

Flexibility consideration in equity valuation

E. Kramna

Abstract— Static discounted cash flow model fails to capture the value of flexibility in decision-making or determination of business value. Companies from sector of building materials are dependent on the growth of the economy and of course on the commodity price. These companies face and uncertain business environment. To illustrate how the flexibility may influence the value of the company the equity of the analyzed company by applying real options concept is determined. The article concentrates on the valuation under risk and flexibility. Empirically, business model for valuation and corporate financial decisions created by Thomas S. Z. Ho and Sang Bin Lee were tested. The equity value and analyze of the potential impact of active management intervention to company value is accomplished. The paper brings new view on business valuation with integration of flexibility.

Keywords— real options, equity valuation, operation and strategic flexibility, business model.

I. INTRODUCTION

THE theory and practice of business valuation has appertained to the most considerable and challenging issues in corporate finance and financial management. In the case of companies listed and traded on a stock exchange, valuation does not seem to be a problem. To get a market value it is necessary only to multiply the number of shares in circulation by their price. On the other side, the companies that are not listed encounter with the problem how to determine the right value of company. However, the question remains which method is more preferable?

A lot of approaches for company valuation can be found at the present time. However, the choice of correct valuation method considerably influences if the estimative subject is accomplished. According to the Dluhosova the valuation methods could be structured in relation with valuation conception (income, assets-based, comparative, market approaches) and with risk and uncertainty (active and passive) [10]. In the case of active methods, the business value by the possibility of active future interventions is influenced. To this method belongs the real option methodology that makes it possible to involve risk and flexibility into the company value.

Real options methodology do not refuse the traditional approaches, on the contrary, the company value by the value of flexibility is extended. An overview on the use and application of the concept of real options is available all above in Dixit and Pindick, Trigeorgis, Copeland and Antikarov, and

Guthrie [6], [8], [13], [27].

The article concentrates on the valuation of the company's equity under risk and flexibility. The present study applies the real option concept to a firm value from the sector of building materials in the Czech Republic. The equity is determined by using the business model for valuation and corporate financial decisions created by Thomas S. Z. Ho and Sang Bin Lee [15].

The paper proceeds as follows. In section II the objectives of the article are described. Afterward, brief review of the real options theory as well as its relation to the strategic planning and business valuation are provided. The section III is by the barriers that are connected with real options using ensemble. In section IV gained data, methodology and the business model and its assumptions are described. In section V, empirical results are presented. Finally, a conclusion is provided.

II. RESEARCH OBJECTIVES

A. Research purpose and objectives

Business valuation belongs to the important area of financial management and it is necessary to pay constant attention to this issue. Although the real option theory is increasingly used in industries, such as energy, research and development, etc., it has not much been applied to the sector of building materials in the Czech Republic.

The article concentrates on the business valuation under risk and flexibility. The main goal is to examine how to incorporate real affects into the company value. This study adds empirical evidence to his line by applying the real option concept to a firm value from sector of building materials in the Czech Republic. Building industry belongs to the important part of Czech economy. Many companies are getting into the very difficult economic situation and maintenance of their position in the construction market will be problematic. The commodity companies are often more dependent on the movement of a macro variable than on firm specific characteristic. The ups and downs of the commodity prices cause that these companies have volatile earnings and cash flows. In my conception, the sector of building materials completes the conditions for applying real options concept. This industry has volatile cash flows due to variability of customer's demand for product's and is connected with the high risk and competition. To get the value of these companies managers could make two mistakes. They either ignore the analysts of the economy and commodity price cycle, and assume that the current earnings will continue forever. However, it is necessary to incorporate these changes into the business value. On this account, the flexible intervention of

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E. Kramna is with the Finance Department, Tomas Bata University in Zlin, Mostni 5139, 760 01 Zlin, Czech Republic (e-mail: kramna@fame.utb.cz).

management to contract the part of the production is incorporated to business value. In this study, the value of equity is determined as American call option by discrete binomial model based on replication strategy assumes that flexible intervention is possibility to buy company for a nominal value of debt.

B. Research question

The paper attempts to help to understand and answer the questions concerns applicability and process of real options concept:

1. How the use of real options pricing influences the equity value?
2. What does the calculated real options value represent and where is it appropriate to use this technique?
3. What steps are involved in applying the real options approach? Which barriers are associated with?

