How Uneven Elementary School Education Quality Leads to Social Stratification in Beijing, China

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Abstract

Studies on (un)evenly distributed compulsory elementary education range from inter-regions, urban-rural areas, social classes and inter-schools. The purpose of this study is to examine stratifications derived from uneven compulsory elementary education quality in Beijing, mainly about inter-school and inter- social class comparisons. Key schools, which will be illustrated in detail later, break the balance among schools, leading to many social issues, such as education stratification among students from different socio-economic classes, and among schools. Also with the unique context of Beijing, School District System adds up to problems caused by uneven compulsory elementary education quality across eight counties in Beijing City. This study is divided into three parts, the first part is the stratification in schools, mainly about their financial statistics which reflects the financial power. Financial data for two elementary schools, one key school and one ordinary one, in Haidian County demonstrates key schools attracts more money, either from parents or government.

The second part is education stratification among students. To reveal that families' socio-economic status plays a role in students' education choices, I use hedonic pricing model to analyze school quality[1]'s influence on real estate market in Beijing City. Further, broad survey centering on parents' opinions in Beijing City could provide better understanding of the status quo of compulsory elementary education stratification among students. It is the goal of this study to provide planners, policy makers, and future researchers some insights on the socio-economic impact of key schools in Beijing.

[1] In this study, education quality and school quality is interchangeable. Firstly, it is hard to quantify education quality; secondly, from empirical observation for over 60 years, key schools have comparably high education quality.(see Footnote 1)

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Introduction

Public services, like public transit, medical service, and green spaces, are important factors of quality of urban life. Among these public services, compulsory elementary education resources gain increasing attention from governments, schools, developers, parents and grandparents because education has been a key channel for upward mobility in China(Xiaogang Wu, 2010). Due to the unevenly distributed public services, stratification has been a pressing problem in Beijing City, let alone migrant families from other cities[2]. This study is centered on stratifications derived from compulsory elementary education in Beijing City, on both school side and registered citizen[3] side.

The scarcity of high-quality education, or say key elementary schools in Beijing City which takes up less than 10% among all elementary schools, is the main culprit for the dilemma for both schools and families with students. On school side, key elementary schools originate from some historical reasons in 1950s, which will be explained later. The uneven status gained momentum in 1978 right after Cultural Revolution. Compared with key elementary schools, ordinary ones get less funding, fewer political subsidies, and lower public attention. This kind of Matthew Effect[4] will be illustrated in the financial comparison of two schools. This trend is unchanged over 30 years, and is becoming worse (Daozhu Huang, Fenghua Xu, 2010). In addition to financial attraction, teacher-student ratios, construction area per capita, and class size could demonstrate the stratification, too; however, given the difficulty of quantifying these

[2] This is another big issue in social science, not the main concern of this study.
[3] Household Registration System in China.
[4] In sociology, the Matthew effect (or accumulated advantage) is the phenomenon where "the rich get richer and the poor get poorer."(Gladwell, Malcolm, 2008)

factors and constrains of open data in Beijing City into consideration, this study will not cover them.

On the parent/student side, different socio-economic classes accumulate remarkably different economic/political power, reputations, and social networks (Fang Li, 2007). One common feature for all classes is that parents are willing to incur significant sacrifice to provide educational opportunities for their children. Cultural and social influences at this stage determine the rigid demand for key elementary schools.

The unique context of Beijing City is the School District System, aimed at getting students enrolled in the nearest schools. But this School District System only considers homeowners, not renters. Conflict between scarcity of high-quality education and the rigid demand for it directly leads to status quo of the abnormal real estate market in Beijing City. "In a society famous for stressing education, parents across China must now pay sky-high costs to own property — as rentals don't count — in the enrollment districts of well-regarded establishments," criticized USA Today reporter Calum MacLeod (2013).[5] For example, two buildings, one inside schools district of Zhongguancun No.1 Primary School[6] and another not inside the district, the difference in average price per square meter is CNY7,600. They share similar characteristics, such as: close to each other, both built in 1990s in similar building types but the discrepancy in the price of real estate between the two is too large not to notice.[7] Beijing City is not the only city experiencing this phenomenon, Shanghai (Hao Feng, Ming Lu, 2010), Wuhan, and Shenzhen are on the list. In Beijing context, what's the significance of key school in

[5] USA TODAY: http://www.usatoday.com/story/news/world/2013/07/04/china-cost-of-education/2489899/
[6] A key elementary school
[7] Soufun.com

this abnormal real estate market? Hedonic Pricing model can help answer this question, which will be illustrated later in Methodology part.

For classes with advantages in any perspective, parents might use the economic power, political power or social networks during the school selection process to facilitate upward mobility. Those disadvantaged parents would strive as much for students' better education. Beyond buying expensive properties, parents can pay school selection fee for key elementary school enrollment, which is over CNY 60,000 in average. Hence, what are public opinions toward such kind of socio-economic stratifications? A broad survey is conducted to answer this question.

Much of the existing literature about uneven elementary education quality is largely focused on inter-region disparity, rural-urban issues or migrant children's education. While a large body of studies have been devoted to Beijing real estate market analysis as a reflection of location choices and economic trend, few of them are centered on School District System and education qualities.

The purpose of this study is to reveal two specific problems derived from key elementary schools: stratification among schools, and different socio-economic classes. Further, as one key channel for upward mobility in current China, what is public opinion towards status quo? Based on SOUFUN data[8], National Statistics Bureau survey data, interviews with school administrators, and my broad survey data, this study will diagnose side effects of uneven education quality to some degree and indicate the significance of equality. Hope this study can arouse awareness in urban planning, public policy and infrastructure sectors in Beijing, and provide clues to step toward more evenly distributed education quality.

[8] SouFun operates the leading real estate Internet portal in China in terms of the number of page views and visitors to its websites in 2014. http://china.soufun.com/

Background

School Choices: Origin and National Contexts

Historically and culturally, Chinese society places a high value on education. Having learning is a source of esteemed social status. In imperial China, individuals spent years studying for the government's civil examination so as to become a government official. The education system during the Republican China period tended to be fragmented and highly differentiated, with limited access that favored students from privileged backgrounds. Families from well-to-do backgrounds undoubtedly had more schooling options for their children.

Education experienced a radical transformation since 1949, with the founding of the People's Republic of China. Traditional private education institutions at all levels were promptly converted to government institutions by the new government. Between 1949 and the early 1990s, traditional private education vanished in the Chinese education system. The conversion was consistent with the heavy emphasis on the role of the State in a socialist country; it was also motivated by the government's attempt to rid the country of western influences and to remove educational differences due to school type which was thought to be related to the socio-economic background of parents. The egalitarian ideal was strong, in society and in school. School choice was not made available to parents. Between 1949 and the early 1980s, the collective or nationalist ideology was dominant, and individual goals were submerged in favor of social goals.

During the post-1949 period, expanding educational access was consistently a focus of educational policy. Over time, the government managed to essentially achieve universal primary education; and by 1985 the major educational goal was universal compulsory education by around 2000 (People's Press, 1985). Access to higher levels of schooling was purportedly based on merit, particularly on performance in examination. However, government spending on

education was persistently low, both in terms of national-effort and fiscal-effort indicators. This low-spending level imposed a serious constraint on educational development in China and contributed partly to the school choice problem in the 1990s.

Chinese Nine-year Compulsory Education System and Governmental Effort

The nine-year compulsory education has been implemented at various levels of government since 1986, when the Compulsory Education Law of the People's Republic of China was issued. It takes 12 years to complete primary and secondary education in mainland China, including primary, junior secondary and senior secondary school in three stages. Primary education lasts either five or six years.[9] At the junior secondary stage, almost 98% students attend three-year schooling, along with a tiny part enrolled in four-year schooling. The total nine years of education in primary and secondary schools pertains to 9-year compulsory education. Generally, senior secondary education lasts another three years, which, along with the former nine years, is called K12. The structure is illustrated by Table 1.

Table 1 K12 Education Structure

		Stage	Length	Percentage of Students Enrollment
K12	9-year Compulsory Education	Primary	5 years	35%
			6 years	65%
		Junior High	3 years	98%
			4 years	2%
		Senior High	3 years	99%

The 4th Nationwide Census Survey in 1990 showed that there were 182 million illiterates[10] among adult people[11], taking up almost 23% of the total population. Accompanied

[9] Data from china.org.cn: 9-year Compulsory Education in China.
[10] Illiteracy in Chinese is usually written as 不识字或识字很少, that is, illiterate or recognizing very few characters.
[11] 15 years old or over.

with China's economic development was China's giant effort towards popularizing education, showing in the following table 2. There is no doubt that since 1980s China has devoted much funding and labor into education and made giant effort towards compulsory education.[12]

Table 2 China's Effort for Education Expansion[13]

Time	**Milestone**	**Significance/Content**
1986	Compulsory Education Law of PRC	
1990	10 Central Government Agencies tele-conference	Set up the goal to help 4,000,000 illiterates become "neo-literates" annually
1992	the 14th National Congress of the Communist Party of China	The nine-year compulsory education and the eradication of illiteracy all over China were emphasized and discussed in details for further implementation
1993	The Outline for Educational Reform and Development in China	To achieve the goal of reducing illiteracy rate among 15- to 45- year old population to 5% or lower
	The Regulations for Illiteracy Eradication was revised	encapsulating all levels of governments
1994	The Suggestions for the Implementation of the Universalization of 9-year Compulsory Education	Emphasized the importance of illiteracy eradication and proposed three-step plan to meet the goal
	The Eradication of Illiteracy Among Middle-Aged and Young Group in China by the End of 1990s	
1996-2000	Top-down mechanism to evaluate the effort toward education expansion	More than 20 evaluations through random sampling by State Education Inspectors were organized to monitor the progresses
2006	The Compulsory Education Law was renewed	It requires compulsory education to be fee free

[12] Wang, J. (1986). An overview of China's ongoing education reform. Canada Saskatchewan.

