Research On Multi Objective Programming In Real Estate Investment

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Abstract

This paper is based on modern portfolio theory, considering the relevant risks and constraints in the process of real estate investment, the establishment of a center for the return and the risk variables of multi-objective programming model for decision-making, so that the combination of investment risk and maximize the profits of the best node minimum.

Keywords

Multi objective programming, Real estate investment, Risk.

1. Introduction

Due to the large amount of investment and high risk of real estate investment, most real estate investment projects need to carry out feasibility study and demonstration before decision making. At present, the demonstration of economic feasibility of project is mainly based on dynamic index such as internal rate of return, net present value, static index such as investment recovery period supplemented by single index calculation. However, at present, there are still some problems in the investment decision of this method: (1) there are deficiencies in the evaluation and calculation of investment decision making project feasibility. (2) due to the fact that the dynamic index is usually considered first, and then the static index is taken into account, there are also deficiencies in the feasibility of using index calculation results to measure the feasibility of the project.

Thus, although the investment decision of the project is simple and easy to use single index, but due to the various independent index calculation, calculation of the index system is scientific and poor, cannot be a comprehensive measure of the whole scheme, ultimately unable to make scientific investment decisions or to make mistakes.

In view of this limitation, the system should adopt the scientific decision-making method of decision making, a comprehensive measure of economic benefits and the degree of risk, the establishment of multi-objective programming model, and to explore the multi-objective problem into a single objective problem, simplify the problem.

The investment decision of the development project is made up by the multi-objective programming model, which makes up for the deficiency of the feasibility and advantages and disadvantages of the single index independent investment project to a great extent, and improves the accuracy of the decision.

2. The application of multi objective decision model in real estate investment

2.1 Setting decision variables

There are n kinds of real estate investment types or business models for investment optimization portfolio, the weight of each project in the total investment is $X_i(i=1,2,3,\cdots,n)$, and $X=(X_1,X_2,\cdots X_n)^T$ is the investment allocation decision variables.

2.2 Analysis of conditions

Real estate portfolio multi - objective planning model set up four constraints.

(1)total investment constraints: the sum of the investment projects and the weight of 1.

2) the size of investment constraints: the first k class real estate projects scale investment ratio, there

are: $X_k \geq b_2$.

3) the advantages of operating the project minimum investment constraints: the advantages of operating projects for the first category of real estate projects, the investment ratio of not less than

$$b_3, X_S \geq b_3.$$

4) real estate investment in the total investment development cycle constraints: i class i real estate investment and investment development cycle, so the overall investment and development cycle.

2.3 Analysis of conditions

The multi-objective planning model sets two objectives: one is the portfolio with the greatest expected return rate; the second is the investment portfolio of the smallest investment risk, that is, through a reasonable portfolio to achieve the expected return on investment and investment risk the best combination.

(1) the overall rate of return objective function

$$\max R_P = \sum_{i=1}^{n} R_i X_i$$

The portfolio's expected yield can be defined as the weighted average of the expected return on investment in the portfolio. Set the expected rate of return on real estate projects, the overall rate of return objective function is:

(2) the overall investment risk objective function

The risk of the portfolio can be defined as the likelihood that the yield of the portfolio is lower than the expected rate of return. The standard deviation of the expected rate of return for the real estate project is that the correlation coefficient between the i-th and the j-th real estate projects is The overall investment risk objective function is:

$$\min \sigma_p^2 = \sum_{i=1}^{n} X_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} X_i X_j \rho_{ij} \sigma_i \sigma_j$$

2.4 The Establishment of Multi - objective Programming Model

In summary, the multi-objective planning model of the real estate portfolio can be established as follows: Objective function:

$$\max R_P = \sum_{i=1}^{n} R_i X_i$$

$$\min \sigma_p^2 = \sum_{i=1}^{n} X_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} X_i X_j \rho_{ij} \sigma_i \sigma_j$$

Restrictions:

$$\begin{cases} \sum_{i=1}^{n} X_i = 1 \\ X_k \geq b_2 \\ X_S \geq b_3 \\ \sum_{i=1}^{n} T_i \leq T_0 \\ X_i \geq 0 \\ i = 1,2, \cdots n \end{cases}$$

3. Application examples using linear weighted sum method to multi-objective problem into a single target problem

A real estate company has three investment programs, namely P1 program, P2 program, P3 program, that is, three kinds of investment projects in the total investment in the weight of the same is not the same. There are two evaluation indicators: the overall rate of return, the overall investment risk.

The indicator values for each program are assumed as follows:

Table 1. The indicator values for each program are assumed as follows

Indicators	Overall rate of return F1	Overall investment risk F2
P_1	62.76	27.25
P_2	51.24	25.50
P_3	43.10	20.10

Proceed as follows:

with the trend

Because f1 requirements as the bigger the better, and f2 requirements as small as possible, so f2 into the biggest problem. Use the formula:

$$f'_{i2} = (Maxf_{i2} + Minf_{i2} - f_{i2})$$

Table 2. The biggest problem. Use the formula

Indicators	Overall rate of return F1	Overall investment risk F2
P_1	62.76	20.10
P_2	51.24	21.85
P_3	43.10	27.25

the amount of system to naturalization

$$F_{ij} = \frac{F'_{ij}}{F_{jMax}} * 100$$

F_{ij} is Table 2 data, F_{jMax} representing the maximum value of column j, resulting in Table 3.

Table 3. Representing the maximum value

Indicators	Overall rate of return F1	Overall investment risk F2
P_1	100.00	73.76
P_2	81.64	80.18
P_3	68.67	100.00

Assuming the weight coefficient of the program evaluation:

$$\lambda = (0.6, 0.4)^T$$

Comprehensive evaluation:

$$G = \sum_{j=1}^{2} \lambda_j f_j = F\lambda = \begin{pmatrix} 100.00 & 73.76 \\ 81.64 & 80.16 \\ 68.67 & 100.00 \end{pmatrix} \begin{pmatrix} 0.6 \\ 0.4 \end{pmatrix}$$

$$= (85.50, 81.05, 81.20)^T$$

Due to 85.50> 81.20> 81.05

So, the final decision is: P1 preferred, P3 second, P3 last.

4. Conclusion

Real estate investment is a multi-objective decision-making problem. By establishing a mathematical model, this paper will standardize the different types of multi-indicators, and further transform the multi-objective problem into a single-objective problem.

In the choice of investment programs to conduct a comprehensive analysis of the investment program, rather than investment in the profitability of the program is a viable option. Because the weight of some of the indicators of evaluation, will lead to alternatives in these goals prevail, but this will lead to greater risk. It is worth noting that the weight of the decision index will have a large impact on the calculation results. If the decision maker wants to express his preference by adjusting its value, it should be very careful when adjusting the index.

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