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REAL OPTIONS IN EVALUATION OF INVESTMENT DECISIONS

Abstract: Real options capture the value of managerial flexibility to adapt decisions in response to unexpected market developments. Companies create shareholder value by identifying, managing and exercising real options associated with their investment portfolio. The real options method applies financial options theory to quantifying the value of management flexibility in a world of uncertainty. If used as a conceptual tool, it allows management to characterize and communicate the strategic value of an investment project. The use of real options is particularly relevant when the total investment will be made on a phased basis and the subsequent investments depend on the situation at the particular time when they are to be made. Such investments have to be reassessed prior to the expiry of the option when a better assessment of the likely returns may be possible.

Keywords: real options, evaluation, investment, decisions.

1. Introduction

The discounted cash flow (DCF) model still operates as the basic framework for most business analyses. In investment analysis, for example, the conventional view is that the net present value (NPV) of a project is the measure of the value that it will add to the firm taking it. Thus, investing in a positive (negative) NPV project will increase (decrease) value. In capital structure decisions, a financing mix that minimizes the cost of capital, without impairing operating cash flows, increases firm value and is therefore viewed as the optimal mix. In valuation, the value of a firm is the present value of the expected cash flows from the assets of the firm.

In recent years, this framework has come under heavy critique for failing to consider the options that are embedded in each of these actions. For instance, the NPV of a project does not capture the values of the options to delay, expand or abandon a project. When comparing across investments, the traditional approach of choosing the model with the highest return or NPV may ignore investments that offer a firm more flexibility in operations and investing. A financing model that focuses on minimizing the current cost of capital does not consider the value of financial flexibility that comes from having excess debt capacity. In acquisition

valuation, the strategic options that might be opened up for the acquiring firm, as a result of the transaction, are often not considered in valuation.

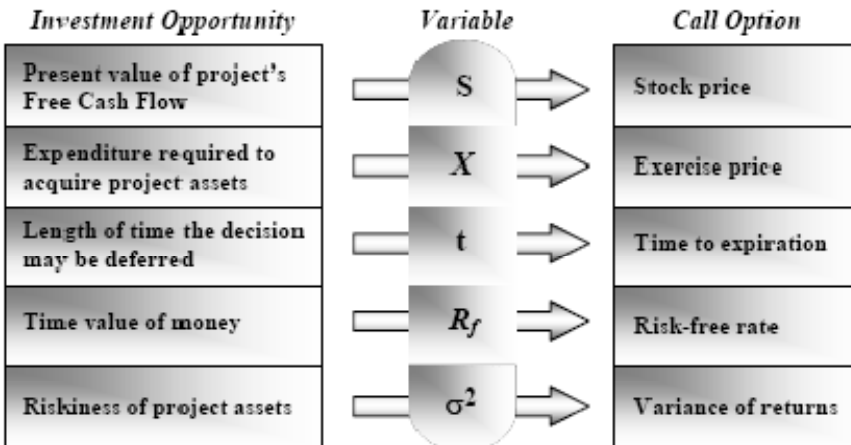
Hence, there is a growing gap between how the market is pricing investments/businesses – especially those fraught with uncertainty – and the values generated by traditional valuation models. Managers and investors instinctively understand that investment valuations reflect a combination of known businesses plus a value for upcoming opportunities. Real options bridge this gap between hard numbers and intuition.

2. Background

An option is a right to buy (call options) or sell (put option) an asset within a specified period of time at a given price (exercise price).

Financial options are usually evaluated using Black-Scholes model, key inputs of which are described below:

- S is the stock price of the underlying stock. If we expect the stock to pay specific dividends before the option expires, we should subtract the present value of those dividends from the stock price and use this “adjusted stock price” as the relevant input for this equation.
- X is the exercise, or strike, price of the option.
- r is the risk-free rate.
- T is the expected life of the option in years.
- σ^2 is the variance of the underlying security



Source: Timothy Luehman, *Investment Opportunities as Real Options*, Harvard Business Review, July-August 1998.

Figure 1. The link between real investment and Black-Scholes model inputs

Source: [6].

The same approach can be used for evaluating real options, as has been shown by numerous researches (e.g. see [5; 7; 11]). Figure 1 demonstrates a link between Black-Scholes model and real options:¹

3. Real options in strategic investment decisions

In strategic investment decisions, the option does not relate to buying or selling an asset, but rather to carrying on with the investment program. Hence the current asset price is normally the present value of the investment's expected cash flow, while the exercise price of the option is the subsequent expenditure required to finish the project and consequently generate the required cash flows. The life of the option is the length of the deferment for these subsequent expenditures. The time value of money is the same as for financial options, although cost of capital is often used instead of risk-free discount factor. Volatility of the investment returns is the most difficult to measure, but quite simply it can be assessed by considering the range of potential outcomes.