[13] All information is from Ministry of Education of the People's Republic of China website: http://www.moe.gov.cn/

Just similar to other goods or services, governmental support spurs the education supply side, with more education opportunities. On the demand side, sustainable economic growth relies on skilled labor, stimulating public willingness to get educated and demand for schools, especially elementary and middle schools. The expansion of education not only boosts culture, it also improves living standard of people, along with the upgrading in quality of labor force, which in turn motivate local economy.

Still what makes compulsory education different from other public services is the government effort in fostering Key Schools. In 1950s, Beijing Municipal Commission of Education designated 40 City Level Key Elementary Schools. These key schools attract much more resources as a result of political subsidies. Due to the increasing emphasizes on equality and sustainability, at 2000 or so the Key School System was abolished, but the long-term influence insists. Till now, there are around 60 "key elementary schools", with comparably high reputation, good quality in both hardware and software, higher key middle school ratio, and solid financial and political power. (Siqi Zheng, Wanyang Hu, Rui Wang, 2015)

Government's emphasis on public service equity

In recent years, China has witnessed fast urbanization pace, at an annual 1 to 1.5 percent growth. In 2012, the urbanization rate reached 52.6%, expecting to reach about 70 percent or even higher by 2030. Similar to other countries who have also undergone fast development, China's economic miracle is accompanied by inequity in income, infrastructure, medical care, education and other social aspects. Different levels of Chinese governments already realize that China has a long way to all-around, well-off society. Figure 1 and 2 show public services in

Beijing and Beijing City[14]. Unevenly distributed public services[15] are illustrated. The summary of green spaces, and 9-year compulsory schools is listed in Table 3. Area of Beijing City only takes 8.34% of total area of Beijing; however, green spaces, tertiary[16] hospitals, elementary schools and junior middle schools have comparably high ratio, at 60.2%, 89.4%, 63.4% and 54.9% correspondingly.

Table 3 Public Service Unevenly Distributed

	Beijing City	Beijing	Beijing City/Beijing Ratio
Total area (Km^2)	1,368.32	16,410.54	8.34%
Green spaces (Km^2)	120.32	199.96	60.2%
Tertiary Hospitals	41	47	89.4%
Elementary schools	438	691	63.4%
Junior middle schools	276	503	54.9%

[14] 8 counties (Chaoyang, Chongwen, Dongcheng, Fengtai, Haidian, Shijingshan, Xicheng, Xuanwu) constitute Beijing City; and Beijing Municipality is composed of Beijing City and 10 other counties.
[15] Data from Beijing City Lab, excluding some schools with undefined locations or unclear names.
[16] Tertiary hospitals round up the list as comprehensive or general hospitals at the city, provincial or national level with a bed capacity exceeding 500. They are responsible for providing specialist health services, perform a bigger role with regard to medical education and scientific research and they serve as medical hubs providing care to multiple regions.

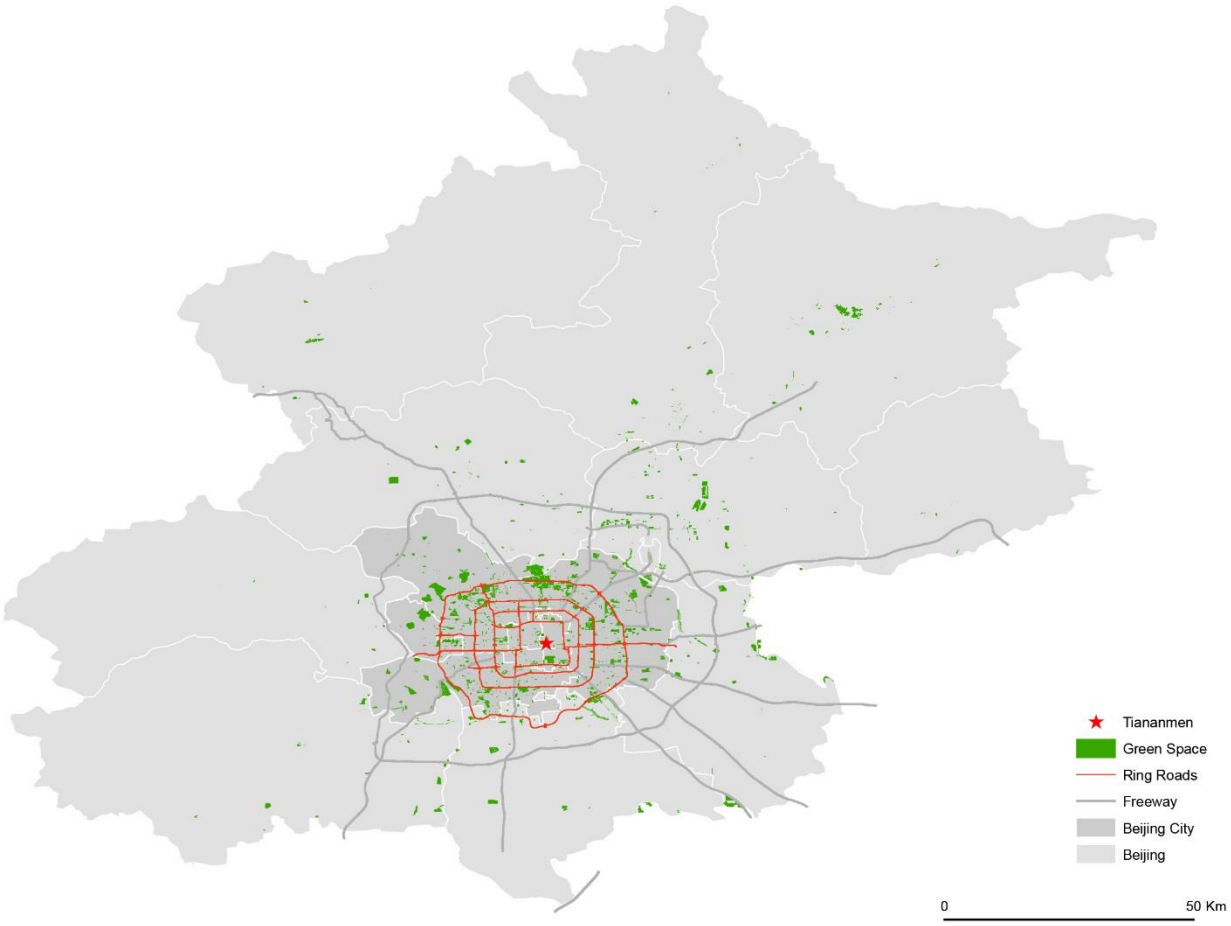


Figure 1 Green spaces in Beijing and Beijing City

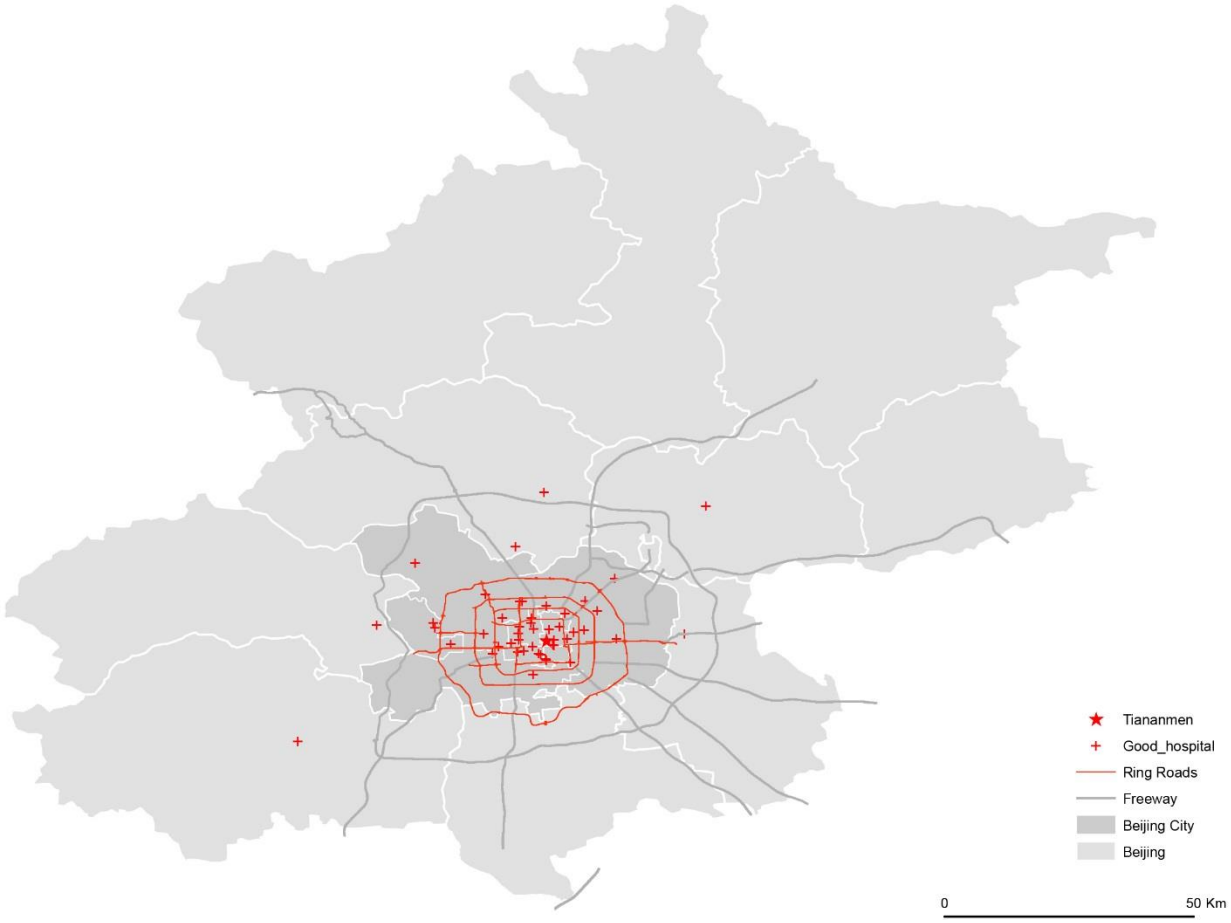


Figure 2 Tertiary Hospitals in Beijing and Beijing City

Confliction between tertiary hospitals and demand for high medical services is also a pressing problem in China, especially in Beijing. Figure 2 shows the spatial allocations of tertiary hospitals, and only 6 tertiary hospitals are located outside Beijing City. Except 8 counties in Beijing City, other counties barely get access to tertiary hospital services.

