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THE UNIVERSITY OF HONG KONG

SCHOOL QUALITY AND HOUSING PRICES:

EVIDENCE FROM HONG KONG

A DISSERTATION SUBMITTED TO

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

APRIL 2010

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.

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Name : _____

Date : _____

ABSTRACT

Residential property agencies in Hong Kong often use “famous school net” as a marketing gimmick. Kowloon Tong, for instance, is widely perceived to have many good schools. Is this one of the reasons for its high housing prices? If so, what is the housing price premium for living in a famous school net? This research aims to answer these questions by conducting two control experiments. Both experiments focus on primary school nets because home location primarily determines its primary, not secondary, school net under the local education system. The primary school nets chosen belong to the same secondary school net.

The first experiment controls for location by comparing properties near the boundary of two nets, where one net is known to be much better than the other in terms of primary school quality. We find that properties in the better net had a 25% premium over those in the other net, although other development-specific factors might also account for that premium.

To control for these other factors, the second experiment makes use of the fact that the two nets were merged together in 2005. This should bring a relative increase in housing prices to the (originally) poorer net. Based on 1,042 transactions, we confirm that the relative increase was 4% (p-value<5%). Moreover, the relative increase was significantly larger for housing units above 40 m^2, a finding that supports a stronger school net effect for larger households.

This research confirms the premium for better school in Hong Kong and the findings will be useful for valuation, marketing of flats and forming education policies.

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Besides, Education Bureau of the HKSAR provided the school net merger history for the dissertation and I am really thankful. Without the data, the tests in this dissertation cannot be conducted.

Last but not least, thank you for my friends and my family for their support, especially for Johnny Lui and John Hung who gathered the relevant information while I was abroad.

CHAPTER 1: INTRODUCTION

Background

The Hong Kong Government spent more than HKD$25 billions on education every year from 2004 to 2009 according to the statistics of the Census and Statistics Department (2009). It accounted for more than 10% of the government operating expenditure, which was almost as much as the expenditure on health. Thanks to the financial commitment and the 9-year free compulsory education policy introduced in 1978, children in Hong Kong enjoy primary school education and 3 years of secondary education free of charge.

Despite the free and stable basic education provided by the government, education is always a hot topic in Hong Kong. The result of central allocation of school places floods the media every year. Any change in education policy often leads to massive debate, and sometimes, resentment.

In particular, the policy of school net system is one of the major concerns of parents as this system governs the allocation of school places. The system applies to all subsidized and government schools in Hong Kong and this represents the majority. About 90% of the primary schools and more than 80% of the secondary schools in Hong Kong are either subsidized or government schools. Under the school net system, students are restricted from applying schools outside their designated school net in the Central Allocation Stage. Although certain choices are free from the restriction in the Discretionary Places Admission Stage, it will be shown in Chapter 3 that school net system matters a lot while parents are struggling for a “better school”.

There are currently 18 secondary school nets in Hong Kong and they are subdivided into 36 primary school nets. The primary school students are assigned with a secondary school net basing on the primary school they go to and children are assigned with a primary school net basing on their residential address. In short, if a parent has any preferred primary or secondary school in mind, the parent has to choose the home location very carefully. By choosing a home location in the school net where the preferred primary or secondary school is located, it boosts the chance of getting into that school. The detail explanation and calculation will be in Chapter 3.

The distribution of the perceived better schools is not even in Hong Kong. If we refer to any publication that provides “tips” for parents, there are a few school nets that are said to be better. The idea is further reinforced by the fact that “better school net” is often used as a mean to promote certain properties. One can observe the properties in the perceived better school nets include “good school net” in the property description (Centaline Property Agency 2010a). Examples are Kowloon Tong, Central and Western District and Ho Man Tin. This does not appear to be random as properties in other school nets do not contain any school net information. The uneven distribution of better schools under the school net system, together with parents’ desire to get their children to better schools, implies that a careful choice of residential address matters.

Objectives

This dissertation aims at exploring the premium for better school on property price. In particular, it further attempts to identify the asymmetric effect on different properties.

The first objective of this dissertation is to work out the first empirical test in Hong Kong to identify the premium for living in a better school net by conducting two

control experiments.

The second objective is to reveal, if any, the asymmetric premium for better school on different households.

With the 2 objectives, 2 hypotheses are formulated. The rationale and their testable implications will be discussed in Chapter 4.

Hypothesis 1 is:
If the school net is better, then the residential property price in the school net will be higher.

Hypothesis 2 is:
If there is a premium for better school on property price, then it is larger for households with education needs.

Research Design

Past research such as Jud and Watt (1981) had proven the positive linkage between better school and residential property price. The concept of boundary-fixed approach was adopted to test the hypotheses (Black 1999, Bogart 2000 and Kane et al. 2006) so that the neighbourhood characteristics could be controlled. Unfortunately, similar research has not yet been carried out in Hong Kong where education floods the media from time to time and better school nets are always used as a promotion tool for residential flats. This attracts the author to research on this topic in Hong Kong. The lack of past research is probably due to the difficulty in locating suitable research location. The boundary-fixed approach used by Black (1999) can hardly be tested

given the current school net distribution. Considering all the school net boundaries in Hong Kong now, there are only few locations where residential buildings are situated on both sides of the boundary and most of them are not having sufficient transactions to carry out an empirical test. After examining every single school net boundary in Hong Kong from 2000 to 2009, only 1 suitable location is found.

The premium identified by the boundary-fixed approach could take into account other development-specific factors. To reinforce such experiment, the author uses an extra experiment, the experiment of the merger of school nets, to complement the boundary experiment and conduct a more promising test for Hypothesis 1. There were once 58 primary school nets in Hong Kong in 2000. The number was gradually reduced to 36 in 2008 as the Education Bureau merged primary school nets over the years. It is found that one of the mergers had great effect on the residents' probability to get into better schools in 2 school nets. By working out the change in both school nets qualitatively and quantitatively, the effect is testable and the restriction of the location (boundary-fixed) is not necessary. The effect of the merger can therefore be tested on top of the boundary-fixed experiment so that a more promising result could be achieved.

It is believed that such school net effect would have a greater value to families with children because the families are the ones who have education needs. The author then tries to test the asymmetric effect of this linkage on properties with different sizes.

Significance of the research

Probably due to the difficulties in quantifying better schools and identifying testable implications, there was no previous research testing the premium in Hong Kong.

Therefore, this dissertation would be a significant first step to study the topic empirically in Hong Kong. Also, the dissertation attempts to test this link on properties with different sizes so that the topic could be linked to the housing choice of families. Both of these would assist further research, such as investment decisions, education policy and marketing of flats.

Structure

The dissertation contains 6 chapters. Chapter 1 provides an introduction of the dissertation. It includes the topic, the motivation, and the objectives and significances.

Chapter 2 is literature review. Past research on the influence of better school over housing are examined in terms of result and methodology. From the review, research gap could be identified. Relevant literatures about proxy for quantifying better schools and Hedonic Model will be included to support the methodology of the research.

Chapter 3 is overview of primary and secondary schooling in Hong Kong. Since the link between residential property price and better school is built upon the school place allocation system and school nets, background information about the system and the implications of school nets will be discussed.

Chapter 4 is hypotheses and methodology. 2 hypotheses of the dissertation and their testable implications are introduced in this chapter. Besides, details of the 3 tests and the robustness check, such as their rationale, predicted result, and their advantages and disadvantages over one another, will be discussed.

Chapter 5 is empirical result. Results of the tests will be interpreted so that they can be cross-checked with the predictions of the hypotheses.

Chapter 6 is conclusion. The summary of findings and the limitations of the research are included. Recommendations for future studies are also provided.

CHAPTER 2: LITERATURE REVIEW

Past researches on the premium for better schooling will be reviewed in this chapter. The theory, evidence and methodology of the researches will be presented. In particular, the way to quantify “better school” will be highlighted due to its high relevance to this dissertation. As quantifying better school is an important element, the public’s attitude of a potential proxy, English Medium of Instruction (EMI) school, will also be reviewed. Then, it is followed by the general theoretical background of the Hedonic Pricing Model which will be used in this dissertation. It will include the review of the variables used by various researches on better schooling and the common variables employed by Hong Kong researches to control different characteristics. At the end of this chapter, the research gap will be identified and the lessons from past literatures will be presented.

Schooling and housing price

The theory and evidence

The linkage between neighbourhood schooling and housing price was established in numerous research with the use of hedonic model. They were based on the theoretical background of Tiebout (1956) which argued that people would move to different locations in order to acquire the geographically defined goods and services. This idea was further reinforced by Rosen (1974) who regarded housing as a series of characteristics and could be separately analyzed. Jud and Watts (1981), basing on the results in Kain and Quigley (1970) and Li and Brown (1980), is the frequently quoted research that established the positive correlation between better schools and housing value. Clark and Herrin (2000) even argued that the attributes of schools were more

highly valued by residents than crime and environmental quality measures.

Methodology

In Black (1999), it was pointed out that previous studies might have insufficient control on neighbourhood characteristics. Better schools tend to be located in better neighbourhoods, such as proximity to employment and recreational amenities (Kane, et al. 2006). Also, Colwell and Guntermann (1999) proved a relationship between house value and the proximity to a school. In previous studies, variables like crime rate, accessibility index, recreation index (Haurin 1996), distance from downtown and neighbour residents (Hayes and Taylor 1996) were adopted to control neighbourhood factors.

In order to minimize the problem, Black (1999) controlled neighbourhood characteristics by comparing housing on the opposite sides of the attendance district boundary. Attendance district boundaries are defined as *"geographic lines that determine which school a child attends within a school district"*. The selected attendance districts were all in Massachusetts so that variation in school spending and property tax were also controlled. This strategy avoided the potential overestimation of the value of better school on housing in previous studies. Same methodology was used (Bogart 2000 and Kane et al. 2006).

Seo and Simons (2008), after reviewing the critiques from Clark and Herrin (2000), Clapp et al. (2005) and Brasington and Haurin (2006), suggested that such boundary-fixed effect is appropriate when study area is small and relatively homogeneous but inappropriate for studies that examine a large geographical boundary.

Bogart and Cromwell (2000), other than adopting the district-fixed effect in a relatively small area, purposely picked a school district widely perceived to be of high quality and this made the research more applicable outside the distressed districts. Controls for racial composition and transportation service were also included.

Findings along the boundaries

Black (1999) and Kane et al. (2006) identified a discontinuous change of housing characteristics and population characteristics respectively in their research. Kane et al. (2006) suggested that housing quality differences were likely to arise when the boundaries for the areas are stable as high income families move in to areas with good schools.

Quantifying better schools

Despite the fact that a positive correlation was identified in the research, different proxies were adopted in the extensive literatures to quantify the quality of schooling. Test score was one of the most common measures. Jud and Watts (1981) adopted the 3^{rd} grade achievement test scores. Black (1999) also argued that better test performance of students would lead to higher property prices while Kane et al. (2006) adopted mean test scores of elemental, middle and high schools as a benchmark. Rosen and Fullerton (1977) supplemented expenditure per pupil by adding achievement test score as another variable and argued that achievement test score is able to improve the result. Some others included 8^{th} grade Mathematics score (Clapp et al. 2008) and the ability to reach the government specified grade (Gibbons and Machin 2003).

Figlio and Lucas (2004) used comprehensive measures of school quality such as

school rating introduced by the No Child Left Behind Act in the US. Oates (1969) suggested higher school spending leads to higher housing value. Hayes and Taylor (1996) argued the higher housing value was the result of the higher marginal effect of school on students, which followed the measurement of school quality in Hanushek (1986). In Hayes and Taylor (1996), premium for school quality was suggested to be the most important determinant of housing value and the analysis revealed that not all the school characteristics were indicators of school quality. The result also implied that the marginal effect of the schools mattered while school expenditures and the characteristics of the student body might not be relevant. Brasington (1999) used similar method as Hayes and Taylor (1996) but researched in a larger scale. More variables such as attendance rate and student-to-teacher ratio were included. It was concluded that proficiency test scores could be a better indicator than value-added. Gibbons and Machin (2002) worked out the first empirical evidence in the United Kingdom by using the percentage of primary school children reaching the government-specified target grade as a benchmark for better neighbourhood. Benchmark of gaining five A-C in GCSEs in secondary schools was also used in research (Rosenthal 2003). Brasington and Haurin (2006) compared value-added approach with other proxies and concluded that little evidence supported the use of it. Seo and Simons (2008) questioned the extent of influences of various proxies and tested their effect after categorizing the proxies in previous studies into input factors such as expenditure per student, output factors such as test scores, and value-added factors such as increase in output levels over the previous period. It is concluded that output variables performed better. A table summarizing the common proxies used in past research is shown in the following page. Their results are also recorded.

