *Land Leasing and Land Sale as an Infrastructure-Financing Option*, World Bank Policy Research Working Paper 4043.

Phillips, R. S. (1988) Residential Capitalization Rate: Explaining Inter-Metropolitan Variation, 1974-1979. *Journal of Urban Economics,* 23 (3)**,** p.278-290.

Rating and Valuation Department. (1991-2005) *Hong Kong Property Review*, Hong Kong: Government Printer.

Roback, J. (1982) Wages, Rents and the Quality of Life. *Journal of Political Economy,* 90 (6)**,** p.1257-1278.

Schiffer, J. R. (1991) State Policy and Economic Growth: A Note on the Hong Kong Model. *International Journal of Regional Research,* 15 (2)**,** p.180-196.

Suen, M. M. Y., Shi, W. C., Fung, K. K., Lau, K. Y. & Hong Kong Policy Research Institute Limited. (2003) The Housing Policy for Hong Kong's Future. IN PUN, P. K. S. & CHEUNG, H. H. P. (Eds.) *Policy Bulletin.* Hong Kong, Hong Kong Policy Research Institute Limited.
Available at: http://www.hktdc.com/econforum/hkpri/hkpri030201.pdf. [assessed on 25 February 2008]

Tsang, D. (2006) Big Market, Small Government. Hong Kong.

Tse, R. Y. C. (1996a) Housing Return and the Determinants of the Capitalization Rate: With Reference to Hong Kong. *Journal of Property Research,* 13**,** p.115-129.

Tse, R. Y. C. (1996b) Mortgage Default Risk and Lending Policy - A Study of Mortgage Lending in Hong Kong. *Australian Land Economic Review,* 2(2), p.12-17 .

Tse, R. Y. C. (1998) Housing Price, Land Supply and Revenue from Land Sales. *Urban Studies,* 35 (8)**,** p.1377-1392.

Tse, R. Y. C., Ho, C. W. and Ganesan, S. (1999) Matching Housing Supply and Demand: An Empirical Study of Hong Kong's Market. *Construction Management and Economics,* 17 (5)**,** p.625-633.

Tse, R. Y. C. and Webb, J. R. (2004) Hong Kong Housing and the Asian Financial Crisis. *Journal of Real Estate Literature,* 12 (1)**,** p.21-32.

Whitehead, C. M. E. (1974) *The UK Housing Market: An Econometric Model.* London, Saxon House.

Wong, G. (2004) Has SARS Infected the Property Market? Evidence from Hong Kong. The Warton School, University of Pennsylvania.

Wong, J. T. Y., Hui, E. C. M. and Seabrooke, W. (2003) The Impact of Interest Rate upon Housing Prices: An Empirical Study of Hong Kong's Market. *Property Management,* 21 (2)**,** p.153-170.

Wong, J. T. Y., Hui, E. C. M., Seabrooke, W. and Raftery, J. (2005) A Study of the Hong Kong Property Market: Housing Price Expectations. *Construction Management and Economics,* 23 (7)**,** p.757-765.

Xiao, Q. and Tan, G. K. R. (2007) Signal Extraction with Kalman Filter: A Study of the Hong Kong Property Price Bubbles. *Urban Studies,* 44 (4)**,** p.865-888.

Yiu, C. Y. and Hui, C. M. (2005) An Empirical Study of the Impact of Income Uncertainty on Private Residential Property Markets in Singapore and Hong Kong. *Housing Studies,* 20 (5)**,** p.753-769.

Yu, K. H. and Wong, T. C. (2007) Ten Years Since the Handover - Fluctuation of Residential Land Price. *Surveyors Times.* Hong Kong, Hong Kong Institute of Surveyors.

Yung, B. (2007) An Interplay between Western and Confucian Concept of Justice: Development of Hong Kong Housing Policy. *Housing, Theory and Society,* 24 (2)**,** p.111-132.