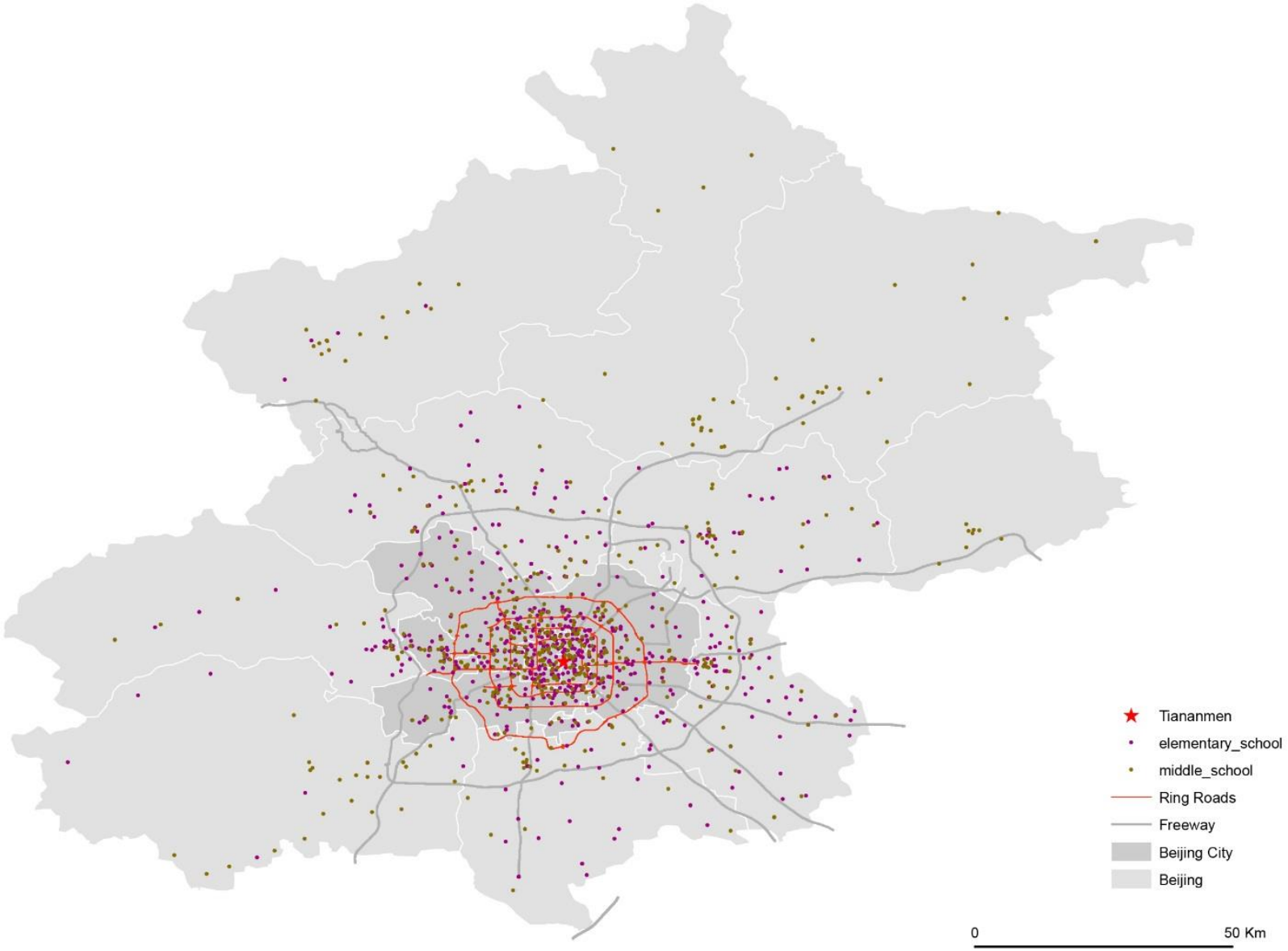


Figure 3 Elementary & Junior High School in Beijing and Beijing City

Aware of such pressing problem, the 18th National Congress of the Communist Party of China carried out the strategy of new-pattern urbanization, which is supposed to promote the justice of public service during the next stage of urbanization. Also, this strategy is aimed to lift quality of urban life, and to increase the Happiness level[17] of residents. In addition, the Third Plenary Session of the 18th Central Committee of the Communist Party of China (CPC) in November 2013 also put forward an explicit proposal, including a main goal to balance the allocation of public resources. Actions were taken at the city/provincial level, too. Beijing Municipal Government put forward the "Green Beijing" Development Guidelines in the Twelfth Five-Year, to balance the allocation of public services, especially in terms of education, medical service and green spaces. This political direction indicates that China, on its way of rapid development, now takes not only quantity but also quality into its consideration.

Status quo of elementary school choices in Beijing

The effort to accommodate parental choice in schooling is a rather recent phenomenon in education in China. Basically only those who own properties in certain school district can get their children enrolled in corresponding school. Parental choice in school is a departure from School District System and it can take one of the following forms:

1. Buying properties inside aimed school district is the most straightforward way. Only owning properties is not enough, students GPA must meet the standard.
2. Without properties inside aimed school district, parents should pay a relatively high school-selection fee. But the amount is set by the school, not by Beijing Municipal Commission of Education.

[17] Happiness level is measured by Gross National Happiness-GNH.

3. Students with a lower GPA which doesn't meet the certain threshold for admission have to pay an admissions fee to the school, which is much lower than school-selection fee.
4. Comparably high socio-economic class can needle their way to key elementary schools, either by social relationship, or by political/financial power.

Key elementary schools attract students and parents. One can easily capture the extreme trend of housing prices in certain school districts.

Financing structure of compulsory education

Since the early 1980s, the financing of education in China has undergone a fundamental structural change from a formerly centralized system with a narrow revenue base to a decentralized system with a diversified revenue base. The financial reform in education took place in the context of a large public-finance reform in the country. In February 1980, the State Council initiated the piloting and subsequently large-scale implementation of the decentralized system of "tong shou tong zhi", meaning complete collection and complete distribution, in which revenue from all lower levels of government were supported by central government and expenditures by lower levels of government were supported by central funds. The decentralization of public finance was based on the principle that each level of government was responsible for its own finances. By 1982, a multi-level public finance system began to emerge, with budgets at the central, provincial, county, and township levels.

The official government policy for the financial reform of basic education was promulgated by the Chinese Communist Party in 1985. This policy consisted of two major components: decentralization in educational administration and financing, and diversification in the mobilization of educational resources. Educational decentralization was based on the

principle that lower levels of government are responsible for the provision of education, with different levels of government administering different levels of education. A common arrangement for counties is that the village, township, and county governments are respectively responsible for the provision, administration, and financing of compulsory education. For cities, a common arrangement is that the county and city governments are respectively responsible. Resource diversification consists of two strategies: broadening the base for government education revenue, and broadening and identifying non-government resource mobilization at the school level. The first strategy involves the collection of education surcharges in urban areas and education levies in rural areas. The second strategy consists of the collection of social contributions to education, school-generated funds, external funds, and school fees. A primary objective of the 1985 reform is the mobilization of additional resources for compulsory education through decentralization and diversification (Xiaoyu Chen, 2012).

It was apparent that, by the early 1990s, a decentralized financing system with budgeted (government allocation) and out-of-budget (surcharges & levies, social contributions, school-generated resources, school fees) sources was well in place for compulsory education. It was also clear that, in the context of sustained and rapid economic growth, substantially more resources were raised for education in general and for compulsory education in particularly. For example, from 1986 to 1992, government budgeted allocation increased by 3.5% per year and out-of-budget funds by 19.7% per year in 1992 constant price. Per student budgeted spending increased by 9.6% per year at the primary level and by 5.1% per year at the secondary level. The increase in out-of-budget funds was especially rapid, resulting in a significant change in the distribution of revenue for compulsory education. In terms of additional resource mobilization through fiscal decentralization and diversification, the 1985 reform was a success.

However, local governments have strong incentive to invest in projects that could quickly reap profits and generate tax revenues, resulting in a low priority for investment in education. This decentralization financing pattern contributed to two major deficiencies, visible by the early 1990s: the financial difficulties of poor and rural areas, and large disparities in per-student spending among areas and regions. These two deficiencies persisted and even intensifies in the 1990s and 2000s (Shanmai Wang, Chunling Li, 1991).

