

Imbalance of Land Supply Structure and House Price

-- Empirical Analysis based on Panel Data of Yunnan Province

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Abstract

This paper studies the influence of land supply structure on the level of housing prices in 16 prefectures and cities of Yunnan Province, and further examines whether the land allocation is consistent with the direction of population flow. Through the analysis of panel data from 2016 to 2020 in Yunnan Province, it is found that the land supply structure in Yunnan Province is unbalanced, the supply of residential and commercial land has a negative impact on the level of housing prices, and the proportion of infrastructure and industrial land has helped the rise of housing prices. In terms of spatial distribution, the per capita construction land of cities with large population inflow in the province is significantly less than that of other states and cities. In order to suppress the differentiation of housing prices and establish a long-term mechanism for the healthy and stable development of the real estate market in Yunnan Province, we should optimize the land supply structure, focus on increasing the land supply in areas with large housing demand, and make the allocation of land elements consistent with the direction of population flow.

Keywords

Land Supply Structure; House Price; Spatial Mismatch.

1. Introduction

From 2016 to 2020, housing prices in Yunnan Province experienced a rapid rise. According to the data of the National Bureau of statistics, the average sales price of commercial housing in the province increased from 5269 Yuan/m² in 2016 to 8173 Yuan/m² in 2020, especially in Kunming, Xishuangbanna and Dali. Under the condition of market economy, the rapid rise of house price will lead to the increase of land supply to meet greater demand, and the rising trend of house price will be restrained. As the main body of land transfer, local governments in China will not put too much land into the real estate market, which makes the land always in a state of supply exceeding demand in the market [1]. Driven by the national policy of development and opening up along the border, the population of urban agglomeration in Central Yunnan, Kunming metropolitan area and open cities along the border has increased rapidly, and the degree of agglomeration has further increased. The urbanization in the future will attract more people to the big cities, and the influx of people also contains a huge demand for housing purchase. Changing the current constraints on land supply in large cities is an effective way to solve the housing demand of urban residents and an inevitable requirement to promote supply side reform. What is the relationship between the change of housing prices and the land supply structure in Yunnan Province? Is the distribution of land resources consistent with the trend of population migration? This is the focus of this paper.

2. Literature Review

The current research mainly discusses and analyzes the rise of housing prices from the perspective of demand and supply. This paper focuses on the impact of land supply on housing prices. Yu Liangliang found that the land supply structure significantly affected the housing price level by using the statistical data of 21 cities at and above the prefecture level in Guangdong Province [2]. Yan Jinhai found that the strategic land supply behavior of local governments with different degrees of tightness leads to the lower elasticity of housing supply in the more developed urban economy [3]. Jianhuang fan believes that the rise of house prices in China is due to the improper allocation of space and structure of land supply, and further finds that the lower the proportion of commercial and residential land supply, the higher the house prices [4]. In addition, some scholars believe that the unreasonable spatial distribution of land supply also has a certain impact on housing prices. Lu Ming believes that the differentiation of house prices is rooted in the mismatch between land supply and land demand [5]. Zhang Lu's research found that there is an obvious spatial mismatch in China's land supply, which is an important driving factor for the rapid growth of housing prices [6]. Ni Pengfei believes that the housing supply of land in large cities is relatively less and less than that in small cities, which leads to the differentiation of housing prices between large and small cities [7].

At present, the relevant theories and Empirical Analysis on the level of housing prices are relatively perfect. Many scholars have gradually shifted their influence on housing prices from the economic fundamentals to the supply level. Based on the panel data of 16 prefectures and cities in Yunnan Province from 2016 to 2020, this paper empirically analyzes the impact of land supply structure on housing prices in Yunnan Province by using the supply ratio indicators of residential land, commercial land, industrial land and infrastructure land, and explains the difference in housing prices in Yunnan Province from the perspective of spatial mismatch.

3. Theoretical Analysis

China implements a strict land use control system and a strict farmland protection system. The primary land market is monopolized by the local government, which determines that the local government plays a very important role in the land and the real estate market. The local government does not supply land at will, but should weigh the combination of land transfer types in the land supply structure to maximize the utility brought by the scarce construction land indicators [2].

