Based on AHP- fuzzy comprehensive evaluation method of real estate investment risk research

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Abstract. This article based on the characteristics of the real estate investment risk and general rules, through to the analysis of the causes of the risk of investment, using the AHP and the fuzzy comprehensive evaluation method of combining the various risk factors of risk size comparison, determine the risk key control object; using expert scoring method to quantify the risk factors, combined with AHP method, through the establishment of investment risk evaluation model, analyzed the effect of real estate investment risk level of sorting, in order to strengthen the real estate

Introduction

The risk uncertainties enterprises will not be able to achieve the expected profits, and ultimately lead to economic or financial loss. Irrational growth due to the high rate of return of the real estate industry due to the scale of investment in recent years to bring the industry a huge risk. According to the national bureau of statistics about real estate investment statistics shown: From 2001 to 2011, the national real estate investment growth by 634.4 billion yuan to 6.174 trillion yuan, the investment scale expand 9.73 times; Since the 2002-2011 national housing price from 2200 yuan/square metre rose to 8809 yuan/square meters , House prices rose 400%. In order to effectively prevent and reduce the probability of occurrence of a risk, promote the development of real estate industry, the real estate investment risk analysis appears particularly important.

The real estate investment risk formation

This paper will stand respectively in micro and macro point of view of the investment risk factor analysis: Macroscopically, mainly reflected in three aspects: the overall economic situation, the real estate market supply and demand and the national economic policy, summarized as economic factor, market factor, policy factor.

Microscopic risk. The real estate industry as capital intensive industry, the development of large scale of investment, long development cycle, asset turnover slow, asset risk high decision once the real estate investment, it is difficult to recover funds in the short term. Therefore microscopic risk mainly manifests in the real estate investment preparation stage, construction stage and later stage of rental. To avoid high risk of real estate investment, it is necessary to real estate investment that may arise during the process of various risk and uncertainty factors to make more accurate qualitative and quantitative analysis.

Real estate enterprise investment risk evaluation

The establishment of a real estate investment risk evaluation index system

Real estate enterprise investment risk evaluation is to identify the investment risk factors of measurement and analysis process, so as to provide a basis for the enterprise investment decision. The enterprise to the risk of investment appraisal is its risk management is an important link, is also the investment risk should be in the face of the premise. Real estate enterprises in the process of

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investment risk factors as is shown in(Table 1) . Based on these factors target layer, criterion layer and index layer division, establish the risk evaluation system.

Table 1: The real estate investment risk factors and the index system

Target layer		Criterion layer	Index layer
Real Estate Investment Risk Factors (A)	Macro Environment	The policy factor B1	Tax policy C11
			Land policy C12
		Market factors B2	Real estate market demand C21
			The real estate market of housing stock C22
			Real estate market purchasing power C23
		Economic factors B3	Inflation rate C31
			Economic growth rate C32
			Bank rate C33
	Micro Environment	Preparatory stage B4	The scale of investment risk C41
			Locations of investment risk C42
			Financing risk C43
		Construction phase B5	Construction project risk C51
			Cost risk C52
		Late rental stage B6	Marketing risk C61
			Price risk C62
			Customer Customer service property management risk C63

Determine the real estate investment risk comprehensive evaluation index weight

The first step, the risk criterion layer factors judgment matrix and weight vector calculation Weight is a relative concept, in order to reflect the importance of each factor. Firstly, First of all, according to the established evaluation system application 1-9 scale method to establish the weight of the judgment matrix and combining with AHP analysis method to determine the weights of evaluation indexes,from(Table 2). Then can get real estate investment risk factor weight judgment matrix , as shown in (Table 3):

Table 2:Weight scale table

Weight scale (1-9)	Relative importance
1	Bi and Bj equally important
3	Bi slightly important than Bj
5	Bi than Bj obviously important
7	Bi Bj important than many
9	Bi than Bj extreme important
2,4,6,8	Take the above adjacent judgement intermediate value

Table 3: Evaluation system of the judgment matrix

A1	B1	B2	……	Bn
B1	b11	b12	……	b1n
……	……		……	
Bn	bn1	bn2	……	bn3

Note: the bij = 1 / bij, bij = 1

According to the expert scoring method to table 1 to establish evaluation system of risk analysis, the establishment of criterion layer risk factors judgment matrix B.