Due to previous planning and development in the long history, the remarkable gaps between urban and rural areas, different tiers of cities/towns, and different counties even within one city inflict challenges for local governments, especially in the perspective of high-quality public service. Urbanization is accompanied with migration from rural to mega cities, contributing to the complexity of public service supply-demand issue, which in turn adds up to the management difficulties of local government.

Literature Review

The literature review contains two parts. The first part explores the inequity of compulsory education in China and its historical reasons, such as economic reforms since 1978. Some sociologists like, Brandt, Loren(2008), Herston, and Alan(2008), have been interested in investigating who wins and who loses in the institutional transition, with literature concerned about the returns into human capital (education) as a result of the market transition. Only a few scholars have explicitly examined the impact of economic reforms on unequal access to educational opportunities.

The second part is mainly about significance of unequally distributed education qualities. From researchers like Siqi Zheng, and Matthew E. Kahn(2013), the imbalance between demand and education resources in terms of spatial distribution led to many serious urban issues. Long distance to favorable public services not only cost citizens time and money, but also creates external social costs, ranging from worsening road conditions, increase in air pollution, and to lower efficiency of city function and economic development. Still, in the unique context of Beijing, the irrational reflection of real estate market is also derived more or less, from the inequity of education resources, especially high quality ones.[18]

1. The economic growth contributes education uneven expansion

1.1 The gap in different social classes

There is no doubt that the central government intended to promote educational opportunities for all its citizens, but economic reforms in rural areas slowed down progress to a

[18] Reuters News report(2013), "In Beijing housing market, education drives location", by LI HUI, BEN BLANCHARD. http://www.reuters.com/article/us-china-school-housing-idUSBRE9B70C320131208#WjoEllUSFcTlxpTU.97

certain extent and yielded a negative impact on school enrollments (Dewen Wang, 2003). On the one hand, rural-urban disparity plays a central role in social classes. The household responsibility system implemented in rural China since 1978 drove rural children out of school for agriculture labor and employment in the rural industry, contributing to the decline in the school enrollment rate in the mid-1980s.

The gap between rural and urban education resources is not the main argument for my research; however, mobility in China increases, leading to the working class influx into megacities, such as Beijing, Shanghai and Shenzhen. Wei Jianwen and Hou Jiawei(2010) analyze a sample from a census in Beijing and find that the Hukou system and the related school district system are the main barriers for children, either "local" children or migrant children.

Further evidence demonstrates that patterns of education stratification underscores the intergenerational inheritance of family social status (Xueguang Zhou, Phyllis Moen, Nancy Brandon Tuma, 1998). In this case, Xueguang Zhou(1998) also mention about the vicious cycle and virtuous cycle in intergenerational influences. For example, parents who can afford to send their children to schools with high school selection fees can thereby foster their children's accumulation of social and cultural capital, which, in turn, promote the children's educational and career advancement.

1.2 The decentralized fiscal reform adds up to unequal education resource

At the beginning of economic reform, right after the culture revolution, to fasten the pace of talent cultivating, Chinese government and local governments divided schools into different tiers, with different subsidiary policies. Due to the unequal political and fiscal subsidies, these key schools got more funding and other education resources, increasing the gaps between schools. Even the official definition of "Key Schools" is dismissed now, key schools still have

high reputation and high education quality, attracting more funding, resources, and students (Ling Wu, Yuan Liu, 2012).

Moreover, the fiscal reform in education in the early 1990s exacerbated the situation. In the context of the decentralization of public finances in China since the early 1980s, the responsibility of funding nine-year compulsory education was shifted to local governments who had had a strong incentive to invest to projects that could quickly reap profits and generate tax revenues, resulting in a low priority for investment in education. The uneven regional economic development further differentiated local governments' capacity in funding education. In some poor counties, local government could hardly raise sufficient revenue to cover teachers' salaries, not to mention other non-instructive costs (Xiaogang Wu, 2010).

In contrast, local governments in developed areas could mobilize significantly more resources, both government and non-government for education. This has resulted in the substantial disparities in per-student educational expenditure across areas and regions, which directly leads the different qualities of compulsory education.

2. Significance of unevenly distributed compulsory education

The unequal spatial distribution of education resources is now a most pressing problem for governors and planners, which has led to many other issues, ranging from fluctuate real estate, terrible transportation condition, to family stability and social segregation. Some local governments have realized the inequity among schools. For example, Hefei government invited The Urban China Initiative to advise its strategic planning of public facilities which serve its 8 million residents and increasing influx of migrants, especially for education resources.[19]

[19] UCI Advises Hefei City on Public Facilities Planning.
http://www.urbanchinainitiative.org/en/content/details_19_61951.html

Given that individuals have differing personal valuations on these services and varying ability to pay the attendant taxes, individuals will move from one local community to another, which maximizes their personal utility.

Comparably higher real estate prices surrounding top schools

For residents, the accessibility to public services has become a key factor for quality of urban life. Balanced allocation of public services provides cities more advantages to attract capital and investment (Siqi Zheng, Yangfei Xu, Yizhen Gu, 2014). For local governments, public services and the spatial allocation should be the main concerns to improve life quality and local economic efficiency, especially for education, medical service and public spaces.

The influence of school district system on real estate market is now studied by many researchers and reported by many critics. Among these studies, many scholars use Hedonic model to quantify the influence of schools, which is a model identifying price factors according to the premise that price is determined both by internal characteristics of the good being sold and external factors affecting it. I will explain it in detail in Methodology part.

Table 4 Housing Prices in different primary school districts, Haidian County (Yiming Wang, 2015)

Types of primary schools	Slab-Type Apt	Tower-Building Apt	Average
Key schools at City Level	￥69,729	￥67,662	￥70,043
Key schools at County Level	￥52,396	￥51,937	￥52,483
Ordinary schools	￥51,681	￥51,865	￥52,149

Unit: CNY

Also, Yizhao Shi and Yiting Wang (2013)used hedonic model to figure out the schools' influence on Shanghai real estate market, and found the coefficient as high as 20.63%, indicating that with other factors similar, the high-quality school district housing prices are 20.63% higher than ordinary ones. Also, in an online survey conducted by IFeng Education in 2009, 6.5% parents said that they are willing to buy school district houses no matter the cost is. 57.3%

parents' responses are willing to buy school district housing as long as the education quality is better than other schools. [20]

Traffic congestion led by students' commuting

Tons of literature has indicated that during peak hours in the morning and evening on weekdays, about 10% of total traffic on roads in Beijing is primary school students related, which increases total congestion level by 15%-20%. Still, emissions further worsen Beijing air pollution, increasing the concentration of PM_{10}[21]. At the meantime, low-income and other vulnerable groups such as migrant workers are more likely to be extruded from favorable locations. With strikingly different accessibilities to public service, there come many social justice issues.

According to the data from Beijing Transportation Research Center, 20% among all students at the stage of nine-year compulsory education commute to and from schools use auto vehicles, indicating parents drive their children to and from schools. Furthermore, for key schools at County level, the proportion increases. The Center made a survey about 3 key schools in Haidian County and 1 key school at Dongcheng County and found that over 60% students use auto vehicles for commuting. [22]

The disparity between school district system and congestion

If the school district system is successful, students with their parents should live near to schools, with 2-kilometer buffer area. But the reality is that students' commuting also add up to

[20] http://edu.ifeng.com/zhuanti/zexiao/

[21] PM10 or Particulate Matter up to 10 micrometers is one major group for particles in bigger size in the air, between 2.5 and 10 micrometers. PM10 are mainly about smoke, dirt and dust from factories, farming and roads. PM10 can cause health problems, especially respiratory health (the lungs and airway). Definition from Air Info Now, http://www.airinfonow.org/html/ed_particulate.html

[22] Details are in the report about *Pilot School Bus Program Feasibility Analysis and Related Supporting Measures*, by Beijing Transportation Research Center. http://www.bjtrc.org.cn/

the congestion problem. According to Siqi Zheng, 2 explanations can help answer this disparity. One is that even under the school district system, some students or those who have already been studying at certain schools, still need to travel long way with auto vehicles. Another explanation is that in order to send their children to favorable schools, parents bought school district housing at high price with poorer living qualities than their current housing. Hence, even they are nominal residents within the school district, they still live farther away from school.

Research Methodology

Introduction

To study the stratifications both among schools and among different socio-economic families, this study employs three main methodologies: case studies of school financial statistics, Hedonic pricing analyzing real estate market, and broad surveys.

1. Case Study by Interview and Government Statistics

Beijing does not provide public access to data related to school financial subsidies, selection fees, expenditure per student, and even the teacher-student ratio. To reveal financial subsidy stratification on school side, I interviewed 4 administrators from 2 schools to obtain financial statistics. Documentation review is also used to confirm the statistics' reliability, either in growth rate of the average number for each item, or second hand data in reports. Table 5 shows the details of my interviews.

Table 5 Interview Details for School Finance

County	School Name	Label	Content
Haidian County	Elementary School Affiliated to Renmin University of China (referred as K school)	Key school at City Level	Government allocation; School selection fee; School-run business; Tuition & Miscellaneous fee; Others.[23]
	Beijing Haidian Chedaogou Elementary School (referred as O school)	Ordinary school	

Haidian County and Chaoyang County are two counties with the most key elementary schools. I chose two schools in Haidian County for two reasons:

[23] According to fiscal decentralization, these 5 kinds of income mainly constitute total financial income of primary schools in Beijing. (Xiaoyu Chen, 2012)

1. To avoid the different contexts in different counties. From Background chapter, we understand that the County governments play a role in elementary schools' financial structure.
2. Having spent 4 years in Haidian County, I have accumulated some social resources which helped me during this case study.
3. 2 administrators in each school can help me figure out controversial statistics. In this case, I will need additional interviewers to prove information. Actually the difference in two interviews are minimal, no larger than 5%. Average is used.

