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Real Options in Management of Modern Corporation: Perspectives of Usage and the Problem of Valuation

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In the given article the approaches to the core of strategic management of company are showed, the role and meaning of various indexes for estimation of corporate strategies effectiveness are analyzed. On the basis of characteristic of modern conceptions about management effectiveness of corporation the interconnection of corporations' strategies with method of real option valuation is revealed, the objective necessity to use this method is disclosed with the aim of increasing the company's valuation and effectiveness of individual project. The nature of adequate estimation of option value is shown. Though the scientific activity in the given area is very active, there is no method of valuation, which can give precisely the quantitative formula of management decisions, built on the base of real options. For valuation of real options the three main methods are in usage, they are: the Binominal Option Pricing Model, the Black-Scholes Model and the Monte Carlo Method. In the given article the following is presented: the core of the approaches, their benefits and drawbacks and the picture of calculation of Real Option price. In the Conclusion part the resume and recommendations are submitted those of choosing this or that method of valuation.

Keywords: strategic management, corporate strategies, competitive strategies, management effectiveness of corporation, Company's capitalization, Real Option, the Binominal Option Pricing Model, binominal lattices, Portfolio Replication Method, Black-Scholes Model, Monte Carlo Method.

Introduction

In the conditions of increased economic instability, high volatility of financial markets and meaning review of traditional methods and management technologies the actuality of search and usage of new tools for effective management of Modern Corporation increases. It refers to the choice of tools both for realizing corporate strategies as a whole and for individual projects, which realize the strategic aims of corporation. The strategy of corporation can be presented as a combination of its strategic projects (business-projects, investment and etc.), or the projects, the realization of which provides the aims' realization of different owners' groups in prospective in the conditions of instability. Accordingly, valuation of a certain project success is roughly determined by that fact how effective the strategic aims are being realized. In its turn the Company's strategy effectiveness depends on the moment, how in planning effects of every projects the owners' aims have

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been taken into account and realized, and on the possibilities of corporation management to react flexibly and operationaly upon the new challenge in the area of technologies, markets, methods of management, human resources as well. It is evident, that reserves of corporative effectiveness are directly connected with the possibilities of tools usage that decrease the level of instability and increase dynamic capability of the Company.

The evolution of Modern Corporation has defined the nature of changes in approaches to the core and type of strategic management of the firm (Katkalo V.S. made a fully enough analysis of stages in the theory development of strategic management in fundamental monograph «Evolution of Strategic Management Theory» (Katkalo, 2008). The ideology of resource approach succeeded in the school of positioning, strategy of competitive advantages in markets, which had been dominating for a long time, as priority the strategy of leadership, anticipatory management, innovative management, network conception of strategic management are being developed. Competitive strategies do not disappear, as competition, as an essential feature of market system, cannot disappear. But the matter and tool of strategies are changing. Determinant things in firm's strategy become its internal potential, unique possibilities as of dynamic organization, effective management, which is capable to take into account the complex interests' structure of corporation subjects (also stockholders) and react on the changing situation. It is evident, that new approaches to the core of strategic management have changed the conception about effectiveness valuation of realizing strategies. The combination of taking into account effects is becoming more varied. Calculation in strategic or project management of effects in the form of minimization of costs, dynamic of financial indexes is expanded by calculation of new effects in the form of possibilities to manage the risks, innovative potential, and other intangible assets, which have a great influence on Company's valuation.

One of the methods, capable to raise considerably the effectiveness of strategic project and the Company's valuation, to create additional effects for its development, is the inclusion of real options' tools in the system of corporation management.

About the valuation of management effectiveness of corporation

Role and limited nature of effectiveness valuation on the base of financial indexes

The appearance of the method of real options, built into the Company's strategy or its individual project and which creates additional possibilities in the process of making management decisions, is the reaction on the limited nature of other management tools and insufficient valuation role of financial indexes. The main cause of financial indexes' limited nature in modern researches is being connected with their static nature (Katkalo, 2008). In the settled for the given date indicators, for example, made firm's potential, capable to create preference in future, is not taken into account.

Together with that, in combination of financial indexes other factors are not reflected as well: specific character of the stage in the Company's life cycle, the type of dominating owner, various interests of different owners' groups.

