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Real option valuation in investment projects

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Abstract

Several new models are used to eliminate lack of classic methods in valuation of investment decisions. Finding an answer for the question "which method is used to value investment" is important for investor to decide right investment. Choice of both methods and the components that are used in these methods are important in valuation of investments. Real options, one of the current methods in project valuation, provide several advantages for investors which apart from classic approximations: Real options give options like postponement, enlargement, growth, abandonment to the investor in decision process, so it creates opportunity that provide more careful valuation. In this study, real option method is used to value real investment project. Furthermore, AHP method is utilized to determine elements that are used in project valuation process. Whereas the investment decision implementation that is made in solar energy sector cannot be carried out with classical approximations, a project case that is valued with real option valuation method can be argued.

JEL classification numbers: G31, D81, E22
Keywords: Valuation methods of investment decisions, financial options, real options, option valuation methods and AHP

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1 Introduction

Hardening of the conditions of competition and globalized economy leads companies to make new investments. It is so important that firms can assess their investment alternatives accurately to maintain their life curve. The project is often to determine fair values of the net present value, cash flow analysis, payback period method and traditional methods such as simple methods of profitability. These methods cannot be used under assumption of uncertainty. The real option method under uncertainty should be considered as an alternative to traditional methods and provide decision makers evaluate projects with different extents.

Options that is a derivative product give its owner buy or sell right on underlying security that is in agreement in future without obligations (Özoğul, 2006). On Other derivative products like future and forward agreements there are several conditions that parties to agreement must comply with (Hull, 2005). Investment project decision-makers about the real-life decision-making time, or pass the decision to implement the investment projects are similar to financial options. Real options theory has emerged using financial options in real investment projects. Fully comparable to the real and financial options are outlined in each other. Financial options traded in financial markets are the main difference between them (Taş and others, 2007). While real investment projects evaluate with real options, financial options valuation methods such as Binomial Tree, Black-Scholes Model, Simulation methods are used (Hull, 2005).

In application of this study, solar energy system investment project has evaluated with global and Turkey's local conditions. Today, renewable energy sources are gaining importance and near future there are a lot of renewable energy investments all around the world. Solar energy is one of the renewable energy source. But, nowadays solar energy investment projects do not seem profitable. This study investigates that question whether it is profitable in near future or not and if it is profitable in near future, when will the best time be?

2 Literature review

2.1 Financial options

According to the definition of Futures and Options Contracts in Capital Markets Board of Turkey, contracts that are given a certain premium by receiving side, are valid at certain date or until a certain date, give the right to sell or buy currency, precious metal, commodity, financial or economic indicators, capital market instrument the price determined at the beginning of the agreement, require seller to comply with the rules of contract, are called option contracts (2011).

Call options give the side taking the contract the right to buy underlying security the agreed price on date or before date without any obligations. American type of options can be done before the date of purchase of the underlying asset. The

European type of options, the purchase can be made only on the date determined. The buyer can do nothing, sell the option in the relevant market or hold the buy right until the date of option (Dubofsky, 1992). If sum of option premium and strike price of option is below the market price, the buyer of the contact perform right to buy.

Put options give the side taking the contract the right to sell underlying security the agreed price on date or before date without any obligations. While contact buyers expect bear market, contact sellers expect bull market (Dubofsky, 1992). If sum of option premium and the market price of option is below strike price, the buyer of the contact perform right to buy.

Today, the option contacts made on shares, currency, interest rate and commodity products are affected by many factors. In American type of call options, as the market price, time to maturity, volatility and risk free interest rate increase, option price increases. But, while strike price and dividend increase, option price decreases. In American type of put options, as strike price, time to maturity, volatility and dividend increase, option price increases. However, option price decreases while market price and risk free interest rate increase. These variables have the same effect on European type of options except time to maturity. Time to maturity effect is unknown for European type of options. These effects on option price are valid when other variables are constant (Hull,2005).