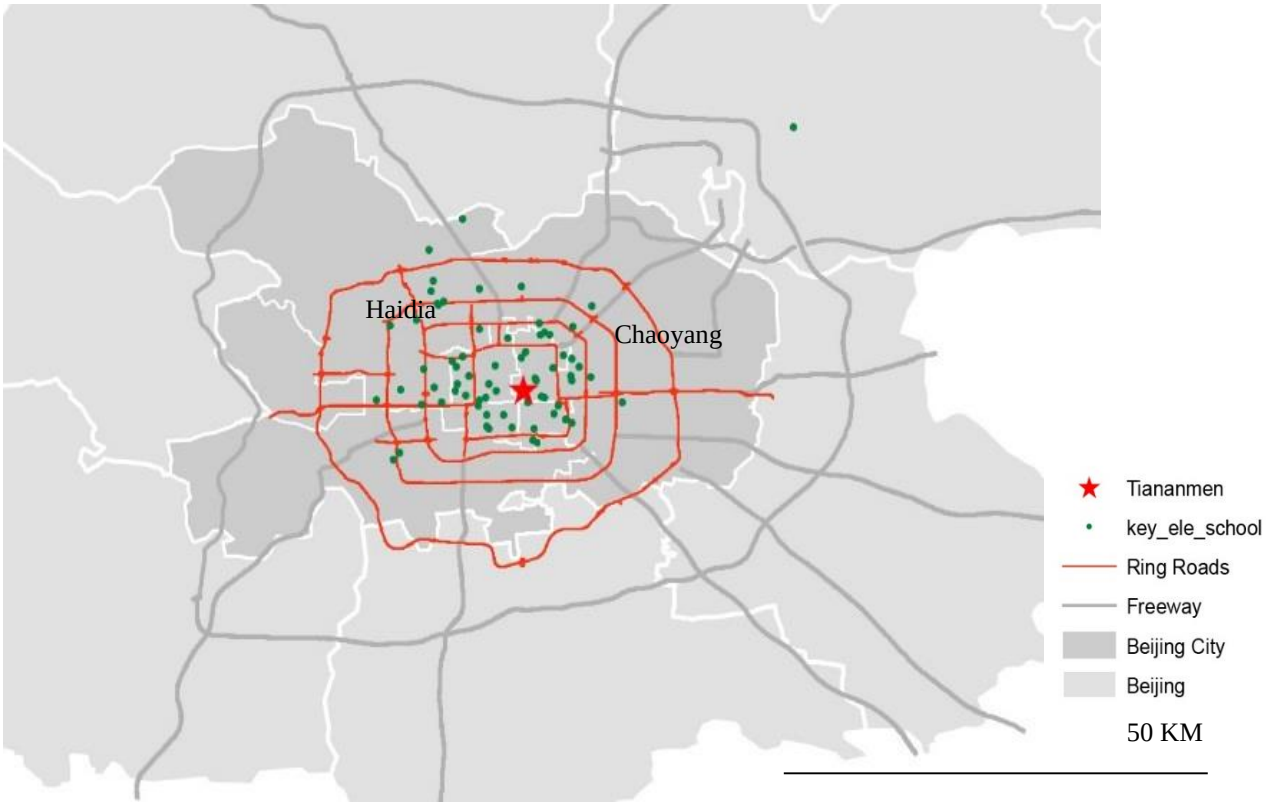


Figure 4 Spatial locations of Key elementary schools

2. Hedonic pricing model analysis for real estate market

Hedonic pricing model is a model identifying price factors according to the premise that price is determined both by internal characteristics of the good being sold and external factors affecting it. The most common example of the hedonic pricing method is in the housing market: the price of a property is determined by the characteristics of the house (size, features, condition) as well as the characteristics of the surrounding neighborhood (accessibility to schools and parks, public transportation condition, etc.)

In the light of newly emerging big/open data, I can use the property prices on Soufun website, helping me with the abnormal real estate market analysis. Here web scraping is the practice of using a computer program to sift through a web page and gather the data that you need in a format most useful to you while at the same time preserving the structure of the data. Then I use ArcGIS to carry out spatial calculation for distances, based on hedonic pricing model.

By this model with enough data, I could analyze the influence of key primary schools, on properties located inside its school district.

Here are 4 assumptions in my analysis:

a) The factor that one property is located in key primary school district has positive influence on property prices.

b) Soufun website does provide information about which school districts one property is located in. However, that's based on straight-line distances to key primary schools, but not the accurate information designated by Beijing Municipal Commission of Education. My analysis is based on information on Soufun website.

c) For the internal characteristics like FAR, Building ages are dismissed in my analysis. One reason is that according to Siqi Zheng (2014) these internal characteristics only play

minimal roles in property prices. Another reason is constrains of data. Web scraping from Soufun is limited to certain amount of properties, especially when I acquire more information.

d) Key Primary & Junior Middle School list is downloaded from Beijing public government data.[24] The key schools are designated as City Level or County Level. This is reasonable to assign equal weight for key schools at City Level and County Level, since they have both comparably high reputation and quality that attracts parents and students.

According to my hypothesis, housing price (in logs) is the dependent variable. Whether inside key primary school district or not is a most important variable in analysis. Other factors ranging from physical features of neighborhood to location features.

Hedonic pricing is like the following:

$$\log Housing\_Price = a_0 + A_1 \times X_{1i} + A_2 \times X_{2i} + \cdots + A_3 \times County_{3i} + \varepsilon$$

X_{1i}, X_{2i} are independent variables like distance to Tian'anmen Square, distance to nearest subway station, etc. $County_{3i}$ represents County Dummy to dismiss influences across different counties. Beijing City is constituted of 8 counties (Chaoyang, Chongwen, Dongcheng, Fengtai, Haidian, Shijingshan, Xicheng, Xuanwu), so in this analysis 7 County Dummies are included. Table 7 shows the variables in this analysis.

[24] Website: www.bjdata.gov.cn.

Table 6 Variables in Spatial Analysis

Variables	**Description**	**Source**
Housing Price (in log)	The average listing selling prices per square meter in one community on Soufun in October 2014, shown in Table 7.	Soufun.com
Distance to subway station (in log)	The distance to nearest subway station.	Beijing City Lab
Distance to parks	The distance to nearest parks.	Beijing City Lab
Distance to Tian'anmen Square (in log)	Tian'anmen Square is considered as city center.	
Distance to Teritary hospitals (in log)	The distance to nearest high quality medical service.	www.bjdata.gov.cn
Distance to nearest schools (in log)	The distance to nearest primary schools.	www.bjdata.gov.cn
Whether inside key primary school districts	To assign binary to properties: Inside = 1; Outside = 0.	www.bjdata.gov.cn Soufun.com
County Dummy	Dummy for different counties, to avoid uncontrollable influences across different counties.	

Table 7 Descriptive Statistics of observations in Beijing

County	*Average price (CNY/sqm)*	*Number of observations in total*	*Number of observations inside key school district*
Chaoyang	41,069.0	1853	**718**
Chongwen	47,219.9	109	97
Dongcheng	54,533.1	426	407
Fengtai	33,250.3	931	311
Haidian	47,568.9	1315	**683**
Shijingshan	29,181.0	72	0
Xicheng	59,996.6	335	250
Xuanwu	42,523.8	268	251
Others	19,233.6	2523	86
Sum/Ave	35,764.9	7832	2803

Note:

a) Here one observation indicates one community with its average property price.

b) Others means the observation is in Beijing but outside Beijing City.

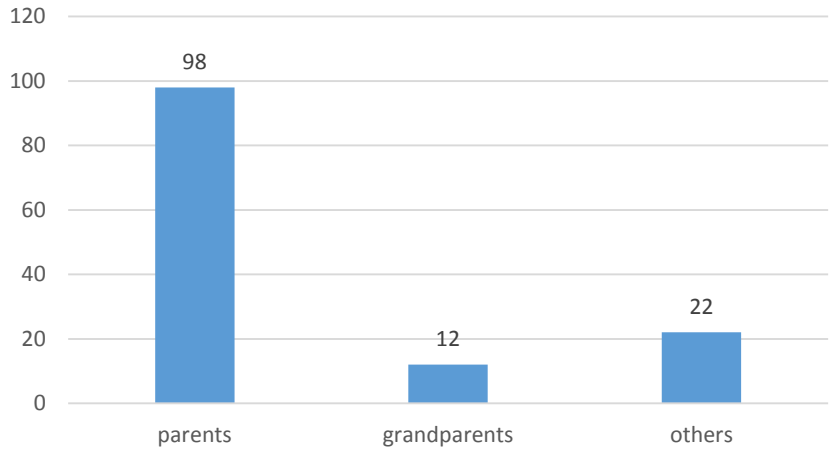
c) Table 7 shows descriptive statistics of observations obtained by web scraping. The disparity in property prices is remarkable, with **Others** much lower than 8 counties in Beijing City. From the perspective of inside school district observations, Chaoyang and Haidian draw our attention, as the top 2.

3. Survey and Its Sampling

Broad survey here is also vital to know public attitude towards compulsory education and the stratifications. By selecting interview subjects closely related to compulsory primary education, or say parents or grandparents, more insights and stories could provide more information about the inequity among schools.

Local schools' administration, time and spatial bias of physical surveys constrained a lot and might lead to biased results. Hence, I switched to online survey among targeted people, via e-mail, and Wechat & Moment[25]. The composition of subjects is listed in following figure.

Figure 5 Composition of Responses



[25] It serves social-networking functions for Wechat users, just like Facebook.

