

# School District Premium in China - Evidence from Tianjin

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## **Abstract**

This paper explores the factors influencing the house prices in Tianjin by constructing a panel with monthly data of second-hand house transactions in Tianjin from 201601-201901 of Chain Home, and mainly explores the premium effect of school district houses on the house prices in Tianjin by constructing dummy variables and interaction terms, and obtains two conclusions: 1. the house prices in Tianjin are basically determined by the location, after all, the location represents more convenient lifestyle and more complete infrastructure; 2. The premium effect of school district on house prices in Tianjin is significant, i.e., the districts with the most significant premium effect are basically matched with districts with abundant educational resources.

# 1 Introduction

The real estate industry is an important industry related to the China's economy and people's livelihood, not only the government uses it as a means to boost the economy, but also the main real estate of the majority of residents, even as a means of investment. In the "13th Five-Year Plan" introduced in 2015, it is clearly pointed out that we should meet the housing needs of the general public, ensure fairness, promote the healthy and orderly development of the real estate industry, vigorously improve the scientific and informational level of the real estate market, and make full use of big data resources. Real estate appraisal, as an important part of the whole property transaction, plays a vital role in the development of the real estate industry, while the current property appraisal market in China mostly follows the traditional market method based on the price of land, which not only needs to improve the accuracy of appraisal, but also has a low efficiency. Compared with the property appraisal market in other developed countries, the appraisal method in China is still as a necessary process for bank mortgage loans, and does not play the role of promoting fairness and regulating the real estate market. The characteristic price model, as a way of real estate appraisal, has been successfully used abroad. It is based on quantitative economics, and the valuation of properties to be appraised is carried out by establishing a functional relationship between property prices and factors affecting property values, which can not only improve the scientific and accuracy of property appraisal, but also greatly improve the efficiency of current real estate appraisal, and also adapt to the informationization of China's real estate market background requirements.

With the process of urbanization, China's real estate industry has slowed down after experiencing rapid development, coupled with the slowdown of economic growth, real estate development is not as hot as it was at the beginning, especially in the second and third-tier cities. However, after more than two decades of development, the commercial housing has formed a considerable stock, and the labor mobility makes the second-hand housing market more active, and the factors influencing the fluctuation of housing price are getting more and more attention. And this paper mainly uses the monthly transaction data of second-hand houses in Tianjin from January 2016 to January 2019 to conduct regression analysis with a large number of observations to find the influencing factors of house prices in Tianjin by shaving off the effects of time effects and inflation. It also focuses on exploring the impact of school district housing on the house prices in Tianjin city based on the matched school district housing information. This paper basically answers two questions: 1) the house prices in Tianjin are still basically determined by location, which after all represents a more convenient lifestyle and more complete infrastructure; 2) the premium effect of school district housing on the house prices in Tianjin is very obvious, i.e. the administrative districts with the most obvious premium effect basically match the administrative districts with rich educational resources.

People realize their consumption preference for public goods by selecting a local government by moving, that is, the idea of "voting with their feet" (Tiebout, 1956)[8], which laid a solid foundation for the follow-up study. Housing has the characteristics of strong durability and cannot be moved in space, and housing prices reflect residents' different preferences for public goods (Rothstein, 2006)[7]. Therefore, under the background of unequal distribution of educational resources, high-quality educational resources have a capitalization effect that results in price premiums for houses in school districts (Zhang Hao et al., 2014)[6].

Considering that housing characteristics, community environment, and neighborhood characteristics all have impacts on housing prices, some scholars used instrumental variable models to overcome the problem of omitted variables (Downes and Zabel, 2002[2]; Gibbons and Machin, 2003[5]). However, since it is unable to determine whether the instrumental variables are effective, the research conclusions cannot be fully confirmed. Black (1999)[1] proposed to compare the housing prices on both sides of the school district boundary, eliminating the influences of unobservable variables. This model is extended by Fack and Grenet (2010)[3] and Gibbons et al. (2013)[4] by considering the distance between residences and the boundary.

