

STUDIES OF URBAN LAND PRICES ON SCALE RESEARCH: A LITERATURE REVIEW

¹Ma Hong

²Oliver Valentine Eboy

^{1&2}Fakulti Sains Sosial dan Kemanusiaan, Universiti Malaysia Sabah

¹mh8762389@gmail.com, ²oliver@ums.edu.my

Tarikh dihantar: 19 Mei 2023 / Tarikh diterima: 14 Jun 2023

Abstract With more people paying attention to the development of the urban land market, the urban land price has become one of the main research subjects in recent years. Land price is always studied within a certain scale. In order to understand the research status of land prices based on the concept of scale, this paper analyzes the research situation in this direction through literature analysis. In addition to a lot of research on land price evaluation methods, the analysis of land price focuses on the time-space analysis of land price. After summarizing the literature, it is found that there are few comparative analyses and micro-scale analyses of land price, and the land price research mainly focuses on the analysis of distribution law and its influencing factors in a single macro-scale or middle-size scale. Therefore, we discuss the causes of this phenomenon and put forward some suggestions for follow-up solutions. In the future, the research on urban land price should be combined with the national conditions, combining theoretical construction with typical case studies, innovating research methods, and promoting the in-depth development of the research and practical application of urban land price under multi-scales.

Keywords: *land price, Scale, Influencing factor, literature review*

INTRODUCTION

The land is the foundation of urban development, the carrier of all urban economic and social activities, and the central link of the real estate market. Land price is the economic realization of land ownership. As an important indicator to measure the land market, the land price has become one of the important research topics in modern society. Land price is the market-oriented performance of the interaction between the comprehensive attributes of land and the surrounding nature, social economy, and ecological environment (Wen&Goodman, 2013). The research on urban land price in China began in the 1980s, when there was no systematic research system, only focusing on the spatial distribution and static distribution of urban land price over time, but lacking research on its dynamic evolution process and mechanism. Wang (1997) is the first scholar in China to study the spatial dynamic distribution of urban land prices. He studied the evolution law and its driving factors of urban land price in time series by using the theories of land price steep slope and land price platform and constructed the framework of four-dimensional space theory of urban land price.

As the most representative and sensitive element of the land market system, the land price has always been the core of the land market operation. The change in land price not only reflects the supply and demand of the land market but also is an indicator of urban economic development and land use (Cao, 2013). The urban land market influences the behavior of land users and land supplier governments through price mechanisms and competition mechanisms, curbing the blind expansion and extensive use of urban construction land, optimizing land use methods, and improving land use efficiency (Chen et al. 2018). As an important information and value judgment standard of land market operation, land price is one of the important means of national macro-control of the land market. With the continuous development of the market economy, its role in improving land resource utilization efficiency and optimizing land spatial allocation has become increasingly prominent (Chang et al., 2011, Gao et al. 2014). Land price is an important tool to regulate the land market and adjust the optimal allocation of land resources, and it is an important indicator to measure the operation of the land market. The rise in a city's land price may have a positive impact on its industrial structure upgrade, and may also have a negative impact (Zeng et al. 2019). Exploring the research status of the rising trend and spatial distribution of land prices can provide a reference for different cities to adjust various influencing factors, thus helping the government to rationally regulate the land market. With the gradual development and improvement of the market economy, the role of land price in standardizing urban land use patterns and optimizing land resource allocation has become increasingly obvious.

The analysis of the influencing factors of urban land prices at different scales is helpful for the horizontal assessment of the level of urban economic development and the living standards of urban residents. Urban land prices are affected by various social and economic factors, such as the international investment environment, market supply, and demand, geographic differences, urban residents' income, and actual disposable quotas, geographical location advantages, the surrounding ecological environment, and the city's Infrastructure, buildings, surrounding educational resources, etc. (Zhou et al., 2019, Zhou, 2020). Using the literature analysis method to analyze the research results of land prices in cities of different scales, and to explore the spatial distribution characteristics and the laws of influencing factors, is conducive to providing the scientific basis for optimizing the urban industrial structure and scientifically and rationally planning the policy formulation of urban infrastructure. Exploring the land price and its influencing factors is helpful to optimize the land use structure and improve urban land use efficiency. The research progress of urban land price on different scales

and comparative analysis can provide a reference for future research of complex things and clarify the necessity of analyzing complex things on different scales.

The scale is an important concept in geographic research. Tobler (1970) invoked the first law of geography: everything is related to everything else, but near things are more related than distant things. Combining scale with the land price to study is a horizontal and vertical study of land price from a geographical point of view, that is, the study of land price in different levels of space and time. For the study of scale, In the 1990s, Meentemeyer et al. (1987) and Goodchild et al. (1997) proposed to establish a "scale science", The National Center for Geographic Information and Analysis (1999) and the University Consortium for Geographic Information Science (2012) also included scale as a priority area of geographic information science research. Scale is the measurement range of natural phenomena and scientific research in space, time, or space-time (Wang et al. 2004). The research shows that the spatial and temporal distribution, mutual coupling, and other characteristics of geographical research objects are scale-dependent. Studying and studying them on a continuous scale sequence can better grasp their internal laws (Li et al. 2005). According to the first law of geography and the scale theory, social and economic processes are intertwined on different spatial scales, so it is necessary to conduct theoretical analysis and research on the spatial organization of economic activities, especially global-local relations, urban-regional restructuring, etc. China's administrative division is also a kind of scale division. China's urban administrative division is the division of land and space by the national administrative organs implementing hierarchical management (Wang et al. 2018). The administrative division system has a rigid hierarchical structure, which has an important impact on the overall management of the country and the development of the regional economy. A distinctive feature of China's space economy is the use of administrative means to solve economic problems, which determines the rigidity and hierarchy of the administrative division system, and makes space units at different administrative levels. "Scale as a hierarchy" is more obvious in China's urban administrative division system. The administrative hierarchy of a city can affect the spatial function of a city as an economic entity and its political and economic relations with other places. There is also a close correspondence between the administrative hierarchy of a city and its scale. Larger cities tend to occupy higher administrative levels. These together constitute the scale relationship of unique Chinese cities (Zuo et al. 2019). In this paper, this paper divides the research scale into macro-scale, meso-scale and micro-scale for literature analysis. When conducting national scale correlation analysis, it refers to taking the country as a plane, selecting a representative and a certain number of research objects as points, and starting from the points, making a comprehensive analysis, so that the points are connected into lines, and the lines merge into a plane. Through the analysis of several research objects in the national scope, we can get the overall laws in the national scope, while the research in the provincial scope is the process of a similar analysis of the research fields in the province. Taking China as an example, the macro-scale refers to the national scale, the meso-scale refers to the scale of each province and city, and the micro-scale refers to the smaller scale, that is, the scale of counties and villages.

