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THE UNIVERSITY OF HONG KONG

BUILDING SAFETY IN HONG KONG: AN EMPIRICAL INQUIRY INTO THE PROLIFERATION OF UNAUTHORIZED BUILDING WORKS IN RESIDENTIAL BUILDINGS

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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HONG KONG
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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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All faults in this dissertation are mine.

Abstract

Owing to the lack of urban space and the continuous population growth in Hong Kong, the proliferation of Unauthorized Building Works (UBWs) is serious. In recent years, a number of incidents involving the collapse of UBWs have raised concerns of the Government, as well as the public towards the harmfulness of UBWs on the building safety issue in Hong Kong. The Government has long encouraged building owners to form an Incorporated Owners which is claimed to be effective to manage and maintain the conditions of buildings. However, conflicts between the Incorporated Owners and property management companies occur frequently. Whether the presence of Incorporated Owners can help improving the safety and conditions of buildings is therefore still questionable. In this dissertation, the problem of UBWs, an influential area of building safety, is extracted for investigation. Determinants affecting the number of UBWs of residential buildings will be identified and studied. Correlations between each of the factors and the number of UBWs of will be discussed.

Multiple regression analysis is adopted to test the relationship between the dependent variable and each of the independent variables identified via literature reviews and real-life observations. Empirical results suggest that the age of building, the number of units, the presence of Incorporated Owners, the presence of property management company, the coexistence of Incorporated Owners and property management company, the coexistence of Owners' Committee and property management company, and the education level of residents of the building are significant factors to explain the variation in the number of

UBWs. Conversely, the presence of Mutual Aid Committee, the presence of Owners' Committee, and the age of residents of the building are insignificant to affect the number of UBWs of the building. It is also found that the presence of Incorporated Owners is ineffective to reduce the number of UBWs. It is instead an obstacle hampering the effectiveness of the property management company to handle the problem of UBWs. Besides, although the presence of Owners' Committee alone will not improve the UBW problem, its coexistence with property management company to is highly significant to trim down the number of UBWs of the building. It is suggested to be the optimal management mode in residential buildings.

It is hoped that results in this dissertation may provide useful insights for the Government, the property owners, the general public and other concerned parties in dealing with the problem of UBWs of buildings in Hong Kong so that effective and practical resolutions will be made to tackle the issue.

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Chapter 1

Introduction

1.1 Background of Research

Hong Kong is a densely-populated city where most people live in multi-storey buildings. Due to the continuous population growth and the huge influx of immigrants in the 1960s, demand for low-cost housing greatly increased. A building boom was therefore triggered to satisfy such demand. After many years of economic recess, the problem of building dilapidation has become apparent in Hong Kong. The inferior construction quality in this era has aggravated the deterioration rate of buildings, which substantial problems concerning building safety and conditions in Hong Kong.

Building safety is actually an of-personal-concern issue for every citizen in Hong Kong. If the city continues to depreciate, the end-victims will be the owners or occupants themselves. Every year, there are accidents due to poor building safety which might cause injuries to human lives (Task Force on Building Safety and Preventive Maintenance, Hong Kong SAR Government, 2001). Since 1990, an increasing trend with the number of building-related accidents in private housing is observed, which suggests that ageing of problems should not be overlooked (Leung & Yiu, 2004). Among these recorded accidents, most of them involved fires, falling objects and collapses, which are not just detrimental to the property owners, but also a threat to the general public.

According to Hunter (1992), the word ‘safety’ means a condition free from exposure to danger, injury or loss, while the term ‘safe’ means freedom from danger. That is to say, issues of safety in buildings offer occupants freedom from hazards or risks (Hunter, 1992). The subject of building safety is a wide topic covering various areas of concerns, including mainly fire safety, falling objects (such as concrete pieces) and unauthorized

building works (normally known as UBWs). After several large fire tragedies (e.g. Garley Building in 1997) in the past few years, the Government and the public have become more aware of the fire safety aspect of buildings. Most literature therefore put an eye on measures about the problem of fire safety in buildings. However, fire safety is only one aspect of the whole building safety issue. As mentioned before, there are other factors affecting the safety of buildings.

Although many people may treat falling objects and authorized building works as separate matters contributing to the safety of buildings, a series of incidents involving the collapse of alleged UBWs in recent years has shown that UBWs are usually major causes for falling objects. In other words, the proliferation of unauthorized building works may constitute various safety problems to buildings. Though UBWs may not be the entire reflection of building safety, they can undoubtedly represent the potential safety problem of the building. In this dissertation, therefore, the author would like to focus on the problem of UBWs in Hong Kong, aiming at providing an insight on the safety and conditions of buildings.

1.2 Research Questions

Owing to the uniqueness of each building, the standard for building safety is hard to define. In recent years, the importance of building repair and maintenance to sustain the safety and conditions of buildings has been stressed. In this research, the following questions will be examined:

1. What are the factors affecting the number of unauthorized building works in residential buildings in Hong Kong?
2. How does each identified factor affect the number of unauthorized building works in residential buildings in Hong Kong?

1.3 Research Objectives

This dissertation aims at explicating the relationship between different factors contributing to the safety conditions of buildings. Due to the constraints of time and resources, buildings targeted in the study are confined to residential buildings in Hong Kong. Two objectives are established as follows:

1. To identify the factors affecting the number of unauthorized building works in residential buildings in Hong Kong;
2. To examine how each identified factor affects the number of unauthorized building works in residential buildings in Hong Kong.

1.4 Significance of Research

Hong Kong is a city densely packed with buildings. As the city develops, the dilapidation of buildings becomes more serious. The safety of building safety is thus of great importance to sustain the life of the whole society. The coverage of building safety is very wide and includes aspects such as fire safety and structural safety. There are studies assessing how fire safety affects occupants of the buildings and suggesting ways to make improvement on this facet. However, these only constitute part of the building safety problem. In fact, it is hard to deal with all issues about building safety in one piece of work. The whole picture of building safety has to be constructed by examinations of various related areas.

Unauthorized building works are common features in buildings in Hong Kong. They are also structures which may affect the safety of buildings since the construction of UBWs has not obtained the approval and consent from the Building Authority to be “lawful” and “safe” structures to the buildings. Consequences due to the existing of UBWs can be severe or even fatal. Therefore, the problem of the proliferation of UBWs cannot be neglected anymore. To tackle the problem of UBWs, actions can be executed in two directions, i.e. to prevent the construction of new UBWs and to remove existing UBWs.

For the former type of action, it is probably more cost-effective for the Government to take the initial role such as implementing legislation to forbid the construction of new illegal structures.

For the latter type of action, however, responsibilities do not only lie on the Government. It is understood that it is a harsh task to force every citizen in Hong Kong to take part in the removal policy or schemes organized by the Government to remove UBWs. Nevertheless, it is better for the Government to identify first the buildings which need immediate concern. They should be buildings in which the proliferation of UBWs is dreadfully serious but no one has taken any action to tackle. As a result, the identification of appropriate target buildings is important to make the removal process of UBWs more efficient. After the factors affecting the number of UBWs are figured out, high-risk buildings will be easier to be spotted. Moreover, the Government can implement appropriate schemes in light of factors that are found to be significant to help reducing the number of UBWs. All these contribute to the author's intention to focus on finding out determinants for the number of UBWs of residential buildings and their empirical relationships in this dissertation.

1.5 Delineation of Terms in the Research

In this research, several terms are delimited by the author so as to suit the scope and purpose of the research.

1.5.1 Residential Buildings

A "building" is defined as a structure that is built for human habitation. Generally, buildings can be used in various ways. For example, people may carry out business (such as retailing), work (such as office) or live (house) in buildings. Accordingly, "residential buildings" refer to buildings that are used for residential purpose, with rooms or suite of rooms that are designed as a residence and generally occupied by more than one household.

In this dissertation, the scope of residential buildings under investigation is limited to high-rise residential buildings, whereas houses are excluded. It is believed that the

problem of UBWs is extremely serious in urban areas where most of the residential buildings are tall. The accumulative number of UBWs of these buildings is remarkable. Moreover, collapses of UBWs from multi-storey buildings can lead to much more serious consequences than that from one- or two-storey houses.

1.5.2 Unauthorized Building Works

The scope of UBWs investigated in this dissertation is narrowed to those observable UBWs on the external walls of the buildings. The main reason for counting only this kind of UBWs is that they are accessible and observable from the outside of the buildings. In many cases, entry to the building is not forbidden by occupants, the management officer or the security guard. Therefore, it is very difficult to investigate UBWs that are not apparent from outside. Another rationale is that UBWs on external wall are major sources of falling objects from buildings, which may constitute to serious or even fatal consequences. That's why the externally-erected UBWs are worth investigating and should be eliminated as soon as possible.

1.6 Outline of Research

In this dissertation, there are five chapters in total.

Chapter 1 is **Introduction**. It includes the background, objectives and structure of this dissertation.

Chapter 2 is **Literature Review**. This chapter provides literature about the existing building conditions in Hong Kong, the problem of unauthorized building works (UBWs), relevant legislations dealing with UBWs, and other factors that may potentially affect the number of UBWs.

Chapter 3 is **Hypotheses and Methodology**. It introduces the hypotheses proposed and the research methodology used in this dissertation. Hypotheses are drawn with reference to relevant literature and real-life observations. To test the hypotheses, a quantitative method, multiple regression analysis, will be adopted. Different variables under

investigation will be discussed and their relationship with the safety and condition of buildings will be examined.

Chapter 4 is **Empirical Results, Discussions and Recommendations**. In this chapter, actual research findings, with the corresponding descriptive statistics will be presented. Discussions of the findings, as well as recommendations on improving the problem of unauthorized building works in Hong Kong will be given.

Chapter 5 is **Conclusion**, which summarizes the results and implications of this dissertation. Limitations of the research and areas for further study will be provided.

Chapter 2

Literature Review

2. 1 Introduction

In this chapter, literature of various aspects regarding the safety and conditions of buildings, as well as the issue about Unauthorized Building Works (UBWs) in Hong Kong will be reviewed. The author aims at providing some insights and background knowledge related to the dissertation topic, building safety and the proliferation of UBWs, to readers through the review of previous research and study. Section 2.2 introduces the current building conditions in Hong Kong. Section 2.3 focuses on the topic of UBWs and defines the term based on legislation. Also, categories of UBWs, reasons for the existence of UBWs and their effects on residential buildings are discussed. The types of UBWs that are included in this dissertation are defined in this section as well. Section 2.4 presents existing legislations which are governing actions against UBWs. In Section 2.5, potential determinants for the number of UBWs of buildings are discussed.

2.2 Building Conditions in Hong Kong

According to the Buildings Department[1], the usage age of buildings in Hong Kong is around 50 to 80 years on average (Buildings Department, 1997). As at 2005, there were about 39,000 private buildings in Hong Kong, 13,000 of which were over 30 years old. In ten years' time, it is expected that the number will increase to 22,000. Therefore, if buildings are not maintained at good safety and conditions now, they will become huge threats to the city environment after some years.

[1] Buildings Deparrtment: http://www.bd.gov.hk/

With reference to a survey carried out by the Department of Building and Construction of the City University of Hong Kong, half of the residential buildings in Hong Kong have shading devices such as overhang, sidefins and balcony. There is a growing trend for buildings to have projecting windows so as to increase the internal usable area. These designs enlarge the exposure of the building facades to the problem of weathering and shorten the buildings' life cycle (Lee, 1999). In Wong's study (1998), he points out that the decay process of buildings is anticipated to continue accelerating. It may be due to four main reasons. Firstly, property owners in Hong Kong normally lack the knowledge of building defects and the understanding on the importance of building maintenance. Besides, they are not aware of the safety of buildings that they often construct illegal building works or undertake alteration works which may damage the building structure. Thirdly, the aspect of proper building management is always ignored so that complex problems concerning building maintenance cannot be efficiently solved. Finally, as humid weather and polluted environment are common in Hong Kong, acid rain which erodes the concrete and steel reinforcing bars in buildings may emerge.

2.3 Unauthorized Building Works

Unauthorized building works UBWs are common features that can be found elsewhere in Hong Kong. The proliferation of UBWs in the area has long been a threatening factor to building safety. There were approximately 800,000 UBWs within all private buildings in Hong Kong in 2001. (Housing, Planning and Lands Bureau 2001b). And there have been about 10,000 new UBWs constructed every year. The situation will be even worse if no remedial actions are taken to tackle the problem.

2.3.1 Definition of Unauthorized Building Works

Section 2 of the Buildings Ordinance (Cap 123)[2] explicitly defines the terms "building" and "building works" broadly that almost any form of construction may fall within the definition of "building works" (Davison, 1990). Section 14 of the Buildings Ordinance (BO) specifies that no construction of building works can be

[2] Buildings Ordinance, Chapter 123, Laws of Hong Kong

commenced without the prior approval of building plans and consent for commencement of the building works from the Building Authority (BA). Any building works contravening this stipulation are regarded as unauthorized building works (UBWs), unless they are exempted under Section 41 of the BO (Yiu and Yau, 2005). Followed is the summary of exempted building works which can be carried out without prior approval and consent from the Building Authority (Lai, 2003):

(i) Buildings which belong to the Government
(ii) Buildings which belong to any person representing the People's Liberation Army;
(iii) Buildings which belong to the Housing Authority under the Housing Ordinance[3];
(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
(vi) Building works of a non-structural nature or which do not contravene any regulation.

2.3.2 Categories of Unauthorized Building Works

"UBW" is a general term to describe those building works explained in the previous section. It covers various kinds of structures which can be found in buildings in Hong Kong. Lai and Ho (2001) categorize UBWs into three broad types in functional terms:

(i) Type 1: advertisement sign boards projecting from external walls or resting on roof tops 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.

Unauthorized structures can be constructed in many different areas, such as the building façade, internal or external common areas and the rooftop. Typical kinds of

[3] Housing Ordinance, Chapter 283, Laws of Hong Kong

UBWs found in buildings in Hong Kong are summarized as follows (Davison, 1990; Leung and Yiu, 2004):

(i) Cages, canopies, metal flower racks and any projection from the external walls 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;
(iv) Metal supporting frames for air-conditioning plants and cooling towers;
(v) Alterations to means of escape;
(vi) Subdivision of approved units in multi-storey residential and industrial buildings; and
(vii) Unauthorized changes of use which may or may not include illegal structures.

2.3.3 Reasons for the Existence of Unauthorized Building Works

Hong Kong is one of the most densely populated cities in the word, with 6,420 persons per square kilometer on average as at end June of 2005 (Hong Kong Government, 2005). In such a congested city, the majority of people are living in tiny flats. The crammed living environment boosts the incentive of property owners to maximize their space and amenities by constructing unauthorized building works. Lai and Ho (2001) reinforce the idea that the existence of unauthorized structures reveals the inadequate supply of space in urban land in Hong Kong.

In addition, some of the economic incentives to build unauthorized structures in private property are identified in the study of Lai and Ho (2001). It is pointed out that the mismatch between architectural design and actual needs or preferences of occupants is a catalyst leading people to build illegal structures. It means that due to the dissatisfaction of people on the original design or layout of the units, they may tend to re-design the units according to their personal preferences.

To look into the existence of UBWs from an economic perspective, it can be analyzed under the demand-supply paradigm. Under perfect market conditions, the number of

UBWs constructed should be "determined" by the market through both demand and supply forces (Li, 2003). As UBWs are economic goods which may generate services and additional space for property owners, owners will continue building unauthorized structures until reaching the point that the marginal cost of production equals to the marginal revenue generated by that particular unit of UBW. That is to say, if the owners find that there is potential benefit, no matter it is monetary or non-monetary, of constructing an UBW, they will tend to produce that particular unit of UBW in order to capture the marginal benefit and maximize their utility level.

Although the existence of UBWs may provide certain extent of benefits or services to the property owners, they may induce a lot of building safety problems to the society. Since the effects of UBWs on the structural and safety performance of buildings cannot be easily observed instantly after the construction of UBWs, people may not be aware of the harmfulness of UBWs. They tend to neglect the hidden problems until accidents really occur.

