Andrew Young School of Policy Studies, Georgia State University

Non-Thesis Master's Capstone Project

What Influences the Housing Prices in Beijing, China?

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Abstract

The Beijing housing market is a complex and dynamic system influenced by various factors. This research study aims to explore the factors that influence housing prices in Beijing, China, using empirical data analysis. The research utilizes a combination of exploratory data analysis, data manipulation, and regression analysis on a dataset collected from reputable sources. The dataset includes information on key variables such as housing prices, building types, room sizes in square feet, number of days on the market, and the number of rooms. Descriptive statistics, correlation analysis, and regression models are employed to examine the relationships and significance of these factors on housing prices in Beijing. The findings of this study reveal that property characteristics such as building types, size, and number of living rooms, kitchens, and bathrooms have a significant relationship with housing prices in Beijing, China. The results provide insights into the key drivers of housing price changes in the Beijing market, which can inform decision-making, investment strategies, and policy interventions.

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Introduction

Housing prices in the city of Beijing, China have skyrocketed in recent years, making it one of the most expensive cities in the world for real estate. This has made it increasingly difficult for many residents to purchase homes, particularly for those who are just starting their careers or have lower incomes. The factors that influence housing prices in Beijing are complex and multifaceted. Understanding these factors is crucial for policymakers and individuals who are looking to invest or purchase homes. Many factors, including size in square feet, building types, number of living rooms, and number of days on the market, can influence the housing market in Beijing.

Despite the importance of understanding the factors that influence housing prices in Beijing, there is a limited amount of research on this topic. Most of the existing research has focused on the housing market in China as a whole, rather than focusing specifically on Beijing. This research gap creates a need for more detailed research on the specific factors that influence housing prices in Beijing.

This study aims to address this research gap by examining the factors that influence housing prices in Beijing, China. Specifically, the study will use a cross-sectional dataset of housing prices in Beijing from 2011 to 2017 to identify the key drivers of housing prices in the city. The findings of this study can provide valuable insights for policymakers, investors, and individuals looking to purchase or rent homes in Beijing. Additionally, the study can contribute to the existing literature on the housing market in China by providing a more detailed analysis of the factors that influence the housing market in Beijing.

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Literature Review

The housing market in Beijing, China has experienced significant growth in recent years, with prices soaring to unprecedented levels. As a result, there has been growing interest in understanding the factors that influence housing prices in the city. In this literature review, we will examine some of the key studies that have investigated the determinants of housing prices in Beijing.

One of the most frequently cited factors affecting housing prices in Beijing is supply and demand. Li et al. (2018) found that the rapid growth of the population in Beijing, coupled with the limited availability of land for development, has contributed to rising housing prices in the city. Other studies have suggested that changes in macroeconomic variables, such as interest rates, inflation, and income, also play an important role in shaping housing prices (Chen et al., 2016; Liu et al., 2019).

Another key factor that has been identified in the literature is government policies. Zhang et al. (2017) found that the implementation of policies such as restrictions on home purchases and increases in down payment requirements has led to a decline in housing prices in Beijing. Similarly, Li and Li (2018) found that the introduction of the “Five New Measures” policy in 2017, which aimed to regulate the real estate market, had a significant impact on housing prices in the city.

In addition to supply and demand and government policies, other studies have explored the impact of various socio-economic and demographic factors on housing prices in Beijing. For example, Wang and Guo (2018) found that factors such as the quality of public services, environmental factors, and transportation infrastructure all have significant effects on housing

prices in the city. Similarly, Chen and Jin (2018) found that demographic factors such as population density and the proportion of middle-aged and elderly residents also play a role in shaping housing prices in Beijing.

Overall, the literature suggests that housing prices in Beijing are influenced by a complex array of factors, including supply and demand, macroeconomic variables, government policies, and socio-economic and demographic factors. Understanding the interplay between these various factors is crucial for policymakers, developers, and investors who seek to navigate the rapidly changing housing market in Beijing.