Research Progress on Land Price

The land is an important tool to evaluate land value. Many years ago, scholars began to study Land prices. Takashi (2000) uses panel cointegration analysis to estimate the long-term equilibrium relationship based on the newly-built county land price data in Japan and then constructs the error correction model for land prices. There are many terms about urban land price, which can be divided into different land price types according to different purposes and classification basis in China's urban land price system. Song (1994) combed China's basic land

price classification system completely, among which the urban land price classification system is shown in table 1. Huang et al. (2003) took the coefficient correction method and other land correction methods as examples to study the relationship between the degree of land development and the benchmark land price under different correction methods.

Table 1: Classification System of Urban Land Price in China

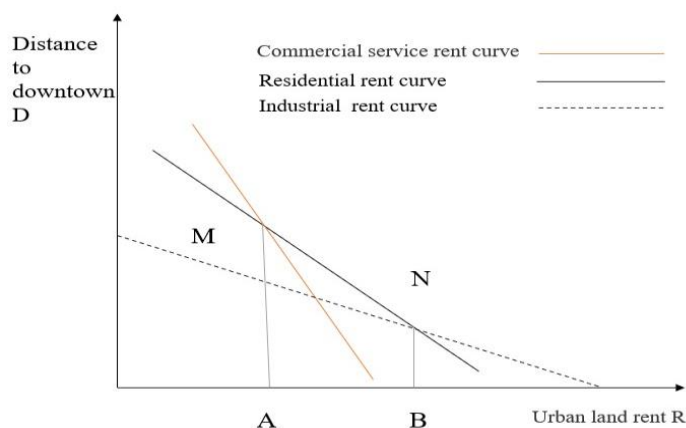
Classification basis	Main types
Usage of land	1. Commercial land price 2. Residential land price 3. Industrial land price
Application of the land price	1. Tax land price 2. Real estate appraisal 3. Evaluation price of land consolidation
Marking method of land price	1. Grade land price 2. District land price 3. Route price 4. Standard parcel land price
Unit of land price evaluation	1 Total land price 2. Land price per square meter 3. land price in terms of per unit floor
The way of land transaction	1. Agreement Price 2. Bidding price 3. Auction price
The formation of land price	1. Monitoring land price 2. Evaluate land price 3. Transaction land price
Land price management level	1. Benchmark land price 2. land lot price 3. Transaction land price
Property of land price Management form of land price	1. Income land price 2. Time value land price 1. Statutory land price 2. Benchmark land price 3. Marked price of land 4. Declare land price 5. Announced land price

Some scholars believe that “land is a commodity with limited supply”, and the finiteness of land also determines that its price follows the law of supply and demand. “In general, in line with the law of supply and demand, the higher the land price, the higher the supply, and the corresponding decrease in demand. The lower the land price, the lower the supply and the higher the demand. However, the sensitivity of land supply and demand to price is different because of the different types of land use.” “The local price exceeds a certain limit, but the supply of land is not increased because of the landlord’s demand for value preservation so that the upward trend of land price cannot be contained, thus the competition for land sales is difficult to establish.” Under this premise, in China, the government has carried out some regulatory actions on the land, and the government’s behavioral factors have had some influence on the land price (Xiao et al. 2008). These studies can explain the real problem of high land prices to a great extent. Ball (2014) based on the undeveloped land price data in the urban fringe of the Melbourne metropolitan area, Australia, and used model analysis to find that the urban growth boundary had a significant positive impact on the trend of urban housing prices. Sampath Kumara et al. (2015) mainly use multiple regression and neural network technology to predict land price in the Indian metropolitan area. The results show that the land price in the southern and western regions of the metropolitan area has increased sharply.

Research Progress on Spatial-Temporal Distribution of Land Price at Different Scales

Before discussing the influencing factors of land price, the spatial distribution of land price is often analyzed, and on this basis, the factors causing the unbalanced distribution of land price are analyzed.

Figure 1: Alonso's Urban Rent Gradient Curve



The German scholar Von Thunen was the first to touch upon the concept of location rent and its spatial changes. He first proposed a land rent model. On this basis, Alonso (1966) proposed a rent curve model for urban land bidding and then derived the theory of urban spatial structure equilibrium. As shown in figure 1, three rent curves representing commercial services, residence, and industry have different slopes. Among them, commercial services are the most sensitive to the distance from the city center (CBD), followed by housing, and the least sensitive to industry. In other words, the influence of the city center (CBD) has the greatest influence on the land price of commercial land, followed by the influence on residential land and the worst influence on industrial land. For the spatial analysis of land price on the macro scale. After that, Asao (2004) compiled panel data on land prices in two major metropolitan areas to study the temporal and spatial characteristics of land prices in Japanese metropolitan areas in the late 1980s. Based on one-dimensional and two-dimensional diffusion models, it is found that the areas where land prices rise the fastest are in a north-northeast and southwest-west directions. On the macro scale, Zhang et al. (2014) used 49 cities with relatively mature land market development as the research object to analyze the trajectory of changes in the center of gravity of comprehensive land prices in Chinese cities, showing that land prices in different periods show a trend of changes from east to the southwest to northeast. Yuan et al. (2017) took the Yangtze River Delta urban agglomeration as an example to explore the spatial pattern of urban land prices based on spatial autocorrelation and geographically weighted regression method (GWR) analysis methods, revealing that the areas with higher urban commercial and residential land prices in the Yangtze River Delta are mainly concentrated in first and second-tier cities. Industrial land prices are increasing from north to southeast.

The changes in land prices show phased characteristics over time. In terms of space, land prices in urban central areas and urban-rural fringe areas have increased the fastest. For the spatial analysis of land price on the middle-size scale, Yang et al. (2016) took Xi'an as the research object and researched the trend and interpolation of land prices. The results showed that the urban land prices showed an irregular circle structure in the spatial distribution, that is, land prices gradually decayed from the city center to the surroundings.