The effectiveness of corporate strategies is firstly determined by the character and the direction of dominating owner's actions. An effective and dominating owner is certainly different things. Historically, two forms of an action display of owner, who has a control or blocking stockholding can be pointed out, which

as a whole reflect various stages in Company's life cycle. The first one is an owner, who is oriented on the growth of Company's sizes, dynamic of absolute financial indexes: sales targets, value of control assets. This approach is mainly peculiar to extensive stage of business development. The effectiveness valuation with the help of similar indexes can actually distort the valuation of real financial Company's condition and effectiveness of its strategies.

The other form of owner's actions according to market transformation of economy directs towards the changes of relative indexes, that is dynamic of profits to the personal capital, a capital turnover, break-even of capital investments, etc. In other words, orientation on the rational usage of Company's resources is typical for the given form.

The both forms of controlling owners' actions present in Russian Economy (certainly, in clear form they can be pointed out in the context of theoretical analysis, it is spoken about tendencies). If, in the first case, the owner is interested in the growth of gross indexes, sooner or later the corporation will face the problem of competitiveness. Such approach an of owner to the results of the Company's activity is often accompanied by preservation the functions of both strategic and operational management by him. In the second way of corporation development in the direction of effectiveness growth, the detachment of propriety from the functions of management is typical. The owner aims at the effectiveness, delegating the functions of active control to management, remaining the functions and power of the strategic development of business. Thus, Company's effectiveness is based on the professionalism of an owner and professionalism of management.

According to the processes development of propriety division from management and complicating the structure of joint-stock propriety into another level the problem of corporation effectiveness is transferred. On the one hand it can be presented as a problem of stockholders and managers' self-identification as subjects of economy, as a determination and effectiveness of using the function in corporation management by him in the interests of the latest one. On the other hand, the problem of corporation effectiveness becomes more complicated by the presence of various stockholders' groups with their specific interests. The corporation effectiveness for various stockholders' groups can be presented as a rule of financial indexes, which are not connected between each other. Thus, the more adequate way of valuation is the method of Company's capitalization, partly taking away the contradictions in aims of various owners' groups. However, the growth of Company's valuation as an effectiveness index of realizing strategies is mainly determined by the mechanisms of stock market. In the condition of high market volatility and financial shock the value index of capitalization for owners roughly decreases.

Including of nonmarket criteria in valuation of effectiveness

The results of corporation, being oriented on the interests and needs of all the subject of corporation, cannot be fully described in terms of market effectiveness. The structure of interests, based on corporate groups is not only varied, but it is not reduced to the system of market indicators. The interest of majority and minority of stockholders can be presented not as an absolute meaning of market parameter, but with the help of hierarchic structure of preference according to the level of importance. The market criteria are not identical to the criteria of economic effectiveness. The criteria of market effectiveness integrate only those preferences and interests, which can become apparent in market.

The economic criteria include also interests of separate corporate groups, which do not interfere in the system of market indexes. So, if aspiration of management for the expansion of control function can be presented in market indexes of economic company's growth, expansion of market share, in this case its interest in growth of activity professionalism implies introducing the indexes of quality of corporate management, corporate culture, etc. Consequently, it is necessary to use another measure system of management effectiveness of corporation. Market indexes incorporate only a part of interests of different stockholders and managers' groups.

One more reason for criteria's nonidentity of market and economic effectiveness is the presence of contradictions between interests of various corporate groups. For example, making effective market decisions by the control owner (via the Board of Directors or the meeting of stockholders by means of «forcing through» this decision) may bring response actions from the side of other stockholders, which are exposed to the legitimacy attack of made decisions. That is why, bearing in mind the complicated structure of interests, to the problem of corporation effectiveness it is impossible to come up from the side of only market criteria. It is necessary to take into account the possible level of costs from opportunistic movement or individual groups of stockholders or managers.

Estimation based on the method of real options

In condition of contradictoriness of financial indexes for valuation of corporate strategies' effectiveness conception of real options is proposed in modern Russian literature (Bukhvalov, 2004). Formation and presence of real options contribute to increase of Company's valuation for its owners, and the usage of method of real options allows putting into the valuation of strategy effectiveness of Company calculation of such effects, which considerably influence on the company's valuation (the value of human capital, flexibility in management, new technologies in management of projects and production, etc). Especially, this method of real options is important in the condition of increasing economic instability and decreasing the role of financial markets in the estimation of company valuation.