2.2 Real options

Real options defined as right to make postponement, expansion, signing a contract or cancellation decision of project or operation a pre-determined time and cost. In real options, assets are evaluated risk free valuation, no arbitrage rather than depending on actual risk. In option flexibility analysis, main parameters have to be defined (de Neufville, Wang, 2005 ; as citied in Taş and others, 2007). While real options are valued, usually risk free probabilities are applied. The market is assumed perfect and without competitiveness, so risk free rate approximation is used. The real option approximation is based on recurrent cash flow. Nevertheless, risk free approximation is invalid if this approximation is not bounded with its market (Edge, 2011). The difference between maximum return from flexible investment project and project without flexibility give the real option price (Chorn and Sharma,2001; as cited Özoğul,2008). This flexibility affects feasibility of project.

Types of real options may be categorized under six groups.

Postponement: To wait until finding answer the question whether conditions are good. It is available conditions that investment decision can postpone.

Enlargement: To benefit relevant opportunities in the future. If firm want to make this option alive, the firm have to make pre-investment.

Progressive investment: The investment project is made real part by part, but if negative state occurs, project is cancelled wholly.

Changing Capacity: To adapt new conditions increasing or decreasing capacity.
Changing Usage : To use alternative technologies depending on variable costs.
Cancellation: When market goes bad, to obtain second hand value or opportunity costs (Özoğul, 2006).

2.3 Comparison of financial options and real options

Real options and financial options have some differences also. First, while real options are exercised on real project or operation, financial options are exercised on assets like indexes, currency, securities and commodities. When real options exercise, it is accepted a agreement between company and external environment and real options are different from financial options because of power of changing value of company. Because of this power, company always have to manage real options (Howell and others, 2001).

Table 1: Comparision of Financial Options and Real Options (Özoğul, 2008)

Financial Options	Real Options
Stock price	Present value of expected cash flows
Strike price	Investment cost
Time to maturity	Time to disappearing of opportunity of investment
Variance of stock return	Uncertainty of cash flow of project
Risk free rate of return	Risk free rate of return

Even if all uncertainties are not known, a decision have to be exercised evaluating with real options. However, if time to maturity is so close in financial options, all variables are known and optimal decisions are exercised. Moreover, it is difficult to avoid fiscal risk in real options, so wary acceptances have to be done. Furthermore, time to maturity is known in financial options. But, in real options, there is no time limit to exercise real project or operation and it is unknown when opportunity is valid. Finally, volatility can be calculated from past data in financial options. But, securities that form basis real options are traded in capital market. Because of this, it is a problem how to determine volatility in real options (Miller and Park, 2002; as cited in Özoğul, 2008). Real options and financial options have some similarities too. These similarities may be investing under uncertainty conditions, irreversibility of investment and right to choose from multiple alternatives (Özoğul, 2008).

2.4 Options valuation methods

2.4.1 Binomial tree

In binomial model, underlying asset price is moving up and down direction and have some assumptions. First, perfect market conditions and perfect competition conditions exist. Second, price and interest up and down moves are known in every discreet time. Finally, it is based on preferring more return rather than less return (Dubofsky, 1992). In binomial option valuation process, it is assumed that process have “n” period. If after “n” period “m” different values are exercised with “u” up and “d” down movement rates for every period, probability that occurs for every loop become of equation (1):

$$P(n,m) = [n!/(m!*(n-m)!)] * p^{m} * (1-p)^{(n-m)} \quad (1)$$

Present value of option is calculated sum of values from m=0 to n.

$$f = e^{-(r*n*\Delta t)} *(\sum[n!/(m!*(n-m)!)] * p^{m} * (1-p)^{(n-m)} * \max[0,(S_0 * u^{m} * d^{(n-m)})-X] \quad (2)$$

Market value of S_0 on T=0 moves up(u) and down(d) after “n” period and is removed from strike price “X”. In call options, if this value more than zero, this difference is used. If it is not, zero is used (Haug, 2007).

2.4.2 Black and Scholes model

Black and Scholes option valuation method is one of the most known and widely used model in finance field. In 1973, the model developed by Fischer Black and Myron Scholes is used to evaluate European type options in which stocks not giving dividends is used as underlying security.

Basically, the model is exercised under hypothetic risk free portfolio assumption. This portfolio consists of short positions of stocks which options, which investor owns risk free interest rate gain and long term call option, are used as underlying security on (Ersan, 1998).