2.3.4 Effects of Unauthorized Building Works on Residential Buildings

The danger of having numerous UBWs in a densely-built city like Hong Kong may be enormous. Due to the advanced construction technology, residential buildings in Hong Kong nowadays normally consist of 20 to 40 storeys. One may imagine that even a small piece of object falls from this height, such as a debonded mosaic tile from the external wall, fatal consequences may be resulted (Leung and Yiu, 2004).

Lai and Ho (2001) address four implications about how the existence of UBWs affects the safety and conditions of the buildings, which include:

(i) *Loading implications* – The presence of UBWs is a source of hazards for Hong Kong. UBWs may impose additional loading to buildings. Any failure and collapse of building structures (authorized or otherwise) due to illegal alteration or addition may lead to fatal accidents.

(ii) *Fire risk implications* – Some of the UBWs may obstruct the means of escape (MOE) requirements under the Buildings Ordinance, potential fire hazards will be induced. These UBWs make fire fighting and rescue more difficult when fire hazards occur. One of the most significant types is rooftop structure in single-staircase buildings. When a fire breaks out in the building, occupants may have no means to escape to the rooftop and wait for rescue.

(iii) *Visual and aesthetics implications* – As UBWs are illegal structures which may not be visually consistent with the original design and appearance of the building, the visual and aesthetics aspects of the building will be negatively affected. This makes the building environment look untidy. Also, occupants of neighbouring buildings will be unhappy with the situation and complain to the Building Authority.

(iv) *Lighting and ventilation* – For a building to be appropriate for living, lighting and ventilation are two important considerations. However, UBWs which project from the external walls such as canopies and hanging iron cages may block natural lighting and ventilation. This problem is particularly significant in office and residential buildings wherein "prescribed windows" have to be provided to habitable rooms since the blockage of natural lighting and ventilation may infringe the requirement that prescribed windows should face into a space uncovered and unobstructed vertically.

Apart from the physical effects of UBWs on residential buildings in Hong Kong, the proliferation of UBWs also hinders the carrying out of maintenance works which make the safety and conditions of buildings worse. For example, many UBWs may be erected on the exteriors and flat roofs of buildings which block access to components of the drainage system. This greatly hampers the execution of repair and maintenance works to the exterior and drainage system of buildings. Also, some externally fixed unauthorized works will affect the structural safety of buildings where they are attached to.

In reality, many owners are normally reluctant to pay for the removal cost of these structures. However, one noticeable point is that if no repair or curing measures are taken by the concerned parties (such as property owners and the Government), the cost of deferred repair and maintenance when the building is old will be much higher (Chan, 2004). In the future, those deteriorating buildings with unpleasant appearance will add immense pressure on the society. As a result, more considerable costs will have to be paid.

Besides, economic loss is also a potential effect posed by UBWs in the senses that if UBWs cause injuries or even kill passers-by, owners may have the civil liability to pay for any compensation. With reference to the collapse of an illegal fish tank and canopy in Albert House which killed one and injured eight people in 1994, building owners of Albert House were held legally bound to pay a huge amount of damages caused by this fatal accident. (South China Morning Post, 10 November 2004)

2.3.5 Types of Unauthorized Building Works included in the Study

In practice, there are many types of structures that fall within the ambit of UBWs. Due to the limitations on resources, time and accessibility during the stage of data collection, the research's realm for UBWs is scaled down. As explained in Section 1.5.2, UBWs counted for analysis in this study may only refer to UBWs erecting on the exteriors of the buildings. Other elements of UBWs such as those inside the flats and are not observable during site inspections will be excluded. Followed are the most common types of UBWs found in residential buildings in Hong Kong and they are extracted for investigation:

(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); and

(ix) Metal cage.

The sum of the abovementioned components attached to the external wall of the buildings will be calculated as the total number of UBWs of the buildings. This data will be used for the regression analysis in latter section.

2.4 Legislation on Unauthorized Building Works

In Hong Kong, all existing private buildings are supervised by the Building Authority (BA) under the Buildings Ordinance (BO). The legislation aims at ensuring that minimum required standards of safety, health, and environment are met (Yiu and Yau, 2005). Various provisions are set out in the BO to give the definition on UBWs and empower the BA to take actions against unauthorized building works.

2.4.1 Buildings Ordinance

Buildings Ordinance (Cap. 123) is applicable to all buildings[4] and building works[5] in Hong Kong, with the exception of government construction, i.e. buildings and building works owned by the Government together with public housing provided by the Housing Society. The Ordinance shall also be applied to the safety of land adjacent to buildings and construction sites (Li, 2003).

Under present legislation, newly completed private buildings are required to be inspected by the Buildings Department ("BD") to ensure that buildings are built in compliance with stipulations and requirements of the Buildings Ordinance before

[4] According to Section 2 of the Buildings Ordinance (Cap123), "Buildings" refers to the whole, or any part, of any domestic or public building or building which is constructed or adapted for use for public entertainment, arch, bridge, cavern adapted or constructed to be used for the storage of petroleum products, chimney, cook-house, cowshed, dock, factory, garage, hangar, hoarding, latrine, matshed, office, oil storage installation, out-house, pier, shelter, shop, stable, stairs, wall, warehouse, wharf, workshop or tower, sea-wall, breakwater, jetty, mole, quay, cavern or any underground space adapted or constructed for occupation or use for any purpose including its associated access tunnels and access shafts, pylon or other similar structure supporting an aerial ropeway and such other structures as the Building Authority may by notice in the Gazette declare to be a building.

[5] "Building works" includes any kind of building construction, site formation works, ground investigation in the scheduled areas, foundation works, repairs, demolition, alteration, addition and every kind of building operation, and includes drainage works under Section 2 of BO.

occupation permits can be issued to the developers. However, no provision about regular building inspection is laid on property owners to take the initiative role. BD is responsible for handling the "blacklisted" buildings and cases transferred by the District Offices and other government departments such as the Fire Services Department (Lee, 1999). Once the Buildings Department confirms that repair work is necessary, a Repair Order will be served on relevant property owners or the Incorporated Owners groups of the building.

2.4.2 Source of Authority

Section 2 of the Buildings Ordinance (Cap 123)[6] defines "Building Authority" as the director of Buildings. Section 24 and Section 26 of the Ordinance empower[7] the Building Authority to serve an order on offenders for the removal or demolition of any building, building works or street works which have been or are being carried out in contravention of the provisions of the Ordinance.

2.4.3 Section 24 of Buildings Ordinance

There are four sub-sections in Section 24 of the Building Ordinance: Section 24, Section 24A, Section 24B and Section 24C. These sub-sections give power to the Building Authority to cope with any building works incompliant with legal requirements under different circumstances without prejudice.

The heading of Section 24 of the Buildings Ordinance is "Order for demolition, removal, or alteration of building, building works or street works". This section replaces the Building (Amendment) Ordinance 1959. Since its first enactment, the Ordinance has been amended subsequently in 1966, 1986 and 1993 and 2004. The Building Authority is empowered by the Ordinance to serve demolition, removal or alteration orders on owners of buildings or building works which contravene the Ordinance. Owners are required to resume their properties back to the status approved by the Authority, or in some cases, subject to the satisfaction of the Building Authority. This section also states the power vested on the Building Authority in

[6] Buildings Ordinance, Chapter 123, Laws of Hong Kong
[7] Section 24 and Section 26 of the Buildings Ordinance, Chapter 123, Laws of Hong Kong.

every case to specify the time within which the demolition, alteration or work required by such order shall be commenced and completed.

Section 24A is entitled "Order to cease or remedy dangerous works". It empowers to the Building Authority to serve an order on owners requiring them to cease any building works or street works which will cause, or will be likely to cause, a risk of injury to any person or damage to any property. Li (2003) points out that the objective of this section is to give power to the Building Authority to order a person responsible for the said defects to carry out remedial works to remove the source of danger. This section was added to the Building (Amendment) Ordinance 1972 and was amended in 1993. Section 24A adds the concept of "dangerous works" into the Ordinance which extends the power of the Building Authority to deal with illegal and dangerous building works and structures.

Section 24B was added in 1990. It is entitled "Priority demolition" which vests the power on the Building Authority to apply to the District Court for an order under subsection (9), instead of making an order under Section 24(1). This section provides alternative means for the removal of building works which contravene the Ordinance. This aims at facilitating the process of handling dangerous or risky building or building works that are detrimental to life and property (Li, 2003). As this sub-section empowers the Building Authority to conduct the ratifying works without serving an order to individual owners under conditions stated in sub-section (1) by applying for a court order, the process of building work demolitions can be facilitated. Without Section 24B, the Authority could only serve orders on relevant owners requiring for the removal, demolition or alteration of specific building works (Li, 2003). This practice limits the actions that the Building Authority can exercise to deal with illegal building works.

Section 24C is entitled "Notice for demolition or alteration of building or building works". This section was added to the Ordinance in 2004. It states that the Building Authority may issue a notice in writing for any building works, have been or are being carried out, in contravention of any of the provisions of the BO and serve on the owner of the land or premises. If such works are connected to other land or premises, or is used by owners or occupiers of that other land or premises, the notice should be

served on the owner of that other land or premises. Since the notice issued under this section may affect the land or premises, it shall be registrable in the Land Registry. After the completion of removing or altering the building works spelt out in the notice, the Building Authority may lodge in the Land Registry of his satisfaction against that notice.

Li (2003) points out that the enactment of Section 24 appears to ensure the safety of buildings or building works, the authority should also implement regulations to protect safety of the public so that a safe living environment can be ensured and provided.

2.4.4 Section 26 of Buildings Ordinance

Section 26 of the Buildings Ordinance consists of two sub-sections: Section 26 and Section 26A. They further vest the power on the Building Authority to deal with building works contravening the Ordinance. Section 26 copes with dangerous buildings while Section 26A is about defective building works, providing alternative ways for the Building Authority to take action on structures which are perceived as dangerous or defective.

Section 26 is entitled "Dangerous buildings". Since the initial enactment of this section, some amendments have been made on the provisions in 1966, 1983, 1990, 1993 and 1996. One of which was about the meaning of "dangerous" in subsection 1 of section 26. It was reviewed and interpreted again in the 1993 amendment. Under this section, "dangerous" was defined as:

> *"Where in the opinion of the Building Authority any building has been rendered dangerous or liable to become dangerous by fire, wind, rain, dilapidation, use, lack of fire escapes or any other cause, the Building Authority may by order in writing served on the owner declare such building to be dangerous or liable to become dangerous." (Subsection 1 of Section 26 of the Buildings Ordinance)*

This prescribes the power given to the Building Authority to serve an order on owners commanding them to remove any unsafe structures or dangers, which in the opinion of the Building Authority, are risky to the public. Section 26 (4) also states that if the Building Authority considers it necessary in case of emergency, he is empowered to undertake remedial works without prior notice to the owners. Although there is no clear indication that unauthorized building works are the same as dangerous building works, the authority may also remove the unauthorized building works relying on the "risk to the public" condition (Li, 2003).

Section 26A is entitled "Defective buildings". It was added to the Ordinance in 1992. Since its first edition, some revisions have been made on this section in 1996. Li (2003) mentions that the most important amendment is the one concerning the assignment of responsibilities and duties to maintain and repair buildings. Under the original Building Ordinance prior to the enactment of this section, the Building Authority had to specify areas of buildings or building works which may potentially constitute threats to the public. If the Building Authority saw the structures or building works to be dangerous, remedial works had to be undertaken by the owners. However, this primary practice was proved to be unworkable due to limited resources. Therefore, the amended provision vests the power to the Building Authority to serve an order on owners of buildings which consist of defects. The owners have to carry out the required remedial works consequently (Li, 2003). This lays some of the responsibilities to individual owners to rectify the defective works

Section 26 prescribes all buildings and building works in Hong Kong, providing other means for the Building Authority to deal with different buildings or structures. For example, it implicitly indicates the power of the Building Authority to handle unauthorized building works which are structurally unsafe to the buildings and may constitute danger to the public (Li, 2003). The application between Section 24 and Section 26 of the Ordinance is actually a complex mechanism which is out of the scope of this dissertation.

2.5 Determinants for the Number of Unauthorized Building Works

Literature regarding to the reasons contributing to the existence of UBWs has been reviewed. Nevertheless, the idea about what influents the extent of UBWs remains a question. Here, a review of research about factors affecting the amount of UBWs of buildings will be provided.

In Li's (2003) study on UBWs of buildings in Hong Kong, 41 buildings located at Tsuen Wan District are included. These samples include residential buildings, industrial buildings, commercial buildings and an R/C composite building. Three explanatory variables, including building age, unit to storey ration, and the existence of a professional management office are put into the regression model to examine their effects on the dependent variable, i.e. the number of UBWs per unit. Findings of Li (2003)'s research are summarized as follows:

(i) The number of UBWs of buildings increase with building age;
(ii) Buildings managed by a professional management company will consist of a smaller number of UBWs; and
(iii) The number of units of buildings will have no effect on the number of UBWs.

The study of Li (2003) provides a general insight on the determinants of the number of UBWs of buildings. However, one should keep in mind that result (ii) is a broad explanation about the effects of building management on the number of UBWs. In reality, there are different kinds of management bodies existing in private buildings in Hong Kong which are of different natures, compositions and authority to manage buildings. Each of them may give diverse performance in building management. Therefore, it is not conclusive enough to categorize building management into two groups only, i.e. with or without professional management company. In section 2.5.3, the author will put in a number of factors concerning building management. They are the different kinds of management bodies available in residential buildings in Hong Kong. This may enhance the explanatory power of the effect of building management on the number of UBWs of residential buildings. In addition to these considerations,

two socio-economic factors will be taken into account to investigate their implications on the number UBWs, i.e. age and education level of residents.

2.5.1 Building Age

In 2005, about one-third of the total private buildings in Hong Kong were over 30 years old (i.e. 13,000 out of 39,000). After ten years, the number buildings aged over 30 is expected to increase to 22,000. A lot of safety-related problems are associated with the ageing trend of buildings. For buildings with older age, the likelihood for them to cause hazards to occupants and the general public is relatively higher. Baldwin (1994) suggests that the cost required to spend on building maintenance is closely related to the age and facility failures of the building. Also, in districts which are packed with old buildings like Sham Shui Po, occupants are usually the elderly or low-income immigrants, who may have less ability to afford high maintenance costs (Wan, 2005). Conditions of these old buildings become even worse.

The removal of UBWs is a part of the common repair and maintenance works in residential buildings. However, the owners' motivation to get rid of UBWs of the buildings is still very weak. Apart from the low affordability of occupants, another reason is that people have been used to live in poor living environment that they do not care about building maintenance although it may improve the safety and conditions of the building (Chan, 2003). On the other hand, even some know that UBWs may pose danger to the buildings and occupants, they still lack the incentive to remove the unauthorized structures. Most of them have the "wait-and-see" attitude towards the potential hazards that may be incurred due to the existence of UBWs. People are insensitive to the seriousness of the consequence created by the proliferation of UBWs.

From the perspective of investment, owners are reluctant to spend much on improving the conditions of older buildings (Walter and Hastings, 1998). As the profit margins and business opportunity generated by the management of very old buildings are small, professional management companies are seldom interested in it. So, many aged buildings are not properly managed. Without the existence of management agents like the Incorporated Owners or property management companies, owners or occupants

may rarely take the initiative role to undertake improvement work. Conditions and appearance of these buildings are left poor and chaotic. In many cases, even some buildings are managed by a management agent, limited services are provided. For example, very often provides caretakers only (Lau, 2003; Chan, 2003). The low investment return and incentive for owners to carry out repair and maintenance on UBWs may further the problem of UBWs.

As there is no definite meaning delineating which building age is old or not, the author adopts the general concept that buildings aged 30 or above will require more concerns on building safety and condition than those below 30 years old. And so, this dissertation will focus on residential buildings which are equal to or more than 30 years old.

