



Investment Risk Evaluation of Pension Real Estate Projects Based on AHP Method

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Abstract. As the growth of the elderly market demand, social endowment service industry arises at the historic moment. Aiming at the construction wave of pension real estate project in the present, and the complicity of investment climate in pension real estate project, the blindness of investment and exploitation, the oneness of operation pattern and other realistic problems, analyze the exploitation, the oneness of operation pattern and other realistic problems, analyze the influence factors of the investment risk of pension real estate project. estate project.

Keywords: Pension Real Estate; AHP Method; Investment Risk

1 Introduction

If a country or region has a population aged 60 or above accounting for more than 10 per cent of the total population or a population aged 65 or above accounting for more than 7 per cent of the total population, the country or region has entered an ageing society. And our country after 1999, 60 years old and above population has accounted for more than 10% of the national population, the proportion of the population will reach 31.2%, to 2050, China's elderly population will exceed 400 million, vigorously develop the home care, community services for the elderly [1], to promote the socialization of elderly care services is imperative.

At present, the practice of China's pension real estate is still in the exploratory stage [2], while Europe and the United States have entered the ageing society earlier, and there have been in-depth studies on pension real estate issues. According to the research of Saari et al. [3], a systematic management tool is constructed by using the comprehensive scoring method, and the comprehensive score of the senior living real estate is calculated by the weights of each aspect, which can make a holistic evaluation of the senior living real estate. Eichholtz et al. [4] found that the return rate of the healthcare real estate trust is higher in the case of the senior living residence and senior living services are the senior living real estate projects that can be separated from each other, and the return rate of the integrated senior living real estate trust is higher in the case of the senior living medical services and senior living home services are needed and in

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high demand. When senior housing and senior living services are required and in high demand, comprehensive senior real estate project development companies receive higher rates of return, which can also prove that the value of senior real estate projects should be more focused on senior living, health care and medical care services. Although the domestic research on senior living real estate started late, scholars have done a lot of research by combining China's national conditions. Li Lanjun [5] By constructing PFI-REITs financing model and using entropy value method to analyze the risk of randomly selected "questionnaires on the risk factors of financing for senior real estate", the results found that the investment policy of senior real estate has become bigger, inflation, and the degree of harmony of stakeholders has a greater degree of influence, which should be attached great importance. Zou Qinghong [6] analyzes the existing problems and opportunities of pension real estate and explains the main risks starting from the composition and characteristics of China's population. Ma Chile et al. [7] believe that the development and operation mode of building a cross-industry strategic alliance for senior care real estate can effectively reduce the cost of capital and realize a win-win situation for developers and investors. Ou Xinyu et al. [8] through SWOT analysis, found that insurance companies investing in senior living communities have unique competitive advantages in terms of brand reputation, financial strength, customer resources, supporting facilities and resource integration.

Through literature research, it is found that scholars' explorations of senior living real estate mainly focus on project investment financing, development design, operation mode, risk elaboration, etc., but few investment risk evaluation of senior living real estate projects are involved. The stage, high risk and combination of investment risk determine the necessity of risk evaluation and analysis. This paper intends to construct an investment risk evaluation system for pension real estate projects from the perspective of developers, in view of the current development status of pension real estate in China and the actual problems it faces, calculate the weights of the indicators by using the AHP method, and take the case to carry out the evaluation of investment risk.

2 Analysis of Investment Risk Influencing Factors of Pension Real Estate Projects

The stage, high risk and combination of investment risks of pension real estate projects determine the necessity of risk decision analysis. Risk identification of projects with investment risks can be better risk assessment and risk decision-making. Aiming at the development status quo of pension real estate, we systematically recognize all the risk factors affecting the realization of the investment objectives of pension real estate projects through risk identification, and analyze the investment risks from the three aspects of the project itself, the macro environment and the real estate industry, so as to lay the analytical foundation for the risk management and risk decision.

2.1 Project's Own Risks

The project's own risk mainly refers to the project's own life cycle, due to changes in relevant factors or estimation errors caused by the investment risk, this type of risk will directly affect the success or failure of the project operation. Specifically can be divided into:

- The first is the risk of decision-making and management.
- The second is the risk of building technology.
- Third, operating expense risk.
- Fourth, natural risks.

2.2 Macro-Environmental Risks

Macro-environmental risk refers to the combination of all macro-environmental factors that have an impact on a senior living real estate project, and these risk factors constitute the project's environmental system, which imposes constraints and limitations on the senior living real estate project in the system. Such risks can be specifically categorized into:

- The first is the risk to the national economy.
- The second is political risk.
- Third, socio-environmental risks.
- Fourth, regulatory policy risk.