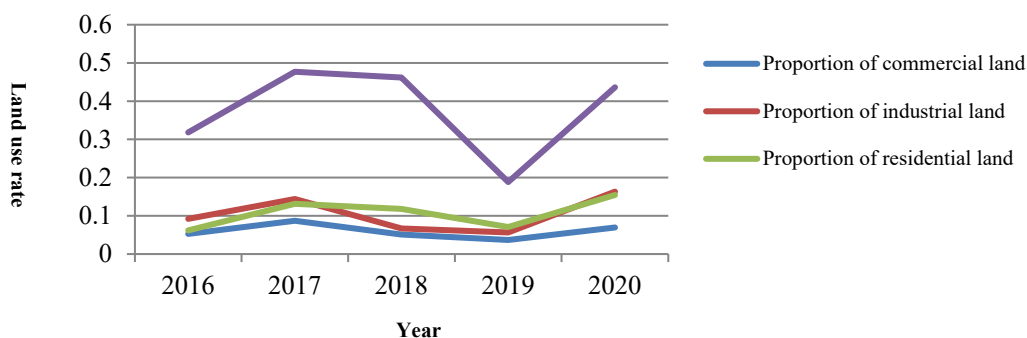


Figure 1. Supply structure of state-owned construction land in Yunnan Province from 2016 to 2020

It can be seen from Fig. 1 that the supply proportion of public management, public service land and transportation land in Yunnan Province has been high, the supply proportion of industrial

land has increased significantly in 2020, the proportion of residential land and commercial land continues to be low, and the supply structure is more distorted. The supply of infrastructure land has far exceeded the best level of society, but the supply is still growing. The local government increases the supply of industrial land, which will reduce the supply of residential land. Although it is conducive to attracting industrial capital, it increases the housing price and increases the living cost of consumers [8]. With the continuous advancement of new urbanization construction in Yunnan Province, the rigid demand for urban housing is becoming more and more obvious, and the supply ratio of residential and commercial land is decreasing year by year. This requires that the real estate market must carry out supply side structural reform.

For the regulation and control of China's housing prices, the government often focuses on restricting demand. Although the central government has also emphasized increasing the housing land supply of some cities with rapid rise in housing prices in the real estate regulation and control, in fact, the land supply in areas with high housing prices still lags far behind the growth of demand [5]. If the supply of land and housing can not meet the demand of labor, there will be a mismatch in the supply of land and housing, which will lead to the differentiation of housing prices among regions.

4. Measurement Model and Variable Selection

4.1. Measurement Model

According to the above theoretical analysis, in order to empirically test the impact of land supply structure on housing prices, the following regression model is set in this paper:

$$\ln HP_{it} = a_0 + a_1 rl_{it} + \alpha X_{it} + \varepsilon_{it} \quad (1)$$

$$\ln HP_{it} = b_0 + b_1 cl_{it} + \beta X_{it} + \varepsilon_{it} \quad (2)$$

$$\ln HP_{it} = c_0 + c_1 il_{it} + \gamma X_{it} + \varepsilon_{it} \quad (3)$$

$$\ln HP_{it} = d_0 + d_1 ml_{it} + \delta X_{it} + \varepsilon_{it} \quad (4)$$

In the above four formulas, subscript i represents 16 states and cities in Yunnan Province; t is time; a_0, b_0, c_0 , and d_0 is a constant term; The interpreted variable is $\ln hp_{it}$ is a variable to measure the level of housing prices in various states and cities; $rl_{it}, cl_{it}, il_{it}$ and ml_{it} is the core explanatory variable of land supply structure in each state and city; X_{it} is the selected control variable; ε_{it} is a random perturbation term.

4.2. Variable Selection

This paper takes 16 prefectures and cities in Yunnan Province as the research object. The time dimension is 2016-2020. The data for measuring the land supply structure is from the Department of natural resources of Yunnan Province. The commercial housing data and other statistical data are from the 2016-2020 Yunnan statistical yearbook, the statistical yearbooks of 16 prefectures and cities, and the statistical bulletin of national economic and social development of various prefectures and cities.