The paper summarizes the relative strengths and weaknesses of the tested model, and specific recommendations on which ones to use in what circumstances.

III. BUSINESS VALUE, UNCERTAINTY AND FLEXIBILITY

A. Real options theory

Real options analysis is a valuation technique that applies financial options theory to real assets. Boute expressed them: "Real options are options on real assets that can be defined simply as opportunities to respond to the changing circumstances of a project. These opportunities to change consist of rights but not obligations to take some action in the future." He add that the role of real options analysis is to quantify how much future opportunities are worth today and by their using is possible to quantify these opportunities and to indicate when these options should be optimally exercise [3]. From this point of view, there are many similarities between financial and real options. The similarities arise because the ability to control or manage a cash flow stream by the management of a firm or by investors of securities represents an option [5]. Both real and financial options offer the owner the flexibility to manage an uncertain future cash flow generated from the associated assets, and the determination factors and valuation methods of both options are similar as well [21].

The real options and financial options have many points in common. The Fig. 1 is adapted from Dluhosova to explain the similarities between financial and real options. The example explains and compares two types of options; financial option on share and real call option as an equity.

Financial option		Real option	
S	Share price	A	Current market price of assets
X	Exercise price	D	Nominal debt value
T	Expiration date	T	Maturity of the company
r	Risk-free interest rate	r	Risk-free interest rate
σ	Volatility of share price	σ	Volatility of assets
VH	$VH_t = \max(S - X; 0)$	VH	$VH_t = \max(A - D; 0)$
C	Option price	E	Equity value

Fig.1 Similarities between financial and real options. Source: [11].

A key assumption for the application of real options methodology is the possibility of an exact definition of the variables that determine their value. These variables include:

- *The value of underlying risky assets* - both the Binomial and the Black-Scholes option pricing models are based on the premise that a replicating portfolio can be created using the underlying asset and riskless lending or borrowing. This assumption is perfectly justifiable the context of listed options on traded stocks [18]. However, in this case study the company is not listed in the stock exchange. For this reason the market value of the firm's assets can be determined using business model created by Ho and Lee. If the value of underlying asset increases, the value of put options decreases.
- *The exercise price* – this is the value of the nominal debt. As the exercise price of an options goes up, so too does the value of the put option.
- *The time to expiration of the option* – it is the period during which an option could be exercised. In the case of determination company's equity it is possible to discussed mainly about American options which could be apply at any time during the option's life. A longer time to expiration will allow us to learn more about the uncertainty and therefore it will increase real options.
- *The standard deviation of the value of the underlying risky assets* – the volatility in firm value can be expressed as the volatility of expected future cash flows by statistic characteristics as variance or standard deviation. In an environment with managerial flexibility an increase in uncertainty will increase option's value.
- *The risk-free rate of interest over the life of the option* - is identical to the risk-free interest rate used for financial options. An increase in the risk-free rate will increase option value since it will increase the time value of money advantage in deferring the investment cost [18].

Real options offer a framework and the metrics for managing strategy, value and risk in current business environment. The effectiveness of using real option technique for the valuation and management strategic investment exists under certain circumstances, as specified in Copeland:

- There is a high degree of uncertainty about the future and the new information often is received over the period of analysis;
- There is a high degree of managerial flexibility that allows managers to respond appropriately to this new information;
- NPV (Net Present Value) without flexibility is near zero [6].

B. Real options and strategic flexibility

Value is considered as a particularly helpful measure of performance because it takes into account the long-term interests of all shareholders and stakeholders in a company [18]. As pointed out by Pavelkova, a lot of financial managers identify a company's success with the value creation. Growth of the value becomes essential objective to business [24]. Similar view to the idea that the growth of company's value should be the central objective and all the other goals like strategy, methods and management techniques should result out of that is mentioned by Ioan and Iuliana [16]. Hamel and Heene saw the strategic flexibility as the key factor for the company's growth. To maximize the value of company's actions means anticipating the competition through processes of internal and external change [14]. Torres believes that strategic flexibility makes company possible to modify its resource base and capacities in response to unexpected market development and changes. In his conception, companies should seek mechanisms that help to encourage this process of adaption to their environment. Real options could be used as a source of strategic flexibility [26]. From my point of view, strategic flexibility is the ability to adapt to changes in the current turbulent environment and thus to gain competitive advantage. Flexible firms are better prepared to facing up uncertainty and this explains that they are able to achieve better results.

