Research on the steady and healthy operation of China's real estate industry in the new development stage

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Abstract: Under the new background that the China's current economy is transforming from high-speed growth to high-quality development, the real estate industry, which is related to the national economy and people's livelihood, urgently needs transformation and upgrading. Based on this, this paper uses the relevant data of the real estate industry from 2002 to 2019 to build a regression model to find out the factors affecting the healthy operation of the real estate industry and conduct a scientific analysis of the current situation of China's real estate industry. The grey model is used to predict the trend of the real estate industry in the next few years, and relevant suggestions are put forward to provide reference for the long-term development of the real estate industry. On the basis of the prediction that the real estate industry will fall back in the next few years, this article suggests that the real estate industry actively innovate, seek new economic growth points and the government improve the land supply policy, strengthen the supervision of the real estate industry, and inject new vitality into the demand side on account of people's wellbeing.

Keywords: real estate industry, high quality development, regression model, grey prediction

1. Introduction

In the short and medium term, China's economic recovery is still limited by the epidemic as the global epidemic has not been effectively brought under control. However, thanks to China's excellent anti-epidemic performance, domestic economic activities have basically returned to normal. In the second quarter of 2021, China's real GDP grew by 7.9% year on year. In the first five months of this year, China's real GDP grew by 25.7% year on year, and e-commerce retail sales grew by 19.9% year on year. In the second quarter, China's industrial added value above designated size continued to rebound, recording a year-on-year growth of 9.8% in April and 8.8% in May. The development of the real estate industry largely depends on the economic situation. The continuous good economic trend also makes the real estate industry has a new development prospect. Therefore, China Economic Times pointed out that the high-quality economic background is an opportunity for the real estate industry, 'the real estate industry will enter a new stage of development'.

The real estate industry is the pillar industry of the national economy and also one of the hot topics of people's livelihood. While the real estate industry has boosted economic development, there have also been many undesirable phenomena such as "speculation", soaring housing prices, "real estate bubble" and "triangle debt". In May 2021, new commercial housing prices in second - and third-tier cities rose 5 percent and 3.8 percent year-on-year, respectively. The average price of new homes in first-tier cities rose 5.9 per cent year on year, the biggest increase since July 2017. How to stabilize housing prices in first - and second-tier cities, how to speed up destocking in third - and fourth-tier cities, and how to ensure the steady and healthy operation of the real estate industry in the new stage of development need to be solved urgently.

2. Literature review

The fifth Plenary Session of the 19th CPC Central Committee pointed out that China will enter a new stage of development. This new stage in the economic field is the economy from high-speed growth stage to high quality development stage. Jin Bei[1] believes that the new development concept of innovation,

coordination, green, openness and sharing is the new requirement of high-quality economic development in the new era. Li Huajun[2] proposed that high-quality economic development is the strategic direction and the only way to solve the main social contradiction at this stage. In view of how to evaluate the degree of high-quality economic development based on the new development stage, Li Mengxin[3] constructed the evaluation index system of high-quality development from the five aspects of the new development concept, preliminarily identified by AHP and evaluated by the integrated method of BP neural network simulation optimization. Yu Yongze [4] used THE SBM model to discuss the space-time transformation characteristics of China's economy from high-speed growth to high-quality development. The transformation and upgrading of economic development is inevitably accompanied by many problems. Liu Zhibiao[5] explored the basic characteristics of high-quality development, difficulties and key problems in reality from the perspective of system analysis.

