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THE UNIVERSITY OF HONG KONG

AN EMPIRICAL STUDY OF THE EFFECTS OF UNAUTHORIZED BUILDING WORKS ON THE PROPERTY PRICES OF RESIDENTIAL BUILDINGS 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
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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: _____

Name: _____

Date: _____

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Abstract

Existence of Unauthorized Building Works (UBWs) has long been a problem in buildings in Hong Kong. Although the problem has widely been publicized and the Government has put a lot of effort and resources in addressing the issue in recent years, the problem still needs a long time to be completely resolved.

The issue of UBWs has been studied by many scholars. Most of them focus on the reasons of existence, determinants of the number of UBWs and the control and enforcement policy of the Buildings Department in solving the problem. Yet, no research has been conducted in the economic perspective of the problem of UBWs and specifically in the relationship between existence of UBWs and property prices.

In this research, two hypotheses are established to study the effect of UBWs on property price. Hedonic price model and regression analysis are adopted. Based on literature reviews and real-life observations, three models are built: two models aim to test the effect of the existence of UBWs on property price; another model focuses on the effect of the amount of UBWs on property price.

Empirical results suggest that the existence of Unauthorized Building Works is a significant factor affecting the property price of residential properties but the actual amount of UBWs is statistically insignificant on property price determination. The results provide insight for the reasons of property owners not having incentives to demolish illegal structures in their properties.

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Chapter 1

Introduction

1.1 Background of Research

Hong Kong is renowned to be a densely-populated city. With her small size but high population, most people live in multi-storey buildings. In the 1960's, the continuous population growth and huge influx of immigrants from mainland China increased the demand for low cost housing and resulted in a housing problem. As the supply was short, people sought means to increase space and facilities in order to improve their living environments. One of the ways is to build unauthorized structures on rooftops or attaching to external walls and canopies. Furthermore, the lack of control gave rise to the proliferation of such unauthorized building works (UBWs) in Hong Kong.

The problem of UBWs has long been besetting the Government. In 1966, the Control and Enforcement Section of the Buildings Ordinance Office[1] was formed to investigate the problem of illegal alterations to existing buildings (Yiu *et al.*, 2004). Then in the later years, there were policies and actions adopted to enforce the removal of UBWs.

[1] BOO, the present Buildings Department

However, due to limited resources, the problem of UBWs remains a great challenge to the Government.

UBWs not only aggravate deterioration of buildings and pose structural and fire safety risks in buildings, but also cause hygiene problems and environmental nuisance to the building environment (living environment in domestic buildings). This is proved by 20 people's lives and 135 injuries claimed by UBWs associated problems, including collapses of illegal structures or building structures with UBWs attached and fire tragedies in illegal structures, from 1990 to 2002 (Yiu *et al*., 2004). These tragedies again aroused Government and public concern.

The Buildings Department on one hand publicized the problem and promoted voluntary removal of UBWs. On the other hand, it conducted a series of large-scale "blitz" clearance operations since 2001. In 2001, the Buildings Department estimated that there were approximately 800,000 illegal structures in 60,000 private buildings in Hong Kong (Audit Commission, 2003). According to the Government statistics, over 255,000 UBWs[2] have been removed from the year 2000 to 2006 (Buildings Department, 2007; Hong Kong Government, 2000, 2001, 2002, 2003, 2004 and 2005). However, there is also an estimated 10,000 new UBWs to be undertaken every year (Ming Pao Daily, 2000).

[2] Details refer to Table 1.1 No. of UBWs removed from 2000 to 2006

As a result, approximately 600,000 illegal structures still exist by 2007 and it remains to be a serious problem. In view of the situation, apart from prohibiting constructions of new UBWs by legislation and removing existing UBWs by carrying out clearance operations or issuing removal orders to spotted targets, it is suggested that the Government should also put more effort in educating the public and promoting voluntary removal of UBWs. An effective way is to provide incentives for the property owner to demolish UBWs on their own initiative.

Year	UBWs removed
2000	18297
2001	20647
2002	37923
2003	49556
2004	41219
2005	49365
2006	48479
Total:	256477

Source: Buildings Department (2007); Hong Kong Government (2000, 2001, 2002, 2003, 2004 and 2005)

Table 1.1: No. of UBWs removed from 2000 to 2006

UBWs not only exist in domestic buildings but the problem of UBWs in residential buildings is most serious and worth concern as it is an issue of safety and hygiene of one's living environment. And in this dissertation, focus will only be put on the problem in residential buildings in Hong Kong.

The price of a residential property indicates the satisfaction of the property to the buyer. As discussed in many literatures, residential property price does not only reflect the structural factors of the property. It is also determined by different environmental factors, which reflect the conditions of the property or its surrounding environment. These environmental factors include the location, the view, the physical condition and the neighbouring facilities. These factors can be interpreted as the convenience, enjoyment, safety and hygiene of the living environment for the occupier(s) of the residential property. As UBWs have unfavourable effects on the safety and hygiene condition of properties, it is likely to be a factor affecting buyer's decision when purchasing property. Therefore, it is reasonable to suspect that the existence of UBWs has an effect (an adverse effect) on the property price. Furthermore, the legal responsibilities of owner of property with UBW(s) and any possible costs which may be entailed and to be paid by the owner also bring about the aforementioned doubt.

A number of modern literatures have focused on the causes, the current situation of and the remedy for the problem of UBW. Yet, people seldom pay attention to the effects of the problem, this is also a reason for people not demolishing UBWs proactively. The author is interested in the economic implications of illegal structures. In this dissertation, therefore, the author would like to look at the effect of UBWs on the market and to affirm

the adverse impact on property price brought along by the existence of UBWs in residential buildings in Hong Kong.

1.2 Research Questions

As said, the problem of UBWs in Hong Kong has lasted for a long time and needs to be tackled with different strategies at the same time. It is suspected that existence of UBWs in residential buildings would affect buyer's decision in purchasing property. In this research, the following questions will be investigated:

1. Is the existence of unauthorized building works a factor affecting the property price of residential buildings in Hong Kong?
2. What is the significance, if any, of the existence of unauthorized building works on the property price of residential buildings in Hong Kong?
3. What is/are the reason(s) for this factor affecting or not affecting the property price of residential buildings in Hong Kong?

1.3 Research Objectives

The aim of this dissertation is to explicate any effect of the existence of UBWs in a building on the property price of residential buildings in Hong Kong. Due to the constraints of time and resources, buildings targeted in the research are confined to residential buildings within a selected area in North Point. Three objectives are formulated as follows:

1. To discover any effect of the existence of unauthorized building works on the property price of residential buildings in Hong Kong.
2. To investigate the significance of the effect of the existence of unauthorized building works on the property price of residential buildings in Hong Kong.
3. To identify the reason(s) for the existence of unauthorized building works affecting or not affecting the property price of residential buildings in Hong Kong.

1.4 Significance of Research

The problem of UBWs existed for decades in Hong Kong. UBWs are structures constructed without the approval and consent from the Building Authority and are illegal.

They may be unsafe and may affect the safety of buildings and hygiene of the building environment. Consequences of the existing of UBWs in buildings can be grievous or even mortal. Therefore, tackling the problem of UBWs is the front burner of the Government and cannot be delayed.

In order to deal with the problem, actions are executed in two directions, to cease the construction of new UBWs and to demolish existing UBWs. There are two methods in performing these two actions, one is by implementing laws and orders and strong policies (to prohibit construction of new UBWs, to carry out clearance operations to "clean" targeted buildings or to issue orders to force property owners to remove UBWs attached to their properties). Yet, the facts proved that this is not sufficient in tackling the problem. The other method is by education and promotion, i.e. to publicize the adverse impact of UBWs such as the safety and hygiene problem caused and the possible legal responsibilities and costs that may incurred and citizens may bear. In other words, to demonstrate the bad effects of UBWs which property owners may want to avoid, which serve as incentives that lure them to participate in the removal policy voluntarily, to remove existing UBWs or not to construct any new illegal structures.

People usually only care about one's own interests. By demonstrating the adverse

effects of the existence of UBWs on the property price of residential buildings in Hong Kong, which means affecting one's interests, it is expected to give insight into the incentives of property owners to take voluntary actions to demolish illegal structures. This is the author's intention to focus on affirming the said question in this dissertation.

1.5 Delineation of Terms in the Research

In this dissertation, the following terms are delimited by the author to suit the scope and intended achievements of the study.

1.5.1 Residential Buildings

"Building" is broadly defined by legislation and is generally understood to be a structure which is constructed for human habitation. Buildings can be classified as domestic and non-domestic buildings. Under this classification, "residential buildings" are domestic buildings which refer to buildings that are intended and suitable for living purpose.

In this dissertation, residential buildings under consideration only refer to multi-storey apartment buildings which are occupied by more than one household. Houses which are

occupied by single household are excluded but low-rise single-staircase buildings which house more than one household are included. This is based on the belief that the problem of UBWs mostly exist in multi-storey apartment buildings as space in such buildings is usually limited.

1.5.2 Unauthorized Building Works (UBWs)

Unauthorized building works (UBWs) mentioned in this dissertation only refer to those attached to external envelop of buildings, i.e. the external wall and rooftop. The reasons for this limitation is that most UBWs are rested on the external envelop of buildings and they are easily observable and accessible from the outside of the buildings. Also, UBWs on external wall and rooftop mainly contribute to the structural and fire safety and building hygiene problems.

1.5.3 Existence of Unauthorized Building Works

In this paper, the "existence of UBWs" has 2 different definitions in different models. A property is described as with "the existence of UBWs in building" means that the residential building in which the considered property located has UBWs attached to it.

Further, if the ratio of the number of UBWs to the number of units in that building is larger than or equal to 1, then each individual property in that building is defined as property with “the existence of UBWs in individual property”

1.5.4 Property price

“Property price” of residential buildings used in this dissertation is referred to the adjusted transaction price of concerned residential properties. The actual transaction price is recorded in the Economic Property Research Center (EPRC) data base. Adjustment is by using the price indices published by the Rating and Valuation Department according to the transaction date and size class of each transaction.

1.6 Outline of Research

In this dissertation, there are all together five chapters.

Chapter 1 is **Introduction**. Background information, structure and objectives of this dissertation are included.

Chapter 2 is **Literature Review**. It contains literature about the problem of unauthorized building works (UBWs), relevant legislation dealing with UBWs, how existence of UBWs relate to property price of buildings and also literature on hedonic price model.

Chapter 3 is **Hypotheses, Data and Methodology**. It introduces the proposed hypotheses, the data and the research methodology used. Hypotheses are drawn bases on real-life observations. The selection of variables and establishment of research models are also given in this chapter.

Chapter 4 is **Research Findings and Discussions**. Actual statistical results and research findings will be illustrated. Interpretation and discussions of the findings will also be presented.

Chapter 5 is **Conclusion**. It summarizes the results and implications of this dissertation. Limitations of the research and areas for further study are also discussed.

