Retraction

Retracted: Optimization of Tourism Real Estate Development Project Based on Option Premium Model

Discrete Dynamics in Nature and Society

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] D. Ying, "Optimization of Tourism Real Estate Development Project Based on Option Premium Model," *Discrete Dynamics in Nature and Society*, vol. 2021, Article ID 2954795, 8 pages, 2021.

Research Article

Optimization of Tourism Real Estate Development Project Based on Option Premium Model

Donglei Ying ![ORCID]

School of Economics and Management, Tongji University, Shanghai 200092, China

Correspondence should be addressed to Donglei Ying; yingdonglei@alumni.tongji.edu.cn

Compared with that of traditional housing real estate, the development of tourism real estate is time-consuming, complex, and irreversible. It is hard to guide investment decision-making on tourism real estate with the conventional discount cash flow (DCF) method. This paper aims to demonstrate that the real option method can improve and optimize the investment decision-making on tourism real estate. Through case analysis, the real option model, i.e., the classic American real option model, and binary tree value distribution model were adopted to analyze the factors affecting the real option of tourism real estate, optimize the development sequence of tourism real estate project, and demonstrate the phased development value of tourism real state, thereby enhancing the development value of tourism real estate projects. The case analysis proves that tourism real estate investment is fully consistent with real option in the uncertain spatiotemporal attributes: uncertainty, irreversibility, and timeliness. Therefore, tourism real estate project carries obvious features of real option. The decision-making by the real option model is much more scientific and superior than that by the conventional DCF method. Since the application of real option theory has been emphasizing housing real estate over tourism real estate, the research results enrich the theory on real option-based investment decision-making for real estate and expand the application scope of real option.

1. Introduction

At present, tourism real estate enterprises still rely on traditional metrics to analyze and evaluate project investment, such as internal rate of return (IRR), payback time, and net present value (NPV) [1]. During project analysis and evaluation, these metrics are theoretically supported by the discount cash flow (DCF) method and suitable for small construction projects requiring one-time investment. In real life, however, tourism real estate development is often highly uncertain [2] as it tends to span across several regions, last a long time, and cover multiple phases. According to the traditional theory, the excessive uncertainty brings a huge risk to the projects. From the perspective of option, the uncertainty will push up the option value [3].

Since its proposal in the 1970s, real option and its pricing method have been applied to various emerging industries and venture capital industries. The application is particularly successful in the real estate sector, producing lots of representative research results (Table 1).

Chinese scholars started to examine real option in the early 21st century. Currently, real option theory is mainly adopted to discuss land market and housing real estate in real estate investment analysis [12].

Some scholars tried to apply real option theory in commercial real estate [13], and some tried to apply in water management [14].

However, by the practice of tourism real estate investment, the author found that very few scholars introduced the theory to other segments of real estate, namely, industrial real estate and logistics real estate by Wu et al. [15], especially in the tourism real estate, which still uses the backward NPV method.

This article attempts to apply the latest real options theory to tourism real estate innovatively.

We use option thinking instead of traditional net present value (NPV) thinking and give options for tourism real

TABLE 1: Representative foreign studies of real estate based on real option theory.

Field	Main topics	Representative works
Real estate mortgage	Mortgage pricing	McDonald and Siege [4]
Mortgage-backed security	Design and pricing of mortgage-backed security	Anderson et al. [5] Yeh and Lien [6]
Formulation of real estate purchase and sales strategies	Analysis on the housing provident fund system; presale pricing strategy for commercial housing	Yao and Pretorius [7]
Lease design and pricing	Design and pricing of different forms of lease; credit difference analysis under default risk	AlShelahi et al. [8]
Investment in real estate development	Analysis on land price structure; investment decisions on real estate development and redevelopment; conversion and hybrid development decisions between different land uses	Jang et al. [9] Dahan [10] Glascock et al. [11]

estate projects. By analyzing the real option value of tourism real estate projects, we can calculate the best development time of tourism real estate projects and realize dynamic optimization under uncertainty and demonstrated that Real Options can better optimize the investment decision-making on tourism real estate than net present value (NPV).