Real estate has played a very important role in national economic and social development, and the change of economic situation means that the real estate industry is in urgent need of transformation and upgrading. Liu Hongyu[6] put forward a long time ago that the housing supply system in the future should be low-end guarantee, interruption support and high-end market structure. Meanwhile, the long-term mechanism of the real estate industry is based on a perfect housing system and land supply system. At present, there is a widespread phenomenon of high housing price in China, which cannot be solved without national macro-control. Chi Zhilin[7] studied the overheating of China's real estate market and analyzed the specific changes of real estate prices, and clarified the impact of the government's macro-control policies on the development of the real estate market. The world is in the era of information Internet. Chen Yiming[8] pointed out that the new environment, new conditions and new development stage in the digital era are the reasons for the urgent transformation and upgrading of the real estate industry. The real estate industry should achieve the goal of carbon peak and carbon neutrality to achieve technological progress and improve project quality. John Ratcliffe, Michael Stubbs, Miles Keeping[9] believe that real estate development planning and real estate development are inseparable, that is, without understanding the development process, it is impossible to make correct planning. Xin Wen[10] constructed HHI index of market concentration based on principal component analysis to measure the concentration of real estate market from the input and output ends, and found that the real estate market at the provincial level in China is extremely fragmented competition. Soltani, Ali and Aghaei, F[11] proposed that three internal factors (building area, age, quality) and external factors (terrain, population density, land use, transportation, etc.) affect housing value. Chen Qiangqiang[12] evaluated the sustainable development of the real estate industry by using TOPSIS-grey correlation analysis, and selected 15 real estate enterprises in China's Fortune 500 with operating revenue over 60 billion yuan for empirical analysis. Cui Ji[13] believed that the era of real estate digitalization had come, listed the application of real estate digitalization and analyzed the existing problems, and pointed out that open and sharing Internet thinking should be established. Guided by the competitiveness theory, Sun Xiaowen[14] systematically sorted out the influencing factors and their interaction mechanism of regional real estate industry competitiveness, and constructed the influencing factor model of regional real estate industry competitiveness. In a word, the real estate industry should follow the trend of The Times, closely follow the development of policies and economic trends, and build a good environment for real estate development.

3. Theoretical model construction

3.1 Entropy weight model

Entropy weight method is a method to assign weight according to the variability of selected indicators. Compared with ahp, Delphi and other subjective weight methods, entropy weight method can explain the results more objectively.

The process of using entropy weight method to determine index weight is as follows:

a) Normalization of original data

The development quality indicators of the real estate industry are respectively the sales area of commercial housing, the number of real estate development enterprises, the added value of the real estate industry, the asset-liability ratio, and the sales profit rate. The first indicator in the first year is: Since the meanings of positive and negative indicators are different, we adopt the following methods to standardize data processing:

For positive indicators:

$$x'_{ij} = \frac{x_{ij} - \min(x_i)}{\max(x_i) - \min(x_i)} \quad (1)$$

For negative indicators:

$$x'_{ij} = \frac{\max(x_i) - x_{ij}}{\max(x_i) - \min(x_i)} \quad (2)$$

b) Calculate the information entropy of each indicator

$$E_j = -(\ln n)^{-1} \sum_{i=1}^{5} p_{ij} \ln p_{ij} \quad (3)$$

Where, E_j represents the information entropy of the jth indicator, $p_{ij} = x'_{ij} \Big/ \sum_{i=1}^{5} x'_{ij}$

c) Calculate the weight of each indicator

$$w_j = g_j \Big/ \sum_{j=1}^{5} g_j \quad (4)$$

Where, g_j represents information entropy redundancy , $g_j = 1 - E_j$, w_j ,represents the weight of each indicator.

d) Calculate the overall score for the first year

$$y_i = \sum_{j=1}^{5} w_j p_{ij} \quad (5)$$

3.2 Grey prediction model

Grey prediction model can make prediction with a small amount of information and has high modeling accuracy. It has a wide range of applications in dealing with small sample prediction problems. Gray prediction is a prediction made for gray system. Compared with black system and white system, gray system contains both known information and unknown information. By identifying the differences in the development of various factors, grey prediction makes correlation analysis, generates new data series with strong regularity, and establishes differential equation model, so as to predict the future development trend.

