

20th International Scientific Conference Economics and Management - 2015 (ICEM-2015)

Flexibility valuation under uncertain economic conditions

Agnė Pivorienė^{a,*}

^a*Kaunas University of Technology, K. Donelaičio g. 73, Kaunas LT-44029, Lithuania*

Abstract

In dynamic and unpredictable environments the capacity to adapt strategic investment decisions quickly to market conditions is becoming one of the most important issues. Flexibility has a value in the context of uncertain strategic projects, as decision makers can gather information repeatedly about the project and market characteristics and, based on this information, change the course of action.

This paper aims to investigate the feasibility of decision tree analysis and real options approach to value flexibility under uncertain economic conditions. The research methods that were used in this paper are the analysis and synthesis of scientific literature, logic analysis and comparative analysis.

The results of this study suggested that although decision tree analysis and real options approach solve the same issue, real options have advantage over decision trees in modelling real asset investment flexibilities and is the most appropriate approach for valuation of flexibility and investment opportunities under uncertain economic conditions.

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Peer-review under responsibility of Kaunas University of Technology, School of Economics and Business

Keywords: Uncertainty; Investment evaluation; Flexibility; Real options; Decision tree analysis.

Introduction

Under conditions of new economy managers encounter a confusing variety of opportunities, uncertainties, technologies, business models and strategic options, and it is robust to forecast costs, profit and risks of strategic investment projects reliably. Within such circumstances it is difficult to make reasonable investment decisions and the value of flexibility to perform a particular action or not is growing. Flexibility is the ability of companies to respond and successively adapt to environmental change, it can be defined as an organization's capability to identify

* Corresponding author. Tel.: +370 37 300561.

E-mail address: agne.pivoriene@ktu.lt

major changes in the external environment, to commit resources to new courses of action in response to change, and to recognize and act promptly when it is time to halt or reverse resource commitments (Greenley & Oktengil, 1998; Greenley & Combe, 2004; Shimizu & Hitt, 2004; Tamayo-Torres, Ruiz-Moreno, & Verdú, 2010). This flexibility enhances the investment opportunity's value by improving its upside potential while limiting downside losses relative to the initial expectations under passive management.

The issue of valuing flexibility is already addressed in finance research, especially in the project appraisal and capital budgeting techniques. A large number of methodologies for investment evaluation under uncertainty was developed and reported in the academic literature over the last few decades. However, while there is agreement among scholars regarding the advantages of decision tree analysis (DTA) and real options approach (ROA) over traditional investment evaluation techniques like discounted cash flow (DCF) approach to evaluate flexibility, very little attention has been paid to the comparison of these techniques.

Many academicians (Trigeorgis, 1993, 2000; Copeland & Keenan, 1998; Yeo & Qiu, 2003; Topal, 2008; Madhani, 2008, 2013) observed that, ROA as a capital budgeting and strategic decision making tool explicitly accounts for the value of future flexibility. Real options are the extension of financial options theory to options on nonfinancial assets that can be defined as opportunities to respond to the changing circumstances of an investment project. Using option pricing models, it is possible to quantify these opportunities and to indicate when these options should be optimally exercised. In contrast, supporters of the DTA argue that decision trees may be an alternative methodology to value flexibility (Smith & Nau, 1995; Brandão, Dyer, & Hahn, 2005; Wang & Halal, 2010). DTA can be used to model managerial flexibility through decision nodes allowing future managerial decisions to be made and altered after some uncertainty has been resolved and more information has been obtained.

The main purpose of this paper is to investigate the feasibility of decision tree analysis and real options approach to value flexibility under uncertain economic conditions. The research is based on the analysis and synthesis of scientific literature, logic analysis and comparative analysis. Systematization and generalization of the scientific literature, as well as the generalization of the findings, is used for the analysis of the peculiarities of flexibility valuation techniques under uncertain economic conditions, specifically decision tree analysis and real options approach. Systematic approach to the analysis is used throughout the research.

2. Flexibility valuation: decision tree analysis and real options approach

The research of scientific literature revealed that decision tree analysis is used to model managerial flexibility in discrete time by constructing a tree with decision nodes that represent future decisions the manager can make to maximize the value of an investment project after some uncertainty has been resolved and more information is obtained over the projects life (Brandão, Dyer, & Hahn, 2005; Wang & Halal, 2010). Decision trees enable the managers to recognize the interdependencies of decisions made at different stages of the project investment. Applying decision tree analysis, it is possible to represent and analyze a series of complex sequential investment decisions to be made over time (Yao & Jaafari, 2003; Reyck, Degraeve, & Vandendorpe, 2008), therefore this approach allows to overcome some of the limitations of the static DCF approach.

Compared with real option pricing models, decision trees model flexibilities with unknown underlying asset distributions. Moreover, since decision tree framework models reality without “no arbitrage” assumption, which is a must in option pricing models, it can be applied in all kinds of markets, complete or incomplete (Wang & Halal, 2010). As a result, decision tree analysis provides an alternative to resolve the essential problem in real option pricing. Makropoulou (2011) demonstrated in a simple framework how decision tree analysis and real options approach yield the same results when markets are complete. His study showed that shortcoming of DTA is a misconception that is overcome using the correct risk-adjusted discount rate for a project with managerial flexibility. These ideas were previously developed by Smith & Nau (1995) and by Brandão, Dyer, & Hahn (2005). Smith & Nau (1995) studied the relationship between option pricing theory and decision tree analysis and demonstrated that the two approaches yield the same results when applied correctly. Brandão, Dyer, & Hahn (2005) described an approach for using binomial decision trees to solve real option valuation problems based on the ideas illustrated by Copeland & Tufano (2004). Their approach called for a mix of discounted cash flow analysis and risk-neutral valuation methods and was implemented using Monte Carlo simulation and binomial decision trees. Smith (2005)

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