All respondents are current residents in Beijing. 130 among all these 132 respondents, or say 98.5% say yes to the first question, “Have you or your friends ever experienced school selection for (grand)children?”. This is nothing surprising, due to Chinese emphasize on education. The sample questionnaire is attached as appendix.

The objective of the three methodologies is to understand stratification on both school side and student side. Also, broad survey help us understand of the current compulsory education stratification better, and will provide clues for future planning and policy making.

Analysis

As mentioned before, the whole analysis will fall into three parts, stratification among schools, among families, and public opinions upon compulsory education in Beijing City, which will give a hint for urban planners and decision makers in future development.

1. Stratification among schools, in financial attraction perspective

For stratification among schools, financial statistics not only serve as financial attraction indicators, but also a reflection of political preference (Siqi Zheng, 2011). Hence, more government budget also indicates more political powers for key schools.

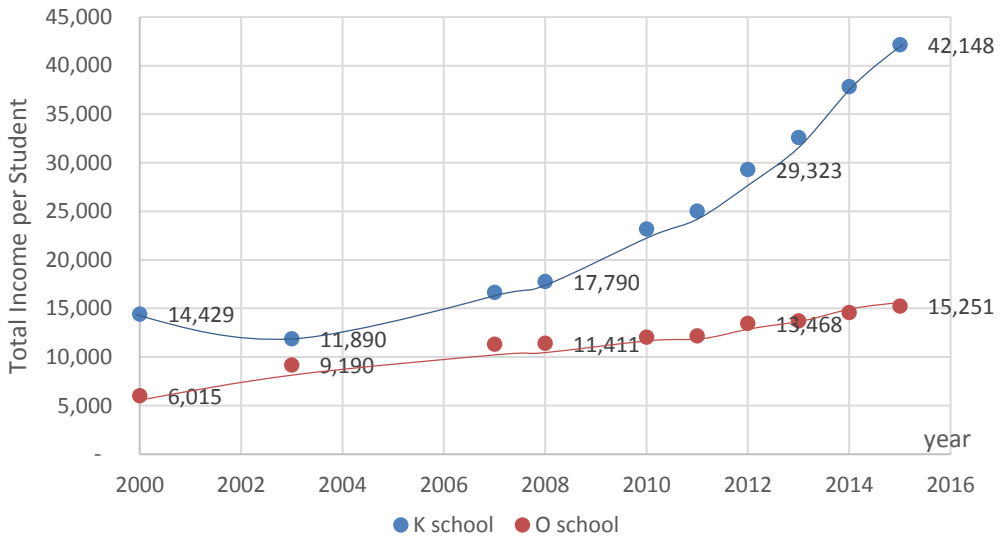


Figure 6 Total Income per Student

The financial statistics of two schools, Elementary School Affiliated to Renmin University of China (referred as K school) and Beijing Haidian Chedaogou Elementary School (referred as O school) in Haidian County, as shown in Figure 6 and Table 7, reflect some interesting facts.

a) Disparity in Total Income per Student jumped since 2003 when the difference was only tiny as shown in Figure 6. In 2015, Total Income per Student of K school almost triples that of O school. This finding in turn verifies that along with giant economic development was stratifications in every public sector. (Xaogang Wu, 2010)
b) Financial budget per student from government even reversed since 2000, with K school surpasses O school by ￥21,482 in 2015, constitutes 79.87% of the difference in Total Income per Student.
c) Besides Financial budget per student, difference in school selection fee per student in 2015 takes 12.71% of total difference.
d) However, school selection fee per student constitutes 14.91% and 18.79% for K school and O school, correspondingly. This finding is beyond my expectation: for O school, school selection fee even takes larger portion of total income per student. If taken migrant students into consideration, the seemingly abnormal finding is reasonable, according to one interview I made.

   "For some migrant workers, school-selection fee is way too high compared with their net income. You know, rent in Beijing is also high for these migrant workers. Hence, they would choose ordinary schools for their children, which is already the best choice without exceeding their economic endurance. If not, their children have to go to some low-quality migrant-child schools."

Key schools, with their excellent performance in academia and education, are considered as one perspective of achievement of local government. The more investment into key schools leads to higher quality in enrolled students, better teachers, and even more supports from charity.

The consequences of stratification among schools are barely constrained just among schools.

> *When a public-school system based on equity and "equality of opportunity" is embedded within a capitalistic society, it can be a little disorienting for students, parents, and teachers, said Michael Godsey*[26].

This stratification in financial attractions reflects political preference. A salient feature of resources arrangement in China (and other state socialist societies in general) is the monopoly of almost all resources in the hands of the centralized state. This centralization allows the state to transfer resources among different economic sectors, localities, and social groups on a much larger scale and at a much faster pace than market economies can do. Hence, key schools have much more advantages over ordinary schools, in the perspective of resources attraction.

The education agencies can proclaim its twin goals of access and excellence with a confidence, but when the system is constructed in a way so that individual school's or parent's motives incidentally hinder those who don't have the same advantages, the compass can be difficult to read. But the conundrum of public school inequality shouldn't be ignored.

Apparently, the "sorting" of high- and low-achieving students by key schools causes uneven distributions early on.

> *We see our kids entering their compulsory education in the same system, but actually they are entering a filter, with varieties of criterion both in schools and families' socio-economic conditions, said one administrator I interviewed.*

So beyond stratification in schools, families' socio-economic classes also plays a main role in the compulsory education selection of students.

[26] Michael Godsey is a contributing writer for The Atlantic and an English teacher based in San Luis Obispo, California.

Table 8 Two schools' financial statistics

		2000	*2003*	*2007*	*2008*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Total Income per student	K school	14,429	11,890	16,670	17,790	23,186	25,027	29,323	32,611	37,838	42,148
	O school	6,015	9,190	11,318	11,411	12,061	12,187	13,468	13,739	14,603	15,251
Financial budget	K school	2,523	5,714	8,737	10,757	15,451	17,336	20,030	23,087	27,788	31,745
	O school	3,963	5,635	6,795	7,486	8,023	8,265	9,024	9,389	9,864	10,262
School selection fee	K school	7,102	2,394	3,041	3,481	4,577	4,575	5,528	5,695	6,041	6,285
	O school	187	1,680	2,271	2,527	2,488	2,309	2,668	2,477	2,728	2,866
School-run business	K school	1,375	545	706	808	1,063	1,062	1,284	1,322	1,403	1,460
	O school	1,098	929	1,120	1,234	1,323	1,363	1,488	1,548	1,626	1,692
Tuition & Miscellaneous Fees	K school	831	1,117	1,597	-	-	-	-	-	-	-
	O school	742	942	987	-	-	-	-	-	-	-
Others	K school	2,598	2,120	2,588	2,744	2,095	2,053	2,481	2,506	2,606	2,658
	O school	25	4	144	164	227	249	288	326	384	430

Unit: CNY/student

Note:

a) Since 2008, compulsory education is gradually free of **Tuition and Miscellaneous Fees**, including fees for tuition, textbooks, facilities, uniforms, etc.

b) Transfer fee from another school, school construction fee, and other items fall into **Others**.

2. Elementary education quality plays a role in real estate market, in Beijing City

As mentioned in Research Methodology part, 5029 observations are located in Beijing City. By Surface Modelling with 7832 observations, the trend in real estate market is revealed in Figure 7. The closer to Tian'anmen Square which is shown as a red five-pointed star in figure, the higher property price is.

Some areas stand out, for example, Zhongguancun, which is a technology hub in Haidian County and also famous for concentration of education institutes, both compulsory education and higher education.

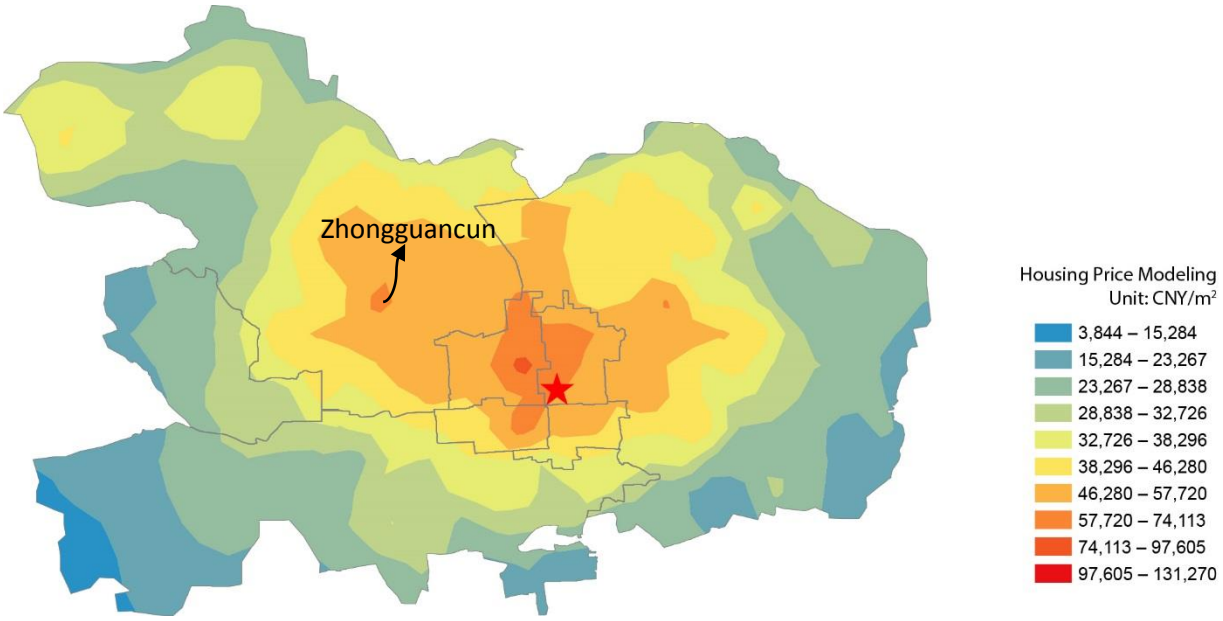


Figure 7 Property Price Estimation in Beijing City by surface modelling in ArcGIS

However, the above map only reveals that distance to Tian'anmen Square plays a significant role in determining property prices. Hedonic pricing model provides us further analysis, including whether inside key elementary school districts, as shown in Table 9.