Real option valuation

The Core of the real options

Distinguishing the method of real options as a tool of corporate strategy, we define a real option as a management right (or a combination of rights) to realize effects, which belongs to the corporation in the form of various, together with economic (level of costs, label productivity), additional effects. In particular, real option is the manager right to display his management flexibility, which will influence on the course of strategic project realization and reflect on the valuation of its effectiveness. Thus, the method of real options is the effective way of project protection from various risks, and also it is the regulator of corporate strategies in different areas in accordance with emergent conditions, which have not been determined clear before.

In fact, real options in context of Company's management or its individual project are the presence of exclusive additional possibilities in the process of project realization, which has strategic status. These possibilities are connected with management flexibility, presence of alternatives to make changes in the course of strategy or project realization. In other words, the Company's possibility to influence on the course of strategy realization becomes an additional asset for it. Together with that the question of formalization of these possibilities, calculation of their valuation in the form of real option valuation remains difficult and controversial.

Approaches to the estimation of real option valuation

Despite the enticing features of such a method, its hand-on application presents a certain difficulty. It is connected with the discussion on objectivity of calculation records. По мнению отдельных авторов, There is a suspicion that of prospective exceeding of real option valuation, especially it could possibly occur with developing markets where information supply for decision taking is lower than on the developed markets and the experience of forecasting is less. The method of real options is deployed when taking strategically significant decisions, so even minor faults could bring financial losses.

To use this method as a tool for valuation of corporate strategy effectiveness, which is a portfolio of real options, and for realization of strategic management aims and management of individual project as well it is very important to chose a suitable method of real option valuation. Real options are valuated via Option Pricing Models. However, the valuation process is extremely cumbersome. Any of the approaches of financial option valuation could merely provide precise estimation. To settle the dispute on what method of real option valuation to choose it is helpful to be aware of the core of every method calculation type, its benefits and drawbacks which the method incurs for the records. The present article discusses the three methods in real option valuation, they are: the Black-Scholes Model, the Binominal Option Pricing Model and the Monte Carlo Method.

Let us take a detailed look at each model separately.

Possibilities of Binominal Option Pricing Model

The Binominal Option Pricing Model is considered to be effort-consuming but with its help one could derive really precise records. This very model implies the existence of only two variants of the project development in the following time interim for every meaning of the value which it could have taken in the prior time step.

In 1979 Cox, Ross and Rubinstein devised the standard Binominal Option Pricing Model. At these times Rendleman and Barter applied the model for valuation. For the purpose of real option valuation the Binominal Model started to be used only in 1990 and just from the very outset it entered into vast application scope. Primordially, in the given approach brackets the estimation was conducted through drawing «the binominal lattices», later they suggested the Portfolio Replication Method. Let us examine each of them.

The Core of the Method

When drawing the «binominal lattices» for every variant of the project development it is determined the likely change rate of the value of the underlying asset. Then «the lattice» itself is to be drawn and the movement along which is launched on the basis of valuation of real options. The lattice drawn could be binary and multilink as well.

Symbolically, the algorithm of drawing the binary tree could be displayed in the following fashion.

Firstly for the project PV of the money inflow of the project is calculated. Then on the assumption of standard volatility and time-steps in the lattice the prospective volatility rate in business value is calculated taking into account optimistic and pessimistic scripts accordingly.

$$u = e^{\sigma\sqrt{T}}$$

$$d = \frac{1}{u}$$

where u – is volatility rate in business value under an optimistic script;

d – is volatility rate in business value under a pessimistic script;

T – is time to option expiration

Then «the binominal lattice» is to be drawn, where S – is current value of the underlying asset and S_u and S_d are – value of the underlying asset under optimistic and pessimistic scripts accordingly.

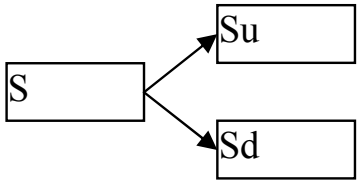

Fig. 1. Option Underlying Asset Lattice.

When in a project a separate risk factor gives a more number of variants of events development, if there are a few sources of uncertainty or a great number of dates of decision taking multinominal lattice is being drawn. Under such conditions the sources of uncertainty are considered not simultaneously but sequentially.