The research on the combination of time and space of urban land price has gradually increased since the 1990s. With the rapid development of geographic information system (GIS) technology, the research on the temporal and spatial evolution of land price has gained new

technical help. Since then, the relevant empirical research on urban land price has gradually increased. McMillen (1996) used GIS technology to study the temporal and spatial differentiation characteristics of land price in Chicago from 1836 to 1990 and found that Chicago was no longer a single-center urban land use pattern after 1960. Since then, McMillen's (2003) research on Chicago has also confirmed the price gradient curve of urban land price. Ahlfeldt et al. (2011) also found a similar law to the above mentioned in their research on Berlin. Their research showed that Berlin kept a single-center land use pattern from 1890 to 1936, during which the gradient curve of land price was relatively gentle. Generally speaking, after the 21st century, the spatial-temporal distribution analysis of land price, which combines land economics and geostatistics, began to be tried a lot. Zhang et al. (2007) analyze the time-space character of residential land price from 2001-2007 based on land price investigation and dynamic monitoring at Hohhot. Among the numerous research results, many scholars have studied the spatial-temporal differentiation of urban land prices from different angles, which can be divided into the following two aspects.

One research angle is based on geostatistics and GIS spatial interpolation technology to describe and analyze the spatial and temporal differentiation characteristics of urban land price and measure the influencing factors and analyze their action mechanism with the help of econometric models. Chen et al. (1999) taking Changzhou as the research object, this paper preliminarily reveals the spatial differentiation and evolution characteristics of urban land price from two dimensions of time and space. Wu et al. (2001) explored the specific application of this method in land grading and benchmark land price evaluation. Zhang (2002) predicted the evolution and future development trend of the spatial structure of urban land price in Lianyungang. Jiang et al. (2005) applied Kriging spatial interpolation method to the spatial distribution of residential land prices in Beijing, and the results showed that the spatial distribution of urban residential land prices was both continuous and variable.

Another main research angle is the spatial-temporal differentiation characteristics of urban land price, which focuses on the coupling of spatial distribution and time series change. Zheng et al. (2004) established the digital land price model of Jinan in 1998 and 2001 and preliminarily revealed the spatial-temporal differentiation characteristics of urban land price from two dimensions. Zhang et al. (2007) used the actual transaction land price data from 2001 to 2005 in Kunming to analyze the spatial and temporal distribution characteristics and influencing factors of land price in the study area. Zhao (2022) took the main urban area of Zhengzhou of China as an example, using the residential land transfer data and POI data from 2015 to 2019, analyzed the spatial distribution pattern of urban residential land prices, and further explore the causes of the spatial differentiation of urban residential land prices.

Research Progress on Influencing Factors of the Land Price at Different Scales

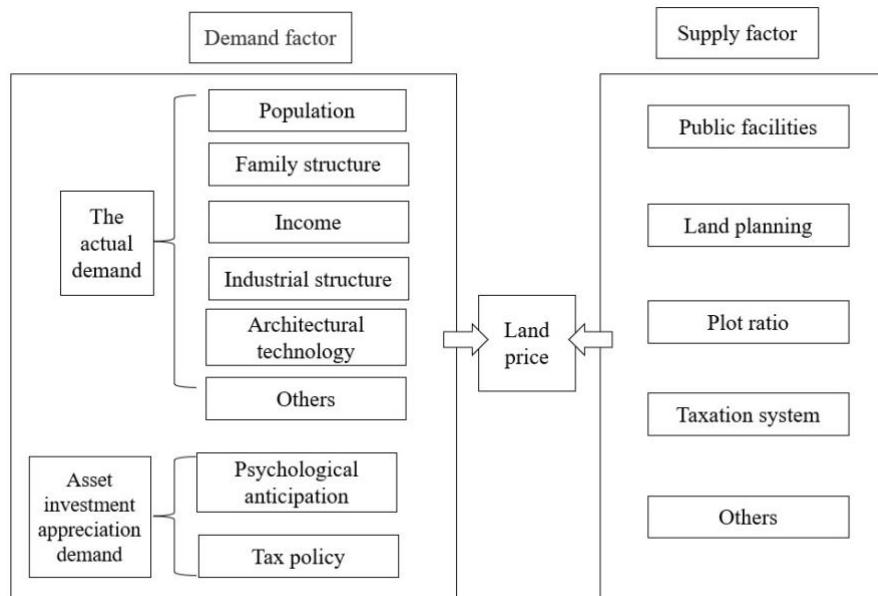
The determination of urban land price factors and their weights has gone through a long process of exploration. It is elaborated from two aspects: the selection of urban land price influencing factors and the determination of the weight of urban land price influencing factors.

The selection of urban land price influencing factors

The stationarity of land determines the non-transferability of land entities in the process of land transaction, which also determines the difference between the formation mechanism of land price and general commodity price. Because of the spatial non-transfer of land entities, the land prices have regional differences, which are manifested in the regional differences in land prices in different cities. On the other hand, it shows the regional differences in land prices within the same city. In the real land transaction, the location factor has always been one of the important

factors of urban land price and income of different grades, and sometimes even plays a decisive role. Therefore, it is necessary to discuss and comment on the location theory, and further discuss the relationship between urban location and land price based on commenting on the location theory.

Figure2: The influencing factor system of the urban land price proposed by Yoshio