Table 1: Summary of results and proxies for better school

Author	**Result**	**Proxy for better school**
Jud and Watt (1981)	5.2% increase in house price per unit of test score	3rd grade reading test score
Black (1999)	2.5% increase in house price per 5% increase in test score	4th grade Masachusetts Educational Assessment Programme
Hayes and Taylor (1996)	0.26% increase in house price per 1% increase in test score; 0.49% increase in house price per 1% increase in expenditure per pupil	6th grade Mathematics achievement, expenditure per pupil, peer group in schools
Clark and Herrin (2000)	5.2% increase in house price per 1.6 student reduction in a class; 2.7% increase in house price per 3.1% increase in student taking SAT	School dropout rate, percentage of senior class that took the Scholastic Aptitude Test (SAT), teacher-student ratio
Gibbons and Machin (2003)	0.67% increase in house price per 1 percentage point increase in the rate of reaching the government specified target grade	Government specified target grade
Brasington and Haurin (2006)	7.1% increase in house price per standard deviation increase in test scores	District's average proficiency test scores and expenditure

Kane, Reigg and Staiger (2006)	10% point increase in house value per standard deviation increase in school's mean test score	Schools' mean test score
Clapp et al. (2008)	1.3-1.4% increase in house price per standard deviation increase in maths score	8th grade Mathematics test score
Seo and Simons (2008)	US$3.5 increase in house price per standard deviation increase of teachers' experience; US$5973 increase in house price per 1 percent passage rate in 4th grade Mathematics; 5.5% to 11% more in house price for the well rated districts, comparing to the poorly rated ones	Teachers' experience, 4th grade Mathematics score, school district report card (A rating given under the No Children Left Behind Act in the US)

As Hanushek (1986) had argued, the measurements of school quality are complicated and not sufficiently quantified. Kane et al. (2006) found that value-added measure was indistinguishable, which was consistent to the result in Rothstein (2006). It was suggested to be reflecting the difficulty the parents faced in differentiating the school quality. West et al. (1998) suggested that researchers cannot rely on institutional assumptions to be valid across different areas of the country and different models have to be employed to study parental behaviours.

Perceived value on English Medium of Instruction (EMI) education

Evidence on the actual benefits brought by EMI to students was inconclusive (Pierson 1987, Lin 1996a and Lin 1996b). However, the status and its importance in career were addressed (Luke 1984, Bourdieu 1991 and Lin 1996b). Perhaps the struggle for English as the medium of instruction in Hong Kong is best summarized as followed.

> *"There is no point in determining whether children in Hong Kong would learn more effectively through English or Chinese. We already know that they would learn more effectively through Chinese . . . Our problems arise because their learning of English will be more effectively achieved by using it as a medium of instruction. So long as this is a dominant aim of the education system then the questions that remain relate to how it can be used with least disturbance of learning within the curriculum and for how many it can be used without serious and irrevocable disruption of learning"*
>
> *Po (2003) p680 (Quoted from Brimer et al. 1985)*

Perceived value

Successful EMI education was seen as a prerequisite for socio-economic advancement (Evans 2000). Po (2003) showed that students associated career with English. In So (1992), with reference to the statistics (So 1984 and So 1986), it was concluded that English standard was the primary concern of parents but there was no evidence showing that they preferred EMI schools or rejected Chinese Medium of Instruction (CMI) schools. Despite the fact that there was no conclusive evidence in past literatures, some literatures did record the reaction of parents and schools regarding to the change of medium of instruction from EMI to CMI of schools. These might show the preference of some parents.

> *"Scenes of tearful teenagers and angry, disheartened parents of 'elite' schools which had failed to retain English teaching were captured on newspapers and TV, often against the backdrop of protest banners on the school premises"*
>
> *(Po 2003 p674)*

> *"…They have to switch back to English medium since they do not want to be labelled as second class, as Chinese-medium schools have traditionally been stigmatised given the socioeconomic domination of English in society"*
>
> *(Lin 1996b p77)*

> *"The parents of the children of a school marched to protest their school's decision to change their medium of instruction to Chinese"*
>
> *Lin (1996b) p77*

Hedonic Pricing Model

The model is one of the most common models used to study the relationship between the dependent variable and independent variables in the property market. Its long history was discussed in various research (Malpezzi 2002 and Sirmans et al. 2005).

The history of Hedonic Modelling can be traced back to Court (1939) where a hedonic price index for automobiles was adopted. Lancaster (1966) and Rosen (1974) were the 2 classic papers for studies on characteristics, with the focus on demand side of the market. In particular, Rosen (1974) did not place the focus on utility but the bid-offer process of the characteristics as well as the marginal change, and concluded that market prices were comparable while differentiated goods were treated as tied packages of characteristics. Thereafter, researchers have been adopting these as the theoretical background to study properties with Hedonic Modelling (Linneman 1980, Hayes and Taylor 1996 and Downes and Zabel 2002).

There were many researches on property in Hong Kong which adopted this model and they covered a wide range of characteristics. For example, amenities in the neighbourhood (Liisa and Antti 2000), floor level, age and accessibility of buildings (Mok et al. 1995) and even the concept of lucky floors in the Chinese tradition (Chau 2001). Theoretically, due to the unique characteristics of a flat or a building, there could be an unlimited number of independent variables that affect the determination of property prices. Researchers are then left with a question on the choice of independent variables. Butler (1982) provided us with a new perspective with his research on bias. It was believed that a lot of characteristics could be included in the model, but there could be more that had been excluded and researchers should be sensitive to the specification bias.

Butler (1982) categorized the independent variables into structural and non-structural. Powe et al. (1995): further broke down the non-structure independent variables into 5 types. The 5 types of independent variables are summarized as:

1. Structural characteristics: e.g. plot size and number of rooms
2. Environmental and neighbourhood characteristics: e.g. landscape and air quality
3. Locational or accessibility characteristics: e.g. access to ships and urban centres
4. Local socio-economic and public sector characteristics: e.g. unemployment rate and wage differentials
5. Property rights or legal constraints regulating the use of the property

Choice of independent variables

A discrepancy in the choice of variables is observed between Western studies and Hong Kong studies. Structural characteristics like number of bedrooms, number of bathroom, plumbing fixtures, type of air conditioning and average room size were taken into account in various Western studies on schooling (Jud and Watt 1981, Brasington 1998, Bogart and Cromwell 2000, Goodman and Thibodeau 2003 and Leech and Campos 2003). Environmental and neighbourhood characteristics like ethnic groups (Goodman 1977) and community size (Brasington 2000) were also included.

These were in addition to the typical variables adopted by Hong Kong research which included age, floor level, sea view and floor area (Mok et al. 1995, Chau 2001, Tse 2002 and Hastings et al. 2005). The major reason could be the compact development in Hong Kong (Li 2005), which resulted in little variation in variables like plumbing

fixtures and air quality in most of the cases. Also, in Hong Kong, locational or accessibility characteristics are not commonly included unless they are under the scope of study (So et al. 1997).

In Hong Kong, socio-economic, public sector characteristics and property rights constraints are not included in researches as they do not vary within Hong Kong.

Research gap and the applications of past methodologies

The positive correlation between better school and property price was well established in the US by the use of Hedonic Pricing Model. The boundary-fixed approach used by Black (1999) and other subsequent researchers is very suitable for the test in Hong Kong as far as the idea from Seo and Simons (2008) is valid as the school nets in Hong Kong are small and relatively homogeneous. However, such research has not yet been carried out in Hong Kong. This motivated the author to research on this topic with the use of the boundary-fixed approach.

Hedonic Pricing Model will be used to test the hypotheses and the variables included will follow the past research norm. Bogart and Cromwell (1999)'s idea of using better school districts will also be employed as Hong Kong is not considered as a distress area. The details of the tests will be explained in Chapter 4 and the background of school nets in Hong Kong will be included in Chapter 3.

It can be seen that there is no general agreement on the proxy to be used to quantify the quality of schools. Output, such as test result, and input, such as expenditure per student, were often adopted and some others suggested comprehensive benchmark which includes both of them. Given that no official information about school output

and input is provided in Hong Kong, the suggestion from West et al. (1998) and Kane et al. (2006) provides a guide for this dissertation and new proxy would be used basing on the information parents receive. Details will be discussed in Chapter 4.

The literatures about EMI are not conclusive but it does reveal some support from parents. This idea will be justified by the requirements imposed by the government on EMI schools in Chapter 4 and it will be used as one of the proxies to quantify better schools.

CHAPTER 3: OVERVIEW OF SCHOOLING IN HONG KONG

Background of the school net system will be introduced. Basing on the current system and past statistics, it will be demonstrated that the majority of primary and secondary students undergo the Central Allocation stage of school places in Hong Kong. It means that home location influences the access of better schools for the majority. This link allows the research on the premium for better education to be conducted in the housing market. At the end of the chapter, parents' perception of "better" schooling will be discussed.

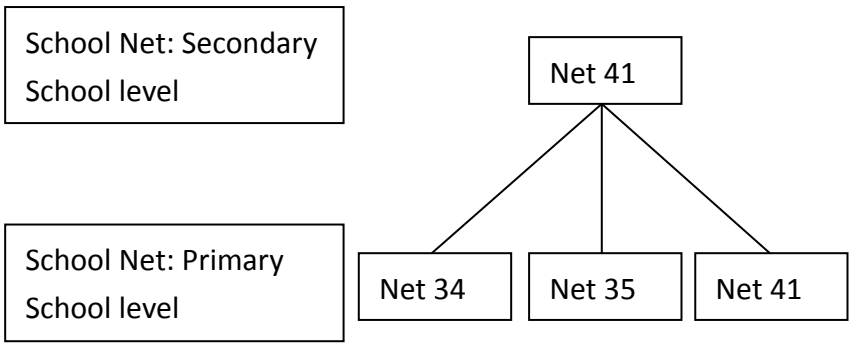
School net system

The Education Bureau (2008) had stated that primary school admission is primarily net-based as it is the goal to avoid children to travel for unreasonably long distances to attend schools. As a result, school nets were formed to govern the restricted school choice of parents after taking into consideration the geographical areas and the distribution of schools.

School net and residential property

There are currently 30 primary school nets under POAS and 18 secondary school nets under SSPA. The division of the 18 secondary school nets under SSPA is literally based on the POAS Primary school nets. In other words, 1 SSPA secondary school net may include more than 1 primary school net. The idea is shown in the following figure.

Figure 1: Illustration of the hierarchy of school nets (with secondary school net 41 as an example)



The place where the children reside will determine the primary school net a student belongs to under POAS. The physical location of the primary school the student attends determines the secondary school net a student belongs to under SSPA. In short, the residential address of a child would determine the primary school net he/she belongs to and therefore influence the school choices of primary schools. This, in turn, also affects the school choice of secondary school indirectly.

Boundaries

The distribution of the current primary and secondary school nets is shown in Appendix 3. It can be observed that the boundaries are always drawn beside non-residential developments. This setting places a difficulty on adopting the methodology proposed by Black (1999) which used the boundary-fixed approach to control neighbourhood factors as mentioned in Chapter 2.

Merger of school nets

It is also important to note that the number of primary school net was reduced from

time to time. The number was 58 in 2000 but it is reduced to 36 in 2009 after various mergers. This allows the tests on the hypotheses and the details will be discussed in Chapter 4.

Overview of the types of primary and secondary schooling in Hong Kong

There are five types of schools as categorized by Education and Manpower Bureau (2002) and they include government schools, subsidized schools, Direct Subsidy Scheme schools, private schools as well as English Schools Foundation and international schools.

Government schools and subsidized schools

Government schools are schools operated by the HKSAR Government while subsidized schools are schools that receive government aid but managed by non-government organizations, such as charity organizations. Standard school fee is 0 due to the government policy of 9-year free and compulsory education. In order to admit to these types of school, students have to undergo The Primary One Admission System and Secondary School Places Allocation System for their admission.

Direct Subsidy Scheme schools

In 1991, the Direct Subsidy Scheme was set up according to the recommendations in the Education Commission Report No.3 (Education Bureau 1988). Under the scheme, participating schools are free to choose their curriculum, fees and entrance requirements. They can still receive subsidies from the government and the amount is based on their operating history and the number of eligible student enrolled. In other words, the tuition fee could be expensive and they have independency over the

policies of student admission.