Made according to the judgment matrix and its weight vector (feature vector) $\overline{M_i} = \{\overline{M_i} \quad \cdots\cdots \quad \overline{M_n}\}^T$, in which $\overline{M_i} = \sqrt[n]{M_i} = \sqrt[n]{\Pi b_{ij}}$, based on M_i normalized processing, even the meet the requirements$\sum M=1$ 。 $\overline{M} = (0.44 \quad 1.04 \quad 0.59 \quad 0.98 \quad 2.04 \quad 1.864)^T$ normalized to $\overline{M} = (0.06 \quad 0.15 \quad 0.08 \quad 0.14 \quad 0.31 \quad 0.26)^T$ Calculating the maximum eigenvalue of the judgment matrix $\lambda_{\max}$

$$B=\begin{bmatrix}1 & 1/3 & 1/2 & 1/4 & 1/3 & 1/2\\ 3 & 1 & 5 & 1/4 & 1/6 & 2\\ 2 & 1/5 & 1 & 3 & 1/4 & 1/7\\ 4 & 4 & 1/3 & 1 & 1/3 & 1/2\\ 3 & 6 & 4 & 3 & 1 & 1/3\\ 2 & 1/2 & 7 & 2 & 3 & 1\end{bmatrix} \quad B\bullet M==\begin{bmatrix}1 & 1/3 & 1/2 & 1/4 & 1/3 & 1/2\\ 3 & 1 & 5 & 1/4 & 1/6 & 2\\ 2 & 1/5 & 1 & 3 & 1/4 & 1/7\\ 4 & 4 & 1/3 & 1 & 1/3 & 1/2\\ 3 & 6 & 4 & 3 & 1 & 1/3\\ 2 & 1/2 & 7 & 2 & 3 & 1\end{bmatrix}\begin{bmatrix}0.06\\ 0.15\\ 0.08\\ 0.14\\ 0.31\\ 0.26\end{bmatrix}=\begin{bmatrix}0.42\\ 1.33\\ 1.46\\ 1.24\\ 2.22\\ 2.23\end{bmatrix}$$

$$\lambda_{\max}=\left(0.42/0.06+1.33/0.15+1.46/0.08+1.24/0.14+2.22/0.31+2.23/0.26\right)\div 6=6.13$$

Due to the application of expert scoring method income bij there exists some error, thus the judgment matrix characteristics not accurate, so it consistency examination, or to B readjustment. $CI=(\lambda_{\max}-n)/(n-1)$, $CR=CI/RI$,CI is for consistency index,CR is for consistency ratio, only when CR<0.1 to satisfy consistency.have $CI=(\lambda_{\max}-n)/(n-1)=0.13/5=0.026$, $CR=CI/RI=0.026/1.24=0.0210<0.1$,satisfy consistency.

The second step risk indicator layer a factor judgment matrix and weight vector calculation .Index layer risk factor B1 judgment matrix for C1, the normalization processing to get the weight vector $\overline{M_i}=(0.17\quad 0.83)^T$, and calculates the maximum characteristic root $\lambda_{\max}$=2.01, for consistency check from (Table4), $CI=0.01\quad RI=0\ CR=0.0<0.1$ satisfy consistency.

Table 4: consistency index

Index	1	2	3	4	5	6	7	8	9	10
RI	-	0	0.58	0.90	1.12	1.24	1.36	1.41	1.46	1.49

Empathy, Calculate criterion layer factor B2, B3, B4, B5, B6、 judgment matrix C2, C3, C4, C5, C6、weight vectorW1, W2, W3, W4, W5, W6 and the largest eigenvalue $\lambda_{\max 2}$, $\lambda_{\max 3}$, $\lambda_{\max 4}$, $\lambda_{\max 5}$, $\lambda_{\max 6}$.

$$C_1=\begin{bmatrix}1 & 1/5\\ 5 & 1\end{bmatrix}\quad C_2=\begin{bmatrix}1 & 1/3 & 1/2\\ 3 & 1 & 4\\ 2 & 1/4 & 1\end{bmatrix}\quad C_3=\begin{bmatrix}1 & 1/2 & 1/4\\ 2 & 1 & 1/3\\ 4 & 3 & 1\end{bmatrix}\quad C_4=\begin{bmatrix}1 & 5 & 3\\ 1/5 & 1 & 1/3\\ 1/3 & 3 & 1\end{bmatrix}\quad C_5=\begin{bmatrix}1 & 3\\ 1/3 & 1\end{bmatrix}\quad C_6=\begin{bmatrix}1 & 6 & 3\\ 1/6 & 1 & 1/5\\ 1/3 & 5 & 1\end{bmatrix}$$

$W_2=[0.15\quad 0.63\quad 0.22]^T\quad W_3=[0.14\quad 0.24\quad 0.62]^T\quad W_4=[0.64\quad 0.10\quad 0.26]^T\quad W_5=[0.75\quad 0.25]^T\quad W_6=[0.63\quad 0.08\quad 0.29]^T$

$\lambda_{\max 2}=3.11\quad \lambda_{\max 3}=3.03\quad \lambda_{\max 4}=3.04\ \lambda_{\max 5}=2\ \lambda_{\max 6}=3.09$ respectively, they checked for consistency by $CR_2=0.094<0.1\quad CR_3=0.025<0.1\quad CR_4=0.034<0.1\quad CR_5=0.0<0.1$, $CR_6=0.078<0.1$, According to the results meet the judgment consistency.