(1) Explained variable. In this paper, the total sales volume of commercial housing in each state and city is divided by the sales area of commercial housing to obtain the average price of commercial housing in each state and city, and then the logarithm value is taken. The result is taken as the explanatory variable to measure the level of housing price [5].

(2) The core explanatory variable. Land supply and housing prices interact with each other and are endogenous. Therefore, the exogenous variable of the proportion of various types of land supply is used as the core explanatory variable of this paper to reflect the land supply of various states and cities, namely, the supply ratio of residential land (RL), the supply ratio of residential land (CL), the supply ratio of infrastructure land (IL) and the supply ratio of industrial land (ML) [2].

(3) Control variables. In order to mitigate the bias of possible missing variables on the regression results, from the demand side, we consider the impact of economic development level [9], population density [10], urbanization rate [11], etc. on house price fluctuations. This paper uses the logarithm of per capita GDP ($\ln p g d p$), the logarithm of population density ($\ln p d$) and urbanization rate (UR) to control. The total amount of land supply [1], land price [12], investment amount of real estate development and completed area of commercial housing [13] will also affect the house price. From the supply side, the per capita supply of construction land (PL), the price of residential land (LP), the proportion of real estate development investment ($\ln i n v$) and the logarithm value of completed residential area ($\ln h b$) are considered to be controlled [2].

5. Empirical Analysis and Results

The endogenous problem among supply, demand and house price in the model will cause common OLS estimation bias. In order to ensure the reliability and robustness of the empirical test, this paper uses static panel estimation and Dynamic Panel System GMM model to reduce the potential deviation of the estimated parameters.

Table 1. Variables description

variable	Variable description	Calculation method	Mean	Std. Deviation	Min	Max
$\ln h p$	housing price	Sales volume of commercial housing / sales area, logarithm	8.591326	0.320203	7.906205	9.326836
$r l$	Proportion of residential land supply	Supply of residential land / total supply of construction land	0.144653	0.116378	0.0001092	0.647148
$c l$	Proportion of commercial land supply	Supply of commercial land / total supply of construction land	0.0808589	0.0653577	0.0010653	0.3806452
$i l$	Proportion of infrastructure land supply	(public management and public service land supply + transportation land supply) / total supply of construction land	0.419594	0.24599	0.0148754	0.870476
$m l$	Proportion of industrial land supply	Supply of industrial and mining storage land / total supply	0.128832	0.128057	0	0.751867

		of construction land				
lnpgdp	Per capita GDP	Per capita GDP (logarithm)	10.47563	0.410827	9.549666	11.44949
ur	Urbanization level	Urbanization rate	0.444653	0.096903	0.3014706	0.797036
lnpd	Population density	Population density (logarithm)	4.572183	0.723566	2.791165	5.971517
lp	Residential land price	Residential land price (logarithm)	7.241744	0.764507	4.797986	10.76758
pl	Per capita supply of construction land	Total supply of construction land / total population of the region	0.000818	0.001369	0.0000223	0.00886
hinv	Proportion of real estate investment	Real estate investment quota / fixed assets investment quota	0.133881	0.101664	0.0084709	0.458486
lnhb	Completed residential area	Completed residential area (logarithm)	3.874473	1.229666	-0.190555	5.977663

In this paper, the above four models are first tested by Hausman test, and the P values are 0.3319, 0.5829, 0.3564 and 0.5180 respectively, which indicates that it is reasonable to use the random utility model to estimate models (1) - (4). The estimation results are shown in columns 1-4 of Table 2. It can also be seen from table 2 that the results of the autocorrelation test AR (2) of the above model are 0.179, 0.682, 0.863 and 0.674 respectively, which indicates that the original assumption of "no autocorrelation of the disturbance term" can be accepted. It is considered that there is no second-order autocorrelation and the system GMM is applicable. In the overidentification test, it can be seen from Sargan and Hansen statistics that the original assumption that "all instrumental variables are exogenous" can not be rejected, which indicates that the model can be estimated by systematic GMM and the results of systematic GMM Estimation shown in columns 5, 6, 7 and 8 can be accepted.

