ABSTRACT

Traditional valuation methods used in valuation of investment projects may be inadequate on their own in uncertain environments. In order to overcome these shortcomings, the real option method has been developed by changing the concept of financial option which has been used for nearly 40 years.

The real option method, which has been used for about 25 years, is used on an investment project and not on any financial asset. As it is known, financial options give the holder the right to buy or sell a certain financial asset at a determined price from today. Since real options are related to investment projects, their amounts are higher than those of financial options. However, the maturity of financial options is shorter than that of real options.

In the valuation of real options, financial option pricing models can be used, the most widely used being the Black & Scholes model. The real option value of the project calculated according to the model created is different from the value of the project calculated according to the traditional method, and we can conclude that the same project which has been valued according to the traditional methods and which has to be rejected should be accepted according to the real option method.

Accordingly, the use of real option valuation method as well as traditional methods in project appraisal will put decision makers in front of different results under uncertainty and help them make investment decisions more accurately.

The purpose of this research is to investigate whether real options offer different results to managers through quantifiable data. In addition to quantitative research techniques, secondary source data and scientific writings of experts were utilized.

Keywords: Valuation methods, investment projects, real option method, financial option pricing models, investment decisions
1. EVALUATION OF INVESTMENT PROJECTS:

Realistic evaluation of investment projects is of great importance for firms. Different methods can be used to evaluate investment decisions. Repayment Period Method, Internal Yield Ratio Method, Net Present Value Method, Profitability Index Method are some of them.

A realistic assessment of investment projects is of great importance to firms. The healthy way of valuing investments is closely related to the financial sector. The company that will invest in front of the investment alternative to the right assessment of the future market conditions for man's life to continue and the expected cash flow is of great importance from the angle. Therefore, investment projects need to be evaluated correctly and realistically. Different methods can be used to evaluate investment decisions. These methods are described together with the following explanations (Usta, 1996; Kenç, 2003; Doğan, 2005)

1. Internal Profitability Method: Internal profitability is the discount (interest) rate that makes the present value of the income to be provided during the economic life of an investment project equal to the investment made. When applying the internal profitability method, NPV is accepted as 0 and the total value of the revenues to be generated from the project is considered equal to the present value of the investment and the required discount rate is tried to be found.

2. Repayment Period Method: It is a simple method used in the evaluation of investment projects. The repayment period refers to the number of years a project must accumulate its net profit to pay its total investment. This method finds a large area of application, especially in the incomes of enterprises faced with liquidity difficulties and in the evaluation of investment alternatives with high risk ratios.

3. Profitability Ratio: Profitability is the ratio of net profit to investment at the beginning of a normal year. This ratio can be calculated on the basis of total investment or equity. If the calculated return on total investment or equity is higher than the interest rates applicable in the capital market, that project can be defined as a good project. When choosing between multiple alternative projects, the project showing the highest average profitability is selected for implementation.

4. Break-even Point: The break-even point (profit crossing point) evaluations include calculations made in terms of sales revenue, production quantity and capacity utilization.

5. Net Present Value (NPV) Method: The net present value of a project is defined as the sum of the difference between the present values of the future cash inflows and outflows of that project. If the net present value of the project is greater than or equal to zero, that project may be considered for profitability.
The investment project showing the highest present value is selected for implementation (Usta, 1996; Kenç, 2003; Doğan, 2005). The net present value method offers advantages because it considers time preferences by reducing the economic life or useful life of the project and future cash flows of the project to its present value. However, the discount rate to be applied in net present value method needs to be determined very well and this rate is quite difficult to determine. Choosing the discount rate high or low has a significant effect on the choice of the project ((Usta, 1996; Kenç, 2003).

Among the above mentioned investment project evaluation techniques, the net present value approach is the most popular and the most preferred method, which facilitates the examination of the projects by direct comparison of the net value added to the firm. In general, the usefulness of the methods used to evaluate investment decisions depends on the existence of the data and the accuracy of the outcome of the method. However, the methods in particular show significant differences in their consideration of uncertainty and risk valuation. (Kenç, 2003)

2. REAL OPTION METHOD FOR EVALUATING PROJECTS

Traditional valuation methods do not take into account the risks that may occur as a result of uncertainties. Postponement, expansion, replacement, and abandonment ignore any changes that may occur. The real option method has been developed to remove ambiguities from risk perception and turn them into opportunities in order to eliminate these inadequacies of traditional methods. In this respect, real options do not override traditional approaches.