The steps of using $GM(2,1)$ for prediction are as follows:

a) Establish the original sequence

$$x^{(0)} = (x^{(0)}(1), x^{(0)}(2), x^{(0)}(3), \cdots, x^{(0)}(18)) \quad (6)$$

b) Generate $1 - AGO$ sequence $x^{(1)}$ and $1 - IAGO$ sequence $\alpha^{(1)} x^{(0)}$

$$x^{(1)} = (x^{(1)}(1), x^{(1)}(2), \cdots, x^{(1)}(18)) \quad (7)$$

$$\alpha^{(1)} x^{(0)} = (\alpha^{(1)} x^{(0)}(2), \alpha^{(1)} x^{(0)}(3), \cdots, \alpha^{(1)} x^{(0)}(18)) \quad (8)$$

Among them, $\alpha^{(1)} x^{(0)}(k) = x^{(0)}(k) - x^{(0)}(k-1), k = 2, 3, \cdots, 18$

c) The immediate mean generation sequence of $x^{(1)}$ is

$$z^{(1)} = (z^{(1)}(2), z^{(1)}(3), \cdots, z^{(1)}(18)) \quad (9)$$

Model $GM(2,1)$ is $\alpha^{(1)} x^{(0)}(k) + a_1 x^{(0)}(k) + a_2 z^{(1)}(k) = b$

d) Whitening equation of the model

$$\frac{d^2 x^{(1)}}{dt^2} + a_1 \frac{dx^{(1)}}{dt} a_2 x^{(1)} = b \quad (10)$$

4. Empirical analysis

4.1 Data description and index selection

In view of the fact that the Statistical Yearbook of 2021 and the impact of COVID-19 have not been released by the National Bureau of Statistics, this paper selects the macro data of China's real estate industry from 2002 to 2019 as research samples. The data sources are the National Bureau of Statistics, urban Statistical Yearbook and China Research Center for Human Capital and Labor Economics.

a) Explained variables

In recent years, real estate enterprises began to compete for quality from the development of quantity. Therefore, this paper constructs indicators from two aspects of quantity and quality. In terms of quantity, three indicators are selected: the sales area of commercial housing [15], the number of real estate development enterprises and the added value of the real estate industry. In terms of quality, in order to avoid the impact of multicollinearity, only the indicators measuring solvency and profitability in financial management, namely asset-liability ratio and sales profit rate, are selected.

When collecting data on the operation of real estate enterprises in China from 2010 to 2019, the sales profit margin in this paper only refers to the ratio of operating profit and main business income due to the lack of data related to net profit and operating income of real estate industry

b) Explanatory variables

This article from the policy factors, market and economy, the supply and demand factors, demographic factors four dimensions to build core variables as a first-level indicators, the embodiment of secondary indicators for primary index, which contains policy factors and land policy, the housing accumulation fund policy, fiscal policy, with residents of residential land accounted, housing accumulation fund loan interest rate, financial revenue and expenditure to measure.

Table 1 Table of variable names and codes

The variable name		Variable code	Variable definitions	Unit
Level indicators	The secondary indicators			
Quantitative index	Commercial housing sales area	**Develop_quality**	Building area	10000 square meters
	Number of real estate development enterprises		Number of enterprises engaged in real estate development and operation	Individual
	Added value of real estate industry		The newly created value of residential units engaged in real estate activities over a given period of time	hundred million yuan
Quality indicators	Asset-liability ratio		Total amount of liabilities/total assets×100％	％
	Profit margin on sales		The ratio of an enterprise's operating profit to its main business income	％
Policy factors	Ratio of residential land occupied by residents	**Ratio_residentialand**	Residential land area/Urban construction land area×100％	％
	Revenue and expenditure ratio	**Ratio_revenue_expenditure**	Fiscal revenue/Fiscal spending	——
Market and economy	The ratio of income to housing prices	**Ratio_income_houprice**	Disposable income of urban residents that year/Average national real estate prices for the year	——
	Gross domestic product	**GDP**	The final result of a country's (or a region's) productive activities over a given period of time	hundred million yuan
The supply and demand factors	Real estate funds in place	**Real_loan**	Including domestic loans, self-raised funds, the use of foreign capital	hundred million yuan
	Urbanization rate	**Ratio_urbanization**	The urban population/ population	％
Demographic factors	Natural population growth rate	**Rate_natural_growth**	(Number of births in the year- Number of deaths in the year)/ Annual average number×100％	‰
	Actual per capita human capital level of labor force	**Real_human_capital**	Average level of human capital of non-retired population over 15 years of age	yuan