Appendix I - Data for the Variables in the Regression Equation

Time t	Real Housing Price	Real Income	Ratio of Housing Stock per Potential Household in Private Market	Real Interest Rate - Change in Price Appreciation	Seasonally adjusted unemployment	Real Housing Price at t-4	Current Land Sale	4-Quarter Lagged Land Sales	8-Quarter Lagged Land Sales	12-Quarter Lagged Land Sales
t	P_t	Y	$STK_v/(H-STK_p)$	INT-PA	U	P_{t-4}	LS	LS_{t-4}	LS_{t-8}	LS_{t-12}
Jan-91	60.86	12,883.44	1.07	0.0146	0.016	56.39	754,400.00	328,979.95	936,271.50	598,594.00
Apr-91	66.59	11,890.61	1.07	0.0084	0.019	56.53	52,450.00	79,472.80	3,168.00	0
Jul-91	76.07	11,962.83	1.09	0.0378	0.018	57.85	267,669.00	53,600.00	283,801.40	64,244.60
Oct-91	83.66	12,000.00	1.10	0.0159	0.019	59.35	580,809.60	296,407.00	159,895.00	451,635.00
Jan-92	87.67	13,215.86	1.12	-0.0031	0.022	60.86	725,073.90	754,400.00	328,979.95	936,271.50
Apr-92	93.64	11,866.24	1.13	-0.0045	0.019	66.59	129,261.00	52,450.00	79,472.80	3,168.00
Jul-92	94.56	11,940.30	1.15	0.0058	0.016	76.07	11,814.60	267,669.00	53,600.00	283,801.40
Oct-92	89.46	12,004.18	1.13	0.0001	0.024	83.66	451,760.80	580,809.60	296,407.00	159,895.00
Jan-93	85.70	13,595.17	1.13	-0.0020	0.021	87.67	869,760.50	725,073.90	754,400.00	328,979.95
Apr-93	90.13	12,673.27	1.13	-0.0074	0.018	93.64	57,450.00	129,261.00	52,450.00	79,472.80
Jul-93	96.07	12,757.61	1.16	0.0096	0.019	94.56	58,384.00	11,814.60	267,669.00	53,600.00
Oct-93	94.81	13,056.09	1.15	-0.0124	0.021	89.46	89,643.50	451,760.80	580,809.60	296,407.00
Jan-94	106.61	14,164.31	1.15	0.0136	0.019	85.70	605,566.00	869,760.50	725,073.90	754,400.00
Apr-94	108.12	13,055.56	1.15	-0.0009	0.015	90.13	237,245.00	0	129,261.00	52,450.00
Jul-94	106.75	13,812.15	1.15	0.0132	0.023	96.07	84,665.20	115,834.00	11,814.60	267,669.00
Oct-94	104.05	13,686.13	1.14	0.0162	0.020	94.81	146,950.00	89,643.50	451,760.80	580,809.60
Jan-95	102.10	15,510.95	1.15	0.0367	0.025	106.61	678,793.40	605,566.00	869,760.50	725,073.90
Apr-95	98.34	13,458.11	1.13	0.0167	0.029	108.12	110,326.50	237,245.00	0	129,261.00
Jul-95	92.17	13,780.92	1.15	0.0261	0.037	106.75	160,816.50	84,665.20	115,834.00	11,814.60
Oct-95	89.40	13,675.96	1.13	0.0290	0.037	104.05	336,452.00	146,950.00	89,643.50	451,760.80
Jan-96	94.47	15,625.00	1.13	0.0375	0.029	102.10	967,083.80	678,793.40	605,566.00	869,760.50
Apr-96	95.81	14,008.44	1.08	0.0133	0.029	98.34	0	0	237,245.00	0
Jul-96	97.85	14,501.26	1.08	0.0420	0.026	92.17	79,707.00	160,816.50	84,665.20	115,834.00