One should point out that to apply a discount rate, which is adjusted through investment risk provision (as a rule WACC), is wrong for the project on the whole, because while using real options, the project risk is on change. That is why while moving along «the lattice» the discount rate is to be adjusted (Arnold and Crack, 2004).

To avoid the necessity of constant reconsideration of a discount rate it is needed to substitute risk-neutral probabilities for all probabilities of events outcome. Application in calculation of the concept of the neutral attitude of the investors towards risk causes one more assumption, namely, the necessary norm of returns for investors equals risk-free rate according to which all cash flows are then discounted.

The formulas of transition from objective to risk-neutral probabilities P_u and P_d look like this:

$$P_u = \frac{\left((1+r_f)^T - d\right)}{(u-d)}$$

$$P_d = 1 - P_u$$

where r_f – is risk-free rate;

u – is volatility rate in business value under an optimistic script;

d – is volatility rate in business value under a pessimistic script;

e – is time to option expiration.

The option value, which is calculated through the method of «a binominal lattice» is determined in the following way:

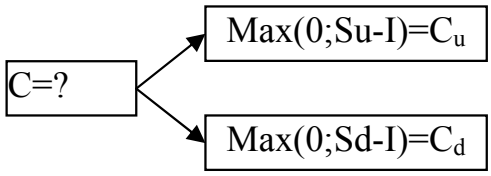

Fig. 2. Option Valuation Lattice

$$C = \frac{C_u * P_u + C_d * P_d}{(1+r_f)^T}$$

where C_u – is the option value under an optimistic script;

C_d – is the option value under a pessimistic script.

In the given model brackets it is possible to enjoy the Portfolio Replication Method. This method implies that on the prospering financial markets there is a total equivalent for the real option, so called «twin-security» which with its rate of utility has equal appeal and value for an investor as well as it has the same risks features as the project possesses, as far as it has totally correlated expected cash flows under the project. Thereby, we make option payoff equal to the value of some investment portfolio. This portfolio implies the purchase

of a certain quantity of twin-securities which have the value of the underlying asset of the company at the current period of time for the money borrowed:

$$C = mS + B$$

where C – is option CALL payoff (the 100% value of the company shares);
S – is the value of the underlying asset at the current period of time;
m – is the share of the underlying asset in a replication Portfolio;
B – the sum of the debt in a replication Portfolio.

Under execution of an optimistic script the price for the twin-security will rise and the Portfolio payoff will equal:

$$uV_0 + B\left(1 + R_f\right)$$

Under execution of a pessimistic script the price for the twin-security will decrease and the Portfolio payoff will equal:

$$dV_0 + B\left(1 + R_f\right)$$

The sum of the debt is adjusted by $(1+R_f)$, as far as the money borrowed is charged. Here it is necessary to settle the system of equation:

$$\begin{cases} umV_0 + B\left(1 + R_f\right) = C_u \\ dmV_0 + B\left(1 + R_f\right) = C_d \end{cases}$$

Under this system of equation one could make a conclusion that parameters for m and B are derived from the following correlation:

$$m = \frac{C_u - C_d}{S\left(u - d\right)}$$

$$B = -\frac{dmS}{1 + R_f}$$

Then we substitute the gained results for the reference formula and calculate the option value (Damodaran, 1999).

Advantages and disadvantages

Making the calculation more complicated could be provided through the American origin of the option but not via the European one, because the American option could be executed at any time before the expiration period. In this case the analysis of every lattice of the binominal lattices is conducted on the basis of the latter, that is the former execution of the option cancels the execution of the latter (Brandao et al., 2005).

In case when under the realization of the project the interest and dividends are charged to the capital assets, they should be deducted from the value of the capital asset.

The Binominal Option Pricing Model is one of the most applicable model for the purpose of providing the estimation of the real option valuation. Its absolute advantage is the simplicity of calculation and a simpler interpretation of the value reached. It also allows to provide a clear picture of a decision taking process through the movement along «the binominal lattice» from one to another lattice from the starting point of the option launch to the time of expiration on the option. It provides the opportunity to understand tentatively the way to act at a certain time-step. As far as the Binominal Option Pricing Model is based on the risk-neutral approach, as well as the Black-Scholes model which will be looked at further, it doesn't necessitate to adjust the rate of earnings yield, but in contrast to the Black-Scholes model, it could be applicable to the more complicated real options.