The analysis in this paper will be developed as follows; the second part will describe the statistics of the data used in the study and briefly describe the policy in the period of the study and corresponding trends in house prices in the Tianjin real estate market; the third part will establish a baseline model and control the fixed effects to explore the factors influencing house prices in Tianjin; the fourth part will introduce the school district dummy and the interaction terms of the school district dummy and the district dummy to specifically explore the premium effect of school district premium on the house prices in Tianjin. The fifth section will summarize the conclusions obtained from the above analysis.

## 2 Data

The data used in this paper is the monthly data of second-hand property transactions in Tianjin City from January 2016 to January 2019 of Lianjia<sup>1</sup>, and match them with the CREIS<sup>2</sup>. We remove the unclear and vague record of the transaction. After preliminary matching, with relevant literature and experience in the real estate industry, the main indicators affecting project prices were selected, such as the location of the ring<sup>3</sup>, whether it was developed by a

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<sup>1</sup>Nasdaq: KE

<sup>2</sup>China Real Estate Index System, including details of real estate, for instance, the building information of a community

<sup>3</sup>The location of the community. The location can be divided in to: inside the inner ring, between inner ring and middle ring, between middle ring and outer ring, outside the outer

brand developer<sup>4</sup>, FAR<sup>5</sup>, green ratio, age of the house, etc. For the transaction amount, we use the inflation indicators of Tianjin from Jan 2016 to Jan 2019 to adjust to the real price indicator.

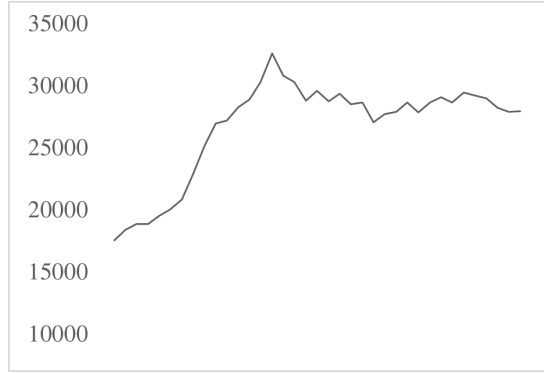


Figure 1: Average Real Price from Jan 2016 to Jan 2019 in Yuan



Figure 2: Growth Rate of Average Real House price in Tianjin

ring, and setting up distance-related variables respectively, which is the distance to the center of the city

<sup>4</sup>top 10 developers in Tianjin in terms of reputation

<sup>5</sup>The ratio of a building's total floor area (gross floor area) to the size of the piece of land upon which it is built.

Period	Policy Content	Effect <sup>6</sup>
2016Q1	Adjust down payment and tax on house	+
2016Q2	Loose the restriction of Individual Housing Provident Fund Loans	+
2016Q3	Reduce the housing fund loan	-
2016Q4	Property-purchasing limitation	-
2017Q1	Property-purchasing limitation, loan period restriction	-
2017Q2	House price limitation	+
2017Q4	Separate the price-limit real estate market	-

Table 1: Policies on housing in Tianjin

From the adjusted real house prices, it can be seen that there was a significant increase in Tianjin house prices from 2016Q1-2017Q3 and stabilized in 2017Q4 to date, which is also related to the house price policies of Tianjin city. In 2016-2017, the Tianjin municipal government has introduced a series of policies in the real estate market, which are listed above. In the first half of 2016, the down payment ratio fell (20% for the first set of down payment and 30% for the second set of down payment), and the favorable policy brought about a high consumer sentiment to buy houses, which led to a hot market and a great rise in housing prices. In the second half of 2016, Tianjin's real estate policy was relaxed to tightened, following the direction of the national policy adjustment to suppress the housing price bubble, implementing the purchase restriction policy in each district and increasing the down payment ratio. Starting from 2017, Tianjin implemented the "strictest ever" house and loan recognition policy and upgraded its mortgage policy to suppress the housing price bubble, thus returning the market to rationality. From the above chart, we can also see that after the rapid growth in 2016, the house price in Tianjin tended to stabilize in mid-2017, no longer showing high growth, the market tends to be rational.

