Essay on Challenges of Real Option Analysis

In this essay, I intend to elaborate on four challenges of Real Options in the business world and capital budgeting projects. The first challenge looks into "the nature of the investment: options embedded in projects", the second challenge is "Linkage of real options to financial options", the third obstacle is "pricing real options" and the fourth illustrates "the right timing of real option exercise". Considering that I have a master's in Finance, I decided to add more detail in this essay.

A. The Nature of Investment: Options Embedded in Capital Budgeting Projects

Traditionally, to evaluate the value of a project and whether it is financially feasible to pursue a project, financiers used Discounted Cash-Flow based measurements like NPV and IRR. However, the assumptions of NPV, like an expected scenario and fixed cost of capital, assert that by using simple NPV, we are performing passive management of capital budgets (Trigeorgis, 1993). By considering the projects in different scenarios, it can be shown that projects usually have options embedded within them such as cancellation during construction (option to abandon), expansion (growth option), option to defer, and countless other options and combinations of options. These options add values to the projects and make a lot of projects that are infeasible, feasible (Trigeorgis, 1990 & 1993). Trigeorgis uses an example of when the base scenario used to calculate NPV, can be extended by adding the optionality on the variability of real riskless interest rate (risk-free rate, changing the discounting part of DCF), salvage value, and projects standard deviation (variability in input and output prices creating variability in cash flows). Considering that the projects bring these real options and rights with themselves based on deviations of the base scenario, we can say that these options have values. Thus, when the value and feasibility of the project are different under a different scenario, one

must consider the value of the base scenario plus the value of the real options to evaluate the whole project value and therefore, feasibility. The upcoming challenge is the valuation of these real options.

B. Linkage of Real Options to Financial Options

After the development of the Black-Scholes-Merton model (Black and Scholes, 1973; Merton, 1973) and its extensions, discrete methods like the binomial approach (Cox, Ross, and Rubinstein, 1976) and the continuous approaches using stochastic process, Ito calculus, and adding the delta-hedge (by considering risk-neutral portfolio) method to the development of financial options, financial option pricing was in reach. However, real options needed to be priced as well in the capital budgeting field. A revolution in option pricing happened after the invention of the risk-neutral valuation method. By creating an equivalent portfolio replicating the option value (a combination of a position on the underlying asset and a position in risk-free asset). This portfolio is built on the no arbitrage system by investing δ portion in the underlying asset and $1-\delta$ portion in risk-free asset (at risk-free rate).

Regarding this matter, it has been shown that real options can be priced like financial options in many scenarios or at least they can be equivalents of financial options in value (Mason and Merton, 1985; Kansanen and Trigeorgis, 1993). However, since financial options and this linkage are highly sophisticated, it is not an easy task for the managers to choose the right model, the right evaluation, and equivalent financial option. Moreover, in contrast to financial options, real options are not traded in the financial markets. This obstacle brings the next challenge to the table so-called “pricing real options”.

C. Pricing Real Options

In capital budgeting, the underlying asset is not traded and the rate of foregone earnings is not derived from the project (underlying of the real option). In the first set of real option valuations, real options are valued separately. Considering the first applications emerged in the natural resource projects, such as the option to defer (McDonald and Siegel, 1986; Paddock, Siegel and Smith 1987) to value offshore petroleum leases and reserves of natural resources (Tourinho, 1979). Option to defer in light of a change in the cost of capital (Ingersolll and Ross, 1987), delay in sequential constructions (Majd and Pindyck, 1987), and many more applications.

In the second set of real option valuation applications, The valuation of multiple real options with interdependencies is discussed, such as the option to shut down and restart a mine, and abandon for salvage (Brennan and Schwarts, 1985). Using the numerical analysis method, the valuation of multiple options first takes place in isolation and then in combination to see how much adding a single option adds to the project's value. After evaluating the real options, one might ask how can we be sure that the optionality embedded in the projects is going to be exercised in the right timing and order? That's the new challenge facing real option pricing.

D. Right Timing of Real Option Exercise

The real options need to be exercised in a timely and rational manner to obtain the measured value. It is shown that a delay in exercising stock options with different volatilities for the underlying stock creates a cost in forms of deviation from the optimal value for the company. This cost increases with the volatility of the underlying asset. The same thing can happen if the option is exercised way ahead of the optimal timing. The value destruction experienced by wrong exercise of the option at the wrong time assert that there should be rules governing when to exercise. To do that, the companies should define the responsibility of who is going to be in

charge of exercising the option, making sure that the responsible person (or department) is motivated and alert and a strategy defined to measure the exercise-decision performance to improve the action-times in managers monitoring the options (Copeland and Tufano, 2004).