Chapter 2

Literature Review

2.1 Introduction

In this chapter, literature on unauthorized building works (UBWs), residential property price determinants and hedonic price model will be reviewed. The author aims at providing some insights and background knowledge about the dissertation topic – the problem of UBWs and factors affecting residential property price, and the methodology – hedonic price model, through the review of previous research and study. Section 2.2 focuses on UBW. In this section, the definition and categories of UBWs, reasons for the existence, the effects, legislations, policies and liabilities of property owners on UBWs will be included. In section 2.3, the hedonic price model will be introduced. Section 2.4 presents some residential property price determinants studied in previous studies.

2.2 Unauthorized Building Works

Unauthorized building works (UBWs) has been proliferated for a long time. UBWs

become common features on older buildings and can be seen everywhere in Hong Kong. They cause safety and other problems not only to buildings, but also to the general public. The problem of UBWs ought to be addressed by all means before the situation gets worse.

2.2.1 Definition of UBWs

There is not a statutory definition for the term "unauthorized building work". The term is not even mentioned in any Hong Kong Ordinance except in Schedule 1 of the Construction Workers Registration Ordinance (Cap. 583)[3]. In which, unauthorized building works expressively mean the *"buildings or building works in contravention of the Buildings Ordinance (Cap 123) within the meaning of that Ordinance"*. Actually UBW is only a term commonly used by both the Government (the Buildings Department) and the general public, including professionals.

"Building" and "building works" are very broadly defined under Section 2 of the Buildings Ordinance (Cap.123)[4] (Davison, 1990; Yiu and Yau, 2005). "Building" is considered as a structure of considerable size, intended to be permanent or to endure for a considerable time while "building works" virtually include any form of construction.

[3] Construction Workers Registration Ordinance, Chapter 583, Laws of Hong Kong
[4] Buildings Ordinance, Chapter 123, Laws of Hong Kong

Under Section 14 of the Buildings Ordinance (BO), no building works can be commenced or carried out without prior approval of building plans and consent for commencement in writing from the Building Authority[5]. Any building works, except those exempted by Section 41 of the BO, contravening the requirements in Section 14 are regarded as illegal and are commonly known as "illegal structures" or "unauthorized building works" (UBWs), as used in this dissertation.

Building works which are exempted from Section 14 of the BO and can be carried out without prior approval and consent from the Building Authority are specified in Section 41 of the BO. As summarized by Lai (2003), such building works include:

i. buildings belonging to the Government;

ii. buildings belonging to any person representing the People's Liberation Army;

iii. buildings controlled and managed by the Housing Authority under the Housing Ordinance (Cap. 283)[6];

iv. street or access road maintained by the Government;

v. drainage works, ground investigation or site formation works which does not affect the structure; and

[5] Building Authority means the Director of Buildings as defined in Section 2 of the Buildings Ordinance.
[6] Housing Ordinance, Chapter 283, Laws of Hong Kong

vi. building works of a non-structural nature or which do not contravene any regulation.

2.2.2 Categories of UBWs

UBWs, as defined in the previous section, refers to any form of building works constructed contravening the BO. They include different kinds of structures. The commonly seen illegal structures around Hong Kong summarized by Davison (1990) are:

i. Rooftop structures and yard structures. These range from squatter huts to exclusive penthouses;

ii. Steel cages and other projections from the face of a building;

iii. Alterations to means of escape;

iv. Subdivision of approved units in multi-storey residential and industrial buildings; and

v. Unauthorized changes of use which may or may not include illegal structures.

As time pass by, the common forms of illegal structures in Hong Kong changed, though, slightly. UBWs are classified into three broad types in functional terms by Lai and Ho

(2001) as follows:

i. Type 1: advertisement sign boards projecting from external walls or resting on rooftops and satellite discs for television and mobile phones.

ii. Type 2: improvised measures to enhance the amenities of property, such as canopies above windows, flower racks.

iii. Type 3: structures to create space for human habitation.

And by Leung and Yiu (2004), the common examples of UBWs in Hong Kong include:

i. Cages, canopies, metal flower racks and any projection from the external wall of a building;

ii. Canopies and structures that project over government land, pavements, or lanes;

iii. Structures on rooftops, flat roofs, yards, or light wells and

iv. Metal supporting frames for air-conditioning plants and cooling towers.

There are different types and forms of UBWs existing inside and outside of buildings in Hong Kong, yet, this study only focus on and deal with those attached to the envelop of buildings which can be easily seen from the outside of the buildings. They include:

i. Solid canopy;

ii. Light weight canopy projecting by exceeding 500 mm;

iii. Light weight canopy projecting by less than 500 mm;

iv. Solid extension;

v. Flower rack;

vi. Drying rack;

vii. Metal frame;

viii. Air-conditioning frame (with a/c in use);

ix. Metal cage;

x. Advertisement sign (in domestic portion); and

xi. Rooftop structure.

The sum of the numbers of these components attached to the envelope of the buildings is the total number of UBWs of the buildings and will be used to calculate the ratio of number of UBWs to number of units in buildings. The ratio then determines the value of the dummy variable in the hedonic price model in this dissertation.

2.2.3 Reasons for the Existence of UBWs

As mentioned in Chapter 1, the housing deficiency resulted by the population growth and influx of immigrants in the 1960's, was the initiative for people to construct UBWs to

increase space and facilities in one's property. Lai and Ho (2001) explain the incentives for building illegal structures on private property. It is explained that the mismatch between architectural design and actual needs of inhabitants and the hunger for urban space of the population in Hong Kong are the underlying rationales for the incentive to build illegal structures to enhance amenities in private property in urban areas and the incentive is described as largely economic.

Li (2003) further investigates the existence of UBWs from an economic perspective and analyzes it under the demand-supply paradigm. It is shown that the existence of UBWs in premises is an economic consequence, can be explained by the law of demand and the number of UBWs constructed can be determined by the market through demand and supply forces. The underlying principle is that UBWs are economic goods and they may generate services and additional space for property owners. Therefore, owners will build unauthorized structures until reaching the point that the marginal cost of production (cost of construction of UBW) equals to the marginal revenue generated (value of services or additional space produced) by that unit of UBW. That is, as proved by Li (2003), owners will construct UBW to capture any monetary or non-monetary marginal benefit and maximize their utility level.

Usually safety problems brought by UBW would not be observed immediately after the construction of the UBW. Therefore, people may not know the possible drawbacks of UBWs or neglect them when deciding to construct UBWs. And they would not know the seriousness of the consequences until accidents actually happen.

2.2.4 Effects of UBWs on Residential Buildings

As mentioned in previous chapter, UBWs aggravate deterioration of buildings, pose structural and fire safety risks in buildings and cause hygiene problems and nuisance to the living environment in residential buildings. As UBWs are constructed without approval and consent from the Building Authority, their design and structure may not be sound and the construction may not be properly carried out. This poses risks of structural failure and falling of the UBWs. Consequences of falling of a small piece of objects, such as a debonded mosaic tile from the external wall, from a normal high-rise residential building consisting of 20 to 40 storeys would even be fatal (Leung and Yiu, 2004), let alone the consequences of accidents caused by any UBWs.

Apart form the fact that UBWs are unauthorized, Lai and Ho (2001) comment that they are problematic. Lai and Ho mention four implications of the presence of unauthorized

structures on safety and conditions of the buildings, including:

i. *Loading implications* – The presence of UBWs is a source of hazards for Hong Kong. UBWs add to the loading of buildings. Any failure and collapse of building structures (authorized or otherwise) due to illegal alteration or addition is hazardous in a high-rise and high-density built environment and is possible to cause fatal accidents.

ii. *Fire risk implications* – UBWs may create potential fire loads or obstruct "means of escape" (MOE) requirements under the Building Ordinance. Thus, fire hazards for users of the property and the public may be created, difficulties in fire fighting and rescue may be rendered when fires break out in the building.

Rooftop structures, especially in single-staircase buildings, imply highest fire risks to buildings. When fire breaks out in a building with rooftop structures, occupants would have no means to escape to the rooftop and wait for rescue.

iii. *Visual and aesthetics implications* – UBWs are illegal and are usually visually inconsistent with the original design and appearance of the building. This makes the building look untidy and aesthetically unpleasant. Occupants of the building or neighbouring buildings would

be affected and unsatisfied with the situation and this may be an incentive for them to complain to the Building Authority.

iv. *Lighting and ventilation* – UBWs projecting from the external walls such as canopies and hanging iron cages may obstruct natural lighting and ventilation. It is particularly relevant in office and residential buildings in which "prescribed windows", which are required to face into a space uncovered and unobstructed vertically, have to be provided to habitable rooms. Unauthorized projections would block natural lighting and ventilation and infringe the requirement for windows below them.

Apart from safety and conditions of buildings, health and hygiene of building environment are also affected by the existence of UBWs. For example, air-conditioning cooling towers cause noise nuisance, exhaust ducts from restaurant kitchens or chimneys cause air pollution (Buildings Department, 1999). According to the Buildings Department[7], UBWs not only constitute structural or fire risks endangering the safety of life or property, but also constitute health nuisance or cause inconvenience to the public and lead to deterioration of the environment. For instance, UBWs may cause water seepage and obstruction to light and air, unauthorized discharge of trade effluents may pollute watercourses and rubbish may accumulate on UBWs. These all cause hygienic

[7] Buildings Department: http://www.bd.gov.hk

problems in the buildings and occupants' health may be affected. Exacerbation of the situation will contribute to the degeneration of an area into a slum.

Furthermore, UBWs often obstruct the daily maintenance work as well as major repairs to a building and render good building management difficult. Unauthorized structures erected on the exteriors and flat roofs of buildings often hinder the repairs and maintenance to the exterior and drainage system of buildings as many components of the drainage system are made inaccessible by these UBWs (Chan, 2004).

In addition, there are monetary impacts by the existence of UBWs. According to Chan (2004), UBWs would give rise to disputes among the co-owners. Tedious and expensive legal proceedings are often resorted in dealing with such disputes. On the other hand, UBWs deteriorate buildings. Cost of deferred inspection, repairs and maintenance are much higher when the building is getting older. Moreover, in case UBWs cause injuries or even fatal accidents, owners would have to pay for any induced compensation in addition to any repairing costs. Thus, UBWs may pose economic loss other than those physical effects on the buildings.

2.2.5 Legislation on UBWs

In Hong Kong, the duty of the Buildings Department is to supervise all existing and new buildings in the private sector and the matters related to these buildings. The Building Authority (BA) is empowered by the BO to ensure the minimum required standards of safety, health and environment (Yiu and Yau, 2005). UBWs in buildings are within the scope of supervision of the Buildings Department. There are provisions in the BO that define UBWs and empower the BA to take action against UBWs.

2.2.5.1 Buildings Ordinance

The Buildings Ordinance (Cap.123) regulates the planning, design and construction of buildings and associated works, makes provision for the rendering safe of dangerous buildings and land and for any matters connected with buildings and land.