### 3 Empirical analysis

#### 3.1 Baseline Regression

Our baseline regression will be set as followed:

$$\ln(P) = \beta_0 + \beta_1 * Distance + \beta_2 * BrandEffect + \beta_4 * Greenrate + \beta_5 * Age + T + \Phi + \epsilon$$

where  $\ln(P)$  is the value that take log to the real price of the house; *Distance*, *BrandEffect*, *GreenRate*, *Age* are the characteristics of the communities; *T* is the time fixed effect; and  $\Phi$  is the district fixed effect. In this section, we will group the transactions by their location, which is urban area and suburb area, and compare their difference to find out individuals' preference on the house in this two area.

Table 2: Results from Baseline Regression

Groups VARIABLES	ALL lnR	URBAN LnR	suburb LnR
Distance	-0.141*** (0.003)	-0.132*** (0.003)	-0.193*** (0.007)
Brand Effect	0.0366*** (0.009)	0.0637*** (0.016)	0.0283*** (0.011)
FAR	-0.0225*** (0.002)	-0.0286*** (0.003)	-0.00846*** (0.002)
GreenRate	0.502*** (0.015)	0.482*** (0.017)	0.587*** (0.031)
Age	0.000 (0.000)	0.000 (0.000)	-0.00120*** (0.000)
Constant	9.588*** (0.037)	9.869*** (0.017)	9.764*** (0.050)
District Fixed Effect	YES	YES	YES
Time Fixed Effect	YES	YES	YES
Observations	27,432	21,061	6,371
R-squared	0.64	0.584	0.466

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

The First column in Table 1 shows that all regression results are as expected, i.e., the negative effect of loop location, floor area ratio, and house age on house price versus the positive effect of greening rate and brand effect. However, the house age variable is not significant, presumably because people have different needs for buying houses, the housing resources within the central city are limited, and the main purpose of buying properties in the central city is to meet daily needs such as going to work and playing, so the consideration of house age is not sufficient, while for the purchase of houses in the suburbs, the main consideration will be the comfort of living, so the requirements for house age are higher, after all, for newer houses will have more complete infrastructure, greenery and properties.

From the second and third column of Table 1, we can find that the negative effect of age variable is more significant in the suburb areas, which indicates that the former analysis is correct, i.e., for houses in the urban area, people pay more attention to the practicality of their location, and do not consider the age of the house and the infrastructure of the property, etc. Consumers who choose to buy properties in the suburb area will prefer the comfort of living, which means they will pay more attention to the indicator of the age of the house, that is, the younger the age of the house means that the house was built later, and the

designers and developers will consider the construction and infrastructure of the property more completely.

### 3.2 School District Premium

**Notice** that, in our point of view, there is no homogeneity in our regression. The main reason is that, since the educational policy in China, the school districts are restricted by the government, and the schools are generally all public schools which can be generally rated as key schools and ordinary schools. For the key schools, they have more educational resource and fund for their daily maintenance. And the school district variable for the community is defined as whether this community is in the key schools district. In other word, the premium we calculate in this paper is the premium for the key schools. And the premium on house represents the cost parents are willing to pay for the key schools. Compared with Black(1999), which is that parents can choose school district by school quality, in our paper, the premium is the cost for the key schools, and there is no selection problem for parents.

#### 3.2.1 General Premium

The equation in this section is set as :

$$Ln(P) = \beta_0 + \beta_1 * SD + b * Controls + T + \Phi + \epsilon$$

where  $Ln(P)$  is the value that take log to the real price of the house;  $SD$  is the dummy about school district, if it is in school district, take value 1;  $Controls$  include all other variables may affect house price, such as green rate, age of the building, the brand effect of the communities etc.;  $T$  is the time fixed effect; and  $\Phi$  is the district fixed effect.