Table 1, the residents of residential land accounted for the ratio of the residential land area and the urban construction land area, the interest rate of housing accumulation fund in each year on January 1, interest rates for the standard, income and housing prices than disposable income for urban residents and the ratio of the national average price commercial housing, including home loans, self-raised funds actually realized real estate investment, the use of foreign capital, etc.

4.2 Model design

This paper constructs the following multiple regression model to verify the relationship between the development quality of real estate industry and other factors in the new stage.

$$Develop\_quality = \alpha_0 + \beta_1 Ratio\_residentialand + \beta_2 Ratio\_revenue\_\exp enditure +$$
$$\beta_3 Ratio\_income\_houprice + \beta_4 GDP + \beta_5 \operatorname{Re}al\_loan + \beta_6 Ratio\_urbanization$$
$$+ \beta_7 Rate\_natural\_growth + \beta_8 \operatorname{Re}al\_human\_capital + \varepsilon$$

4.3 Analysis of empirical results

a) Descriptive statistics

Table 2 shows the result of descriptive statistics on the data of explanatory and explained variables from 2002 to 2019. Real estate development quality score (Develop_quality) mean value is 0.055, variance is 0.017; The mean value of Ratio_residentialand was 0.31 and the variance was 0.009, indicating that the state's control over land use was relatively stable and strict. The mean value of Ratio_income_houprice is 4.022, and the variance is 0.472. Although the housing price rises rapidly in recent years, the per capita disposable income is also increasing.

Table 2 Descriptive statistics

Variable name	Number	Mean	Variance	Min	Max
Develop_quality	18	0.055	0.017	0.019	0.078
Ratio_residentialand	18	0.31	0.009	0.288	0.323
Ratio_revenue_expenditure	18	0.906	0.058	0.797	1.031
Ratio_income_houprice	18	4.022	0.472	3.313	4.612
GDP	18	478423.3	279211.2	120480.4	986515.2
Real_loan	18	82961.908	57589.748	9749.95	178608.59
Ratio_urbanization	18	0.509	0.076	0.391	0.627
Rate_natural_growth	18	5.54	1.015	3.32	7.43
Real_human_capital	18	140282.2	61253.2	62724.7	255309.5

b) Regression results

According to the empirical results, table 3 shows that the ratio of income to housing prices, urbanization rate, real per capita labor human capital level affects the quality of the real estate industry development at 5% significance level; Residents of residential land accounted and gross domestic product (GDP) affects the quality at the 10% level significantly; The ratio of fiscal revenue to expenditure and the natural growth rate have a significant influence at 15% level.

Table 3 Steady and healthy operation of the real estate industry

Develop_quality	Coef.		Std.Err	P-value&sig.
Ratio_residentialand	-0.579		0.301	0.086 (∗∗)
Ratio_revenue_expenditure	-0.134		0.078	0.122 (∗)
Ratio_income_houprice	-0.023		0.01	0.046 (∗∗∗)
GDP	2.67E-07		1.35E-07	0.08 (∗∗)
Real_loan	3.78E-08		3.39E-07	0.914
Ratio_urbanization	0.976		0.244	0.003 (∗∗∗)
Rate_natural_growth	-0.004		0.002	0.082 (∗)
Real_human_capital	-2.17E-06		6.75E-07	0.011 (∗∗∗)
Constant	0.147		0.162	0.387
R-squared	0.948		Number	18
F-test	20.592		Prob > F	0.000

Note: ***, ** and * are significant at 5%, 10% and 15% levels respectively.