2.5.2 Number of Units

Demand for housing in urban areas is great because most employment opportunities are found in these areas (Lai and Ho, 2001). However, due to the limited supply of urban space, the living environment in Hong Kong is normally congested. To deal with the large demand for accommodation, one of the solutions is to construct high-rise residential buildings. To increase the number of units provided, it is now very common in Hong Kong to build "twin tower" private residential blocks (Lai and Ho, 2001). This form of structure may consist of 30 storeys and 12 units on each floor. More then 1,000 people are accommodated. According to the Council for Sustainable Development[8], the average flat size in Hong Kong is around 650 square feet (the calculation included also luxurious residential buildings). In such limited living areas, the construction of UBWs becomes more widespread. As units in a resident block are usually of similar layout, it is believed that the demand for UBWs is alike in every unit within the same building, other things being constant. From real-life observations, it is not difficult to see drying racks are erected on the external wall of every unit of the building. That is to say, the erection of UBWs in all individual units will substantially increase the number of UBWs contained in the building.

[8] Council for Sustainable Development: http://www.susdev.org.hk/en/index.html

UBWs erected in common areas of the building are difficult to deal with since the execution of removal or remedial works has to be compromised by owners of the buildings. The more units existing means that more people may be involved in the decision making process. Consensus is hard to attain (Lee, 1997). The large number of parties involved will also add burden to the management company to coordinate the maintenance or repair works within the building owing to the diverse objectives and intentions of different parties. Individual owners tend to maximize their own interests and this renders difficulty for management company to implement improvement works (Walter and Hastings, 1998). Although it is argued that people will tend to join together and make a consensus if cooperation is the best interest of all owners(Walter, 2002), the transaction costs involved to get the agreement made may be too high that obstruct the carrying out of the works (Lai and Ho, 2001).

Due to the accumulative power of UBWs in individual units, as well as the costs and difficulties involved in undertaking maintenance, repair and improvement works, it is believed that having more units in a building is a barrier to solve the problem of UBWs.

2.5.3 Building Management

Looking back at the history of buildings in Hong Kong, buildings in the 1960s were normally of just three to six storeys owing to limited technology of construction methods and building services (Leung and Yiu, 2004). Until the 1970s, building technology grew rapidly. The height of buildings increased to an average of 20 storeys. As the supply of space is inadequate in Hong Kong, buildings nowadays are mostly high-rise (up to about 40 storeys high) so as to accommodate a larger population. In this densely-populated city, problems associated with buildings are serious.

Buildings in Hong Kong are commonly made of reinforced concrete. Building materials depreciate over time due to both artificial (e.g. inappropriate use of buildings) and non-artificial (e.g. fire disaster, rain and strong wind) factors. Building management therefore plays a very important role to ensure buildings are operated in safe and good conditions. If buildings have been left unmanaged for years, problems

concerning building safety and condition will inevitably emerge. One of the serious problems that buildings commonly pose is concrete- and debonded mosaic tile- falling from the external wall (Leung and Yiu, 2004). The consequences of these accidents can be fatal. Therefore, proper building management has become increasingly important to preserve the life of buildings.

2.5.3.1 Definition of Building Management

"Building Management" has been defined in many ways from different perspectives. Macey (1978) gives the interpretation on building management from both physical and social perspectives. It is defined as the "application of skill in caring for the property, its surroundings and amenities, as well as developing a sound relationship between landlord and tenant and between tenant and the estates". Macey (1978) points out that the management of buildings does not only cover the caring of the property and its associated facilities, but also the relationship between different concerned parties of the property. The Chartered Institute of Housing (1980), a professional property management organization, also indicates the social consideration for the definition of building management. It states that (Institute of Housing, 1980):

> *"the management of housing property is provided primarily as a service to the community or some part of it, but not excluding property owned for profit… and the giving of advice on the extent… in particular areas and on the management aspects of design and layout"*

Loo (1991) and Baldwin (1994) give a wide definition to building management. It is stated that building management should be the management of various human activities or interactions in dealing with consequences arising from the use or occupation of premises for various or mixed properties (Loo, 1991) and "the total care of buildings" (Baldwin, 1994). In brief, building management is about how buildings are operated in an appropriate manner so that the environment of the property and its surrounding amenities can be maintained; and people related to the buildings (such as owners and tenants) can be taken care of.

To understand the scope of works covered by the management of buildings, the Code of Practice on Building Management and Maintenance includes three main concerns:

1. Environment hygiene;
2. Waste separation and recovery; and
3. Repair and maintenance.

Wan (2004) indicates that the Code of Practice can be a reference or guideline for management bodies to follow when dealing with daily operations. But they are not the whole picture of building management (Wan, 2005). Apart from the mentioned aspects, Loo (1991) suggests that security and financial management should not be ignored for the management of buildings. According to the classification of real estate category that needs management given by Kyle (2000), the four major groups are residential, commercial, industrial, industrial and special purpose. As far as this research is concerned, the author will focus on the first category, i.e. residential apartment buildings.

2.5.3.2 Source of Authority of Building Management

For many years the Hong Kong Government has been criticized to have done very little to prevent the deterioration of buildings. However, there is still no legal mandatory building inspection or maintenance scheme which explicitly requires property owners to maintain their properties (Chan, 2003). To encourage and improve the building management practices in Hong Kong, Building Management Ordinance[9] (BMO) is enacted to statutorily control issues concerning the management of buildings. Apart from the BMO, the Deed of Mutual Covenant (DMC) of buildings also set out provisions to deal with building management affairs. Nevertheless, BMO and DMC exert different influences on building management. Details will be discussed in the following.

[9] Building Management Ordinance, Chapter 344, Laws of Hong Kong

2.5.3.3 Building Management Ordinance

In 1970, the Multi-storey Buildings (Owners Incorporation) Ordinance [10] was endorsed. It provided a legal framework for owners to form Incorporated Owners (IOs) and to manage their own buildings. This practice aimed at promoting the owners' participation in the management of the properties [11]. In 1993, the Government reviewed the Ordinance and re-titled it as the Building Management Ordinance (commonly called BMO). The BMO specifies in detail the rights and obligations of owners when forming Incorporated Owners of the building. The Ordinance also specifies provisions stipulating owners on how buildings should be managed. Incorporated Owners (IO) is given specific powers and responsibilities regarding the management of the common parts of the buildings.[12] According to the long title of BMO[13], the main objective of the Ordinance is:

> *"To facilitate the incorporation of owners of flats in buildings or groups of buildings, to provide for the management of buildings or groups of buildings and for matters incidental thereto or connected therewith."(Long title of the Building Management Ordinance)*

The Government hopes that owners can be assisted by the Ordinance to manage their property and resolve relevant building management problems on a self-help basis.[14] So, owners of multi-ownership buildings are empowered to officially form an Incorporated Owners (IO) to manage their properties through the operation of the IO (Wan, 2005). In order to facilitate the formation of Incorporated Owners, the requirements for setting up an Incorporated Owners have been relaxed in the 1998 and 2000 amendments of the Ordinance. Moreover, in order to further improve the management standards of buildings, the Government empowers the Authority, i.e. the Secretary for Home Affairs, to order the Incorporated Owners of a building which has serious management and maintenance problems to appoint a building management agent to manage the buildings under the Building Management (Amendment)

[10] The current "Building Management Ordinance, Chapter 344, Laws of Hong Kong"
[11] Home Affairs Bureau: http://www.hab.gov.hk/
[12] Home Affairs Bureau: http://www.hab.gov.hk/
[13] Building Management Ordinance, Chapter 344, Laws of Hong Kong
[14] Home Affairs Bureau: http://www.hab.gov.hk/

Ordinance 2000. If such building does not have an Incorporated Owners, the Authority may apply to the Lands Tribunal to order a meeting of owners requiring them to form an Incorporated Owners and to assign a management agent to manage the building.

2.5.3.4 Deed of Mutual Covenant

As defined in section 2 of Building Management Ordinance, "Deed of Mutual Covenant" (DMC) means a document which[15]:

1. defines the rights, interests and obligations of owners among themselves; and
2. is registered in the Land Registry.

DMC is a legal document in the form of a contract which is signed by the developer, the first purchaser of the unit and the manager appointed by the DMC (if any). As required by the BMO, a DMC needs to be registered in the Land Registry so as to become binding (Central & Western Provisional District Board, 2001). Since all signatories, assignees and successors are legally bound by the DMC, each party, especially owners of the properties including their successors in title, should take careful note on all terms under the DMC.

In Hong Kong, DMC is also a main source of authority for owners to manage their properties. However, as DMC is normally drafted by a solicitor appointed by the developers, some unfair terms may be put in the DMC which are in favour of the developers (Colliers Jardine, 1991). Wan (2004) exampled the *Uniland Investment enterprise Limited* case[16] to indicate the potential for developers to include unfair terms in DMCs. According to the judgment of the high court deputy judge in the above case, it was stated that:

> *"It would not be difficult for developers to introduce unfair terms in the DMCs as the first buyers are usually associated with the developers to be*

[15] Building Management Ordinance, Chapter 344, Laws of Hong Kong
[16] Sihombing, J. and Wilkins, M. (1994) *A Student's Guide to Hong Kong Conveyancing*, Hong Kong: Butterworth Asia

speculators who are indifferent as to the terms of the DMCs, while other buyers are automatically bound by the DMCs and have no freedom of contract."

In brief, although DMCs explain the rights and responsibilities of different parties related to the properties, terms set out might incur unfairness to the owners (Wan, 2005). This led to the implementation of the Building Management Ordinance, which further clarifies how buildings should be managed. This helps dealing with unfair terms in DMCs. In case of any inconsistency found between the BMO and a DMC, provisions in the BMO prevail over DMC, as stated in section 34C to section 34L, and the Seventh Schedule of the Ordinance.

2.5.3.5 Mutual Aid Committees and Owners' Committees

Mutual Aid Committee (MAC) is building-based resident organizations which provide communication channels between the Government and residents. MAC is formed by residents (owners or tenants) of buildings under the approval of the District Officer. They are established with the objectives to promote a sense of friendliness, mutual help and responsibility among members, to promote better security, cleanliness and more effective management of multi-storey buildings[17]. With reference to the Home Affairs Department, there were 3,045 Mutual Aid Committees formed by August 31, 2005. However, MAC is not statutory in nature. The legal function of MAC is not the same as IO. MAC may therefore induce potential difficulties when dealing with management issues and undertaking maintenance works.

Like MAC, Owners' Committees (OC) are also management agents which are non-statutory in nature. OC is different from MAC in the sense that OC is formed by owners of the buildings. As resident's participation is highly encouraged by the Government, MAC and OC provide a focal point for residents to participate in community activities. On the other hand, although these committees are claimed to provide a channel of two-way communication between the Government and the

[17] Home Affairs Bureau: http://www.hab.gov.hk ; Home Affairs Department: http://www.had.gov.hk

residents, tenants or owners on matters affecting the well-being of the individual and the community, without sufficient authority for MAC and OC to handle management problems, their efficiency is still uncertain.

2.5.3.6 Incorporated Owners

An Incorporated Owners (IO) is an independent legal entity set up under the BMO and DMC. The formation of IO has been encouraged by the Government for years. However, it is up to the owners' choice to decide whether to form an IO or not. Lai (2004) points out that the degrees of motivation for owners to form an IO may depend on the size of the property, owners' income and education levels, the number of owners, etc. Lai (2004) also interprets owners' willingness from the economic perspective. He suggests that the more the transaction costs involved in forming an IO, the lower the incentives of the owners.

An IO is responsible for managing the common parts of a building so that common interests of all owners can be protected. Concerning the power of Incorporated Owners, IO is different from an Owners' Committee in the sense that Owners' Committees are usually formed under the DMC. They are consultative in nature and do not have decisive power in building management (Ng, 2004). IO is given much power to take over the management of the building from management agents employed or to and supervise the performance of property manager. At the same time, IO is liable to be sued as a legal entity.

For the implementation of IO, there are both pros and cons suggested concerning its effectiveness in enhancing the management and maintenance of buildings.

On one side, as IO is an organization which puts management works within the buildings into operation, it brings positive effects on maintaining the conditions of buildings (Kwok, 2001). As committee members in the IO are also owners of the building, they may have more incentive to upkeep the environment of their accommodation spaces. Problems and opinions related to building safety or conditions can be brought to the IO meetings directly since members in the committees experience the problems personally (Ng, 2004). IO will not escape the

responsibility to tackle the situations. Hence, owner's participation is constructive to help uphold the value of the properties, as well as to maintain good relationship with the neighbourhood under the assumption that people want to maximize their interests. This is supported by the encouraging factors suggested by Kwok (2001).

On the other hand, there are arguments against the effectiveness of IO in managing and maintaining building conditions. The main concern is the lack of professionalism and expertise of IO members. As aforesaid, committee members are owners of flats in the building. They join the committee in a voluntary basis and have no experience and professional skills to manage the property. In Lee's (1983) study concerning two high-rise buildings in Kwun Tong and North Point, it is revealed that the management practice in these buildings was inadequate as a result of problems regarding the residents' management within the IO.

Members in IO may be uneducated and not able to understand the Building Management Ordinance which sets out requirements regarding building management[18]. Based on real-life observations, IO members are sometimes frustrated when they come across obstacles in executing management practice and deal with uncooperative owners.

In addition, several negative influences related to the operation of IO on building management were found by Tam and Wong (1998) in their study. They include:

1. Least support from owners other than members in the IO;
2. Lack of commitment;
3. The hypothesis of "free-rider";
4. Inadequate representation;
5. High legal costs (Government is unwilling to enforce the Building Management Ordinance);
6. Bureaucratic participation; and
7. Unqualified and inexperienced "self-help".

[18] Hong Kong Policy Research Institute Limited. (2001) *Opinion Survey Report on Government Support on Owners' Incorporation (in Chinese)*, Hong Kong.

Concerning the legal costs to resolve building management problem, Ng (2004) adds the point that IOs seldom exercise its power to sue owners who violate the DMC. He indicates that the high legal cost for bring the case to the Land Tribunal, as well as the lengthy time for settling the case may discourage IOs to perform their authorized duties.

In brief, there are different opinions relating to the effectiveness of an IO to manage a building. Although the establishment of an IO may not be the best solution to create collective action (Tsang, 2003), one cannot ignore the advantages brought by the IO which help organizing management and maintenance works within a building, especially those are over 20 years old.

2.5.3.7 Property Management Company

Property management companies are professional bodies which have experience and expertise in managing buildings. According to Fung (1997), property management companies can be categorized into three types, including:

(i) Management companies which are the subsidiaries of developers;
(ii) Independent surveyor firms which also deal with property management business; and
(iii) Independent management companies which focus on property management business.

In Hong Kong, developers normally have their own management companies to manage their completed properties. This "after-sales service" aims at providing high quality management for the newly-constructed private buildings. According to the statutory requirement for drafting Deed of Mutual Covenants, provisions should be included in the DMC to allow property owners to form their own Incorporated Owners. The IO formed is able to terminate the contract with the existing management company if it gets 50% owners shares. Another management agent can thereafter be employed by the IO to manage the building.

So as to improve the services provided and increase the competency within the property management industry, property management companies have become more quality-oriented and customer-oriented (Wong, 2000). They understand that the only way to keep customers continuing to employ the companies is to provide quality services which achieve customers' expectation and satisfaction. Therefore, property management companies are believed to be the specialists in managing buildings.

In brief, property management companies are believed to help improving the safety and condition of buildings due to their professionalism, its efficiency to reduce the number of UBWs may be highly significant.

2.5.3.8 Relationship between Incorporated Owners and Property Management Company

Both Incorporated Owners and property management companies play the managing role in the operation of a building. However, the presence of an IO may not necessarily reinforce the effectiveness of property management companies. From previous literature, there exist diverse views about whether IOs are value-added upon the performance of property management companies.