Table 3: General Premium

VARIABLES	LnR	LnR
SD		0.204*** (0.00827)
Controls	Yes	Yes
Time Fixed Effect	Yes	Yes
District Fixed Effect	Yes	Yes
Observations	27,432	27,432
R-squared	0.64	0.651

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

According to the second column in Table 2, the school district premium is positive and significant, which shows that the effect of school district premium on the house price in Tianjin city is about 20%. In the next section, we firstly focus on the education policy in Tianjin, classify school district housing in Tianjin, and explore the premium of different educational stages; In addition, we will set up interaction terms to find out the school district premium at different educational stages (elementary school, middle school, and high school) in different districts. That is, figure out the effects include following perspectives: 1. Which administrative district has the highest school district "premium"? 2. Among elementary school, high school and senior high school, which stage has the highest "premium"?

### 3.2.2 Educational Policies and School District house identification

The educational reform in Tianjin carried out in 2015, therefore, from Jan 2016 to Jan 2019, which is our data time range, the educational policy is consistent. The content of the policies is as followed:

Table 4: Educational Policies in Tianjin

Educational Stage	Policy
Elementary School	<ol style="list-style-type: none"> <li>1. Different elementary schools have specific areas to street and door numbers.</li> <li>2. Only those whose registered permanent residence is within the elementary school district are allowed to enroll in the corresponding elementary school.</li> </ol>
Middle School	<ol style="list-style-type: none"> <li>1. All the public middle schools attendance are randomly assigned within the range of districts<sup>7</sup>.</li> </ol>
High School	<ol style="list-style-type: none"> <li>1. All the high schools admission are through High School Entrance Examination.</li> <li>2. In high school admission process, urban area and suburb area are separated, which means the student in suburb area cannot be admitted in urban high school.</li> <li>3. Generally the urban high schools has better school quality.</li> </ol>

Before classifying educational stage school district, let's make a hypothesis about "Urban Area": since Tianjin is a centralized city, there are different rings to divide the city, and within the outer ring, the level of transportation facilities, commercial facilities and other infrastructure does not differ much, so the level of living services in the urban area is defined similar. The next analysis



is based on the observation in Urban Area, and we will figure out the school district premium in the "Urban Area".