This paper is mainly composed of three parts: Introduction, Real Option Model, and Case Analysis. The first part explains the dilemma of investment decision-making in tourism real estate and summarizes that real option theory is mainly applied in land market and housing market, rather than tourism real estate. The second part interprets the diagram of option value, solves the real option tourism real estate model, and evaluates the influence of relevant variables on the model. The third part calculates the real option value of tourism real estate and determines the binary tree value distribution in each phase.

2. Modeling Basis

Black and Scholes and Merton pioneered the correct way to real options in 1973 and even won the Nobel Prize in Economics in 1997. Myers first proposed the concept of real options in 1977. The real options analysis framework believes that decision makers have the right to invest, expand, and abandon a project based on the new information obtained.

Considering the characteristics of tourism real estate, this article adopts the "classic, continuous, open," stochastic integral methods for pricing American options and innovatively discusses the effect of real options factors on tourism real estate project value.

2.1. Option Value Diagram.

Option value was divided into two parts: internal value and time value [16]. The internal value of option is the sum of the two parts (Figure 1).

Specifically, the intrinsic value of the call option = the market price of the underlying asset–the exercise value of the option (present value).

The time value of an option refers to the profit potential value during the validity period.

The value of the option is the lower limit of the intrinsic value and the upper limit of the call option underlying asset price.

Obviously, the higher the volatility of the underlying asset price, the greater the time value of the option. And the volatility of the underlying asset is more advantageous than the disadvantages for the option owner.

This asymmetry leads to the willingness of the bulls to pay more options for the volatility over a period of time, thus generating time value.

2.2. Classic American Real Option Model.

Suppose the project value V changes by the following geometric Brownian motion (GBM):

$$dV = \alpha V dt + \sigma V dz, \tag{1}$$

where α is the percentage growth rate of GBM, i.e., the drift coefficient of simple Brownian motion; σ is the fluctuation rate of GBM, i.e., the change parameter of Brownian motion; and Dz is the increment of Wiener process. Formula (1) shows that the current project has a known value. However, the future value of the project obeys lognormal distribution. The variance will grow linearly with the change of time period. Hence, the project will have an indefinite future value. As a result, the investment opportunity of the project is equivalent to the long-term call option. Then, the meaning of investment decision-making is to decide when to exercise the option. Therefore, investment decision-making can be treated as an option pricing problem and solved through dynamic planning.

2.2.1. Solution Features.

Through dynamic planning, the solution features can be obtained by option pricing (contingent debt) [16]. Then, it is necessary to find the rule to maximize $F(V)$, the value of option investment. At time t, investment has a return of $V_t − I$. Thus, the expected present value can be maximized by

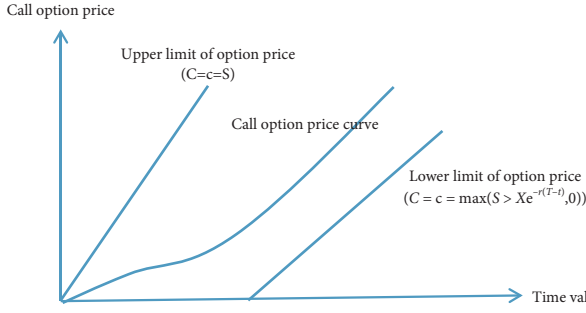$$F(V) = \max E\left[(V_T − I)e^{-\rho T}\right], \tag{2}$$

Figure 1: European call option price curve of no income assets.

where p is the discount rate; T is the time of decision-making in the future; and E is the expectation. To maximize constraint (2) on project v, it must be assumed that $\alpha < p$.

α is the percentage growth rate of GBM; if $p < \alpha$, the e^{-pT} factor will become infinite and the value growth rate of the project will be infinite too, causing the formula insolvent.

So, we have to assume that $\alpha < p$ and assume that $\delta = p - \alpha > 0$ later and constrain the value of α to solve the formula solution.