For new buildings or building works, all building works have to be approved and consent has to be obtained from the BA before commencing, as mentioned in earlier section. In case of a newly constructed private building, it has to be inspected by the Buildings Department after completion of construction under the ordinance, to ensure that the

building is built in compliance with stipulations and requirements. Occupation permits for that building can then be issued to the developer if all conditions are fulfilled.

For existing buildings, though there is a Mandatory Building Inspection Scheme under discussion, there is no enforceable requirement laid down in the BO, requiring regular building inspection at present. The Buildings Department can only take enforcement action against dangerous or defective buildings and buildings works and take the role to promote regular maintenance of buildings.

2.2.5.2 Section 24 and Section 26 of Buildings Ordinance

Under Section 24 and Section 26 of the BO, the BA is empowered to serve orders on owners of buildings, building works or street works which are in contravention of any of the provisions of the ordinance to require the demolition or alteration such buildings or building works. Dangerous buildings, defective buildings and buildings or building works which will cause, or will be likely to cause, a risk of injury to any person or damage to any property are also bound in these two sections. The BA is also empowered to serve removal orders on owners of such buildings or building works. Owners receiving such orders are required to resume their properties to the status as approved by

the Authority or subject to the satisfaction of the BA. The time limit for the commencement and completion of the demolition or alteration work is also specified in the BO.

Section 24B empowers the BA to conduct ratifying works without serving an order to owners. This facilitates the BA to handle dangerous or risky buildings or building works which are detrimental to life and property (Li, 2003). Section 24C empowers the BA to issue notice in writing for any building works in contravention of any provisions in the BO and serve on the owner of the land or premises. It is also stated that such notice shall be deemed to be an instrument affecting land or premises and shall be registered in the Land Registry.

Once an order or notice is registered in the Land Registry, any transaction of the premise is forbidden. Not until the subject building or building works has been demolished or altered to comply with the provisions in the BO, the BA may lodge in the Land Registry an appropriate instrument of satisfaction against that notice. Where the order made under Section 24 is made on an unauthorized structure erected in the common area of a building, the title of all units within the building are affected, until the order has been complied with (Lai and Ho, 2001).

2.2.6 Policies of the Buildings Authority towards UBWs

The proliferation of the UBW problem hinders the BA from taking action against all of them at the same time. The BA adopted a pragmatic approach in its action against UBWs in the form of a policy of "toleration" in respect of the priority of clearing illegal structures in 1975. Priority is given to action against UBWs where they pose a hazard to lives and properties and are under construction when a complaint was received or a building was inspected. Under the BA's policy, UBWs are classified into a high priority group and a low priority group. For UBWs in the high priority group, enforcement action shall be taken as a matter of urgency. Otherwise, enforcement action may be deferred. (Lai and Ho, 2001)

The policy was then revised in 1988 and priorities were refocused on the removal of imminent danger, new items and environmental nuisances. Apart from the priority policy, the Buildings Department also implemented some actions to deal with the problem of UBWs, including:

i. Introducing the Building Safety Improvement Loan Scheme to provide financial support to property owners in 1998;

ii. Increasing the number of staff members in the Control and Enforcement

Section of the Buildings Department greatly;

iii. Outsourcing contracts for inspecting unauthorized building works to private companies;

iv. Undertaking "Blitz" UBW clearance operations; and

v. Issuing "Guidelines for the removal of typical Unauthorized Buildings Works and General Maintenance of External Walls" in 2000. (Yiu *et al.*, 2004)

In light of limited resource, the Authority ignores most of the non-approved structures. This discourages property owners to take an initiative role in demolishing the UBWs. As owners are normally reluctant to pay the cost of removal and will take no voluntary action unless removal orders are served. Some owners may appeal to the Building Appeal Tribunal or even resort to the judiciary system to decide and attempt to avoid the responsibilities. As a result, higher costs incurred.

The large-scale blitz clearance operations, increase of workforce and outsourcing of inspection and clearance operations are shown to be effective in increasing the rate of removing UBWs. However, evaluation of the investment in these actions shows that the average cost of inspecting UBWs is very high (Yiu *et al.*, 2004). Furthermore, results of the studies on the effectiveness of outsourcing inspection of UBWs are not positive.

Leung J.P.H. (2003) concludes that there is no apparent fact to show that outsourcing is more effective than in-house performance, while Wong (2004) suggests that deficiencies related to the consultants' experience of inspection work of UBW contribute to the reduction of efficiency and effectiveness of the operations. By the fact that numerous UBWs still exist, the policies of the BA against UBWs are insufficient and there are rooms for improvements.

2.2.7 Liabilities of Owners of Properties with UBWs

Owners should take the initiative to organize for the demolition of UBW in their premises. For UBW erected in the common areas of a building, the co-owners of the building should co-ordinate for demolishing the UBW.

As when order of removal is served to property owner requiring the demolition of any UBW in the premise, owners shall comply with the order and remove the UBWs within a specified period of time. It is a criminal offence to carry out unauthorized building works and to fail to comply with a statutory order. According to Section 40 of the BO, the maximum penalty for carrying out unauthorized building works (contravening Section 14(1) of the BO) is two years' imprisonment, a fine of $400,000 and a daily fine of

$20,000 while that for failing to comply with a statutory order issued by the BA under Section 24(1) of the BO is one year's imprisonment, a fine of $200,000 and a daily fine of $20,000. If owner does not comply with the order of removal nor appeals to the Building Appeal Tribunal, the BA is empowered to carry out the demolition work and the owner shall be liable to the cost of the demolition work.

In case accidents happen as a result of lack of management of the building, which include mismanagement of UBWs in the building, owners may be liable to pay damages. The amount of damages depends on the number of victims in the accident, their age and how much their earnings were when the accident happened which are beyond the control of the property owners and the amount may be as high as the price of several flats in the same building (Leung H.F., 2003).

2.3 Hedonic Price Model

Hedonic price model was first mentioned by Rosen (1974). He concludes that "when goods can be treated as tied packages of characteristics, observed market prices are comparable on those terms" and defines hedonic price as the implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products.

Value of a property is contributed by every characteristic in the tied package and the property price is the sum of the implicit prices of each characteristic given by the market. By using regression analysis, the implicit price of each attribute and the extent to which each attribute affects the property price can be estimated. In this dissertation, hedonic price model is adopted to investigate the effect of the existence of UBWs on the residential property price.

2.4 Determinants of Residential Property Price

Residential property price indicates the buyer's willingness to pay for the property. Property buyer is not simply paying for the property as a physical asset but paying for various housing attributes of the property. These attributes include the physical and structural factors of the property itself and also the external characteristics of the property. Housing attributes are categorized into three categories: locational, structural and neighbourhood attributes in previous studies (Butler, 1982; Mok *et al.*, 1995). Locational attributes include the accessibility to economic and social facilities, such as distance to public transportation terminal. Distance to MTR station is a commonly used attribute in relevant studies in Hong Kong. District in which the property is located is also taken into account as this reflects the distance from central business district.

Structural attributes include the basic descriptors of the properties such as the gross floor area (GFA), storey and age of building. Neighbourhood traits are about the quality of the neighbourhood. Health, hygiene and pollution of the neighbouring area can be considered as neighbourhood attributes. For the attribute being studied in this dissertation, the existence of UBWs, it seems there is no definite category. UBWs are attached to properties/buildings. UBWs affect not only the properties they attached to, but also the neighbouring properties. In other word, existence of UBWs in the neighbourhood of a property may affect the property price. That is, the existence of UBWs may be considered as a structural attribute or a neighbourhood trait.

Throughout decades, there are many factors proved to be or not to be attributes contributing to the property price in numerous studies. The contribution of each attribute may be positive or negative; some attributes are of great importance while some contributions are not significant. Some major attributes have been examined and shown to have significant effects on property price include the GFA, the age of building, the distance from major public transit, the sea view, the form of institutional arrangement, the floor level, etc. Most of the time, these attributes are taken into account when studying other attributes. Other attributes such as the development scale, the reputation of developer, the lucky floor number, etc. have been covered in previous studies. In this

dissertation, the author attempts to study the contribution of another attribute, the existence of UBWs, which has never been examined, on the residential property price. By looking at the effect of the UBWs on the market, the economic implication of the illegal structures can be studied.

Apart from the housing attributes, time factor also greatly affect the property price. Property transaction carried out at different time with different economic environment and market status would affect buyers' willingness to pay for different attributes greatly.

Chapter 3

Hypotheses, Data and Methodology

3.1 Introduction

It is mentioned in previous chapters that different attributes would affect the property price to different extent and the aim of this dissertation is to see whether the existence of UBWs is an attribute contributing to the residential property price and to find out the significance of its effect. In this chapter, section 3.2 will deliver the hypotheses set as basis of testing. Section 3.3 will talk about the data used in this dissertation. Following by section 3.4, discussion on different variables used will be included. Methodology adopted to examine the relationship between the existence of UBWs and residential property price will be discussed in section 3.5.

3.2 Hypotheses

With reference to real life observations and previous literature, the proposed hypotheses are:

(1) The existence of UBWs has negative impact on the property price of residential buildings in Hong Kong.

(2) The larger the number of UBWs in properties, the lower is the residential property price.

Data will be collected and hedonic price models will be set up. Coefficients of the hedonic price model are then estimated by using the Ordinary Least Square (OLS) regression approach.

3.3 Data

In conducting the research, a number of data have been encountered. Data sets of target buildings are collected, they include:

i. Number of unauthorized building works exist in the building;

ii. Number of units in the building;

iii. Building age (date of issue of Occupation Permit);

iv. Property size (GFA);

v. Transaction price; and

vi. Transaction date.

The matters about the data will be discussed in following sections.

3.3.1 Source of Data

Number of UBWs exist in the building is collected from the data base for the project of Building Quality Index (BQI) carried out by the Department of Real Estate and Construction, the Faculty of Architecture, the University of Hong Kong. As to the author's knowledge, the data of UBWs in each building is recorded in 2005 through site inspection. The author also visited to the target buildings to substantiate the data in February 2007.

Other data sets, number of units in the building, building age, property size, transaction price and transaction date, are collected from the Economic Property Research Center (EPRC) data base and through Internet search on the websites of the Home Affairs Department[8], Midland Realty[9] and Yahoo Hong Kong Real Estate[10].

3.3.1.1 Data base of the BQI project

The data base of the BQI project contains data recording types and numbers of UBWs exist in buildings at the time of site inspection which was carried out in 2005. The

[8] Home Affairs Department: http://www.had.gov.hk
[9] Midland Realty: http://www.midland.com.hk
[10] Yahoo Hong Kong Real Estate: http://hk.realestate.yahoo.com

studied area is North Point but not all buildings are inspected. The types of UBWs included in the data base are limited to those attached to the external wall of building as site inspection was conducted only from the outside of the buildings. This is in-line with the delineation of UBWs in this dissertation as mentioned in Chapter 1 section 1.5.2 except that rooftop structures are not included. Therefore, site inspection is conducted by the author to target buildings and number of rooftop structures on each building is recorded. With the aid of these data, total number of UBWs exist in each target building can be calculated.

