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A Simplified Utility Framework For the Analysis of Financial Risk

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Abstract

The von Neumann-Morgenstern utility (risk-preference) theory is the most consistent and comprehensive theory of risk. Yet it has been used very little for representation of financial risk problems. Instead, special purpose methods of risk representation have purpose methods of risk representation have been used. The goal of this paper is to propose a simplified utility framework. Three different possible axioms are considered. They all possible axioms are considered. They all uniquely imply that the utility function must be of the exponential form. It appears that this simplified utility framework will be more fruitful than other special purpose methods for risk representation. A two-stage method of risk analysis is recommended and an example from oil exploration is shown.

Introduction

An axiomatic, consistent representation of risk can lead to simple models that convey much insight. Such a foundation is the von Neumann-Morgenstern theory of utility (risk preference). This concept of risk is relative to preference). This concept of risk is relative to an individual decision maker. It is assumed that the individual's fundamental measure of wellbeing is his quantity of wealth. Thus, the argument of an individual's utility function is his wealth. This assumption commonly is made in treating financial problems.

The goal of this paper is to develop a simplified utility framework that trades off some of its generality to gain ease of solution for practical risk problems. The method is to assemble many well known facts into a comprehensive picture of the properties of exponential utility functions.

Following Pratt's notation, let x represent total wealth at the initial time. Let U(x) represent the individual's utility function for wealth at the end of the period. It is assumed that U(x) is continuous and possesses second derivatives. Let z represent the profit or net return (increment to wealth) during the period. Then the terminal wealth will be x + z period. Then the terminal wealth will be x + z at the end of the period. The profit is a random variable at the initial time. It has a probability distribution with

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density function probability distribution with density function f(z). This probability distribution may be discrete or continuous. However, without loss of generality, the notation of continuous random variables will be used.

At the initial time the individual's utility position is the expected utility of terminal wealth:~E {U(x+z)} = U(x+z)f(z)dz .....(1a)

Keywords: **strategic planning and management**, **Upstream Oil & Gas**, **financial risk**, **decision support system**, **Game Theory**, **utility theory**, **Artificial Intelligence**, **portfolio**, **utility framework**, **risk management**

Subjects: **Risk Management and Decision-Making**, **Strategic Planning and Management**, **Exploration and appraisal strategies**

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