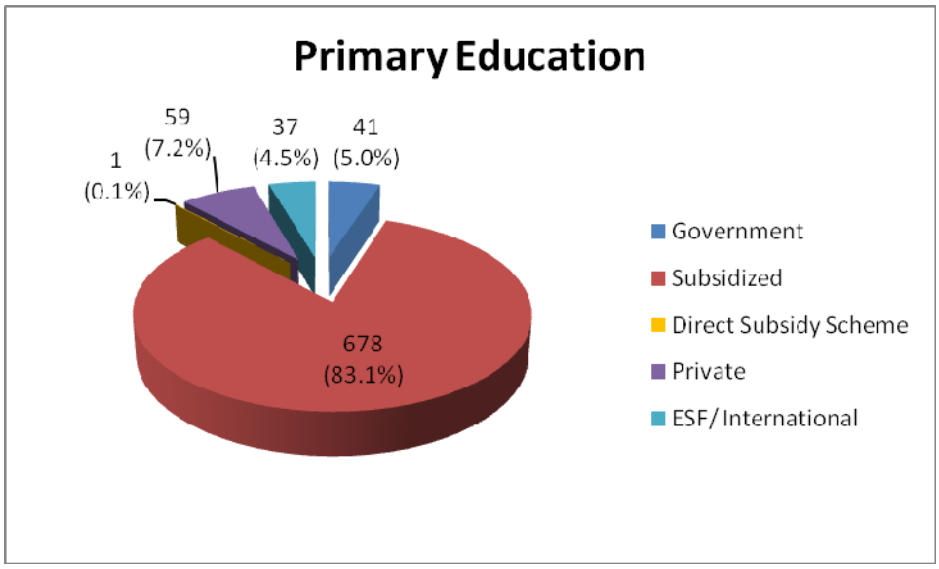
Private schools, English Schools Foundation (ESF) and international schools

Private schools are operated by private organization with independence in areas like admission policy and school fees. The school fee of this type of school could be more than HK$20000 per annum. International schools are schools offering full non-local curricula to students. These schools provide an alternative of the mainstream curriculum but tuition fee generally could be more than HK$70000 per annum. ESF is an organization which operates more than 21 international schools in Hong Kong. The difference between ESF schools and international schools is that ESF is formed under The English Schools Foundation Ordinance (CAP 1117). Despite receiving subsidy from the Hong Kong Government, the ESF basically charge HK$58100 for primary school fee and HK$89250 for secondary school fee per annum. It also has independent admission policies.

Students under the government school admission system

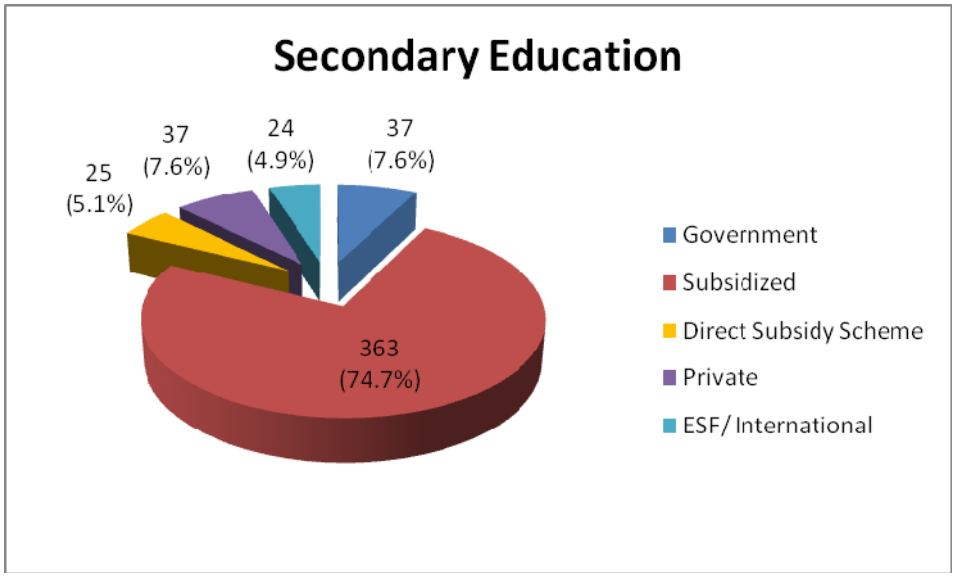
The number of school under each of the above mentioned school types are recorded in 2002 by the government.

Figure 2: Number and percentage of primary schools under different categories



Education Bureau (2002)

Figure 3: Number and percentage of secondary schools under different categories



Education and Manpower Bureau (2002)

The figures show that about 90% of the primary schools and more than 80% of the secondary schools are either government or subsidized schools. Although the figure may have fallen due to the expansion of Direct Subsidy Scheme schools, the majority is still government and subsidized schools. In other words, the majority of the

students, who wish to study in Hong Kong, are required to undergo the school allocation process provided by the Hong Kong Government so as to secure a place in government or subsidized schools.

The Primary One Admission System (POAS)

It is the current primary school place allocation system in Hong Kong for government and subsidized schools. The system aims at eliminating the pressure imposed on children by the competition to enter popular primary schools. The details are listed at the website of Education Bureau (2010). 4 prerequisites have to be met by applicants:

1. reach the age of 5 years 8 months when the child is enrolled in primary 1 in September each year
2. be a Hong Kong resident
3. not be attending any primary schools
4. have never been allocated a primary 1 place

The system is divided into 2 stages and they are namely Discretionary Places Admission stage and Central Allocation stage. Under the system, the territory is divided into 30 school nets. Parents can only apply for the primary schools that are under the primary school net they reside in the Central Allocation Stage.

Discretionary Places Admission (DPA)

If the parents have a preferred school in mind, they could choose to participate in this admission stage. In this stage, parents can apply for 1 government or aided school which could be within or outside the primary school net they reside. Their application will then be processed under 2 different categories.

The applications will be under the first category if the applicants are having sibling or

parent working in the school. This category will take up about 30% of the school's primary 1 place. If the applications exceed 30% of the places, the shortfall will be made up by the places reserved for the central allocation. On the other hand, if the number is less than 30% of the places, the remaining places will be allocated to the second category – the Points System.

Not less than 20% of the primary 1 school places will be taken up by the Points System and applications will be assessed solely on the predetermined criteria which are listed in the following table.

Table 2: List of criteria to score points under the Points System

Content	**Point**
Parent(s) teaching or working full-time in the kindergarten or secondary section if it is of the same address as the primary school	20
Sibling(s) studying in the secondary section if it is of the same address as the primary school	20
Parent(s) being a school manager of the primary school	20
Parent(s) or sibling(s) being a graduate of the primary school	10
First-born child (the eldest child in the family irrespective of sex)	5
Same religious affiliation as the sponsoring body which operates the primary school	5
Parent(s) being a member of the same organization which sponsors the operation of the primary school	5
Applicant of the right age (5 years 8 months to 7 years old)	10

The 30% of the school places is not believed to be significant to the parents due to the relatively little influence on school allocation. First of all, if none of the sibling of the parent of the child is working in the preferred school, the child will not be qualified under the first category. This is rather physical and can hardly be controlled by parents. Secondly, criteria under the Points System, such as sibling studying in the preferred school or parents working in the secondary sector of the school, are also hard to be controlled. Thirdly, even though some parents may still bet on the Points System, the school places under the system is relatively few and there is a little chance to get into the school through this system. Take the better primary schools in school net 34[1] as

[1] Will be defined in Chapter 4 and the figures used here are in 2005.

an example, there are only 54 to 156 primary 1 school place in each better school. As a result, there are only about 11 to 31 school places in each better school under the Points System admission. These places are open for every single eligible applicant for competition under the point system. Consider the several ten thousands of eligible children and probably thousands of children possess similar points, there is a very low chance of winning this bet.

Central Allocation Stage (CAS)

Children who are not offered with a place under DPA or those who did not apply for DPA will participate in CAS. Parents have the discretion to choose up to three choices of schools regardless of which school net they reside (unrestricted school choices) while the remaining choices (restricted school choices) are bounded by school nets. This restricted school choices is the key linkage between better schooling and home location as home location determines the school net a child belongs to. Primary schools will reserve about 50% of their primary 1 places for the allocation under CAS. In this 50% school places, 10% will be assigned to the applicants under unrestricted school choices. The remaining 90% are for the applications which are restricted school choices. Application under unrestricted school choices will be process first and then followed by the process of restricted school choices.

In CAS, there are 2 criteria for the allocation of school places. They are parental choices of schools and random number.

<u>Parental choices of schools</u>

Parents have to rank the selected primary schools in their order of preference on the application. School places allocating will follow the preference. However, if the

school is oversubscribed, random number will be used.

Random number

A computer programme which adopts "random number" is employed by the government while allocating school places of the oversubscribed schools. This random number, which is unique to each applicant, will decide the order of priority in allocating school places.

Similar to the school places allocation under DPA, the unrestricted school choices are believed to be insignificant to the parents. There are only 5% of the primary school places of a school allocated in such way and it is only talking about 5 to 16 school places in a school and it is open for competition in the territory (regardless of school net which is based on home location).

Therefore, it is the restricted school choice which matters. Although only 50% of the school place is allocated in this way, the competition is restricted to the students in a school net and there are only about few thousands eligible applicants in a school net. Also, unlike DPA, parents are able to choose more than 1 school to apply. By having a home location in a better school net which has lots of better schools, the chance of their child to get into a better school will then be improved significantly. Take the previous example of school net 34. Given the 50% of better school[2] place accounts for about 300 school places and the eligible applicants accounts for about 900 people, the chance of getting into a better school is about 30% and this is a very high rate comparing to the less than 1% chance in DPA and unrestricted school place in CAS.

Now we turn to secondary school place allocation.

[2] Will be defined in Chapter 4 and the figures used here are in 2005.

Secondary School Places Allocation System (SSPA)

If parents wish their children to be allocated a government or subsidized secondary 1 school place, they will undergo the SSPA upon the completion of primary school education. Details are also presented at the website of Education Bureau (2010). The prerequisites for application are:

1. being a Hong Kong resident
2. studying in a Primary school participating in the SSPA System
3. never been allocated an secondary 1 place before

Like the POAS, the system is divided into Discretionary Places Admission (DPA) and Central Allocation Stage (CAS).

Discretionary Places Admission (DPA)

Parents could choose up to 2 participating secondary schools listed in the Handbook for Application for Secondary 1 Discretionary Places. These choices are free from the restriction of secondary school nets. Secondary schools are allowed to reserve not more than 30% of their secondary 1 places for DPA and may admit students according to their educational philosophy and other criteria which are made public.

Central Allocation Stage (CAS)

If students are not assigned with a school under the DPA or they do not choose to undergo DPA, they will then enter the CAS. After the deduction of the places for repeater (less than 5% of the school places) and discretionary places, the remaining places are allocated under CAS. Similar to POAS, there are unrestricted school choices and restricted school choices, with the later choices bounded by school nets. There will be 10% of the school places under CAS assigned for unrestricted school

choices while 90% will be assigned for restricted school choices.

CAS allocates places according to 3 criteria and they are namely allocation band, parental choice of schools and random number. The details of the later two criteria are same as those in the CAS in POAS except that parents can choose up to 30 schools under the category of restricted school choices in SSPA. To avoid duplication, only allocation band will be discussed in this part.

Allocation band

Bandings will be granted to applicants with reference to the students' internal assessment results at the end of primary 5, mid-year and the end of primary 6 after scaling. There are 2 types of banding which deal with unrestricted and restricted school choices.

As regard to the allocation of school places for unrestricted school places, the students in the territory will be equally divided into 3 Territory Bands with each band accounts for one third of the total number of primary students.

As regard to the allocation of school places in for restricted school choices, the students within the same school net will be divided into 3 Net Bands with each consisting of one third of the total number of primary students in the school net. The banding will be used as one of the proxies for better school. Details will be discussed in Chapter 4.

Given the same rationale as in POAS, it is believed that restricted school choices

matter. However, as the effect of secondary school net is controlled by the sampling[3] in this dissertation, it will not be discussed in details here.

"Better" schools

There is currently no official information like banding and average open examination scores provided to the parents due to the avoidance of labelling effect as stated in the minutes of Legislative Council Panel on Education dated 19th April, 1999.

As a result, many parents resort to informal information. For instance, Chiu (2004 and 2005) are the leading publication for school choice written by teachers and reporters. Ming Pao Publication Limited secured the information through series of interviews. 3 categories of schools are included as "better" in the 2 publications:

1. schools having a high rate of oversubscription under Discretionary Places Admission
2. schools having a high percentage of student allocated with allocation band 1, the best allocation band under Secondary School Places Allocation System
3. schools having a high percentage of student admitting to an English Medium Instruction secondary school

It is not hard to understand why the first 2 categories are regarded as better schools. Oversubscription reflects the preference of parents and banding reflects the internal assessment result of the students.

[3] Will be explained in Chapter 4

Regarding to the third category, literatures included in Chapter 2 had provided a brief background of parents' preference but it not conclusive. A more in-depth discussion on EMI schools is therefore needed.

There are actually a few standards that the EMI schools have to meet so as to maintain their EMI status. This has provided a kind of quality control (Education Bureau 1997). It is required that the not less than 85% of the students should be able of learn effectively in English as assessed by the Medium of Instruction Grouping Assessment. Also, the teachers of these schools should be capable enough and Education Bureau will send inspectors to gather information from time to time. Last but not least, support strategies and programmes such as bridging courses have to be provided to students. All these quality control provide a sign of "better" to parents. Admitting to these schools will be regarded as something good and the use of this indicator in Chiu (2004 and 2005) is reinforced.