There is also the optimal stopping problem in continuous time. The investment opportunity $F(V)$ will not generate any cash flow prior to the time of investment T. The only return is the capital gain. For the investor, V does not have an optimal value. Thus, the continuous-time Bellman equation can be established as follows:

$$pF\mathrm{d}t = E(\mathrm{d}F).\tag{3}$$

Formula (3) shows that, for the investment opportunity, the expected total return $pF\mathrm{d}t$ equals the expected added value in the period $\mathrm{d}t$. Expanding $\mathrm{d}F$ by Itô's lemma,

$$\mathrm{d}F = F'(V)\mathrm{d}V + \frac{1}{2}F''(V)(\mathrm{d}V)^2.\tag{4}$$

Substituting $\mathrm{d}V$ of formula (1) to the above formula and making $E(\mathrm{d}z) = 0$,

$$E(\mathrm{d}F) = \alpha V F'(V)\mathrm{d}t + \frac{1}{2}\sigma^2 V^2 F''(V)\mathrm{d}t.\tag{5}$$

Dividing the above formula by $\mathrm{d}t$, the Bellman equation can be obtained as follows:

$$\frac{1}{2}\sigma^2 V^2 F''(V) + \alpha V F'(V) - pF = 0.\tag{6}$$

If α is substituted with $p - \delta$, it must be assumed that $\delta > 0$ or $\alpha < p$ to ensure the existence of the optimal solution. After the substitution, $F(V)$ must satisfy the following:

$$\frac{1}{2}\sigma^2 V^2 F''(V) + (p - \delta)V F'(V) - pF = 0.\tag{7}$$

In addition, $F(V)$ must meet the following boundary conditions:

$$F(0) = 0,\tag{8}$$

$$F(V^*) = V^* - I,\tag{9}$$

$$F'(V^*) = I.\tag{10}$$

Condition (8) means $F(V) = 0$ under $V = 0$. Thus, if $V = 0$, the investment option has no value. The other two conditions are designed for investment optimization. As the value of optimal investment, V^* can reflect the net return $V^* - 1$ obtained by the enterprise. Formula (10) is the smooth boundary condition. If a weak $F(V)$ is not continuous and if the critical exercise point V^* is not smooth, then the return can be increased by dispersing the investment across different points.

Formula (7) is a second-order differential equation, which needs to conform to both boundary conditions. Although the first boundary has a known position, the second boundary is unknown. That is, the second boundary is necessary to make V^* a part of the solution. Formula (9) can also be explained after being converted into $V^* - F(V^*) = I$. If an enterprise makes an investment, t could obtain a project of value V. However, the investment option or opportunity whose value is $F(V)$ will be discarded. Hence, the net income is the value-opportunity cost: $V - F(V)$. At the point of critical value V^*, the net income equals the tangible or direct investment cost I. Similarly, the equation can be transformed to $V^* = I + F(V^*)$ so that the total cost of project value and investment is the sum of opportunity cost and direct cost.

Formula (7) must be solved under constraints (8)–(10) to obtain $F(V)$ rapidly. The functional form can be speculated. If it is effective, then the actual solution can be determined by substituting the form into the formula. We firstly described and derived some features of the solution, before giving its details.

To satisfy formula (6), the following form must be adopted for the solving process:

$$F(V) = AV^\beta.\tag{11}$$

Here is a modification of the formula. β and A are all calculated by each parameters.

And all parameters satisfy Brownian motion and Wiener formula (1) where α is the percentage growth rate of GBM, i.e., the drift coefficient of simple Brownian motion; $\delta = \rho - \sigma$ is the fluctuation rate of GBM, i.e., the change parameter of Brownian motion; and ρ is the risk-free drift rate, i.e., the risk-free yield.

