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Systematic Prediction Errors in O&G Project and Portfolio Selection

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Abstract

The normal rule for choosing between alternatives in a decision situation is to select the one with the maximum estimated value. Due to uncertainty in the estimates (prediction errors), the mere fact of choosing the maximum induces a systematic bias that guarantees that, over repeated decisions, less than the estimated expected value will be realized. Although some “proof-of-concept” instances of this behaviour (variously termed Post-decision Surprise, the Optimizer’s Curse, Inevitable Disappointment) have been reported, it is not well-publicised in the O&G world and its importance/relevance in realistic O&G decision situations has not been thoroughly assessed.

This paper places the effect in a more-widely applicable theoretical context and reports a systematic study that explores its impact on typical O&G decisions, using NPV as the value measure. Three typical situations, with different characteristics, are identified for investigation: intra-project alternative selection, using a Max[NPV] decision criterion; project “go”/“no go” decisions, using an NPV > 0 decision criterion; constrained portfolio selection, using a Max[NPV/I] criterion, subject to a budget limit. Sensitivity analysis of the magnitude of the effect is carried out in each case.

We conclude that, whilst the effect is real and its magnitude may be large in some situations, it was of order 2% and 10% respectively, for the project and portfolio cases we analyzed. Further, the real prediction error, defined as expected difference between the true values of the selected alternative and the genuinely best alternative, was about half the above values. Given the range of other sources of prediction errors, plus the fact that its impact may be reduced due to corrective decisions as a project is executed, it may not, in practice, be as significant as previously suggested.

Introduction

In a decision situation, the normal procedure for choosing among alternatives is to estimate their values and apply a decision criterion such as: select the alternative with the maximum estimated value. Due to error in these value estimates the mere fact of choosing the maximum induces a systematic bias that guarantees that, on average, we will realize a lower value than estimated, leading to possible disappointment. This is true, even if the value estimates are unbiased.

The aims of this paper are threefold. First, increase understanding of prediction errors in the oil & gas industry and increase awareness of their relevance to decision making. Second, explore generic factors that control the magnitude of the selection-process bias. Third, investigate if and when this bias might be important by assessing the magnitude of its impact on project and portfolio decisions that are typical of our industry.

We first review decision-making and some common types of prediction errors before summarizing the development of various authors’ insights about how selection procedures induce systematic errors, illustrating the phenomenon by a simplified example. Then we investigate its impact on intra-project decisions, where the objective is to choose among mutually exclusive alternatives (e.g. development plan A, plan B or no investment) using scenarios that are reasonably typical of our industry. Next we investigate the magnitude of its impact on portfolio decisions under two selection conditions, the first being when all projects that pass a hurdle are accepted, the second being a budget constraint. Finally we discuss the implications of our analysis and point to possible ways of overcoming the bias, should that be deemed necessary.