Black and Scholes option valuation method has some basic assumptions. First, in model, risk free interest rate is used as a interest rate and this rate is certain and constant. The returns of stocks used as the underlying asset are assumed to comply with lognormal distribution. Furthermore, it is assumed that options do not give dividends. European type options are used in model and this type of options are used at maturity. Moreover, efficient market hypothesis is assumed and according to efficient market hypothesis movements of market and stocks are not been able to be predicted. Finally, operation of buy and sell of options are assumed to be costless (Mun, 2002).

When start of time is taken zero, equations of Black and Scholes of call and put European type options may be stated as below;

$$c = S_0 * N(d_1) - K * e^{-(r*T)} * N(d_2) \quad (3)$$

$$p = K * e^{-(r*T)} * N(-d_2) - S_0 * N(-d_1) \quad (4)$$

"d_1" and "d_2" variables in equations:

$$d_1 = [\ \ln(S_0/K) + (r + \sigma^2/2)*T\ ] / (\sigma* \sqrt{T}\ ) \quad (5)$$

$$d_2 = [\ \ln(S_0/K) + (r - \sigma^2/2)*T\ ] / (\sigma* \sqrt{T}\ ) = d_1 - (\sigma* \sqrt{T}\ ) \quad (6)$$

where C is the call option value, p is the put option value, S_0 is the market value of underlying asset, K is the strike price, T is the time to maturity, σ is the volatility, r is the risk free interest rate, N(d) is the cumulative standard normal distribution. The more volatility of underlying security increases, the more this value increases (Hull, 2005).

2.4.3 Simulation methods

Simulation methods calculate option value basing on possible thousands of paths of underlying asset that follows in the future. Monte Carlo Simulation method, widely evaluates European type options, is commonly applied (Boyle, 1977). This simulation uses random sample outputs (dz).

"dz" is called Wiener Process: $dz = \varepsilon\sqrt{\Delta t}$ (7)

Denotations in model are that $S(t+\Delta t)$ is the change of underlying asset price, S(t) is the underlying asset price at time t, μ is the expected return of stock, Δt is the unit time change, ε is the zero mean and one standard deviation sample and σ is the volatility.

It is assumed that underlying security follows Brownian motion:

$$S(t+\Delta t) - S(t) = \mu*S(t)*\Delta t + \sigma*S(t)*\varepsilon*\sqrt{\Delta t} \quad (8)$$

This equation calculates the price of underlying asset at "$t+\Delta t$". This operation continues thousands of time. Then, mean is calculated.
With Itô Theorem:

$$d(\ln S) = (\mu-\sigma^2/2)\ dt + \sigma dz \quad (9)$$

Then, equation(10) and equation(11) are obtained:

$$\ln S(t + \Delta t) - \ln S(t) = (\mu-\sigma^2/2) * \Delta t + \sigma*\varepsilon*\sqrt{\Delta t} \quad (10)$$

$$S(t + \Delta t) = S(t) * \exp\ [(\mu-\sigma^2/2) * \Delta t + \sigma*\varepsilon*\sqrt{\Delta t}] \quad (11)$$

This equation is used to evaluate unstandardized payments of derivative products at time "T" (Hull, 2005).

3 Methodology and data

The investor firm like to see whether solar energy production projects can be applied in Turkey and what could be the optimum investment time. The firm has decided to invest in Karaman, Turkey because of Karaman's annual solar radiation rate and geographical location. This firm plans to start investing soon if it decides to invest. On the other hand, the firm has certain concerns about making sufficient profits since the competition for energy needs and good government incentives may be provided in near future are uncertain.

The project has some assumptions while it is being evaluated. First, postponement alternative in real options is exercised and this process is likened call options. Investment life is 30 years and set up time is 6 months because of easy set up process. Investment is evaluated for 30 years an annual basis. First investment cost is 200 million Euros. Furthermore, because of developing technology and engineering studies , production efficiency will increase 2,5% and investment cost will decrease 2,5% every year. It is expected that maximum production capacity is 26 megawatts in 620000 square meters land. It is assumed that Karaman's daily mean solar time is 8.24 hours. 26*8,24*365= 78197,6 mwh is one year expected energy. All of the energy will be sold by government incentives. Moreover, variable cost is 6% of sales. Because of government incentives, solar energy buy price is 0,13 dolars/kwh (0,1 euro/kwh). After 2 years from now solar energy price will be 0,13 Euro/kwh because of increasing government incentives. Because of big incentives in Europe, insufficient energy sources for future and renewable energy gaining importance, assumed price will be: increased between 2-6 years 20%, between 6-10 years 2%, between 10-20 years 1% and decreased last ten years by 2% because of competition annually. Finally risk free rate is 8% and tax rate is 20%.