From the regression results in columns 1 and 5, it can be seen that the proportion of residential land supply has a significant negative impact on the housing price in a region. In both columns of results, the significance test at the level of 10% is passed. The regression coefficients of the static and dynamic models are -0.594 and -0.980 respectively, which indicates that when the proportion of residential land supply increases by 1%, the housing price will drop by 0.594% and 0.980%.

From the regression results in columns 2 and 6, it can be found that the housing price level is obviously negatively affected by the proportion of commercial land. Through the significance test at the level of 10% and 5%, the static and dynamic model regression coefficients are -0.692 and -1.578 respectively. From the regression results, it can be seen that when the supply ratio of commercial land is increased by 1%, the housing price is decreased by 0.692% and 1.578% respectively.

From the results in columns 3 and 7, it can be seen that the proportion of infrastructure land supply has significantly contributed to the rise of house prices, and has passed the significance test at the level of 5%. The regression coefficients of the two estimates are 0.170 and 0.356 respectively, which indicates that if the total proportion of public management, public service and transportation land supply is increased by 1%, the corresponding house prices will rise by 0.170% and 0.356%.

From the data in columns 4 and 8, it can be seen that when the proportion of industrial land increases, it will significantly help the price rise. The significance test at the level of 1% and 5%

shows that if the share of industrial land is increased by 1%, the house price will rise by 0.506% and 0.855% respectively.

Table 2. Estimation results of benchmark regression model

variable	RE(1)	RE(2)	RE(3)	RE(4)	S-GMM(1)	S-GMM(2)	S-GMM(3)	S-GMM(4)
lnhpi _{t-1}					0.578***	0.647***	0.825**	0.321**
					(0.136)	(0.181)	(0.341)	(0.131)
rl	-0.594*				-0.980*			
	(0.331)				(0.553)			
cl		-0.692*				-1.578**		
		(0.362)				(0.776)		
il			0.170**				0.356**	
			(0.0859)				(0.179)	
ml				0.506***				0.855**
				(0.176)				(0.394)
lnpgdp	0.206*	0.520***	0.573***	0.637***	0.0982	0.0811	0.0563	0.408
	(0.106)	(0.0972)	(0.0989)	(0.101)	(0.381)	(0.0817)	(0.315)	(0.266)
ur	0.273	0.702	0.704	0.991*	0.435	0.876	1.139	0.714
	(0.596)	(0.602)	(0.602)	(0.596)	(2.974)	(1.629)	(1.034)	(3.978)
lnpd	0.00484	0.144	0.160	0.183	0.0506	0.0379	0.0381	0.0116
	(0.0769)	(0.119)	(0.119)	(0.115)	(0.140)	(0.118)	(0.134)	(0.276)
lp	0.117**	0.0527	0.0322	0.0219	0.105	0.0177	0.0859	0.128
	(0.0538)	(0.0321)	(0.0314)	(0.0309)	(0.167)	(0.0507)	(0.0652)	(0.0416)
pl	-49.31	-41.43**	-9.670	-48.94***	-59.58	-37.74	-24.38	-68.04**
	(30.90)	(18.80)	(18.10)	(18.13)	(43.55)	(28.42)	(38.62)	(27.96)
hinv	1.671***	1.194***	1.037***	1.053***	0.588	0.983***	1.777	0.954
	(0.427)	(0.403)	(0.388)	(0.377)	(3.965)	(0.277)	(2.105)	(0.894)
lnhb	-0.0581	-0.0678**	-0.0556*	-0.0606*	-0.0349	-0.0187	-0.0193	-0.00161
	(0.0424)	(0.0322)	(0.0338)	(0.0313)	(0.0439)	(0.0393)	(0.0491)	(0.0562)
_cons	5.804***	2.605**	1.946*	1.550	2.182	2.653**	1.261	1.447
	(1.056)	(1.068)	(1.081)	(1.067)	(5.617)	(1.185)	(3.020)	(2.164)
AR(2)					0.179	0.682	0.863	0.674
Sargan					0.209	0.157	0.430	0.192
Hansen					1.000	1.000	0.936	1.000
Observed value	80	80	80	80	80	80	80	80

Note: *, **, *** are significant at 10%, 5% and 1% respectively; Values in brackets are standard deviation.