The higher the fiscal revenue and expenditure ratio, the lower the fiscal expenditure, the lower the capital for real estate investment. From the perspective of real estate enterprises, when other factors remain unchanged, the higher the housing price, the more conducive to the short-term development of real estate industry, and the lower the ratio of income to housing price; Urbanization helps to drive domestic demand and promote economic development, and the real estate industry is the unique beneficiary of this process. The improvement of urbanization rate means the increase of urban population, thus increasing the number of potential urban housing buyers. The level of human capital mainly measures the knowledge and cultural level of workers, labor skills and other factors of population quality. The higher the population quality is, the more rational consumption will be. Gross domestic product measure of country or region's economic development level, the increase of GDP is conducive to the further development of the real estate industry, and the GDP variable coefficient is small, on the one hand is due to the effect of replacement of the other factors in the regression model, on the other hand also accord with Zhong fang zhi ku, the latest research results, that is, the dependence of the growth of real estate; The continuous growth of population will lead to the rise of Engel's coefficient, which will further weaken residents' housing consumption and ability to pay. Meanwhile, it will also aggravate the scarcity of resources, such as job opportunities and education level, which will further reduce per capita income and affect real estate investment. The financing environment will affect the capital turnover capacity of real estate enterprises. The easier an enterprise can obtain funds, the stronger its supply capacity will be. This factor is not significant in the results of this paper, which indicates that under the background of the current housing surplus, the continued excessive development of real estate by enterprises will not contribute to the high-quality transformation and development of the real estate industry.

5. Conclusions and Suggestions

5.1 Analysis of prediction results

Grey prediction model $GM(2,1)$ is used to obtain the prediction results as shown in Figure 1. It can be seen that the development quality score of the real estate industry starts to decline after 2021 and gradually tends to be stable.

Table 4 Grey prediction results

| year	The actual value	Predictive value
2002	0.018593864	0.018593864
2003	0.020220111	0.024348314
2004	0.034221349	0.027994326
2005	0.04155835	0.031857478
2006	0.042410907	0.039518976
2007	0.047281081	0.040153957
2008	0.062148343	0.044530814
2009	0.063068744	0.0490105
2010	0.064878367	0.053545826
2011	0.063055342	0.058080755
2012	0.06292696	0.062549703
2013	0.067588318	0.066876855
2014	0.058133952	0.070975524
2015	0.057405752	0.074747541
2016	0.063070291	0.078082724
2017	0.068562889	0.080858415
2018	0.077836521	0.08293913
2019	0.072279887	0.084176327
2020	—	0.084408326
2021	—	0.083460407
2022	—	0.08114511
2023	—	0.07726277
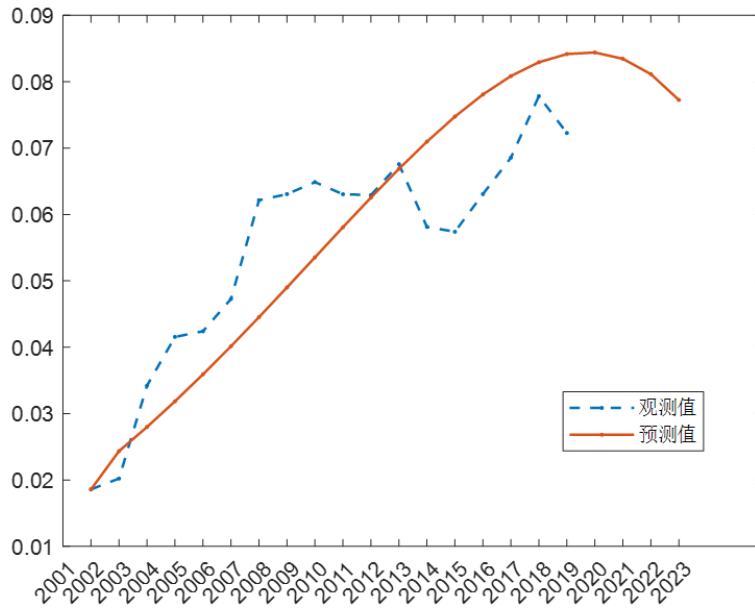
Figure 1 Prediction results of real estate development

