Research on Land Transfer Decision-making from the Perspective of Macro-policy: A case from Hangzhou

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Abstract: Based on the historical data of residential land transfer in Hangzhou from 2006 to 2016, this paper uses the Hedonic model and the survival analysis cox regression model to study the impact of market volatility on land transfer prices and the possibility of transfer in different policy environments. The conclusions of the study show that there is an option value in the land transfer price under the loose policy background, but the value is not reflected in the tightening environment. At the same time, house price volatility and housing transaction volume volatility have different effects on the possibility of transfer in different policy environments.

1. Introduction

In recent years, with the prosperity of the real estate market, the phenomenon of land transfer premium has frequently occurred. As a demand for land development, land price factors have always been the focus of researchers. The relationship between house prices and land prices is also the focus of many debates. Most studies based on Granger causality test believe that there is an interaction between the two, but there are different conclusions on the direction and time of influence. A study using nonlinear Granger test found that house price fluctuations will cause significant fluctuations in land prices in the same direction. Subsequent research based on simultaneous equations and endogenous impact models of land prices and housing prices found that the impact of house prices on land prices is greater than the impact of the reverse, and high house prices are the main cause of the emergence of land kings.

The above studies and the study of land price influencing factors based on microdata and hedonic models ignore the effects of uncertainty and development options on land prices. In fact, land can be seen as a physical asset based on housing, and the value of land includes the value of developing options. Studies have shown that the right to develop housing constitutes more than 50% of the land price [4][9], and the development rights premium in the Chinese real estate market accounts for about 70% of the land price. During the period of rapid growth in housing prices, land prices will more reflect the value of options. In addition, due to the existence of land investors' decision-making on the timing of land investment, there are still a large number of idle or inefficient land in large cities with large margins [10]. Compared to technological innovation, land investment and construction completion timing decisions are more profitable [1]. In the context of China's current tax-sharing system, the government tends to sell land at a higher price, thereby obtaining higher transfer fees. At the same time, due to the monopoly of land supply by local governments, they have certain decision-making flexibility in land transfer arrangements. Decision makers can get more market information by delaying development opportunities, achieving risk aversion, optimizing decisions and redeeming options. The value of land investment is affected by market uncertainty. The increase of uncertainty will increase the option value of land investment and delay the investment opportunity of land [8]. Empirical studies have found that the average option premium of waiting for investment reflected by land market prices is around 6% [3]. The price increase of housing prices during the boom period, and decline during the recession is related to the increase or decrease of the value of options [2]. In addition, most studies have found that uncertainty has a negative impact on housing construction [7] [8].

Therefore, based on the real option theory, this paper uses the land transfer data of Hangzhou to study the impact of market uncertainty on government land transfer decisions under different policy environments.

2. Model and Data

2.1. Model selection

This article takes the volatility of house prices and trading volume as an indicator of uncertainty. Based on the variable characteristics and regression effects, we determined the Hedonic model of the composite form, as follows:

$$\ln LP = a_0 + a_1 Z_1 + \sum_{i=2}^{m} a_i Z_i + \sum_{j=m+1}^{n} a_j \ln(Z_j) + \varepsilon \quad (1)$$

Where LP is dependent variable, the land transfer price, takes a logarithmic regression. Z_1 is the rate of change in house prices or trading volume that measures uncertainty. Z_i is a linear factor that affects the price of land transfer. Z_j is a variable that returns in logarithmic form, mainly the distance of the plot from the center of the city.

The study of land supply decision-making is done using the survival analysis method: Land parcels with supply conditions are considered as “survival” samples, and local blocks are characterized as “death” when they are sold. Uncertainty variables, neighborhood variables and macroeconomic variables affect the “death” risk rate of the plot. The survival analysis model is as follows:

$$h(t) = h_0(t) exp(X'\beta) \quad (2)$$

Where $h(t)$ is the risk rate function, that is, the conditional probability that the sample is "alive" at t, and "death" at t+1, representing the possibility of land transfer at t. The baseline risk function $h(0)$ defines the risk that the variable is at the baseline level (all explanatory variables are 0), representing the law of risk over time. $exp(X'\beta)$ describes the law of risk as a function of covariates:

$$X'\beta = \gamma_1 Z_1 + \sum_{i=2}^{n} \gamma_i Z_i \quad (3)$$

γ_1 and γ_i are pending coefficient, Z_1 and Z_{i} are the same as formula (1).