The two constants, namely, critical value V^* of optimal investment and constant A, can be solved by substituting boundary conditions (9) and (10) into formula (11):

$$V^* = \frac{\beta}{\beta - 1}I,\tag{12}$$

$$A = \frac{V^* - I}{(V^*)^\beta} = \frac{(\beta - 1)^{(\beta - 1)}}{\beta^\beta I^{\beta - 1}}.\tag{13}$$

Formulas (11)–(13) define the optimal investment rule, i.e., the critical value V^*, and the value of investment opportunity. Investing on that point can optimize the features. The features of the solution will be described in detail in the subsequent analysis.

2.2.2. Solving β. Since tourism real estate project has an optimal development time, the said solution is important to the project.

[Footnote: Dixit and Pindyck [17]].

Notably, it can be derived from $\beta > 1$ that $(\beta/\beta - 1) > 1$ and $V^* > I$. Therefore, the NPv rule is proved sufficiently accurate. For tourism real estate project, there is a wedge between investment cost I and critical value V^* due to the irreversibility and uncertainty of the project. The wedge size equals the factor $\beta/\beta - 1$. The factor should be considered fully in order to examine the response of the wedge to the changes of some parameters, as well as the magnitude of the parameter values. For this purpose, it is necessary to analyze the solution to formula (9) in greater details.

Factor (7) is linearly correlated with dependent variable F and its derivative. Hence, the general solution of (7) can be considered a linear combination of two independent solutions. If the function AV^β is selected, it can be assumed that β is the root of homogeneous equation. Thus, we have

$$\frac{1}{2}\alpha^2\beta(\beta - 1) + (\rho - \delta)\beta - \rho = 0. \tag{14}$$

The two roots of the equation can be expressed as follows:

$$\beta_1 = \left(\frac{1}{2} - \frac{\rho - \delta}{\alpha^2}\right) + \sqrt{\left(\frac{1}{2} - \frac{\rho - \delta}{\alpha^2}\right)^2 + \frac{2\rho}{\alpha^2}} > 1,$$

$$\beta_2 = \left(\frac{1}{2} - \frac{\rho - \delta}{\alpha^2}\right) - \sqrt{\left(\frac{1}{2} - \frac{\rho - \delta}{\alpha^2}\right)^2 + \frac{2\rho}{\alpha^2}} < 0. \tag{15}$$

Since $\beta > 0$, β_1 is the root of the equation.

β_1 is a definite value; as long as each parameter is determined, it is unique. This formula reflects the relationship between σ, p, and δ.

So that we can also calculate V^*, A, and $F(V)$, which just is the best real option value by formulas (11)–(13).

2.2.3. Influence of Real Option Factor. As the effects of project value, α, δ, and p can be evaluated by a standard static comparison:

(1) α is the percentage growth rate of GBM, i.e., the drift coefficient of simple Brownian motion. It can be understood as the expected yield.

If α is larger, it indicates that the investor's expected rate of return is higher, and it also indicates that the investor is willing to take greater risks.

If α changes with time or the variable V, it will become more uncertain when determining the optimal investment rule.

Different decision makers have different expectations, which directly affects the valuation results of real option price.

With the growth of α and decrease in β_1, the value of $\beta_1/\beta_1 - 1$ will increase. Then, value V will become more uncertain in the future, resulting in a larger project value $F(V)$.

(2) $\delta = p - \sigma$ is the fluctuation rate of GBM, i.e., the change parameter of Brownian motion. It can be understood as the fluctuation rate of the project. $\delta = p - \sigma$ describes the deficiency of return or convenience yield.

Because generally we believe that a competitive product market will prevent prices from being too high or too low. Product prices fluctuate based on the intrinsic value of the product and obey the mean reversion.

Therefore, the distribution of product prices is more in line with the normal distribution, that is, in line with the Brownian motion on the function. This is why we put forward the geometric Brownian motion (GBM) formula at the beginning.

And more importantly, $\delta = p - \sigma$ can just express the extent of price deviation from value, which is also the volatility of price. Therefore, δ can be regarded as the volatility of the project price.

Since β_1 increases with δ, a higher δ leads to a smaller wedge $\beta_1/\beta_1 - 1$. The growth of δ will stabilize the future value V and suppress the project value $F(V)$ in the future.