(i) Positive Effects of Incorporated Owners

As mentioned before, under the Building Management Ordinance, the IO of a building has the right to terminate the contract which assigns management works of the building to a property management company if the IO gets 50 % owners' shares. The IO can then employ another property management company to take care of the building management affairs. Normally, the original property management company employed is subsidiary companies of developers. After an IO is formed, it will be up to the IO the decide whether to employ the company or not. If the performance of the property management company is not satisfactory, the IO will probably end the employment with it. In other words, IO can monitor what property management companies do as it has the power to hire other companies to take over the job. So as to keep existing clients and to compete in the market, property management companies

will strive to provide quality service. IO is therefore beneficial for the efficient operation of property management companies.

Nevertheless, the existence of an IO in a building may not be necessarily in all cases. Although it acts as an agent supervising works done by property management companies, it may have its disadvantages on the operation of building management.

(ii) Negative Effects of Incorporated Owners

With reference to previous literature, it is found that conflicts of interest may exist between an IO and a management company (Carincorss et. al., 1997). Ho (2002) points out that the prime intention of management companies is to protect the interest of developers, rather than owners of the buildings. From Chan's (2002) study, he suggests various kinds of possible conflicts between IOs and management companies (such as the selections of service contractors and the use of common areas). With limited resources and funds, IOs and management companies may struggle against each other in order to achieve their own goal (Chan, 2002). Wong (2003) reinforces that many property management companies are not willing to facilitate the formation of an IO in the estate.

As IO have the power to determine the employment of the management company under DMC, IOs can kick the management company out if they are not satisfied with the company's performance. Management companies therefore tend to impede the formation of an IO (Ho, 2002). In short, in case that there exist both IO and property management company in a building, IO may also be a potential barrier for the property management company to implement management schemes and to decide on maintenance works.

Briefly, it is still too early to conclude whether the influence of IO on property management companies is constructive. However, owing to the potential conflicts and uncertain effects that may be exerted by IO on professional property management company, the safety and conditions of buildings managed solely by a property management company may be better than that with the presence of an IO.

2.5.4 Age of Residents

Apart from the physical factors which may affect the number of UBWs, one may not ignore the socio-economic factors such as the age, education or income level of occupants or owners of the building.

According to Lee (1999)'s study, the main limitations influencing repair and maintenance decisions include also the economic behaviour of property owners. Due to the fact that older people may not have much income for their living, many of them depend on the Government allowance to sustain their daily expenses. Therefore, the age of people is believed to be correlated with the income level of the owners. It means that, the income level of the middle-aged will be higher than that of the elderly since the middle-aged group will be capable to earn more, other things being constant. Therefore, it is argued that as the youth grows, they will have more money to tackle the UBW problem. But when the middle-aged owners become old, they are less likely to undertake repair and maintenance works for the buildings. This view is supported by Lee (1999) who argued that older people were financially incapable to afford the cost of maintenance and they were also less concerned with the property resale values and he building deterioration problems.

2.5.5 Education Level

People's education level is usually correlated with their income level in the sense that they are more competent to find jobs with higher salaries. In Beattie, C. *et al* (1971)'s study, it is suggested that education is positively related to salary. It means that higher educated people normally earn more for their salary. With more income for highly educated people, they are more willing to spend on tackling the problem of UBWs.

Additionally, people having low level of education are assumed to have lower income. This group of occupants is less likely to be willing to spend time to take care of the building and its environment since they are busy with their living (Terpstra, 2003). Therefore, many safety problems of the building, such as UBWs, are usually ignored. In addition to the amount of time spent on caring the property, low-income owners of occupants may not be able to afford the cost of building repair and maintenance (Fung,

2002). In another word, even owners may know that some repair works should be done, their financial ability does not allow them to make any improvement.

In brief, due to the differences in knowledge obtained, time available and financial ability between people with high and low education level, it is suggested that the number of UBWs is related to residents' education level. To examine the empirical relationship between them, the percentage of people obtaining tertiary level of education in the building is adopted for the analysis.

Chapter 3

Hypotheses & Methodology

3.1 Introduction

In this dissertation, multiple regression analysis is adopted for the verification of the relationship between the dependent and independent variables. In order to test the proposed hypotheses, data sets have been collected. They include:

1. Number of unauthorized building works;
2. Building age;
3. Number of units in the building;
4. Types of management bodies;
5. Age of people; and
6. Education level of residents.

Data collected is tested by using the Ordinary Least Square (OLS) regression approach. In the analysis, the number of UBWs of buildings is assigned to be the dependent variable, whereas other factors, including building age, number of unit, types of management bodies, people's age and education level are the independent variables. The validity of the hypotheses made can therefore be verified by examining the statistical significance of the sign and magnitude of the regression coefficients of those factors identified. The results are analyzed to reflect the relative weightings of the factors contributing to the number of UBWs, which is an imperative area regarding building safety and maintenance.

In the following sections, hypotheses of this dissertation and explanation on the variables proposed and the methodology used in the model will be given.

3.2 Hypotheses

After identifying the determinants with reference to previous literature and real life observations, eight hypotheses are proposed:

(i) For residential buildings aged over 30 years old, the number of UBWs increases with building age.

(ii) Residential buildings with more dwelling units have more UBWs.

(iii) The existence of Incorporated Owners (IO), property management company, the coexistence of Incorporated Owners and property management company, and the coexistence of Owners' Committee and property management company are significant factors affecting the number of UBWs.

(iv) The number of UBWs of buildings managed by a property management company alone is less than that of buildings managed by the coexistence of Incorporated Owners and property management company.

(v) The number of UBWs of buildings managed by the coexistence of Incorporated Owners and property management company is less than that of buildings managed by an Incorporated Owners alone.

(vi) The number of UBWs of buildings managed by an Incorporated Owners alone is less than that of buildings consist of no management bodies.

(vii) Residential buildings of which the residents are older have more UBWs.

(viii) Residential buildings with a larger proportion of highly educated residents have less UBWs.

3.3 Data Sample of the Model

In this dissertation, most of the data is collected from the data base of the pilot study of Building Safety and Condition Index (BSCI) carried out by the Department of Real Estate and Construction, the Faculty of Architecture at the University of Hong Kong. The reason to adopt this set of data is that the data is easily accessible to the author. Also, as the author has been used to participate in the inspection works of the research, it will be better for the author to understand the data collected.

A total of 172 multi-storey buildings located in North Point were randomly selected for investigation in this research. The intention is to collect a set of balanced (non-skewed) sample with respect to building age, number of units, types of management bodies, etc. All of the samples selected are residential buildings aged between 5 and 57 years old. The data sets were collected by site inspection and internet search, i.e. the number of UBWs was obtained by site inspection, while information about building age, number of units, details about the existence of any management bodies, age and education level of residents were collected via internet search, such as websites of the *Home Affairs Bureau*[19], *YPmap*[20]and *Centamap*[21].

3.4 Choice of Variables

To test the hypotheses drawn, variables are set for verification. In this section, different variables in the model are explained. Among them, the number of UBWs of the buildings is considered as the dependent variable, which is regressed against other independent variables.

3.4.1 Dependent Variable

The dependent variable of this study is the number of UBWs of buildings (UBW). The aim of this dissertation is to adopt the number of UBWs, an important area for building safety and maintenance, as an explanatory proxy to discuss how building safety of

[19] Home Affairs Bureau: http://www.hab.gov.hk
[20] YPmap: http://www.ypmap.com
[21] Centamap: http://www.centamap.com

residential buildings is affected. Due to constraints encountered during site inspections, only observable UBWs are included in the sum calculated.

As mentioned in Section 2.3.5, only externally-erected UBWs, which are the major causes of falling objects, are included for the analysis because time and resources are limited. Consequently, nine groups of UBWs that are commonly found in residential buildings in Hong Kong are extracted as follows:

(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); and
(ix) Metal cage.

During site inspections, the total number of UBWs constructed on the external wall of the building is counted. Figures showing the sum of UBWs within the above groups are recorded as the total number of UBWs of the whole buildings. Although each type of the UBWs may be different in size, material and location, they are treated as the same in this research. They are assumed to have the same extent of influence on the safety of buildings for simplicity. For example, a metal cage embracing the balcony of a unit will be counted as 1 unit of UBW while an air-conditioning frame (with a/c in use) will also be counted as 1 unit of UBW, although their coverage and size are different. In other words, the independent variable assigned is the cumulative sum of UBWs which fall within the above categories, whereas the existence of each piece of UBWs is counted as 1, regardless their size, material used, location, usage, physical weight, etc.

3.4.1.2 Limitations of the Dependent Variable Used

Although UBW is known as an influential factor affecting the safety of buildings, there are some limitations when using the total number of UBWs observed during site inspections as the dependent variable.

According to the definition of UBWs, they are building structures which contravene the stipulations stated in Section 14 of the Buildings Ordinance[22] (Cap. 123), unless they are exempted in Section 41 of the Ordinance. It means that if prior approvals of building plans and consent for commencement of the building works have been obtained from the Building Authority, these structures are "legal". There is a potential risk that some legal building works recorded may be wrongfully regarded as unauthorized structures during site inspections since it is very difficult to distinguish whether the building works are authorized or not by only on-site observations.

As time and resources are constrained, it is impracticable to cross check building plans of each building to scrutinize whether the structures are authorized or not prior to site inspections. Owing to that reason, an assumption is made in this dissertation that the UBWs recognized and counted during site inspections are in truth unauthorized. In a strict sense, therefore, UBWs included in samples of dependent variable should be "suspected" or "alleged" to be illegally built. However, even there may probably exist such kind of limitation in the analysis, this problem is believed to be insignificant due to the real practice of most of the households in Hong Kong.

3.4.2 Independent Variables

As mentioned in the previous section, 11 explanatory variables are identified to find out their effects on the number of UBWs of buildings.

They consist of the building age, the number of units, the presence of Incorporated Owners, the coexistence of IO and property management company ,the presence of property management company, the presence of Owner's Committees, the coexistence of

[22] Buildings Ordinance, Chapter 123, Laws of Hong Kong

Owners' Committees and property management company, the presence of Mutual Aid Committee, the age and education level of residents.

Table 3.1 shows the specifications of the variables.

VARIABLES OF MODEL	DESCRIPTION
Dependent Variable	
UBW	Number of UBWs of the buildings
Independent Variables	
AGE	Age of the buildings
AGE30	Dummy variable which 1 represents the building age is equal to or over 30 and 0 otherwise
UNITS	Number of Units of the buildings
IO	Dummy variable in which 1 represents the presence of Incorporated Owners only and 0 otherwise
PM	Dummy variable in which 1 represents the presence of property management company only and 0 otherwise
IOPM	Dummy variable in which 1 represents the coexistence of Incorporated Owners and property management company and 0 otherwise
OC	Dummy variable in which 1 represents the presence of Owners' Committee only and 0 otherwise
OCPM	Dummy variable in which 1 represents the coexistence of Owners' Committee and property management company and 0 otherwise
MAC	Dummy variable in which 1 represents the presence of Mutual Aid Committee only and 0 otherwise
PAGE	Age of residents of the buildings *i.e. Median age of female residents x ratio of female residents of the district + Median age of male residents x ratio of male residents of the district*
HEDU	Percentage of residents having tertiary and above level of education *i.e.* $\frac{\text{Re}\,sidentWithTertiary\ \&\ AboveEducationLevel}{TotalPopulationOfTheArea}$

Table 3.1 Specifications of Variables

(i) AGE and AGE30

AGE is a continuous variable which indicates the age of building as at January 2006, with reference to the year of which an Occupation Permit is issued to the building. Data is collected from internet search, i.e. the website of *Centamap*[23].

AGE30 is a dummy variable which 1 represents the building is of the age of 30 or above, 0 otherwise. In this dissertation, the author aims at figuring out the effect of age of old buildings on the number of UBWs. AGE will therefore be multiplied by AGE30 to form an interaction term in order to examine their joint effect on the dependent variable, i.e. the number of UBWs of the building.

(ii) UNITS

UNITS is a continuous variable which indicates the total number of units of the buildings. Data is collected from internet search, i.e. the website of *Centamap*[24].

(iii) Incorporated Owners (IO)

It is a dummy variable where 1 represents the presence of IO only in the building, 0 otherwise. The sole existence of IO is hypothesized to have significant effect on the number of UBWs of the building.

(iv) Property Management Company (PM)

It is a dummy variable where 1 represents the presence of PM only in the building, 0 otherwise. The sole existence of PM is hypothesized to have significant effect on reducing the number of UBWs of the building.

(v) Incorporated Owners and Property Management Company (IOPM)

[23] Centamap: http://www.centamap.com
[24] Centamap: http://www.centamap.com

It is a dummy variable where 1 represents the coexistence of Incorporated Owners and property management company (PM) in the building to take the responsibility of managing the building, and 0 otherwise. The coexistence of IO and PM is hypothesized to have significant effect on the number of UBWs of the building.

(vi) Owners' Committee (OC)

It is a dummy variable where 1 represents the presence of OC only in the building, 0 otherwise. The sole existence of OC is hypothesized to be insignificant to the number of UBWs of the building.

(vii) Owners' Committee and Property Management Company (OCPM)

It is a dummy variable where 1 represents the coexistence of Owners' Committee and property management company of the building, 0 otherwise. The coexistence of OC and PM is hypothesized to have significant effect on the number of UBWs of the building.

(viii) Mutual Aid Committee (MAC)

It is a dummy variable where 1 represents the presence of MAC only in the building, 0 otherwise. The sole existence of MAC is hypothesized to be insignificant to the number of UBWs of the building.

(ix) PAGE

PAGE is a continuous variable which denotes the average age of residents living in the area. Data is obtained by internet search, i.e. the website of *YPmap*[25]. As this dissertation aims at finding out the age effect of old residents on the rate of increase in the number of UBWs of the buildings, PAGE is imported as a squared function.

[25] YPmap: http://www.ypmap.com

(x) HEDU

HEDU is a continuous variable which denotes the percentage of residents having tertiary and above level of education in the buildings. Data is obtained by internet search, i.e. the website of *YPmap*[26].

3.5 Collection of Data

After identifying the variables being tested in the model, data sets are collected through various means. Raw data obtained form the basis for the regression analysis of this dissertation. Followed explains two major means to collect data, i.e. site inspection and internet search:

3.5.1 Site Inspection

Since UBWs are building works that are shown on approved plans of the buildings, relevant data has to be collected by on site inspections. The main objective of site inspections is to ascertain the real condition and the number of UBWs attached to the buildings which are under investigation.

As defined in Section 2.3.5, types of UBWs counted in this study contain only unauthorized structures erecting on the external walls of the buildings as, i.e. solid canopy, light-weight canopy, solid extension, flower rack, drying rack, metal frame, A/C frame and metal cage. During site inspections, the number of UBWs of each building is calculated.

3.5.2 Internet Search

Data including year built of buildings, number of units, presence of different types of management bodies, age and education level of residents and total population of the area is collected through internet search.

[26] YPmap: http://www.ypmap.com

To obtain the abovementioned data, various websites are visited. *Database of Private Buildings in Hong Kong* in the website *of Home Affairs Department*[27] is visited to find out information about the types of Resident's Organization and Building Management Bodies existing in the buildings. The *Census and Statistics Department*[28]is visited to note the male-female ratio of residents living in the North Point district. *Centamap*[29] is visited to extract data regarding the number of units in the buildings, the year built of the buildings (for the calculation of building age). *YPmap*[30] is visited to extract data about the population of different designated areas which comprise a few buildings within the North Point district, as well as the information related to the age and education level of residents living in these areas. However, since an area may refer to a group of adjacent blocks, data assembled is not exactly focusing on each individual block. There may be slight divergence between the actual data of every individual block and the designated areas. But this problem is not likely to be eliminated since it is impossible and impractical to examine all the corresponding data of each building individually. This divergence is assumed to be insignificant to affect the results of the analysis.