Data

The raw data used in this study consists of cross-sectional data of housing prices in Beijing, China from 2011 to 2017. The data was obtained from a Chinese website called Lianjia.com and was posted on Kaggle by a user named Ruiqurm. The data set contains 318,851 observations and 26 variables.

The unit of observation in this dataset is the city of Beijing, and there is no information provided on how the data was collected. The variables in the data set include the property ID, community ID, transaction ID, transaction date, housing area, number of bedrooms, number of living rooms, number of bathrooms, floor level, building age, building type, renovation condition, building structure, elevator availability, property rights, geographical location, listing price, transaction price, and a few other variables.

Empirical evidence

To identify the key factors affecting housing prices in Beijing, the study employed multiple regression analysis. The analysis involved developing a model to predict the relationship

between housing prices and the various independent variables. The dependent variable was the housing price, and the independent variables were the number of kitchens, square size per feet, building types, and other relevant characteristics of the housing units.

The research began by exploring the data using descriptive statistics, such as mean, standard deviation, minimum, and maximum, to understand the distribution of the variables. Afterward, a correlation analysis was conducted to determine the relationships between the independent variables and the dependent variable. Then, multiple regression analysis was performed to identify the key factors influencing housing prices in Beijing.

Table 1: Descriptive statistics

Variable	Mean	Sd	Min	Max
Total Price	409	254	0.1	4900
Price Per Square Feet	51448	24111	1	156250
Tower	0.26	0.44	0	1
Bungalow	0.00021	0.014	0	1
Combination	0.19	0.39	0	1
Plate	0.55	0.5	0	1
Number of Kitchens	0.99	0.12	0	3
Number Drawing Rooms	1.1	0.51	0	5
Number of Living Rooms	2	0.77	0	7
Square Feet	83	37	7.4	640
Number of Bathrooms	1.2	0.43	0	6
Followers	26	44	0	1143
Days on the Market	29	50	1	1677

[1] Notes: The table above shows the summary statistics of the dependent and independent variables. The dependent variable is the total price, and the rest of the variables are independent variables, except for the price per square foot, which shows the average housing price in Beijing per square foot. Towers, Bungalows, combination, and plate were initially under one category called 'Building Type'. The categories were separated by creating dummy variables for each building type to understand how each building type affects the total

[1] Since it is not specified in the dataset, this research assumes that the total price is in thousands, and the currency is United States dollars. The unit of measurement is also assumed to be in square feet.

price of a house. The combination variable is the combination of tower and plate. Followers represent the number of people following each building transaction.

The summary statistics table above displays two distinct price variables: the total price and price per square feet. The price per square feet variable represents the average price per square feet, while the total price is denoted as the overall price in thousands. Based on the descriptive statistics, the minimum total price is $100, the average total price is $409,000, and the maximum total price is $4,900,000. The summary table provides us with a glimpse of the distribution of the selected variables based on the total price. The data suggest a positive correlation between the total price and the key variables, as an increase in price is associated with an increase in the value of the remaining variables. To further examine the relationship between price and other key variables, this paper uses a correlation matrix, bar chart, and line graph.