2.1. REAL OPTION DEFINITION AND TYPES

In simple terms, the real option approach is the application of financial options on non-financial real assets. Some define real options as options on fixed assets (non-financial), extending the theory of financial options (Amram, Kulatilaka, 1999), while others define a transaction (deferral, extension, contract signing, termination) at a predetermined cost (option). The price at the time of use) refers to the right (not the obligation) to make at a predetermined time (the maturity of the option) (Copeland, Antikarov, 2001). Assets such as factory equipment patents can be subject to real options (Anbar, Alper, 2018, pp. 344). Real options are useful in projects where higher levels of uncertainty and information increase are expected to increase (Leslie and Michaels, 1997). One of the earliest studies aimed at valuing a company with a real option approach was made by Schwartz and Moon (2000). Unlike financial options, real options are not traded. For example, a company owner cannot sell his decision to expand his factory to another company. Real options do not reject and replace cash flow or net present value analysis. (KESTER, 1984)
2.2. REAL OPTION TYPES

The options of making an investment now, delaying the investment decision, making investments phase by stage, exiting the investment in the future or changing the size of the investment are all real options for the company. Real options can be divided into types such as postponement, expansion, abandonment, staging, changing inputs or outputs, narrowing the scale of the project and giving up during the implementation phase. (Tan, 2004)

1- Postponement option: it can be defined as postponement of investment decisions in order to see better market conditions due to uncertainty. Investors may use the option of waiting for a certain period of time or, in other words, to postpone the investment in order to find out more before making a final decision on the investment they plan to make, to eliminate uncertainty by seeing the economic progress.

2- Expansion option: it is the flexibility to change the scale of an investment that has been made according to the market conditions. It is in the hands of the investors to increase the amount of the investment made according to the market conditions.

3- Give up option: in case of serious deterioration of management market conditions, they may wish to use the option to obtain scrap value or secondary market value of the investment by giving up their investment due to the inability to obtain the expected cash flows from the investment project.

4- Staging Option: If it is decided that the investment is not attractive by making the investment at certain stages and increasing the information at hand at any time, then the decision can be made to stop it at this stage. Thus, by dividing an investment into steps and giving the opportunity to approve and implement the steps according to the conditions, making the whole investment one at a time and protecting against the risk that the investment will all go to waste when a negative result occurs.

5- Change inputs or outputs: investment decision makers can change inputs, production methods or production locations in the production process to produce the product mix produced according to the change in price or demand, or the same or different output

6- The option to reduce the scale of the project: according to the market conditions, if the demand in the market has stopped and is decreasing, investors can go downsizing in their investments.

7- Option To Give Up During The Application Phase: If the cash flows from the projects that have been invested and started are significantly less than estimated or if the cash inflows provided by the project are less than the cash outflows, the option is to dispose of the investment instead of maintaining the existing investment project and move to a new investment if necessary.
2.3 COMPARISON OF REAL AND FINANCIAL OPTIONS

Financial options have been traded on the markets for nearly three decades to protect against the negative side of risk. In addition, real options have been used to evaluate financial investment decisions in the last decade (Özoğul, 2005).

Although there are many similarities between financial options and real options, there are key differences between the two types of options. For example, the maturity of financial options is usually as short as a few months, while the maturity of real options is several years, and even the maturity of some exotic options may be indefinite. In financial options, options are traded on stocks and there are many different business variables in real options. These variables can be free cash flows, market demand or commodity prices. Therefore, when analyzing physical assets, when using real option analysis, particular attention should be paid to what this variable is. The reason for this is that the volatility measurements used in option modeling differ according to the type of the variable in question. With the adjustments made in financial options, option owners cannot manipulate stock prices in their own interests, at least in theory. On the other hand, in real options, since some strategic options can be created by management, management decisions make the price of the real option. It may raise. In addition, the prices of financial options are lower than real options.

Finally, since financial option models are based on marketable securities and visible asset prices, they are easier and more objective to create. Since real options are formed on the basis of assets not traded in the market, management's predictions play a key role in the valuation of real options. However, the role of management in financial options remains much lower (Mun, 2002).

4. BLACK&SCHOLES MODEL:

This pricing model was developed by Black and Scholes in 1973 to calculate the prices of European-type options that do not pay dividends. As with the Binomial model, the Black and Scholes Model requires certain assumptions:

- Financial markets are functioning properly. There are no transaction costs and tax payments. Investors can easily access all kinds of information. There is no single buyer or seller directing the markets.

- The risk-free rate of return is fixed. The amount of the option contract is known.

- The financial asset overwritten does not pay dividends.

- It is assumed that the option is used on the maturity date.
- The cumulative rate of returns on the financial asset overwritten by the option corresponds to the normal distribution.