The discount rate is determined by applying analytical hierarchy process. (Saaty, 2008).

The discount rate is determined to be 10% after generation of ratings and criteria by Tas (2011). Initialy, the project is evaluated by net cash flow method. The sum of discounted cash flows is 184.549.882 Euros. Then the total cost is removed from sales and hence 15.450.118 Euros loss is obtained. Therefore, the net cash flows method refers not to make the project.

By applying payback period method, the cash flow of first eleven years is calculated as 189.013.234 Euros.

11+(200.000.000-189.013.234,5)/24.966.010=11,44 years.

Internal rate of return is computed as 9,27%. Then, the project is rejected since IRR is less than discount rate 10%.

All of this values show that the project has to be rejected. However, these methods incur a lack of postponement option of the project. In near future, the project may be profitably exercised. There is no obligation to the firm make real investment project today. Firm has right to make real the project at optimal time and at optimal price. Black and Scholes option valuation method is used to determine whether project is profitable or not and if it is profitable, what is the best time to exercise project? It is less complex than Binomial model, Binomial model fit Black and Scholes model after some time step and both model convergences risk free approximation, so Black and Scholes model is chosen. The highest value European type call option is chosen as optimal investment time (Özoğul, 2006). Annual standard deviation is assumed to be 15,79% (Appendix A). In model the following assumptions are arbitrarily made. The investment costs for every year is the strike price, discounted cash flows after investment time is discounted today market value and time is the time to maturity of European call option.

Table 2: Decision Matrix

	Capital Structure Policy	Investment Policy	Operating And Financing Decisions	Interest Rate	Tax Rate	General Economic Conditions	Market Conditions	Sum
6%	0,082	0,156	0,151	0,215	0,278	0,080	0,441	0,182
8%	0,261	0,311	0,297	0,261	0,380	0,139	0,234	0,258
10%	0,384	0,295	0,338	0,339	0,147	0,378	0,131	0,310
12%	0,185	0,156	0,148	0,120	0,125	0,250	0,124	0,162
14%	0,088	0,083	0,066	0,065	0,069	0,153	0,070	0,087
Weight	0,222	0,114	0,119	0,195	0,074	0,153	0,122	

4 Findings and results

The model reaches every option value after postponements.

These evaluations give the values of European type of options at the end of the term. The option value reaches its maximum at six year with 34.143.393 Euros. Therefore, the firm should postpone its investment decision until year six, then the firm should make its solar energy investment. On the other hand, the firm may invest at the third or the fourth year if the firm likes to gain an experience for future competition. The firm profits less prior to year 6, however, the firm can make adjustments by changing engineering improvements, prices, incentives, production conditions.