Figure 1: Correlation Heatmap

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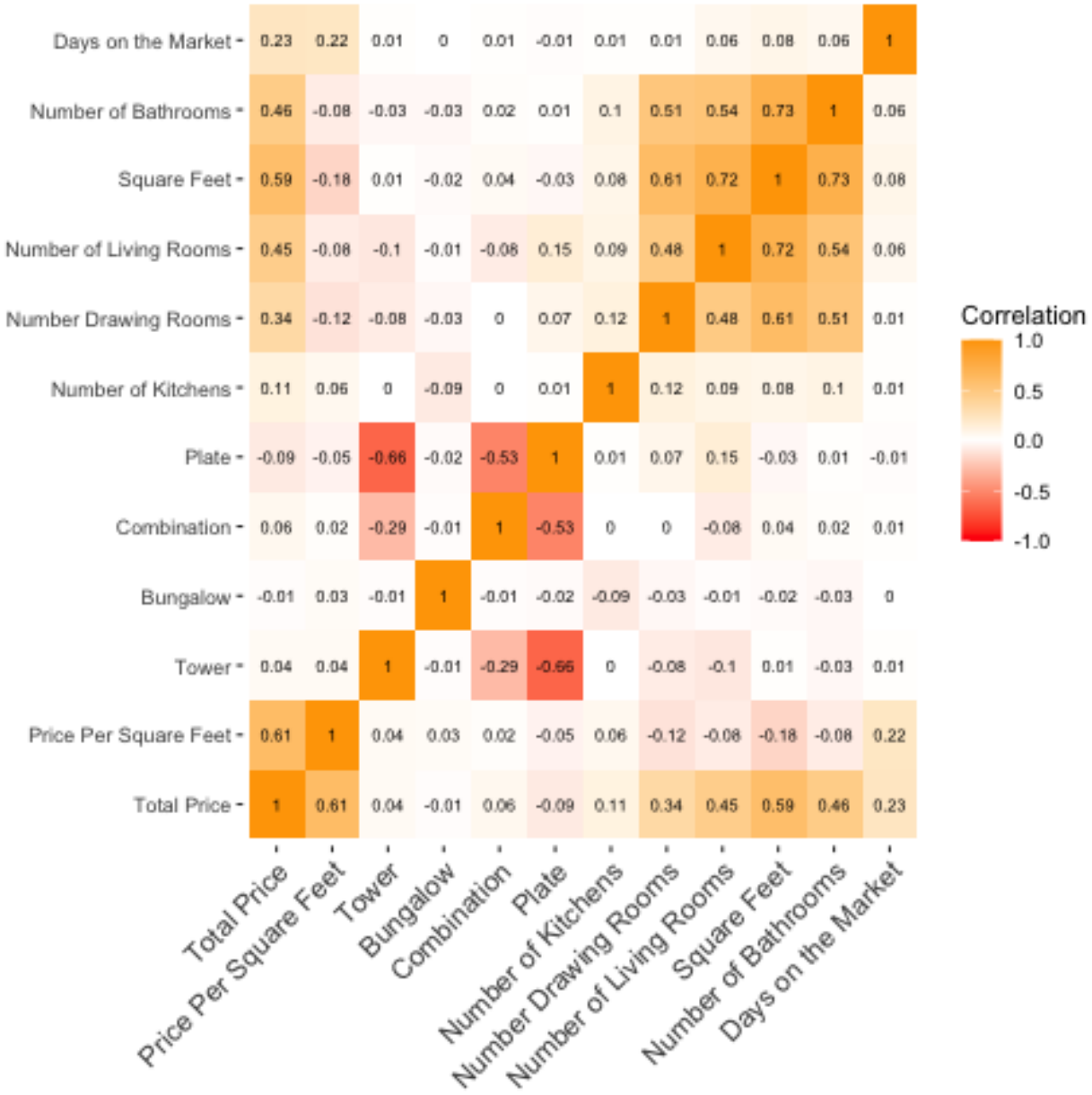


