

Comprehensive method to determine real option utilizing probability distribution

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Abstract—the purpose of this paper is to develop a method that determines the real option value more realistically. Different stochastic phenomena affecting the real options are considered in the calculations. Present methods of calculating the real option value result in a single quantity but this single quantity is not able to state all distinct aspects of the real option value. In the proposed method, calculating real option value turns out into a stochastic variable in which, besides the mean, other characteristics such as dispersion, probability distribution are also determined.

Keywords: *Real option, Optimization, Option pricing model*

I. Introduction

In these days, importance of making decisions in projects in order to manage budgets and direct actions towards predetermined goals is in growing. Decision making, according to its nature, often gets very complicated even though many methods are developed to contribute in convoluted situations. One of these methods increasingly used in recent years, is real options.

Determination of proper template for project portfolio selection using real option valuation method is an increasingly used technique in financial engineering and project management.

Main characteristic of real option that makes it a useful tool is considering risks of projects in financial valuations. This feature becomes more important in high risk projects like R&D and huge oil projects since there is no data or cognition over the market or lots of stochastic factors affect valuation of projects.

Project portfolio selection can be performed in different ways such as zero one programming including project value, switching model and real option valuation, developed NPV (Net Present Value) methods, to name but a few. In these techniques NPV of projects are being reported by a single number and only the information existing in expected value is used to value project portfolios

While as mentioned, the real options approach takes risks into account, so considering distribution of

gathered data might provide some other useful information about real option value of projects in portfolio selection.

Distribution of real option value can provide several advantages. Distribution will show dispersal of variable, so optimum decisions can be made in different levels of certainty and according to the nature of the problem, different certainty levels might be defined for parameters of the problem. Another advantage in determining distribution of real option value is simplifying sensitivity analysis of the decision making optimization problem.

Due to the fact that the NPV of the projects are made up of different stochastic factors, a simplifying assumption can be made that the NPV distribution of project are considered as normal or lognormal distribution which has certain expected value and standard deviation.

By considering the NPV of the project as a stochastic variable with a specified distribution, the common methods of real option valuation can be developed in order to determine the distribution of the real option and if it is not possible, at least expected value and variance of real option value can be determined.

In section 2, a review of the performed studies in real option area are surveyed, in section 3, present equations for calculating real option are introduced and expanded, and the new methodology is developed. In section 4, a simple numerical example is presented and objective parameters are calculated using new methodology. In last section, conclusions are made.

II. Literature review

Real option is defined based on the similar principles of option in financial engineering. Real option, unlike option, includes real assets. First articles of applying real option to solve an investment problem were published by [1] and [2]. Afterwards, growing numbers of studies in the field of real option are published.

One of the most important fields in which real option is applied, is R&D and portfolio selection for new products. As an example of this, [3] presented a model to optimize making the decisions to select the best R&D