Analysis of Black-Scholes model reveals that a higher value of the real option is driven by:

- a higher net present value of the project's cash flows,
- a lower expenditure to implement the project,
- a longer time left till option expiry,
- a higher risk (more volatile returns of the project).

The cumulative volatility impact from the real options built into the investment may more than offset the current negative net present value. This investment would not be accepted under traditional DCF analysis, even using the cumulative probability factors. The use of real options is particularly relevant when the total investment will be made on a phased basis and the subsequent investments depend on the situation at the particular time when they are to be made. Such investments have to be reassessed prior to the expiry of the option when a better assessment of the likely returns may be possible.

Real options are often referred to as a value added by imbedding flexibility into an inflexible project. Hence, under uncertainty,

$$\text{Expanded Value} = \text{Expected NPV} + \text{Value of Real Options.}$$

Real options capture the value of managerial flexibility to adapt decisions in response to unexpected market developments. Companies create shareholder value

¹ *Binomial* is an alternative method of evaluating real options. It is based on decision tree model, where each knot represents a key stage of the project and implies the management choice of the best option. Since an option represents the right but not the obligation to make an investment, the payoff scheme to the option-holder is asymmetric. In other words, options are only exercised if they have a positive value and are left unexercised if worthless. Time and the range of outcomes are key to option value.

by identifying, managing and exercising real options associated with their investment portfolio. The real options method applies financial options theory to quantifying the value of management flexibility in a world of uncertainty. If used as a conceptual tool, it allows management to characterize and communicate the strategic value of an investment project.

Real options enable the management to assess the possibility to modify and make strategic decisions in future in line with the constantly inflowing information. It is exactly the issue of DCF that it fails to quantify such opportunities at the project appraisal stage. Hence the companies usually call a certain decision “strategic” if the project that it wants to accept has a negative NPV.

Thus, there are three areas in particular where traditional DCF, most widely articulated as the net present value rule (NPV), comes up short versus options theory [7]:

Flexibility. Flexibility is the ability to defer, abandon, expand, or contract an investment. Because the NPV rule does not factor in the value of uncertainty, it is inherently less robust than an options approach in valuing flexibility. For example, a company may choose to defer an investment for some period of time until it has more information on the market. The NPV rule would value that investment at zero, while the real options approach would correctly allocate some value to that investment’s potential.

Contingency. This is a situation when future investments are contingent on the success of today’s investment. Managers may make investments today – even those deemed to be NPV negative – to access future investment opportunities. Traditional budgeting models inadequately value these option creating investments. Pharmaceutical company investments are a good example. Future spending on drug development is often contingent on the product clearing certain efficacy hurdles. This is valuable because investments can be made in stages, rather than all up-front.

Volatility. Somewhat counterintuitively, investments with greater uncertainty have higher option value. In standard finance, higher volatility means higher discount rates and lower net present values. In options theory, higher volatility leads to higher option value due to asymmetric payoffs.

The real options approach is particularly relevant when three elements are in place:

- 1) smart management team, focused on creating, identifying, and exercising real options,
- 2) market leading businesses which tend to get the best look at strategic opportunities and can offer economies of scale and scope,
- 3) uncertain markets are where options are most valuable. Industries where the real option models are used most frequently are: resource extraction, pharmaceuticals, hi-tech businesses.

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OPCJE RZECZYWISTE W OCENIE PROJEKTÓW INWESTYCYJNYCH

Streszczenie: Opcje rzeczywiste umożliwiają zarządzającemu elastyczność w dostosowaniu decyzji w odpowiedzi na nieoczekiwany rozwój sytuacji rynkowej. Przedsiębiorstwa, tworząc wartość dla akcjonariuszy, zarządzają opcjami rzeczywistymi związanymi z ich portfelem inwestycyjnym. Metoda opcji rzeczywistych jest stosowana w warunkach niepewności jako narzędzie zarządzania strategicznego w wyborze projektów inwestycyjnych. Korzystanie z opcji rzeczywistych ma szczególne znaczenie, gdy inwestycji dokonuje się stopniowo i późniejsze inwestycje zależą od sytuacji w chwili ich dokonywania. Takie inwestycje muszą zostać ponownie ocenione przed wygaśnięciem opcji, gdy ma się dokładniejszą ocenę prawdopodobieństwa. Opcje rzeczywiste stwarzają możliwości modyfikowania i podejmowania decyzji strategicznych w przyszłości w przypadku napływu nowych informacji. Tradycyjne metody oceny strategicznych decyzji inwestycyjnych nie odzwierciedlają bowiem w pełni możliwości wystąpienia wysokiego ryzyka.