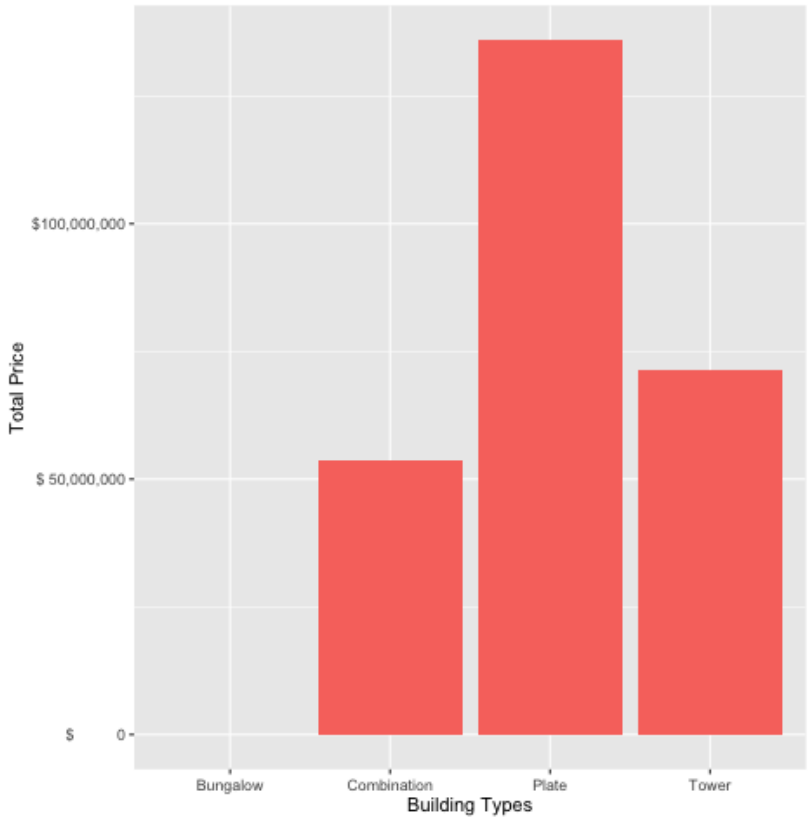
[2] Notes: A correlation heatmap is used to find potential relationships between variables and to understand how strong these relationships are. The heatmap above shows the correlation between each variable. The red color indicates a strong negative correlation, white indicates no correlation, and yellow indicates a strong positive correlation.

Each square shows the correlation between the variables on each axis. Correlation ranges from -1 to +1. Values closer to zero indicate that there is no linear trend between the two variables. The

[2] The combination variable denotes the building types that are the combination of towers and plates.

closer the correlation is to 1, the more positively correlated they are; that is, as one increases, so does the other, and the stronger this relationship is. A correlation closer to -1 is similar, but instead of both increasing, one variable will decrease as the other increases. The correlation heat map shows that square feet, number of bathrooms, number of living rooms, number of kitchens, and number of days on the market are strongly and positively correlated with the total price in Beijing, China. In contrast, towers, combination of building types, and number of followers have a weaker positive correlation. Bungalow and plate have a weak negative correlation.

Figure 2: Price by Building Type



Notes: The column graph above is used to compare the total housing prices by building type in Beijing, China. The building types are derived from the categorical variable column labeled 'building type' in the dataset. The categories are named based on the corresponding numbers assigned to each category.

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Based on the graph, it is evident that the type of building significantly affects the price of a house. Building type plate appears to be the most expensive while bungalow, combinator of plate and tower and tower are relatively less expensive. The difference in prices between the building types can be attributed to the construction materials used, as mentioned in the context. The graph indicates that the choice of construction materials is a crucial factor in determining the price of a house. Hence, builders and homeowners should consider the type of building and construction materials used to achieve the desired price range.

To further examine the relationship between price and key variables of interest, simple and multiple linear regression analyses were carried out. In these analyses, total price is the dependent variable, while square feet, number of kitchens, towers, bungalows, combinations of tower and plate, plate, number of drawing rooms, number of living rooms, number of bathrooms, and number of days on the market are the independent variables.

Result and Discussion

The estimated equations are:

- Total price=b_0+$b_1$square +ε̇
- Total price=b_0+$b_1$tower +ε̇
- Total price=b_0+ $b_1$square +$b_1$tower +ε̇
- Total price=b_0+b_1Square+b2Kitchen+b3 Building Type+b_4Drawing Room +b_5 Living Room + b_6 Bathroom + b_7Day on the Market+ε̇

The equation above shows the multiple regression model, which will help to answer the question to examine the effect of the selected variables on price.

