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Empirical Cost Models for TLPs and Spars

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Abstract

Cost models for deepwater oil and gas facilities can be valuable tools for concept comparison and selection, field development planning and optimization, and in benchmarking performance. This paper estimates cost models for spar and tension leg platform projects using public and private data on 24 major projects. In addition to providing an analysis of the variables that affect cost, the paper investigates the complexity of regression model specification in a decision-making setting. We evaluate sensitivity to modeling assumptions, sample selection bias, and other model specification issues. The evidence suggests that sample selection bias is not a significant problem in cost models for spars, but that it is potentially significant in total cost models for TLPs.

Introduction

Cost models for deepwater oil and gas facilities have a variety of uses. Cost models can be employed early in prospect development to estimate expected lease values, to prepare bidding strategies, and to select prospects and manage the portfolio. As exploration prospects mature into defined development projects, cost models can be used to inform concept comparison and selection, to aid in field development planning and optimization, and to benchmark projected and actual costs.

Given these virtues, it is surprising to find so little in the offshore production facility literature on empirical cost models or cost modeling methods.¹ We believe that the primary causes of this gap are (i) the proprietary nature of cost and technical data that greatly increases the effort required to collect the data for detailed models, and (ii) the underlying nature of the facility selection decision process that results in a non-trivial sample selection problem.² We address both of these issues in this study. First, we use private cost data carefully organized by industry experts based on public information and interviews with operating companies. The specifications are parsimonious, allowing us to use publicly available technical data, but without a sacrifice in model explanatory power. Second, we define a constrained facility choice model that facilitates diagnosis and treatment for sample selection. This case study estimates cost functions for spars and tension leg platforms (TLPs) using data from 24 completed projects. A two-stage regression model is specified that accounts for the underlying facility selection process.

Offshore Oil and Gas Projects and Production Facility Selection

The general progression of an offshore oil and gas project begins when an oil company acquires exploration and production rights from the host government. The oil company drills exploration and appraisal wells based on geological data and analysis. If economic quantities of hydrocarbons are discovered, the prospect is developed with additional production wells and associated surface and subsea production facilities. A recent overview of project development and stage-gate project management systems as applied in the oil and gas industry is available in Walkup and Ligon (2006).

¹ Publications that examine design optimization and cost estimating for specific technologies and/or projects are abundant (see for example Brooks and Carroll (1994), Zimmer (1994), and Stokes et al. (1996)). The gap we are referring to is in the area of aggregated analysis across projects and operators; the most recent published study known to the authors is Karlik (1991).

² Sample selection problems in statistics and regression analysis occur when the sampling is not random. In this case study, the samples of spars and TLPs are the result of a selection process assumed to be based on profit maximization. Therefore, the observations cannot be construed as a random sample and additional computations are required to correct for this feature of the data.