(3) p is the risk-free drift rate, i.e., the endogenous discount rate and correlation coefficient in dynamic planning. It can be understood as risk-free yield.

Since β_1 has a negative correlation with p, a higher p means a larger wedge $\beta_1/\beta_1 - 1$. The growth of p will destabilize the future value V,] and bolster the project value $F(V)$ in the future.

2.3. Influence of Real State. Therefore, it can be discovered that

(1) When ρ and δ remains unchanged, the real option value will increase with α, i.e., the expected yield, and decrease with α.

The α value is deeply affected by the bounded rationality of tourism real estate investors. Optimistic investors often overestimate the expected yield, and conservative investors tend to underestimate the expected yield.

Therefore, when the expected yield of tourism real estate project is overestimated, the real option value must have been overestimated; when the expected yield is underestimated, the latter must have been underestimated, even to a level below the investment cost, making the project seemingly unsuitable for investment. In this case, if investors are not confidence about the benefit of tourism real estate project or strictly control the development risks of tourism real estate, they could wait for another investment

opportunity or give up the investment opportunity in order to avoid investment risks.

In general, a project with high investment difficulty has a high-risk factor. It is often believed that a high-risk is often accompanied by a high benefit. Thus, investors may expect more benefits from difficult projects. For tourism real estate investment, man-made tourism real estate is more difficult and uncertain than natural tourism real estate or human tourism real estate. Therefore, man-made tourism real estate has a higher expected yield than the latter two tourism real estates.

(2) When ρ and δ remain unchanged, the real option value will decrease with the growing convenience rate of tourism real estate δ, i.e., the dividend yield implied in the fund invested in tourism real estate or the opportunity cost of fund utilization, and increase with the decrease in δ.

Therefore, there is a cost to utilize the fund invested in tourism real estate. The utilization of the fund does not bring any excessive income. If the investment fund has a high dividend yield, conservative investors would rather wait than invest in tourism real estate. The investment in tourism real estate can be stimulated by a low convenience yield, a low dividend yield, and the bounded rationality of investors. Table 2 shows the relationship between classic real option parameters and project value.

3. Case Analysis

3.1. Real Option Value of Project A. After summarizing the incomes and costs of project development, the net cash flow of the tourism real estate project can be clarified as Table 3. The NPV of Project A can be calculated by taking the discount rate of 4%. According to the NPV formula, simply adopt the bank five-year average loan interest rate of 4%, as the discount rate.

3.1.1. Calculation of Real Option Value. According to the abovementioned formula, real option value can be calculated by

$$\beta_1 = \left(\frac{1}{2} - \frac{\rho - \delta}{\alpha^2}\right) + \sqrt{\left(\frac{1}{2} - \frac{\rho - \delta}{\alpha^2}\right)^2 + \frac{2\rho}{\alpha^2}} > 1. \quad (16)$$

The real option value is optimal (maximum) when $V = V^*$.

The first step is to calculate the expected growth rate α. From Table 3, it can be seen that the total investment cost is 3,755,970,000 yuan, the total investment income is 4,396,520,000, and time T is 7. Then, $\alpha = 2.66\%$ can be solved by the growth rate formula as follows:

$$4,396,520,000 = 3,755,970,000 * (1 + \alpha)(7 - 1). \quad (17)$$

Taking the discount rate of 4%, the convenience yield equals 4%. Then, it can be computed that $\beta = 11.145$ and

$A = 9.62798E{-}59$ (close to zero). Setting the cost I to 3,755,970,000 yuan, then

$$V^* = 4,126,201,100 \text{ yuan},$$
$$F(V) = 370,231,100 \text{ yuan}. \quad (18)$$

3.1.2. Optimal Development Cycle. For real option investment decision-making for tourism real estate, a key consideration is the optimal development cycle. After analyzing the project development, the initial year discount and initial value of the project enterprise were both 3,755,970,000.

