

# The Externality Impact of Urban Rail Transit on Urban Real Estate Prices in China

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**Abstract.** China has the largest and fastest growing urban rail transit system in the world. The system plays an important role in China's urbanization process, city governance and residents' daily commutes. The development of urban rail transit (URT) has influenced China's urban spatial structure and real estate supply, and has produced externalities on real estate value, including both positive and negative externalities. The research shows a positive correlation between URT and China's real estate prices in general. The closer rail transit systems are, the greater the premium on real estate prices. In addition, the impact of rail transit on real estate prices shows a trend of first increasing and then decreasing. Different land use types and urban areas will also be affected. The research also found that the three stages of URT construction: planning, engineering construction and traffic operation have different effects on housing prices. At the same time, the impact of URT on land price will also change with China's economic situation and urbanization process. These influencing mechanisms above between URT and real estate prices may be linked to some factors. This research attempts to explain it by introducing urban spatial and land rent transformation, changes in real estate supply and demand, gentrification process, and different employment and housing pattern. This research points out the shortcomings and possible research directions of existing studies. In order to provide a reference for academic research and government policy making.

**Keywords:** Urban rail transit system, Externality, Gentrification, Job-housing balance.

## 1. Introduction

Both the people living in cities and the quantity of automobiles on the road are rising as China's urbanization process progresses, resulting in an increased demand for commuting in cities, and road congestion is becoming more serious. At the same time, urban environmental pollution, job-housing mismatch and other problems have attracted more and more attention. Urban rail transit systems (URT), seen as one of the solutions to the aforementioned problems, have gained importance among urban administrators in China. URT is a large-capacity urban passenger transportation method that is quick and effective, safe and comfortable, energy-efficient, and environmentally friendly. It refers to a public transport system built in a city with a fixed track and operated along designated lines.. According to the Urban Public Transport Classification Standard, it includes various systems such as the subway, urban rapid rail transit, light rail, tram, monorail, automatic guided rail (APM), maglev, etc. [1].

Due to the characteristics of URT, it is widely believed to promote urban development, optimize traffic structure, enhance land value, boost business prosperity, create employment opportunities, and support industrial development. Researchers have always been concerned about the effect of URT on the cost of urban real estate. Alonso's urban land use theory provides a classical location explanation for the formation of urban land price [2]. In the method, the eigen price model and hedonic model are widely used in the empirical research of land price or housing price. In order to explore the spatial correlation and differentiation of land price or housing price, spatial statistical methods such as spatial regression and geographical weighting have been widely used. Cases from many Chinese cities show empirically that urban property values are indeed affected by rail transit systems. Most studies show that positive externalities are a major part of these effects, but there are also negative externalities. At the same time, these influences have different laws in time, space and different parts of the city. Regarding the explanation of its influencing mechanism, the majority of studies hold that the

economic geographical mechanism that encourages the change in real estate prices is the impact of urban rail transit construction on traffic accessibility, land supply, employment and housing pattern, as well as urban environmental renewal.

In addition to discussing the externality effect of URT on the value of urban land assets and potential sources of this effect, this study seeks to provide further details on the construction state and development pattern of URT in China. It covers elements including development mode, urban space/work-housing balance, and limitations in the field's present study. to serve as a resource for additional study on URT and its financial advantages in Chinese cities.

## **2. Current Situation of Urban Rail Transit Construction in China and Its Investment, Financing and Development Mode**

China presently has one of the biggest and fastest-growing URT systems in the world after 43 years of building. URT is primarily concentrated in central and economically developed cities in China [3]. Some of these cities, such as Shanghai, are among the world's largest in terms of URT. It can be seen that the rail transit system has become an important transportation infrastructure and means of commuting in Chinese cities. The construction of URT in China contributes to urban development by fostering urbanization, rejuvenating old neighborhoods, encouraging factor and industrial agglomeration, and enhancing urban competitiveness. Moreover, these influencing factors may also contribute to changes in real estate prices [2].