Table 9 Hedonic Pricing model results

Independent variables	*(1) log(HP)*		*(2) log(HP)*		*(3) log(HP)*		*(4) log(HP)*		*(5) HP*	
Distance to subway station (in log)	-0.025	*	-0.0381	**	-0.0181		-0.0142		-0.0143	
Distance to parks	-0.039	**			-0.0416	**	-0.0366	**	-0.0341	**
Distance to Tian'anmen Square (in log)	-0.269	***	-0.2491	***	-0.2869	***	-0.2588	***	-0.3071	***
Distance to Tertiary hospitals (in log)	-0.070	***	-0.0880	***			-0.0600	***	-0.0427	**
Distance to nearest key schools (in log)					-0.0822	*	-0.0657			
Whether inside key elementary school districts	**0.101**	*******	**0.0811**	*******	**0.0546**	******	**0.0617**	******	**0.118**	*******
number of observations	5029		5029		5029		5029		5029	
R^2	0.152		0.140		0.150		0.151		0.170	

Note:

a) All coefficients are standardized coefficients. Here the standardized coefficients are obtained in the regression results, when we standardize all of the variables in the regression, including the dependent and all of the independent variables, and run the regression. By standardizing the variables before running the regression, we've put all of the variables on the same scale, and we can compare the magnitude of the coefficients to see which one has more of an effect. We will also notice that the larger betas are associated with the larger t-values and lower p-values, indicating more significant the variables are.

b) ***, ** and * denote 0.1%, 1% and 5% significance level, correspondingly. The more asterisks, the results are more significant.

Based on different assumptions, I ran 5 regressions to certify that the results are reliable and robust. In these 5 models in Table 9, Distance to Tian'anmen Square has a comparably larger magnitude than Distance to subway station, Distance to parks, and Distance to Tertiary hospitals, but they all inflict negative impacts on property prices.

Whether inside key elementary school districts is the targeted variable in this study, displaying a consistent effect on property prices: if the community is located inside key elementary school districts, the property price gets higher. The magnitude almost offsets half that of Distance to Tian'anmen Square, which means education quality does play a main role in determining property prices. When going back to Figure 7, one can easily know the magnitude of educationquality. Education stratification in socio-economic classes here is also certified.

This kind of selection by buying properties, or say by families' socio-economic conditions, distort the real estate market and add too much financial burden for families. The average property price per square meter is ￥47,568.9 in Haidian County, so for a 60 square meters apartment (one bed/one bath apartment), the total cost is ￥2.85 million. Compared with ￥43,910, the average annual income per capita in Haidian County in 2015, the price means a couple need to work 32.5 years without any expenditure, which is impossible for ordinary families!

As a main upward mobility path, good compulsory education benefits these who can afford it, which in turn accumulate the family's socio-economic resources.

We want to give our kids the best education we can afford, but the reality is always cruel for us. If our kids end up in a struggling life to make ends meet just like us, we cannot forgive ourselves, said a couple.

As an essential public service, education does make everything hard for middle classes. Next I will reveal general opinions towards current education condition in Beijing.

3. People's preference towards getting students high quality education

The third part of analysis is based on my survey among Beijing residents, detailed information is listed in Research Methodology part. The gathered data tells us several interesting findings.

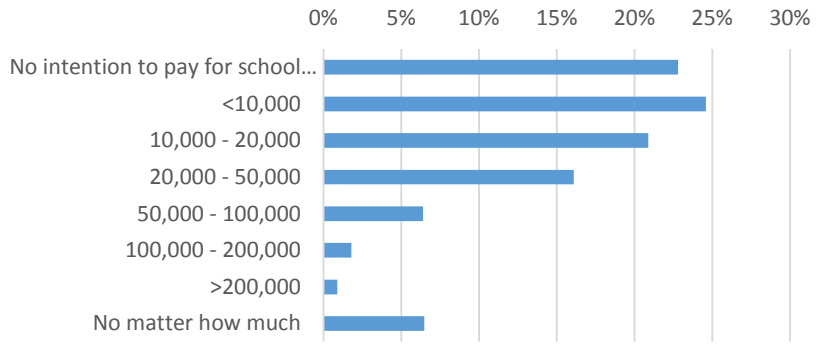


Figure 8 People's Willingness to pay for children's school selection

To the beginning, parental sacrifice in China is revealed here through their willingness to pay for children's school selection, especially compared with the average annual income per capita, which is CNY43,910. 31.70% parents are willing to pay over CNY20,000 for their children's school selection, not to mention all kinds of expense for education; 6% parents are determined to pay whatever it cost to help their children get into desired elementary schools, according to the survey results.

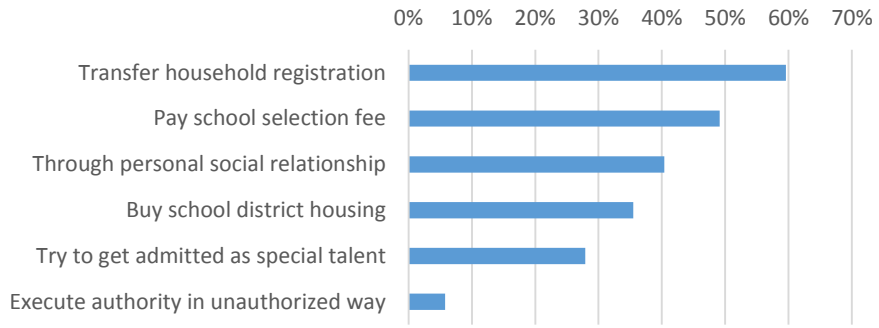


Figure 9 Preference towards different school selection methods

Figure 9 gives us a glimpse of preferable ways to get into desired elementary school, according to the survey among Beijing (grand)parents. Among the listed 6 ways, 5 ways are based on families' socio-economic status, except for *Trying to get admitted as special talent*. Also, Figure 10 reemphasizes the stratification both among families and schools.

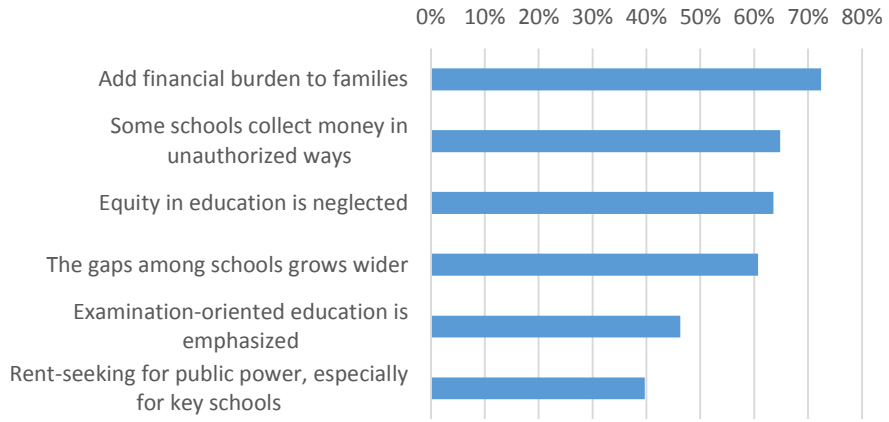


Figure 10 Side effects of school selection

Among these side effects, *Some schools collect money in unauthorized ways* draws my attention, right after *Adding financial burden to families*. Actually, this is derived from decentralization without mature regulation.(Shanmai Wang, 1991)

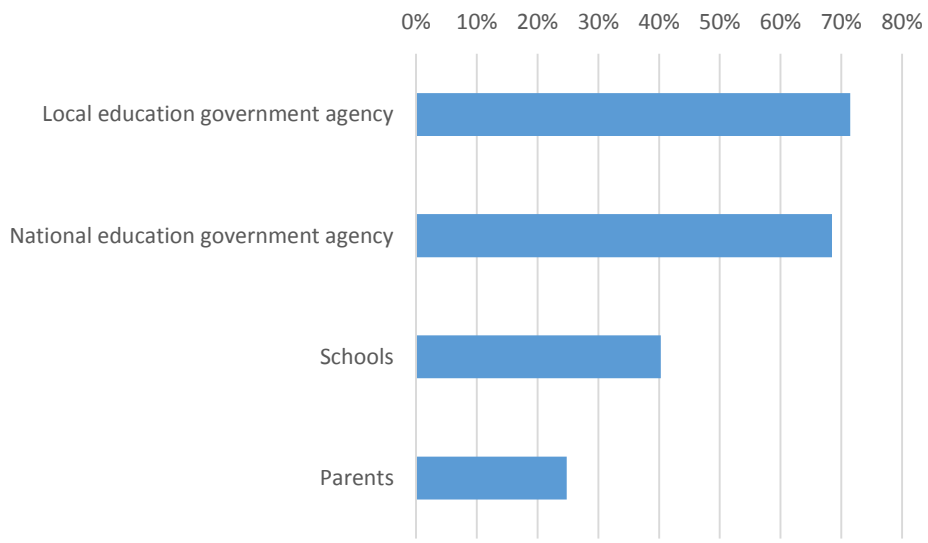


Figure 11 Who should be responsible for current dilemma?