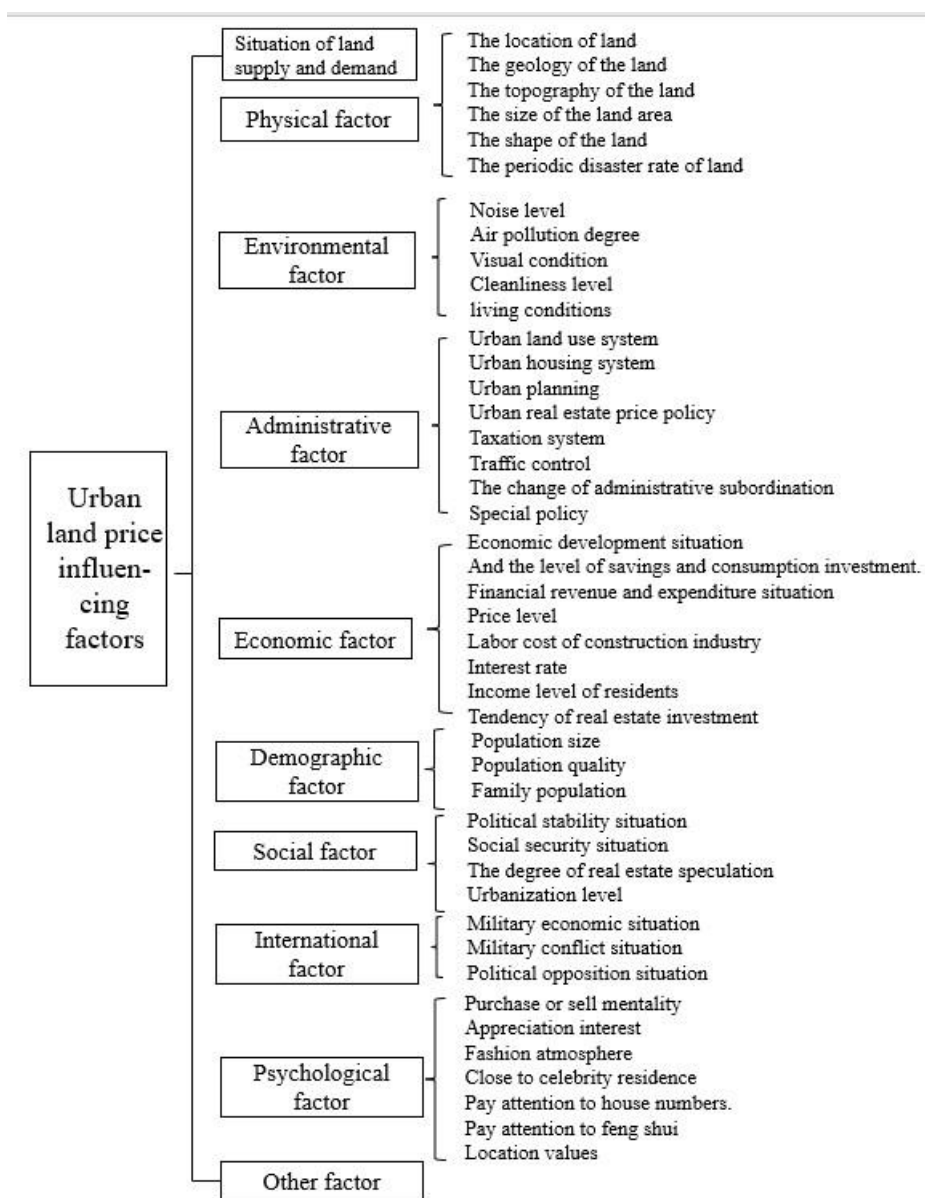


Discussions on the factors affecting land prices have gradually increased, and urban land prices are affected by many factors. There are many ways to classify the influencing factors. Based on different research perspectives and inductive classification standards, some scholars have classified the influencing factors.

Japanese scholar Yoshio (1997) divided the factors affecting urban land prices into two categories: demand factors and supply factors according to the mechanism of influencing factors (Figure2).

In China, as shown in figure 3, Yang (1994) separated the supply and demand of urban land, physical factors, population factors, international factors, etc. He classified the influencing factors into ten influencing factors, which generally covered the influencing factors of land price. Charles et al. (2001), based on the classical quartering method, added the psychological factors of people who are the main body of land consumption into the system of influencing factors of urban land price.

Figure 3: The influencing factor system of the urban land price proposed by Yang Jirui



It is common to classify the influencing factors according to their different spatial research scales. Some of these are divided into macro-factors and micro-factors according to the different ways and sizes of their effects, and some of them can be divided into internal factors and external factors according to the different influences of the internal and external conditions of land prices. Guo et al. (2021) in order to study the land price change and its influencing factors in China's surrounding capital and Xiong'an new area, selected the internal factors of land transfer as evaluation factors, and the grey correlation method was used to study the influence degree of these factors on the land price. The results show that the policy effect and urbanization rate are the two influencing factors that have the greatest influence on the land price changes in China's surrounding capital and Xiong'an new area.

The formation of urban land prices is greatly influenced by macro-factors, which are mainly discussed in a general way from the aspects of the urban economic level, urban planning, the urbanization process, national policies and regulations, population quantity, and

growth rate. Keith (2007) studied the effect of land use development plans in more than 100 cities in Florida on land prices and found that greater regulatory restrictions would reduce land prices. Micro-factors that affect the urban land price is mainly those individual and special factors that affect the change of urban land price. They mainly affect the price difference of different plots within a region.

On the middle-size scale, He (2016) studied the spatial-temporal differentiation of residential land price and the spatial-temporal characteristics of influencing factors in the main urban area of Chongqing. Chen et al. (2020) to study the influencing factors of housing land price in Nanchang of China, referring to the index system of urban land grading factors in Nanchang.

The microcosmic factors are analyzed from the aspects of parcel factors, location factors, and neighborhood factors. Individual factors of a parcel are the factors that affect its land price due to the change of its conditions, such as the shape, area, natural conditions, micro-location, and plot ratio of a parcel in a region, etc. Location factors generally include the influence factors of CBD, urban traffic factors, agglomeration factors, purchasing power factors, etc. Barrett (2017) analyzed the influence of a single specific factor on the macro scale, using the spatial difference method to study the impact of Wal-Mart's new store location on land prices in American cities and found that land prices rose the fastest within a quarter-mile of the new Wal-Mart store area. Robert et al. (2002) applied the Hedonic model to study the relationship between different rail transit services and land prices, it is found that the land prices of commercial services near the train station are significantly higher than those of residential areas. Micro-factors of neighborhoods mainly include three factors, namely, socio-economic variables, such as the distribution of occupational distinction, the infrastructure provided by the government, environmental factors including environmental pollution, etc.

At present, through reading the literature, the selection methods of influencing factors of urban land price are summarized into two types: The expert evaluation method and the Logical data analysis method.