2.3 Real Estate Industry Risks

Risk factors in the real estate industry mainly refer to unknown factors related to the market environment and economic development of the senior living real estate market, and these risks arising from economic fluctuations or market changes act on the senior living real estate project, which will affect the acquisition of the project's target rate of return on investment. Such risks can be categorized as:

- First, market supply and demand risks.
- The second is inflation risk.
- The third is the real estate economic cycle.
- Fourth, the risk of peer competition.

3 Quantitative Evaluation of Investment Risks in Elderly Real Estate

Elderly real estate project is a complicated system, and the risk subject is affected by many risk factors in the operation, and any change of risk factors such as the project itself and macro environment will have a great impact on the investment return, construction cost and operation of the project in the future. Therefore, we should face up to the existing risks, choose the systematic evaluation method, set up the appropriate risk index system, and carry out the quantitative evaluation of the risks of senior real estate investment.

3.1 Selection of the AHP Method

The AHP method, i.e. hierarchical analysis, is a system analysis method that combines qualitative analysis and quantitative measurement, and is suitable for comprehensive evaluation of multiple factors and trend prediction. The advantage of the AHP method is that it uses a combination of qualitative and quantitative methods to logically analyze the system, with a higher degree of comparability and a smaller error; the disadvantage is that it restricts the number of factors that are the subject of the evaluation, or else it is easy to reduce the accuracy of the risk assessment if there are too many risk factors. [9].

3.2 Quantitative Evaluation Analysis of Senior Real Estate Investment Risk Based on AHP Methodology

3.2.1. Establishment of a Risk Indicator System for Senior Real Estate Investment.

When using the AHP method to analyze the investment risk of senior real estate, we reasonably analyze the investment environment of senior real estate, determine various types of risk factors and factor indicators, and establish the investment risk management system.

The index system of risk, categorize and identify the identified risk factors, select the investment risk factors according to the relevant analysis in order to construct the index system, arrange the various risk factors from top to bottom according to the affiliation, establish the interrelated hierarchical structure, and then construct the multi-level index system for the evaluation of the risk investment environment.

3.2.2 Determination of Weights for Each Evaluation Indicator.

The relative importance of the risk factors was analyzed based on the listed hierarchical model of investment system risk and expert advice, and a 1-9 ratio scale was used to construct the matrix for each layer to determine the relative importance of the factors in each layer (Table 1).

Table 1. Evaluate the scale and meaning of the matrix ratio

Scale a_{ij}	define
1	Factor i is equally important compared to factor j
3	Factor i is slightly more important than factor j.
5	Factors i and j are more important than the latter
7	Factor i is very much more important than factor j.
9	Factor i is absolutely more important than factor j.
2, 4, 6, 8	is the scalar value corresponding to the intermediate state between the two previous judgments
from the bottom (lines on a page)	Factor i is more important than factor j, with the latter being more important than the former in increasing order of importance

Using the formula $U_i = \prod_{j=1}^n a_{ij}, ij = 1,2, \dots n$, the $u_i = \sqrt[n]{u_{ij}}$ and $W_i = \frac{u_i}{\sum_{i=1}^n u_i}$

The eigenvectors of the risk factors were calculated and then normalized to determine the maximum eigenvalue of each judgment matrix and the consistency index CI, and the average randomness index RI was checked against the RI values in Table 2.

Table 2. RI values

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

Apply the formula $CR = CI/RI$ Calculate the consistency test coefficient CR, if the calculation result $CR \leq 0.1$, then the judgment matrix has consistency, and the weight of its eigenvector W is basically reasonable; otherwise, the judgment matrix needs to be adjusted until the consistency index is obtained. According to the above calculation steps, the judgment matrix of senior real estate investment risk and the corresponding weights of each risk factor are obtained.

3.2.3 Total Relative Weight Ranking.

The relative weights W_i derived from the individual matrices were total ranked to determine the combined importance of each risk factor for the senior real estate project.

4 Empirical Analysis of Quantitative Evaluation of Investment Risk of Pension Real Estate Projects

4.1 Project Overview

Henan Luoyang a community project is located in Luoyang City, Henan Province, Luanchuan County, invested by Henan Province Zhenghong Industrial Development Co., Ltd, covers an area of more than 600 acres, mainly divided into three phases of development, the first phase of the project with a total investment of 120 million yuan in December 2014 groundbreaking, in 2016 was included in the Henan Province, the key construction projects, 2,000 beds for the elderly, in October 2018, to move in and use.