To run the model in latter sections, all data is given an input figure, either continuous or dummy, which are dependent on their nature and representation of the data. There are altogether 172 observations in this research. All of which are residential buildings in the North Point district (See Appendix I & II).

3.6 Regression Analysis

Regression analysis is a powerful statistical method which scrutinizes the relationship between a dependent variable and a number of independent variables. Applying to the model of this research, it means to express the total number of UBWs (dependent variable) of the building as an equation of variables affecting the number of UBWs (independent variables). The equation itself is only a statistical presentation but the extension of statistics obtained can evaluate predictions internal for the results.

[27] Home Affairs Department: http://www.had.gov.hk
[28] Census and Statistics Department: http://www.censtatd.gov.hk/
[29] Centamap: http://www.centamap.com
[30] YPmap: http://www.ypmap.com

Simple regression analysis shows how ONE variable affects another variable. It is used for predicting an unknown value of variable in relation to the know value of only one variable. If several variables are used to explain a prediction, multiple regression analysis should be adopted. By inputting the independent variables into a multiple regression analysis, whether the independent variables have positive or negative effects on the dependent variable can be verified. Correlation analysis shows the extent of influence of each independent variable exerting on the dependent variable. The statistical relationship among variables may be linear or curvilinear. As there are 11 independent variables in this dissertation, multiple regression analysis is adopted to investigate the effects of each variable on the dependent variable, i.e. the number of UBWs of the building.

3.6.1 Dummy Variables

To run a regression analysis, all variables have to be quantitative. Although in many cases, some factors cannot be easily quantified due to their qualitative nature, qualitative variables may still be incorporated into the operation of a multiple regression by using “dummy variables”. A dummy variable is of the value of either 1 or 0. It represents that when a particular condition happens, the value of that variable is 1, and otherwise it is 0. For example in considering the type of management bodies existing in the building, each type of management body can be assigned a dummy variable. When one kind of management body is present, the corresponding dummy variable will be given the value of 1 while other dummy variables for management agents are 0.

3.6.2 Application of Regression Model

In reality, it is found that there are a number of factors contributing to the number of UBWs of the buildings. The aim of using a multiple regression model is to investigate the correlation among factors which may affect the variation of number of UBWs of buildings. The multiple regression theory assumes that there is a probability distribution of the quantity of UBWs for each combination of the values of the independent variables (including building age, number of units, presence of Incorporated Owners, coexistence of IO and property management company ,

presence of property management company, presence of Owner's Committees, coexistence of Owners' Committees and property management company, presence of Mutual Aid Committee, age and education level of residents). Empirical data samples are used in the regression analysis to estimate the statistical relationship between the number of UBWs and the variables affecting it. The use of computer aids arriving reliable predictions.

In the following, explanation of the model used, which is the multiple regression analysis, is given to investigate the correlation between the number of UBWs of the buildings and other factors.

3.6.3 Model Specification and Expected Results of Independent Variables

The model adopted in this dissertation consists of a function relating to the dependent variable and a set of independent variables. The assigned dependent variable is regressed against the independent variables. This is still a hypothesized model, meaning that it can be confirmed or refuted by consequent data testing. By adopting variables identified in Section 3.4, a multiple regression model is established as follows:

$$UBW = f\,(AGE,\ AGE*AGE30,\ UNITS,\ IO,\ PM,\ IOPM,\ OC,\ OCPM,\ MAC,\ PAGE,\ HEDU) \text{ --- (1)}$$

Where,

UBW is the total number of UBWs of the building

AGE is the age of the building

AGE30 is a dummy variable which 1 represents buildings aged 30 or above, 0 otherwise

UNITS is the total number of units of the building

IO is a dummy variable in which 1 represents the presence of IO only, 0 otherwise

PM is a dummy variable in which 1 represents the presence of property management company (PM) only, 0 otherwise

IOPM is a dummy variable in which 1 represents the coexistence of IO and property management company, 0 otherwise

OC is a dummy variable in which 1 represents the presence of Owners' Committee (OC) only, 0 otherwise

OCPM is a dummy variable in which 1 represents the coexistence of OC and PM, 0 otherwise

MAC is a dummy variable in which 1 represents the presence of Mutual Aid Committee (MAC) only, 0 otherwise

PAGE is the average age of residents of the area

HEDU is the percentage of residents who have tertiary (and above) level of education

Due to the consideration that the effect of PAGE on UBW may not be in linear form, $PAGE^2$ is included in this dissertation. It is to test the existence of non-linear effect of PAGE, i.e. the number of UBWs of buildings may increase more/ or less than the proportion as people's age increases.

Table 3.2 shows the expected results of each independent variable:

Independent Variable	Meaning	Expected Sign
AGE	Age of buildings	+ ve
AGE*AGE30	Interaction term if AGE and AGE30	+ ve
UNITS	No. of units of buildings	+ve
IOPM	Coexistence of Incorporated Owners and property management company	- ve
IO	Presence of Incorporated Owners only	-ve
PM	Presence of property management company	- ve
OCPM	Coexistence of Owners' Committee and property management company	- ve
OC	Presence of Owners' Committee only	+ve
MAC	Presence of Mutual Aid Committee only	+ve
PAGE	Age of Residents	- ve
$PAGE^2$	Age of Residents in non-linear form	- ve
HEDU	Percentage of residents having tertiary (and above) education level	- ve

Table 3.2 Expected Results of Independent Variables

3.6.4 Fitting Approach and Operation of Regression

In this study, an Ordinary Least Squares (OLS) regression is used to fit the model. This technique assumes that the dependent variable is a linear function of the independent variables. Independent variables are assumed to work jointly to induce variations of the dependent variable. By using the OLS method, the true but unobservable functions can be estimated. This regression model minimizes the sum of the squares of the deviation of the observed values of the dependent variable from the corresponding values on the regression line. Results can then be obtained by fitting the model to the data sets collected. Generally, computer software is used to run the model. In this research, data will be processed in the form of spreadsheet by employing *Eview Version 3.0*.

3.7 Interpretation of Results

After inputting all data into the computer software, *Eview*, results are given in the form of numerical figures. To explain the implied results in detail, some techniques about understanding the meanings of output obtained from *Eview* are used. There are various areas that should be observed during interpretation, which include the direction (positive or negative) that the independent variables affect the dependent variable, the explanatory power of the whole hypothesized model, and whether the independent variables exert significant influence in varying the dependent variable.

Hypotheses 1, 2, 6, 7 and 8

To confirm hypotheses 1, 2, 6, 7 and 8 - *"For residential buildings aged over 30 years old, the number of UBWs increases with building age", "Residential buildings with more dwelling units have more UBWs", "The number of UBWs of buildings managed by the an Incorporated Owners alone is less than that of buildings consist of no management bodies", "Residential buildings of which the residents are older have more UBWs" and "Residential buildings with a larger proportion of highly educated residents have less UBWs",* partial coefficients of the corresponding independent variables are examined.

With reference to the following equation, which is established from the multiple regression of this research,

$$UBW = a_0 + a_1*AGE + a_2*AGE*AGE30 + a_3*UNITS + a_4*IO + a_5*PM + a_6*IOPM + a_7*OC + a_8*OCPM + a_9*MAC + a_{10}*PAGE + a_{11}*PAGE^2 + a_{11}*HEDU + \varepsilon \quad \text{--- (2)}$$

Where,
UBW is the total number of UBWs of the buildings
AGE is the age of the buildings
AGE30 is a dummy variable which 1 represents buildings aged 30 or above, 0 otherwise

UNITS is the total number of units of the buildings

IO is a dummy variable in which 1 represents the presence of IO only, 0 otherwise

PM is a dummy variable in which 1 represents the presence of property management company (PM) only, 0 otherwise

IOPM is a dummy variable in which 1 represents the coexistence of IO and property management company, 0 otherwise

OC is a dummy variable in which 1 represents the presence of Owners' Committee (OC) only, 0 otherwise

OCPM is a dummy variable in which 1 represents the coexistence of OC and PM, 0 otherwise

MAC is a dummy variable in which 1 represents the presence of Mutual Aid Committee (MAC) only, 0 otherwise

PAGE is the average age of residents of the area

HEDU is the percentage of residents who have tertiary (and above) education level

Partial coefficients of the independent variables give indications regarding the effect of those independent variables on the dependent variable. The sign (+ve or -ve) of the partial coefficients denotes the direction of relationship between the number of UBWs of buildings and each independent variable, either it be positive or negative. The absolute values of the partial coefficients indicate the marginal effect of an additional unit of an independent variable on the dependent variable (i.e. the number of UBWs of buildings).

From equation (2), a_0 is the constant term, a_1, a_2, a_3 … a_{11} are partial coefficients of the corresponding independent variables, and ε is the stochastic error term. The magnitude of the partial coefficient shows the degree of influence of each independent variable on the number of UBWs. In order to confirm hypotheses 1, 2, 6, 7 and 8, a_2 and a_3 should be positive, while a_4, a_{10} and a_{11} should be negative.

Hypotheses 4 and 5

To confirm hypotheses 4, 5 - *"The number of UBWs of buildings managed by a property management company alone is less than that of buildings managed by the coexistence of Incorporated Owners and property management company", "The number of UBWs of buildings managed by the coexistence of Incorporated Owners and property management company is less than that of buildings managed by an Incorporated Owners alone", and* observation on the partial coefficients of their corresponding independent variables will be examined.

To verify hypotheses 4 and 5, not only the signs of the partial coefficients have to be considered. As it is hypothesized that the extents of effects of various independent variables are different, some are better than the others, the magnitudes of the partial coefficients have to be taken into account. Therefore, prior to observing the magnitudes of the partial coefficients, the sign of the independent variables in hypotheses 4 and 5 have to be considered in the first place. Thus, two sets of possibilities showing the situations for determining whether to confirm or refute hypotheses 4 and 5 are stated below (Tables 3.3).

PM	IOPM	Hypothesis 4
+ ve	+ ve	Confirmed if $a_5 < a_6$
+ ve	- ve	Refuted
- ve	+ ve	Confirmed
- ve	- ve	Confirmed if $a_5 > a_6$

IOPM	IO	Hypothesis 5
+ ve	+ ve	Confirmed if $a_6 < a_4$
+ ve	- ve	Refuted
- ve	+ ve	Confirmed
- ve	- ve	Confirmed if $a_6 > a_4$

Table 3.3 Conditions to Confirm Hypotheses 4 and 5

Hypotheses 3

To confirm hypothesis 3 - *"The existence of Incorporated Owners, property management company, the coexistence of Incorporated Owners and property management company, and the coexistence of Owners' Committee and property management company are significant factors affecting the number of UBWs",* results of t-statistics will be used.

$$ti = \frac{a_i}{Sa_i} \quad \text{--- (3)}$$

Where,

t_i is the calculated t observed

a_i is the regression coefficient

Sa_i is the standard error of the coefficient

According to the above equation, the value of t is dependent on a_i and Sa_i. A more accurate result will be given when a larger t_i is obtained, and a_i will be less likely approach zero. This technique does only test the significance of effect of the independent variables on the dependent variable, but not the magnitude of the effect exerted. To find out whether the variable is significant at a particular confidence interval, one has to compare the calculated t (t_i) and the critical t value at a given significance level (i.e. x %) the degree of freedom. For example, if t_i is higher than the critical t value at an x % significance level and degree of freedom, it means that the coefficient (a_i) is "significant at the (1-x) % confidence interval". In this dissertation, the null hypothesis (H_0) is:

H_0: Estimated Coefficient = 0

It is set that H_0 (the independent variable is insignificant) will be tested at the 95% confidence interval. In other words, to confirm hypothesis 3, the independent variables IO, IOPM, PM, OCPM are expected to be significant at the 95% confidence interval and therefore, the null hypothesis is rejected. As well, OC and MAC are expected to be insignificant at the 95% confidence interval which means the null hypothesis is accepted.

Chapter 4

Empirical Results, Discussions and Recommendations

4.1 Introduction

In this chapter, empirical results of the regression model are reported so as to provide a picture for the actual findings of this dissertation. Section 4.2 gives the summary of the group descriptive statistics of the continuous variables. Section 4.3 reviews the empirical results obtained from the observations. Durbin-Watson Statistics of the model is presented in this section as well. Section 4.4 consists of tests for confirming or refuting the hypotheses defined in Section 3.2. Section 4.5 includes discussions on each independent variable. Both groups of significant and insignificant variables are analyzed. Finally, Section 4.6 provides recommendations about how to improve the problem of UBWs for buildings in Hong Kong.

4.2 Descriptive Statistics

Table 4.1 below shows the means, medians, maximum and minimum values, as well as the standard deviations (SD) of the continuous variables in the model.

Variable	Description	Mean	Median	Max. Value	Min. Value	SD
UBW	No. of UBWs of buildings	120.9593	73.5000	863.0000	0.0000	151.7490
AGE	Age of buildings	33.25581	34.0000	57.0000	5.0000	12.23712
UNITS	No. of Units of buildings	68.70349	42.0000	464.0000	4.0000	78.51703
PAGE	Age of residents	38.85901	38.5000	43.0000	35.50000	1.903012
HEDU	Residents' education level	0.233740	0.213800	0.424600	0.084700	0.087711

Table 4.1 Group Statistics of Continuous Variables

4.3 Empirical Results

As established in the previous chapter, the model used in this dissertation is as follows:

$$UBW = f(AGE, AGE*AGE30, UNITS, IO, PM, IOPM, OC, OCPM, MAC, PAGE, HEDU) \quad \text{--- (1)}$$

Where,

UBW is the total number of UBWs of the building

AGE is the age of the building

AGE30 is a dummy variable which 1 represents buildings aged 30 or above, 0 otherwise

UNITS is the total number of units of the building

IO is a dummy variable in which 1 represents the presence of IO only, 0 otherwise

PM is a dummy variable in which 1 represents the presence of property management company (PM) only, 0 otherwise

IOPM is a dummy variable in which 1 represents the coexistence of IO and property management company, 0 otherwise

OC is a dummy variable in which 1 represents the presence of Owners' Committee (OC) only, 0 otherwise

OCPM is a dummy variable in which 1 represents the coexistence of OC and PM, 0 otherwise

MAC is a dummy variable in which 1 represents the presence of Mutual Aid Committee (MAC) only, 0 otherwise

PAGE is the average age of residents of the area

HEDU is the percentage of residents who have tertiary (and above) level of education

After processing the data by *Eview 3.0*, the computer statistical software, results are shown in Table 4.2. The table also indicates the confidence interval at which the corresponding independent variable is found to be significant.

Dependent Variable: UBW

Method: Least Squares

Sample(adjusted): 1 172

Included observations: 172

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	-0.479254	1.867259	-0.256662	0.7978
AGE*AGE30	1.759541	1.034987	1.700060 *	0.0911
UNITS	1.427827	0.121580	11.74393 ***	0.0000
IO	64.66589	25.60634	2.525386 **	0.0125
PM	-86.68172	43.83591	-1.977414 **	0.0497
IOPM	57.93532	30.29645	1.912281 *	0.0576
OC	42.45394	104.9176	0.404641	0.6863
OCPM	-237.2648	57.72520	-4.110247 ***	0.0001
MAC	25.28066	37.00577	0.683154	0.4955
PAGE	-43.23318	151.4744	-0.285416	0.7757
PAGE^2	0.403643	1.918144	0.210434	0.8336
HEDU	-307.4506	112.6856	-2.728394 ***	0.0071
C	1106.561	2996.412	0.369295	0.7124

R-squared	0.576631	Mean dependent var	120.9593
Adjusted R-squared	0.544678	S.D. dependent var	151.7490
S.E. of regression	102.3965	Akaike info criterion	12.16815
Sum squared resid	1667120.	Schwarz criterion	12.40605
Log likelihood	-1033.461	F-statistic	18.04657
Durbin-Watson stat	2.060116	Prob(F-statistic)	0.000000

Table 4.2 Summary Table of Regression Model

(Remarks: *, ** and *** denotes that the variable is significant at the 10% 5% and 1% significance levels respectively)

The squared term of PAGE (i.e. Age of residents) is used in this model so as to capture the non-linear relation between PAGE and UBW. To analyze the results, it is the first

point to identify all significant factors affecting the dependent variable (i.e. in this research, the number of UBWs of building).