Summary

Students participating CAS under POAS

To summarize the information, about 45% of the school places of each primary government or subsidized school places are allocated under CAS of POAS and are restricted by primary school nets. The school places matters a lot as far as the chance of getting into a better school is concerned. So parents, who have a preferred primary school in mind but without sufficient point under the point system to admit to that school and at the same time none of the parent or children's sibling is working in the school, the only thing they can resort to is their chance in CAS by switching their home to the school net where the preferred primary school is located.

Students participating CAS under SSPA

About 63% of the school places of each secondary government or subsidized school are allocated under the CAS of SSPA each year with the restriction of secondary school nets. By locating in a school net where the preferred secondary schools are situated, it gives parents higher chance of going to the primary schools in that school net as restricted school net matters most. This, in turn, means an increase in the chance of getting into a preferred secondary school under CAS in SSPA by the same token.

Better School and home location

As far as parents perceive some schools as “better” and they are unevenly distributed in the school nets, there will be some “better” school net and some “worse” ones. Therefore, research can be conducted and it will be elaborated in Chapter 4.

CHAPTER 4: METHODOLOGY AND DATA

Hypotheses and their rationale will be explained. 2 experiments are formulated accordingly and they are namely boundary-fixed approach and school net merger. Their details and applications in the 3 regression tests as well as in the robustness check will be described. The variables in each test and their source will also be included in this chapter.

Hypotheses and rationale

There are 2 hypotheses in this dissertation. Hypothesis 1 is based on the previous researches mentioned in Chapter 2 that proved the positive relationship between better schooling and housing prices, such as Jud and Watt (1981). Also, under the school place allocation in Hong Kong described in Chapter 3, the school net system, home location has great effect on the access of better schooling and people could be willing to pay a premium.

Hypothesis 1 is:

If the school net is better, then the residential property price in the school net will be higher.

“Better” school nets

Better school net is defined by the dissertation as:

“A primary school net has a higher probability of admitting to a better school”.

Higher probability is defined as a higher ratio of:

“Number of primary 1 school places of better subsidized or government school divided by the number of eligible applicants of The Primary One Admission System in the school net”.

To illustrate, the statistics of the school nets studied in this dissertation are presented below. Before the merger of school net in 2005 and recall the better school defined by Chiu (2004 and 2005) in Chapter 3, the probability is calculated as follows:

Table 3: Statistics of primary school net 34 and 36

	Net 34	Net36
(1) “Better” school places	311	0
(2) Eligible student	852	789
Before merger = (1)/(2)	36.50%	0.00%
Conclusion	Better	Worse

“Better” schools

The view of West et al. (1998) is adopted and different proxies for better school are used under the unique socio-economic context in Hong Kong. As discussed in Chapter 3, it is impossible to identify a proxy from the information provided by the HKSAR Government due to the avoidance of labelling effect. “Better” schools will be defined by the unofficial information parents can gain access. The 3 categories of better schools are based on Chiu (2004 and 2005) as referred in Chapter 3.

1. schools having high rate of oversubscription under Discretionary Places Admission
2. schools having a high percentage of student allocated with allocation band 1, the best allocation band under Secondary School Places Allocation System
3. schools having a high percentage of student admitting to an English Medium Instruction secondary school

The rate of oversubscription does not fall into any of the 3 proxy categories (output, input and value-added) for better schools as defined by Seo and Simons (2008), but it can be seen as a reflection of parents' preference. Allocation band is a proxy of the output of the schools. The definition relying on EMI admission is backed up by some literatures which showed the perception of the parents and students. Besides, the requirements by the Education Bureau act as a quality control which secures the quality of the education in EMI schools. The percentage of students admitting to an EMI secondary school can therefore be seen as a proxy for the output of the primary schools.

In this dissertation, only primary schools are studied and there are 2 reasons. Firstly, home location primarily determines the primary school net a student belongs to. Secondly, there is only 1 primary school net boundary where the use of boundary-fixed approach as well as the study of merger can feasibly be conducted after examining all the primary and secondary school net boundaries in Hong Kong. Besides, the "better" schools have to be government or subsidized schools so that home location affects school place allocation under CAS as discussed in Chapter 3.

From hypothesis 1, 2 testable implications can be developed. Firstly, the residential property price in the better school net will be higher. Secondly, when the school net becomes better after the merger, the residential property price of the school net will increase.

Hypothesis 1 can be tested against the null hypothesis of:
If the school net is better, then the residential property price in the school net will not be higher.

Hypothesis 1 is supported if this null hypothesis is rejected.

Hypothesis 2 is based on the belief that the premium for better school is asymmetric to different households. Households with education needs (those with children) will have a larger premium. It is believed that families with children would secure a larger living space. As it is hard to find a flat in the studied area with only 1 bedroom, the author then used a threshold of gross floor area as a proxy. The cutoff is based on the class classification by the Rating and Valuation Department which will be discussed in the next section.

Hypothesis 2 is:
If there is a premium for better school on property price, then it is larger for households with education needs.

Households with education needs

Households with education needs are defined as those households with children. To yield testable implications from the hypothesis, the author makes the following

assumption:

Households with education needs (children) will live in bigger properties.

This is assuming households with children will secure a bigger living space as the household size is larger. The term “bigger” will be defined in the next paragraph.

“Bigger” properties

“Bigger” property mentioned in the assumption is defined as the non-Class A residential properties as defined in the Technical Notes of the Rating and Valuation Department (2009). In other words, residential flats with saleable area more than or equal to 40 m^2 will be classified as big. On the other hand, any Class A flat will be classified as “small” (less than 40 m^2).

Hypothesis 2 will be tested against the null hypothesis of:

If there is a premium for better school on property price, then it is not larger for households with education needs.

Hypothesis 2 will be supported if this null hypothesis is rejected.

Experiments

Experiment 1: Boundary

The studying of boundary follows the footstep of Black (1999) which used a boundary-fixed approach to minimize the effect of neighbourhood characteristics. Clark and Herrin (2000) suggested that the approach can only work on a fairly small area and this is suitable for the case in Hong Kong.

The study also follows the concept of Bogart and Cromwell (1999), which purposely pick the school nets which are perceived by parents to be “better” so that it is more applicable to the case in Hong Kong. The primary school nets chosen in the study are both under the same secondary school net. This secondary school net is regarded as a famous one as mentioned in various publications in Hong Kong (Chiu 2004, Sing Tao Daily 2006, Sun Daily 2007, Oriental Daily 2008a and Oriental Daily 2008b).

As mentioned earlier, there is almost nowhere in Hong Kong where highly transacted residential properties are found on both sides of a school net boundary. The only feasible location found, given the further restriction adopted from Bogart and Cromwell (1999), is the boundary between primary school net 34 and 36 along Ma Tau Chung Road. Along this boundary, 2 housing estates are chosen to test the hypothesis, and they are namely Majestic Park in school net 34 and Horae Place in net 36.

Figure 4: Appearance of Majestic Park

Figure 5: Appearance of Horae Place

The locations of the 2 housing estates are shown below, with Majestic Park highlighted in Red and Horae Place highlighted in purple.

Figure 6: A map showing properties of the first test

Centaline Property Agency (2010c)

Table 4: Details for the properties in the first test

Development	**Occupation Date**	**Number of Floor**	**Class**	**Gross Floor Area**	**School net**
Majestic Park	Jul-98	5 to 29	A, B, & C	560 to 1173	34
Horae Place	Jul-98	5 to 22	A & B	498 to 718	36

According to the definition of “better school” defined in the hypothesis section and the Primary School Profile (2004) which stated the number of school place in each school, primary school net 34 had 299 better primary 1 school places while primary school net 36 had none before the merger. Considering the number of students eligible for the admission of primary 1 in each school net basing on the population data of the

Census and Statistics Department (2006), there were 2.85 students competing for 1 better school place in net 34 while there was no better school place in net 36 under the Central Allocation System of primary school places. As a result, by adopting the definition of "better school net" in the hypothesis section, net 34 will be the better school net in this case, comparing to net 36. Also, it should be noted that the 2 primary school nets belong to the same secondary school net so that the effect of CAS under SSPA is controlled.

Experiment 2: merger

Complementing the boundary test is the experiment on the effect of merger. In July 2005, the Education Bureau of the HKSAR Government announced that the primary school net 34 and 36 will be merged and form a new primary school net 34. The exact date is not provided and it is assumed by this dissertation to be on 1st July, 2005. The assumption is supported by some news recording the merger (Ming Pao 2005, Apple Daily 2005 and Sing Tao Daily 2005). Newspaper and the internet had shown no sign of ex-ante expectation. The merger yields implications on the probability in getting into a better school under the Central Allocation System in each net. As school net 36 has no better school, it saves the trouble of quantifying the quality of each school.

From the findings from the previous paragraph, there was about 36.50% chance of getting into a better school in primary school net 34 before the merger while the chance was 0 in net 36. After the merger, the children from net 36 were able to apply for schools in net 34 because they became 1 single school net. The former primary school net 34 was worse off and the primary school net 36 was better off after the merger as the new chance became 18.95% for both nets. The test on the change will be carried out repeatedly with different samples.

Table 5: Chance of getting into a better school

	Net 34	Net36
Before merger	36.50%	0.00%
After merger	18.95%	18.95%

Only the effect of merger on net 36 will be tested because the media described net 36 as better off after the merger (Apple Daily 2006, Sing Tao Daily 2007a, Sing Tao Daily 2007b and Hong Kong Economic Times 2008) while net 34, after the merger, was not described as worse off but was still said to be a famous school net together with former net 36 (Sun Daily 2007, Oriental Daily 2008a and Oriental Daily 2008b). No adverse information is found regarding to the worse off of net 34. Given the importance of informal information in school choice in Hong Kong, the author would test on the effect of merger in net 36 but not in net 34 as the latter is believed to be insignificant.

Experiment design: 3 tests and a robustness check

This research tests the hypotheses by 2 experiments and a robustness check using Hedonic Pricing Model. 3 regression tests are done and each test adopts different controls and they jointly aim at identifying the premium for better school.

The studied period is from 1st January 2003 to 31st August 2009. As there was another school net merger in 2002 which may distort the result, the studied period has to start in 2003. The studied period ends in August 2009 because the deflator used in the dissertation is only available until this time and the author would like to include as many transactions as possible.

First test: examining boundaries of school nets

It tests hypothesis 1.

Hypothesis 1:

If the school net is better, then the residential property price in the school net will be higher.

A small scale regression is done by comparing 2 different housing estates on the opposite sides of the primary school net boundary, namely Majestic Park in primary school net 34 and Horae Place in primary school net 36. As discussed, net 34 is considered to be better than net 36. This test aims at identifying the effect of better schooling on the residential property price by reducing the influence of locational and neighbourhood factors to minimal. The effect of the merger of school nets, which worsened net 34 and improved net 36, will also be studied.

The equation for the first test is as followed:

$LOG(NP) = a_0 + a_1LOG(INDEX) + a_2AGE + a_3FLOOR + a_4GAREA + a_5GAREA^2 + a_6NET36 + a_7NET36*POST200507$

Table 6: Explanations and expected signs of the variables in the first test

Variable	Explanation	Expected sign
LOG(NP)	Logarithm of the nominal price	
LOG(INDEX)	Logarithm of the deflator of nominal price	+
AGE	Age of the building in terms of month	-
FLOOR	Floor level	+
GAREA	Gross floor area (square feet)	+
$GAREA^2$	Square term of gross floor area (square feet)	-
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-
NET36*POST200507	A variable which equals to 1 when the transaction is in the Primary school net 36 after July 2005 (date of the announcement for merger) and otherwise 0	+

School net 36 is considered worse than net 34 under this dissertation given the evidence and definition in the earlier part of this chapter. Coefficient NET36 yields implication on the first testable implication of hypothesis 1 by testing if the property in net 36 is lower than those in net 34. Given hypothesis 1, the coefficient is predicted to be negative. NET36*POST200507 is testing the second testable implication of

hypothesis 1 which predicts that property price will increase when the school net becomes better. So, NET36*POST200507 is predicted to be positive given that net 36 is better off after the merger.

Second test: generalizing the hypothesis by pooling more transactions

The test aims at testing hypothesis 1 again by including more transactions from the 2 nets so as to generalize the hypothesis. This is similar to the first test except that the buildings are not all situated along the school net boundary so that there is a lack of control over locational and neighbourhood characteristics. The coefficient NET36 is merely a control over these characteristics and the bias of property price in general in the 2 school nets as the property price in net 34 is apparently higher than in net 36 in general but the effect of school net is indistinguishable from locational and neighbourhood characteristics. As a consequence, it is not appropriate to establish the argument simply basing on the result of NET36 though it can be in line with the prediction of hypothesis 1 (negative). The focus of this test is therefore on the coefficient of the different effect of merger over the net 36 (NET36*POST200507).

