The Real Estate Market Simulation Experiment about the Urban Housing Destocking Strategies

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Abstract: To stabilize the urban housing market is one of the main contents of the China national economic work in 2016. This paper, taking the third-tier city Yichang as the research object, built a simulation model of the urban real estate market based on the urban characteristics and the historical data. With the aid of this simulation model, the paper analyzed the influence of the average housing price, the household per capita disposable income and the changes in the density of resident population in the city, to the housing inventory. Furthermore, quantitative tests and analysis were made, by ways of repeated experiments, on the mechanism of action and the strength of intervention from main policy factors on the market supply and demand; the long-term effects of the de-stocking policy tools of the city were predicted and corresponding policy suggestions were brought forward, which provided references for the local government to formulate and implement, by using the big data analysis tools, the market intervention policies applicable to local conditions.

Keywords: Modeling and simulation; de-stocking; household average income; urban resident population

1.Introduction

In recent years, significant differentiation has been observed in the urban real estate market of China: The price and turnover of the real estate market in the first-tier cities and some second-tier cities are always staying at a high level, while many third-tier and fourth-tire cities show daily increasing housing stock, along with the drainage of population and the shrinkage of effective demands, and the phenomenon of “ghost cities” and “empty cities” get worse in some cities. For the purpose of keeping the medium and high speed of economic development and eliminating the possible systematic risks from huge stock, the Central Economic Working Conference 2015 listed the “real estate destocking” as one of the core contents for the economic work in 2016. A bunch of policies were made, by different functional departments, to stabilize the market, including to accelerate the urbanization of migrant workers, to relax restrictions on urban household registration, to reduce the down-payment scale and the mortgage rate for house loans, to expand the coverage of housing fund, the cut down taxes from house trading, to apply the money-based resettlement for shantytowns transformation, to stop or delay the new public housing projects, etc.
This paper aimed to, by firstly building the NETLOGO-based microscopic simulation model of real estate policies and checking, by the way of experiments, the mechanism and strength of actions from all influence factors to the total housing inventory of the city, find the key factors and bring forward rational and enforceable policy proposals.

2. Simulation Model

Researches on the generation and digestion of the real estate inventory are usually included in the general framework of macro-control and stimulating policies for the real estate market. A lot of useful researches on the market changes are made, with few researches focusing on quantitative tests by the measure of modeling and simulation. This paper tried to, by the way of bottom-up modeling and simulation, analyze the effectiveness and effects of destocking policy tools. Here, the NETLOGO-based simulation model was built to simulate the evolution of the real estate market in the coming couple of years. Changes in the housing inventory from changes in main factors, including the urban population and household income, were tested and universal laws were concluded based on the trend and the direction of such changes. Key factors influencing the destocking effects were discussed, and effective and feasible policy suggestions were given, so that

to facilitate the realization of destocking targets and maintain the sustainable healthy development of the real estate industry.

2.1Simulation Theories and Experiments

The theories of this simulation were to predict and evaluate the medium and long-term performance of specific policies or their combinations, by building an artificial city and a real estate market (containing population and geography information) and simulating the evolution of the future market with the aid of simulation software. To be specific, this simulation simulated the actual real estate market ecology, combined the elements of the real estate market, including the demands, price, population structure and income, to form a simulation system, and took the market intervention policies as external variables of the system. Running and evolution of the simulation system (period: 2015-2025) were observed and the input and output changes were recorded to analyze the transmission mechanism of policies and the influence of the superimposed effects.

The research process was to carry out repeated experiments by using the simulation system. A series of polices aiming to stabilize the current market and the behavior of the microcosmic bodies of the market were combined. The performance of multiple intervention policies or their combinations was predicted by building the simulation model, testing and experiment. By the way of repeated experiments, the influence and the time-effectiveness relation of the existing policies to the stabilization of the whole market in the future were observed, so were the influence of specific policies to the households with different income and different housing situation. Finally, the ideal policy combinations were backward deduced and the relatively applicable range of parameters was worked out, based on the difference between the results of experiments and the expected targets of these policies.

To better approach to the real housing market, this paper tried and built a market model by using the internationally universal simulation platform NETLOGO. This model was near to the actual city for it took into consideration over 20 interlinked variables including the effective time of housing policies, the price, quantity, area, and spatial distribution of houses, and the population, income and current housing situation of households. By outputting the statistical data and figures after collecting the subject attribute values, the model could, in a very intuitive and convenient way, check and pre-estimate the medium and long-term effects of the government's market intervention policies released to stabilize the market and reduce the inventory. This software, by giving running commands to the independent smart "subjects", explored the relationship between the behavior of microscopic individuals and the macro-model.

