



SPE 116681

Application of the Efficient Frontier Concept to Resource Play Budget Evaluation and Portfolio Optimization

Robert R. Tonnsen, SPE, EnCana Oil & Gas (USA) Inc.

Copyright 2008, Society of Petroleum Engineers

This paper was prepared for presentation at the 2008 SPE Annual Technical Conference and Exhibition held in Denver, Colorado, USA, 21–24 September 2008.

This paper was selected for presentation by an SPE program committee following review of information contained in an abstract submitted by the author(s). Contents of the paper have not been reviewed by the Society of Petroleum Engineers and are subject to correction by the author(s). The material does not necessarily reflect any position of the Society of Petroleum Engineers, its officers, or members. Electronic reproduction, distribution, or storage of any part of this paper without the written consent of the Society of Petroleum Engineers is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of SPE copyright.

Abstract

The oil and gas industry contains significant inherent risks that greatly affect a company's ability to achieve predicted performance. In an attempt to better manage risk and uncertainty during the decision making process, the efficient frontier concept has been proposed as a method for portfolio optimization. This paper analyzes the application of the efficient frontier concept to a yearly budget allocation process considering unconventional resource play opportunities. Economic and optimization models were developed with assumptions specific to resource plays. The models show that the expected risk, uncertainty, and return on investment change according to the level of investment, project selection, the number of planned wells, and to the grouping of wells for budgeting purposes. The budget dependency of the risk and return cause an oddly shaped efficient frontier resulting in mean-variance efficient portfolios that may not be optimal when based on a set level of risk. In addition, the results show that conventional rank and cut methods for portfolio selection may suffice for resource play budget allocation. However, even though the efficient frontier does not often offer definitive solutions for portfolio optimization, illustrating the interactions among portfolio properties and providing insight into inefficient budget allocations could make the efficient frontier optimization process invaluable.

Introduction

In Markowitz's seminal article of 1952, he introduced the investment community to the idea of the Efficient Frontier (EF) and mean-variance efficient portfolios. An efficient portfolio maximizes expected value for a given level of risk (or uncertainty) and a set capital investment (Figure 1). Many articles have analyzed the possibility of using EF concepts for oil and gas development decisions (Adekunle 2006; Edwards and Hewett 1993; Erdogan et al. 2005; Faya et al. 2007; Haskett et al. 2004; Merritt 2000; Orman and Duggan 1999; Schuyler 2003; Simpson 2002) and a review of these articles is suggested for more elaborate elucidation on the topic.

The goal of the project was to explore the potential for the application of the EF for budget allocation among resource play opportunities. Can the EF provide insight for the decision making process? Ideally, a decision framework could provide a concise answer to a problem. However, most studies suggest that the EF should only be used to gain clarity on the interactions among a large number of correlated and uncorrelated investments, and to illustrate which portfolios are not

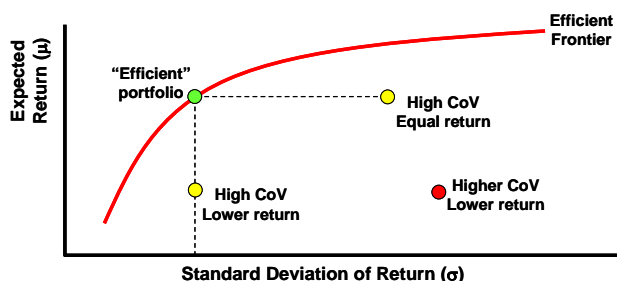


Figure 1. The Efficient Frontier represents the maximum return on investment for any given standard deviation (adapted from Letzelter, 2006).

efficient and thus should be avoided (Adekunle 2006; Bratvold 2003; Edwards and Hewett 1993; Erdogan et al. 2005; Faya et al. 2007; Simpson 2002). In contrast, the more conventional rank and cut method based on an economic metric for budget allocation may not be perceived as the best method for risk reduction, but it does provide a specific answer, and it may in fact be an acceptable risk-mitigating method for resource play budget allocation.

This paper presents the results of a pilot project undertaken to discover whether or not EF concepts could be applied to unconventional resource play portfolio optimization and budget allocation through the creation of economic and optimization models. It examines optimizing a business division of an organization which consists of four specific areas that contain numerous resource play