Pertaining to the disadvantages of the Binominal Option Pricing Model, the name of the model itself reflects its main pitfall. In the real-world situation the number of likely project scripts could be much more than two as well as the project

could be influenced by more than one risk factor at a time. On the other hand, frequently the two well-prepared scripts, executed in line with the decision taken, could substitute the large number of the events development variants which don't differ from one another greatly. (Limitovskiy, 2004)

Possibilities of the Black-Scholes model

The Black-Scholes model, suggested by Fischer Black and Myron Scholes Robert in 1973 and which then was improved by C. Merton, was awarded the Nobel Prize.

The core of the method

The core of the model is that the number of time-steps is aiming at an infinite quantity, at this time the time scale between the steps is greatly small.

The formula to determine the current price of the European CALL option, derived from the risk-neutral approach with the provision that the profit for the underlying asset is not charged, is the following:

$$C_0 = S\,N(d_1) - X\,e^{-rt}\,N(d_2),$$

$$d1 = [\ln(\frac{S}{X}) + (r + \frac{\sigma^2}{2})\,T\,] / [\sigma\sqrt{T}]$$

$$d_2 = d1 - \sigma\sqrt{T}$$

where C_0 – is a current price of the CALL option;

S – is current value of the underlying asset;

X – is a strike price;

r – is a risk-free interest rate corresponding to the life of the option;

T – is a life to expiration of the CALL option;

σ – is annual mean-square volatility of the underlying asset;

N(d) – is a standard normal cumulative distribution function.

As far as the parameters value is indicated for the financial options, it is necessary to give their compatibles for applicacation in the theory of real options (Tab. 1). (M. Limitovskiy, 2004)

In line with the Put-Call Parity Theorem, the value of the option could be displayed in the following way:

$$P = C - S_o + Xe^{-rt}$$

The Black-Scholes Model is the development of the Binominal Option Pricing Model, that is why the determinants of value in these models are the same – the current value of the stock price, the variability in stock prices, the time to expiration on the option, the strike price, and the risk-free interest rate. The principle of replicating portfolios that is used in binomial valuation also underlies the Black-Scholes model. In fact, embedded in the Black-Scholes model is the replicating portfolio. (Damodaran, 1999).

$C_0 = S_0 \underline{N(d_1)}$ $\quad - \underline{Xe^{-rt}N(d_2)}$

Buying N(d1) shares — Borrowing the necessary quantity

The $N(d_1)$ and $N(d_2)$ probabilities yield the likelihood that an option will generate positive cash flows for its owner at exercise, i.e., when $S_0 > X$ in the case of a CALL option and when $X > S_0$ in the case of a PUT option. The portfolio that replicates the CALL option is created by buying N(d1) units of the underlying asset, and borrowing $X\,e^{-rt}\,N(d_2)$. The portfolio will have the same cash flows as the CALL option and thus the same value as the option (Damodaran, 2002).

Advantages and disadvantages

The strongest point of the Black-Scholes Model is not only its feature to provide real option valuation but it also reveals the factors which make an impact on the project efficiency. The influence of factors is displayed in the table below (M. Limitovskiy, 2004) (Tab. 2).

Table 1

Parameter of the Black-Scholes model	Compatible for the theory of real options
S_0 – current value of the underlying asset	Current value from expected investment cash flow
X – strike price	Current value of needed investment into real assets
σ – annual mean-square volatility of the underlying asset	Mean-square deviation of the company share; mean-square deviation n the industry
T – life to expiration of the CALL option	Time during which one could enjoy the investment opportunity
r_f – annual rate of risk-free profitability	Risk-free profitability rate; quasi-risk-free profitability rate, which displays risk-free rate with the country risk

Table 2

Model parameters influence on the project	
S_0	The more the value of the underlying asset (in the case of a real option it is business value), the more the CALL option payoff and the less that is of a PUT one. In the case of real options it means that the value of a likely dissolution, when the price of the business itself is rising, is decreasing and on the contrary the value of further development prospects is increasing.
X	As the strike price is escalating, the CALL option premium is decreasing, and the PUT option premium is rising. In case with real option it means that the more capital investment business development requires, the less is the value of the opportunity of such development. And the more price the business buyers are ready to pay for its assets when dissolution, the more valuable is business or a project.
δ	As the standard volatility is increasing (measure of risk), options payoff is also in rise, both of CALL and PUT options.
T	The more the life to option expiration is, the more opportunities there are, those of profitability of the option execution in future (even if its execution could be give no gain). Therefore as the life to expiration is rising, any option value is more expensive under other equal conditions.
r_f	In economy the more the risk-free rate is, the more the CALL option price is, and the less is that of the PUT option.