3.3.1.2 EPRC Data Base

The EPRC data base recorded details of transactions registered in the Land Registry since 1991, including transaction price and date. Information of property like address, gross floor area, floor level and date of issue of Occupation Permit, are also provided. As the data for some of the properties are incomplete, Internet search is conducted to aid completing the data sets.

3.3.1.3 Site Inspection

Site inspection is conducted in February 2007 to record the number of unauthorized rooftop structures in target buildings and to verify the data sets collected. This is also to familiarize the author with the target area and buildings and to ensure that there is no other significant attribute in the neighbourhood has been forgone.

3.3.2 Selection of Target Buildings

When selecting the target buildings for study in this dissertation, many aspects have to be concerned. The process of selection and justification of decisions will be discussed in this section.

First of all, a target district for study is selected. North Point is selected to be the target area in the study as the transaction data and information of UBWs of buildings in North Point are readily available to the author. Also, it is the home district of the author that the author is familiar with.

Secondly, target area is confined to a small area to minimize the effects from other factors.

Three neighbouring streets namely Fort Street, Kin Wah Street and Ming Yuen Western Street are then selected.

Thirdly, target buildings are selected from the three streets such that all buildings have no sea view and are of similar distances to the nearest Mass Transit Railway station (North Point MTR station) and other major public transport terminal. Therefore the factor of sea view and distance to public transport facilities, which are shown to be significant factors affecting the property price by literatures and are commonly included in other studies of property price determinants, can be kept constant in this study. As time and resources are limited, site inspection and record of types and numbers of UBWs to all buildings is not allowed. Therefore, only buildings which have been inspected and are in the data base of the BQI project with available information are within consideration when selecting target buildings. Fourteen buildings located in the three streets are selected. Among them, there are buildings with various types and numbers of UBWs and buildings without UBWs.

3.3.3 Collection of Transaction Data

After the target buildings for study have been selected, transaction data of the fourteen

selected buildings are then collected from the EPRC data base. Data of transactions taken place from January 2001 to April 2006 are used. After sorting out the duplicated data, 231 transaction data are taken for investigation.

The reasons for using the data of transactions taken place from January 2001 to April 2006 can be justified. The factor under investigation (the existence of UBWs) has time implication. The number of UBWs may vary from time to time as the UBWs may be demolished or newly constructed. The data recorded in 2005 may not be able to reflect the situations in the previous or following years. If only transactions carried out in 2005 are used, the time effect can be ignored. However, the data size will be too small and the result of analysis may not be precise and unable to reflect the real situation. Therefore a reasonable period (2001 to 2006) close to 2005 is used, such that a reasonable size of data can be obtained and at the same time the time effect of the attribute being studied can be minimized. This has to work with the assumption that the number of UBWs in each target building remains unchanged throughout the period from 2001 to 2006 and is the same as when site inspection is carried out and the number of UBWs is recorded in 2005.

3.3.4 Data Adjustment for Time

Apart from the number of UBWs, the transaction price is also affected by time. The property market is influenced by the economic environment, government policy and social condition. With the high respond rate of the market, property price level changes from time to time. That is, the property price of the same property may vary at different times. Consequently, data adjustment is required to eliminate the effect of time and inflation. This makes sure the fluctuation and difference in transaction price are due to the factors discussed instead of owing to the overall market trend such that the data can reflect the real property price more accurately. To achieve this, transaction prices in transactions carried out at different time periods (the nominal price) are deflated by the respective price indices to a common time base.

In this dissertation, price indices in the *Private Domestic – 1979-2005 Price Indices by Class (Territory-wide)*[11] and *Rental and Price Indices by Class*[12] published by the Rating and Valuation Department are employed to deflate the nominal price. In which, the base

[11] Price Indices for January 2001 to December 2005 obtained from *Private Domestic – 1979-2005 Price Indices by Class (Territory-wide)*, available from website of the Rating and Valuation Department: http://www.rvd.gov.hk/en/doc/statistics/his_data_4.pdf

[12] Price Indices for January to April 2006 obtained from *Rental and Price Indices by Class*, available from website of the Rating and Valuation Department: http://www.rvd.gov.hk/en/doc/statistics/rvd1_2.pdf

year is 1999 (price index of 1999 = 100) and monthly price indices of each size class[13] are available.

The adjusted property price should then have no time effect and be able to truly reflect the property buyer's preference over the property.

3.4 Variables

In this dissertation, the hedonic price model is adopted for the verification of the effect of the existence of UBWs on the residential property price. Data collected are converted into variables in the hedonic price model. In this section, different variables in the model will be explained.

[13] According to the *Technical Notes* published by the Rating and Valuation Department (available from: http://www.rvd.gov.hk/en/doc/statistics/15_technotes.pdf), private domestics units are sub-divided by reference to floor area as follows:
Class A – area less than 40 m^2
Class B – area of 40 m^2 to 69.9 m^2
Class C – area of 70 m^2 to 99.9 m^2
Class D – area of 100 m^2 to 159.9 m^2
Class E – area of 160 m^2 or above

3.4.1 Dependent Variable

DPRICE – Deflated Property Price

The dependent variable in the model is the Deflated Property Price (DPRICE). The Deflated Property Price refers to the deflated nominal price collected from the EPRC data base. As discussed in previous section, the nominal prices are adjusted by using the corresponding price indices obtained from the Rating and Valuation Department, which has the same base year. That is, the Deflated Property Prices are price data based on the same price level in 1999, free from time effect and can truly reflect the effects of the discussing variables.

The Deflated Property Price is obtained by the following equation:

$$DPRICE = NPRICE_t \times \frac{100}{INDEX_t}$$

where DPRICE = Deflated Property Price (Property price at price level of 1999)

$NPRICE_t$ = Nominal price at time t

$INDEX_t$ = Corresponding price index of time t

(Price Index for 1999 is 100)

3.4.2 Independent Variables

As discussed in previous section, there are many different attributes affecting the property price. In light of limited time and resources, it is impossible to include all attributes in the study. Though inclusion of more variables may help increasing the predictability of the study, its complexity will increase as well. Therefore, only several crucial attributes are chosen to be the independent variables so as to preserve the explanatory power of the study. The specifications of the chosen variables are illustrated in Table 3.1. Detailed description of the independent variables and the rationale for choosing them will be discussed in following sections.

Variables of Model	Description
Dependent Variable	
DPRICE	Deflated Property Price
Independent Quantitative Variables	
GFA	Gross Floor Area of property
FL	Floor Level of property
AGE	Age of building when transaction takes place
RATIO	Ratio of Number of UBWs to Number of Units in building i.e. $\frac{\text{Number of UBWs in building}}{\text{Number of Units in building}}$
Independent Qualitative Variables	
UBW1	Dummy variable in which 1 represents the presence of UBWs in building and 0 otherwise
UBW2	Dummy variable in which 1 represents the presence of UBWs in an individual property (i.e. **RATIO** $\geq$ 1) and 0 otherwise

Table 3.1: Specification of Variables

Two of the most important and commonly used attributes – sea view and distance from public transport facilities, are omitted in this dissertation. This is because all target buildings under study are within a purposely selected small area such that all properties concerned, i) have no sea view; and ii) have similar distance to the nearest public transport facilities. The effect of sea view does not exist and that of the distance from public transport facilities is minimized.

3.4.2.1 Independent Quantitative Variables

GFA – Gross Floor Area

GFA is the gross floor area of the property under transaction. There is not much discussion on this variable as size of property is no doubt the principle determinant of property price. The reason for choosing GFA but not usable floor area (UFA) which is also available in the EPRC data base is that more selected transaction data are available with GFA than that with UFA. The unit for GFA is square feet. For example, a property with a gross floor area of 500 square feet, the value of GFA for that transaction is 500.

FL – Floor Level

FL is the floor level on which the property under transaction is situated in the multi-storey building. Floor level of property is included as it determines the view and the impact of environmental factors such as noise and air pollution from the street and it is one of the most important attributes affecting the property price. The data for FL is obtained from the EPRC data base. For example, a property is on the 10^{th} floor, the value of FL for that transaction is 10.

AGE – Age of Building

AGE is the age of building when transaction is taken place. The age of a building usually determines the deterioration of building and that of the living environment. It is a very common determinant of property price. In this dissertation, the age of building is calculated as the time period between the transaction date and the date of completion of building. The transaction date and date of completion of building are all obtained from the EPRC data base and the age of the property is calculated in month. For example, if date of completion of building is in August 1983 and the transaction is taken place in April 2001, then the value of AGE for that transaction is 212.

RATIO – Ratio of Number of UBWs to Number of Units in Building

RATIO refers to the ratio between the total number of UBWs exist in the building to the number of units (apartments) in the building. This can be considered as the average number of UBWs exists in an apartment in the building.

As mentioned in Section 2.2.2, only UBWs attached to the external envelope of the building are included in the study. They include eleven types of UBWs which are commonly found attaching to external wall of residential buildings in Hong Kong and the rooftop structures. Numbers of different types of UBWs are collected from the data base

for the BQI project except that of the rooftop structures which is collected by site inspection conducted by the author. The eleven groups of UBWs included are:

i. Solid canopy;

ii. Light weight canopy projecting by exceeding 500 mm;

iii. Light weight canopy projecting by less than 500 mm;

iv. Solid extension;

v. Flower rack;

vi. Drying rack;

vii. Metal frame;

viii. Air-conditioning frame (with a/c in use);

ix. Metal cage;

x. Advertisement sign (in domestic portion); and

xi. Rooftop structure.

The total number of UBWs in building is then the sum of the numbers of the above types of UBWs existing in the building while the number of units in building is obtained from the Home Affairs Department website. For example, if the number of UBWs in a building is 50 and number of units in the building is 20, then the value of RATIO for transactions of that building is 2.5.

RATIO is included in the model to test for Hypothesis 2. Larger the ratio means more UBWs exist in the property on average. Whether Hypothesis 2 is to be rejected or confirmed depends on the sign of the coefficient of this variable.

3.4.2.2 Independent Qualitative Variables

UBW1 – Dummy Variable for the existence of UBWs in the Building

UBW1 is a dummy variable where 1 represents the presence of UBWs in the building in which the considered property situated, 0 the otherwise. Whenever the total number of UBWs for a building is not equal to zero, there is a presence of UBWs in that building and the value of UBW1 for transactions of that building is 1, otherwise, it is 0. UBW1 is used in the model to test Hypothesis 1.

UBW2 – Dummy Variable for the existence of UBWs in a Property

UBW2 is a dummy variable where 1 represents the presence of UBWs in the property, 0 the otherwise. As time and resources are limited, the actual existence and number of UBWs attached to each individual property under transaction are not considered. Instead, the existence and number of UBWs attached to the buildings in which the concerning property located is taken into account. As defined in section 1.5.3, if the

ratio of the number of UBWs to the number of units in a building is larger than or equal to 1 (i.e. RATIO ≥ 1), properties in that building are regarded as "with the existence of UBWs". This is because when ratio of UBWs to units of a building is 1 or above, there are on average 1 or more UBWs in every property in that building.