The above empirical regression results show that the house price fluctuation of 16 prefectures and cities in Yunnan Province is significantly affected by the land supply structure in the random effect and System GMM model. The more the supply of residential and commercial land, the lower the house price, the more the supply of infrastructure (public management and public services, transportation land) and industrial land, and the higher the house price.

As shown in the regression results in Table 2, the house prices in the previous year passed the significance test at the levels of 1%, 1%, 5% and 5%, and their respective regression coefficients are positive, which indicates that the current house price level will have a significant impact on the future house price level. The level of per capita GDP in a region is closely related to the level of housing prices. Areas with a high degree of economic development tend to have a high level

of housing prices. The relationship between urbanization rate and housing price has a certain degree of correlation, but it is not a decisive factor. Housing price is directly proportional to urbanization rate. Population density plays a positive role in promoting housing prices, which also means that the larger the population density, the more housing demand, and the higher the housing prices. In the static regression, the 5% significance test results show that the continuous rise of residential land prices has driven the rise of housing prices. The static and dynamic panel regression results show that the per capita supply of construction land has a restraining effect on the rise of housing prices. The proportion of real estate investment plays a positive role in promoting the housing price, indicating that a large amount of funds are invested in the real estate market at present, and the overheating of real estate and the speculation brought by it also lead to the rapid rise of the housing price. The completed residential area has a negative impact on the housing price, which shows that the government's regulation of land supply has caused the oversupply of the real estate market, and the imbalance between supply and demand will inevitably lead to the rise of the housing price.

The fluctuation of housing price level in Yunnan Province is not unrelated to the large number of labor migration accompanying the development of urbanization. The widening gap in economic development between regions in Yunnan Province has led to the widening gap in residents' expected income and other aspects, thus attracting a large number of labor to the developed areas. The high level of urban development has produced a strong "magnetic field effect" on population migration.

There is no public data on population migration between cities in China. In order to measure the population flow of various cities in Yunnan Province, according to Lang Yu's research ideas, this paper uses "(population at the end of the year - population at the end of the previous year - population at the end of the previous year * natural population growth rate) / population at the end of the year" as the calculation formula, and the obtained value (PFS) is used to measure the speed of population flow [9]. When PFS > 0, the population flows in. This paper uses geoda's natural breakpoint method to show the population flow of various prefectures in Yunnan Province in 2016, 2018 and 2020, as shown in Figure 2.

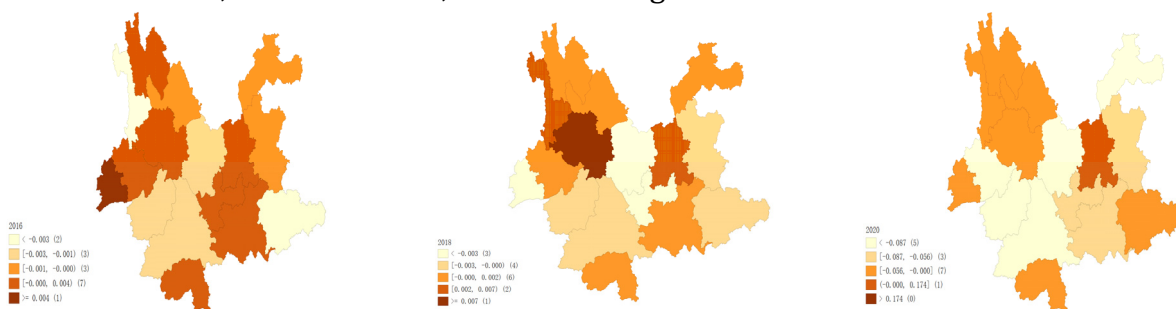


Figure 2. Population flow in Yunnan Province from 2016 to 2020

With the implementation of policies such as new industrialization and urbanization of agricultural transfer population, Yunnan Province has made historic achievements in the construction of population urbanization, and the population continues to gather in regional central cities with more developed economy and better public services. From the perspective of population flow, the population of the whole province continues to gather in Central Yunnan, central cities along the border and regional central cities.