The disadvantage of the model could be considered as the ability of application only to the European options. But it could be partially balanced with the acceptance of the conservative option valuation, that is the price of the European option is the lowest limit for the price of the American option with equal issue conditions (M. Limitovskiy, 2004).

Apart from this the Black-Scholes Model could be applied in a limited way due to preconditions in its basis. Therefore, for understanding and then application of the Black-Scholes Model it is of a primary concern to get insights into its reference assumptions. The major prerequisite is the assumption that of market efficiency, which is provided with the sporadic price volatility, because the time difference between information circulation and its impact on the price is minimal. With the provision of neglecting this assumption, as is a regular case with a number of real options, the Model is sure to underestimate the option valuation, the price of execution of which is much bigger (for the CALL option) or smaller (for the PUT option) than the current market price of the asset which is on the basis of the option.

Moreover, the Black-Scholes Model implies that the standard volatility is known and unchangeable along the option life. This assumption carries sense for the short-term options with converting shares. However the theory of option pricing is applied to the long-term

real options which makes invariance and stability of standard deviation prejudiced. No doubt, there are modified versions of option pricing models which allows some change in standard volatility, but they demand that the process in which changing standard volatility could be observed, is to be carefully planned.

As the Black-Scholes Model is based on the theory of Portfolio Replication, which in its turn has the basis of buying the underlying asset against risk-free borrowing, it is necessary for the underlying assets, which is on the basis of the option, to be quick and ready to be traded on the stock exchange. Whereas this assumption is fully lawful when talking about stock exchange options with converting shares, the given assumption doesn't work for the non-trading underlying assets for the arbitrage is not applicable in the case. In some fields, such as gold mining or petroleum production, the underlying asset is negotiable on the stock market, giving the chance to establish Replicative Portfolio. However, the Black-Scholes Model requires not the chance but the necessity of Replicative Portfolio establishment. There is no information if any company has such Replicative Portfolio at its disposal.

One more limitation for the Black-Scholes Model application is the assumption of the instant option execution, because for the execution of real options complicated manipulations could be required, for instance, such as buildings or oil derricks rising (Damodaran, 1999).

Possibilities of the Monte Carlo simulation Method

The core of the method

Also the option valuation could be provided through the application of the Monte Carlo simulation Method.

Simulation models may be used to give numerous possible path of evolution for underlying state variables from the present to the final date in the option. In the commonly used Monte Carlo simulation method, the optimal strategy on each path is determined and the payoff is calculated. (Amram and Kulatilaka, 1999)

For this purpose, firstly, the prospective asset value, which is created using Geometric Brownian Motion, is simulated. That is, starting with an initial seed value of the underlying asset, multiple future pathways are simulated out using random number generation.

$$\delta S_t = S_{t-1}\left(r_f(\delta_t) + \sigma\varepsilon\sqrt{\delta_t}\right)$$

That means that the change of the asset value δS_t at the t time illustrates the asset value at the previous period S_{t-1}which is multiplied by the formula which determines Brownian Motion

$$\left(r_f(\delta_t) + \sigma\varepsilon\sqrt{\delta_t}\right)$$

where r_f – is a risk-free rate,

δ_t – time step,

σ – standard volatility,

ε – the simulated value from a standard-normal distribution with mean of zero and a variance of one.

The first step in imitating simulation through the Monte Carlo Method is the decision on a number of steps to simulate and a number of simulation trials performed in each one

In theory, when the number of time-steps in a binomial lattice is large enough, the results approach the closed-form Black-Scholes results. Similarly, if the number of simulation trials is adequately increased, coupled with an increase in the simulation steps, the results stemming from Monte Carlo simulation also approach the Black-Scholes value.