That is,

$$\text{UBW2} = \begin{cases} 1 & \text{when} \quad \text{RATIO} \geq 1 \\ 0 & \text{when} \quad \text{RATIO} < 1 \end{cases}$$

This is based on the assumption that UBWs in the building are evenly distributed to all units in the building. UBW2 is also used to test Hypothesis 1.

3.5 Methodology

The methodology used in this dissertation is the hedonic price model and Ordinary Least Squares technique is applied to estimate the variables of the hedonic price model.

The objective of this dissertation is to study the impact of the existence of UBWs on the residential property price in Hong Kong. UBWs exist in a building as a whole and in an individual property are considered. The impacts of the existence of UBWs in these two situations are analyzed. Also, the impact of amount of UBWs existing in building is

studied.

3.5.1 Hedonic Price Model

Hedonic price model is a regression model which is based on the assumption that the unknown variable can be expressed as a function of some known and measurable variables. Such that residential property price can be expressed as an equation of variables affecting it. From the statistics obtained from the analysis of the equation, predictions/hypotheses can be evaluated. In adopting the model, it is assumed that all customers would consider all factors before they make any decision and they are informed with full information on all those factors.

There are some points about the model to note:

- Heteroscedasticity is a limitation in the regression analysis. It will occur in the model if the variance of the error terms is not the same. This may arise if (1) some data are measured more accurately than the others, (2) the variance of the error terms is correlated with the dependent variable, (3) there is misspecification of the functional form or (4) certain independent variables are missing out. Biased and incorrect estimations may be resulted if Heteroscedasticity occurs. In this

dissertation, White's Test is used to test for Heteroscedasticity.

- The choice of functional form of the regression model depends on the nature of the relationship between the dependent and independent variables. In this dissertation, there is no priori knowledge on the relationship between property price and the testing factors and time and resources are limited. Therefore, linear function is used in the model.
- Dummy variables are used to model qualitative factors which affect the dependent variable. The existence of UBWs is a qualitative factor. So, dummy variables are used for the existence of UBWs, which are quantified as 1 or 0, to investigate its effect.

3.5.2 Models Specifications

In order to test the hypotheses, well-defined regression models have to be set up. 3 regression models are set up in this research to test the 2 hypotheses.

As mentioned in previous section, the property price (DPRICE) is assigned to be the dependent variable; size of property (GFA), floor level of property (FL), building age (AGE) and the ratio of number of UBWs to the number of units in building (RATIO) are

the independent quantitative variables, whereas the existence of UBWs in building (UBW1) and that in individual property (UBW2) are the independent qualitative variables (dummy variables). Among the variables, DPRICE, GFA, FL and AGE are used in every model, while RATIO, UBW1 and UBW2 are used in the models separately. The validity of the hypotheses made can then be verified by testing the statistical significance of the sign and magnitude of the regression coefficients of these variables. The results are analyzed to reflect the significance of effects of the existence and quantity of UBWs on the property price.

Hypothesis 1 The existence of UBWs has negative impact on the property price of residential buildings in Hong Kong.

To confirm hypothesis 1, two models are established as follows:

Model 1

$$DPRICE_i = \alpha_1 GFA_i + \alpha_2 FL_i + \alpha_3 AGE_i + \beta UBW1_i + \varepsilon$$

where $DPRICE_i$ is the deflated property price of property i

GFA_i is the gross floor area of property i;

FL_i is the floor level on which property *i* situated;

AGE_i is the age of the building in which property *i* situated as when it was transacted;

$UBW1_i$ is a dummy variable in which 1 represents the existence of UBWs in the building in which property *i* situated, 0 otherwise;

α_j (j = 1, 2 and 3) and β are the coefficients to be estimated; and

ε is the stochastic term.

Model 1 assumes that deflated property prices are a function of gross floor area and floor level of the property, age of the building and the existence of UBWs in the building. It is established to test hypothesis 1 which suggests that the existence of UBWs has negative impact on the residential property price. Model 1 only considers the existence of UBWs in the building as a whole. This is to see whether the existence of UBWs in the building but not necessarily attaching to the individual property does have impact on the residential property price.

Model 2

$$DPRICE_i = \alpha_1 GFA_i + \alpha_2 FL_i + \alpha_3 AGE_i + \beta UBW2_i + \varepsilon$$

where $DPRICE_i$ is the deflated property price of property *i*

GFA_i is the gross floor area of property i;

FL_i is the floor level on which property i situated;

AGE_i is the age of the building in which property i situated as when it was transacted;

$UBW2_i$ is a dummy variable in which 1 represents the existence of UBWs in property i, 0 otherwise;

α_j (j = 1, 2 and 3) and β are the coefficients to be estimated; and

ε is the stochastic term.

Model 2 assumes that deflated property prices are a function of gross floor area and floor level of the property, age of the building and the existence of UBWs in the property. It is established to test hypothesis 1 which suggests that the existence of UBWs has negative impact on the residential property price. Model 2 considers the existence of UBWs in the individual property. This is to see whether the existence of UBWs attaching to the individual property does have impact on the residential property price.

To confirm Hypothesis 1, coefficients of UBW1 and UBW2 in model 1 and model 2 respectively should be negative and the results should be statistically significant.

Hypothesis 2 The larger the number of UBWs in properties, the lower is the residential property price.

Model 3 is established as follows to confirm hypothesis 2:

Model 3

$$DPRICE_i = \alpha_1 GFA_i + \alpha_2 FL_i + \alpha_3 AGE_i + \beta RATIO_i + \varepsilon$$

where $DPRICE_i$ is the deflated property price of property i

GFA_i is the gross floor area of property i;

FL_i is the floor level on which property i situated;

AGE_i is the age of the building in which property i situated as when it was transacted;

$RATIO_i$ is the ratio between the number of UBWs and the number of units in the building in which property i situated

α_j (j = 1, 2 and 3) and β are the coefficients to be estimated; and

ε is the stochastic term.

Model 3 assumes that deflated property prices are a function of gross floor area and floor level of the property, age of the building and the ratio of the number of UBWs existing to

the number of units in the building. Model 3 tests hypothesis 2 which proposes that larger the number of UBWs in the properties, lower the residential property price is. This is to see whether larger the number of UBWs attaching to the building or property does lower the residential property price.

To confirm hypothesis 3, the variable RATIO in model 3 should have a negative coefficient and the result should be statistically significant.

3.5.3 Expected Results of Independent Variables

By common sense and real life observations, larger the size of the property, higher the level on which the property situated and younger the building, the property price should be higher. Therefore, the coefficients of the variables GFA and FL are expected to be positive while that of AGE is expected to be negative. From the hypotheses, it is expected that the existence of UBWs, no matter in the building or in the property, and larger the ratio of UBWs to units have negative effects on the property price. Hence, the expected coefficient for UBW1, UBW2 and RATIO is negative.

The expected signs of coefficient of each independent variable are tabulated in Table 3.2:

Independent Variables	Meaning	Expected Sign
GFA	Gross floor area of property	+ ve
FL	Floor level of property	+ ve
AGE	Age of building when transaction taken place	- ve
UBW1	Presence of UBWs in building	- ve
UBW2	Presence of UBWs in property	- ve
RATIO	Ratio of number of UBWs to number of units in building	- ve

Table 3.2: Expected signs of coefficients of independent variables

3.5.4 Fitting Approach and Operation of Regression

Ordinary Least Squares (OLS) technique is the most common method of estimating the parameters of the regression model and it is employed in this study. The dependent variable is assumed to be a linear function of the independent variables in each model. In which the variations of the dependent variable is assumed to be induced by the combination of independent variables. The OLS technique estimates the true but unobservable function and minimizes the sum of the squares of the differences between the actual and the forecast values of the dependent variable on the regression line. The computer software EViews Version 3.0 is employed for the regression analysis.

3.5.5 Interpretation of Results

Data are run by the computer software, EViews, results are given in the form of numerical figures. There are implied results in the numerical figures generated. Among the figures, there are three areas have to be observed. They are the sign and magnitude of the partial coefficient[14] and the p-value[15] of each independent variable and the adjusted R-squared[16]. They represent the trend (either positive or negative) of impact that the independent variable has on the dependent variable, the significance of the impact and the explanatory power of the hypothesized model respectively.

[14] Figures under the column 'Coefficient' in the Estimated Output (Table 4.2, 4.3 and 4.4)
[15] Figures under the column 'Prob.' in the Estimated Output (Table 4.2, 4.3 and 4.4)
[16] Figure of Adjusted R-squared in the Estimated Output (Table 4.2, 4.3 and 4.4)

Chapter 4

Research Findings and Discussions

4.1 Introduction

In this chapter, results of the regression models will be discussed. 231 data sets are used to generate the results. Statistical results of each model will be presented and analyzed. The implications of the results will also be discussed. Section 4.2 presents the descriptive statistics of the quantitative variables. Section 4.3 gives the empirical results of the models. Section 4.4 gives the validation of the hypotheses while section 4.5 includes discussions on the independent variables.

4.2 Descriptive Statistics

Table 4.1 presents the descriptive statistics of the data in terms of means, medians, maximum values, minimum values and standard deviations. Only quantitative variables in the models are included as it is meaningless to show such descriptions of a dummy variable.

Variables	DPRICE	GFA	FL	AGE	RATIO
Mean	1.881975	631.8831	11.45455	242.4632	1.599318
Median	1.691429	570.0000	12.00000	254.0000	1.369231
Maximum	5.115528	1525.000	26.00000	454.0000	6.033333
Minimum	0.523560	355.0000	1.000000	39.00000	0.000000
Std. Dev.	0.739355	222.1705	6.636943	78.36585	1.718511
Observations	231	231	231	231	231

Table 4.1: Descriptive Statistics of Quantitative Variables

4.3 Empirical Results

As established in the previous chapter, the models used in this dissertation are:

Model 1: $DPRICE_i = \alpha_1 GFA_i + \alpha_2 FL_i + \alpha_3 AGE_i + \beta UBW1_i + \varepsilon$

Model 2: $DPRICE_i = \alpha_1 GFA_i + \alpha_2 FL_i + \alpha_3 AGE_i + \beta UBW2_i + \varepsilon$

Model 3: $DPRICE_i = \alpha_1 GFA_i + \alpha_2 FL_i + \alpha_3 AGE_i + \beta RATIO_i + \varepsilon$

where

$DPRICE_i$ is the deflated property price of property i

GFA_i is the gross floor area of property i;

FL_i is the floor level on which property i situated;

AGE_i is the age of the building in which property *i* situated as when it was transacted;

$UBW1_i$ (in Model 1) is a dummy variable in which 1 represents the existence of UBWs in the building in which property *i* situated, 0 otherwise;

$UBW2_i$ (in Model 2) is a dummy variable in which 1 represents the existence of UBWs in property *i*, 0 otherwise;

$RATIO_i$ (in Model 3) is the ratio between the number of UBWs and the number of units in the building in which property *i* situated;

α_j (j = 1, 2 and 3) and β are the coefficients to be estimated; and

ε is the stochastic term.