The above model dependent variables are land transaction price (Price) and land survival time (Time). In addition, the independent variables include the new house price volatility (Volatility) and the new house transaction volatility (Transfer-Vol) obtained by the GARCH (1, 1) model regression, equation (4). And including land use property (Property), density ratio (Density), greening rate (Green), distance from the plot to West Lake (D_XH), distance from the civic center (D_CP), and a grading variable for measuring the neighborhood feature of the plot based on the price level (Neighbor). In addition, there are three macroeconomic variables: long-term financing costs (Cost), the average of three- to five-year and five-year loan interest rates; one-year government bond interest rates (Debt) and broad money year-on-year growth rate (M2).

$$\sigma_t^2 = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \beta_2 \sigma_{t-1}^2 \quad (4)$$

Where σ_t^2 is the calculated volatility. ε_{t-1}^2 is the squared of Lag phase of return residual. σ_{t-1}^2 is the volatility for the lag phase.

2.2. Data Sources

We collected data on residential land sales in the main administrative districts of Hangzhou from 2004 to 2016 through the China Real Estate Big Data Information Platform (CREIS). The housing price and transaction volume are based on the average monthly sales price and number of the newly built commercial housing from 2006.1 to 2017.3. The macro variable data comes from the statistics of the People's Bank of China. The monthly volatility data calculated using GARCH (1,1) is shown in Figure 1 and Figure 2.

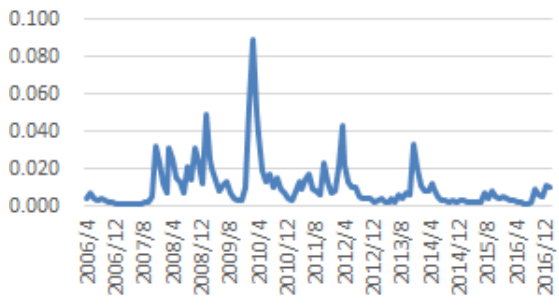

Figure 1. Volatility of prices

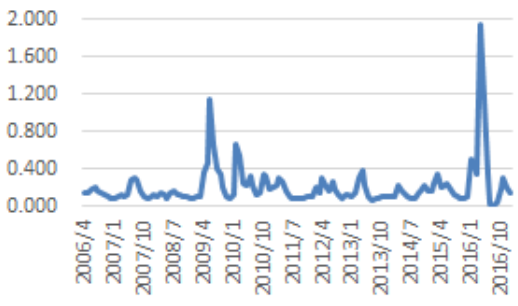

Figure 2. Volatility of transaction

3. Results and Discussions

The paper references the relevant literature to sort out the real estate policy of Hangzhou and the annual financial policy at the national level from 2006 to 2016 [5][6]. And the regression analysis based on sample partitioning at two policy levels, the Hangzhou policy is divided into the model HZ_1—HZ_4, and the national level policy division model GJ_1—GJ_4. The sample time period is as follows: HZ_1, Loose, 2006-2007; HZ_2, Loose, 2008-2009; HZ_3, Tight, 2010-2013; HZ_4, Loose, 2014-2016; GJ_1, Tight, 2006-2007; GJ_2, Loose, 2008-2009; GJ_3, Tight, 2010-2011; GJ_4, Loose, 2012-2016.

3.1. Land transfer price impact study

For the study of the impact of volatility on land transfer prices, we use the characteristic price model for regression. The results are shown in Table 1.

The results show that: in the HZ_2&GJ_2 stage of policy loosening, the house price volatility variable is significant, and it has a positive effect on the land transfer price. In the national policy tightening phase GJ_3, House price volatility is significantly negative, suggesting that different policy environments have a significant impact on the value of options in land transfer prices. Under the loose policy background, the land transfer price increases as the house price volatility increases; In a tight environment, it will decline as house price volatility increases. Although the price volatility coefficient of the other three sub-samples is not significant, the symbols also conform to the above characteristics. Fluctuations in trading volume were also significantly positive during the policy easing period, but negative at the HZ_2&GJ_2 stage, which may be related to the background environment of the financial crisis at the time. In addition, with the passage of time, the variables in the regression model passed the significance test increased, indicating that the real estate market in Hangzhou gradually showed higher interpretability under the guidance of the policy. The decision logic in government land transfer can be combined with the analysis of the possibility of transfer under uncertain conditions.