The expert evaluation method refers to the method by which experts engaged in land price evaluation determine some factors that affect urban land prices and distribution differences based on long-term evaluation and research experience. In the book "The Principles of Land Value" (RM Hard,1924), land prices are governed by the following three factors: the motivation to create cities, the macro-location of the city, and the development direction of the city. On the macro scale, Dong et al. (1989) initially discussed participation factors and factor systems. He put forward the four main factors affecting urban land prices: city location, city facilities, environmental quality, and natural conditions. Dong et al. (1993) analyzed the main factors affecting the regional differences in urban land income based on the research in 1989. Established a multi-factor comprehensive evaluation index system with a total of 17 indicators in six aspects. On the middle-sized scale, Dong et al. (2005) conducted a horizontal comparison of 11 cities in the Yangtze River Delta and showed that there is a clear correlation between the level of urban land prices in the region and the level of regional economic development of macro factors. Yan et al. (2006) divided the factors affecting land prices into core factors and external factors. The results show that the the core factors are relatively large. The impact on land prices is greater than external factors.

With the deepening of research on the factors affecting urban land prices, the proposed factors gradually increase. At present, through reading and analyzing the literature, the influencing factors in the literature are listed and classified, to find out the influencing factors with the highest utilization rate and help the analysis results to be more comprehensive and objective by using the logical analysis method. Logical data analysis methods such as principal component analysis are often used to help analyze the influencing factors more scientifically. Through mathematical transformation, many factors are transformed into several main

components that are not collinear with each other, and then the influencing factors are scientifically analyzed to reduce the problems caused by the subjectivity of the factor determination and make the evaluation results more reasonable.

In the macroscopic scale, Du and Mulley (2006) used the Tyne and Wear area of the United Kingdom as an example, studying the relationship between traffic accessibility and land prices. The results showed that traffic accessibility has both positive and negative effects on land prices in certain areas. Le et al. (2016) explored the dynamic evolution process of the spatial structure of land prices in Shenzhen under the influence of rail transit factors. Through descriptive analysis and spatial measurement model empirical research, it is found that the land price around the rail transit station is affected by the distance from the city center or cluster center and the space attenuates, while showing obvious station orientation. Huang et al. (2017) used the 2007-2013 industrial land price data and prefecture-level city socio-economic data to test the impact of local government economic behavior on industrial land prices under different industrial structures.

The Weight of Urban Land Price Influencing Factors

The research method of the weight of urban land price influencing factors mainly includes the subjective assignment method, regression analysis method, and geographically weighted regression method.

Subjective assignment method

This method is mainly to ask experts and scholars in related majors to score or compare and sort the factors according to their importance and get the weight of each factor after sorting it out. Commonly used methods are the Expert grading method, Factor pair comparison method, and Analytic hierarchy process (AHP). Although this kind of method has carried out certain management organization analyses, it emphasizes qualitative analysis and does not have a strong mathematical theoretical foundation. Qiu et al. (2010) studied the AHP method to analyze the factors affecting land prices. He believes that economic factors are the most important factor affecting land prices. On the microscopic scale, Lin (2016) used the AHP method to evaluate the land intensive use in Taoyuan New District of Hangzhou. Subjective evaluation methods such as Analytic Hierarchy Process come from the long-term evaluation and research experience of experts engaged in land price evaluation. They propose some factors that affect the difference in the spatial distribution of urban land prices as evaluation indicators. Although this method makes qualitative evaluation and has a certain reference value, the determination of index weight is subjective and lacks objective data support (Wang et al, 2019).

Regression analysis method

Both the influencing factors and the weight determination of urban land prices have undergone a long-term exploration process. In the early days, some main ideas were put forward mainly based on experience, but this method is highly subjective, and then gradually transitioned to a logical quantitative method. The regression analysis method is the main application of the logical quantity method. Regression analysis is an analytical method to verify whether the independent variable has a significant influence on the dependent variable by conceptualizing the real problem as the relationship between the independent variable and the dependent variable (Huang, 2014). The ordinary least squares (OLS) method is the basic form of regression analysis. For most application fields, establishing an appropriate mathematical function model that fits the relationship between variables based on existing data is an

indispensable and important means to reveal the internal relationship between variables. It is one of the methods with a more ideal fitting effect (Mo et al, 2019). The Ordinary least squares (OLS) method is the most commonly used estimation method for linear models. The Ordinary least squares (OLS) method is known as a traditional parameter estimation method, and it is also one of the main methods for studying influencing factors.

Ding et al. (2015) compared and analyzed the relationship between capital structure and its influencing factors through the analysis results of the OLS model at the macroscopic scale. On the microscopic scale, Wei et al. (2017) used the OLS regression method and quantile regression method, from the external environment and peasant household resource endowments analyze the relevant factors that affect the household income of peasant households. But when multiple variables are used for influencing factor analysis, multicollinearity is prone to occur, which will make the parameter estimates unstable in practical applications and may lead to inconsistent results reasonable. In response to these effects of multicollinearity on model estimation, Horel and Kennard respectively proposed and developed a method to improve ordinary least squares estimation in 1962, namely Ridge Regression. At the middle-sized scale, Shu (2018) uses the ridge regression method to analyze the influencing factors of the total retail sales of consumer goods in Shanghai. At the micro-scale, Wang (2019) used the ridge regression principle and method to study the effect of retail sales of consumer goods on urban residents' income, rural residents' income and urbanization rate. The ridge regression method is an improvement of the least square method. The ridge regression model is used to avoid the influence of this problem in the model, to better explain the influencing factors of urban land prices, and then to formulate the government Related policies to provide a reference. Although the ridge regression analysis method is seldom used in the analysis of influencing factors of land price, it can be used to supplement the regression analysis method in the future.