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Factors that Influence the Housing Price in Beijing, China

	Dependent variable:			
	`Total Price`			
	(1)	(2)	(3)	(4)
Square Feet	4.066***		4.064***	3.326***
	(0.014)		(0.014)	(0.026)
Number of Kitchens				125.115***
				(4.300)
Tower		23.135***	21.199***	36.519***
		(1.444)	(1.170)	(1.210)
Bungalow				155.337***
				(34.651)
Combination of Plate and Tower				43.911***
				(1.351)
Plate				
Number of Drawing Rooms				-10.665***
				(1.241)
Number of Living Rooms				25.278***
				(0.957)
Number of Bathrooms				34.710***
				(1.724)
Days on the Market				0.939***
				(0.010)
Constant	73.198***	402.947***	67.757***	-114.239***
	(1.271)	(0.740)	(1.305)	(4.440)
Observations	159,376	159,376	159,376	159,376
R^2	0.344	0.002	0.345	0.391
Adjusted R^2	0.344	0.002	0.345	0.391
Residual Std. Error	205.604 (df = 159374)	253.631 (df = 159374)	205.394 (df = 159373)	198.091 (df = 159366)
F Statistic	83,541.020*** (df = 1; 159374)	256.638*** (df = 1; 159374)	42,020.640*** (df = 2; 159373)	11,369.500*** (df = 9; 159366)

Notes: The regression models above are used to analyze the relationship between the dependent variable "Price" and various independent variables. The models use the dataset of 159,376 observations which is different from the initial 318,851 observations in the raw dataset. The reason for the decrease is because of the number of missing variables that was omitted out from the dataset to arrive at the actual analytics dataset. Significance Level (*p**p***p<0.01)

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Model 1 only includes the square feet variable as the independent variable. The coefficient estimate for square feet is $4,100, which means that for every one-unit increase in the square size of a house, the total price of the house increases by $4,100. The p-value of the square variable is less than 0.01, indicating that the effect of the square feet variable on total price is statistically significant.

Model 2 adds the tower variable as an independent variable to the previous model. The coefficient estimate for the tower variable is $23,135, which means that the total price of a house is $23,135 higher if the building is a tower. The p-value of the tower variable is less than 0.01, indicating that the effect of the tower variable on total price is statistically significant.

Model 3 includes the bungalow variable as an independent variable in addition to the variables in Model 2. The coefficient estimate for the bungalow variable is positive, which means that some price increases if the type of building is a bungalow. The p-value of the bungalow variable is less than 0.01, indicating that the effect of the bungalow variable on price is statistically significant.

Model 4 includes all the independent variables. The coefficient estimate for Drawing Room is negative, which means that the presence of these drawing rooms in a house decreases the price of the house. On the other hand, the coefficients of towers, plates, combinations of plates and towers, number of living rooms, number of bathrooms, and number of days on the market are all positive, which means that the presence of the variables increases the total housing price. The p-values of all the variables are less than 0.01, indicating that their effects on Price are statistically significant.

The R-squared value of the models indicates the percentage of the variation in Price that is explained by the independent variables. The R-squared value increases from Model 1 to Model 4, indicating that the addition of more variables improves the model's explanatory power. The Adjusted R-squared value is the same as the R-squared value in all models, indicating that the addition of variables did not increase the model's complexity to the point of overfitting. The Residual Std. error indicates the average distance between the actual total price and the predicted total price by the model, with lower values indicating a better fit. The F Statistic tests whether any of the independent variables have a significant effect on the dependent variable, and all models have a statistically significant F Statistic.

Conclusion

This paper examines the factors that influence housing prices in Beijing, China using correlation heatmaps, graphs, and multiple regression models. Based on the regression results, we can conclude that the independent variables have statistically significant relationships with the total housing prices. All the variables have positive coefficients except one. The number of drawing rooms has a negative coefficient, indicating that the presence of drawing rooms does not increase housing prices in Beijing. Furthermore, the adjusted R-squared value indicates that the model explains 39.1% of the variation in house prices, which is a moderate amount. However, the p-values for all the coefficients are less than 0.01, indicating that the relationship between these variables and the total price is statistically significant. All in all, the independent variables used in this research are all important factors that influence the housing prices in Beijing, China. Therefore, real estate agents and buyers should consider these variables when deciding to purchase a home.

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