Hypothesis 1 is:

If the school net is better, then the residential property price in the school net will be higher.

The housing estates include Dragon View, Ellery Terrace and Majestic Park in net 34 as well as Metropolitan Rise, Horae Place, Jubilant Place and Hillville Terrace in net 36. Their details are listed in the following table.

Table 7: Details of the properties in the second test

Development	**Occupation Date**	**Number of Floor**	**Class**	**Gross Floor Area**	**School net**
Dragon View	Jun-98	1 to 25	B	665 to 1028	34
Ellery Terrace	Sep-00	8 to 46	C	1168 to 1528	34
Majestic Park	Jul-98	5 to 29	A, B, & C	560 to 1173	34
Metropolitan Rise	Apr-01	5 to 40	A & B	539 to 739	36
Horae Place	Jul-98	5 to 22	A & B	498 to 718	36
Jubilant Place	Jan-98	2 to 20	B	691 to 1037	36
Hillville Terrace	Oct-99	6 to 29	B	890 to 941	36

The equation for the second test is:

$LOG(NP) = a_0 + a_1LOG(INDEX) + a_2AGE + a_3FLOOR + a_4GAREA + a_5GAREA^2 + a_6NET36 + a_7NET36*POST200507$

Table 8: Explanations and expected signs of the variables in the second test

Variable	Explanation	Expected sign
LOG(NP)	Logarithm of the nominal price	
LOG(INDEX)	Logarithm of the deflator of nominal price	+
AGE	Age of the building in terms of month	-
FLOOR	Floor level	+
GAREA	Gross floor area (square feet)	+
$GAREA^2$	Square term of gross floor area (square feet)	-
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-
NET36*POST200507	A variable which equals to 1 when the transaction is in the Primary school net 36 after July 2005 (date of the announcement for merger) and otherwise 0	+

Using the same rationale as the first test, the coefficient NET36*POST200507 is predicted to be positive.

Third test: testing the effect on flats with different sizes

The dataset used is the same as the second test. The test aims at testing hypothesis 2 by including variable NET36*BIG*POST200507. By incorporating this variable, the effect of school net merger on big flats will be captured and NET36*POST200507 will be reflecting the effect on the flats in net 36 in general. As the test focuses on the effect of merger on bigger flats in net 36, the author carefully capture any asymmetric correlation between the deflators and the flat with different sizes (BIG or non-BIG) by the addition of the variable INDEX*BIG. The result is more promising after capturing the bias on larger flats due to the different betas of the coefficient INDEX.

Hypothesis 2 is:

If there is a premium for better school on property price, then it is larger for households with education needs.

The equation for the third test is:

$LOG(NP) = a_0 + a_1 LOG(INDEX) + a_2 LOG(INDEX)*BIG + a_3 AGE + a_4 FLOOR + a_5 GAREA + a_6 GAREA^2 + a_7 NET36 + a_8 NET36*POST200507 + a_9 NET36*BIG*POST200507$

Table 9: Explanations and expected signs of the variables in the third test

Variable	Explanation	Expected sign
LOG(NP)	Logarithm of the nominal price	
LOG(INDEX)	Logarithm of the deflator of nominal price	+
LOG(INDEX) *BIG	A dummy variable which represents logarithm of the deflator of nominal price when it is a non-Class A flat	?
AGE	Age of the building in terms of month	-
FLOOR	Floor level	+
GAREA	Gross floor area (square feet)	+
$GAREA^2$	Square term of gross floor area (square feet)	-
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-
NET36* POST200507	A variable which equals to 1 when the transaction is in the Primary school net 36 after July 2005 (date of the announcement for merger) and otherwise 0	+
NET36*BIG* POST200507	A variable which equals to 1 when the transaction in the Primary school net 36 after July 2005 (date of the announcement for merger) and it is a non-Class A property. Otherwise it is 0	+

The coefficient NET36*BIG*POST200507 is predicted to be positive given hypothesis 2 while NET36*POST200507 is predicted to be positive under hypothesis 1.

Robustness Check

It aims at testing the hypothesis 1 again by strictly controlling the development-specific factors.

Hypothesis 1 is:

If the school net is better, then the residential property price in the school net will be higher.

Another small scale regression comparing 2 different housing estates is carried out, with one of them in net 34 and the other in net 36. The 2 housing estates are Dragon View in school net 34 and Hillville Terrace in net 36. The structural characteristics are very similar so that they are well controlled. As all the properties are non-Class A flats (Class B), it avoids the bias of the different effect of school nets over Class A and non-Class A properties as tested in the third test. However, the 2 housing estates are not chosen along the boundary so that this experiment cannot yield implication on school net coefficient. It is merely a control for locational and neighbourhood characteristics. The coefficient of the different effect of merger over the 2 nets is the highlight of this test.

Figure 7: Appearance of Dragon View

Figure 8: Appearance of Hillville Terrace

The locations of the 2 housing estates are shown below, with Dragon View highlighted in red and Hillville Terrace highlighted in purple.

Figure 9: A map showing the properties of the robustness check

Centaline Property Agency (2010c)

Table 10: Details for the properties in the robustness check

Development	**Occupation Date**	**Number of Floor**	**Class**	**Gross Floor Area**	**School net**
Dragon View	Jun-98	1 to 25	B	665 to 1028	34
Hillville Terrace	Oct-99	6 to 29	B	890 to 941	36

The equation for the robustness check is as followed.

$LOG(NP) = a_0 + a_1 LOG(INDEX) + a_2 AGE + a_3 FLOOR + a_4 GAREA + a_5 GAREA^2 + a_6 NET36 + a_7 NET36*POST200507$

Table 11: Explanations and expected signs of the variables in the robustness check

Variable	Explanation	Expected sign
LOG(NP)	Logarithm of the nominal price	
LOG(INDEX)	Logarithm of the deflator of nominal price	+
AGE	Age of the building in terms of month	-
FLOOR	Floor level	+
GAREA	Gross floor area (square feet)	+
$GAREA^2$	Square term of gross floor area (square feet)	-
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-
NET36*POST200507	A variable considering the transaction in the Primary school net 36 after July 2005 (date of the announcement for merger)	+

The coefficient for NET36*POST200507 is meaningful and is predicted to be positive under hypothesis 1, given the similar structural characteristics of the 2 properties and the control for location and neighbourhood by the coefficient NET36.

Variables included in the equation

Dependent variable

Logarithm of nominal price (LOG(PRICE))

Nominal prices are gathered from the EPRC database and they are expressed in Hong Kong Dollars (million).

Independent variable

Logarithm of deflator (LOG(INDEX) and LOG(INDEX)*BIG)

Only the real transaction price is the concern of the tests as the nominal price could be biased by time-effect caused by inflation and other market fluctuations. As a result, an independent variable “INDEX” is adopted to deflate the nominal prices to real prices. This index is obtained from Rating and Valuation Department (2010a and 2010b) and it uses 1999 as base year. The monthly index will be used as the property market in Hong Kong is volatile and this makes quarterly or yearly data unsuitable. Also, different indices are calculated for flats of different “Class”. There are 5 Classes as shown in Appendix 1 and they are classified by their saleable floor area. The deflator (INDEX) for each transaction will be using the appropriate index according to its Class.

Instead of incorporating the index in the nominal price and form a dependent variable for the tests, it will be included as an independent variable since the selected properties may not be 100% correlated to the index which serves the whole territory. It is expected to find a positive coefficient.

Log(INDEX)*BIG will be included in the third test so as to capture any potential difference in the interaction of price and the deflator.

Age (AGE)

Age of the building at the time of transaction is calculated on a monthly basis. The number of months between the Occupation Date provided by Centaline Property Agency (2010c) and the date of instrument for the transaction will be considered as the age of the building.

In general, buildings will deteriorate and therefore depreciate gradually. It is expected to find a negative coefficient.

Floor level (FLOOR)

Floor level means the number of floor a flat is located above the ground level. Generally speaking, properties at a higher floor levels are preferred by the purchasers as lower floor levels suffer from nuisance such as traffic noise and higher floor levels enjoy a better view. It is expected to find a positive coefficient.

Gross Floor Area (GAREA)

The area is defined by Regulation 23(3) of the Building (Planning) Regulations (Cap 123) which states that "*the gross floor area of a building shall be the area contained within the external walls of the building measured at each floor level (including any floor below the level of the ground), together with the area of each balcony in the building, which shall be calculated from the overall dimensions of the balcony (including the thickness of the sides thereof), and the thickness of the external walls of the building"*.

Purchasers are expected to pay for the extra area and it is expected to find a positive coefficient.

School net (NET36)

Dummy variable is employed as school net is qualitative and impossible to be quantified in terms of numbers. Property transactions are assigned with a dummy variable according to the Primary school net they are in, namely net 34 and net 36. The dummy variable NET36 equals to 1 when the property is in the school net 36 and it is 0 when the property is not in net 36 (net 34).

Effect of merger (NET36*POST200507)

The effect of the merger on school net 36 will be tested and the detail will be discussed in the later part of this chapter. As the merger occurred in July 2005, the dummy variable POST200507 will be 1 if the transactions took place after the merger and will be 0 if the transaction took place before the merger. Therefore, the variable NET36*POST200507 represents the transaction in school net 36 after the merger.

Effect of merger on non-Class A properties (NET36*BIG*POST200507)

The dummy variable BIG equals to 1 when the flat is non-Class A property and 0 when it is Class A property. NET36*BIG*POST200507 represents the transactions in school net 36 after the merger and they are non-Class A properties.

Square term (GAREA^2)

Square term of gross floor area is employed to capture any possible non-linear effect of the variables. It represents the rate of change of the variable.

Functional form adopted

Linneman (1980) showed that 86% overestimation of his results from hedonic pricing model could be explained by inappropriate choice of functional form. The choice is

made depending on whether prior information is available. If prior information is available, there will be not much trouble. However, if there is none, trial and error approach have to be used.

Testing of better education well established by extensive literatures discussed in Chapter 2. It is the practice of using Semi-Log method to carry out the regression and it will be followed in this dissertation. Ordinary Least Square technique, which minimize sum of the squares of the differences between the actual and the forecast value of the dependent variable, will be used. Linear function is assumed.

Source of data

The observations of the transactions of selected residential properties are collected from the Economic Property Research Centre (EPRC) database. It contains transaction data of the property sales in Hong Kong since 1991. All the transactions are gathered from the Land Registry of the HKSAR Government. Each of the transaction includes the nominal price, unit, floor level, gross floor area and date of instrument. Information on Occupation Date as provided by Centaline Property Agency is used to calculate AGE.

Although the tests in this dissertation only focus on residential flat sale transactions, the author is aware of the alternative of renting a flat. However, such rental record is not available and the tests can only be done on the purchase of flats. It is believed that the potential premium for better school on rent is reflected on prices because price is theoretically the discounted value of the future income, rent.

Also, only second-hand transactions will be included in the tests. This is done by the choice of the studied period. The start of the period is years after the occupation of the buildings.

Adjustment for data

It is observed that there are duplications among the transactions and they are excluded from the dataset. All the Re-Agreement of Sale and Purchase and duplicated Provisional Agreement of Sale and Purchase are excluded.

CHAPTER 5: EMPIRICAL RESULTS

As mentioned in Chapter 4, there are 2 experiments to test the 2 hypotheses of the dissertation. The 2 experiments will be conducted in 3 tests and a final robustness check will be included at last. In the first test, hypothesis 1 will be tested by studying the boundary of school nets as well as the effect of merger. In the second test, hypothesis 1 will be tested again by pooling more housing estates so as to generalize the hypothesis and the focus is on school net merger only. In the third test, hypothesis 2 will be tested by working out the second test again and capturing the effect of merger on non-Class A properties. In the robustness check, very similar properties in net 34 and 36 will be chosen to test hypothesis 1 to further substantiate the findings by minimizing the variation in structural characteristics, such as difference in Class. The results of the tests are shown in this chapter so that they can be compared with the predictions.

First test: examining boundaries of school nets

This test aims at testing hypothesis 1 by following the boundary-fixed approach in Black (1999) and, at the same time, testing hypothesis by studying the effect of merger. School net 36 is the worse school net before the merger and it became better after the merger as defined in Chapter 4.

Hypothesis 1:

If the school net is better, then the residential property price in the school net will be higher.