Geographically weighted regression method

Based on regression analysis, some scholars began to use geographically weighted regression (GWR) and other models to analyze the degree of influence of each factor in different regions. In the middle-size scale, Lv et al. (2010) apply spatial statistical analysis and the GWR model, exploring the effects of various factors on residential land price in Beijing based on the GWR model. Zhang et al. (2012) constructs a GWR model of residential land price and explores the influential factors and their spatial variability characteristics that impact on residential land prices in different Jiangsu urban areas in 1997, 2005 and 2008. Zhang et al. (2018) combine the characteristic price method with the geographically weighted regression (GWR) model to explore the spatial differentiation and the influencing factors of the second-hand house price in Beijing. Lai et al. (2019) uses the GWR model to explore the important factors affecting commercial land price changes based on the analysis of the spatial characteristics of land price in the central city of Nanchang. The geographically weighted regression (GWR) model reveals the mechanism of action of each factor on land prices in different spatial locations through the spatial differences of influencing factors and their intensity. This model has the advantage of revealing spatial non-stationarity and spatial dependence (Mulley et al, 2018). But in the modeling process, an important assumption of using the GWR method is "significant spatial heterogeneity or non-stationary characteristics in the spatial data relationship", which has strict requirements on the spatial position balance of the study area (Lu et al, 2020). Tang et al.(2012) used different models to analyze the spatial differentiation and influencing factors of Shanghai's housing prices and found that the GWR model is intuitive in revealing the complex relationship between housing prices and spatial influencing factors, and can visualize the spatial structure of urban housing prices, which is

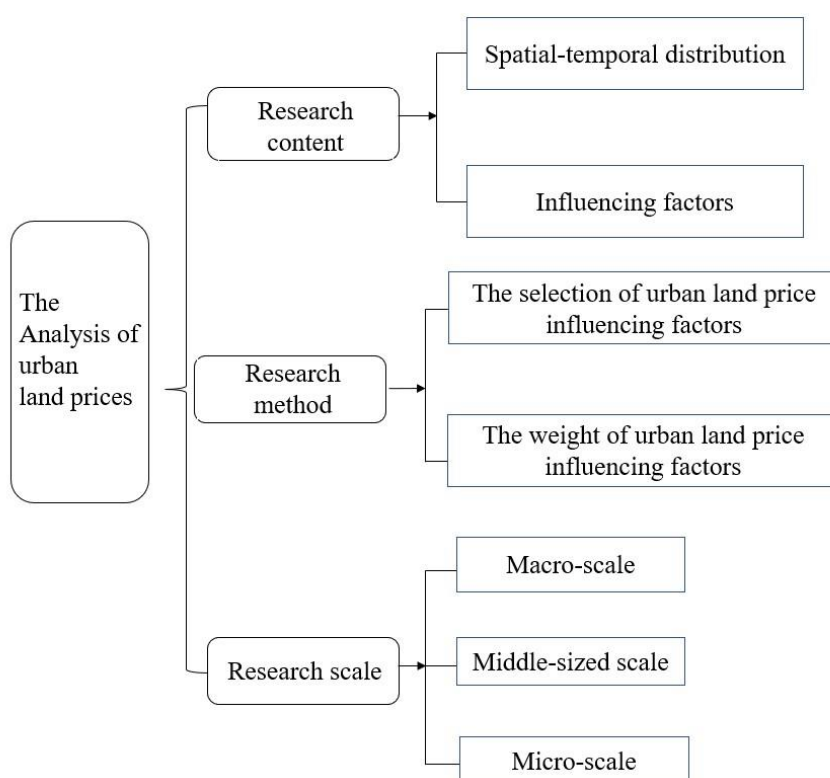
suitable for the study of the spatial and temporal differentiation and influencing factors of urban land prices when the data is large and meets the operational requirements.

When evaluating the influencing factors, we can get more scientific and reasonable results by choosing the appropriate regression analysis method to analyze the data. Because of the influencing factors and factors of the urban land price at different scales, including economic data, population data, urban construction data, residents' living standard data, etc. Regression analysis including the GWR method can give full play to the advantages of the geographic information system, reveal the complex spatial relationship in land price data, give full play to its powerful spatial data processing and analysis ability, and carry out a scientific and comprehensive analysis of data.

CONCLUSION AND DISCUSSION

From figure 4, we can see the research framework for the analysis in this paper. The research of urban land price is mainly listed and analyzed from the aspects of research contents, research methods, and research scales.

Figure 4: The Research framework of the Analysis of influencing factors of urban land price



From the above research results on urban land prices, scholars have done a lot of research to study land price-related issues. Urban land price research mainly focuses on theoretical research, spatial differences, and the influencing factors of land price. The theoretical results are more abundant than before, but there are still fewer people who have discussed it from different scale perspectives.

At present, the research on the spatial distribution characteristics of urban residential land prices primarily focuses on two perspectives. The first perspective involves the description and analysis of the spatial-temporal distinctive features and evolution of urban land prices using

geostatistics and GIS spatial interpolation technology. Additionally, econometric models are utilized to measure the influencing factors and deconstruct their mechanisms. The other is the study on the spatial-temporal differentiation characteristics of urban land price, which focuses on the coupling study of spatial distribution and time series change. The temporal and spatial distribution of land prices at different scales are different, and the influencing factors are also different. Although there are many research methods and research models, it is not enough to analyze the influence degree of the influence factor on a single scale. It is necessary to continue a multi-scale comprehensive discussion and analysis of land prices.

From the research of scale angle on the influencing factors of urban land price, there are both normative research and empirical research, but in the empirical research, micro-scale research is relatively few, mainly because the construction of the land market in small administrative units is not perfect, and the land data is updated slowly and the updated results are difficult to obtain. On the macro scale and meso-scale, the urban land market is relatively perfect, the degree of land marketization is high, and most of the data are open, and the easy availability of data makes the scholars' research on land price more in-depth and specific. Therefore, in the future, when studying urban land prices, we should pay attention to micro factors. Additionally, the study of the factors that influence land prices mostly took one or several cities in the same year or one city in different years as the empirical object, lacking the whole research on the influencing factors of land price of different scales. Therefore, in the future, when studying urban land prices, we should pay more attention to the related content of influencing factors of different scales of land prices. Through reading and analyzing the literature, the study takes the analysis of the whole research on the influencing factors of residential land price of different scales. These findings are used to enrich the existing land price research system and provide ideas for people who want to study land prices from different angles. In addition, the comprehensive analysis based on the scale is helpful to provide a reference for different regions to formulate land price-related policies.

ACKNOWLEDGMENT

Part of this article was extracted from a doctoral thesis submitted to Universiti Malaysia Sabah, Sabah.