The optimal development cycle of real option can be defined by

$$T = \frac{1}{\alpha} \ln\left[\frac{\rho I}{(\rho - \alpha)X_0}\right],$$
$$T = \frac{1}{2.66\%} \ln\left[\frac{4\%}{(4\% - 2.66\%)}\right] = 41.11 \text{ (years)}. \quad (19)$$

Under the discount rate of 4%, if the tourism real estate project maintains an annual yield of 2.66%, then the optimal development cycle of the project is 41.11 years. The option value of the project will peak in the 41.11 year. That is, the optimal lifecycle of the project is 41.11 years.

Note that the later operating phase faces a very high uncertainty. The development and operation must be adjusted according to the actual environment. After each adjustment, the cash flow and real option value must be recalculated. This reflects the agility and managerial flexibility of real option.

3.2. Real Option Value Distribution. By real option premium, the housing subprojects were ranked and subjected to phased development. As shown in Figure 2, the project development covers four phases:

(i) *Phase I*. Tourism project I (rainbow forest and tourism facilities): Give full play to the role of the rainbow forest and the supporting facilities, creating an elegant, safe, and harmonious atmosphere for the tourism real estate project. In this way, the premiums of the land and real estate project will be further improved.

(ii) *Phase II*. Real estate project I (mall high-rises): Because of the large option premium, start construction immediately when rainbow forest is about to complete, to avoid affecting follow-up construction.

(iii) *Phase III*. Tourism project II (man-made resources): Develop dream islands and children's playground, providing the necessary resources for subsequent real estate development.

(iv) *Phase IV*. Real estate project II (real estate project): Develop high-rises block and villa block following the relevant procedures, aiming to obtain option premium and maximize project income.

TABLE 2: Relationship between classic real option parameters and project value.

Parameter	Meaning	Correlation with F
α	Expected yield	Positive
σ	Fluctuation rate	Positive
P	Discount rate, risk-free yield	Positive
Δ	Convenience yield (dividend yield)	Negative

TABLE 3: Cash flow of the tourism real estate project under Project A (unit: yuan).

| Development plan	Total	2016	2017	2018	2019	2020	2021	2022
Development cost-housing	2,455,650,000	887,650,000	387,970,000	257,580,000	379,760,000	410,550,000	132,120,000	0
Development costs-tourism	1,300,320,000	477,800,000	0	74,400,000	35,050,000	406,800,000	254,830,000	51,430,000
Total investment cost	3,755,970,000	1,365,450,000	387,970,000	331,980,000	414,810,000	817,350,000	386,960,000	51,430,000
Housing sales revenue	3,310,520,000	0	476,160,000	734,400,000	214,400,000	1,122,790,000	762,760,000	0
Tourism sales revenue	1,086,000,000	0	0	0	276,000,000	0	405,000,000	405,000,000
Total investment income	4,396,520,000	0	476,160,000	734,400,000	490,400,000	1,122,790,000	1,167,760,000	405,000,000
Net cash flow	327,770,000	−1,365,450,000	88,180,000	402,410,000	75,580,000	305,440,000	780,800,000	353,560,000
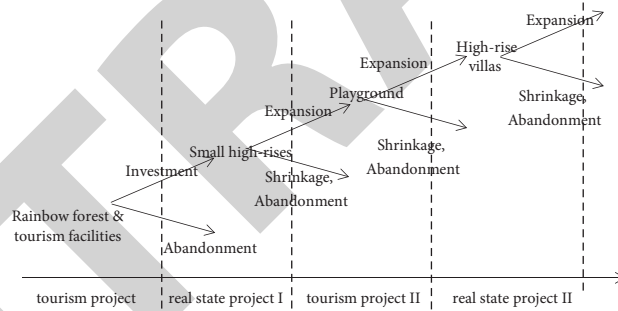
FIGURE 2: Improved development phases of tourism real estate project.