- It is allowed to sell the financial asset short, i.e., the investor is not allowed to sell the financial asset (securities) (Alpan, 1999; Dubofsky, 1992).

\[
V_c = C = S_0 N(d_1) - E e^{-rT}N(d_2)
\]

\[
d_1 = \frac{\ln\left(\frac{S}{E}\right) - (r + \frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}
\]

\[
d_2 = d_1 - \sigma\sqrt{T}
\]

\[
V_c = c = \text{American or European type, value of a dividend-paying stock}
\]

\[
N(d_1), N(d_2) = \text{cumulative normal probability distribution values (d1 and d2 to)}
\]

\[
N(d_1) = \text{stock ratio in portfolio}
\]

\[
N(d_2) = \text{probability of use of stock option}
\]

\[
S_0 = \text{current stock price}
\]

\[
E = \text{option price}
\]

\[
r = \text{Risk-Free interest rate}
\]

\[
\sigma = \text{Annual standard deviation of stock's rates of return}
\]

\[
T = \text{Time remaining until option expiration}
\]

\[
e^{-rT} = \text{discount rate} = \text{natural logarithm value (}\cong 2.7182\text{)}
\]

\[
r = \text{risk-free interest rate}
\]

\[
\sigma = \text{standard error of cash flows provided by the project}
\]

\[
T = \text{time remaining to maturity}
\]

Calculation of variance or standard deviation of real options such as assets, financial options, and whether or not they are traded in the market

it's quite difficult for him. Three approaches can be mentioned in the calculation of variance or standard deviation: (Değer, 2007)

I. Method: an approximate value is estimated based on the standard deviation of the firm's stock return. The variance of the firm's stock return would be smaller than the variance of an average project. If the variance of the firm's stock return is 17%, the standard deviation is
estimated by the assumption that the variance of a typical project must also be between 20% and 25%.

II. Method: calculate variance based on cash flows provided by each possible result. For this purpose, a single variance can be obtained from the variances calculated for each year.

III. Method: by dividing the expected present value in the year the option expires into standard deviation, the standard deviation can be calculated using the change coefficient. The value of the option is determined by adding the option price to the net present value of the project. Accordingly;

Real Option Value = Net Present Value + Option Value

A SAMPLE APPLICATION ON THE COMPARISON OF REAL OPTION METHOD AND TRADITIONAL PROJECT APPRAISAL METHODS

In the light of the above explanations, this section will compare the net present value analysis, which is the traditional project evaluation method with the real option method, on a sample. Suppose an entrepreneur will invest in a new factory in the following conditions. (Akkaya, 2005)

Investment Facility Duration: 1 year, Investment amount: 600.000 $ economic life: 20 years Capital Cost: 12 %, In the example, depreciation, scrap value, tax and working capital investments are not taken into account.

The revenues of the investment will be 80.00 $ annually and will remain constant throughout the economic life of the project.

NPV = net present value CF = cash inflows provided by the project CC= cash outs caused by the project

k = discount rate NPV: (80.000*7,4694)- 600.000  NPV: 597.552- 600.000: - 2.448 $  

in this case, the net present value of the project will be - 2.448 YTL. Therefore, according to NBD criteria, the decision maker will reject the project.

However, the evaluation of the above project does not answer some questions. For example;

• If the duration of the investment lasts one year, what will be the cost of abandoning the investment in each period?

• What will happen if the project is more successful than expected and the project requires expansion and growth in its economic life?
What will happen if the project fails more than expected, and only a low cost of abandonment occurs?

What will happen with the option to postpone the project for the future rather than now?

It is quite difficult to find the answers to the questions asked in the net present value analysis. The real option method helps decision-makers in solving the questions listed above. The real option is useful in converting the present value of a project that looks negative to positive.

Project value for real option; Net Present Value + Option Value

The option value mentioned above

• postponing the project

• expand the project

• abandon the project and so on.

It consists of the value to be determined for various options such as.

The option value is determined by the present value of the projected cash flows, the application price of the option, the expiry time of the option, the risk-free interest rate and the uncertainties in the present value of the project.

Assuming that the present value of the option to postpone the project for the above example is 10,000 $, the value of the project compared to the real option - 2,480 + 10,000 = 7,552 $(Akkaya, 2005)

RESULT

In order to eliminate the weaknesses of traditional valuation methods used in cases where uncertainties are found during the valuation of investment projects, the concept of financial options has been changed and the real option method has emerged. Financial options pricing models can be used in the valuation of real options. The Black & Scholes model used is one of the most commonly used models. The real option value of the project calculated according to the model created is different from the value of the project calculated according to the traditional method, and we can conclude that the same project which is valued according to the real option method of a project that has been valued according to traditional methods and should be rejected should be accepted. This study shows that real options give
decision makers the opportunity to make decisions by calculating the real values of uncertainties and variables in their investment decisions.

The increasing competition and especially the importance of capital costs pressure managers to make the right decision. The Real option model provides managers with the opportunity to open a new vision and alternative decision options along with traditional methods. It is not complementary to traditional methods. In today's conditions where there is an evolving and continuous flow of information, real option models guide decision makers to make accurate and correct decisions.

REFERENCES


[5] AKKAYA, Cenk. Dokuz Eylül University Academy of economic and Administrative Sciences, s.177-178


[16] Usta Ö. “İşletme Finansı ve Finansal Yönetim”, Anadolu Matbaası, s. 9-20, March 1996,