REFERENCES

- Alonso, W. (1964). Location and land use. Toward a general theory of land rent. *Location and land use*. Toward a general theory of land rent.
- Asao, A., Uchida, R. (2004). The Space-Time Structure of Land Prices in Japanese Metropolitan Areas. *The Annals of Regional Science*, 38(4):655-675.
- Ball, M., Cigden, M., & Taylor, E. (2014). Urban Growth Boundaries and Their Impact on Land Prices. *Environment and Planning A*, 46(12):3010-3026.
- Barrett A. Slade. (2017). Big Box Stores and Urban Land Prices: Friend or Foe? *Real Estate Economics*, 46(4).
- Cao, T.B., Huang, K.L., & Li, J.B. (2013). Research on spatial variation and evolution of residential land price in Nanjing based on the GWR Model. *Geographical Research*, 32(12):2324-2333.
- Chang, J., Liao, Q.F., & Wang, L.J. (2011). Spatial distribution and influencing factors of urban land price in Changsha City. *Geographical Research*, 30(10): 1901-1909.
- Charles H. Wentzbach. (2001). *Modern Real Estate*. Beijing: Renmin University Press.
- Chen, F., Li, M.C., & Zhou, Y.K. (1999). Geostatistical analysis of the spatial distribution of urban land price. *Journal of Nanjing University (Natural Science Edition)*, 6, 77-81.

- Chen, K.Q. (2018). *Research on the Effect Mechanism of Urban Land Market Efficiency on the Coordination of Urbanization* [Doctoral thesis, Hunan University].
- Chen, Z.P., Guo, X., Zhao, L.H., &Guo, X.G. (2020). Research on the evaluation of residential land price based on the BP neural network model —— taking Nanchang city as an example. *Jiangxi Science*, 38 (04): 504-509+536.
- Ding, M.M., &Yu, C.Y. (2015). Influencing Factors of Capital Structure of Commercial Banks in China-Based on OLS Regression and Quantile Regression. *Journal of Nanjing University of Finance and Economics*, 01, 25-32.
- Dong, L.M., &Feng, C.C. (1989). A preliminary study on the theoretical method of the comprehensive economic evaluation of urban land. *Journal of Geography*, 44 (3): 323-332.
- Dong, L.M., Li, X.M., &Feng, C.C. (1993). Study on the regional differences and grading of paid use of urban land in China. *Journal of Geography*, 48 (1): 1-9.
- Dong, M.L., &Zhu, D.L. (2005). Study on the Relationship between Urban Land Price and Regional Economic Development in Yangtze River Delta. *Price Theory and Practice*, 6, 48-49.
- Gao, J.L., Chen, J.L., &Su, X. (2014). Influencing factors of land price in Nanjing Proper during 2001-2010. *Progress in Geography*, 33(2): 211-221.
- Goodchild, M. F., &Quattrochi, D. A. (1997). *Scale, multiscale, remote sensing, and GIS*. Boca Raton: CRC. Lewis Publisher, 1-11.
- Guo, A.Q., Han, S.Q., Li, Z., &Sun, Y. (2021). Analysis of land price changes and influencing factors around the capital and Xiong'an new area. *Science and Technology and Industry*, 21(08):281-287.
- Du, H., &Mulley, C. (2006). Relationship between Transport Accessibility and Land Value: Local Model Approach with Geographically Weighted Regression. *Journal of the Transportation Research Board*, 1997(1997):197-205.
- Hard, R. (1924). *Principles of city land values*. New York: Ann Arbor University Microfilm.
- He, T. (2016). *Study on the influencing factors of land price in the main urban area of Chongqing based on the characteristic price model* [Master thesis, Chongqing University].
- Huang, H.J. (2014). Application of AHP and Fuzzy Comprehensive Evaluation Method in Public Policy Evaluation [Master thesis, Central China Normal University].
- Huang, J.S., Chen, L.G., Zhang, Y.Y., &Zhao, A.D. (2017). Research on local government's economic behavior and industrial land price under the difference in industrial structure. *Industrial Economic Research*, 03, 81-90.
- Huang, Z.Y., Ge, J.F., &Liang, Y.Q. (2003). Revision of land development degree and its application in updating benchmark land price: a case study of Shijiazhuang City. *Journal of Hebei Normal University*, 06, 631-633+648
- Jiang, F., &Zhu, D.L. (2005). Study on spatial distribution law of land price based on GIS-taking Beijing residential land price as an example. *Economic Geography*, 25(2):199-202.
- Keith R. Ihlanfeldt. (2007). The effect of land use regulation on housing and land prices. *Journal of Urban Economics*, 61(3):420-435.
- Lai, X.H, Guo, X., Zhao, X.M., Yi, D., &Han, Y. (2019). Analysis of driving factors of commercial land price in downtown Nanchang based on GWR. *China land science*, 33(11):28-38.
- Le, X.H., Chen, J.X., &Yang, J.W. (2016). Influence of Shenzhen Rail Transit on Urban Spatial Structure: Analysis Based on Land Price Gradient and Development Intensity Gradient. *Geography Research*, 35(11):2091-2104.