4.2 Empirical Analysis of Quantitative Evaluation of Project Investment Risk

First of all, the project investment risk index system should be established. According to the investment risk factors selected in the previous analysis to build the indicator system, the various risk factors are arranged from top to bottom according to the subordinate relationship, to establish the interrelated hierarchical structure, and finally to build a 3-level indicator system for risk investment environment evaluation, see Figure 1 for details. The second step is to determine the weights of the evaluation indicators. According to the expert scoring method, each risk factor or indicator of a community project in Luoyang is scored fuzzy, and then the judgment matrix is constructed after organizing the relevant data to determine the weight value in the matrix. In the expert

scoring method, the expert committee consists of 10 experts from universities and scholars in Henan Province, relevant government departments, financial institutions and the real estate industry. According to the relevant calculation methods and steps, the judgment matrix of the project investment risk and the corresponding weight values of each risk factor are shown in Table 3 to Table 6.

According to the scoring results in Table 3, $CI=0.0016<0.1$, the comparison matrix meets the consistency test.

According to the scoring results in Table 4, $CI=0.027<0.1$, the comparison matrix meets the consistency test.

According to the scoring results in Table 5, $CI=0.006<0.1$, the comparison matrix meets the consistency test.

According to the scoring results in Table 6, $CI=0.029<0.1$, the comparison matrix meets the consistency test.

Finally, the relative weights W_i derived from each of the above matrices are summarized to determine the combined importance of the project's risk factors (Table 7).

From the calculation of the above index system, it can be seen that the greatest influence on the investment risk of a community project in Luoyang is the risk of regulatory policy (B8), the risk of the national economy (B5) and the risk of market supply and demand (B9).

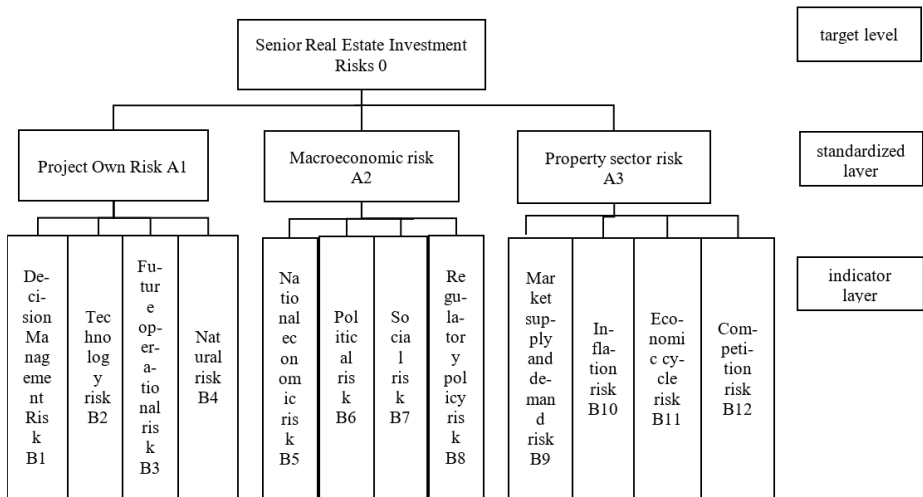


Fig. 1. System of investment risk indicators for pension real estate

Table 3. Critique matrix O-A and weight values

	o	A1	A2	A3	W
A1		1	1/5	1/3	0.1498
A2		5	1	2	0.5241
A3		3	1/2	1	0.3261

Test: $\lambda_{max} = \sum_{i=1}^n \frac{[AW]_i}{nw_i} = 3.0037, CI = \frac{\lambda_{max}-n}{n-1} = 0.0016, RI=0.52, CR=CI/RI=0.004<0.1$

Table 4. Critique matrix A1-B and weight values

A1	B1	B2	B3	B4	W
B1	1	2	2	3	0.4358
B2	1/2	1/4	1	4	0.1969
B3	1/2	1	1	4	0.2784
B4	1/3	1/4	1/4	1	0.0889

Test: $\lambda_{max} = \sum_{i=1}^n \frac{[AW]_i}{nw_i} = 4.082, ci = \frac{\lambda_{max}-n}{n-1} = 0.027, RI=0.96, CR=CI/RI = 0.028 < 0.1$

Table 5. Critique matrix A2 -B and weight values

A2	B5	B6	B7	B8	W
B5	1	3	2	1	0.3260
B6	1/3	1	1/2	1/4	0.0941
B7	1/2	2	1	1/5	0.1393
B8	1	4	5	1	0.4405

Test: $\lambda_{max} = \sum_{i=1}^n \frac{[AW]_i}{nw_i} = 4.019, CI = \frac{\lambda_{max}-n}{n-1} = 0.006, RI=0.96, CR= CI/RI = 0.007 < 0.1$

