

# Data-driven urban Development Prospects Based Research

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**Abstract:** This study evaluates the future development prospects of Changchun and Hohhot through a data-driven approach, focusing on key factors such as housing prices, service levels, urban resilience, and sustainable development. The research integrates advanced modeling techniques including multiple linear regression, random forest, and XGBoost to analyze various urban indicators. In housing, the models identify price fluctuation factors and estimate housing stock using indirect metrics, with gradient boosting regression emerging as the most effective model. Changchun is found to excel in retail, finance, and lifestyle services, while Hohhot excels in public infrastructure, though both cities require balanced development to address disparities in facility distribution. Urban resilience is assessed by examining response capabilities to extreme weather and emergencies, with targeted investments suggested to enhance resilience and service accessibility. Sustainable development strategies for both cities are proposed, with Changchun focusing on green transportation and mixed-use developments, and Hohhot emphasizing healthcare and tourism infrastructure. Both cities are encouraged to adopt smart city technologies to optimize resource allocation. The study concludes that tailored development strategies, informed by data-driven insights, are crucial for achieving balanced, resilient, and sustainable urban growth, with practical recommendations for policymakers to improve service equity and foster long-term urban vitality.

**Keywords:** Sustainable Development, Smart City Technologies, Urban Resilience, Data-Driven Analysis, Housing Price Prediction.

## 1. Introduction

Urbanization in China has reached unprecedented levels in recent decades, with cities expanding rapidly to accommodate growing populations and economic demands. However, the country now faces new challenges that threaten the sustainability and quality of urban growth [1]. One of the most pressing issues is the accelerating trend of population aging, which, combined with the anticipated negative population growth from 2022 onward, will fundamentally alter the demographic structure in many cities. This shift presents significant challenges for second-tier and third-tier cities, which are particularly vulnerable to the effects of demographic decline, such as labor shortages and a reduction in consumer demand [1, 2].

At the same time, cities are grappling with the consequences of global climate change, including more frequent extreme weather events. These events not only affect the physical infrastructure of cities but also challenge their ability to ensure the safety, health, and well-being of residents. The ongoing economic downturn further complicates these challenges, straining resources available for urban development and investment [3].

This study focuses on two cities in China—Changchun and Hohhot—exploring their future development prospects in the context of these challenges. Changchun, the capital of Jilin Province, has a strong industrial base and serves as a key hub for automotive and manufacturing industries [4].

The primary objective of this study is to evaluate the development prospects of Changchun and Hohhot using data-driven approaches. This involves analyzing key variables

such as housing prices, service levels, urban resilience, and sustainable development. By utilizing advanced modeling techniques—including multiple linear regression, random forest, and XGBoost regression—the study aims to identify critical factors affecting urban growth and propose targeted strategies for improving the quality of life for residents [4, 5].

This study makes several important contributions to the field of urban development, particularly in the context of second- and third-tier cities in China, such as Changchun and Hohhot. The key contributions of this research are as follows:

- (1) Data-Driven Evaluation of Urban Development.
- (2) Urban Resilience and Sustainable Development Insights.
- (3) Tailored Development Strategies for Changchun and Hohhot.
- (4) Practical Application of Smart City Technologies.
- (5) Sensitivity Analysis for Robust Urban Planning.
- (6) Contributions to Sustainable Urban Policy and Decision Making.
- (7) Advancing Comparative Urban Analysis in China.

In conclusion, this study provides a robust, data-driven framework for assessing the development prospects of Changchun and Hohhot, offering practical and actionable recommendations for urban policy makers. By emphasizing the importance of resilience, sustainability, and smart technologies, the research contributes to the ongoing effort to create more livable, sustainable, and resilient urban environments in China.

## 2. Methodology

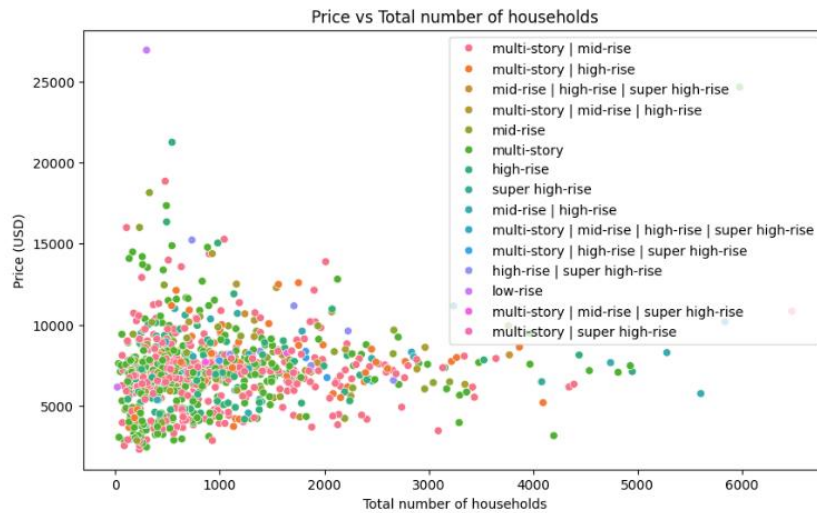
### 2.1. Future Housing Prices

We select two cities Changchun and Hohhot.