- Li, S.C., &Cai, Y.L. (2005). Preliminary discussion on some problems of geographic scale transformation. *Geography Research*, 01, 11-18.
- Lin, J.W. (2016). Evaluation of Intensive Land Use in Development Zones Based on Analytic Hierarchy Process [Master thesis, Zhejiang University].
- Lu, B.B., Ge, Y., Qin, K., &Zheng, J.H. (2020). Overview of Geographically Weighted Regression Analysis Technology. *Journal of Wuhan University (Information Science Edition)*, 45(09):1356-1366.
- Lv, P., &Zhen, H. (2010). Study on influencing factors and spatial law of residential land price in Beijing based on GWR model. *Economic Geography*, 30 (3): 472-479.
- McMillen, D. P., McDonald, J. F. (1997). A nonparametric analysis of employment density in a polycentric city. *Journal of Regional Science*, 37(4):591–612.
- McMillen, D. P. (1996). One hundred fifty years of land values in Chicago: a nonparametric approach. *Journal of Urban Economics*, 40(1):100-124.
- Meenrenmeyer, V., &Box, E. O. (1987). *Scale effects in landscape studies*. Turner M Ged. Landscape Heterogeneity and Disturbance. New York: Springer-Verlag.
- Mo, X.Q. (2019). Linear and nonlinear fitting based on the least squares method. *Wireless Internet Technology*, 16(04):128-129.
- Mulley, C., Tsai, C. H. P., & Ma, L. (2018). Does Residential Property Price Benefit from Light Rail in Sydney? *Research in Transportation Economics*, 67, 3-10.
- Qiu, X.H., &Yu, W.J. (2010). Analysis of influencing factors of land price based on AHP. *Economic research guide*, 25, 148-151.
- Robert Cervero, Michael Duncan. (2002). Land Value Impacts of Rail Transit Services in San Diego County. *National Association of Realtors Urban Land Institute*.
- Sampathkumara, V., Helen, M., &Santhib, J. Vanjinathanc. (2015). Forecasting the Land Price Using Statistical and Neural Network Software. *Procedia Computer Science*, 57:112-121.
- Shu, F.H. (2018). Analysis of influencing factors of retail sales of social consumer goods in Shanghai based on ridge regression. *Journal of Shanghai Business School*, 19(05):39-45.
- Song, Y. J. (1994). On the Connotation of China's Land Price System. *China land science*, 05, 7-10.
- Takashi, H. (2000). Bank lending behavior under a liquidity constraint. *Japan and the World Economy*, 12(2):127-141.
- Tang, Q.Y., Wei, X., &Ai, F.L. (2012). Research on the spatial differentiation of Shanghai housing prices and its influencing factors based on geographically weighted regression. *Economic Geography*, 02,52-58.
- Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography*, 46(2), 234–240.
- Wang, C.Y., &Qiao, J. (2019). Application of Improved Analytic Hierarchy Process and Fuzzy Comprehensive Evaluation Method in the Evaluation of Dangerous Removal and Reinforcement of Dangerous Reservoirs. *Hydropower Energy Science*, 37(10):64-67.
- Wang, J.Y., &Cheng, Y. (2004). Multi-scale features and automatic synthesis of spatial data. *Ocean Surveying and Mapping*, 04, 1-3.
- Wang, K.Y., &Chen, T. (2018). Geographical prospects of spatial governance through a review of administrative divisions. *Acta Geographical Sinica*, 73(4): 688-700.
- Wang, M.C. (1997). On the spatial evolution law of urban land price and its motivation. *Tropical Geography*, 17 (4): 347-353.
- Wang, Y. (2019). Analysis of influencing factors of retail sales of social consumer goods in Jiangsu Province based on ridge regression. *Journal of Xuzhou institute of technology (Social Science Edition)*, 34(02):52-60.

- Wei, H.L., & Qi, Y.J. (2017). Analysis of influencing factors of household income of farmers based on quantile and OLS regression. *Journal of Agriculture and Forestry Economic Management*, 16 (1): 40-47
- Wen, H., & Goodman, A. (2013). Relationship between urban land price and housing price: Evidence from 21 provincial capitals in China. *Habitat International*, 40, 9-17.
- Wu, Y.Z., & Wu, C.F. (2001). Research on urban benchmark land price evaluation based on Kriging technology. *Economic Geography*, 05, 584-588.
- Xiao, G.S., & Li, Z.Y. (2008). Econometric Analysis of the Influence of Government Behavior Factors on Urban Land Price, *Jiangxi Social Sciences*, No.1. Page 86.
- Yan, T. (2006). A theoretical and empirical study on the influencing factors of urban land price under the background of regional economic integration. *Journal of Huazhong Agricultural University*, 5, 47-52.
- Yang, J. R. (1994). Analysis of the system of factors affecting land price. *Land Economy*, 03, 23-29.
- Yang, Y.Y. (2016). Study on Spatial Distribution Characteristics and Influencing Factors of Urban Land Price [Master thesis, Xi 'an: Northwest University].
- Yuan, S.F., Zhu, C. M., & Yang, L.X. (2017). Spatial distribution pattern and influencing factors of land prices of various industries in Yangtze River Delta urban agglomeration. *Resources and Environment of Yangtze River Basin*, 26(10):1538-1546.
- Noguchi, Y. (1997). *Land Economics*. Beijing: Commercial Press.
- Zeng, G.A., & Ma, Y.J. (2019). Research on the Impact of Land Prices on the Upgrading of Urban Industrial Structure—An Empirical Analysis Based on the Data of 105 Cities at Prefecture Level and Above in China. *Macroeconomic Research*, 06, 95-107.
- Zhang, H., & Jin, J. (2007). Empirical Study on Spatial Change of Land Price in Capital Cities of China-Taking Kunming as an Example. *China Land Science*, 21(1):24-30.
- Zhang, J., Zhang, L.F., & Pu, L.J. (2012). Study on the temporal and spatial evolution of urban residential land price based on GWR model-taking Jiangsu Province as an example. *Geography Science*, 32 (7): 828-835.
- Zhang, L. (2002). Spatial Structure of Land Price in Urban Development [Master thesis, Nanjing Normal University].
- Zhang, L.K., Yang, H.X., & Ge, J. F. (2014). Study on the Shift of Land Price Gravity Center and Driving Factors in Major Cities of China. *Geography and Geographic Information Science*, 30(06):70-74.
- Zhang, Y. F., & Li, J. (2007). Comparative analysis of urban benchmark land price and its influencing factors in counties of Hohhot. *Geography Research*, 02, 373-382.
- Zhang, Y.H. (2018). Research on the spatial differentiation of second-hand housing prices in Beijing based on the GWR model and its influencing factors [Master thesis, China University of Geosciences (Beijing), 2018].
- Zhao, J.M., Zhu, D.L., & Li, Y.Y. (2022). Research on spatial differentiation and influencing factors of urban residential land price based on new data-taking Zhengzhou as an example. *Modern Urban Research*, 03, 112-118.
- Zheng, X.Q., Wang, J.Y., & Yan, H. W. (2004). Application of digital land price model in spatial and temporal analysis of urban land price. *Resources Science*, 01,14-21
- Zhou, X.P., Qin, Z.Y., Zhao, S., & Chai, D. (2019). Spatial pattern, evolution characteristics, and influencing factors of China's residential land price-price ratio —— Based on spatial econometric analysis of 35 large and medium-sized cities. *China Land Science*, 33(01):40-48.
- Zhou, Y., Tang, N., & Wang, W. (2020). Study on the influence of multidimensional proximity on the spatial correlation of urban land price. *Regional Research and Development*, 39(03):65-69+82.

Zuo, Y.Q., &Chen, X.S. (2014). Study on the adjustment of urban administrative divisions in China from the perspective of scale theory. *Journal of Tianjin Administration College*, 16(03):27-33.