Table.1. Impact of land transfer price

	ZT	HZ_1&GJ_1	HZ_2&GJ_2	HZ_3	HZ_4	GJ_3	GJ_4
C	10.76***	1.870	-4.946	12.42***	17.71***	9.709***	12.65***
Volatility	0.705	3.813	18.345*	-1.641	14.320	-10.289**	5.802
Trans-Vol	0.239***	2.899**	-0.674*	0.110	0.159*	0.669	0.198**
Density	0.265***	0.323***	0.276***	0.197***	0.189***	0.223***	0.243***
Green	0.173***	0.386***	0.069	0.112**	0.109*	0.099	0.102**
Neighbor	0.295***	0.020	0.454***	0.208***	0.089**	0.130***	0.193***
Ln(D_CP)	-0.284***	-0.215	-0.421***	-0.411***	-0.195**	-0.521***	-0.266***
Ln(D_XH)	-0.509***	-0.634***	-0.375***	-0.531***	-0.963***	-0.494***	-0.698***
Property	0.080*	0.344**	0.037	0.098*	0.253***	-0.026	0.182***
Cost	-0.397***	1.211***	1.718***	-0.445***	-0.803***	-0.051	-0.196***
Debt	0.042***	-0.044	-0.063	0.028***	0.056***	0.021	0.010*
M2	0.003***	-0.004	0.020***	0.003	-0.026***	0.007*	-0.008***
Adj. R^2	0.624	0.591	0.584	0.691	0.795	0.649	0.728
Sample	830	125	183	322	200	148	374

3.2. Land transfer possibility study

For the empirical analysis of the probability of transfer, we use the survival analysis Cox model pair regression results are shown in Table 2.

Table.2. Impact of land transfer possibilities

	ZT	HZ_1&GJ_1	HZ_2&GJ_2	HZ_3	HZ_4	GJ_3	GJ_4
Volatility	2.800	-72.13**	67.11***	32.24***	152.5***	16.03	-1.927
Trans-Vol	-0.336*	13.58***	7.404***	-4.891***	0.279	-2.069	-0.095
Density	0.009	-0.221	-0.114	0.004	-0.076	-0.061	0.110
Green	-0.046	0.315**	-0.270**	-0.176*	0.221	-0.103	-0.020
Neighbor	-0.115*	-0.362	-0.718***	0.097	0.035	-0.002	0.000
Ln(D_CP)	-0.055	-1.146*	2.038***	0.055	-0.487	0.574	-0.451
Ln(D_XH)	-0.219	1.372*	-2.218***	0.063	0.067	-0.708	0.134
Property	0.135*	-0.122	0.504***	0.149	0.010	0.020	0.151
Cost	4.741***	-46.913	45.734*	1.530***	40.967*	-47.182	46.782**
Debt	-0.218***	-0.424*	0.116	-0.285***	0.410***	-2.498**	-0.207***
M2	0.031***	-0.026	-0.061***	0.077***	0.152***	0.136***	0.056***
Samlpe	830	125	183	322	200	148	374

In exploring the impact of different policy environments on the probability of land transfer, the regression results of subsamples show that house price volatility and trading volume volatility are basically significant in the subsamples of Hangzhou policy background:

In terms of house price volatility, house price volatility has a significant positive effect on the possibility of transfer under a loose policy environment. Especially in the HZ_4 stage, a standard deviation of house price fluctuations led to a 2.33% increase in the probability of transfer, indicating that the relaxed policy environment has contributed to local government land transfer decisions. In the policy tightening phase, the coefficient of house price volatility has been significantly reduced, even negative. Local policies in the HZ_3 stage have tightened, although the policy at the national level has been relaxed in the next two years, and the early effects of housing price uncertainty on the timing of the transfer have been greatly reduced. At the HZ_1&GJ_I stage of policy tightening at the national level, housing price volatility can lead to delays in the timing of the transfer.

The possibility of plot transfer is related to the change of housing transaction volatility and the policy environment of Hangzhou: In the relaxed environment of Hangzhou policy, the volatility of housing transaction volume has a positive effect on the possibility of land transfer. In a policy-tightening environment, there is a result of delaying the possibility of land transfer. Because local governments need to consider the market supply and demand situation in addition to the option value in land sales. This shows that the policy at the Hangzhou level plays a key role in the impact of housing transaction volatility on the probability of land transfer, and the impact of national-level policies on this variable does not appear.

4. Conclusion

This paper uses the land transfer data of Hangzhou to empirically analyze the real options and the possibility of transfer in the transfer price. The land feature price model reveals that under the background of loose macroeconomic policies, the volatility has a positive impact on the land transfer price; but in the context of austerity, it does not show a significant positive impact, and even has a negative impact. In the empirical analysis of the possibility of transfer, the timing of land transfer is affected by changes in house price volatility and is related to the trend of regulation and control at the national level; The timing of the transfer is also affected by the volatility of housing transactions, but more related to local policies.

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