Company creates shareholder value by identifying, managing and exercising real options connected with their investment portfolio [21]. Shareholder value under this approach is therefore based on the discounted cash flow method associated with investments. Value creation requires the strategic capabilities both to manage the current portfolio and lead the company through in the world of uncertainty and frequent changes. Company's strategy should be focus on maintaining its strategic portfolio through managing both the known and the uncertain as it positions itself for the future. A real options approach has the potential to connect value analysis to the problems of uncertainty, resource allocation, flexibility in decision-making, managing innovation, etc. [25].

From my point of view, the shareholder value creation requires active managerial control because optimal exercise of real option that give managers a flexibility in changing decisions, should enhance the value of a firm's real options.

C. Barriers of real options

Real options approach represent a new technique for company valuation and management of investment. However, this concept is faced with the criticism because of some difficulties connected with the parameter determining. Some economics negative comment mathematically complexity, lack simplicity and usage of non-tradable assets, etc. [12]. Very little interest of this method is confirmed by research of Palka and Knapkova. They examined the level of penetration of different capital budgeting method and identify barriers of using real options concept in the Czech practice. As main barrier of usage of real options method is seen complexity because of its not so easy task and requires. The other barriers towards option implementation belong problems concerning prediction of needed inputs remain, problems with correct result's interpretation, distrust in immaterial values and lack of complex software [23]. Despite all of these facts, real options do come in very handy when tradition pricing tools fail to provide us with a clear answer to a valuation problem, as presented by Trigeorgis [27]. And those reasons should be a challenge to overcome barriers to use real options methodology in practice, especially for business valuation or decision-making in companies with significant future flexibility.

D. Modern financial evaluation technique using real options approach

Currently, Discounted Cash Flow (DCF) method is the most popular valuation instrument. The value of the company is therefore the present value of all free cash flows created from the company's business model that are available claimants on the company. This model is based on the assumption that a company evolves in a standardized manner over time [17]. However, the realization of cash flows is likely to differ from the initial expectation of the financial managers because of the change and uncertainty. In consequence, questions still arise whether the discounted cash flow is the best tool which presents a more accurate valuation.

Critics have argued that the DCF model leave out the management's ability to adjust the business strategies according to the market situation because it cannot capture the value of operating options due to its dependence on future events that are uncertain at the time of the initial decision. They claim that the real option valuation incorporates the management abilities into the valuation process [21].

It is necessary to point out that a lot of contributions to the equity valuation by real options approach can be found. The initial theories of company value were proposed by Miller and Modigliani. Their theory provides a framework to examine how a company's value is influenced by capital structure decisions and determining optimal capital structures [20]. The pioneers in the real options theory were presented by Black, Scholes and Merton. They formalize the association between a company's equity and debt. From their point of view, the equity can be defined as an option on the company's assets with the value of debt being equivalent to the residual of the value of assets over the value of equity [2]. The other paper

concerning the real options approach is presented by Brennan and Schwartz that use this concept to determine the firm value as a contingent claim on the business risk. Using this approach, they determine the growth model of a mining company [4]. The equity value was proposed as the NPV sum composition of its operating cash flow and its portfolio value of real options. The value of firm and its investment opportunities can count on the additional contribution of financial flexibility on debt financing condition, as mentioned by Trigeorgis [28]. A popular overview on the use and the concept application of real options to the equity valuation is available in Trigeorgis and Damodaran. Both of them expressed equity as stockholder's residual right on the company's assets that can be valued as a call option [7], [28]. The importance of modeling a business by Ho and Lee is completed. They proposed a valuation model of a bond with default risk. In comparing with the structural model in the research literature, their model suggests that the firm value an option price process is followed and with a compound option debt is embedded [15].

Companies create value by investing capital to generate future cash flows at rates of return that exceed their cost of capital. The faster they can grow and deploy more capital at attractive rates of return, the more value they create [18].