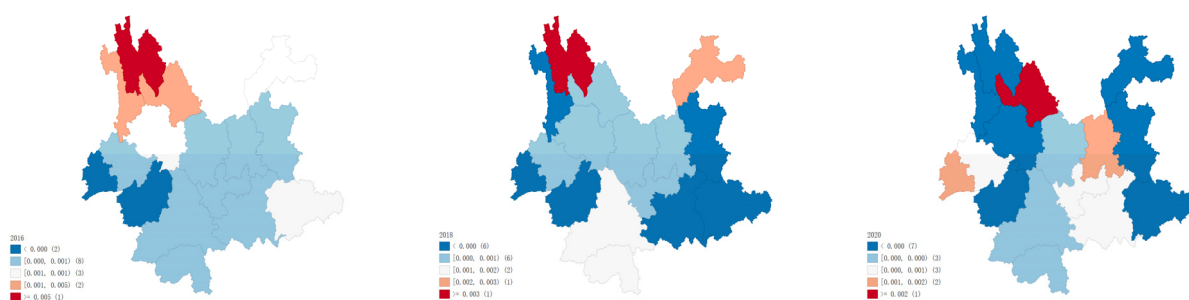


Figure 3. Per capita construction land area in Yunnan Province from 2016 to 2020

Kunming, the provincial capital, has always been the city with the highest house price in Yunnan Province. As the political, economic and transportation center of Yunnan Province, in May 2017, the house price of Kunming successfully exceeded 10000, standing on a new platform. For other cities in the province, Kunming is the provincial capital city with higher economic development level and more resource advantages, which can attract more population inflow. However, the per capita construction land over the years is relatively small compared with other states and cities in the province. In recent years, many new real estate development enterprises have poured into the real estate market in Kunming. The developers have obvious demand for the land market, and the new development enterprises are facing the dilemma of "lack of land", which has played a very important role in promoting the housing price in Kunming. As a well-known destination in Yunnan and even the whole country, Dali has witnessed rapid economic growth and further increase in housing prices. In April 2017, Dali began to comprehensively implement the "seven activities" for the protection of Erhai Lake. In order to protect the ecological environment of Erhai Lake, the urban center of Dali moved eastward. Its land resources have become increasingly scarce. It can be seen from Figure 3 that the per capita construction land area in Dali is at a low level in the province. From the perspective of land structure, the supply of residential land in Dali is relatively short. "Land scarcity and high house prices" are the difficulties faced by Dali Prefecture at present.

Xishuangbanna with excellent ecology and the connection of China Laos Railway (Pan Asia high speed railway) attract a large number of people. Housing prices in Xishuangbanna have experienced many ups and downs. Since 2018, housing prices have remained high. By 2020, the outbreak of the epidemic has hit the housing prices in Xishuangbanna, but the per capita construction land area is also at a low level in the province

With the continuous inflow of population, the disease in big cities has become more and more serious, resulting in the deterioration of urban environment, traffic congestion and high housing prices. In order to mitigate the negative impact of too high house prices on the economy, we should first improve the spatial distortion of land supply and increase the land supply to large cities to ease the rise of house prices.

6. Conclusion and Policy Recommendations

This paper takes the 16 prefectures and cities in Yunnan Province as an example, and makes a statistical analysis of the land supply data of the 16 prefectures and cities. The results show that the land supply of the 16 prefectures and cities presents the phenomenon of internal structure imbalance and spatial mismatch. The study finds that the supply of residential and commercial land has a significant negative effect on housing prices, while the supply of infrastructure and industrial land has a significant positive effect on housing prices. In terms of spatial distribution,

Kunming, Dali, Xishuangbanna and other cities have always been cities with large population inflow. However, compared with other cities, the land supply is more restricted, which is specifically reflected in the per capita supply of construction land. The above phenomena and results show that Yunnan Province has not allocated valuable land resources to those areas with the most urgent use and the highest efficiency, resulting in the rapid rise of housing prices in these areas. The proportion of housing prices to income far exceeds the acceptable reasonable range, and there is a large gap in housing prices between regions, which has a negative impact on the long-term development of Yunnan Province.