Table 3: Valuation of option

Year	Investment Cost (TL)	Disc. Cash Flows After Inv Time	d1	d2	N(d1)	N(d2)	Option Value
0	200000000	184549882	0	0	0	0	0
1	195000000	180272599	0,0929	-0,0650	0,5370	0,4741	11468612
2	190125000	172143911	0,4034	0,1801	0,6567	0,5715	20457616
3	185371875	163400165	0,5821	0,3086	0,7198	0,6212	27026127
4	180737578	153937253	0,6979	0,3821	0,7574	0,6488	31438107
5	176219139	143641621	0,7690	0,4159	0,7790	0,6613	33793448
6	171813660	132388890	0,8005	0,4137	0,7883	0,6605	34143393
7	167518319	121740379	0,8266	0,4089	0,7958	0,6587	33850289
8	163330361	111661905	0,8472	0,4006	0,8016	0,6556	33037971
9	159247102	102121366	0,8620	0,3883	0,8057	0,6511	31805193
10	155265924	93088602	0,8708	0,3715	0,8081	0,6449	30233060
11	151384276	84612249	0,8752	0,3515	0,8093	0,6374	28450889
12	147599669	76657309	0,8746	0,3276	0,8091	0,6284	26509837
13	143909677	69191047	0,8686	0,2992	0,8075	0,6176	24453005
14	140311936	62182841	0,8566	0,2657	0,8042	0,6048	22317074
15	136804137	55604041	0,8378	0,2262	0,7989	0,5895	20133594
16	133384034	49427835	0,8112	0,1796	0,7914	0,5713	17930074
17	130049433	43629132	0,7757	0,1246	0,7810	0,5496	15730952
18	126798197	38184441	0,7295	0,0595	0,7671	0,5237	13558549
19	123628242	33071772	0,6703	-0,0180	0,7487	0,4928	11434088
20	120537536	28270533	0,5951	-0,1111	0,7241	0,4558	9378917
21	117524098	24157605	0,5234	-0,2002	0,6996	0,4206	7687885
22	114585995	20401755	0,4386	-0,3021	0,6695	0,3813	6142166
23	111721345	16971981	0,3368	-0,4205	0,6319	0,3371	4743216
24	108928312	13839973	0,2124	-0,5612	0,5841	0,2873	3495117
25	106205104	10979881	0,0565	-0,7330	0,5225	0,2318	2405867
26	103549976	8368096,8	-0,1458	-0,9509	0,4420	0,1708	1489232
27	100961227	5983062,9	-0,4224	-1,2429	0,3364	0,1070	767158,4
28	98437196	3805093,3	-0,8366	-1,6721	0,2014	0,0473	271229,1
29	95976266	1816211,1	-1,5918	-2,4421	0,0557	0,0073	32330
30	93576860	0,000001	-35,78	-36,644	0,0000	0,0000	0

In model, each variable affects option price differently. Volatility is the key for the option pricing formula. Volatility provides option price to reach its probable maximum. But, it does not change optimal investment time, because it affects whole process nearly same percents. Volatility is the best approximation of real options, different from classical approaches. Today, volatility is generally calculated from historic sale prices, but it is necessary to improve. Volatility includes various correlated or independent variables. Moreover, the more tax rate, discount rate, cost of investment increase, the more option value decreases. These values can also affect optimal time of investment. Furthermore, the more efficient production and electricity prices increase, the more option value increases. These increases can make optimal time shorter. If firm want to make its investment both today and after year six, then the face value is sum of these two investments (Öztürk, 2010).

34.143.393 Euros - 15.450.118 Euros = 18.693.275 Euros

If the pricing expectations happen to be as presumed, the investment project can be a viable investment for the firm.

5 Conclusion

Financial options and real options are explained literature review of this study. Differences and similarities of financial options and real options are manifested with comparison of financial and real options and literature review is concluded with option valuation methods. Assumptions are explained with investor firm. Discount rate is determined with Analytical Hierarchy Process approximation. First, solar energy investment is evaluated with net present value approximation, payback period and internal rate of return. But, project is not feasible economically with these methods when investment is made real today. On the other hand, when the postponement options of real options method is calculated, project reaches its maximum value at sixth year investment. So, if firm wait six year, then decide the investment, solar energy investment will be profitable to the firm. Black and Scholes option valuation method is continuous version of Binomial Tree method. When branches of the Binomial Tree method goes to infinity, it reaches Black&Scholes valuation method. But, it is difficult for the Binomial Tree method and its discreteness is eliminated with Black&Scholes method. So, Black and Scholes model is chosen. Investment project can be made real whenever firm wants because there is not any obstacle. If firm wants, they can make project real with 3-4 year postponements. Because of future demands for renewable energy sources and lack of energy, firm can want to be more experienced. Volatility is calculated from historical industry electricity prices. Despite existence of other variables, model assumes this. Volatility model that will include other variables can give more correct answers. As a result, project is not feasible with traditional valuation methods. However, applying postponement option makes this project profitable and viable.

References

[1] P.P. Boyle, Options: A Monte Carlo Approach, *Journal of Financial Economics*, **4**, (1977), 323-338.

[2] L.G. Chorn and A. Sharma, Valuing Investments in Extensions to Product Lines and Services Offerings When Facing Competitive Entry, *Fifth Real Option Conference*, Los Angelas, (2001).

