Game Equilibrium of the Same Products Price Competitive of Real Estate Based on Rank Dependent Utility Theory

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Abstract. The projects show the homogenization of the competition state with the steady development of the real estate development. Based on the rank dependent utility theory and the traditional homogeneous product price competition between developers, this paper builds price competition game model of the homogeneous product and analysis competitive equilibrium in the price. Finally it discusses the influence of the main game equilibrium results in the emotional preference.

Introduction

With the steady development of real estate industry, real estate development products (especially housing) combination present a high degree of homogeneity, such as building facades, product types, the structure of the family, community, landscape planning, decoration standard of form a complete set, compound property and so on, composition content is almost the same: enter a little wrong layer, the central garden with swimming pool, subtropical landscape, community center with a variety of gym, intelligent security systems and digital network, primary and secondary school union, etc., much of a muchness, except case for home buyers in the face of homogeneous simply cannot effectively distinguish between real estate goods.[1]

The emergence of real estate development products homogeneity in regional scale has formed the industry development enterprise more competitive situation, because it can't form effective product homogeneity, most developers adopted to strategy in terms of price. Such as in the first half of 2011, under the condition of property market continues to tighten policy regulation, Dongguan city market situation is still good, so is quantity and price, but into the housing market began to appear after June watershed, declining volume, prices fall, the hot property market finally become calm. As the shortage of the second half of the developer fund chain, presents and differentiation, the main sales group is 20% of the buildings facing investors in Shenzhen, 80% of the development project without competition characteristic and bright spot, is the price adjustment, introduced a large number of special price room. Therefore, this paper will introduce a rank according to utility theory; real estate development project is used to analyze the game and equilibrium between homogeneous competitors.

The Introduction of Rank Dependent Utility Theory

Since its establishment, expected utility theory, a term used to describe the same group of each subject interactive decision-making behavior game model, become the main interests related to the theory basis of making decisions. But the theory is in the process of its development, with the deepening research and it was found that the independence axiom of expected utility theory contrary evidence, such as common scale effect, etc. Because of the limitations of the theory itself made based on a game model on the basis of the research and application of the deficiencies [2] .In

addition, the utility theory of utility function is not fully illustrate main interests related to risk and uncertainty about the future. In view of this, formed a smooth as generalized utility theory, and duality theory and rank in accordance with the utility theory to improve sex than expected utility theory, which rank in accordance with the utility theory supported by many scholars, and get a large number of experiments and empirical support, prospect theory is a kind of can successfully overcome the limitation of a research theory and method [3]. The rank homogeneity in accordance with the utility theory is introduced into the real estate development project price competition, for developers are affected by the utility and emotion. The main theoretical basis for.

To set the utility function u, emotional function e, random variables x, y, and $x \geq y$, the essence of the developers decisions function V, then $V(x,u,e) \geq V(y,u,e)$. As i kinds of situation $(i = 1,2,3...n)$, The corresponding probability of $x_1, x_2, ...x_n$ is $p_1, p_2, ...p_n$. The relationship between Probability and emotional function e is $e(p)$ and is monotone increasing function, the domain and range are $[0,1]$ and $e(0) = 0, e(1) = 1$, the $V(x,u,e) = \sum_{i=1}^{n} u(x_i)e_i(p)$ and for p uncertainty emotional preference [4].

Real Estate Development Same Product Price Competition Game Model

Homogeneity of real estate development exists in the product in the market competition more severe price competition, each developer is a non-cooperative game relation between game process, the strategy space for (price, price) [5]. In the act of homogeneous development product price competition game, for convenience of analysis, in the same area within the scope of the existence of two homogeneous product development project, corresponding development enterprise developer 1 and developer 2 respectively. If both sides in the competition to take "no price" strategy, their profits are U. When the two sides take the price strategy, one can occupy the market share, by reducing prices to expand its sales volume, revenue increase for U_s, On the other side still take the "no price" strategy, will lose the price enterprise proceeds; If two development enterprise to homogeneous competitive products on sale at the same time, in the selling price to the buyers are not attractive, the loss due to cut down the price U_d in the market, As shown in figure a form of profit matrix.

