دهمین کنفرانس بین المللی مهندسی صنایع
Tenth International Industrial Engineering Conference
۷ و ۸ بهمن ماه ۱۳۹۲
27-28 January, 2014

A dynamic programming approach for investment problem with stochastic number of investment chances

Mohammad Modarres
Professor, Department of Industrial Engineering
Sharif University of Technology
Tehran, Iran
modarres@sharif.edu

Mohammad Feizabadi; Reza Yousefi M.
Master Student; Department of Industrial Engineering
Sharif University of Technology
Tehran, Iran
Feizabadi_mohammad@yahoo.com;
yousefi.m_reza@yahoo.com

Abstract—**This paper uses a dynamic programming (DP) approach to obtain the optimal policies for an investor who faces a stochastic number of investing chances (with Poisson distribution) and a stochastic profit for every chance occurring (with uniform distribution). First a model with deterministic number of investing chances is introduced. Then an approach is developed for obtaining optimal solutions for stochastic model using the concept of conditioning. For more clarity a numerical example is presented.**

Keywords: Investment Planning, Marcovian Decision Process, Dynamic Programming, Stochastic process

I. INTRODUCTION

Dynamic programming techniques offer a convenient mathematical structure to quantify results for decision policy construction [1]. The approaches used as core of DP include modeling the problems through dividing them in to small stages. Then the optimal policy for every stage is searched by considering the effects that this stage has on the previous or next steps. This makes DP a very suitable tool for determining optimal policies at a variety of problems in diverse industries [2].

DP approaches specially are used in optimizing policies regarding investment decisions. To give some example, paper [1] demonstrates a policy development approach that combines the Bellman equation for DP with a real options valuation algorithm for petroleum development investments. In [3], an option pricing model and a dynamic programming model are developed. These models contribute to the improvement of the decision making process to estimate the satisfactory gross revenue for investing in multi-metal mines. [4] examines a DP approach to evaluating options and a valuation by arbitrage approach and end by comparing the two approaches with respect to how they treat time and risk.

Specifically they are utilized in policy refining regarding financial instruments like options. To mention some examples [5] shows that DP combined with finite elements is particularly well suited for options involving decisions at a limited number of distant dates during the life of the installment option contracts. Paper [6] develops a DP procedure to price installment options. It study in particular the geometric Brownian motion case and derive some theoretical properties of the installment option contract within this framework. Paper [7] proposes a DP approach for pricing options embedded in bonds, the focus being on call and put options with advance notice. In [8] a novel semi-parametric estimator of American option prices in discrete time is introduced. It uses DP to make explicit the nonlinear restrictions on the Euclidean and functional from option data.

All firms face finite financial resources. In order to model and solve the resource allocation problem DP approaches are useful. Investment chances can be interpreted as options to invest or not invest.

This paper considers the problem of selecting an investment chance, when the number of chances