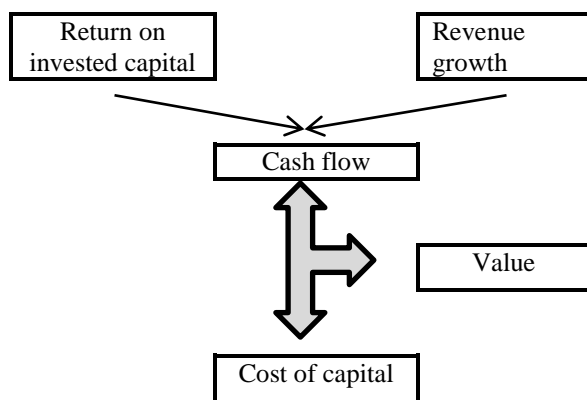


Fig.2 The core principle of value creation. Source: [18].

As illustrated on above figure, a company's return on invested capital and its revenue growth together determine how revenues are converted to cash flows. The amount of value is therefore the difference between cash inflows and the cost of the investments made discounted by the cost of capital that reflect the fact that tomorrow's cash flows are worth less than today's because of the time value of money and the riskiness of future cash flows [18].

There are four basic input parameters that are need for a value estimate; cash flow from existing assets, expected growth of these cash flows for a forecast period, the cost of capital and the value of debt. DCF approach is based on a static view ignoring flexibility and variability that lead to misvalue investments with non-linear payoffs as mentioned by Nowak and Hnilica [22]. This problem could be solved by using real options methodology. It allows us to make flexible changes of plan that may have a substantial impact on value. Real options are especially helpful by determining the value of

companies that dynamically evolving and changing in the time. According to Copeland, actively respond to changes in market conditions, companies may have the prerequisites for greater profit [2].

Real options methodology can take the best features of discounted cash flow approach and decision tree analysis without their failings as noted by Alleman. The real options method can make a significant difference in the valuation because it incorporate management flexibility and strategic interaction into the result [1].

On the basis of above mentioned ideas I could give a summary that real options cannot replace tradition discounted cash flow because valuing an option using real options value still depends on knowing the value of underlying assets. It represents a technique that can be taken as a supplement of traditional methods in the case of high uncertainty and flexibility.

IV. DATA AND METHODS

The input data are obtained from the published financial statements and market data and therefore the model is empirically testable. The firm from the sector of building materials is analyzed from 2005 to 2010.

A. Company overview

The given company X was formed in 1991. The company included between the main players in the market of transport of cement concrete in the second half of the 90 years in the Czech Republic. This position is still holding by the company both in the Czech Republic and the Slovak Republic. The company is also a producer of aggregates, the basic raw materials for concrete production. The company employs more than 500 people. The company recorded revenues of CZK 2,115 million during the financial year ended December 2010. The operating profit of the company was CZK 170 million during 2010 and decrease of 34% over 2009. The following section explains the process of equity valuation using real options approach.

B. Equity as an American call option

The equity valuation as real options is more exacting compared to traditional methods considering the possibility of flexible operational interventions that could be as an option valued and included to the value of the company, in consequence. The value of a company with real options could be shown according to the Dluhosova as below:

$$\begin{aligned} \text{Expanded firm value (EV)} \\ = \text{passive value (V)} + \text{flexibility value (FV)} \end{aligned} \quad (1)$$

Where passive value is determine without active intervention and flexibility value represents value of flexibility operation interventions [9].

C. Replication strategy for option

Afterward, according to the replication strategy the business valuation could be realized, as Zmeskal suggested [29].

The replication strategy is based on the fact that the

portfolio consist of underlying (risk) assets, S, with and risk-free asset, B, so that in any development the value of derivative was replicated, i.e. the value of the portfolio to the value of the derivative was identical.

Portfolio value, π_t , at the beginning at the time t :

$$\pi_t = aS_t + B_t = f_t \tag{2}$$

Portfolio value, π_t in the end at the time $t+dt$ by increase of assets:

$$\pi_{t+dt} = aS_{t+dt}^u + B_t e^r = f_{t+dt}^u \tag{3}$$

Portfolio value, π_t in the end at the time $t+dt$ by decrease of assets:

$$\pi_{t+dt} = aS_{t+dt}^d + B_t e^r = f_{t+dt}^d \tag{4}$$

Where, S, is the value of underlying assets, a , the amount of underlying assets, B, is the value of risk-free asset, f_t is the value of the derivative, r is risk-free rate, u (d) increase (decrease) underlying assets value index, S_{t+dt}^u (S_{t+dt}^d) underlying assets value by increase (decrease).