Fig. 1 The Game Matrix of Two Development Enterprise

Real Estate Development Enterprises 1		Real Estate Development Enterprises 2	
		On sale	No cut
	On sale	$U-U_d, U-U_d$	$U+U_s, U-U_s$
	No cut	$U-U_s, U+U_s$	U, U

In the game process, Real estate development enterprise 1 choice to lower prices, the probability is p, the probability of no cut is $1-p$, The probability of real estate development enterprise 2 choice strategy to lower prices is q, the probability of no cut is $1-q$ [6]. Emotional preference factor is introduced into the game behavior, The development enterprise 1 emotions influence function is $e_1(p) = p^{u_1}(u_1 \in U)$, the development enterprise 2 emotions influence function is $e_2(p) = p^{u_2}(u_2 \in U)$, According to the decision models of rank dependent expected utility theory can get the Expected payoff function of real estate development enterprise 1 and 2 on rank game behavior, respectively:

$$\pi_1(p,q,e) = (p^{u_1}, 1-p^{u_1}) \begin{pmatrix} U-U_d & U+U_s \\ U-U_s & U \end{pmatrix} \begin{pmatrix} q^{u_2} \\ 1-q^{u_2} \end{pmatrix} \tag{1}$$

$$\pi_2(p,q,e) = (p^{u_1}, 1-p^{u_1})\begin{pmatrix} U-U_d & U-U_s \\ U+U_s & U \end{pmatrix}\begin{pmatrix} q^{u_2} \\ 1-q^{u_2} \end{pmatrix}$$

(2)

The two businesses expected payoff function expressed as $\pi_i(p.q.e)(i=1,2)$,With N to show the two sides of game players and $N=\{1,2\}$,A is a mixture of two development enterprise strategy, The homogeneous product rank expression of the rank dependent utility price strategy can be $F=[N_i,\{A_i\},\{\pi_i\}]$ .In the strategy game:(1)when $u_1=1, u_2=2$, $e_1(p)=p, e_2(q)=q$ express that emotional factors in the process of game have no influence on two property developers, π_1 and π_2 degrade into the traditional game payoff function;(2)when $u_1>1$, $e_1(p)$ means the concave function of p ,so the real estate development enterprises 1 adopted a positive attitude for choosing "the price" strategy, and the optimistic attitude impact on enterprises;(3)when $u_1<1$, $e_1(p)$ means concave function of p ,so the real estate development enterprises 1 adopted a pessimistic attitude for choosing "the price" strategy and it's a risk abominator[7].Similarly to the emotional characteristics of performance of real estate development enterprises 2.

Game Equilibrium Results in the Emotional Impact Analysis

To analyze the game participants in price and reduction of the probability and emotional factors on the result of game equilibrium, in does not affect the analysis conclusion, the two real estate enterprise's profit function is used to numerically set, according to Fig.1,given $U=10, U_d=2, U_s=3$,we can get the profit of real estate development enterprise 1 and 2 under different strategy combinations, that is(On sale, On sale)=(8,8),(On sale, No cut)=(13.7),(No cut, On sale)=(7,13)和(No cut, No cut)=(10,10).Taking the real estate development enterprise 1 for example to analyze, According to the formula ① we can get

$$\pi_1(p,q,e) = (p^{u_1}, 1-p^{u_1})\begin{pmatrix} 8 & 13 \\ 7 & 10 \end{pmatrix}\begin{pmatrix} q^{u_2} \\ 1-q^{u_2} \end{pmatrix} = 3p^{u_1} - 3q^{u_2} - 2p^{u_1}q^{u_2} + 10$$

(3)

So,

$$\frac{\partial \pi_1}{\partial p} = 3p^{u_1-1} - 2p^{u_1-1}q^{u_2}$$

(4)