The specific reasons are as follows:

First, the rise of land prices to promote housing prices continue to rise. Under the current fiscal and tax system, a large part of China's fiscal revenue comes from land sales. In 2021, land prices will rise by 26% in second-tier cities and 10% in third-tier cities. Rising land prices will push up housing prices and hinder the steady and healthy transformation of the real estate industry in the long run.

Second, as more and more housing enterprises are facing debt risks. The real estate market is closely tied to the financial system, and the real estate crisis can easily evolve into financial risks. In order to maintain the real estate market and financial stability, the state has tightened the financing policies of real estate developers in the past two years, and requires real estate developers to actively resolve debt risks. In this environment, only a small part of real estate enterprises are able to afford bank loans, and the entry of new real estate developers and the development of small and medium-sized real estate developers have generated huge obstacles.

Third, population growth has slowed. People are the main body of economy and market. In 2021, the natural growth rate of population has decreased to 1‰, and the number of new births has decreased, which will restrain the demand for house purchase in the future to some extent. At the same time, due to the large population base, population growth will aggravate the problem of resource scarcity and unequal distribution.

Fourth, the improvement of educational level and the promotion of educational equity. This paper shows that the actual per capita level of human capital is conducive to the long-term and healthy development of real estate industry. This year, the nationwide implementation of a large scale policy to reduce the burden of primary and secondary school students, including cracking down on educational institutions, cracking down on school district housing disorder and other behaviors, has promoted educational equity, to a certain extent to the traditional development model of the real estate industry pressure. In the next few years, China will be committed to the realization of quality-oriented education, the actual per capita labor capital level will be a new level, the real estate industry has a higher quality development requirements.

5.2 Relevant suggestions

a) Innovation is the core support for the transformation and upgrading of real estate industry.

Innovation plays an important role in the development of real estate industry. The China Real Estate Innovation Conference proposed that the development of the industry needs "new products", "new technologies", "new models" and "new drivers". As the economy changes from high-speed development to high-quality development, the supply side should improve product quality and sustainability to meet

the demand side's needs for a better life, such as strengthening personality and customized design, carrying out smart home, building automation management, etc., to achieve technical empowerment.

b) Policy is an important guarantee for the steady development of real estate industry

Under the new normal of the economy, the government should play an active role in guiding and promoting the development of the real estate industry, and fully implement the "three stability" goals of General Secretary Xi Jinping. First, optimize land supply management. Land policy involves the regulation means and development direction of the real estate industry. The government should optimize the way of land transfer, coordinate the price and quality of real estate, grasp the market rhythm and form effective supply. Second, we need to establish and improve the market supervision system. We will strengthen market monitoring, establish an early warning and forecast mechanism for market operation and housing price changes, and make timely adjustments to policies to stabilize the market. Third, strengthen positive public opinion guidance and ideological and quality-oriented education for the masses. We will guide people to consume rationally, and avoid blindly following the trend or making misleading purchases.

c) People's livelihood is an integrant part of the healthy development of the real estate industry

In the process of real estate transaction, basing on people's livelihood is an important concept of real estate developers and their brand development. In his report on the work of the Government, Premier Li Keqiang reiterated that housing should not be sold, and amenities should be improved to make cities more livable for people to work in. We will do our utmost to help new citizens and young people solve their housing difficulties and high housing burden, solve the problem of lack of impetus on the demand side, and inject new impetus into industrial development.

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