[3] De Neufville and T.R. Wang, *Real Options "in" Projects*, *9th Real Options Annual International Conference*, Paris, (2005).

[4] D.A. Dubofsky, *Options and Financial Futures: Valuation and Uses*, McGraw-Hill, New York, 1992.

[5] P. Edge, Stochastic Discount Factors and Real Options, *Real Options Theory Meets Practice 15th Annual International Conference*, Turku, Finland, (June 15-18, 2011).

[6] I. Ersan, *Financial Derivatives:* Futures & Options & Swaps, Literature, Istanbul, 1997.

[7] E.G. Haug, *The Complete Guide to Option Pricing Formulas*, McGraw-Hill, New York, 2007.

[8] S. Howell, A. Stark, D., Newton, P. Dean, M. Cacus, J. Pareira and K. Patel, *Real Options Evaluating Corporate Investment Opportunities in a Dynamic World,* Prentice Hall, 2001.

[9] J. Hull, *Options, Future and Other Derivatives*, Pearson Prentice Hall, New Jersey, 2005.

[10] L. Miller and C.S. Park, Decision Making Under Uncertainty: Real Options to the Rescue?, *The Engineering Economist*, **47**(2), (2002), 105-150.

[11] J. Mun, *Real Options Analysis Course: Tools and Techniques for Valuing Strategic Investments and Decisions*, John Wiley & Sons, New York, 2002.

[12] C.O. Özoğul, *Real Option Approach to the Evaluation of Enterprise Resource Planning Systems: Implementation of Hospital Information System*, Ph.D. Thesis, Istanbul Technical University Institute of Social Sciences, 2008.

[13] S.A. Özoğul, *Evaluation of Investment Decisions Real Options: Information Technology Application,* Ph.D. Thesis, Istanbul Technical University Institute of Social Sciences, 2006.

[14] S. Öztűrk, *Evaluation of Investment Projects and Real Options: An Application in Mining Industry*, Master Thesis, Istanbul Technical University Institute of Science, 2010.

[15] T.L. Saaty, Decision Making With the Analytic Hierarchy Process, *Int. J. Services Sciences*, **1**, (2008), 83-98.

[16] O. Taş, Ç. Yaşaroğlu and K. Tokmakcioğlu, Comparison of Financial Options and Real Options and Real Options as an Investment Project Evaluation, *Journal of Dokuz Eylul University Faculty of Economics and Administrative Sciences*, **2**, (2007), 339-355, available at: http://www.spk.gov.tr/displayfile.aspx?action=displayfile&pageid=77&fn=77.pdf.

Appendix

Schedule A: Volatility Calculation with Historical Electricity Price

Year	Price (USD/Kwh)	u=ln(Pn/Pn-1)	(u-µ)^2
1978	0,06	-	-
1979	0,055	-0,0870	0,01379
1980	0,095	0,5465	0,26638
1981	0,092	-0,0321	0,00391
1982	0,118	0,2489	0,04773
1983	0,12	0,0168	0,00019
1984	0,132	0,0953	0,00421
1985	0,122	-0,0788	0,01193
1986	0,168	0,3199	0,08382
1987	0,169	0,0059	0,00060
1988	0,16	-0,0547	0,00725
1989	0,145	-0,0984	0,01661
1990	0,139	-0,0423	0,00528
1991	0,15	0,0762	0,00209
1992	0,16	0,0645	0,00116
1993	0,155	-0,0317	0,00387
1994	0,174	0,1156	0,00726
1995	0,138	-0,2318	0,06876
1996	0,166	0,1847	0,02381
1997	0,155	-0,0686	0,00980
1998	0,149	-0,0395	0,00489
1999	0,166	0,1080	0,00602
2000	0,175	0,0528	0,00050
2001	0,225	0,2513	0,04879
2002	0,227	0,0088	0,00047
2003	0,188	-0,1885	0,04793
2004	0,176	-0,0660	0,00929
2005	0,166	-0,0585	0,00791
2006	0,155	-0,0686	0,00980
2007	0,145	-0,0667	0,00943
Sum		0,8824	0,72347
Mean		0,0304	
Variance(s^2)		0,0249	
Standard Deviation (s)		0,1579	
Annual Std. Deviation(σ)		0,1579	