After processing the data sets by EViews 3.0, the estimated output results of the three models are shown in Table 4.2, Table 4.3 and Table 4.4 respectively.

Dependent Variable: DPRICE

Method: Least Squares

Sample: 1 231

Included observations: 231

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA	0.002045	0.000272	7.516325	0.0000
FL	0.019629	0.005525	3.553000	0.0005
AGE	-0.002519	0.000498	-5.060323	0.0000
UBW1	-0.412901	0.114171	-3.616515	0.0004
C	1.318574	0.231316	5.700307	0.0000

R-squared	0.603930	Mean dependent var	1.881975
Adjusted R-squared	0.596920	S.D. dependent var	0.739355
S.E. of regression	0.469406	Akaike info criterion	1.346711
Sum squared resid	49.79733	Schwarz criterion	1.421222
Log likelihood	-150.5451	F-statistic	86.15156
Durbin-Watson stat	1.717238	Prob(F-statistic)	0.000000

Table 4.2: Estimated Output for Model 1

Estimated Equation of Model 1:

DPRICE = 0.002045*GFA + 0.019629*FL - 0.002519*AGE

- 0.412901*UBW1 + 1.318574

Dependent Variable: DPRICE

Method: Least Squares

Sample: 1 231

Included observations: 231

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA	0.002068	0.000266	7.786902	0.0000
FL	0.022097	0.006114	3.614194	0.0004
AGE	-0.001647	0.000719	-2.290365	0.0229
UBW2	-0.341044	0.093793	-3.636141	0.0003
C	0.913486	0.188082	4.856844	0.0000

R-squared	0.596020	Mean dependent var	1.881975
Adjusted R-squared	0.588870	S.D. dependent var	0.739355
S.E. of regression	0.474070	Akaike info criterion	1.366484
Sum squared resid	50.79181	Schwarz criterion	1.440996
Log likelihood	-152.8290	F-statistic	83.35853
Durbin-Watson stat	1.657653	Prob(F-statistic)	0.000000

Table 4.3: Estimated Output of Model 2

Estimated Equation of Model 2:

DPRICE = 0.002068*GFA + 0.022097*FL - 0.001647*AGE

- 0.341044*UBW2 + 0.913486

Dependent Variable: DPRICE

Method: Least Squares

Sample: 1 231

Included observations: 231

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFA	0.002191	0.000285	7.679652	0.0000
FL	0.020315	0.006136	3.310862	0.0011
AGE	-0.002514	0.000686	-3.665890	0.0003
RATIO	-0.035830	0.024966	-1.435142	0.1526
C	0.931854	0.214587	4.342551	0.0000

R-squared	0.567103	Mean dependent var	1.881975
Adjusted R-squared	0.559441	S.D. dependent var	0.739355
S.E. of regression	0.490744	Akaike info criterion	1.435619
Sum squared resid	54.42752	Schwarz criterion	1.510130
Log likelihood	-160.8140	F-statistic	74.01610
Durbin-Watson stat	1.567858	Prob(F-statistic)	0.000000

Table 4.4: Estimated Output of Model 3

Estimated Equation of Model 3:

DPRICE = 0.002191*GFA + 0.020315*FL - 0.002514*AGE

- 0.035830*RATIO + 0.931854

To analyze the results, the significant factors affecting the dependent variable, in this research, the deflated residential property price (DPRICE), have to be identified.

To determine whether a factor is significant to the dependent variable, the t-statistics (t-Statistic column) or the p-value (Prob. column) has to be considered. Larger the t-statistic value or smaller the p-value of the factor, more accurate the estimate and statistically more significant the factor is. In this dissertation, the significant level of factors is determined by looking at the p-value. Say, the p-value of a factor is X (where X is a positive real number), the factor is said to be significant at [(1-X) × 100] % confidence level. The factor is statistically significant to the dependent variable if it is significant at 95% confidence level or above.

In this dissertation, all factors in Model 1 are found to be significant at over 99% confidence level – with all p-values smaller than or equal to 0.01. In Model 2, GFA, FL and UBW2 are significant at over 99% confidence level while AGE is significant at 95% – with all p-value smaller than or equal to 0.05. Lastly, in Model 3, GFA, FL and AGE are significant at over 99% confidence level. Among all independent variables in the three models, only RATIO is found to be statistically insignificant to the dependent variable as its p-value is 0.1526 and it does not have a confidence level of 95% or above.

Apart from the significant level of factors, the explanatory power of the model also has to be considered. R-squared and adjusted R-squared are used to measure the explanatory and predictive power of the regression model. They indicate how much the dependent variable can be explained by the independent variables in the model. The explanatory and predictive power of a regression model also depends on the number of independent variables included in the model and the sample size used. Therefore, adjusted R-squared which also takes account of these two factors, is normally used.

In this dissertation, the adjusted R-squared in the models are 0.596920, 0.588870 and 0.559441 respectively. These mean that about 60%, 59% and 56% of the dependent variable can be explained by the independent variables in Model 1, 2 and 3 respectively. By comparing the adjusted R-squared of models with the same dependent variable, predictive power of different models can be ranked. Model 1 and 2 in this study can be compared, it can be said that Model 1 has greater explanatory power than Model 2 and is a more forceful model but the difference between their explanatory powers is not so significant. For Model 3, though it has the same dependent variable as Model 1 and 2, they are purposely established to investigate different problems. Therefore, it is unsubstantial to compare their explanatory power. What is more, there is no previous study in this area and no similar model can be used as a basis for comparison. Whether

these models are convincing enough to reflect the real situation cannot be concluded.

4.4 Hypotheses Testing

After observing the specification of the models, the results have to be interpreted. In Chapter 3, two hypotheses are established and the criteria to confirm the hypotheses are stated. By observing the p-value and the sign and magnitude of the partial coefficient of the independent variable in each model, whether each hypothesis is to be confirmed or rejected can be determined.

Hypothesis 1

The existence of UBWs has negative impact on the property price of residential buildings in Hong Kong.

It was found that UBW1 in Model 1 and UBW2 in Model 2 are statistically significant at over 99% confidence interval to the dependent variable. The partial coefficients of UBW1 and UBW2 are of negative sign, meaning that the deflated property price decreases with the effect of the presence of UBWs, no matter it is considered in the building in which the property situated or that individual property. Hence, hypothesis 1

is confirmed.

Hypothesis 2

The larger the number of UBWs in properties, the lower is the residential property price.

In Model 3, the sign of the partial coefficient of RATIO is negative. This means the deflated property price decreases as the ratio of the number of UBWs to the number of units in building increases. However, it is found to be statistically insignificant to the dependent variable. This represents that there is no significant relationship between the ratio of UBWs to units, i.e. average number of UBWs in property, and the deflated property price in linear form. Therefore hypothesis 2 is rejected.

4.5 Discussions of Independent Variables

From the results obtained, all independent variables except RATIO are statistically significant to the dependent variable at 95% confidence level and most of them are significant at 99% confidence level. In this section, the significance and effect of each independent variable on the dependent variable, the implications and limitations of the variables are discussed.

4.5.1 GFA, FL and AGE

The independent variable GFA, FL and AGE are statistically significant at 95% or above confidence level in all three models. In all models, GFA and FL show positive signs towards the dependent variable, deflated property price, while AGE shows a negative sign towards it. This is in accordance with common sense and the expected results. There is not much to discuss on the rationale for the expectation as it is mentioned in previous chapter. The coefficients of GFA in the three models are around 0.002, while that of FL and AGE are about 0.02 and -0.002 respectively. The figures are consistent in the three models. These figures are considered to be small when comparing to the coefficients of UBW1, UBW2 or RATIO and seems inconsistence with people's conception that these factors contribute a lot to the property price.

This may be explained by the limitations and assumptions made on the data. In the study, gross floor area (GFA) is used to represent the size of property instead of useable floor area (UFA) which is more likely to be considered by property buyers in reality as it reflects the actual size of space that people can enjoy. This may help to explain why GFA has little influence on property price in the models.

The influence of floor level is more or less related to the view of the apartment as higher floor would worth higher price only if it would lead to better view or living condition. However, the view of the property is not considered in this study due to limited information. Having a coefficient of 0.02 is already good enough to show the effect of floor level on property price regardless of the view and other relating conditions.

AGE in the models represent the time elapsed from the time the building is built to the time the transaction of that property taken place in terms of month. This may be biased as age of building is usually considered as the building age after the issuance of the occupation permit (OP). The difference between the time of issuance of OP and the time of building completion may vary. Therefore, the AGE considered in this research may be not that accurate and different from the fact and the extent is unknown. Furthermore, although Yung (2006) proves that age of building alone does not affect the number of UBWs significantly in her paper, the effect cannot be completely eliminated. Some underlying co-relation may exist. Hence, there is limitation on the variable AGE in this study and the result may not fully reflect the reality. Yet, as the coefficient is in negative sign, the result is more or less representable.

4.5.2 UBW1 and UBW2

Independent variable UBW1 in Model 1 and UBW2 in Model 2 are statistically significant at 99% confidence level and their partial coefficients are negative in sign. This represents that when compared with buildings which have no UBWs, the presence of UBWs has negative effects on the property price regardless the number and form of the UBWs, as well as the area in consideration (in building or in individual property). The magnitude of the coefficients (0.4129 and 0.3410 respectively) is comparatively high. This indicates that each of the factors is affecting the dependent variable, property price, to a quite large extent.

The results may be explained by the possible costs incurring to and underlying responsibilities of owners of properties with UBW attaching to. These may include maintenance responsibility and the cost induced, the legal responsibility and cost of removal in case the Buildings Department issues order of removal against the illegal structure and any possible claim of damages in case accident happens in relate to the illegal structure. It is logical to think that people will be willing to pay less for assets which would require further costs to make good. This not only applies to individual property, but also the whole building since all property owners (the co-owners or the

management body i.e. OC or IO) would be responsible for any UBWs existing in common areas in multi-ownership buildings (Lai and Ho, 2001; Buildings Department, 2006). Yet, information on locations of UBWs in buildings is not obtained. Thus, whether this situation exists cannot be concluded.

Apart from the costs and liabilities aspects, the safety, health and hygiene problems may also contribute to the result. Any projections of structures from the external wall may heap rubbish or filth. Say, canopy above window projecting from the external wall may trap rubbish, dirt or may be rain water. This may cause nuisances to occupants of the apartment above. Another possible situation is that a flower rack attached outside a property. Rubbish and dirt may be accumulating right outside the window and nuisances may be caused to occupants of that property in this case. All these may explain the great influence of the existence of UBWs on property price as shown in the results.

However, the data is not bias-free. First of all, data of transactions taken place between 2001 and 2006 are used in the study while site inspection and record of number and type of UBWs is taken place in 2005. Though site inspection has been carried out by the author in 2007, consistency of data cannot be guaranteed. Assumption is made such that the number and hence the ratio of UBWs existing in buildings are supposed to be

remained unchanged throughout the years from 2001 to 2006.