Table 6. Critique matrix A3-B and weighting values

A3	B9	B10	B11	B12	W
B9	1	3	2	2	0.4167
B10	1/3	1	1/2	1/3	0.1087
B11	1/2	2	1	2	0.2662
B12	1/2	3	1/2	1	0.2084

Test: $\lambda_{max} = \sum_{i=1}^n \frac{[AW]_i}{nw_i} = 4.088, CI = \frac{\lambda_{max}-n}{n-1} = 0.029, RI=0.96, CR= CI/RI = 0.033 < 0.1$

Table 7. Combined importance

(B1) 0.065283	(B2) 0.1969	(B3)0.041704	(B4) 0.013317
(B5) 0.170857	(B6) 0.049318	(B7)0.073007	(B8) 0.230866
(B9) 0.135886	(B10)0.035447	(B11)0.086808	(B12)0.067959

That is, W(B1-B4), W(B5-B8), and W(B9-B12) are multiplied by W(A1), W(A2), and W(A3), respectively, respectively

4.3 Investment Risk Avoidance Suggestions for Pension Real Estate Projects

4.3.1 In-depth Grasp of Policy Developments to Enhance Investment Decision-Making.

In view of the current situation of China's pension problems, we should pay close attention to and study the changes in the national policies on pension real estate to effectively control the policy risk and promote the sustainable development of pension real

estate. A community project in Luoyang and other new elderly real estate projects is in-depth grasp of the relevant government policy dynamics to finalize the investment decision, which has a certain reference value for other regions and other cities of the elderly real estate project investment decision-making.

4.3.2 Full Consideration of Market Demand and Avoidance of Market Supply and Demand Risks.

In the market positioning of the pension real estate project, the economic development level of the region and city, the developer's own conditions and the local consumption ability and other factors should be considered, and the market positioning of the project, the program selection and sales methods should be analyzed reasonably. Unique product concepts, good site selection and planning and design are all established on the basis of a full understanding of consumers in Luoyang, which will lay the foundation for the project to avoid market supply and demand risks and gain consumers' favor.

4.3.3 Flexible Choice of Financing Options and Reasonable Pace of Development.

Pension real estate projects with large capital consumption and long payback period mainly use indirect financing. Therefore, on the one hand, reference can be made to the current operation mode of commercial real estate to carry out project financing according to local conditions, reasonably adjust the financial leverage of financing and transfer the financing risk. On the other hand, it can reasonably grasp the development rhythm of the project and carry out the project development in time segments. A community project in Luoyang has effectively alleviated the pressure of project funds by developing the project in a rhythmic manner in phases, so that the development of the project has been carried out smoothly and better economic benefits have been obtained, which is also of reference significance for the development of pension real estate projects in other regions.

4.3.4 Drawing on Foreign Experience in Old-Age Services to Form An Operation System for Old-Age Services.

Drawing on successful overseas experiences, such as the Swedish elderly care service, which integrates family, community and institutional resources to provide comprehensive and continuous care services, and the long-term care insurance system in the United States, which shares the pressure on the cost of elderly care services and makes high-quality elderly care services affordable to more older persons.

4.3.5 Explore Diversified Profit Models.

Providing medical and home living services, establishing or cooperating with medical institutions to provide comprehensive medical services, such as health check-ups for the elderly, chronic disease management and rehabilitation care. This not only meets the health needs of the elderly, but also increases income through the provision of quality medical services.

Subletting property assets or homes to lease some of the senior living community's properties for a long period of time to ensure a consistent and stable rental income. This model is suitable for properties that are not intended to be sold for the time being, while providing seniors with flexible living options.

This will not only increase the source of income and enhance the economic benefits of the project, but also effectively avoid the investment risks of the pension project and ensure the long-term stable development of the project.

5 Conclusion

This paper constructs an investment risk evaluation system for senior living real estate projects from the perspective of developers. The AHP method is used to calculate the weight of each investment risk evaluation index, summarize the risk factors that should be considered first in the investment and development of senior living real estate projects, and at the same time, combine with the cases to carry out the risk evaluation of the investment scheme. Currently there are numerous methods to determine the weights, while this paper adopts AHP to determine the coefficients of the evaluation indicators, which not only considers the subjective judgment of the importance of each indicator, but also systematically assigns the weight value of each indicator, avoiding one-sidedness, and making the results more sensible and reasonable. Although the construction of the investment index of the pension project is currently realized, the research method still needs to be improved in order to further analyze the risk of project investment and obtain the maximization of benefits.

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