We find out some information about two cities, as of the end of 2023, the total population of Changchun City was 9.1019 million, of which the permanent urban population was

6.2053 million, accounting for 68.2% of the total population. The permanent population of Hohhot was 3.6041 million, an increase of 53,000 over the end of the previous year.

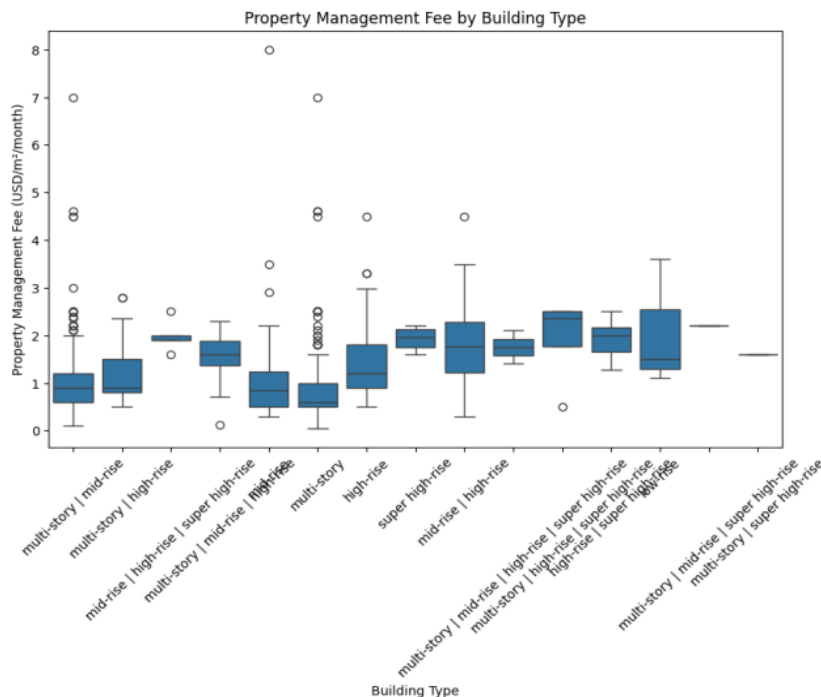
Through the data preprocessing, we cleaned up abnormal data and standardized the field format to ensure data consistency and accuracy of analysis. The scatter plot is display in figure 1.



**Figure 1.** Graph and analyze the processed data

The scatter plot illustrates the correlation between price and the aggregate number of households across various building types. Generally, the aggregate number of households has minimal influence on price, with prices predominantly falling within the 5,000 to 10,000 range, and experiencing greater variability at the lower end of the household count spectrum. Multi-story buildings, such as „multi-story“ and „mid-rise“, are predominantly situated in areas with lower to mid-range

prices and smaller aggregate household numbers. Conversely, buildings categorized as high-rise and super high-rise encompass a broader price spectrum. Additionally, the plot reveals some exceptional data points, including high-priced units exceeding \$20,000 and low-priced units with a substantial number of households, suggesting that larger communities may benefit from lower unit prices due to economies of scale.



**Figure 2.** Box plot of the variation in property management fees across different building types

Figure 2 illustrates the variation in property management fees across different building types. It is evident that there are substantial differences in fees among various building types, with some types, like multi-story and mid-rise, exhibiting lower medians, while others, such as high-rise and super high-

rise, which include extremely tall structures, demonstrate higher medians. Additionally, the graph highlights the presence of several outliers, particularly among the building types with higher fees. Generally, there is a correlation between the complexity of building types and the level of

property management fees, as taller or super-tall buildings tend to incur higher fees.

## 2.2. Weather and Emergencies

In order to assess the resilience of the two cities to extreme weather and emergencies, we analyze relevant data from multiple perspectives [6].