Secondly, determination of value of UBW2 (1 or 0) depends on another variable, RATIO, which also has its limitations. It is assumed that the UBWs existing in the building are evenly distributed to each unit such that a ratio of 1 or above means UBWs exist in all properties in that building (UBW2 = 1). The credibility of this assumption greatly affects the determination of value of UBW2. With these limitations and assumptions, results generated from these data may not be comprehensive.

4.5.3 RATIO

Independent variable RATIO in Model 3 has a negative-signed partial coefficient which is consistent with the expectation but it is statistically insignificant. The p-value is about 0.15 which means that only about 85% of the dependent variable can be explained by this factor. This represents that the increase in number and ratio of UBWs has negative effects on the property price but the effect is statistically insignificant. Let alone the significance, the magnitude of the coefficients (0.0358) is not high though. This indicates that the factor is affecting the dependent variable, property price, only in a small extent.

The effect is shown to be insignificant. This may be interpreted as the low awareness of property buyers on the number of UBWs existing in the building or the property. Though more UBWs may lead to more problems, and hence, higher costs and higher the costs to make good the flat lower the property price the buyer willing to pay; People may think that as long as there is UBW existing in the building, the responsibilities, costs and other problems on safety, health and hygiene may arise irrespective to the number of UBWs.

The insignificance may also be because of the relationship between the property price and the ratio of UBWs to units may not be linear. However, as time and resources are constrained, further test on hypothesis 2 with other non-linear model cannot be done in this dissertation.

Furthermore, possible biases and limitations on data of number of UBWs used in this dissertation as mentioned in earlier section may contribute to the insignificant result.

Chapter 5

Conclusion

5.1 Introduction

This concluding chapter aims to review the whole process of the study. Reviews on the research will be given in section 5.2. Section 5.3 presents the implications of the research while section 5.4 gives limitations of the study. Finally, suggested areas and improvements for further study are included in the last section.

5.2 Review of Research

The proliferation of unauthorized building works (UBWs) has long been a problem in buildings in Hong Kong. Though the Government has put in a lot of efforts in addressing the problem, UBWs have yet been vanished.

This dissertation studies the issue of UBWs in Hong Kong. When looking into the issue, it is found that scholars tend to study the situation of, the reasons for and the policies

about UBWs but pay little attention to the effects of UBWs. Therefore, the author aims at investigating the effects of the UBWs in the economic perspective, hence, the effects of the existence of UBWs as well as the level of influence exerted on the residential property price.

After objectives of research are identified, literature is reviewed to understand more and deeper about the issue of UBW in Hong Kong and the property price determinants. It is believed that property buyers consider the factors affecting their enjoyment and interests, like size, floor level, views and neighbouring facilities and amenities, when choosing properties. Legislations and Government policies on UBWs and liabilities of owners are greatly influencing property owners' interests. Thus, these aspects of the issue are reviewed in addition to the definition and categories of UBWs.

Based on past literature and real-life observations, hypotheses are established, regression models are set up. Data sets are collected, fed into models and tested empirically in the research. Regression analysis is an effective and unbiased method to examine the relationship between the dependent variable and each of the independent variables.

With reference to the results generated from the regression analysis, the property price is

shown to be significantly affected by the existence of UBWs either considering the building as a whole or considering each individual property. However, the average number of UBWs in building is found to have no significant effect on the property price.

5.3 Implications of Research

Outspread of unauthorized building works (UBWs) in buildings in the territory shows that the present Government policies are not enough to solve the problems. This also implies that property owners have little or no incentives to voluntarily fulfill their obligations as citizens to demolish the illegal structures. This dissertation provides preliminary insights towards the UBW issue. The findings are generally satisfactory and are significant in affirming the adverse effect of the existence of UBWs on the property price. The results give an insight into the problem of incentives for property owners to demolish UBWs.

The effect of the existence of UBWs is reflected on the property price. This means that property buyers do take the existence of UBWs into consideration when buying properties.

Though property with the existence of UBWs will lead to a lower property price as proved in this study, it seems that this is not enough to be an incentive for property owners to voluntarily remove UBWs in real-life situation.

Concluding all three models and the two hypotheses, it is shown that property buyers will only consider whether there is UBWs or not but will not take the number of UBWs into consideration when buying properties. From this result, it is shown that no matter the UBWs exist in other units of the building or in the unit under transaction, the property price will be adversely affected. This implies that even if a property owner voluntarily removed the illegal structures attaching to his/her own property, the price of his/her property may not be higher as long as there are other UBWs existing in other properties in the same building.

Furthermore, the number of UBWs existing does not affect the property price as shown in results of Model 3 in this dissertation. This suggests that if there are more than one UBW existing in the property, property owners may not get the initiation to demolish the illegal structures unless the UBW to be demolished is the last one in the building and the demolition is going to increase the property price.

These situations explain why the property owners do not have enough incentives to demolish illegal structures existing in their properties voluntarily. This applies to properties in multi-storey buildings which make up a large proportion of buildings in Hong Kong. This further intimates that only if the co-owners carry out collective actions to remove all UBWs in the whole building, individual property owners would not initiate the demolition.

After knowing this issue, the Government is suggested to review the present policies on encouraging voluntary removal of illegal structures in private properties.

5.4 Limitations of Research

This study is not comprehensive and conclusive to conclude that the existence of UBWs has adverse effect on residential property price due to the limitations involved.

5.4.1 Limitations on Data Samples

There are only 231 transaction data sets used as observations for the regression analysis. This is far less than enough for carrying out a representable analysis. Also, transactions

from only 14 buildings are taken into consideration. The coverage of building samples in terms of location, development size, property size and age is not comprehensive enough to represent the UBW situation in all residential buildings in Hong Kong. However, due to the limitation on time and resources, the problem cannot be evaded.

Also, target buildings are selected based on the availability of UBW information and transaction data from the data base for the BQI project and the EPRC data base respectively instead of being collected randomly. This may affect the reliability of the data and the result of analysis may be biased.

5.4.2 Limitations on the Types of UBWs Included

Despite the mentioned limitations on selection and collection of data samples, there are limitations on the types of UBWs considered. The delineation of UBWs in this dissertation are confined to those attaching to the external envelop of buildings. UBWs inside the buildings such as illegal partitioning and alteration to pipe works are excluded in this research due to constraints on time, resources and authority to access target buildings.

Moreover, the number of UBWs is considered regardless the size and type. Thus, the degree of influence of different kinds of UBWs is assumed to be the same. Yet, the existence of different types of UBWs may have different effects on the property price. These limitations may reduce the explanatory power of the study.

5.4.3 Assumptions

Apart from the limitations on the data used, a number of assumptions are made throughout the process of collection of data, determination of variables and establishment of models. These assumptions are mentioned or discussed in previous chapters and are summarized as follows:

It is assumed that

- the number of UBWs in each target building remains unchanged throughout the period from 2001 to 2006 and is the same as when site inspection is carried out and the number of UBWs is recorded in 2005;
- UBWs in the building are evenly distributed to all units in the building;
- the unknown variable can be expressed as a function of some known and measurable variables in the regression model;

- all customers would consider all factors before they make any decision and they are informed with full information on all those factors;
- the deflated property prices are a function of gross floor area and floor level of the property, age of the building, as well as the existence of UBWs in the building in Model 1, the existence of UBWs in the property in Model 2 or the ratio of the number of UBWs existing to the number of units in the building in Model 3;
- the dependent variable is a linear function of the dependent variables in each model; and
- the variation of the dependent variable is induced by the combination of independent variables in the models.

All these assumptions constrained the comprehensiveness and conclusive power of the study.

5.5 Areas for Further Study

As discussed in last section, the validity of this dissertation is affected by its limitations and assumptions. Actually, the research topic of this study may be repeated in a larger scale to examine more comprehensive findings about the extent and significance of the

effect of UBWs on the property price. Enlarging the area in study, taking more buildings and hence more transaction data within a shorter period into account, collecting more accurate data on the number and types of UBWs existing in each individual property and testing the data with non-linear models can help eliminate most of the assumptions and give a more comprehensive and conclusive results.

Monitoring target properties throughout a period, investigating the changes in property price of the same property before and after the construction or demolition of UBWs is another alternative way to study the effect of the existence of UBWs on property price in a more complete and determinative manner.

Furthermore, the problem of UBWs cannot be solved without continuous effort by the Government and the general public. For future study on the UBWs, one may focus on finding or deriving possible incentives for property owners to demolish UBWs based on the findings of this dissertation.

Appendix I – Location of Target Buildings

Source: Centamap at http://www.centamap.com

Appendix II – List of Target Buildings

Building Name	Address	Building Completion Date	Units	UBWs
Siu Man Court	7-9 Fort Street	Mar 1983	40	9
Wah Hai Mansion	10-16 Fort Street	Aug 1983	104	351
Wiseman Building	11-17 Fort Street	Jul 1980	100	0
Kava Mansion	29-31 Fort Street	Jun 1975	55	224
May Wei Mansion	36-38 Fort Street	Jun 1968	46	145
Elgar Mansion	41-43 Fort Street	Mar 1983	88	187
King's Court	48-52 Fort Street	Aug 1993	82	1
Echo Peak Tower	61 Fort Street	Sep 1986	22	93
Wing Shun Mansion	9 Kin Wah Street	Jun 1993	48	0
Raymond Court	14-16 Kin Wah Street	May 1979	65	89
Fok Wa Mansion	17-19 Kin Wah Street	Oct 1974	30	181
Nan Chu Mansion	7-9 Ming Yuen Western Street	Jul 1986	24	7
Ming Court	19-23 Ming Yuen Western Street	Mar 1984	24	4
Kashi Court	36 Ming Yuen Western Street	Oct 1997	24	0

Appendix III – List of Transaction Data

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
1	3.914824	1382	22	266	1	0	0.225
2	1.269036	793	3	221	1	0	0.225
3	2.757143	793	21	249	1	0	0.225
4	2.741359	793	7	256	1	0	0.225
5	2.857143	1105	15	212	1	1	3.375
6	3.430233	1105	4	235	1	1	3.375
7	2.254283	1105	4	258	1	1	3.375
8	2.734761	1105	5	262	1	1	3.375
9	3.554622	1105	20	271	1	1	3.375
10	1.696833	1525	8	209	1	1	3.375
11	3.795812	1525	13	228	1	1	3.375
12	1.264223	1525	8	244	1	1	3.375
13	3.155996	1525	20	258	1	1	3.375
14	2.180233	555	24	245	1	1	3.375
15	2.449529	810	12	226	1	1	3.375
16	2.557201	810	9	226	1	1	3.375
17	2.678571	810	20	244	1	1	3.375
18	2.428571	810	19	244	1	1	3.375
19	2.247596	810	13	250	1	1	3.375
20	1.120381	810	6	251	1	1	3.375
21	2.733964	810	13	255	1	1	3.375
22	2.426199	810	2	262	1	1	3.375
23	2.547771	810	18	265	1	1	3.375
24	2.049861	810	3	271	1	1	3.375
25	3.352007	980	25	266	1	1	3.375
26	2.453988	990	24	246	1	1	3.375
27	1.349528	732	1	257	0	0	0
28	2.475928	732	4	261	0	0	0
29	2.063274	732	12	261	0	0	0
30	1.37741	732	10	263	0	0	0
31	3.024653	732	23	268	0	0	0
32	2.728707	732	8	270	0	0	0