Among all independent variables spotted, it is found that OC and MAC are statistically insignificant to the dependent variable. The equation being estimated now is:

$$UBW = C - 0.4793AGE + 2.7595AGE*AGE30 + 1.4278UNITS + 64.6659IO - 86.6817PM + 57.9353IOPM + 42.4539OC - 237.2648OCPM + 25.2807MAC - 43.2332PAGE + 0.4036PAGE^2 - 307.4506HEDU \text{ --- (2)}$$

In practice, the value of adjusted R-squared will be observed, rather than that of R-squared. It is because the value of R-squared cannot reduce, but may improve, with the inclusion of additional independent variables. Therefore the use of R-squared to measure the explanatory and predictive power of a multiple regression model is flawed (Leishman, 2003). In this model, the adjusted R^2 in this model is 0.5447. It means that 55% of the dependent variable can be "explained" by the independent variables. However, the problem is that there is no similar model that can be compared in this area.

Another specification that should be addressed is the Durbin-Watson Statistics, which tests first-order autocorrelation of the disturbance term θ. The Durbin-Watson Statistics, denoted by d, ranges from 0 to 4, whereas:

(i) $d > 2$ for negative autocorrelation of θ;
(ii) $d = 2$ for 0 autocorrelation of θ; and
(iii) $d < 2$ for positive autocorrelation of θ.

In this regression model, the Durbin-Watson Statistics is about 2 (i.e. 2.06). It means that the error term θ, is not auto-correlated and therefore the proposed specification is adequate for the purpose.

4.4 Hypotheses Testing

After observing the specification of the model, it comes to the step of interpreting the results. In Chapter 3, eight hypotheses are established and the methods of result-interpretation are explained. In this section, results generated by *Eview 3.0* are used to test against the hypotheses. Each hypothesis may be confirmed or refuted statistically by referring to the t-statistics, the signs and magnitudes of the coefficients. In latter sections, discussions over each independent variable, as well as their effects on the dependent variable are given.

Hypothesis 1

> *"For residential buildings aged over 30 years old, the number of UBWs increases with building age."*

It was found that independent variable AGE is statistically insignificant to the dependent variable, while the interaction term of AGE*AGE30 is significant at 90% confidence interval. The partial coefficient of AGE*AGE30 is of positive sign, meaning that the number of UBWs increases with the joint effect of building age and buildings aged over 30 years old. To compare these two regressor variables, it is discovered that the problem of UBWs increases with buildings aged 30 or above. The increase in building age alone is not significant enough to explain the number of UBWs of the building. Thus, hypothesis 1 is confirmed.

Hypothesis 2

> *"Residential buildings with more dwelling units have more UBWs."*

The independent variable UNITS is found to be statically significant to the dependent variable at 99% confidence interval and the sign of its partial coefficient is positive. It means that the number of UBWs increases with the number of units of buildings. Accordingly, hypothesis 2 is confirmed.

Hypothesis 3

> *"The existence of Incorporated Owners (IO), property management company, the coexistence of Incorporated Owners and property management company, and the coexistence of Owners' Committee and property management company are significant factors affecting the number of UBWs."*

It is found that independent variables IOPM is statistically significant to the dependent variable at 90% confidence interval, IO and PM are statistically significant at 95% confidence interval and OCPM is statistically significant at 99% confidence interval, while independent variables OC and MAC are not statistically significant to the dependent variable in this model. Therefore, hypothesis 3 is confirmed.

Hypothesis 4

> *"The number of UBWs of buildings managed by a property management company alone is less than that of buildings managed by the coexistence of Incorporated Owners and property management company."*

Both independent variables PM and IOPM are found to be statistically significant to the dependent variable (PM is significant at 95% confidence interval and IOPM is significant at 90% confidence interval). The sign of the partial coefficient of PM is negative while that of IOPM is positive. It means that the presence of property management company alone is significant to reduce the number of UBWs of buildings and conversely, the coexistence of IO and PM is significant to increase the number of UBWs of buildings. In other words, the number of UBWs of buildings managed by PM alone is less than that managed by both IO and PM. As a result, hypothesis 4 is confirmed.

Hypothesis 5

> *"The number of UBWs of buildings managed by the coexistence of Incorporated Owners and property management company is less than that of buildings managed by an Incorporated Owners alone."*

Independent variables IOPM and IO are found to be statistically significant to affect the number of UBWs at 90% and 95% confidence interval respectively. The signs of their partial coefficients are both positive, representing that their existence increases the number of UBWs of the building. Both of them are unable to reduce the number of UBWs of the building. In addition, the magnitude of the partial coefficient of IOPM is less than that of IO, which means that the increase in the number of UBWs induced by the presence of IO alone is larger than that by the coexistence of IO and PM. Hypothesis 5 is therefore confirmed.

Hypothesis 6

"The number of UBWs of buildings managed by an Incorporated Owners alone is less than that of buildings consist of no management bodies."

The partial coefficient of the independent variable IO is found to be positive. It can be explained that when it is compared with buildings without any management body, the presence of Incorporated Owners will increase the number of UBWs of the building. So, hypothesis 6 is refuted.

Hypothesis 7

"Residential buildings of which the residents are older have more UBWs."

Both independent variables PAGE and its squared-term, $PAGE^2$, are statistically insignificant to affect the dependent variable. It represents that there is no significant relationship between the number of UBWs and the age of residents of the building, neither in linear nor non-linear form. Thus, hypothesis 7 is refuted.

Hypothesis 8

"Residential buildings with a larger proportion of highly educated residents have less UBWs."

HEDU is found to be a significant independent variable affecting the dependent variable at 99% confidence interval. The partial coefficient of HEDU is negative. This indicates that buildings with a larger proportion of highly educated residents will have less UBWs than buildings with mainly low-educated residents. Hypothesis 8 is therefore confirmed.

4.5 Discussions of Independent Variables

In accordance with the results obtained, all independent variables except MAC and IO are found to be statistically significant to the dependent variable at 90% confidence interval. Among them, UNITS, OCPM and HEDU are significant at 99% confidence interval; IO, PM and $PAGE^2$ are significant at 95% confidence interval while AGE30 and IOPM are significant at 90% confidence interval. In this section, the significance and effect of each independent variable on the dependent variable will be analyzed. Implications and limitations of each variable will also be discussed.

4.5.1 Implications and Limitations of Significant Variables

4.5.1.1 AGE*AGE30

The interaction term of AGE and AGE30 shows a positive sign towards the dependent variable as hypothesized. It can be interpreted that for buildings aged over 30, the effect of building age on the number of UBWs is positive and in a linear form. The author has added the independent variable AGE into the model so as to examine whether the increase in the number of UBWs concentrates on residential buildings older than 30 years old. It is observed that the increase in AGE alone is not significant to affect the number of UBWs of the buildings. But it is significant for buildings which are equal to or more than 30 years old. This indicates that the problem of UBWs is relatively serious in residential buildings aged over 30. More concerns should therefore be made on this group of residential buildings.

As it is difficult to draw a cutting line to delineate different age groups of buildings, the author chooses the age of 30 for demarcating buildings into two groups in order to examine whether there is a disparity on the problem of UBWs between these two groups. The choice is made based on the author's opinion only. Though the results show that for

buildings aged 30 or above, their increase in age will be significant to raise the total number of UBWs of the building, it does not necessarily mean that 30-year is the best point to define the age groups of residential buildings. This may only suggest that there is a difference between buildings aged over and below 30 in explaining the amount of existing UBWs.

4.5.1.2 UNITS

The result of independent variable UNITS indicates that the number of units of buildings is extremely significant to the dependent variable. It shows a positive relationship with the number of UBWs of the buildings. It can be interpreted that with a larger number of units, the total number of UBWs of the building will increase. This gives indication that the impact of the scale of development (the larger the scale, the more the units) on UBWs is heuristically significant.

Data about the total number of units in the buildings are collected by internet search. Consequently, the sum of units included refers to the multiplication of the number of storeys and the number of units per floor. This does not illustrate cases in which property owners have partitioned the unit into several rooms for renting out to other tenants. The actual number of units of the building will therefore be increased in this situation. The effect of the number of households living in the building due to partitioning is thus eliminated in this study.

4.5.1.3 IO

Independent variable IO is statistically significant at 95% confidence interval and is positive in sign as found from the empirical results. It represents that when compared with buildings which have no management bodies, the presence of Incorporated Owners has positive effect on increasing the number of UBWs of the building, instead of helping to reduce them. This observation is refuting the Government's claim that the establishment of IO can improve the management and maintenance of the building.

One of the possible rationales may be that as IO is formed by the owners of the building, they are more concerned with their personal interests. Due to the discovery that most of

the UBWs found in residential buildings are structures such as flower racks and metal supports for air-conditioners, people usually consider them to be minor problems of the buildings that may not induce serious danger. Also, the removal of unauthorized structures may involve some preparation works such as the erection of scaffolding. This may add additional cost to the owners. The increase in cost, as well as the nuisance caused by the removal project may hinder the motivation of owners to clear up the problem of UBWs.

As the existence of UBWs is very common in residential buildings in Hong Kong, people's ideas on UBWs may be positive and consider them to be beneficial. Since the construction of UBWs (such as illegal frames built to support different utilities) is relatively convenient, easy and cheap, people tend to avoid the expensive and complex procedures set out under the Buildings Ordinance when they want to construct any additional structures to the building/ units. The transaction cost of constructing a "legal" building structure greatly outweighs that of an unauthorized one. This can be logically deduced that people will choose the option with lower overall cost.

Moreover, by comparison of the magnitudes of the partial coefficients of IO and other significant dummy factors which have positive effect on the number of UBWs (such as IOPM), it is observed that the extent of influence of the presence of IO is significantly greater than the positive effect exerted by other factors. (57.93 of IOPM compared to 64.67 of IO in absolute values). From real-life observations, it is not uncommon for the IOs of the buildings to initiate a large-scaled construction of drying racks for which owners of the whole buildings may join in order to lower the transaction cost involved. Thus, it may be argued that the effectiveness of IO that claimed by the Government in dealing with the maintenance of buildings is refuted.

Among all possible factors that may contribute to the ineffectiveness of Incorporated Owners, the major reason may be the lack of professionalism of IO members in building management and maintenance. As discussed in Section 2.5.3.6, members of IOs may be even unable to understand what are stipulated and guided in the Building Management Ordinance. Besides, although members of IO are elected by vote, there usually exist conflicts between IO and other unsupportive owners of the buildings. In addition, the inadequate time of IO members to spend on taking care of the building is also a possible

influential factor. These are all obstacles for IO to effectively manage and maintain the conditions of the building.

4.5.1.4 PM

Independent variable PM was found to be negative in sign and significant to the dependent variable at 95% confidence interval. It can be interpreted that the presence of property management company is a significant factor reducing the number of UBWs of the building.

Property management companies are professional organizations which may have more skills, experience and expertise in building management and maintenance services. As they are devoted to handling the operation of the buildings in full-time, they have more time to understand and resolve problems associated with the buildings. As a whole, property management companies may provide professional services to maintain the condition of the building. They are proficient to deal with maintenance problems of the buildings and hence, the problem of UBWs may be lessened.

Comparing the partial coefficients of PM and IO, it was found that the signs of the two independent variables are different. PM is negative in sign whereas IO is positive. This shows that the presence of PM greatly improves the problem of UBWs in Hong Kong.

4.5.1.5 IOPM

As observed from the empirical results, independent variable IOPM is significant to the dependent variable at 90% confidence interval. The positive sign of IOPM suggests that the coexistence of IO and PM may significantly increase the number of UBWs.

When comparing the partial coefficients of IO, PM and IOPM, both IO and IOPM are found to be positive, while PM is negative in sign. This implies that PM is the only variable which has a negative relationship on the number of UBWs. Although the efficiency of PM is considered significant to reduce the number of UBWs, the presence of IO over PM strongly affects the result. It also reflects that the authority IO posses prevail that of PM. In the mathematical sense, when a negative factor (PM) is added by a positive

factor (IO), the positive sum suggests that the positive factor is larger than the negative one. Applying to the empirical results, it can be interpreted that when there exists an IO together with PM, the efficiency of PM to reduce the number of UBWs disappears. As IO is found to be significant to increase the number of UBWs, this effect greatly outweighs the effect of PM to reduce the amount of UBWs.

However, the difference between the magnitudes of the partial coefficients of IOPM and IO (57.94 for IOPM and 64.67 for IO) states that the increased number of UBWs due to the presence of IO is greater than that of the coexistence of IO and PM. It means that the addition of PM into the management of the building may slightly diminish the number of UBWs that is increased by the presence of IO alone.

The finding showing the destructive effect of the presence of IO to the problem of UBWs may be due to several reasons. Firstly, as committee members in IOs are property owners, they lack professional knowledge in maintaining good conditions of buildings. Property management companies on the other side are believed to be specialized in taking care of properties. Their performance is thus relatively stable and efficient to properly maintain and manage the buildings. On the contrary, the performance of IO is influential to the ultimate performance of PM. If IO is motionless to interfere with policies suggested by the property management company, it is more or less like the absence of IO. However, if IO is too active to obstruct or comment on PM's policies, the implementation of management and maintenance schemes will be hampered (Wan, 2005). In addition, conflicts may exist between PM and IO since property management companies aim at protecting the interest of the developers, rather than the owners' (Ho, 2002). As discussed in Chapter 2, IO has the authority to kick out the property management company which IO is unsatisfied with, PM's policies will therefore usually be constrained.

4.5.1.6 OCPM

From the empirical study, independent variable OCPM is found to be significant at 99% confidence interval. Its partial coefficient is negative in sign, with the magnitude of 237.32. This shows that the coexistence of Owners' Committee (OC) and property management company is highly significant to reduce the number of UBWs of residential buildings. Even it is compared with the sole presence of PM, OCPM is more efficient to

deal with the problem of UBWs. The presence of OC over PM is therefore of great importance.

Nevertheless, the results also illustrate that the presence of OC alone as the management agent of the building is not significant to affect the dependent variable, i.e. the number of UBWs. As OC is not statutory in nature, it has no authority to kick out the property management company. PM may be more flexible to exercise its professionalism without obstacles. Instead, OC may act as a bridge between owners and the management company since members in the Owner's Committee are all owners of the building, they are end-users of the buildings and can sense the problem of the building immediately. They can also reflect instant building conditions to PM so that PM can respond to the problem quickly and efficiently. This helps PM to smoothly implement its policies.

An additional point to note is that the considerable coefficient value of OCPM may be due to the sample set. In the data samples, there are altogether 6 buildings being managed by OCPM. All of them are estate type development and managed by experienced professional property management companies such as MTR Property Management and Ka Lee Properties Management Ltd. The presence of UBWs in these large comprehensively-planned private residential estates is relatively not apparent. Lai and Ho (2001) suggest that the reasons may be in threefold:

(i) *Less Incentive of Owners* – Owners do not want to create title defects for their units so as to ensure a high re-sale rate of the property. The presence of UBWs in private residential buildings will negatively affect the overall image of the property. Owners will therefore put pressure on the property management company to take action to remove the UBWs. Owners are more motivated to maintain the property in a prestigious standard since this may enhance their personal interests.

(ii) *Up-market Units* – In general, owners of property in large private residential estates are the higher-income group. Illegal structure in these units is unlikely to be works that accommodate squatters.

(iii) *Resourceful Proprietors and Property Manager* – Proprietors and property manager in these buildings are financially more resourceful to take legal action against the owner who erects UBWs. In addition, as large estates are normally managed by companies connected with developers, their property managers would have better experience and expertise. Enforcement actions against UBWs taken by these managers who are familiar with the legal machinery are therefore more efficient than those taken by non-professional Incorporated Owners.