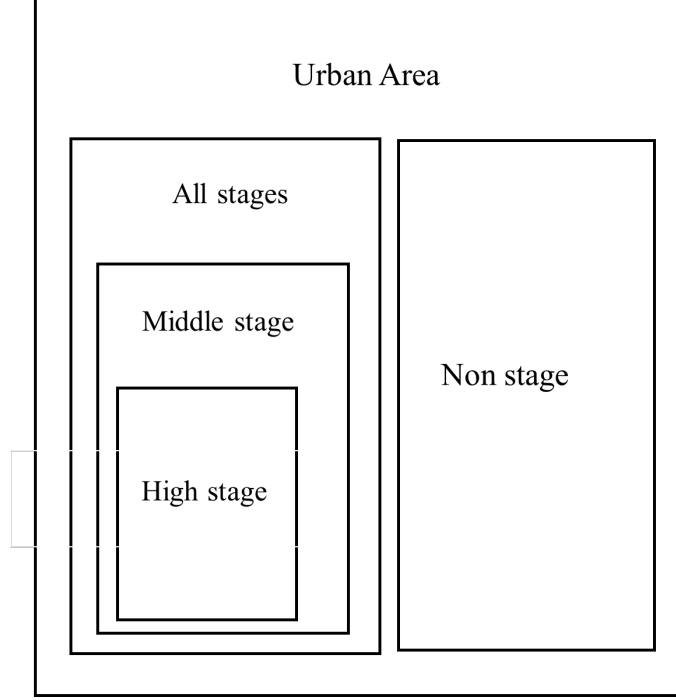


Figure 3: Division of educational Stage in Urban Area

Based on the policies above and assumptions, we do a more detailed division<sup>8</sup> of school district houses on the full sample: full-stage school district houses, middle school stage school district houses, high school stage school district houses, and central city non-school district houses. all-stage school district houses are those that are in the school district of key elementary schools from the elementary school stage, and are located in the administrative districts of the top private junior high schools (according to the educational ranking, such key private middle schools are located in Heping District and Hexi District) and in the six districts of Tianjin where key high schools have unified admission; Middle school district houses are those that are not in the school district of key elementary schools, but are located in key junior high schools and high schools from the junior high school stage; High school district houses are those that are in the school district of high schools. The same applies to high school-level school district houses; non-school district houses in the urban area mainly is a control variable, which are located in the above assumed urban area (within

<sup>8</sup>Generally, in the urban area, a community which is a elementary school district is the school district for all stages. And the division can be seen in Figure 3

the outer ring) area, but are not considered to be school district houses at any stage.

### 3.2.3 School District Premium at Different Educational Stages

In this section, our empirical model is defined as follows:

$$Ln(P) = \beta_0 + \beta_1 * \begin{bmatrix} AllStage \\ MiddleStage \\ HighStage \\ NonStage \end{bmatrix} + b * Controls + T + \Phi + \epsilon$$

Table 5: Results of Educational Stages

VARIABLES	lnR	lnR
SD	0.201*** (0.008)	
All stages		0.613*** (0.013)
Middle Stage		0.438*** (0.009)
High Stage		0.206*** (0.008)
Non Stage		0.0151* (0.008)
Controls	YES	YES
Time Fixed Effects	YES	YES
District Fixed Effects	YES	YES
Observations	27,432	27,432
R-squared	0.651	0.548

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The results from educational stage regression show that, All three stages of school district housing will have a premium impact on house prices, and from all stages of school district housing to high school district housing three categories show a decreasing trend, the impact on house prices from about 60% to about 20%, and significant under 1%, basically in line with the logic of the inclusion between the three, while the central city non-school district housing is not sufficiently significant and the impact of about 1% can be seen as basically no impact.

### 3.2.4 School District Premium at Different Administrative District

In this section, we apply the interactive terms of educational stage and administrative dummy to find out the premium difference between different districts. The model is as followed:

$$\begin{aligned} Ln(P) &= \beta_0 + \beta_1 * AllStage * UrbanDistricts + b * Controls + T + \Phi + \epsilon \\ Ln(P) &= \beta_0 + \beta_1 * MiddleStage * UrbanDistricts + b * Controls + T + \Phi + \epsilon \\ Ln(P) &= \beta_0 + \beta_1 * HighStage * UrbanDistricts + b * Controls + T + \Phi + \epsilon \end{aligned}$$

From the results in Table 7, among the all-stage school district houses, the houses located in Heping District has the largest premium, which shows the high quality of educational resources in the district. In addition, among the six districts in the city, the school district premium in Heping(HP), Hexi(HX) and Nankai(NK) is more obvious compared to the other three districts, which also reflects that the distribution of education in Tianjin is skewed in these three districts, which can also be seen from the distribution of Educational resource in Tianjin (Table 6). In the third column in Table 7, the results show that the premium of school district houses in Heping, Hexi and Nankai districts is significantly positive even the enrollment of high school is no longer designated by district(by the high school entrance examination within the six districts of the city(urban area)). The explanation for this results is that, people still prefer to live in the communities near the relatively high-quality educational resource for the convenience of school attendance.