Analyze the formula ④ now, In view of the equilibrium strategies traditional for $u_1=1$, Analysis is now only $u_1>1$ and $u_1<1$:

(1)Case 1: $u_1>1$, This situation shows the development enterprise 1 hold optimistic attitude to choose the strategy of "price", But the attitude is affected by the development enterprise 2 mood, by the formula ④ can be obtained that $q^*=(\frac{2}{3})^{\frac{1}{u_2}}$,so:

①If $u_2>1$,the development enterprise 2 hold optimistic attitude to choose the strategy of "price", The q^* rises with the increase of u_2 ,the development enterprise 2 increases the probability of selection strategy to lower prices, he game equilibrium strategy of two companies is(On sale, On sale).

②If $u_2<1$, the development enterprise 2 hold pessimistic attitude to choose the strategy of "price", The q^* drops with the increase of u_2 , the development enterprise 2 decreases the probability of selection strategy to lower prices, it's strategic choice tendency is "No cut".

(2)Case 2: $u_1<1$, This situation shows the development enterprise 1 hold pessimistic attitude to choose the strategy of "price", and $p\neq 0$,But the attitude is affected by the development enterprise

2 mood as well, by the formula ④ can be obtained that $q^* = (\frac{2}{3})^{\frac{1}{u_2}}$,so:

①When $u_2 > 1$, the development enterprise 2 hold optimistic attitude to choose the strategy of "price", the q^* rises with the increase of u_2, the development enterprise 2 increases the probability of selection strategy to lower prices. But in the process of game, the development enterprise 1 hold a pessimistic attitude instead, On the game between the two sides failed to reach a balance, resulting in the competition.

②When $u_2 < 1$, the development enterprise 2 hold pessimistic attitude to choose the strategy of "price", The q^* drops with the increase of u_2, the development enterprise 2 decreases the probability of selection strategy to lower prices, if u_2 is small enough, the greater q^* .At this point the two development enterprises are conservative, and they will choose "no price" strategy. According to the formula ② to analyze development enterprise 2, the same can be:

$$\pi_2(p,q,e) = (p^{u_1}, 1-p^{u_1})\begin{pmatrix} 8 & 7 \\ 13 & 10 \end{pmatrix}\begin{pmatrix} q^{u_2} \\ 1-q^{u_2} \end{pmatrix} = 3q^{u_2} - 2p^{u_1}q^{u_2} - 3p^{u_1} + 10 \tag{5}$$

$$\frac{\partial \pi_2(p,q,e)}{\partial q} = 3q^{u_2-1} - 2p^{u_1}q^{u_2-1} = 0 \Rightarrow p^* = (\frac{3}{2})^{\frac{1}{u_1}} \tag{6}$$

For Real Estate Development Enterprises 2's results, also affected by enterprise 1 mood, the analysis process is similar to enterprise 1, and here is not a detailed analysis.

The mixed strategy game equilibrium results of property developer 1 and 2 are obtained by the above comprehensive analysis are $((\frac{2}{3})^{\frac{1}{u_2}}, (\frac{3}{2})^{\frac{1}{u_1}})$,according to the equilibrium results we can get the players of emotional factors and the probability of a larger influence on the result.

Conclusion

Traditional game is a classic game under the assumption of complete rationality to form balanced, but in a real game process, any one party decision are influenced by the other party. The game assumptions, the mood of the preference to break through the traditional make game result more tend to rationalization. In the price competition of real estate development project is homogeneity essentially caused by the development enterprise decision makers' preference of strategic competition. Price competition is the main content of the competition under the condition of market economy; price is the product the form of competition. Through the analysis enterprise in front of the mood of the preference for the parties to the strategic choice and the resulting benefits all have great influence, in the process of the game to consider this factor can effectively prevent vicious competition in the market, the homogeneity product competition can't rely on price competition, and should begin from the property management services, product quality and product features and other aspects to improve the added value of the development project.

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