Chapter 9

Risk Behavior in Petroleum Exploration

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Most highly risk-averse people (and firms) never realize the high price they pay for their conservatism.
—Peter R. Rose

INTRODUCTION

Exploration and Risk Aversion

Like many other common four-letter words, risk is widely and variously used in petroleum exploration. Megill (1971, 1979) defined it as "an opportunity for loss." In this chapter, I use the term in the sense of risk aversion, which weighs the magnitude of investment against four factors: (1) size of available budget, (2) potential gain, (3) potential loss, and (4) probabilities of each outcome. It is not synonymous with uncertainty, which is defined as the range of probabilities that some condition may exist or occur—although uncertainty clearly affects risk behavior.

Modern petroleum exploration consists of a series of investment decisions on whether to acquire (1) additional technical data (geological, geophysical, engineering, drilling, or economic) and/or (2) additional mineral interests (Rose, 1987). Each decision should allow a progressively clearer perception of project risk versus reward and should support timely management action concerning the inferred accumulation. An idealistic definition of exploration could be "a series of investment decisions made under decreasing uncertainty." Every exploration decision involves considerations of both risk and uncertainty. Risk comes into play in deciding how much to pay for additional data or mineral interests and in considering the high impact of front-end costs on project profitability, as well as the substantial likelihood of ultimate project failure. Uncertainty is intrinsically involved in all geotechnical predictions with respect to the reserves contained in the prospective accumulation, the chance of discovery, and the costs to both find and develop it. Great uncertainty also attends forecasts of future oil and gas prices.

Companies searching for oil and natural gas make hundreds of such exploration decisions each year. So the problem in serial exploration decision making is twofold: (1) to be consistent in the way we deal with risk and uncertainty and (2) to perceive risk and uncertainty accurately and reduce them where possible. Risk aversion is not just a hypothetical nuisance. It causes explorationists to make inconsistent investment decisions, and it costs exploration companies millions of dollars annually in lost opportunities, bad choices, and wasted investment dollars.

Expected Value and Risk Aversion

The concept of expected value (EV) can be explained using the example of a simple game in which a coin is flipped one time (see Chapter 7). If you call the outcome (heads or tails) correctly, you win $20,000; if you call it incorrectly, you win nothing. If you were able to play this game free of charge, the EV of the game would be +$10,000. If you paid $10,000 each time you played, the EV would be zero. This can be shown as follows:

Free Trial: \(0.5 \times 20,000) + 0.5 \times 0 = 10,000 \) EV

$10,000 Trial: \((0.5 \times (20,000 - 10,000)) + 0.5 \times (-10,000)) = 0 \) EV

The question is, how much would you, with your own unique financial status, obligations, and values, be