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
33	3.166144	732	18	271	0	0	0
34	2.881647	732	14	276	0	0	0
35	2.43617	732	17	296	0	0	0
36	2.486772	732	5	297	0	0	0
37	2.897603	732	7	299	0	0	0
38	3.035144	732	24	301	0	0	0
39	3.428571	732	17	304	0	0	0
40	3.234323	732	25	307	0	0	0
41	2.520516	769	7	251	0	0	0
42	2.461899	769	6	251	0	0	0
43	2.535211	769	5	254	0	0	0
44	1.188904	769	21	258	0	0	0
45	2.69179	769	18	259	0	0	0
46	1.991925	769	12	263	0	0	0
47	2.192982	769	18	266	0	0	0
48	2.37594	769	6	271	0	0	0
49	2.938497	769	23	289	0	0	0
50	2.147971	886	2	311	1	1	4.072727
51	2.013245	886	21	318	1	1	4.072727
52	2.018843	886	11	321	1	1	4.072727
53	2.34375	886	10	348	1	1	4.072727
54	2.479142	886	11	349	1	1	4.072727
55	2.315227	886	10	359	1	1	4.072727
56	1.629564	886	17	359	1	1	4.072727
57	1.033852	886	25	361	1	1	4.072727
58	2.409403	886	18	368	1	1	4.072727
59	1.081081	680	6	401	1	1	3.152174
60	1.386749	680	4	413	1	1	3.152174
61	1.517707	680	9	419	1	1	3.152174
62	1.389474	680	5	443	1	1	3.152174
63	2.022099	680	5	448	1	1	3.152174
64	1.470588	680	9	453	1	1	3.152174
65	1.937567	680	6	454	1	1	3.152174
66	1.054638	355	4	220	1	1	2.125
67	1.397713	355	15	220	1	1	2.125
68	0.936639	355	3	226	1	1	2.125

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
69	0.895317	355	3	226	1	1	2.125
70	1.221591	355	3	229	1	1	2.125
71	1.159091	355	3	229	1	1	2.125
72	1.440922	355	1	230	1	1	2.125
73	1.105691	355	6	238	1	1	2.125
74	1.197183	355	14	245	1	1	2.125
75	0.998308	355	9	246	1	1	2.125
76	1.150592	355	19	246	1	1	2.125
77	1.078905	355	9	248	1	1	2.125
78	1.207729	355	20	248	1	1	2.125
79	1.180575	355	14	257	1	1	2.125
80	1.038813	355	3	264	1	1	2.125
81	1.163842	355	22	265	1	1	2.125
82	1.164144	355	3	267	1	1	2.125
83	1.531213	355	22	268	1	1	2.125
84	1.237543	355	19	269	1	1	2.125
85	1.314685	355	19	271	1	1	2.125
86	1.212121	355	6	272	1	1	2.125
87	1.242236	439	18	220	1	1	2.125
88	1.290323	439	14	222	1	1	2.125
89	1.329715	439	12	227	1	1	2.125
90	1.397558	439	20	230	1	1	2.125
91	1.437403	439	2	235	1	1	2.125
92	1.37224	439	18	238	1	1	2.125
93	1.536	439	22	247	1	1	2.125
94	1.4688	439	11	247	1	1	2.125
95	0.52356	439	5	254	1	1	2.125
96	1.413613	439	20	254	1	1	2.125
97	0.540541	439	2	256	1	1	2.125
98	1.308901	439	5	257	1	1	2.125
99	1.382979	439	20	264	1	1	2.125
100	1.176471	439	13	267	1	1	2.125
101	1.430143	439	13	275	1	1	2.125
102	1.43573	439	1	276	1	1	2.125
103	2.083333	531	18	98	1	0	0.012195
104	1.879195	531	2	101	1	0	0.012195

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
105	1.926174	531	2	101	1	0	0.012195
106	1.686047	531	3	125	1	0	0.012195
107	1.823204	531	8	126	1	0	0.012195
108	1.880674	531	15	127	1	0	0.012195
109	1.830808	531	8	132	1	0	0.012195
110	2.094818	531	17	149	1	0	0.012195
111	2.55164	702	14	91	1	0	0.012195
112	2.944099	702	12	95	1	0	0.012195
113	2.843137	702	2	107	1	0	0.012195
114	2.785185	702	16	109	1	0	0.012195
115	1.500858	702	13	119	1	0	0.012195
116	2.762431	702	15	126	1	0	0.012195
117	2.594034	702	10	127	1	0	0.012195
118	2.945026	702	18	129	1	0	0.012195
119	3.012107	702	13	136	1	0	0.012195
120	2.550336	702	19	138	1	0	0.012195
121	2.857143	706	17	89	1	0	0.012195
122	2.657718	706	12	101	1	0	0.012195
123	2.773498	706	20	112	1	0	0.012195
124	2.08	706	11	122	1	0	0.012195
125	2.670807	706	6	124	1	0	0.012195
126	2.55814	706	9	125	1	0	0.012195
127	2.762431	706	20	126	1	0	0.012195
128	2.502646	706	12	140	1	0	0.012195
129	2.433862	706	16	140	1	0	0.012195
130	2.850829	706	16	146	1	0	0.012195
131	2.766252	1058	2	190	1	1	4.227273
132	2.777156	1058	6	211	1	1	4.227273
133	2.855543	1058	20	211	1	1	4.227273
134	3.210332	1058	21	225	1	1	4.227273
135	2.564576	1058	4	225	1	1	4.227273
136	2.161491	570	13	97	0	0	0
137	1.956815	570	5	102	0	0	0
138	1.956815	570	7	102	0	0	0
139	2.038043	570	8	105	0	0	0
140	1.994498	570	14	106	0	0	0

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
141	2.252374	570	8	107	0	0	0
142	1.997245	570	14	108	0	0	0
143	2.0928	570	22	124	0	0	0
144	1.965409	570	15	125	0	0	0
145	3.503106	570	21	126	0	0	0
146	2.005814	570	12	127	0	0	0
147	1.642105	570	2	143	0	0	0
148	1.013514	463	16	270	1	1	1.369231
149	1.342282	463	16	272	1	1	1.369231
150	1.105651	463	10	263	1	1	1.369231
151	0.972973	463	13	270	1	1	1.369231
152	1.315436	463	13	272	1	1	1.369231
153	1.037613	463	3	298	1	1	1.369231
154	1.351351	463	3	302	1	1	1.369231
155	1.294737	463	18	312	1	1	1.369231
156	1.214751	463	14	314	1	1	1.369231
157	1.299255	463	13	315	1	1	1.369231
158	0.745342	470	6	260	1	1	1.369231
159	1.327434	470	21	267	1	1	1.369231
160	1.357527	470	20	269	1	1	1.369231
161	1.40056	470	15	278	1	1	1.369231
162	1.092437	470	16	278	1	1	1.369231
163	1.299559	470	14	279	1	1	1.369231
164	1.591963	470	16	281	1	1	1.369231
165	1.287879	470	21	299	1	1	1.369231
166	1.262626	470	14	299	1	1	1.369231
167	1.27027	470	12	302	1	1	1.369231
168	1.041667	470	5	306	1	1	1.369231
169	1.246973	470	5	307	1	1	1.369231
170	1.208054	470	5	309	1	1	1.369231
171	1.326316	470	12	312	1	1	1.369231
172	1.180645	477	12	267	1	1	1.369231
173	1.275168	477	9	272	1	1	1.369231
174	1.006711	477	16	272	1	1	1.369231
175	1.792717	477	23	278	1	1	1.369231
176	1.155624	477	18	282	1	1	1.369231

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
177	1.254125	477	6	286	1	1	1.369231
178	1.133333	477	7	291	1	1	1.369231
179	1.381215	477	7	297	1	1	1.369231
180	0.704657	477	17	306	1	1	1.369231
181	1.185682	477	10	309	1	1	1.369231
182	1.470588	477	18	313	1	1	1.369231
183	1.425509	477	15	316	1	1	1.369231
184	1.416122	477	17	322	1	1	1.369231
185	1.639752	550	1	319	1	1	6.033333
186	1.078431	550	1	377	1	1	6.033333
187	1.750948	680	5	322	1	1	6.033333
188	1.871049	680	3	322	1	1	6.033333
189	1.78129	680	12	322	1	1	6.033333
190	1.806452	680	9	323	1	1	6.033333
191	1.922043	680	14	324	1	1	6.033333
192	2.032564	680	6	331	1	1	6.033333
193	2.121849	680	13	333	1	1	6.033333
194	1.79558	680	11	352	1	1	6.033333
195	2.435724	680	11	356	1	1	6.033333
196	1.153439	680	3	366	1	1	6.033333
197	1.938998	680	3	377	1	1	6.033333
198	2.922423	1030	11	221	1	0	0.291667
199	1.064738	387	4	186	1	0	0.291667
200	1.231317	387	1	235	1	0	0.291667
201	1.6	394	9	216	1	0	0.291667
202	1.164144	394	12	227	1	0	0.291667
203	1.522755	515	6	179	1	0	0.291667
204	1.0279	515	1	193	1	0	0.291667
205	1.471609	515	8	198	1	0	0.291667
206	1.475054	515	1	228	1	0	0.291667
207	1.525054	515	8	236	1	0	0.291667
208	1.525054	515	4	236	1	0	0.291667
209	1.58231	563	11	205	1	0	0.166667
210	1.217391	563	16	206	1	0	0.166667
211	1.586716	563	12	207	1	0	0.166667
212	1.689189	563	3	212	1	0	0.166667

Observation	DPRICE	GFA	FL	AGE	UBW1	UBW2	RATIO
213	1.659919	563	21	213	1	0	0.166667
214	1.763908	563	6	215	1	0	0.166667
215	0.770416	563	10	225	1	0	0.166667
216	1.536545	563	19	234	1	0	0.166667
217	1.792	563	9	235	1	0	0.166667
218	1.677019	563	16	237	1	0	0.166667
219	1.660182	563	7	240	1	0	0.166667
220	1.491569	563	7	240	1	0	0.166667
221	1.616162	563	3	241	1	0	0.166667
222	1.824324	563	11	244	1	0	0.166667
223	1.790576	563	18	245	1	0	0.166667
224	1.739645	563	19	250	1	0	0.166667
225	1.691429	563	2	260	1	0	0.166667
226	1.598677	563	2	262	1	0	0.166667
227	1.655773	563	8	264	1	0	0.166667
228	4.099379	686	1	39	0	0	0
229	5.115528	686	26	39	0	0	0
230	1.875	686	15	85	0	0	0
231	1.770153	686	12	101	0	0	0

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