By solving all above mentioned equations the unique general relationship for option pricing could be gained. Afterwards, the equation for the option pricing by assuming risk neutral probability of growth, p , according to the Zmeskal could be simplified [29]:

$$f_t = e^{-r} [f_{t-dt}^u (\hat{p}) + f_{t-dt}^d (1 - \hat{p})] \tag{5}$$

$$\text{where } \hat{p} = \frac{e^r S_t - S_{t+dt}^d}{S_{t+dt}^u - S_{t+dt}^d}.$$

When expressed the underlying assets value by the proportional payout income, c , according to geometric Brownian motion as follows:

$$S_{t+dt}^u = S_t e^{u+c}, S_{t+dt}^d = S_t e^{d+c} \tag{6}$$

Could be \hat{p} as follows:

$$\hat{p} = \frac{e^{r-c} - e^d}{e^u - e^d} \tag{7}$$

Determining the value of equity as American call options by binomial model based on replication strategy assumes that flexible intervention is possibility to buy company for a nominal value of debt, D, as following:

$$V_t = \max\{(pV_{t+1}^u + qV_{t+1}^d)(1 + r_r)^{-1}; VH_t\} \tag{8}$$

where p (q) is the risk neutral probabilities of increase (decrease):

$$p = \frac{(1+r)A_t - A_t^d}{A_t^u - A_t^d},$$

or

$$p = \frac{(1+r) - d}{u - d}$$

$$\text{if } A_t^u = A_t u, \quad A_t^d = A_t d, \quad p + q = 1 \tag{9}$$

V^u, V^d is the value of equity for next period by increase, u , and decrease, d ; A^u, A^d are the underlying asset by increase u and decrease d ; VH_t is pay-off function of real option.

In determining the equity value by using real options methodology, we based on the idea that the firm's equity, E, is a call option to the firm's assets, A, owned by shareholders with a strike price equivalent to the nominal value of debt, D, at the time of maturity, T. Pay-off function of an American call options takes the form:

$$E_t = VH_t = \max(A_t - D_t; 0) \tag{10}$$

where pay-off function, VH_t , at time t , indicates market value of assets, A, at time t and D_t is nominal value of debt at the time t .

D. Business model

To determine the value of underlying risky assets of firm is used Business model created by Ho and Lee. The model is a discrete time, multi-period, contingent claim model. They assume that a firm is subjected to a business risk. The revenues are generated from a capital asset and the firm incurs both fixed operating costs and variable costs. The assumptions by Ho and Lee describing the business model are follows:

- the yield curve is flat and is constant over time at an annual compounding rate of;
- all the individuals make their investment decisions and trading at each node on the lattice;
- the market is perfect, with no transaction costs;
- corporate and personal taxes such that the assumptions are consistent;
- the capital structure does not affect the value of the firm;
- firm has a fixed capital asset and the capital asset generates uncertain revenues;
- risk-free interest rate is constant;
- take into account only the business risk and ignores the risk of interest;
- firm seeks to maximize shareholder wealth [15].

The parameters used in the model are discussed as follows:

- The Business Risk of the Firm (GRI);
- Cost of capital for the business risk (ρ);
- Volatility (σ);
- Investment (I);
- Fixed operating cost (FC);
- Fixed assets (CA).

Ho and Lee assumed that the firm has a fixed capital asset and the capital asset generates uncertain revenues. In this model it is use the sales of the firm as the risk driver unlike the many standard real options model The gross return on investment (GRI), capital asset turnover ratio, is defined as the

revenue generated per \$1 of the capital asset. They considered that a firm is endowed with a capital asset that does not depreciate and can generate perpetual revenues. GRI is given by following equation:

$$GRI = \frac{Sales}{CA} \tag{11}$$

GRI follows binomial lattice process where the proportional increase, u , of $\exp(\sigma)$ with probability q and a proportional decrease, d , of $\exp(-\sigma)$ with probability $(1 - q)$ are given:

$$q = \frac{1 - e^{-\sigma}}{e^{\sigma} - e^{-\sigma}} \tag{12}$$

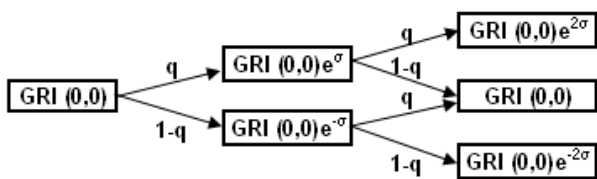


Fig.3 Binomial lattice process of GRI for two periods. Source: [10].