An essential component of URT projects is the manner of development and construction, which is strongly correlated with the price of urban land and has a major effect on the local real estate market. The popular model of URT development in China is the TOD model. A TOD is a community or functional block that densely interweaves various functions around a public transport hub [4]. TOD projects are frequently marketed as effective means of boosting car usage reduction and transportation utilization, while also spurring neighborhood development and improving the standard of living in other failing neighborhoods. [5].

## **3. The Effect of China's Urban Rail Transit Development on the Value of Urban Real Estate**

### **3.1. The total effect on urban real estate values of China's urban rail transport systems**

The externalities of urban land use development through URT are primarily classified into two categories in land economics: price effect and quantity effect. The former demonstrates how the location and level of land development will impact the urban spatial organization as well as the development of URT. The latter one-- price effect, that is, its impact on real estate prices, belongs to the premium effect of URT. In essence, it is a reflection of the reduction of transportation cost and the improvement of economic efficiency in the real estate value [2].

The general view is that URT system can promote the increase of urban real estate value. By improving the accessibility and convenience of the surrounding real estate, enhancing facilities and services, unlocking urbanization potential, facilitating real estate development and urban renewal, and alleviating traffic congestion, URT enhances the appeal of surrounding areas and attracts residents, thereby increasing demand for nearby real estate and contributing to the appreciation of urban property values [5].

Overall, empirical evidence from numerous Chinese cities indicates that the positive externality of the rail transit system affects the value of urban real estate, and the influence of URT on real estate prices exhibits comparable trends. not just in developed central cities, but also in other cities [6]. Take the housing price of Chinese cities as an example, the premium range generally falls between 5% and 25%, which is slightly higher than that observed in European and American cities [2]. At the same

time, this kind of premium effect has a more complex form and mechanism, such as spatial effects and time effects, and there are also differences among distinct regions in the same city.

### 3.2. Spatial effect

Spatial effect refers to the variation in the premium effect on real estate at [2]. Traditionally, this effect suggests that the premium increases as the distance decreases... The empirical case of Guangzhou shows that the land price contour line around the subway is dense. While the farther from the subway line, the less land price contour line is. It indicates that the sensitivity of land price decreases with the increase of distance from the subway station, and the subway station has an objective impact on land price [5]. The first-hand houses, rental prices and land purchase prices are all affected in this way [2]. The four variables that have the biggest effects on residential real estate prices are: whether the nearby subway station is a transfer station; how far away the property is from the nearest subway station; how far away the property is from the urban center; and how long the nearby subway station will take to complete [7].

The importance level of a station also affects property prices. Subway stations can be divided into interchange stations (that is, stations where multiple lines meet) and regular stations. Research shows that the housing around the transfer station not only has a faster increase, but also its expected price is higher than that of the same real estate around the ordinary subway station [7].

Examples from around China show that different land types have different impacts. Business office have regional stickiness to urban centers, that is, they are less affected by the premium of URT systems. Compared with the office, the subway has a greater impact on the residential value, commercial area and industrial land, and its characteristics of the circle structure are prominent. The closer to the subway station, the higher the land price. However, the price change of industrial land caused by the impact of subway stations and lines is the smallest among all the land price changes [5].

Overall, the analysis highlights the fundamental correlation between URT and urban real estate prices in China, which is that the closer an asset is to a subway station, the more valuable it is.; After the distance reaches a certain degree, the further the distance, the higher the price. In other words, the trend of this value-added effect is to first increase and then decrease, showing an inverted "U-shaped" relationship [8]. The land prices of different types of land at different sites generally meet the circle structure: the land prices of the inner circle are generally higher than the land prices of the outer one, showing a distance attenuation. And the high land prices only appear in a certain range away from the site.

### 3.3. Time effect

Apart from the geographical separation, the impact of time on housing costs is also quite evident. The term "time effect" describes how different URT initiatives have an impact on neighboring real estate prices at different times.