- (1) Critical infrastructure assessment
- (2) Emergency service assessment
- (3) Emergency response capability
- (4) Environmental adaptability assessment
- (5) Regional vulnerability analysis

Through these steps, we get some scatter plot in Figure 3 and Figure 4:

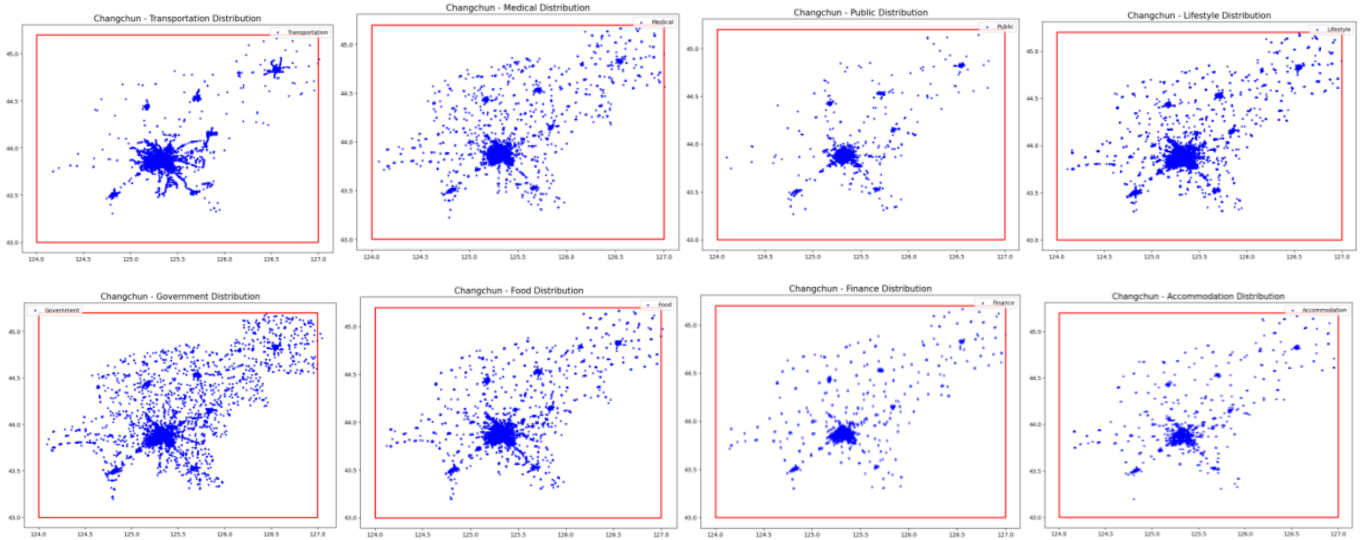


Figure 3. The distribution of Changchun

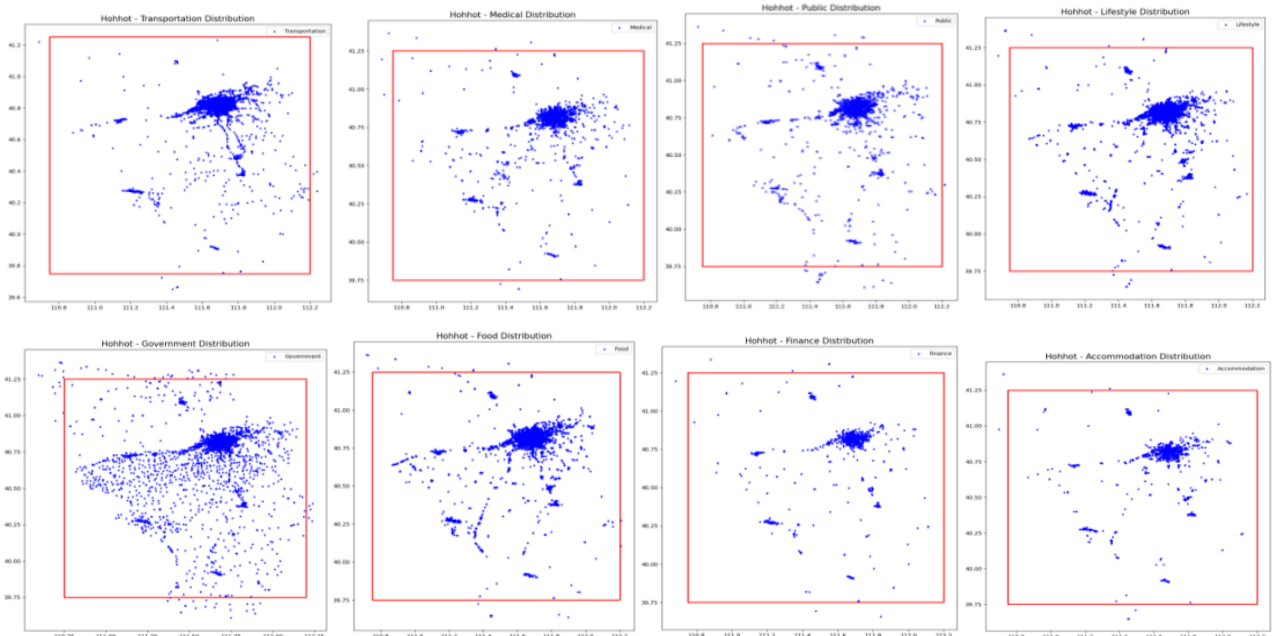


Figure 4. The distribution of Hohhot

## 3. Results and Discussion

### 3.1. Results

According to the steps below, we know the distribution of Changchun and Hohhot:

(1) Changchun City

Short-term plan:

a. Transportation network enhancement: Focus resources on improving the public transit network connecting the central urban area to the periphery, and mitigate commuting pressure in the central urban area by adding bus routes and refining road configurations.

b. Site selection for key public facilities: Give priority to

peripheral areas with significant population densities for the construction of community libraries, small parks, and other infrastructures to bolster local living convenience.