Equation:

$$LOG(NP) = a_0 + a_1 LOG(INDEX) + a_2 AGE + a_3 FLOOR + a_4 GAREA + a_5 GAREA^2 + a_6 NET36 + a_7 NET36*POST200507$$

Table 12: Descriptive data of the first test:

Whole dataset:

	PRICE	INDEX	AGE	FLOOR	GAREA
Mean	3.371413	96.38261	97.90870	14.46957	795.4783
Maximum	21.00000	147.1000	136.0000	29.00000	1173.000
Minimum	0.600000	58.50000	55.00000	5.000000	498.0000
Std. Dev.	1.689052	19.70213	23.43076	5.756063	203.2389
Observations	230	230	230	230	230

Net34:

	PRICE	INDEX	AGE	FLOOR	GAREA
Mean	3.935396	94.96558	96.81169	14.61688	886.6558
Maximum	21.00000	147.1000	136.0000	29.00000	1173.000
Minimum	0.600000	58.50000	55.00000	5.000000	560.0000
Std. Dev.	1.802402	20.56371	24.55560	5.947700	186.6924
Observations	154	154	154	154	154

Net36:

	PRICE	INDEX	AGE	FLOOR	GAREA
Mean	2.228605	99.25395	100.1316	14.17105	610.7237
Maximum	2.930000	126.4000	136.0000	22.00000	718.0000
Minimum	1.380000	60.00000	56.00000	5.000000	498.0000
Std. Dev.	0.327194	17.60964	20.94586	5.372493	57.96012
Observations	76	76	76	76	76

Table 13: Extract of EVIEWS result of the first test

Dependent Variable: LOG(PRICE)

Method: Least Squares

Included observations: 230

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	-5.670071	0.939105	-6.037742	0.0000	***
LOG(INDEX)	1.149493	0.216130	5.318519	0.0000	***
AGE	-0.003188	0.001864	-1.709754	0.0887	*
FLOOR	0.002407	0.001703	1.413793	0.1588	
GAREA	0.003824	0.000542	7.053017	0.0000	***
GAREA^2	-1.65E-06	3.23E-07	-5.105608	0.0000	***
NET36	-0.247134	0.033646	-7.345116	0.0000	***
NET36*POST200507	0.015718	0.032280	0.486919	0.6268	

R-squared	0.712026	Mean dependent var	1.132214
Adjusted R-squared	0.702946	S.D. dependent var	0.394646
S.E. of regression	0.215093	Akaike info criterion	-0.201332
Sum squared resid	10.27080	Schwarz criterion	-0.081746
Log likelihood	31.15316	Hannan-Quinn criter.	-0.153094
F-statistic	78.41476	Durbin-Watson stat	1.694161
Prob(F-statistic)	0.000000		

Note: *** means significant at 1% level

** means significant at 5% level

* means significant at 10% level

Table 14: Extract of result of the first test

Independent variable	**Explanation**	**Expected sign**	**Actual sign**	**Level of significance**
LOGINDEX)	Logarithm of the deflator of nominal price	+	+	1%
AGE	Age of the building in terms of month	-	-	10%
FLOOR	Floor level	+	+	Insignificant
GAREA	Gross floor area (square feet)	+	+	1%
$GAREA^2$	Square term of gross floor area (square feet)	-	-	1%
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-	-	1%
NET36*POST200507	A variable representing the transaction in the primary school net 36 after 1st July 2005 (merger)	+	+	Insignificant

Adjusted R-square is 0.702946 which indicates that about 70.3% of the change in price can be explained by the change in the independent variable(s). F-statistic is <0.01%. This rejects the null hypothesis which assumes none of the independent variable can explain the change of the dependent variable.

The coefficient of the independent variables of LOG(INDEX), AGE, GAREA, $GAREA^2$ and NET36 are significant and the signs are as expected. However, despite the expected signs, FLOOR and NET36*POST200507 are insignificant.

The positive sign for LOG(INDEX) represents the property prices studied are in line with the deflator index. The negative coefficient of AGE follows the logic that buildings would deteriorate over time. The positive coefficient of GAREA and negative coefficient of $GAREA^2$ indicates that buyers are willing to pay more for extra space but this effect diminishes when the gross floor area increases.

The negative coefficient of NET36 means the property in net 36, as represented by Horae Place, is having a 24% lower property price than the property in net 34, as represented by Majestic Park. This confirms hypothesis 1 given the fact that net 34 is a better school net than net 36 in terms of the probability to get into better schools.

The insignificance of NET36*POST200507's coefficient could be resulted from the insufficiency in observations. Therefore hypothesis 1 is rejected as the insignificant result fails to reject the null hypothesis of "If the school net is better, then the residential property price in the school net will not be higher.". However, the author suggests that the result could be distorted by the variation in structural characteristics of the 2 housing estates. The 2 housing estates are occupied in the same year, having

similar storeys and are located on the opposite sides of the same road, but the gross floor area of the flats in the developments varies quite a lot, with the flats in Majestic Park is generally larger. The descriptive data is provided in Table 11.

The insignificance of FLOOR's coefficient is believed to be the result of the insufficiency in observations. Also, it might be due to the fact that the property is not located along main roads or adjacent to an open view so that higher floor level may not help reducing the nuisance or yielding extra benefits.

Merit and limitations

The negative and significant coefficient of NET36 confirms hypothesis 1 and reinforces the idea of Black (1999) which suggested that the premium for better school exists, given the well controlled locational and neighbourhood characteristics in this small studied area.

However, the test only included 2 housing estates with 216 transactions due to the limited choice for the boundary test and it may leads to insufficiency in sample size. The restricted small studied area prevents an effective control for development-specific characteristics. Therefore, the coefficient of NET36 may include other omitted development-specific factors. Also, the coefficient for NET36*POST200507 is insignificant and hypothesis 1 is rejected.

Second test: generalizing the hypothesis by pooling more transactions

This test attempts to test hypothesis 1 in light of the deficiency of the first test. More housing estates in net 34 and net 36 are under studied.

Hypothesis 1:

If the school net is better, then the residential property price in the school net will be higher.

The equation for the second test is:

$LOG(NP) = a_0 + a_1 LOG(INDEX) + a_2 AGE + a_3 FLOOR + a_4 GAREA + a_5 GAREA^2 + a_6 NET36 + a_7 NET36*POST200507$

Table 15: Descriptive data of the second and the third test

Whole dataset:

	PRICE	AGE	INDEX	FLOOR	GAREA
Mean	3.761732	86.34837	97.22994	16.49232	904.0192
Maximum	21.00000	143.0000	147.9000	46.00000	1528.000
Minimum	0.600000	23.00000	56.60000	1.000000	498.0000
Std. Dev.	1.830446	28.71317	19.31476	10.26697	249.6097
Observations	1042	1042	1042	1042	1042

Net34:

	PRICE	AGE	INDEX	FLOOR	GAREA
Mean	4.900497	83.53638	98.74033	19.02911	1043.322
Maximum	21.00000	137.0000	147.9000	46.00000	1528.000
Minimum	0.600000	31.00000	58.50000	1.000000	560.0000
Std. Dev.	2.036589	27.38832	21.57482	11.18533	253.0295
Observations	481	481	481	481	481

Net36:

	PRICE	AGE	INDEX	FLOOR	GAREA
Mean	2.785358	88.75936	95.93494	14.31729	784.5811
Maximum	5.738000	143.0000	126.4000	40.00000	1037.000
Minimum	0.980000	23.00000	56.60000	2.000000	498.0000
Std. Dev.	0.777420	29.61438	17.05508	8.856951	173.1593
Observations	561	561	561	561	561

Table 16: Extract of EVIEWS result of the second test

Dependent Variable: LOG(PRICE)

Method: Least Squares

Included observations: 1042

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	-3.883953	0.150171	-25.86353	0.0000	***
LOG(INDEX)	0.813196	0.030415	26.73661	0.0000	***
AGE	-0.000807	0.000237	-3.408626	0.0007	***
FLOOR	0.005971	0.000498	11.98722	0.0000	***
GAREA	0.002176	0.000119	18.27309	0.0000	***
GAREA^2	-5.51E-07	6.22E-08	-8.854523	0.0000	***
NET36	-0.217658	0.015276	-14.24864	0.0000	***
NET36*POST200507	0.035104	0.015914	2.205895	0.0276	**

R-squared	0.873596	Mean dependent var	1.228013
Adjusted R-squared	0.872741	S.D. dependent var	0.430394
S.E. of regression	0.153536	Akaike info criterion	-0.902114
Sum squared resid	24.37482	Schwarz criterion	-0.864119
Log likelihood	478.0016	Hannan-Quinn criter.	-0.887702
F-statistic	1020.879	Durbin-Watson stat	1.967431
Prob(F-statistic)	0.000000		

Note: *** means significant at 1% level

** means significant at 5% level

* means significant at 10% level

Table 17: Extract of result of the second test

Independent variable	**Explanation**	**Expected sign**	**Actual sign**	**Level of significance**
LOG(INDEX)	Logarithm of the deflator of nominal price	+	+	1%
AGE	Age of the building in terms of month	-	-	1%
FLOOR	Floor level	+	+	1%
GAREA	Gross floor area (square feet)	+	+	1%
$GAREA^2$	Square term of gross floor area (square feet)	-	-	1%
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-	-	1%
NET36*POST200507	A variable representing the transaction in the primary school net 36 after 1st July 2005 (merger)	+	+	5%

Adjusted R-square is 0.872741 which indicates that about 87.3% of the change in price

can be explained by the change in the independent variable(s). F-statistic is <0.01%. This rejects the null hypothesis which assumes none of the independent variable can explain the change of the dependent variable.

As the implications and the rationales for variables LOG(INDEX), AGE, FLOOR, GAREA and $GAREA^2$ are discussed in the previous test, they will not be discussed again in this or the following tests unless they are insignificant or their signs contradict with the predictions. The focus of the interpretation would be on the interaction terms that are test-specific or those that yield implications to the hypothesis. In this test, the signs for LOG(INDEX), AGE, FLOOR, GAREA, $GAREA^2$ are under prediction and significant.

NET36 in this test will not be meaningful as discussed in Chapter 4. It is merely controlling the locational and neighbourhood characteristics and representing the difference in price in general over net 34 and net 36.

The coefficient of NET36*POST200507 is positive and significant. It shows that the prices of residential properties in net 36 increases by 3.1% after the merger. This confirms hypothesis 1 which predicts a higher property price when the school net gets better.

Merit and limitation

The test remedies the study in the first test by pooling more transactions in both net. The positive and significant coefficient of NET36*POST200507 confirms hypothesis 1 which states that the property price will be higher when the school net is better. However, as the sample includes more building, there could be more omitted variables.

Third test: testing the effect on flats with different sizes

The transactions in the dataset of the second test are further categorized under Class A (SMALL) and non-Class A property (BIG) as defined in the part “Definitions” in Chapter 4. The test is based on the assumption that families with children would prefer larger flats and it aims at testing hypothesis 2.

Hypothesis 2 is:

If there is a premium for better school on property price, then it is larger for households with education needs.

The equation for the third test is:

$LOG(NP) = a_0 + a_1LOG(INDEX) + a_2LOG(INDEX)*BIG + a_3AGE + a_4FLOOR + a_5GAREA + a_6GAREA^2 + a_7NET36 + a_8NET36*POST200507 + a_9NET36*BIG*POST200507$

Table 18: Extract of EVIEWS result of the third test

Dependent Variable: LOG(PRICE)

Method: Least Squares

Included observations: 1042

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.791406	0.152346	-24.88689	0.0000 ***
LOG(INDEX)	0.840774	0.030429	27.63077	0.0000 ***
LOG(INDEX)*BIG	0.001531	0.006108	0.250664	0.8021
AGE	-0.001189	0.000258	-4.605843	0.0000 ***
FLOOR	0.006116	0.000478	12.80511	0.0000 ***
GAREA	0.001826	0.000158	11.57208	0.0000 ***
GAREA^2	-4.05E-07	7.75E-08	-5.217652	0.0000 ***
NET36	-0.231328	0.014945	-15.47907	0.0000 ***
NET36*POST200507	-0.037530	0.029307	-1.280567	0.2006
NET36*POST200507*BIG	0.109719	0.029885	3.671434	0.0003 ***

R-squared	0.876753	Mean dependent var	1.228013
Adjusted R-squared	0.875678	S.D. dependent var	0.430394
S.E. of regression	0.151754	Akaike info criterion	-0.923566
Sum squared resid	23.76611	Schwarz criterion	-0.876071
Log likelihood	491.1777	Hannan-Quinn criter.	-0.905551
F-statistic	815.7156	Durbin-Watson stat	1.977460
Prob(F-statistic)	0.000000		

Table 19: Extract of result of the third test

Independent variable	**Explanation**	**Expected sign**	**Actual sign**	**Level of significance**
LOG(INDEX)	Logarithm of the deflator of nominal price	+	+	1%
LOG(INDEX)* BIG	A dummy variable which represents logarithm of the deflator of nominal price when it is a non-Class A flat	?	+	Insignificant
AGE	Age of the building in terms of month	-	-	1%
FLOOR	Floor level	+	+	1%
GAREA	Gross floor area (square feet)	+	+	1%
$GAREA^2$	Square term of gross floor area (square feet)	-	-	1%
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-	-	1%
NET36* POST200507	A variable representing the transaction in the primary school net 36 after 1st July 2005 (merger)	+	-	Insignificant

NET36*BIG* POST200507	A variable which equals to 1 when the transaction in the Primary school net 36 after July 2005 (date of the announcement for merger) and it is a non-Class A property. Otherwise it is 0	+	+	1%

Adjusted R-square is 0.875678 which indicates that about 87.6% of the change in price can be explained by the change in the independent variable(s). F-statistic is <0.01%. This rejects the null hypothesis which assumes none of the independent variable can explain the change of the dependent variable.