The short-term impact takes into account the rail transit system's cycle of building and operation. This cycle comprises three stages: construction application planning, engineering construction, and traffic operation. Taking residential real estate as an example, this three-stage period has different impacts on housing prices [7]. The price rises fastest in the planning stage of construction application, but shows a slight increase in the construction stage, and basically stable after the traffic operation stage. There are some exceptions, too: The empirical research results show that the approval of the first phase of Hangzhou Metro network and the official opening of the network brought 11.04%, 10.90% and 18.46% value-added to the housing price within 800m around the station respectively [9].

In a longer economic cycle, along with the differences in China's economic situation and urbanization process, the impact of URT on China's land price also varies in stages. The premium effect of URT is more evident the earlier in the urbanization process [5]. Additionally, the premium impact decreases as rail transit reaches further into the suburbs. The instances from Beijing and

Guangzhou demonstrate this. Finally, it is worth noting that spatial effects and temporal effects often cross in the same URT project.

### **3.4. Negative externalities and sub-market effects**

It is important to note that, alongside positive externalities, URT can also have negative impacts on real estate prices. Negative externalities are the adverse effects of an economic activity on others or society other than its participants. For instance, the construction process of URT may give rise to issues like demolition disputes, construction pollution, and traffic jams. Upon completion, additional challenges such as public security concerns, increased passenger flow, noise pollution, and obstructed vision may emerge, causing inconveniences for nearby residents and businesses. Consequently, these factors can diminish the overall attractiveness and value of surrounding real estate.

Take the siphon effect in China's URT system as an example: The siphon effect in the housing market refers to the rise in demand and housing prices in popular areas, while those in nearby areas that are relatively far away or less popular will fall [10]. Research on the Shanghai metro suggests that increased public demand for housing close to the subway leads to a siphon effect on housing markets farther away, causing prices and demand to fall further away. Within the range of 2500 meters, the premium effect of housing keeps positive, first increases and then decreases. Beyond a distance of 2,500 meters, the premium effect turns negative [11], that is, the price of houses outside the 2,500 meters range is affected by the relative decline.

At the same time, research on the definition of sub-markets shows that the value of urban real estate is greatly affected by the rail transit system in different areas of the same city. Therefore, researchers need to conduct specific analysis of different real estate markets. For example, the situation may not be the same between urban centers, regional centers, and suburbs and exurbs. The Shenzhen example demonstrates how the URT system's influence on residential values along its route varies depending on the city's spatial areas. Conversely, the direction of influence varies. For instance, certain metro lines, like the Longgang Line, may increase the prices of residences along the line in the suburbs, while contributing to the decline of residential property prices in the outer suburbs [12].

## **4. Plausible Rationales for the Influence of Urban Rail Transportation on Property Values**

The reasons behind the impact of URT development on the cost of urban real estate in China include: the urbanization process promoted by China's URT construction and the change of land rent; China's URT affects urban spatial change: it promotes gentrification and changes in the pattern of employment and housing, and then lead to the change of real estate prices.

### **4.1. Urbanization process and land rent**

The theory of land rent points out that there are two main factors affecting the price of real estate: land price and building price. In the process of urban spatial distribution, the price of buildings, including construction costs, usually does not have a big change; The other determinant, land value, is highly variable - largely because of urban location. A major factor contributing to the URT's positive externality on real estate prices is rising land values. [13].

The effect is different in the city centre than in the suburbs. With the ongoing process of urbanization, population migration, and industrial upgrading, there is an increasing demand for real estate, particularly high-end properties. This has resulted in a surge in land prices in the city center, driven by the influx of population and the development of industries. As one moves away from the urban center towards the suburbs, the trend in land costs changes: land costs gradually decrease, while transportation costs increase. The opening of URT has a significant impact on the transportation cost. Compared with other locations, the transportation cost of residential and commercial real estate along the line is lower, and its demand and value are also higher [14].

The extension of URT has built the basic framework of China's urbanization and promoted urban expansion and population increase. On the one hand, the land supply is reduced: the land in the city is limited. With the advancement of urbanization, the demand for land is increasing, which makes the land supply in the city gradually decrease, and land gradually becomes a scarce resource. If the number of permanent urban residents is taken as an indicator to measure the level of urbanization, this promoting effect on urbanization has been confirmed in the empirical analysis (Beijing)[14]. On the other hand, in the process of urban expansion to the suburbs, the commuting distance increases, the transportation cost keeps rising, and the appreciation of land and real estate prices keeps rising.