Since the data samples only consist of 6 observations which are managed by the coexistence of Owners' Committee and property management company only, it may be argued that the general effects of OCPM on the number of UBWs may not be fully justified by the findings. This case is very likely as reflected by the 3-time difference in the coefficients' magnitude of OCPM and PM.

4.5.1.7 HEDU

From the empirical result, it is found that independent variable HEDU is significant to the dependent variable at 99% confidence interval. HEDU is negative in sign, with the magnitude of partial coefficient be 295.72. These figures suggest that HEDU is a considerable factor affecting the number of UBWs. In this dissertation, HEDU, i.e. the percentage of residents of the buildings who have tertiary (and above) education level, is imported as an independent variable. HEDU is a comparative function of people having low education level (sixth-form and below).

Salaries of people who got tertiary level of education are supposed to be higher than those having low education level as the former type is more competent to work at high positions in corporations. In another word, their disposable income[31] will be higher and are more able and willing to spend on non-daily necessity expenses such as building repair and maintenance. Among all significant continuous independent variables which are negative in sign, the magnitude of HEDU is of the highest value. This statistically shows the substantial marginal effect of HEDU on the dependent variable. It can be

[31] Disposable income means personal income (after tax) which is available for spending, investing and saving.

interpreted that high level of education (higher income level) may greatly reduce the number of UBWs constructed. Another possible reason for the significance of high education level may be people's understanding and recognizing of the importance of building maintenance and safety.

In this research, it is assumed that people having higher education level will earn higher wages since they are more skilled and educated to work in senior occupations. This assumption implicitly supports the implications analyzed based on the results regarding the effect of residents' income on the number of UBWs. Some may be argued that the assumption may not necessarily hold. This limitation may hinder the explicit implication of the results.

Seeing that the education level of residents is considered as an average percentage on a building-basis, occupants or owners of individual units within the same residential buildings may probably greatly differ in their education level. For example, family members in some households may all be educated with tertiary level or above, while some other households in the same buildings may consist of no member that are highly educated. In this case, individual units are not considered separately. Instead, the average percentage of highly educated occupants of the entire building is examined. Therefore the results may not be precisely describing the situation of each individual flat. To combat this limitation, extensive surveys can be carried out to interview occupants or owners of every residential unit. However, this process is extremely resource- and time-consuming. In order to minimize the effect of this limitation, all data sets in this dissertation are considered on a building-basis, rather than a unit-basis. Thus, it is the overall condition of the building to be investigated.

4.5.2 Implications and Limitations of Insignificant Variables

4.5.2.1 OC

As hypothesized, the presence of Owners' Committee (OC) is insignificant to the dependent variable in this study. It can be explained that the existence of OC does not have significant effect on the number of UBWs of residential buildings. Although OC is formed by owners of the building, it is not a statutory body to manage the building. Also,

OC has no authority to exercise maintenance and management proposal for the building. Perhaps that's why it has nothing to do with the number of UBWs.

Although OC is found to be ineffective to reduce the number of UBWs of residential buildings, its insignificance may be due to the bias in the sample set. Among the 172 buildings under investigation, only one of them is managed by OC alone. It implies that the empirical estimate may be skewed towards buildings managed by other types of management bodies in explaining the number of UBWs of residential buildings. So that there may exist a limitation that the effect of OC cannot be fully reflected in the result.

4.5.2.2 MAC

The existence of Mutual Aid Committee (MAC) is found to be insignificant to the number of UBWs of buildings. It suggests that when comparing with buildings having no management body, the presence of MAC is still insignificant to affect the number of UBWs of residential buildings.

One of the possible reasons may be related to the nature of MAC. As discussed in Chapter 2, MAC is not a statutory body, it does not have sufficient authority to implement maintenance schemes within the building. MAC may not be able to trigger the motivations of building owners to remove their UBWs. Besides, as members in the MAC may not necessarily be the owners of that building, they are less concerned with the safety and conditions of the buildings, as well as the individual units. All these contribute to the result that MAC is insignificant to reduce the number of UBWs of residential buildings.

4.5.2.3 PAGE and PAGE^2

Independent variables PAGE and PAGE^2 are both found to be statistically significant to affect the number of UBWs. It means that there is no significant relationship between the age of occupants, neither linear nor non-linear, and the number of UBWs of the buildings. This refutes the hypothesis that old people may hinder the removal of UBWs. Also, the result points out that although it is always claimed by Government officials that they may come across great difficulties in requiring older owners or occupants of the buildings to remove UBWs, it is found that the age of property owners is actually not significant to

affect the number of UBWs. Therefore, it may be argued that it is an excuse for the Government to lay the fault of the ineffectiveness to remove UBWs of residential buildings on old occupants.

Like independent variable HEDU, similar limitations do exist for independent variable PAGE in the sense that information about the age of residents is also collected on a building-basis. This does not specifically reflect the effects of age of occupants on individual units on the number of UBWs.

4.6 Recommendations

The problem of UBWs is serious in residential buildings in Hong Kong. In this empirical study, several elements affecting the number of UBWs of residential buildings have been identified and discussed. The substantial existence of UBWs may cause potential safety problems to the buildings, as well as the general public. That is to say, if the problem of UBWs is ignored, huge costs, in terms of money and human lives, will have to be paid. To solve the problem of the proliferation of UBWs in Hong Kong, efforts should be put by all concerned parties. Recommendations regarding the issue have been given my various parties.

4.6.1 Government Policies and Schemes

A series of incidents involving the collapse of UBWs occurred in recent years has raised the awareness of the public. The Government is trying to find ways to prevent the situation from worsening (Lai, 2003). In 2000, A Task Force on Building Safety and Preventive Maintenance was set up under the Housing, Planning and Lands Bureau to formulate policies to tackle UBWs.

4.6.1.1 Large-scale Clearances of UBWs

Large-scale operations to remove UBWs are believed to be effective to slim down the number of UBWs. For example, the Sham Shui Po District Board set aside $150, 000 to remove 1, 000 illegal structures in 1983 (South China Morning Post, 27 July 1984). To cease the increasing number of UBWs, an immediate removal policy has been adopted by

the Building Authority for newly erected UBWs. The Building Authority has launched two large scale operations to clear UBWs, which include the "Blitz" Operations and the Coordinated Maintenance of Buildings Scheme.

(i) "Blitz" Operations[32]

The aim of "Blitz" operations is to identify individual buildings of 20 to 40 years old for large-scale clearance of UBWs. It has been proved that these operations are effective to improve owners' compliance[33]. Buildings targeted are usually those located along heavy traffic routes since the disrepair of the UBWs' building elements may impose large potentials to cause serious consequences. It is hoped that these large-scale operations will remove 150,000 to 300,000 UBWs in five to seven years.

(ii) Coordinated Maintenance of Buildings Scheme (CMBS)[34]

CMBS is a proactive approach to tackle building maintenance and UBWs in one operation. It is a comprehensive scheme that shows the Government's support for building owners to deal with building maintenance and UBWs issues. A "one-stop" service is provided under the CMBS, which may assist owners in contract procurement and offer tendering services for the engagement of professionals and contracts for carrying out works for building maintenance and removal of UBWs. In order to make the operation smooth, five Government departments are involved in the CMBS, including Home Affairs Department, Food and Environmental Hygiene Department, Electrical and Mechanical Services Department, Water Supplies Department and Fire Services Department. Buildings Department will then act as a Building Coordinator to liaise with different bodies and provide technical advice and assistance.

[32] Housing, Planning and Lands Bureau. (2001b) *Task Force on Buildings Safety and Preventive Maintenance*. Implementation Plan, Hong Kong: Hong Kong Special Administrative Region Government.
[33] Buildings Department. 2001b. *Monthly Digest*. Hong Kong Special Administrative Region
[34] Buildings Department. 2000. An Introduction to the Coordinated Maintenance of Buildings Scheme. Electronic Brochure

4.6.1.2 "Encumbrance" on Property

As stated in the Buildings Ordinance (Cap 123), orders issued under the Ordinance have to be registered in the Land Registry. Once the orders are registered, it induces an "encumbrance" on the property. In the case of *Lam Mee Hing vs Chiang Shu Yin* (1995), it is held that:

> *"...a building order which required remedial works could incur expenses to the owners of the flat and such expenses could become a charge to the property. This charge arising from the building order could be discharged if the vendor, the defendant, undertook the responsibility for the apportioned costs incurred form the remedial works." [Lam Mee Hing vs Chiang Shu Yin (1995)]*

This prescribes that "encumbrance" is a claim to the property or charge which could be imposed upon the property, and will remain until the orders are fully complied with, subject to the satisfaction of the Building Authority (Lai, 2003). The presence of UBWs may also amount to a defect in the title of the property and become an obstacle to the acquisition of the title. These can be shown in the following cases:

> *"The existence of unauthorized structures required the Government to take enforcement action and constituted a defect in title." [Giant River Ltd vs Asia Marketing Ltd. (1990)]*

> *"...the presence of unauthorized structures together with a risk of enforcement action by the Government constituted a defect in title and an encumbrance was therefore created on the property." [Ip Cho Sau and Another vs Leung Kai Cheong and Others (2000)]*

This approach of encouraging owners to comply with orders issued by the Building Authority is effective to a certain extent since building owners may not want to have an "encumbrance" on their property, which may affect the title of their property. However, due to limited resources of the Building Authority, it is extremely difficult to issue every

UBW an order asking for removal. Thus, it is still a question that whether the function of "encumbrance" on property can be applicable to all UBWs in Hong Kong.

4.6.2 Legislation and Control on Unauthorized Building Works

The problem of UBWs has existed in Hong Kong for many years. However the situation remains unimproved for decades. This is a signal showing that current legislation is not strict enough to cope with the proliferation of UBWs. It is unwise to sit aside and wait for the "windfall" of solutions. One of the possible ways is to put owners under statutory obligations to properly manage and maintain their properties.

4.6.2.1 Stricter Penalty

It is always believed that prevention is better than cure. Hence, stricter penalties or even the criminalizing of UBW erection can be imposed to property owners who contravene the provisions. In that case, the cost of the construction of UBWs will be greatly increased. This may hinder the incentive for owners to build new UBWs

4.6.2.2 Compulsory Engagement of Professional Management Company

As the empirical results show that professional property management companies are effective to reduce the number of UBWs, the Government may statutorily require residential buildings to employ a property management company to take up the responsibility to maintain and manage the conditions of the buildings.

However, Li (2003) points out that there is no condition set out in the lease to engage a property management company. The administrative fee may be huge which will not be economical for many building owners.

4.6.3 Education on Property Owners

Although the removal of UBWs is beneficial to the society, it is not an easy task to persuade all property owners to take part in the process. The ignorance of people about

the importance of building safety contributes greatly to the occurrence of "man-made" disasters caused by UBWs of the buildings.

To maintain a safe building environment in Hong Kong which is free of UBWs, it is not only the Government's responsibility to participate, attitudes of property owners towards UBWs are of paramount importance in tackling the UBW problem. However, it is not enough to just educate owners on improving their own premises. Owners should be educated the concept of contributing to the community environment as a whole. Although it is tremendously difficult to ensure that every citizen knows the impacts of UBWs and the responsibility of property owners, it is a good start for the Government to first target on the buildings' representatives, such as members in the Incorporated Owners (Housing, Planning and Lands Bureau 2001c[35]).

[35] Housing, Planning and Lands Bureau. (2001c) *Government Pledges Action with Assistance for Building Safety*, Press Release, Hong Kong: Hong Kong Special Administrative Region Government

Chapter 5

Conclusion

5.1 Introduction

This is the concluding chapter of the dissertation, which aims at reviewing the whole process and picture of the research. Section 5.2 gives a review the study with reference to discussions included in previous chapters. Section 5.3 and 5.4 state the implications and limitations of the research respectively. Suggested areas for further study are given in Section 5.5.

5.2 Review of Research

The proliferation of unauthorized building works (UBWs) has long been a problem of building safety which has drawn the attention of the Government for years. However, the problem has yet been tackled.

This dissertation is an attempt to discuss the issue of unauthorized building works in Hong Kong. The author aims at figuring out the factors affecting the number of UBWs in residential buildings in Hong Kong, as well as their relationship with and level of influence exerted on the number of UBWs. Based on the definition of UBWs defined in this study, a theoretical framework is outlined and is tested empirically in the analysis.

After identifying the objectives of the research, literature is reviewed to get a deeper understanding and more concepts about the building conditions and the UBW issue in Hong Kong. Although it is very difficult to quantify “building safety”, it is believed that the safety and conditions of buildings are directly related to the safety of human being since people spend a very large proportion of time to stay in buildings. Building safety

does not only affect the property owners themselves, but also the general public and the whole community. Even UBWs may not represent the full picture of building safety, their existence poses threatening potential consequences to the city. Therefore, the situation and possible causes to the proliferation of UBWs in Hong Kong are reviewed.

To generate results from the data collected, a multiple regression model is adopted in this study. It is believed that the regression analysis is an effective way to examine the relationship between the dependent variable and each of the independent variables identified. Those regressor variables are recognized from the review of past literature and research, along with the real-life observations of the author.

With reference to the results obtained from the regression analysis, it is illustrated that the number of UBWs is significantly affected by building age, number of units, the presence of Incorporated Owners (IO), the presence of property management company (PM), the coexistence of IO and PM, the coexistence of Owners' Committees (OC) and PM, and the education level of residents of the building; while the presence of Mutual Aid Committee (MAC) and OC, with the age of residents are not influential to the number of UBWs. Among them, the education level and the coexistence of OC and PM are the most dominant factors to lessen the number of UBWs existing. OCPM is believed to be the optimal management mode in residential buildings. However, the presence of IO is found to be unable to reduce the number of UBWs.

5.3 Implications of Research

Incidents involving falling objects (especially UBWs) from the external walls of buildings which happened in recent years have indicated that the problem of UBWs is continuously a hazard to the society. This dissertation provides preliminary results and insights towards the UBW issue. The findings are generally satisfactory and are significant in providing the relationships between UBWs and the explanatory variables. By understanding the factors affecting the number of UBWs, appropriate actions can be taken in the light of those leading elements contributing to the problem. A clearer picture about how to improve and cure the situation is given.

5.3.1 Determinants for the Number of UBWs

Seven factors are found from the empirical testing to be determinants to the number of UBWs as reviewed in Section 5.2. These represent that they are significant to affect the amount of UBWs in residential buildings. They can be used as considerations for identifying which residential buildings should be of immediate concerns. Relevant parties such as Government departments and the property owners may take them as reference for the safety and condition of the building.

5.3.2 Importance of Professional Management Company

The presence of professional management company is found to be able to reduce the number of UBWs in the building. This implies that engaging a property management company to manage and operate the building is an effective way to improve the situation of UBWs in residential buildings. This may be due to the expertise and financial resources that are available in property management companies.

5.3.3 Inefficiency of Incorporated Owners in dealing with UBWs

Although the Government always advocates property owners to form Incorporated Owners (IO) and vests power to the IO to manage the building, it is found empirically that the presence of IO does not improve the problem of UBWs but on the contrary, worsens the situation. As IOs are given the power to prevail decisions made by property management company, it is discovered that with the presence of IO, the performance of property management company is greatly reduced. If the Government keeps insisting the ideal function of IO blindly without providing appropriate and sufficient training, instruction and guidelines to IO, IO will potentially turn out to be a “Government-made cause” to the problem of UBWs in residential buildings..

5.4 Limitations of Research

This study on UBWs is, of course, in no way comprehensive and conclusive enough to explain the existence of and the removal of UBWs due to the limitations contained.

5.4.1 Limitations on the Types of UBWs included

Despite the mentioned selection bias, this dissertation only concentrates on observable UBWs which are erected to the external facades of the buildings. This is restrictive by definition. As discussed, UBWs may consist of various kinds of building works. However, as there are restrictions on time, resources and accessibility of information, UBWs such as pipe work and illegal partitioning are not covered in this research.