The change in value from this initial value to the first period is seen as

$$\delta S_1 = S_0\left(r_f(\delta_t) + \sigma\varepsilon\sqrt{\delta_t}\right)$$

Hence, the value of the asset at the first time-step is equivalent to

$$S_1 = S_0 + \delta S_1 = S_0 + S_0\left(r_f(\delta_t) + \sigma\varepsilon\sqrt{\delta_t}\right)$$

The procedure is then repeated for each time step. Notice that because ε changes on each simulation trial, each simulation trial will produce an entirely different asset evaluation pathway.

On completion of every approach the maximum value from random generated numbers is chosen. That is, the price of the European CALL option for the t time-steps and the number of performed trials i is equal.

$$C_{t,i} = Max\left[S_{t,i} - X, 0\right]$$

After some thousands of simulations we could compute the average value of all simulated prices of options which is discounted up to the initial time-step under a risk-free discount rate (Mun, 2006).

$$NPV = Average * e^{r_f T}$$

Monte Carlo simulation also provides the maximum and minimum option values obtained during the simulation, which represents the best and the worst scenario for the option (Korn K. and Korn E., 2001). So, for the 95 % confidence step the formula is seen as:

$$\left[C_{t,i} \pm 1{,}96\sigma\right]$$

Advantages and disadvantages

The Monte Carlo Method has a number of strong points opposing the previous models. The major advantage of the model under consideration in comparison with both the Binominal Option Pricing and the Black-Scholes Models is the feature to be able to take into account a certain number of uncertainty sources. None of the project could possess the only uncertainty resource. The Monte Carlo Method is able to factor into all their simultaneous impact. There is one more weighty difference comparing the above-considered methods is the opportunity of American option valuation.

The disadvantages of the method could be considered as the requirement to have powerful computing tools, and the inflexibility in top-management acceptance of the method. To justify the disadvantages there could be given the following arguments: modern computing programs could easily solve the problem, the top-management deals not with the method, with the help of which the research was conducted, but with the records of an analytical report.

However, it is worth paying attention to the fact that the optimization method is targeted at maximization of the parameter set through the selection of arbitrary combinations, that is the method based on the random number generation principle and it could seek the numbers irregularly, which doesn't maximize the parameter set at full capacity. Therefore, the most significant factor influencing the record, as it has been before mentioned, is the number of time-steps and the number of researches conducted at each time-step.

Conclusion

In the article the directions of changes in approaches to the determination of core of strategic management have been considered, the characteristic of various indexes of effectiveness valuation of realizable corporate strategies has been given. As evolutionary and complicating feature of market system raises the demands to the valuation of strategy effectiveness, valuation methods and tools are changing. In the modern literature as a method, which takes into account

the influence of various effects on the value of company for strategic behavior valuation in condition of unstable market system it is supposed to use methods of real options. The possibility to apply this method into practice directly depends on the choice of a certain method of value real option valuation.

In the article the major methods of real option valuation have been considered. The advantages and pitfalls are examined. Also through the pictures the calculation of every method is under inspection. The values, which have been derived, are nearly equal. It differs much from a real-world situation, it hinges on the initial data and the features of a method to take into account all of the project peculiarities.

Opting a certain method is dependable on a number of factors, they are: characteristics of a project, its input parameters and terms and conditions of the implementation, and the experience of an analyst as well. Despite all the assumptions, in a real-world situation the Binominal Option Pricing Model is of a wide application thanks to its simplicity and visualization, also the Monte Carlo Method is greatly applied in practice due to its feature to grant the opportunity to consider all the sources of uncertainty, to determine the valuation of the American Option, and to get the minimum and maximum option valuation. The Black-Scholes Model is the most inconsistent method of real option valuation, for it was created for the effective market and then it is adjusted for the market of venture investment and volatile economic conditions.

Ignoring all the disadvantages, the afore-considered valuation methods are justified to be applied into practice. Once having the quantitative characteristic of a managerial decision expression at the disposal, it is useful to bear in mind that this record is of a rough value. It is not true to the full extent. Frequently one deals with the overestimated records expected. However, such value real option valuation provides the chance to establish the company strategy, to set a certain frame of mind, so called «an option way of thinking».

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