Long-term plan:

a. Peripheral comprehensive development plan: Plan and implement comprehensive commercial-residential mixed areas in peripheral areas, encourage enterprises and residents to move in, and promote economic activities and living convenience in the area [7].

b. Green transportation construction: Invest in the construction of rail transit and BRT (bus rapid transit system) to connect the central urban area and peripheral areas, reduce carbon emissions, and promote sustainable development of the city [7, 8].

## (2) Hohhot

### Short-term plan:

a. Core-to-periphery transportation improvement: Optimize transportation facilities from the center to the periphery, including increasing bus routes and road maintenance to improve commuting convenience.

b. Addition of medical facilities: Prioritize the establishment of small medical stations or community clinics in remote areas to ensure basic medical insurance coverage and improve the quality of life of residents.

### Long-term plan:

a. Regional transportation hub construction: Build transportation hubs to connect multiple urban areas, improve the efficiency of the overall transportation system, and encourage the gathering of economy and residents in peripheral areas.

b. Tourism service improvement: Invest in infrastructure construction near tourist attractions, including accommodation, catering and commercial services, to promote tourism development and increase urban income.

## 3.2. Discussion

The assessment of urban resilience revealed that both cities are vulnerable to extreme weather events and emergencies, though their resilience strategies differ. Changchun's robust transportation network stands in contrast to the limited medical infrastructure in peripheral areas, while Hohhot faces transportation challenges, especially during extreme weather conditions. The uneven distribution of public facilities and healthcare resources highlights the need for more targeted investments in infrastructure to improve resilience [9].

Overall, the study highlights the need for a tailored, data-driven approach to urban planning that balances economic growth, environmental sustainability, and social equity. While both Changchun and Hohhot possess strong economic foundations and infrastructure, they must address service distribution disparities, housing affordability, and urban resilience to achieve long-term sustainable development. The integration of smart city technologies offers a powerful tool for optimizing urban management, but it requires careful planning and continuous adaptation to meet the cities' evolving challenges. Strategic investments in key sectors, supported by advanced modeling techniques and sensitivity analyses, will be crucial in ensuring that both cities can achieve balanced and resilient growth in the face of future challenges.

## 4. Conclusion and Future Work

This study provides a comprehensive, data-driven evaluation of the development prospects for Changchun and Hohhot, focusing on key variables such as housing prices, service levels, urban resilience, and sustainable development. By applying advanced modeling techniques, including multiple linear regression, random forest, and XGBoost, the analysis delivered valuable insights into the urban dynamics of both cities.

This study underscores the need for region-specific development strategies, where infrastructure expansion is balanced with the integration of smart technologies. The proposed strategies aim to enhance urban resilience, promote sustainable growth, and improve the livability of both cities in the face of challenges such as population aging, economic shifts, and climate change.

Building on this study, future research can expand in

several key areas to further refine urban development strategies for Changchun, Hohhot, and other cities with similar contexts:

**Enhanced Data Integration and Model Refinement:** The inclusion of additional data sources, such as real-time traffic data, health outcomes, and environmental variables, could improve model accuracy. Furthermore, integrating more advanced AI models, such as deep learning, could capture complex relationships more effectively, enhancing predictive power.

**Long-Term Monitoring and Feedback Loops:** Establishing continuous monitoring systems for key urban indicators, such as population growth, service demand, and housing trends, is essential for maintaining the adaptability of development plans. Real-time data can update predictions and strategies, ensuring that urban planning remains responsive to emerging challenges.

**Urban Resilience and Climate Adaptation:** As climate change continues to affect urban areas, future work should explore additional strategies to enhance resilience, including the adoption of green infrastructure, sustainable water management, and disaster preparedness. Such strategies would support long-term urban sustainability and adaptability in the face of extreme weather events.

In conclusion, while this study provides a strong foundation for understanding urban development through data-driven methods, the complexity of urban systems necessitates continued research and adaptation. By incorporating real-time data, leveraging new technologies, and addressing emerging challenges like climate change, future urban planning can ensure sustainable, resilient, and equitable growth for cities like Changchun and Hohhot.

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