In view of the imbalance of land supply structure and spatial mismatch in the real estate market of Yunnan Province, in order to effectively suppress the differentiation of housing prices, this paper puts forward the following policy suggestions:

(1) We will accelerate the adjustment of the land supply structure, optimize the land supply structure, reduce the supply of land for infrastructure, increase the supply of land for residential and commercial use, strengthen the construction of ordinary commercial housing and low rent housing, ensure the stability of housing prices, and ensure that urban residents have a place to live.

(2) We will focus on increasing land supply in cities with large numbers of people moving in, curb the rise of housing prices, and further improve the elasticity of housing supply in large cities. Reduce the land supply of States and cities with large population outflow, slow population growth and long housing depopulation cycle, so as to reduce the supply elasticity.

(3) Ease the excessive population concentration and promote the coordinated development of various states and cities. By balancing public services and economic convergence, the population attraction of a specific city can be reduced, the reasonable distribution of population can be promoted, the house price can be stabilized, and the healthy and stable development of the real estate market can be promoted. Under the guidance of the "14th five year plan" of Yunnan Province, we will give play to the comparative advantages of major urban agglomerations and formulate development goals and strategies suitable for ourselves. Strengthen the coordinated development of regional economy, improve the degree of regional economic agglomeration, narrow the income gap between urban and rural residents, and promote the rational distribution of population.

References

- [1] Wang Ruigong, He Jiachen Yuan Yuan. Study on the Endogenous Mechanism of Urban Land Resources Allocation and house price dynamic change--building data models affecting housing prices from the perspective of supply and demand. *Price: Theory & Practice*, 2019(8):4.
- [2] Yu Liangliang, Cai Yinying. Land Supply Structure, Financial Pressure and Housing Price: Empirical Evidence from Guangdong Province. *China Land Science*, 2018,32(08):30-36.
- [3] Yan Jinhai1, Feng Lei. Land Supply Regulation, Housing Supply Elasticity and Housing Price Fluctuation. *China Land Science*, 2019,33(03):16-24.
- [4] Fan J, Zhou L, Yu X, et al. Impact of land quota and land supply structure on China's housing prices: Quasi-natural experiment based on land quota policy adjustment. *Land Use Policy*, 2021, 106 (4): 105452.
- [5] Han Libin, Lu Ming. Supply-Demand Mismatch: Solving the Puzzle of China's Housing Price Divergence. *The Journal of World Economy*, 2018,41(10):126-149.
- [6] Zhang Lu. Imbalance of Land Supply Structure and Housing Price in Chinese Cities—Based on Land Transaction Records. *Research on Economics and Management*, 2019.
- [7] Ni Pengfei. Easy Monetary Policy, Spatial Mismatch between Supply and Demand, and Continuous Housing Price Differentiation. *Economic Research Journal*, 2019,54(08):87-102.

- [8] Pi Yabin, Li Chao. Regional Competition, Land Supply Structure and Urban Housing Price in China. *Finance & Trade Economics*, 2020, 41(5):15.
- [9] Zou Linhua, Zhong Chunping. Hunger Marketing or Impulse Sale? Evidence Based on Land Sale and Housing Price Data of Cities of Prefecture Level and Above. *Finance & Trade Economics*, 2022,43(03): 82-97.
- [10] Lin Xin, Lv Ping. Spatial Correlation and Influencing Factors of Housing Price in Beijing-Tianjin-Hebei Urban Agglomeration Based on Spatial Durbin Model. *Inquiry into Economic Issues*, 2021(01): 79-90.
- [11] Zhong Wen, Zheng Mingguo, Zhong Changbiao. Land Transfer, Resource Mismatch and High-Quality Economic Development. *Economy and Management*, 2022,36(01):1-9.
- [12] Ye Gui, Zhu Kewei, ZHANG Jihong. The Causality between Housing Price and Land Price based on Empirical Test in Chongqing. *China Land Science*, 2016,30(06):62-70.
- [13] Kuang Weida. Expectation Speculation and Urban Housing Price Volatility in China. *Economic Research Journal*, 2010,45(09):67-78.