#### **4.2. Gentrification and job-housing balance**

The influence of URT on land price in China is also related to the change of urban residential pattern. This change in residential pattern includes the gentrification of the old urban areas and the change in the balance of employment or housing in the overall urban space.

Gentrification refers to the cultural, economic and social transformation of a region or social group towards the middle class. In the process of middle class, areas or social groups that were originally low-income or working class gradually improve their economic conditions and quality of life and enhance their social status [15]. Or leave the area because they can't afford the increasingly high rents.

For the old built-up areas of the city, URT improves the accessibility and promotes a large number of commercial and office needs to gather in the city center. Along with urban renewal and environmental improvement, high-end residential, commercial and service industries gradually replace the old and dilapidated areas in the region. And low-income groups move out or transform into middle and high-income groups [16], which may cause the price of such real estate to rise. Studies of some Chinese cities have shown that the development and construction of subway stations can indeed cause this process [17]. At the same time, research shows that the most popular development mode of URT in China, the TOD model, may further affect the process of urban gentrification. The TOD based on rail transit development, which meets the needs of high density, small blocks, high-quality environment and one-stop shopping required by commercial activities, has become an important means of urban renewal in China and is conducive to increasing commercial land prices [18].

Job-housing balance is also an important factor. Urban job-housing pattern refers to the relationship and distribution pattern between the working and living place of urban residents. It reflects the industrial structure, employment opportunities and the flow of residents in different areas within the city. The convenience of URT enables workers who cannot afford the high cost of living in the city center to live in the lower cost of living in the suburbs and still work in the city center. The improvement of accessibility in urban environment also promotes the clustering of high-end industries such as the financial industry in the city center, which further increases the land price. In city suburbs, residential and industrial areas along rail transit are often favored—relatively convenient transportation and a low cost of living promote the concentration of population and industries along rail transit, showing a trend of agglomeration development. This promotes the continuous increase of residential population and industrial numbers in the region [19], potentially pushing up land prices for residential and commercial land.

### **5. Conclusion**

This study evaluates and summarizes several research instances based on Chinese cities in response to the question of how China's URT system affects the values of urban real estate. It also provides pertinent theoretical explanations for the reasons of these cases. And it points out that on the whole, the externality of URT development on urban land use is generally demonstrated in spatial terms; specifically, the closer the distance, the larger the premium. URT has a first positive and subsequently negative effect on the appreciation of real estate values along the route. Different types of land use have different impacts, and different regions in the same city have different impacts. In

terms of time, it is shown that the three stages of URT line construction planning, engineering construction and traffic operation have different characteristics on the housing price. In a long economic cycle, with the different economic situation and urbanization process in China, the impact of URT on China's land price also has different stages. These effects may be related to urbanization, changes in land rents, gentrification and changes in employment and housing patterns.

This study is important because it sheds light on how URT affects real estate prices, which can help China formulate land use and urban planning policies. It also helps to rationally allocate residential, commercial, and office land across the country in order to maximize social and economic benefits. This not only reduces commuting time and costs but also enhances the quality of life for residents.

In terms of research direction, the existing research focuses on the discussion of urban real estate prices, and the research on other types of real estate is not fully sufficient. Simultaneously, the internal discussion of URT systems is insufficient. For instance, it does not distinguish which stations or lines are more crucial, and whether these specifics will impact real estate prices. Secondly, due to the complexity of urban block infrastructure, it is difficult to exclude the influence of other infrastructure and factors. Finally, the interaction mechanism between different real estate prices is also worth further attention.

On the whole, in addition to building a sound rail transit network, the government should integrate land development planning, construction and management of supporting facilities, strengthen coordination between urban planning and transportation, and pay attention to the positive and negative externalities of real estate prices.

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