When coming to responsibility, parents themselves are escaping. But they know clearly that schools are just passive among all stakeholders, with current situation. Even the general public lack of information about education system, the answers still allude something. The decentralization of finance and administration provides more power for local education agency, without mature regulations.

4. Other social issues related with unevenly distributed education qualities

Actually I intended to analyze further about students' commuting time in the survey, but only got 10 responses of that question. People don't want to talk about their commuting time. Obviously, some families just bought inside key school district properties but don't live in there.

I bought an extra apartment inside Zhongguancun No.1 Primary School 3 years ago for my son's education. But I don't like that apartment, which is tiny and old but really expensive. That apartment is rented to a couple who work at Zhongguancun. Every day I have to get up earlier than before to get my son to his school, and then head to my office. The same for after

school time. Since my son starts his compulsory school here I barely have time for a movie in the evening, said one mom whose son is enrolled in Zhongguancun No.1 Primary School.

This is a common phenomenon for most young parents, who have their jobs in CBD but want to get their children better education. The increasing commuting time, not only results heavier traffic on road, but also places more stress among young parents both financially and mentally. Then this brings a broader issue in transportation planning, environmental planning, which is not the main topic in this study.

Conclusions and Recommendations

The scarcity of high-quality education, or say key elementary schools in Beijing City, and the rigid demand of high quality education from students, along with School District System, make the whole situation seemingly complicated. However, as direct or indirect result, stratifications among schools and families should be paid enough attention.

On school side, key elementary schools get more funding than ordinary ones; on parent/student side, families with more economic/political power can get their children into desired schools, in various ways. Among these ways, buying school district property is demonstrated in this study. The feature that whether a property is located inside a key elementary school district does contribute to its prices.

But why school selection exists? Figure 11 gives us clues. The top 1 reason is gaps among schools, which in turn contributes to stratification among elementary schools. This vicious cycle is rooted in historic path. Actually, all reasons listed in Figure 11 have been criticized ever since 1990s.

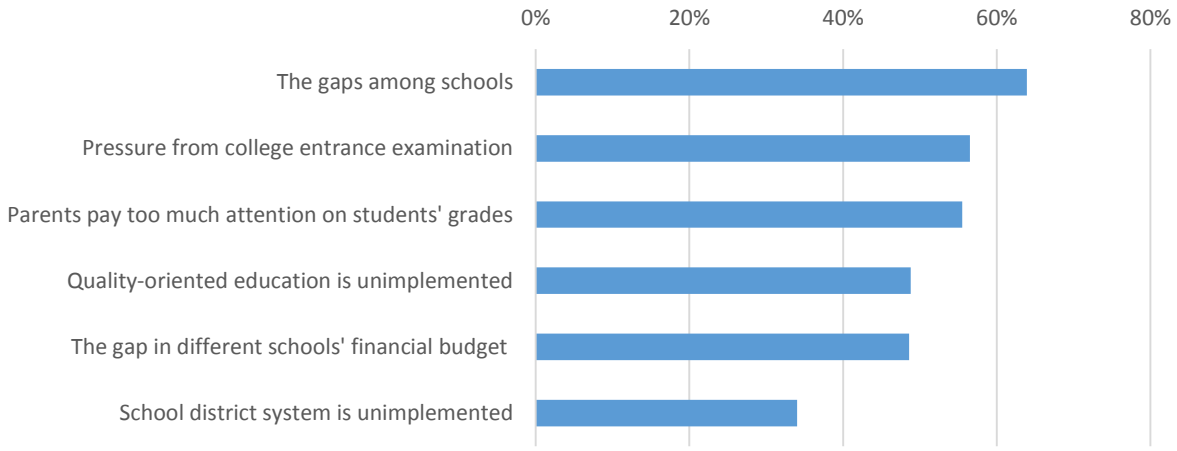


Figure 12 Why school selection exists?

So how to better current condition? Based on my analysis and data, this study is to arouse the awareness of unevenly education quality, and clue urban planners and decision makers in future projects. From parents' views, demolishing all kinds of school selection fee is the most effective way to improve status quo, which in my opinion is impossible. The current dilemma is derived from the tension between demand and supply; even without school selection fee, there should be another way for key elementary schools to choose students, and for parents to select desired schools for their children. Similar reason for quality-oriented education, which is hard to be quantified.

My survey about this question brings up another problem: the general public don't have a clear image of elementary education in Beijing. Also, implementing school district system strictly might exaggerate the stratification in socio-economic classes.

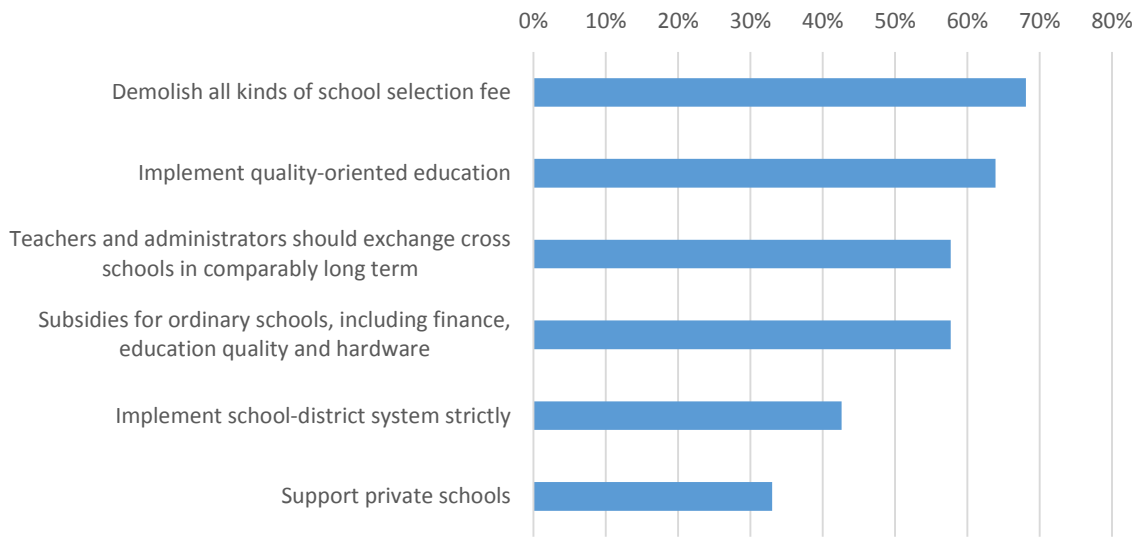


Figure 13 Preferable recommendation for governments

Previous analysis about stratification on both school side and parent/student side provides hint for us. However, it is hard to narrow down gaps among socio-economic classes (MUN C.

TSANG, 2001), which means we'd better narrow down gaps among schools or decrease opportunities to use socio-economic power.

Firstly, to ease the tension between the scarcity of high-quality elementary education and rigid demand, private schools are alternative. In fact, private schools in Beijing have taken 10% of elementary education market, either as full-time or part-time. (MUN C. TSANG, 2001) Secondly, the gap between key elementary schools and ordinary ones could be narrowed down by the exchange system, which is an old idea originated in 1980s. In this system, teachers and administrators will exchange in a fixed period, balancing education quality of different school. In addition, subsidies for ordinary elementary schools, both in political and financial, may help to certain degree. If ordinary elementary schools also have comparably high education quality, the stratification in schools might be alleviated.

On the demand side, we'd better spread general knowledge of compulsory education system and encourage them to choose private education. This is still the balance between supply and demand, but in a complicated system.

In terms of policy, the encouraging news is that Beijing already begins to ease its previously strict school district system since 2015, but we need to wait until the condition stabilizes to make conclusion. Also, to either increase the supply of private education, or encourage parents to choose private schools or ordinary schools with good quality, instead of needling their way to key schools, information transparency is important.

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Appendix: Survey and Summary

Total responses		*132*
Composition	parents	98
	grandparents	12
	others	22
1. Have you or your friends ever experience school selection for (grand)children?	130	98.50%
2. In your opinion, why school selection exists?	The gaps among schools	63.90%
	Pressure from college entrance examination	56.50%
	Parents pay too much attention on students' grades	55.50%
	Quality-oriented education is unimplemented	48.80%
	The gap in different schools' financial budget	48.60%
	School district system is unimplemented	34.00%
3. List the top 3 or more side effects of school selection.	Add financial burden to families	72.40%
	Some schools collect money in unauthorized ways	64.80%
	Equity in education is neglected	63.60%
	The gaps among schools grows wider	60.70%
	Examination-oriented education is emphasized	46.30%
	Rent-seeking for public power, especially for key schools	39.70%
4. Who is responsible for the current condition in compulsory education?	Local education government agency	71.50%
	National education government agency	68.50%
	Schools	40.30%
	Parents	24.80%
5. How to handle with school selection dilemma	Demolish all kinds of school selection fee	68.10%
	Implement quality-oriented education	63.90%
	Teachers and administrators should exchange cross schools in comparably long term	57.70%
	Subsidies for ordinary schools, including finance, education quality and hardware	57.70%
	Implement school-district system strictly	42.60%
	Support private schools	33.00%
6. Preference towards different ways for school selection	Transfer household registration	59.60%
	Pay school selection fee	49.10%
	Through personal social relationship	40.40%
	Buy school district housing	35.50%

	Try to get admitted as special talent	27.90%
	Execute authority in unauthorized way	5.80%
7. Willingness to pay for children's school selection	No intention to pay for school selection	22.80%
	<10,000	24.60%
	10,000 - 20,000	20.90%
	20,000 - 50,000	16.10%
	50,000 - 100,000	6.40%
	100,000 - 200,000	1.80%
	>200,000	0.90%
	No matter how much	6.50%