Table 6: Educational Resource Distribution in Administrative perspective

<b>Educational Stage</b>	<b>Distribution</b>
Key Elementary School Top 20	Heping District: 7 Hexi District: 4 Nankai District: 4 Hebei District: 2 Hedong District: 1 Hongqiao District: 1
Key Middle School Top 5	Heping District: 2 Hexi District: 2 Nankai District: 1
multirow2*Key High School Top 5	Heping District: 2 Hexi District: 2 Nankai District: 1

Table 7: School District Premium at Different Administrative District

Variables	lnR	lnR	lnR
ALL stages NK	0.350*** (0.012)		
ALL stages HP	0.538*** (0.016)		
ALL stages HD	-0.102*** (0.017)		
ALL stages HB	-0.025 (0.035)		
ALL stages HX	0.350*** (0.010)		
ALL stages HQ	-0.282*** (0.048)		
Middle Stage HP		0.308*** (0.014)	
Middle Stage HX		0.208*** (0.004)	
High Stage HP			0.313*** (0.015)
High Stage HX			0.211*** (0.007)
High Stage NK			0.125*** (0.007)
High Stage HD			-0.101*** (0.007)
High Stage HB			-0.117*** (0.007)
High Stage HQ			-0.0501*** (0.008)
Controls	YES	YES	YES
Time Fixed Effects	YES	YES	YES
District Fixed Effects	YES	YES	YES
Observations	27,432	27,432	27,432
R-squared	0.483	0.48	0.516

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Combining the distribution of key schools in each administrative district in Table 6 with the regression results in Table 7, it is easy to see that the premium in key school districts is very significant, and the high price of housing in Heping District is not only due to its unique location as a commercial, cultural

and political center, but also inextricably linked to its skewed distribution of educational resources.

## 4 Conclusion

Real estate prices still remains an issue that affects the general public currently. Combining previous literature and this paper, our conclusions are mainly in three aspects:

1. The house price is generally determined by its characteristics, especially the location. A Better location means better employment opportunities, more prosperous commercial facilities and more complete infrastructure, so it will also bring a higher premium to the property. In addition, the developer's brand effect, greening rate, FAR and other factors will also have an impact on the unit price of the property. The effect of the the age of the house are significantly different in the regressions of suburb and urban areas: residents living in urban areas value more on convenience and commercial facilities, while residents living in suburb areas value more on the living experience, which means the newer house have more completely facilities.

2. The school district premium in Tianjin is obvious and significant. Through the initial definition of the school district housing variable and regression analysis, we find that the model with the school district housing dummy variable has a better fit than the original baseline regression model, indicating that the model with the school district housing dummy variable can explains the house price better in Tianjin. Moreover, the house prices in Heping District are much higher than those in other administrative districts, which has been confirmed in the empirical model, and most of the premiums originate from its educational resource.

3. After a more detailed division of school district houses, we find that the premium generated by school district houses near key schools, i.e., high-quality educational resources, is significantly greater than that of school district houses near ordinary educational resources. All three stages of school district housing have a premium impact on house prices, and there is a decreasing trend from full-stage school district housing to high school district housing, with the premium decreasing from about 60% to about 20% and significant at 1%, which is basically consistent with the relationship among the three divisions, while non-school district housing in the central city is not sufficiently significant and the impact is about 1% which can be regarded as basically no impact. In addition, among the six districts in the city, the premium of the school district houses in Heping, Hexi and Nankai District are more obvious compared to others, which also reflects that the distribution of education in Tianjin is tilted in these three districts, which can also be seen from the distribution of schools in Tianjin. The above can also show that people still prefer to live near relatively high quality

educational resources in Tianjin.

In the current situation of Tianjin, under the general trend of comprehensive national limitation of housing prices, the real estate market in Tianjin has been gradually tightened and no longer has a great upward momentum, indicating that a series of government policies have begun to bear fruit. With the results in this paper, the fact that school district house can have such a premium effect on housing prices in Tianjin is also inextricably linked to the education policy. Therefore, it is suggested that, in addition to pursuing the current policy of tightening the real estate market, consideration should be given to how to implement a more appropriate and relatively more equitable education policy, so that educational resources can be allocated more equitably and every family with school-age children can receive a better education without a high-premium school district house.

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