Time t	Real Housing Price	Real Income	Ratio of Housing Stock per Potential Household in Private Market	Real Interest Rate - Change in Price Appreciation	Seasonally adjusted unemployment	Real Housing Price at t-4	Current Land Sale	4-Quarter Lagged Land Sales	8-Quarter Lagged Land Sales	12-Quarter Lagged Land Sales
t	P_t	Y	$STK_v/(H-STK_p)$	INT-PA	U	P_{t-4}	LS	LS_{t-4}	LS_{t-8}	LS_{t-12}
Oct-96	104.84	14,681.89	1.08	0.0201	0.025	89.40	313,649.00	336,452.00	146,950.00	89,643.50
Jan-97	125.16	16,353.23	1.06	0.0404	0.023	94.47	488,175.70	967,083.80	678,793.40	605,566.00
Apr-97	132.72	14,297.06	1.06	0.0300	0.022	95.81	96,255.50	0	0	237,245.00
Jul-97	134.44	15,067.41	1.07	0.0433	0.021	97.85	41,563.10	79,707.00	160,816.50	84,665.20
Oct-97	126.69	15,175.10	1.07	0.0759	0.022	104.84	328,886.25	313,649.00	336,452.00	146,950.00
Jan-98	110.41	15,573.12	1.06	0.0920	0.033	125.16	156,477.90	488,175.70	967,083.80	678,793.40
Apr-98	97.65	13,693.27	1.06	0.0648	0.043	132.72	294,559.00	96,255.50	0	0
Jul-98	81.82	14,048.93	1.06	0.1112	0.052	134.44	698,415.50	41,563.10	79,707.00	160,816.50
Oct-98	79.50	13,492.06	1.06	0.1204	0.059	126.69	0	328,886.25	313,649.00	336,452.00
Jan-99	83.40	14,646.05	1.07	0.0830	0.063	110.41	0	156,477.90	488,175.70	967,083.80
Apr-99	83.52	14,274.06	1.06	0.0866	0.061	97.65	244,814.10	294,559.00	96,255.50	0
Jul-99	83.11	14,166.67	1.07	0.1168	0.063	81.82	253,673.30	698,415.50	41,563.10	79,707.00
Oct-99	79.85	14,249.79	1.08	0.0784	0.063	79.50	217,860.80	0	328,886.25	313,649.00
Jan-00	81.66	15,780.59	1.10	0.0958	0.056	83.40	482,936.40	0	156,477.90	488,175.70
Apr-00	76.65	15,148.94	1.10	0.0799	0.051	83.52	280,745.58	244,814.10	294,559.00	96,255.50
Jul-00	75.16	15,490.53	1.11	0.0786	0.048	83.11	108,025.00	253,673.30	698,415.50	41,563.10
Oct-00	73.32	15,679.44	1.10	0.0630	0.044	79.85	356,318.00	217,860.80	0	328,886.25
Jan-01	70.37	17,028.67	1.11	0.0667	0.045	81.66	40,335.00	482,936.40	0	156,477.90
Apr-01	70.67	15,665.80	1.12	0.0394	0.045	76.65	21,680.00	280,745.58	244,814.10	294,559.00
Jul-01	68.98	15,789.47	1.12	0.0401	0.052	75.16	17,375.22	108,025.00	253,673.30	698,415.50
Oct-01	65.06	14,912.28	1.12	0.0460	0.063	73.32	26,846.04	356,318.00	217,860.80	0
Jan-02	65.86	16,071.43	1.12	0.0551	0.070	70.37	51,240.00	40,335.00	482,936.40	0
Apr-02	64.58	15,116.28	1.12	0.0328	0.075	70.67	275,168.60	21,680.00	280,745.58	244,814.10
Jul-02	62.34	14,986.38	1.13	0.0313	0.073	68.98	23,366.10	17,375.22	108,025.00	253,673.30
Oct-02	60.00	15,023.04	1.14	0.0288	0.074	65.06	0	26,846.04	356,318.00	217,860.80
Jan-03	59.02	15,710.25	1.15	0.0233	0.075	65.86	0	51,240.00	40,335.00	482,936.40

Time t	Real Housing Price	Real Income	Ratio of Housing Stock per Potential Household in Private Market	Real Interest Rate - Change in Price Appreciation	Seasonally adjusted unemployment	Real Housing Price at t-4	Current Land Sale	4-Quarter Lagged Land Sales	8-Quarter Lagged Land Sales	12-Quarter Lagged Land Sales
t	P_t	Y	$STK_v/(H-STK_p)$	INT-PA	U	P_{t-4}	LS	LS_{t-4}	LS_{t-8}	LS_{t-12}
Apr-03	57.31	14,367.82	1.14	0.0312	0.085	64.58	0	275,168.60	21,680.00	280,745.58
Jul-03	57.85	15,024.39	1.13	0.0512	0.082	62.34	0	23,366.10	17,375.22	108,025.00
Oct-03	62.98	15,166.34	1.14	-0.0091	0.075	60.00	0	0	26,846.04	356,318.00
Jan-04	72.51	15,763.55	1.14	0.0037	0.072	59.02	0	0	51,240.00	40,335.00
Apr-04	76.74	15,407.55	1.14	0.0103	0.067	57.31	181,445.50	0	275,168.60	21,680.00
Jul-04	78.51	15,741.68	1.14	0.0194	0.067	57.85	0	0	23,366.10	17,375.22
Oct-04	84.12	15,842.58	1.14	0.0001	0.066	62.98	228,427.50	0	0	26,846.04
Jan-05	90.17	16,349.05	1.14	0.0204	0.060	72.51	0	0	0	51,240.00
Apr-05	94.25	15,952.14	1.14	0.0209	0.057	76.74	0.00	181,445.50	0	275,168.60
Jul-05	93.75	16,032.06	1.16	0.0318	0.054	78.51	160,539.00	0	0	23,366.10
Oct-05	89.95	15,968.06	1.16	0.0321	0.052	84.12	0.00	228,427.50	0	0