To determine the value of the underlying asset is necessary to establish a free cash flow. The lattice of cash flow at each node is follows:

$$FCF_{(n,i)} = (GRI_{(n,i)} \times m \times CA - FC) - (1 - \tau) + O - \Delta NWC - I \tag{13}$$

where:

- GRI gross return on investment
- M EBIT/sales
- CA capital assets
- FC fixed cost
- τ taxes,
- O depreciation,
- ΔNWC change in the working capital

Value of all the firms' free cash flow along all the paths on the lattice by cost of capital, ρ , is discounted. In particular, the lattice of firm value is given as:

$$A_{t(n,i)} = \frac{FCF_{(n,i)}}{\rho} \tag{14}$$

E. Methodology for equity valuation

Determination of the equity value as a real option with possibilities of flexible interventions proceeds in two steps, as showed by Dluhosova [10].

First step: Passive value (V)		+ Passive value (V) = Expanded value (EV) Flexibility value (FV)
Options with financial flexibility interventions		
1	calculate pay-off function $VH_t = \max(A_t - D_t; 0)$	
2	equity option pricing as American call option $V_t = \max\{(pV_{t+1}^u + qV_{t+1}^d)(1 + r_f)^{-1}; VH_t\}$	
Second step: Value of flexibility (FV)		
Value of flexibility operational interventions		
3	determining pay-off function of compound option (possibility of expanding) $VH_t = \max(xV_t - I_{Ft}; 0)$	
4	value of flexibility $FV_t = \max\{(pFV_{t+1}^u + qFV_{t+1}^d)(1 + r_f)^{-1}; VH_t\}$	

Fig.4 Equity valuation methodology. Source: [10].

First of all, the value of underlying assets is determined by using Business model. Afterthat, the equity is established according to the passive financial strategy. In this simulated model as the value of equity, forward is seen. Subsequently, the equity is determined as an American call option by active financial strategy that takes into account calculating the value of flexibility. The active intervention of management on equity is also analyzed.

V. RESULTS

In the following sections, the application of real options equity valuation is illustrated. Firstly, the equity in accordance to the passive and active financial strategy is assessed. Consequently, the flexibility value of potential impact of active management intervention to company value is provided.

A. Equity option pricing as American call option

The parameters required to use Binomial model for valuing options are as follows:

Table 1. Basic input parameters. Source: own.

Parameter	Characteristic	Value
n	Number of planned years	4
r	Riskless interest rate	3,66%
σ	Volatility	46 %

Solving for the risk-neutral probabilities of binomial model, we have:

Coefficient of up movement: $u = e^{\sigma\sqrt{dt}} = 1,5813$
 Coefficient of down movement: $d = e^{-\sigma\sqrt{dt}} = 0,6323$
 $p^u = \frac{e^{r_f dt} - d}{u - d} = \frac{e^{0,0366} - 0,63}{1,58 - 0,63} = 0,4259$
 $p^d = \frac{e^{r_f dt} - u}{d - u} = \frac{e^{0,366} - 1,58}{0,63 - 1,58} = 0,5740$

Table 2. Parameters for binomial tree. Source: own.

Parameter	Characteristic	Value
u	Up movements	1,58
d	Down movements	0,63
p	Probability of up movements	0,43
1-p	Probability of down movements	0,57

B. Underlying asset value

First of all, the value of GRI indicator 2.2 was established for the first year. Subsequently, using the binomial lattice future value of the random development of GRI was estimated for the next five years. Afterwards, the free cash flow was calculated. The value of cash flows for each node of binomial tree was determined. In order to estimate the FCFF for each year and scenarios, it is assumed the expected next five years' free cash flow of the company would follow the up-movement and down-movement indexes that characterized their volatility. The FCFF at each node can be expressed as $FCFF_{t+dt}^u = FCFF_t * u$ (in the case of increase), and $FCFF_{t+dt}^d = FCFF_t * d$ (in the case of decrease).