This paper firstly built the fictitious market environment based on macro indexes of a specific city and later generated the experience database based on the geographic information, planning information, population structure, household income and actual market situation of the city. Next, the behavior rule database was generated based on the housing rental and sales behaviors and the decision basis of households with different incomes and housing situations. After the two defined the initial state of the model, the policy performances were output from the automatic running and evolution of the programs. Later, evaluation was made on the policy tools by comparing and analyzing the difference between the performance and the targets of these policies.

2.2 Selection of Indexes and Data Declaration

According to the China's Housing Development Report 2015-2016, the housing inventory exist mainly in some third-tier and fourth-tier cities and the central and western regions. Therefore, this paper chose Yichang of Hubei Province, a non-provincial-capital city, as the simulation object, with all the data coming from the national economy and social development statistical report of Yichang in 2006-2015. After standardizing the local indexes of Yichang in the simulation system, this paper simulated the data-changing trend for the year 2016-2025, with the aim to evaluate the influence of the housing sales price, the per capita disposable income and the permanent population of the city, on the commercial housing inventory.

Main parameters were set as below:

1) According to the hypothesis of single urban center and taking reference from researches by Hao Qianjin and Cheng Jie, the housing sales price is associated with the distance from such houses to

the urban center [15]. Regression was made with the data of Yichang 2006-2015, and exponential function HP= Pindex × e ^ (b1 × distance+ b2 × distance^2) +ε was chose. Here, HP is the average housing price, Pindex the price of housing at the central point, b1 the estimated value, and "distance" the distance from the house to the urban center. The results of data regression of Yichang: b1=-0.0749, b1=-0.1 and b2=0.001. ε is a random number obeying normal distribution, with the mean value of 0 and the variance 50 (CNY).

2) Net growth of the urban household quantities was assumed, including temporary population households and new resident population households. The fitting increasing function of the total household of Yichang: Total Household=137+6.2t; that is, the yearly increase was approximately 1.21% of the base period. The natural population growth of Yichang was nearly 0.27%, while the permanent population grew slowly (1.63% annually). Considering that the growth of temporary population was greater than that of resident population, it was assumed that the growth of resident population household contributed 40% to the total household growth, while the growth of temporary population household contributed 60% to the same. Therefore, the growth function of resident population household: Resident Population Household（T+1）=0.02TotalHousehold(T), while the temporary population household growth function: Temporary Population Household （T+1）=0.03 ×Total Household(T).

3) It was assumed that Yichang was a single-center city and was divided into five strength areas (namely, 5 concentric circles) by the radius of 8km. Houses were supplied uniformly in these 5 strength areas.

4) According to the statistical report of Yichang, SPSS was used to fit the per capita disposable income in 2006-2015 according to the quadratic function curve, with higher fitting level. The function was Household Income=3421+3.581 t +83.26 t2; in the first initial configuration (after random confirmation as positive distribution), the sequence of different income stratums kept unchanged and all satisfied this change rule. The average disposable income function of any family at the moment T1 was Household Fixed Income （T1）=household fixed income(T0)+3.581 +2×83.26 t (derivation), while that household savings at the moment T+1 = household income of the household at the moment T + the disposable income of the current period + interest on deposits –house payment of the current period –house trade taxes payable of the current period –rent payable of the current period-installment amount for the house – traffic cost- house duties – daily consumption. The traffic cost =average traffic cost per kilometer x household population x the total distance from the house to activity centers.

5) It was assumed that the bank's deposit and loan interest rate, the tax policies and other macro factors kept unchanged during the measuring period.