In the light of the actual situation, the binary tree value of the tourism real estate project was analyzed and calculated. The first is to solve the fluctuation rate. The rate was obviously 37.9%, as mentioned in the above analysis. In our plan, the values of S and X are already given: 439,652 (10,000 yuan) and 375,597 (10,000 yuan). Besides, $\alpha = 0.2539$, $T = 7$, and $\rho = 0.04$.

Then, the rise factor, fall factor, and risk neutral probability can be, respectively, calculated by

$$u = e^{\sigma\sqrt{\xi T}} = e^{0.3790 * \sqrt{1/7}} = 1.056,$$

$$d = e^{-\sigma\sqrt{\xi T}} = \frac{1}{u} = \frac{1}{1.056} = 0.947, \qquad (20)$$

$$p = \frac{e^{P(\zeta T)} - d}{u - d} = \frac{e^{4\%(1/7)} - 0.947}{1.056 - 0.947} = 0.539.$$

Next, the tourism real estate project was decomposed by the seven periods (years). The binary tree model of real option was derived for each period (Figure 3 and Table 4).

Different from the traditional market-driven development strategy, our development strategy, which is based on the optimal value of the real option premium model, integrates high-rises, multistory buildings, with villas, and develops all these subprojects at once, thereby avoiding the construction difficulty in cross-development in the preliminary phase. In addition, the least popular subproject, i.e., the high-rises, was developed first, and the priciest villas were developed at the end of the project such that the villas can be sold at a high price.

After being improved by the real option method, Project A can obtain option premium and live up to development needs. The improved project plan is highly feasible.
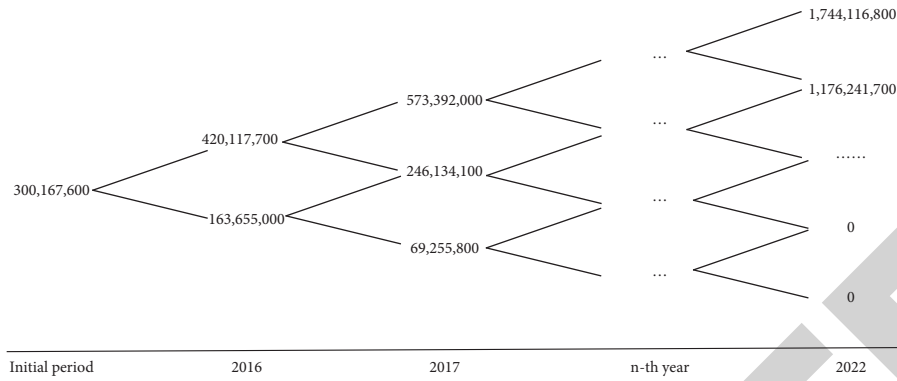
FIGURE 3: Real option value distribution of tourism real estate project (unit: yuan).

TABLE 4: Real option value of tourism real estate project in each period (unit: yuan).

Initial period	2016	2017	2018	2019	2020	2021	2022
300,167,600	420,117,700	573,392,000	760,774,700	978,607,300	1,218,980,400	1,473,877,100	1,744,116,800
0	163,655,000	246,134,100	361,434,900	515,545,800	709,733,000	936,114,200	1,176,241,700
0	0	69,255,800	114,385,500	185,743,400	294,913,500	453,874,500	666,998,700
0	0	0	17,351,400	32,376,400	60,411,900	112,724,000	210,334,300
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	00	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

4. Conclusions

Through drawing real option theory to the tourism real estate investment decision, this article has achieved certain results. However, there are also some shortcomings, such as the limitation of data access, the simplified application of formula models, and the lack of consideration of more special circumstances.

In the future, it is necessary to further deepen the discussion on the option game and behavioral economics of tourism real estate.

After reviewing the dilemma of investment decision-making in tourism real estate, this article innovatively applies real options to the tourism real estate, which is very different from the previous net present value (NPV) method that cannot adapt to tourism real estate.

And this article further uses real option factor parameters to explain the changes in tourism real estate, derives the real option tourism real estate model, and applies the model to the development of an actual project.