The third step calculation combined weights .According to the above request: Criterion layer weight vector set M and index layer weight vector set W, it can be concluded that the real estate investment risk system weight V and V = M × W,V is the index layer C relative and evaluation target system of A weight vector.

$$V=\begin{bmatrix}0.17 & 0 & 0 & 0 & 0 & 0\\ 0.83 & 0 & 0 & 0 & 0 & 0\\ 0 & 0.15 & 0 & 0 & 0 & 0\\ 0 & 0.63 & 0 & 0 & 0 & 0\\ 0 & 0.22 & 0 & 0 & 0 & 0\\ 0 & 0 & 0.14 & 0 & 0 & 0\\ 0 & 0 & 0.24 & 0 & 0 & 0\\ 0 & 0 & 0.62 & 0 & 0 & 0\\ 0 & 0 & 0 & 0.64 & 0 & 0\\ 0 & 0 & 0 & 0.10 & 0 & 0\\ 0 & 0 & 0 & 0.26 & 0 & 0\\ 0 & 0 & 0 & 0 & 0.75 & 0\\ 0 & 0 & 0 & 0 & 0.25 & 0\\ 0 & 0 & 0 & 0 & 0 & 0.63\\ 0 & 0 & 0 & 0 & 0 & 0.08\\ 0 & 0 & 0 & 0 & 0 & 0.29\end{bmatrix}\bullet\begin{bmatrix}0.06\\ 0.15\\ 0.08\\ 0.14\\ 0.31\\ 0.26\end{bmatrix}$$

V=W×M=[0.01 0.05 0.02 0.09 0.03 0.01 0.02 0.05 0.09 0.01 0.04 0.23 0.08 0.16 0.02 0.08]

V is for final evaluation results, this a list of generation number representation for all real estate investment risk evaluation index integrated principal grading, The higher the score that real estate investment project risk is higher, in all risk evaluation index of integrated performance is poor. Whereas the lower score that real estate investment project risk is lower, in all risk evaluation index of integrated performance is optimal. The results will be more income and index layer corresponding

to each risk factor, finally can come to the real estate enterprise investment risk comprehensive evaluation index weight, such as(Table 5) shows.

Table 5: The real estate project investment risk weight system

Target layer	Target layer	Weight
Real Estate Investment Risk Factors （A）	Tax policy C11	0.01
	Land policy C12	0.05
	Real estate market demand C21	0.02
	The real estate market of housing stock C22	0.09
	Real estate marke tpurchasing power C23	0.03
	Inflation rate C31	0.01
	Economic growth rate C32	0.02
	Bank rate C33	0.05
	The scale of investment risk C41	0.09
	Locations of investment risk C42	0.01
	Financing risk C43	0.04
	Construction project risk C51	0.23
	Cost risk C52	0.08
	Marketing risk C61	0.16
	Marketing risk C62	0.02
	Customer service property management risk C63	0.08

The results of the study

The research results show that： the real estate company's A investment project, the construction period risks, marketing risks, the scale of investment risk, and housing stock risks, respectively, 23%, 16%, 9%, 9%, when Investors in decision-making should give more attention in these aspects can be achieved through the improvement of the internal control system and to take effective measures to avoid the risk or reduce the probability of occurrence risk, to ensure the successful completion of the investment project. Also need to note that this article is the point of view of the specific company-specific analysis of the risk of investment in real estate projects, the investment environment facing different real estate conditions of the business and investment environment facing the same real estate enterprises of different projects different, as well as experts from different scoring criteria is not the same, different real estate projects in the final risk assessment results are not the same. So, the real estate enterprises in investment, must be combined with itself and the environment in which to conduct an objective evaluation of the indicators, and ultimately get the scientific results of the evaluation.

Concluding

In recent years, with the rapid development of the real estate industry, On the one hand to estate business to bring huge profits, on the other hand, the risks of investment is becoming more and more big. The real estate industry as China's national economic backbone industry, its development is closely related to the national economy and people's livelihood, Therefore, through the application of AHP-fuzzy comprehensive evaluation method of real estate investment risk study not only for real estate enterprises to provide decision basis, more can provide basis for national macro policy, and finally promote the health of the real estate industry sustainable development.

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