The market value of the firm assets by discounting expected cash flow at the weighted average cost of capital was estimated. For the Discount Cash Flow (DCF) valuation, cash flows are discounted using the average WACC that is illustrated in the following table.

Table 3. Determination of average cost of capital (WACC). Source: own.

Year	2011	2012	2013	2014	2015
WACC	8,95	9,86	10,68	10,23	9,94

Based upon these inputs, the binomial model provided the following value for the underlying asset, as shown below:

2011	2012	2013	2014	2015
				8417375
			4809425	
		2680054		3434692
	1584254		1916013	
1340864		1089410		1442065
	699237		758907	
		453296		645194
			296169	
				326517

Fig.5 Underlying asset value. Source: own.

C. Determination value of equity

At this point, the pay off-function as difference between underlying asset value and nominal value of debt was calculated.

2011	2012	2013	2014	2015
				5050425
			3216570	
		2056064		2060815
	1321403		1325986	
856067		860488		865239
	565340		569923	
		382365		387116
			267565	
				195910

Fig.6 Value of equity of the company. Source: own.

Afterwards, the equity by replication strategy was determined. It was based on assumption that the option price at maturity equals pay-off function and value determination from the end rolled back to the beginning. The option pricing framework yields some valuable insight into the drivers of value of this equity. The most crucial variables determining its value are the life of the options and variance in firm value.

Using active and passive strategies in determining the equity value equal, results were meant that the value of financial flexibility was zero. The equality of results by the same pay-off function of both variants was caused due to the fact that the value of underlying assets by the nominal value of debt at any node was exceeded. As you can see, the equity in this firm according to the option framework was CZK 856,067 thousand, compared with the book value CZK 823,202 thousand. The fact that the value was higher by assumption of going-concern of the company was caused.

D. Value of operation flexibility

The value of operation flexibility by option to construct was quantified. In the case of negative developments of the market conditions, the financial management of selling a productive hall could determine. This would cause a 20 percent reduction of processing and company will gain disposable investment income of CZK 220 thousand. The intervention as American put option was calculated.

The value of option to construct was 56,856 thousand CZK.

2011	2012	2013	2014	2015
				0
			0	
		0		0
	20 919		0	
56 856		37 777		0
	87 148		68 219	
		129 341		90 961
			160 766	
				154 697

Fig.7 Option to contract. Source: own.

The American put option will be used by management if disposable investment income from the reduction of production greater than the market value of assets after the reduction of production.

As evident from pay-off function illustrated above, the management could make decisions to reduce the production in nine nodes of the binomial tree in the event that economic conditions are unfavorable in the future. On the other side, lower disposable investment income compared with value of assets after reduction of production to option to contract unused would be. The company will continue in production at the existing production capacity.

Taking advantage of option to contract where YES represents reduction and NO continuing in production is demonstrated below.

2011	2012	2013	2014	2015
				NO
			NO	
		NO		NO
	YES		NO	
YES		YES		NO
	YES		YES	
		YES		YES
			YES	
				YES

Fig.8 Decision tree of option to contract. Source: own.

E. Expanded firm value

The expanded value of firm as passive value plus value of operation flexibility was determined. The total business value CZK 912,923 thousand was, as interpret below:

Table 4. Expanded firm value. Source: own.

	CZK thousand
Passive value	856 057
Flexibility value	56 856
Expanded firm value	912 923

VI. CONCLUSION

In this article real option approach has been used in equity valuation. The main goal of this paper was the application of the flexible business model, supposed by Ho and Lee for valuation of company empirically tested.

The results confirm that ability of firm to change its investment opportunities has the significant contribution to the equity value. It is also acknowledge that the application of passive methods tended to underestimation of the true value of companies and also decision-making options and range of investment opportunities are going to reduce. It is true that option techniques require detailed information and assumptions. However, the study has shown that the possibility of changing the decision-making according to the current market conditions is best recognized in option pricing model. On the bases of these results, I agree with Ho and Lee that the model is applicable to many business sectors (pharmaceutical, energy, information technology, etc.) that deals with high level of risk and flexibility and their revenues are generated from a core capital investment and expense involved both, fixed and variable costs.

Finally, it could be said that real options approach become a new philosophy of management of companies due to rationality improving decision making. It represents an effective strategic management tool for an equity valuation with incorporating flexibility.

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