In this test, the signs for LOG(INDEX), AGE, FLOOR, GAREA and $GAREA^2$ are all under prediction and they are significant. NET36 cannot yield implication as it is again representing the general price discrepancy between the 2 school nets.

The coefficient of NET36*BIG*POST200507 is positive and significant. This implies a 7% increase in property price in school net 36 applies to non-Class A flats (big flats). The result for NET36*POST200507 represent the effect of merger on Class A properties (small flats) in net 36 is insignificant, which implies that it is not affected by the merger in statistical sense. The test controls the different price variation of larger flats over time comparing to the smaller flats. This is done by the deflator INDEX*BIG which takes into account “Class” (BIG). As larger flats are allowed to have a different sensitivity to changes in the deflator (BIG*INDEX), the result of a positive NET36*BIG*POST200507 is further strengthened.

LOG(INDEX)*BIG is found insignificant. It means that there is no identifiable correlation between the deflator and the non-Class A flats on top of the correlation between the deflator and Class A flats.

Merit and limitation

The test confirms hypothesis 2 which opens the research gap for future studies.

However, the proxy used is not conventional and there is no theoretical background in adopting Class A and non-Class A definition. Other proxies could be used to test the hypothesis again in the future.

Robustness check

The development-specific factors are not strictly controlled in the three above tests. This test aims at checking the robustness of the tests by controlling the development-specific factors of the sample strictly so as to reinforce the findings.

The equation for the robustness check is:

$LOG(NP) = a_0 + a_1 LOG(INDEX) + a_2 AGE + a_3 FLOOR + a_4 GAREA + a_5 GAREA^2 + a_6 NET36 + a_7 NET36*POST200507$

Table 20: Descriptive data of the robustness check

Whole dataset:

	PRICE	AGE	INDEX	FLOOR	GAREA
Mean	3.655461	91.82383	97.28705	13.50777	857.0155
Maximum	5.990000	134.0000	126.4000	29.00000	1028.000
Minimum	1.830000	25.00000	58.50000	1.000000	665.0000
Std. Dev.	0.746133	28.95309	17.03812	7.212633	111.3073
Observations	193	193	193	193	193

Net34:

	PRICE	AGE	INDEX	FLOOR	GAREA
Mean	3.650789	101.6842	98.34408	12.45395	840.8618
Maximum	5.990000	134.0000	126.4000	25.00000	1028.000
Minimum	1.830000	56.00000	58.50000	1.000000	665.0000
Std. Dev.	0.772153	21.94859	17.68282	6.804594	120.0723
Observations	152	152	152	152	152

Net36:

	PRICE	AGE	INDEX	FLOOR	GAREA
Mean	3.672780	55.26829	93.36829	17.41463	916.9024
Maximum	5.738000	92.00000	119.5000	29.00000	941.0000
Minimum	2.520000	25.00000	63.60000	6.000000	890.0000
Std. Dev.	0.648928	21.58706	13.89486	7.419487	19.37757
Observations	41	41	41	41	41

Table 21: Extract of EVIEWS result of the robustness check

Dependent Variable: LOG(PRICE)

Method: Least Squares

Included observations: 193

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	-5.196097	0.886859	-5.858991	0.0000	***
LOG(INDEX)	0.772133	0.186630	4.137248	0.0001	***
AGE	-0.001667	0.001769	-0.942636	0.3471	
FLOOR	0.006149	0.001899	3.238086	0.0014	***
GAREA	0.006247	0.002297	2.719856	0.0072	***
GAREA^2	-3.08E-06	1.41E-06	-2.189551	0.0298	**
NET36	-0.220823	0.090839	-2.430921	0.0160	**
NET36*POST200507	0.097642	0.033071	2.952542	0.0036	***

R-squared	0.650837	Mean dependent var	1.274897
Adjusted R-squared	0.637625	S.D. dependent var	0.209885
S.E. of regression	0.126346	Akaike info criterion	-1.259019
Sum squared resid	2.953209	Schwarz criterion	-1.123778
Log likelihood	129.4954	Hannan-Quinn criter.	-1.204251
F-statistic	49.26261	Durbin-Watson stat	2.505143
Prob(F-statistic)	0.000000		

Table 22: Extract of result of the robustness check

Independent variable	**Explanation**	**Expected sign**	**Actual sign**	**Level of significance**
LOG(INDEX)	Logarithm of the deflator of nominal price	+	+	1%
AGE	Age of the building in terms of month	-	-	Insignificant
FLOOR	Floor level	+	+	1%
GAREA	Gross floor area (square feet)	+	+	1%
$GAREA^2$	Square term of gross floor area (square feet)	-	-	5%
NET36	A dummy variable which equals to 1 for transactions in Primary school net 36 (worse school net) and otherwise 0	-	-	5%
NET36*POST200507	A variable representing the transaction in the primary school net 36 after 1st July 2005 (merger)	+	+	1%

Adjusted R-square is 0.637625 which indicates that about 63.8% of the change in price can be explained by the change in the independent variable(s). F-statistic is <0.01%. This rejects the null hypothesis which assumes none of the independent variable can explain the change of the dependent variable.

In this test, the signs for Log(INDEX), FLOOR, GAREA and $GAREA^2$ are under prediction and they are significant. NET36 in this test will not be meaningful as discussed in Chapter 4, as it is a control for the difference in price over the 2 housing estates and this can be due to the difference in locational and neighbourhood characteristics.

The coefficient of NET36*POST200507 is positive and significant, which confirms hypothesis 1. The positive coefficient implies an increase in price by 9% in net 36 after the merger.

The coefficient of AGE is insignificant. It is believed to be the result of renovation and sound property management.

Merit and limitation

Fewer transactions are included and locational and neighbourhood characteristics may not be controlled as well as in the first test. Nonetheless, the test controls the “Class” (size of the flats) which has proven to have an implication in the third test. The positive and significant coefficient for NET36*POST200507 has confirmed hypothesis 1 by minimizing the bias due to omitted development-specific factors.

CHAPTER 6: CONCLUSION

There was no previous research working on this topic in Hong Kong. After observing all kinds of advertisement which rely better school net as a value enhancing attribute, this research aims at testing the effect of better school in Hong Kong quantitatively. It is concluded that premium for better school net exists and this is larger for households with education needs. The practical implications of the findings will be discussed. The limitations and areas for further study will also be included.

Summary of the findings

The first test in this dissertation had once again confirmed the effect of better school using the boundary-fixed approach adopted by many researchers. It had shown that the property price could vary by 25% when the property is located within or outside a better school net. However, this figure includes other omitted development-specific factors.

The first and the second test confirmed hypothesis 1 and the third test confirmed hypothesis 2. This implies that school net effect does exist and it is larger on bigger flats. The robustness check further reinforced the idea the idea by controlling more development-specific factors.

To sum up the regression results in this research, the school net effect does exist in Hong Kong, and it is very significantly affecting residential property price. This effect is greater for larger flats.

Implications of the findings

The research confirms the premium for better school net in Hong Kong. It is the first empirical study in Hong Kong which establishes a scientific methodology to test the link. The finding can be used as a foundation for future literatures.

The positive effect is justifying the inclusion of this characteristic into advertisements and it yields implications on property marketing strategy. Besides, developers and investors should be aware of the effect to make business decisions.

Furthermore, the government can take it into account the premium of better schooling when ascertaining the effect of education policy changes.

Limitations of the study

The author tried to quantify better school and better school nets by new proxies. However, there is no support for such definitions as they are merely some indicators generally used in the public.

The vague definition for big and small flats also lacks concrete evidence to support. There is no concrete evidence showing the preference of families with children. The definition of non-Class A properties is just a proxy, which the author thinks is the best, given the available information.

Due to the difficulties in locating feasible location for the research, the test can only be tested on 2 primary school nets. The small scale research has led to the problem of insufficiency in data. The research period before and after the merger are asymmetric as a consequence. Due to the same reason, there are only 2 housing estates included in

the first test and the result may not be very accurate given the different in the omitted structural characteristics.

Area for further studies

The research is just a preliminary move to test the premium for better school in Hong Kong. Future research could verify the result by improving the methodology of the research.

More importantly, the research shows that housing characteristic, namely a certain threshold of gross floor area, is a critical factor for the effect of better school. This can be linked to research for housing choice for families and marketing of residential properties. By testing the effect of better school, the preferences of families with children could be revealed.

Last but not least, the author is also attracted by the difference in the flats' gross floor area across the school net boundary. It is also found that the properties in the better school net, net 34, are generally more expensive. This is in line with the findings in Black (1999) and Kane et al. (2006). It appears to the author that the developers may be aware of the asymmetric effect of better school and purposely build the flats that suit the school net. This could be tested by future researchers. The details of the data could be traced from Table 11, Table 14 and Table 19.

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APPENDICES

Appendix 1: Extract of Technical Notes on the definition of "Class"

1.1 Private Domestic units are defined as independent dwellings with separate cooking facilities and bathroom (and/or lavatory). They are sub-divided by reference to floor area as follows:

Class A - saleable area less than 40 m^2
Class B - saleable area of 40 m^2 to 69.9 m^2
Class C - saleable area of 70 m^2 to 99.9 m^2
Class D - saleable area of 100 m^2 to 159.9 m^2
Class E - saleable area of 160 m^2 or above

Public sector developments, including domestic units built under the Private Sector Participation Scheme for subsidised sale, and all units built under the Home Ownership, Buy or Rent Option, Mortgage Subsidy, Sandwich Class Housing, Urban Improvement and Flat-for-Sale Schemes are not included. Data relating to rental estates built by the Housing Authority and Housing Society, units sold under the Tenants Purchase Scheme, and Government owned quarters are also excluded. Completions and forecast completions are exclusive of village houses.

Source: Rating and Valuation Department (2010)

Appendix 2: Price indices by class

私人住宅 — 各類單位售價指數 (全港)
PRIVATE DOMESTIC - PRICE INDICES BY CLASS (TERRITORY-WIDE)
(1999 = 100)

年 / 月 Year / Month		A	B	C	D	E	A, B & C	D & E	所有類別 All Classes
2003	1	61.5	63.4	67.2	72.6	79.9	63.0	74.6	63.6
	2	61.0	63.8	66.5	70.7	75.7	62.9	72.1	63.4
	3	60.0	60.6	64.3	68.8	73.9	60.7	70.2	61.2
	4	59.4	59.8	64.1	67.7	72.6	60.0	69.1	60.5
	5	58.2	59.3	63.3	67.6	71.2	59.2	68.6	59.7
	6	57.3	59.2	62.6	66.6	71.7	58.8	68.1	59.3
	7	56.6	58.3	61.1	64.9	73.4	57.9	67.4	58.4
	8	56.8	58.5	60.8	66.2	73.7	58.0	68.4	58.6
	9	59.1	60.2	65.5	70.5	75.1	60.3	71.8	60.9
	10	61.3	62.5	68.6	73.8	80.4	62.6	75.7	63.4
	11	62.1	63.6	69.5	74.3	81.7	63.6	76.5	64.3
	12	63.2	64.4	70.0	79.1	85.6	64.5	81.1	65.4
2004	1	66.4	68.8	75.4	81.1	92.2	68.5	84.5	69.5
	2	69.2	72.4	81.5	86.9	96.2	72.1	89.7	73.2
	3	72.9	77.1	89.0	96.0	102.9	76.7	98.0	78.1
	4	73.4	79.2	89.3	98.1	101.7	78.0	99.2	79.4
	5	72.8	76.4	87.4	96.0	103.1	76.2	98.1	77.5
	6	69.7	73.9	83.2	92.1	106.3	73.3	96.2	74.7
	7	70.0	74.0	83.9	93.4	103.5	73.5	96.3	74.9
	8	73.1	76.4	87.8	93.3	104.1	76.3	96.4	77.6
	9	74.7	80.5	91.2	100.3	113.8	79.4	104.0	80.9
	10	77.6	83.2	95.8	106.0	117.1	82.4	109.0	84.1
	11	75.9	81.6	95.1	106.8	117.3	80.9	109.6	82.7
	12	76.4	82.6	94.1	107.9	120.8	81.5	111.2	83.3
2005	1	78.6	84.5	98.9	112.7	124.0	83.8	115.5	85.7
	2	81.6	89.4	102.1	110.9	127.0	87.9	114.8	89.4
	3	87.6	94.0	108.7	118.7	125.9	93.1	120.4	94.6
	4	88.5	94.5	110.2	120.7	134.8	93.8	124.0	95.4
	5	87.2	95.0	112.3	119.4	132.1	93.8	122.3	95.3
	6	85.9	91.8	108.4	121.4	131.2	91.2	123.7	92.9

