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Decision Support

Applying the maximum NPV rule with discounted/growth factors to a flexible production scale model

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ABSTRACT

This study examines the maximum net present value of the market entry and exit thresholds derived by the traditional net present value method and combines the real options approach for the project investment or disinvestment. The discounted and growth factors are incorporated into the proposed entry and exit models, facilitating the complicated calculations required to identify the discounted and growth rates so as to assess and determine the expected present value of uncertain cash flow streams. Consequently, this investigation successfully combines applying the maximum net present value method and the real options approach to decision-making with the simple consideration of the discounted and growth factors in the flexible production scale model.

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1. Introduction

Most decision-making in capital budgeting follows the net present value (NPV) method. Typically, the NPV method can be applied in making a decision and relevant conditions are assumed to be static and certain. Giri and Dohi (2004) regarded the NPV method as an approach of determining the economic manufacturing quantities for an unreliable production system over an infinite planning horizon. The NPV of the expected total cost was obtained under general failure and repair time distributions, and its asymptotic characteristics were examined via the perturbation of the instantaneous discounted rate in the EOQ (economic order quantity) model. Kylaheiko et al. (2002) focused on the difficult issue of managing and valuing dynamic capabilities for designing the firm's strategic boundaries in decision-making regarding network relations, and took a broad look at the real options approach (ROA) as a special method of the NPV rule to illuminate the issue of coping with technological and market uncertainty.

Meanwhile, the ROA is devised based on the options pricing model of Black and Scholes (1973). Dixit and Pindyck (1994) revealed a lot of similarities in findings and the mathematical methods for investment strategic behavior with the ROA. The ROA provides the appropriate heuristic framework for competency and exploratory searching. Miller and Park (2002) comprehensively reviewed the research on the ROA, focusing on the decision-making of engineering economy under uncertainty. Furthermore, the decision-making process based on the ROA is more realistic than that based on the NPV rule since it considers the uncertainty regarding future costs and output prices, investment irreversibility, and managerial flexibility, meaning the decision is not "now or never" but rather "now or later". Thus, the ROA is a novel approach for assessing projects, investments, businesses, and technologies by applying the financial options theory.

Bengtsson and Olhager (2002) introduced the ROA to demonstrate that the flexibility value of strategic adoption decreases with increasing demand volatility, flexible resources are substantially more valuable than dedicated resources, and the flexibility value of marginal capacity decreases with an increasing capacity level. Boute et al. (2004) studied that project management can wait for additional information to serve as the basis for rescheduling the project. This management flexibility enhances the value of the project by improving its upside potential while limiting its downside losses relative to the initial expectations.

McDonald and Siegel (1986) studied the investment timing problem and evaluated the value of waiting so as to derive an optimal decision rule and the value of the investment opportunity. The authors introduced the correct discounted rate success for assessing the actual rate of return on the investment opportunities. However, this study examines the maximum NPV of the market entry and exit thresholds derived by the simple discounted and growth factors, facilitating the complicated calculations required to identify the discounted and growth rates and thus determine the expected present value of uncertain cash flow streams. Consequently, this investigation successfully combines applying the maximum NPV rule and the ROA to decision-making with the simple consideration of the discounted and growth factors in the flexible production scale model.



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