Application of Fuzzy Mathematics in Real Estate Valuation

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Abstract. Similarity degree and the principle of selection are analyzed in this paper. Fuzzy mathematics is used to Market comparison approach. By applying fuzzy theory into real estate valuation, calculation example shows that the application of the method of real estate assessment can overcome the shortcomings of traditional methods, the valuation results are more scientific and rational and fair.

Keywords: Market Comparison Approach, Fuzzy Mathematics, Fuzzy Similarity Degree, Membership Functions, Real Estate Valuation.

1 Introduction

Real estate is a special commodity. In order to really grasp the formation of its price, it is necessary fully to understand the theory of price formation, and for specific analysis. Real estate prices are the core of the real estate market [1][2][3][4]. It reflects the needs of the relationship between the real estate investors and consumers. So assessment includes speculation and judgments of between people and real estate on real estate prices. The process of estimating the valuation, real estate appraisers is essentially the process of economic studies. Since the actual situation in each country or region different, real estate development and application of valuation methods are also different. At present, the property valuation used in the more popular methods are: cost approach, income approach, market comparison approach [5][6]. In order to achieve a better valuation effect, the fuzzy thinking will be applied to the market comparison approach. Using fuzzy similarity degree in mathematics, the examples are analyzed [7][8][9]. Choose to be estimated with the most similar to the real estate transaction as a comparable instance. Calculate the price of real estate to be estimated.

2 Fuzzy Mathematics Theories

Fuzzy Mathematics are founded by L. A. Zadeh Professor in 1965.It is an approximation of accuracy and fuzzy. It set up a bridge between mathematics and the real world.[10]

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2.1 Fuzzy Similarity Degree

Similarity degree is a measure of fuzzy sets and fuzzy sets near the level. Its values is $[0\ 1]$.When the similarity degree is equal to 1,the two fuzzy sets are completely close. When the similarity degree is equal to 0, the two fuzzy sets are not completely close.

Definition: let $\tilde{A}$, $\tilde{B}$ are two fuzzy sets in number field U , then

$$\tilde{A}\cdot\tilde{B}=\vee_{i=1}^{n}\left(A\left(x_i\right)\wedge B\left(x_i\right)\right)=\vee_{x=U}\left(A\left(x\right)\wedge B\left(x\right)\right) \tag{1}$$

$\tilde{A}\cdot\tilde{B}$ is called with the inner product $\tilde{A}$ and $\tilde{B}$.

$$\tilde{A}\otimes\tilde{B}=\wedge_{i=1}^{n}\left(A\left(x_i\right)\vee B\left(x_i\right)\right)=\wedge_{x=U}\left(A\left(x\right)\vee B\left(x\right)\right) \tag{2}$$

$\tilde{A}\otimes\tilde{B}$ is called with the outer product $\tilde{A}$ and $\tilde{B}$.

$$\sigma\left(\tilde{A},\tilde{B}\right)=\frac{1}{2}\left[\tilde{A}\cdot\tilde{B}+\left(1-\tilde{A}\otimes\tilde{B}\right)\right] \tag{3}$$

$\sigma\left(\tilde{A},\tilde{B}\right)$ is called with the similarity degree $\tilde{A}$ and $\tilde{B}$.

2.2 Near the Principle of Selection

Sets of known model $A^{(1)},A^{(2)},\cdots A^{(n)}\in F(X),A\in F(X)$ will be recognized. If $N(A^{(i)},A)=\vee_{k=1}^{n}(A^{(k)},A)$, then A and $A^{(i)}$ are the most closely. Because similarity degree of A and $A^{(i)}$ is Maximum, A and $A^{(i)}$ are the most closely, A is belong to $A^{(i)}$,It is near the principle of selection.

Set There are 6 elements in the U . The standard model library is consisted by the following fuzzy vectors:

$$a_1=\left(1,0.8,0.5,0.4,0,0.1\right) \tag{4}$$

$$a_2=\left(0.5,0.1,0.8,1,0.6,0\right) \tag{5}$$

$$a_3=(0,1,0.2,0.7,0.5,0.8) \tag{6}$$

$$a_4=\left(0.4,0,1,0.9,0.6,0.5\right) \tag{7}$$

$$a_5=\left(0.8,0.2,0,0.5,1,0.7\right) \tag{8}$$

$$a_6=\left(0.5,0.7,0.8,0,0.5,1\right) \tag{9}$$

Fuzzy vector b will be identified

$$b=(0.7,0.2,0.1,0.4,1,0.8) \tag{10}$$

σ_1 as the standard by proximity, and seek

$$\sigma_1(b,a_1)=0.3333 \tag{11}$$

$$\sigma_1(b,a_2)=0.3778 \tag{12}$$

$$\sigma_1(b,a_3)=0.4545 \tag{13}$$