私人住宅 — 各類單位售價指數（全港）

PRIVATE DOMESTIC - PRICE INDICES BY CLASS (TERRITORY-WIDE)

(1999 = 100)

年 / 月 Year / Month		A	B	C	D	E	A, B & C	D & E	所有類別 All Classes
2005	7	84.9	92.2	109.3	122.4	129.0	91.1	123.9	92.8
	8	86.3	93.9	106.5	122.1	131.3	92.3	124.2	93.9
	9	86.7	93.3	109.9	121.6	138.2	92.4	125.4	94.0
	10	85.8	90.5	107.1	121.6	135.9	90.2	124.7	91.8
	11	82.5	87.5	102.1	118.8	130.1	86.9	121.3	88.5
	12	83.7	89.5	103.6	119.4	135.6	88.5	123.0	90.1
2006	1	84.1	90.7	105.0	117.5	136.7	89.4	121.8	90.8
	2	84.3	90.9	106.0	117.5	138.5	89.6	122.2	91.1
	3	86.6	91.8	108.3	119.0	137.3	91.2	123.2	92.6
	4	86.6	92.9	109.8	121.9	138.8	91.9	125.9	93.4
	5	87.6	93.1	110.1	124.6	135.1	92.4	127.0	94.0
	6	86.0	91.4	107.8	119.7	140.3	90.7	124.5	92.3
	7	85.7	91.2	106.4	117.8	133.2	90.4	121.5	91.9
	8	87.3	91.5	106.8	123.1	140.8	91.2	127.3	93.0
	9	87.6	91.8	108.1	121.5	141.8	91.6	126.4	93.3
	10	87.3	91.5	108.1	123.0	135.3	91.3	126.0	93.1
	11	87.4	91.1	109.4	122.8	134.2	91.3	125.6	93.0
	12	88.4	91.6	109.8	123.2	139.2	92.0	127.2	93.8
2007	1	89.4	93.4	109.3	125.5	145.3	93.3	130.3	95.2
	2	91.0	94.6	111.5	127.6	144.6	94.7	131.8	96.6
	3	93.3	95.4	112.0	128.1	149.6	96.0	133.3	97.9
	4	94.1	95.8	114.1	131.2	152.5	96.7	136.4	98.7
	5	95.5	97.9	116.6	131.5	153.7	98.6	137.0	100.5
	6	96.6	98.8	117.1	135.7	156.1	99.5	140.7	101.6
	7	97.6	100.2	118.8	136.1	157.2	100.8	141.2	102.8
	8	98.9	101.0	120.1	140.3	164.9	101.8	146.3	104.0
	9	100.0	102.4	120.9	142.4	169.2	103.1	149.0	105.3
	10	103.6	104.9	125.0	146.0	177.2	106.2	153.6	108.5
	11	108.9	108.8	131.5	152.6	178.7	110.9	158.8	113.3
	12	112.8	113.2	138.7	159.1	188.5	115.4	165.9	117.9

私人住宅 — 各類單位售價指數（全港）

PRIVATE DOMESTIC - PRICE INDICES BY CLASS (TERRITORY-WIDE)

(1999 = 100)

年 / 月 Year / Month		A	B	C	D	E	A, B & C	D & E	所有類別 All Classes
2008	1	118.9	118.2	143.7	164.2	190.0	120.8	170.2	123.2
	2	121.7	120.4	146.5	165.6	192.5	123.3	171.8	125.5
	3	122.8	121.0	147.7	167.1	193.7	124.1	173.1	126.4
	4	121.3	119.5	143.3	166.2	194.2	122.4	172.5	124.7
	5	122.8	121.3	147.1	167.0	195.2	124.2	173.3	126.4
	6	123.2	121.4	147.9	169.6	197.3	124.4	175.7	126.6
	7	121.1	120.6	144.8	162.9	196.4	122.9	170.2	124.9
	8	119.4	118.7	142.9	158.1	195.1	121.0	166.2	122.9
	9	118.7	118.0	140.4	157.7	180.3	120.2	162.5	121.9
	10	112.6	110.7	127.6	145.6	166.6	112.9	150.0	114.3
	11	104.2	101.6	116.1	131.2	150.7	103.8	135.2	104.9
	12	104.0	102.0	113.8	131.6	151.5	103.7	135.8	104.8

( ) 表示少於 20 宗交易。

由 1984 年第一季起，計算售價指數時已陸續加入新界各區物業的售價；而由 1987 年第一季起，已加入新界所有地區的物業售價。

由於四捨五入關係，這裏較早年期重訂基期的指數，與以往出版的舊有指數計算而成的，會略有不同。

同樣地，在這裏，1980年初的綜合指數已採用劃一的加權方法，這與過去已出版的數字採用不同的加權機制，未必吻合。

( ) Indicates fewer than 20 transactions.

Prices for properties in the New Territories were gradually added by district from the first quarter of 1984. Since the first quarter of 1987, all districts have been included.

Due to rounding, the re-based indices here in respect of earlier years may differ slightly from converting past published figures.

Also, a standard weighting method is adopted here to derive composite indices which for earlier years in the 1980s may not tally with past published figures using a different weighting mechanism.

1.5

私人住宅 — 較受歡迎屋苑的售價指數
PRIVATE DOMESTIC - PRICE INDICES FOR SELECTED POPULAR DEVELOPMENTS
(1999 = 100)

年 / 月 Year / Month	A, B & C 市區 Urban	A, B & C 新界 N.T.	A, B & C 合計 All	D & E 市區 Urban	D & E 新界 N.T.	D & E 合計 All	所有類別 Overall 市區 Urban	所有類別 Overall 新界 N.T.	所有類別 Overall 合計 All
2007	107.5	84.6	95.7	150.3	133.1	142.0	110.4	87.3	98.5
2008	126.8	98.2	112.1	179.6	151.2	166.7	130.3	101.3	115.4
2008 4 - 6	134.8	103.1	118.5	190.4	161.6	177.4	138.6	106.4	122.1
7 - 9	128.6	99.7	113.8	184.9	154.5	171.2	132.4	102.9	117.3
10 - 12	108.5	87.4	97.6	152.0	132.7	142.9	111.4	90.0	100.3
2009 1 - 3	109.3	87.7	98.1	149.3	127.2	139.1	112.0	90.0	100.6
4 - 6	120.8	94.6	107.4	164.0	132.6	150.2	123.7	97.0	110.0
7 - 9 *	132.7	103.1	117.5	186.6	148.4	170.1	136.4	105.9	120.7
2008 6	135.8	103.3	119.1	187.9	158.5	174.7	139.4	106.5	122.5
7	132.3	101.2	116.4	191.6	156.0	175.9	136.3	104.4	120.0
8	127.9	100.0	113.5	188.3	155.2	173.6	132.0	103.2	117.1
9	125.6	98.0	111.5	174.9	152.3	164.2	129.0	101.2	114.7
10	116.0	92.4	103.8	163.2	143.4	153.7	119.2	95.3	106.9
11	105.3	84.6	94.7	149.7	129.4	140.2	108.2	87.2	97.4
12	104.2	85.1	94.3	143.2	125.2	134.7	106.8	87.4	96.7
2009 1	106.9	87.0	96.6	146.0	126.7	136.9	109.6	89.4	99.0
2	109.6	87.4	98.1	148.8	127.7	139.0	112.2	89.8	100.6
3	111.3	88.6	99.6	153.1	127.3	141.5	114.2	90.9	102.2
4	116.0	91.4	103.4	155.2	129.9	143.8	118.7	93.7	105.9
5	120.3	94.3	106.9	163.7	130.9	149.3	123.2	96.6	109.4
6	126.1	98.2	111.8	173.2	136.9	157.5	129.3	100.6	114.6
7	129.5	100.6	114.6	180.1	146.1	165.2	132.9	103.4	117.7
8	132.8	103.4	117.8	188.0	147.5	170.5	136.6	106.1	121.0
9 *	135.8	105.3	120.1	191.8	151.7	174.5	139.6	108.1	123.5
10 *	137.5	106.0	121.4	194.5	151.8	176.1	141.4	108.7	124.7
11 *	136.8	106.6	121.3	194.9	150.3	175.8	140.8	109.3	124.6

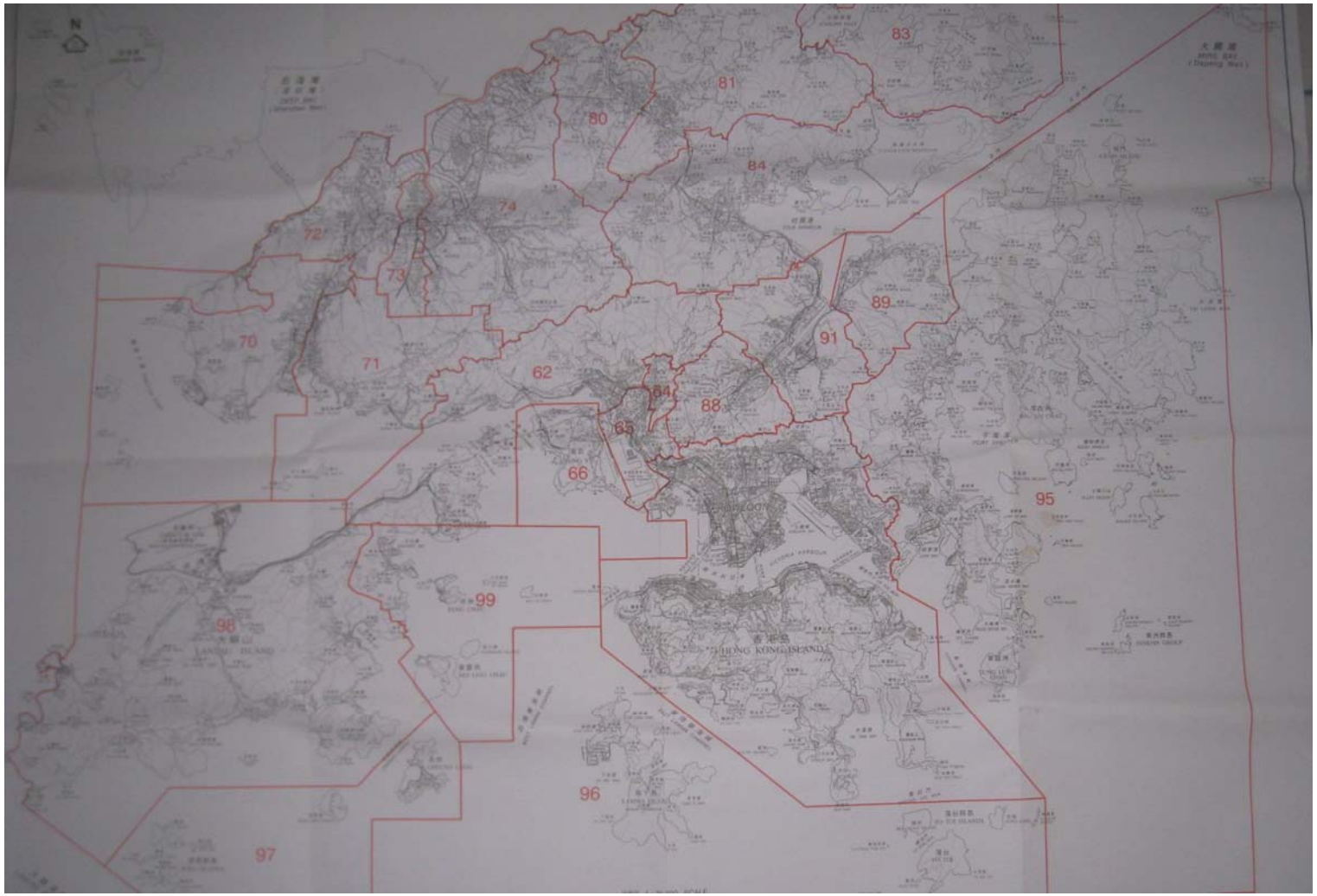
* 臨時數字
請參閱二零零七年六月號內特別附註的較受歡迎屋苑名單。

* Provisional figures
Please see Special Note of June 2007 issue of this publication for the list of Selected Popular Developments.

Source: Rating and Valuation Department (2010a and 2010b)

Appendix 3: School net boundaries


N
45
41
43
40
46
32
34
九龍
KOWLOON
九龍灣
KOWLOON BAY
48
35
31
VICTORIA HARBOUR
NORTH POINT



Source: Education Bureau, 2010 Primary One Admission School Nets