It is concluded that tourism real estate project carries obvious features of real option; real option-based decision-making is much better than market-driven decision-making; and the tourism real estate project becomes more valuable after being improved by the real option tourism real estate model. It greatly deepens research on options in tourism real estate.

The research results provide a good reference for applying real option in the investment decision-making for tourism real estate.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

References

[1] C. Ghosh, M. Liang, and M. T. Petrova, "The effect of fair value method adoption: evidence from real estate firms in the EU," *The Journal of Real Estate Finance and Economics*, vol. 60, no. 12, pp. 205–237, 2020.

[2] P. Bednarek, D. M. Te Kaat, C. Ma, and A. Rebucci, ""Capital flows, realestate and local cycles: evidence from German cities, banks and firms," *Working Paper Series Monetary Economics*, vol. 268, no. 20, pp. 1–65, 2020.

[3] J. P. Cohen and M. LaCour-Little, "New perspectives on real estate valuation," *The Journal of Real Estate Finance and Economics*, vol. 60, no. 12, pp. 1-2, 2020.

[4] R. McDonald and D. Siegel, "The value of waiting to invest," *Quarterly Journal of Economics*, vol. 101, no. 11, pp. 707–727, 1986.

[5] R. I. Anderson, S. Krautz, and N. B. Rottke, "Is real estate private equity real estate? - dynamic interactions between real estate private equity funds, non-real estate private equity funds, and direct real estate investments," *Journal of Property Research*, vol. 33, no. 3, pp. 252–268, 2016.

[6] I.-C. Yeh and C.-H. Lien, "Evaluating real estate development project with Monte Carlo based binomial options pricing

model," *Applied Economics Letters*, vol. 27, no. 4, pp. 307–324, 2020.

[7] H. Yao and F. Pretorius, "Demand uncertainty, development timing and leasehold land valuation: empirical testing of real options in residential real estate development," *Real Estate Economics*, vol. 42, no. 4, pp. 829–868, 2014.

[8] A. AlShelahi, J. Wang, M. You, E. Byon, and R. Saigal, "Data-driven prediction for volatile processes based on real option theories," *International Journal of Production Economics*, vol. 226, 2020.

[9] M. Jang, Y. Ku, H. Choi, T.-H. Kwon, J. Kim, and J. Kim, "A study on the multiple real option model for evaluating values based on real estate development scenario," *Korean Journal of Construction Engineering and Management*, vol. 16, no. 5, pp. 114–122, 2015.

[10] A. A. Dahan, "The future of the real estate industry of Dubai-- the demand for real estates (2000–2020)," *Journal of Global Economics*, vol. 6, no. 4, 2018.

[11] J. L. Glascock, W. Prombutr, Y. Zhang, and T. Zhou, "Can investors hold more real estate? Evidence from statistical properties of listed REIT versus non-REIT property companies in the U.S," *The Journal of Real Estate Finance and Economics*, vol. 56, no. 2, pp. 274–302, 2018.

[12] S. Q. Chen, "Research on economic evaluation of real estate investment projects based on real options," *Wealth Today: Chinese Intellectual Property*, vol. 1, no. 3, pp. 51-52, 2017.

[13] X. Zhao, "Research on the real option characteristics and application framework of commercial real estate investment," *Journal of Engineering Management*, vol. 1, no. 5, pp. 45–47, 2006.

[14] J. Zhang, X. Y. Wang, and L. Hua, "Informed options trading prior to dividend change announcements," *Financial Management*, vol. 47, no. 1, pp. 81–103, 2017.

[15] C. L. Wu, G. Hu, and Y. R. He, "Decision of logistics real estate investment based on the fuzzy real option theory," *Journal of Hebei University (Natural Science Edition)*, vol. 35, no. 6, 2015.

[16] L. Trigeorgis, *Real Options: Managerial Flexibility and Strategy in Resource Allocation*, Qinghua University Press, Beijing, China, 2007.

[17] R. K. Dixit and R. S. Pindyck, *Investment under Uncertainty*, China Renmin University Press, Beijing, China, 2001.