In addition, the degree of influence of different kinds of UBWs is all assumed to be the same in the analysis. But it should be kept in mind that each kind of UBWs may have different extents of effects on building safety. For instant, UBWs related to structural elements like metal cages and roof-top structures are believed to be more “influential” than that of amenity features such as flower racks and drying racks.

5.4.2 Limitations on Data Sample

There are only 172 sets of data used for the regression analysis. This is insufficient for carrying out cross-sectional analysis. Also, all buildings under investigation are residential apartment buildings. The coverage of building types is not comprehensive enough to represent the UBW situation in all kinds of buildings. However, due to the limitation on time and resources, this problem cannot be avoided and so that, the author has put the focal point on one kind of buildings only.

Also, some of the data in the sample is collected based on the area where the building is located at. Although using the separation of these areas as the basis is more precise than using the statistics of the whole district, the data is not specific enough to reflect the problem of each individual unit.

In brief, all of the above do reduce the explanatory authority of the study.

5.5 Areas for Further Study

The problem of UBWs cannot be solved in one morning or evening. It is a continuous process that the Government and the general public have to put resources and efforts into it. For future study on the topic of UBWs, one may include more different types of UBWs in running the same regression model, or use independent variables that are different from or excluded in this dissertation so as to examine more comprehensive findings about what contribute to the number of UBWs. Of course, the more observations that can be incorporated into the regression model will improve the power in explaining the empirical condition of UBWs.

Another possible way to understand further about the relationship between UBWs and each explanatory variable is to separate UBWs into high-risk and low-risk UBWs based on definition. This may help examining whether some factors are more influential to the construction of high-risk UBWs and are needed to be combated first. As some data (such as age of residents) in this dissertation is extracted on a building-basis, the data is no means specific enough to reflect the situation of individual units. The same research can be done in the future by collecting information from each residential unit (e.g. survey) so that the results will be more explicit to reflect the problem of UBWs affected by different households with dissimilar characteristics.

Concerning potential research on the safety of buildings in Hong Kong, since the Government is now considering the implementation of the "Mandatory Building Inspection Scheme", one can also examine the effectiveness of this scheme to improve building safety, with more empirical observations available.

Appendix I – Survey Results of Data Set I

Observation	AGE	AGE30	UNITS	IO	PM
1	37	1	15	0	0
2	43	1	18	1	0
3	40	1	28	0	0
4	40	1	20	1	0
5	41	1	12	1	0
6	16	0	32	0	0
7	27	0	42	1	0
8	40	1	30	0	0
9	33	1	42	0	0
10	31	1	20	1	0
11	23	0	48	1	0
12	36	1	20	1	0
13	36	1	42	1	0
14	32	1	50	1	0
15	30	0	25	1	0
6	40	1	20	0	0
17	25	0	47	1	0
18	41	1	49	1	0
19	41	1	29	1	0
20	17	0	27	0	0
21	41	1	89	1	0
22	40	1	52	0	0
23	53	1	7	0	0
24	44	1	8	1	0
25	39	1	32	0	0
26	49	1	58	0	0
27	44	1	16	0	0
28	22	0	10	0	0
29	37	1	12	0	0
30	39	1	16	1	0
31	38	1	20	0	0
32	45	1	24	1	0
33	54	1	8	0	0
34	44	1	8	0	0

Observation	AGE	AGE30	UNITS	IO	PM
35	52	1	5	0	0
36	24	0	20	0	0
37	52	1	8	0	0
38	49	1	16	1	0
39	47	1	36	0	0
40	47	1	30	0	0
41	45	1	28	1	0
42	45	1	12	0	0
43	57	1	4	0	1
44	46	1	20	1	0
45	48	1	10	0	0
46	21	0	12	1	0
47	39	1	22	1	0
48	50	1	11	0	0
49	52	1	6	0	0
50	52	1	8	0	0
51	51	1	8	0	0
52	44	1	20	1	0
53	52	1	10	0	0
54	38	1	22	0	0
55	51	1	10	0	0
56	51	1	10	0	0
57	50	1	13	0	0
58	57	1	8	0	0
59	49	1	8	0	0
60	40	1	17	0	0
61	34	1	8	0	0
62	34	1	22	0	0
63	51	1	10	0	0
64	50	1	10	0	0
65	28	0	92	0	0
66	40	1	205	1	0
67	45	1	59	1	0
68	24	0	92	0	0
69	34	1	93	1	0
70	32	1	53	1	0

Observation	AGE	AGE30	UNITS	IO	PM
71	12	0	84	0	1
72	38	1	164	1	0
73	26	0	375	0	0
74	8	0	22	0	1
75	23	0	88	0	0
76	21	0	200	0	0
77	32	1	97	1	0
78	28	0	30	0	0
79	20	0	88	1	0
80	23	0	165	1	0
81	5	0	46	0	0
82	21	0	94	0	0
83	21	0	112	0	0
84	18	0	138	0	0
85	33	1	132	0	0
86	24	0	160	1	0
87	30	0	69	1	0
88	20	0	235	0	1
89	44	1	99	1	0
90	18	0	50	0	0
91	44	1	286	0	0
92	19	0	46	1	0
93	25	0	72	1	0
94	28	0	27	0	0
95	29	0	67	1	0
96	28	0	24	0	1
97	8	0	24	0	1
98	31	1	55	1	0
99	17	0	50	1	0
100	18	0	46	0	0
101	18	0	46	1	0
102	30	0	12	1	0
103	31	1	32	1	0
104	13	0	82	0	0
105	34	1	35	0	0
106	18	0	26	1	0

Observation	AGE	AGE30	UNITS	IO	PM
107	42	1	30	1	0
108	41	1	22	0	0
109	44	1	65	1	0
110	28	0	22	1	0
111	19	0	40	1	0
112	39	1	46	0	0
113	10	0	46	0	0
114	42	1	41	1	0
115	21	0	24	0	0
116	18	0	146	0	0
117	22	0	101	0	0
118	42	1	114	1	0
119	20	0	24	0	0
120	9	0	6	0	0
121	20	0	75	0	0
122	22	0	65	1	0
123	39	1	42	1	0
124	20	0	90	0	0
125	24	0	50	1	0
126	23	0	40	1	0
127	40	1	80	0	0
128	44	1	68	1	0
129	16	0	72	0	1
130	24	0	104	0	0
131	20	0	20	1	0
132	44	1	96	1	0
133	13	0	105	0	1
134	14	0	48	0	0
135	25	0	100	0	0
136	33	1	275	0	0
137	31	1	139	0	0
138	27	0	201	1	0
139	24	0	168	0	0
140	45	1	60	0	0
141	18	0	328	0	0
142	39	1	313	0	0

Observation	AGE	AGE30	UNITS	IO	PM
143	22	0	22	0	0
144	38	1	76	1	0
145	19	0	78	1	0
146	24	0	52	0	0
147	47	1	32	0	0
148	47	1	44	0	0
149	46	1	12	0	0
150	46	1	12	0	0
151	35	1	464	1	0
152	49	1	42	1	0
153	47	1	40	1	0
154	18	0	199	0	1
155	43	1	99	0	0
156	34	1	52	1	0
157	46	1	11	1	0
158	30	0	72	1	0
159	44	1	38	0	0
160	42	1	34	1	0
161	41	1	10	1	0
162	43	1	56	0	0
163	19	0	46	0	0
164	34	1	96	1	0
165	19	0	208	0	0
166	20	0	360	0	0
167	44	1	28	1	0
168	28	0	224	0	0
169	17	0	240	0	0
170	32	1	162	1	0
171	21	0	162	0	0
172	28	0	208	0	1

Appendix II – Survey Results of Data Set II

Observation	IOPM	OC	OCPM	MAC	PAGE	HEDU
1	0	0	0	0	38.479	0.3372
2	0	0	0	0	43	0.1985
3	0	0	0	0	38.479	0.3372
4	0	0	0	0	39.479	0.1242
5	0	0	0	0	42	0.2448
6	1	0	0	0	38.479	0.3157
7	0	0	0	0	40	0.2480
8	1	0	0	0	39.479	0.1242
9	1	0	0	0	38	0.1641
10	0	0	0	0	38.479	0.3157
11	0	0	0	0	38	0.1641
12	0	0	0	0	38.437	0.3853
13	0	0	0	0	38.479	0.3372
14	0	0	0	0	40.2605	0.2344
15	0	0	0	0	38.479	0.3157
6	1	0	0	0	42	0.2448
17	0	0	0	0	39.479	0.1242
18	0	0	0	0	38.479	0.3372
19	0	0	0	0	43	0.1985
20	1	0	0	0	38.479	0.3157
21	0	0	0	0	38.563	0.1996
22	1	0	0	0	42	0.2448
23	0	0	0	0	38	0.1641
24	0	0	0	0	43	0.1985
25	1	0	0	0	38.563	0.1996
26	1	0	0	0	38.437	0.3853
27	0	0	0	1	40	0.2480
28	0	0	0	0	38.437	0.3853
29	0	0	0	1	40	0.2480
30	0	0	0	0	40.2605	0.2344
31	0	0	0	0	39.084	0.2501
32	0	0	0	0	41.042	0.1122
33	0	0	0	0	41.042	0.1122
34	0	0	0	0	35.521	0.4246

Observation	IOPM	OC	OCPM	MAC	PAGE	HEDU
35	0	0	0	0	35.521	0.4246
36	0	0	0	1	41.042	0.1122
37	0	0	0	0	39.084	0.1763
38	0	0	0	0	39.916	0.1295
39	0	0	0	1	37.479	0.2779
40	1	0	0	0	37.479	0.2779
41	0	0	0	0	37.958	0.2826
42	0	0	0	0	37.958	0.2826
43	0	0	0	0	35.7185	0.2960
44	0	0	0	0	37.521	0.2538
45	0	0	0	0	37.521	0.2138
46	0	0	0	0	38.521	0.2092
47	0	0	0	0	37.521	0.2138
48	0	0	0	0	35.521	0.4246
49	0	0	0	0	38.521	0.2092
50	0	0	0	0	41.563	0.1468
51	0	0	0	0	41.563	0.1468
52	0	0	0	0	38.084	0.1219
53	0	0	0	0	39.916	0.1295
54	0	0	0	0	43	0.1985
55	0	0	0	0	40.958	0.1371
56	0	0	0	0	38.521	0.1974
57	0	0	0	0	38.563	0.1996
58	0	0	0	0	43	0.1985
59	0	0	0	0	43	0.1985
60	0	0	0	0	43	0.1985
61	0	0	0	0	37.3235	0.1964
62	0	0	0	0	38.084	0.1179
63	0	0	0	0	35.521	0.4246
64	0	0	0	0	35.521	0.4246
65	1	0	0	0	37.3235	0.1964
66	0	0	0	0	37.521	0.2538
67	0	0	0	0	41.042	0.1653
68	1	0	0	0	39.521	0.2925
69	0	0	0	0	36.479	0.3963
70	0	0	0	0	41.042	0.1122

Observation	IOPM	OC	OCPM	MAC	PAGE	HEDU
71	0	0	0	0	38.521	0.2092
72	0	0	0	0	41.563	0.1468
73	1	0	0	0	38.437	0.3853
74	0	0	0	0	37.521	0.2538
75	1	0	0	0	37.521	0.2538
76	1	0	0	0	35.521	0.4246
77	0	0	0	0	39.084	0.2501
78	1	0	0	0	37.521	0.2138
79	0	0	0	0	39.521	0.2925
80	0	0	0	0	39.521	0.2925
81	1	0	0	0	38.521	0.2092
82	1	0	0	0	39.521	0.2925
83	1	0	0	0	35.7185	0.2960
84	1	0	0	0	38.521	0.2092
85	1	0	0	0	41.042	0.1122
86	0	0	0	0	42.605	0.2238
87	0	0	0	0	37.479	0.2779
88	0	0	0	0	38.479	0.3157
89	0	0	0	0	39.521	0.1415
90	1	0	0	0	41.563	0.1468
91	1	0	0	0	38.084	0.0847
92	0	0	0	0	41.563	0.1468
93	0	0	0	0	37.3235	0.1964
94	1	0	0	0	39.479	0.1242
95	0	0	0	0	38.8235	0.1239
96	0	0	0	0	38	0.1641
97	0	0	0	0	35.521	0.4246
98	0	0	0	0	37.521	0.2538
99	0	0	0	0	39.084	0.1763
100	1	0	0	0	39.916	0.1295
101	0	0	0	0	38	0.1641
102	0	0	0	0	36.479	0.3963
103	0	0	0	0	37.479	0.2514
104	1	0	0	0	37.521	0.2138
105	1	0	0	0	40.958	0.1371
106	0	0	0	0	41.042	0.1122

Observation	IOPM	OC	OCPM	MAC	PAGE	HEDU
107	0	0	0	0	37.3235	0.1964
108	0	0	0	1	38	0.1641
109	0	0	0	0	38.084	0.1219
110	0	0	0	0	43	0.1985
111	0	0	0	0	39.916	0.1295
112	0	1	0	0	37.521	0.2138
113	1	0	0	0	36.479	0.3963
114	0	0	0	0	37.3235	0.1964
115	1	0	0	0	35.521	0.4246
116	1	0	0	0	35.521	0.4246
117	1	0	0	0	41.563	0.1468
118	0	0	0	0	38.084	0.1219
119	1	0	0	0	35.521	0.4246
120	0	0	0	0	39.084	0.2501
121	1	0	0	0	38.521	0.2092
122	0	0	0	0	35.7185	0.2960
123	0	0	0	0	38.479	0.3157
124	1	0	0	0	38.479	0.3372
125	0	0	0	0	36.479	0.3963
126	0	0	0	0	42.605	0.2238
127	1	0	0	0	37.958	0.3085
128	0	0	0	0	39.916	0.1295
129	0	0	0	0	38.479	0.3372
130	1	0	0	0	37.521	0.2022
131	0	0	0	0	38.521	0.2092
132	0	0	0	0	36.958	0.1884
133	0	0	0	0	36.479	0.3963
134	1	0	0	0	37.521	0.2022
135	1	0	0	0	42.605	0.2238
136	1	0	0	0	38.084	0.1179
137	1	0	0	0	39.916	0.1295
138	0	0	0	0	38.521	0.1974
139	0	0	1	0	38.479	0.2762
140	1	0	0	0	38.084	0.0847
141	0	0	1	0	38.479	0.2742
142	1	0	0	0	38.084	0.1500

Observation	IOPM	OC	OCPM	MAC	PAGE	HEDU
143	1	0	0	0	38.084	0.1179
144	0	0	0	0	39.521	0.3127
145	0	0	0	0	39.521	0.3127
146	1	0	0	0	38.958	0.3081
147	0	0	0	1	37	0.2239
148	0	0	0	1	41.042	0.1653
149	0	0	0	1	38.958	0.2599
150	0	0	0	1	41	0.2165
151	0	0	0	0	39.521	0.1415
152	0	0	0	0	41.042	0.1653
153	0	0	0	0	41	0.2165
154	0	0	0	0	36.958	0.1884
155	1	0	0	0	38.958	0.2599
156	0	0	0	0	36.521	0.1623
157	0	0	0	0	38.958	0.2599
158	0	0	0	0	38.958	0.2599
159	0	0	0	1	37	0.2239
160	0	0	0	0	40.479	0.1836
161	0	0	0	0	41	0.2165
162	0	0	0	1	40.479	0.1836
163	1	0	0	0	38.958	0.2599
164	0	0	0	0	42.479	0.1782
165	0	0	1	0	38.479	0.1716
166	0	0	1	0	36.958	0.3483
167	0	0	0	0	38.958	0.2599
168	1	0	0	0	39	0.2624
169	0	0	1	0	36.479	0.2595
170	0	0	0	0	36.521	0.1786
171	0	0	1	0	37	0.2239
172	0	0	0	0	39.479	0.3109

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