2.3 Results of Experiment

(1) Average household disposable income of Yichang

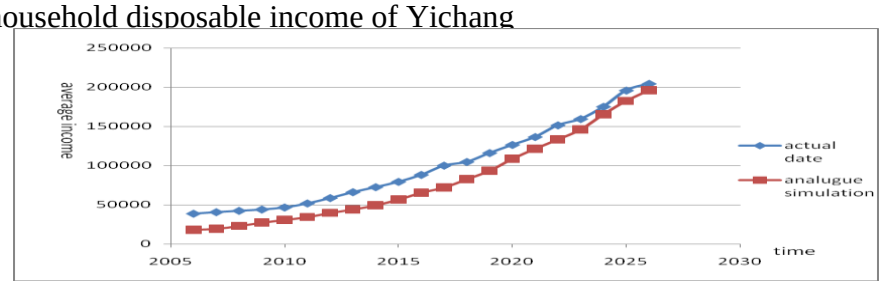

Fig. 1 Average household disposable income of Yichang

(2) Inventory rate

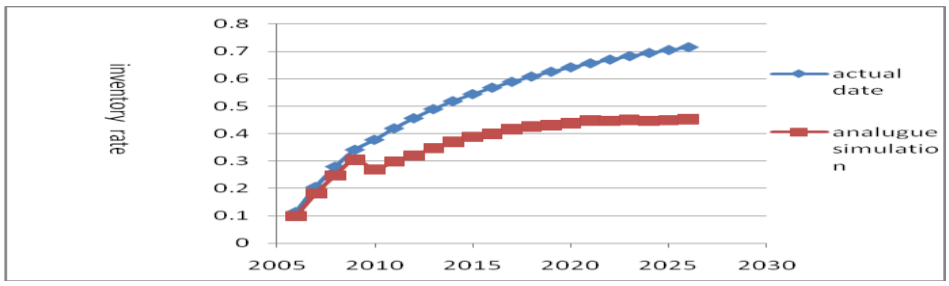

Fig. 2 Urban housing inventory rate of Yichang

(3)Simulation of changing trend of inventory rate when the house price changes

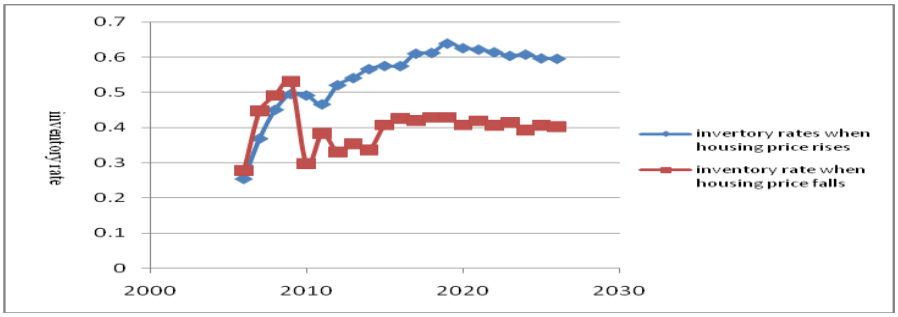

Fig. 3 Simulated change trend of inventory rate when the house price changes

2.4Main Conclusions

The figures simulated based on the actual data of 2005-2015 fit roughly the development trend of figures obtained from the regression and correlation analysis, which proves that the above hypothesis are roughly correct and satisfies the theoretical expectation.

The actual growth of the household average income shown in Figure 1 roughly fit the expected value and kept consistent with the target of the country to realize affluent society by 2025. Thus, it is clear from the general economic development trend that the household economic development shows good performance and provides economic basis for the real estate market development. It can be seen from comparing the absolute amount of Figure 1 and Figure 2 that the housing inventory didn't decrease greatly along with the increase of household income and showed no significant inverse proportional change; however, the relative amount showed that the growth speed of income was greater than that of inventory, although it didn't eliminate the absolute increase but restricted the same in certain degree.

Figure 3 showed the influence from the rise and the fall of housing price to the housing inventory. It can be found that the changes in housing price showed no significant negative correlation with the inventory rate. That is, the rise of housing price didn't increase the inventory greatly, and the fall of housing price didn't decrease the same greatly. The possible reason could be the consumer's psychology of "running after rising and refusing after falling".

3. Suggestions

3.1Well Build the Supply Side to Reduce Housing Inventory

Houses are never single commodities and they are parasitic on certain social and economic environment. To well reduce the housing inventory, we should well build the supply side based on the economic environment. Measures can be taken from two aspects: 1) Well build and control the supporting production and living environment in the area 5-10km away from the urban center, according to the urban size, location of functional areas and far-seeing plan; 2) Further make perfect and optimize the layout and construction of public supporting facilities, such as schools, hospitals, supermarkets, etc, so that to strengthen the housing demands with the regional economic development and the improving regional public service.

3.2Develop Satellite Cities Actively

To well reduce housing inventory in the third-tier and the fourth-tier cities, a good measure is to build satellite cities of megalopolis or build metropolitan areas. For example, the mode applied by the U.S.A to develop the Silicon Valley in California can be referred to. In this mode, enterprises were set up and built in the wilds with rough natural environment and small-medium-sized cities favorable for both living and working were built. For the purpose of attracting enterprises, the California governments offered a lot of policy support, which not only facilitated the development of these enterprises and local economy but also driven the development of regional real estate development. The Silicon Valley today has changed from a barren land in the past into a hi-tech center of the U.S.A. Furthermore, in 2008 after the economic depression, the California government proposed to develop the urban economic cluster focusing on Los Angles, that is, to build satellite cities within 30 to 60 minutes away from Los Angles by car so that to drive the development of surrounding regions. The actual effects proved that a lot of towns, including Irvine, Monterey Park, slowly and finally got melted into the rapid development area under the stimulation of this policy. Considering the housing inventory in the third-tier and the fourth-tier cities of China, local governments are recommended to facilitate the local economic development by developing satellite cities so that to reduce housing inventory. Take Yichang for example, its geographical advantages (located in the middle stream of the Yangtze River and adjacent to Hubei, Chongqing and Sichuan provinces) could be used to build it into a logistics, science and technology or internet economic center.

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