An empirical analysis of dayrates in the global offshore rig market

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Overview

The mobile offshore development unit (MODU) market is unique in that the majority of the rig fleet is owned by independent rig management firms and leased to oil and gas companies for exploration and production. Managing a given firms rig fleet is a complex profit maximization process by which managers decide what rigs to keep active in search of contracts, temporarily idle or cold stack, reactivate from cold stacking, upgrade, or sell. Despite substantial financial implications of those decisions, empirical research on the MODU market has been limited. In this paper we take advantage of a new global set of panel data for individual rig contracts and estimate econometric models that describe contract day rates for active rigs. The purpose is to re-examine and investigate the factors driving the observed contractes rates n the market. In general, these decisions seen as being driven by a rigs utility via observable and unobservable heterogeneity, market conditions, as well as a firms' size. In particular, we show for the first time, the impact of inter-regional rig movements on rate levels. In addition to extended rig-specific drivers behind the day rates, we also account for additional explanatory variables that capture the contract heterogeneity.

Methods

To investigate the formation of rig rates and take advantage of our extensive panel dataset we base our methodology upon the model by Osmundsen et al. (2012) who utilized a non-linear random effect model. However, we initiate a few deviations from the benchmark paper. First of all, we account for factor prices by including lagged values or a moving average of the oil and gas price series. Secondly, we do not set a benchmark of the high utilization rate (set to be 98% in the benchmark study) to capture the nonlinearities in the day rate-utilization nexus. The reason for this exclusion is lack of theoretical and empirical motivation behind this set-up. Instead, as a robustness check we include higher order polynomials for utilization to capture potential convexities. Thirdly, we cluster the determinants into macro, rig-specific, and contract-specific groups as well as estimate the pooled model at the end. From interpretational point of view this helps us in explaining the day rate formation when looking from multiple angles (for example, how important is the macroeconomic environment ignoring the rig and contract specific features). From econometric point of view, this allows us utilizing both panel data estimation techniques (fixed effects as well as random effects models). Osmundsen et al. (2012) relied on maximum likelihood estimation of the random effects model only, as due to low variability in the rig characteristics the variables of interest could not be estimated using the fixed effects model. Clustering the determinants into three categories allows us mitigating this problem, as macro and contract specific variables show enough of intra-variability and thus the coefficients can be estimated even after demeaning.

We estimate standard errors that are robust to heteroskedastic and autocorrelated disturbances in a Generalised Least Squares (GLS) framework. Further, to allow for individual unobserved rig heterogeneity and to benefit from the fact that we have panel dataset, we employ the random effects and fixed effects models. Random effects model relies on quasi-demeaned data and thus utilizes variation between the individual rigs. However, its unbiasedness is conditional upon the unobserved heterogeneity being uncorrelated with explanatory variables over time. The fixed effects model relaxes the latter condition, but fails to identify the effect of time-invariant explanatory variables and thus suffers from lower efficiency as compared to random effects model. We base our choice on which estimation technique is preferred to individual models on the results of Hausman test. The latter test checks for the consistency of the estimates and gives a decision rule on whether random effects model suffers from abovementioned bias.

In addition to estimating the random effects model using the feasible Generalized Least Squares (GLS) method developed by Baltagi and Wu (1999), as a robustness check we also estimate the model using the Maximum Likelihood Estimation (MLE). Compared to GLS, MLE has an additional restriction that the disturbances follow normal distribution (Breusch, 1987).

Results

When investigating the determinants of the day rates, we cluster the factors into macro, rig- and contract-specific models. One-period lagged utilization rates are the only substantial and significant predictor of the day rates in the macro model after including factor prices (both oil and gas) as well as regional and time controls. Long build times and substantial costs of new build rigs imply that in the short run the supply of the rigs is inelastic. Thus our relatively large coefficient obtained in front of the lagged utilization rates supports this proposition.

We have also quantified the differences between the day rates charged for jackups, semisubs and drillships. The latter type of rigs demands significantly higher day rates compared to jackups, while, as expected, newer rigs that are able to operate in deeper waters, severe environment and have larger accommodation capacity earn more. Having an extensive data set covering the global market, we are the first ones to draw the attention to the mobility of the rigs – rigs that are contracted in different region compared to initial one earn around 10% more compared to their counterparts. Moreover, offshore rigs in the North Sea earn significantly larger day rates when benchmarked to the rigs operating in other regions. The last cluster of determinants relates to the contract specifications. We show that the lead time has a positive effect on the day rate, while we find no support for the long-term contract premium hypothesis. Contracts with embedded options have, as expected, lower day rates. When it comes to the contract counterparties, state oil companies do not seem to overpay for the rigs compared to international oil companies. Firms who are leasing the rig seem to set the rig rates based on economies of scale rather than market power considerations.

When re-estimating the models using MLE instead of GLS, the coefficients obtained are virtually the same with a few notable exceptions. The maximum drilling depth appears to have positive and significant (already at 1% significance level) effect on the day rates after including time- and region-specific dummy variables. Secondly, the coefficient in front of the dummy variable indicating whether the counterparty is the NOC or not is not significant in any of the specifications (with or without controls), while that in front of the contract length is. Moreover, the contracts that have embedded options are significantly different from their counterparts (have lower day rates) in both specifications. Finally, in a combined model Maximum Drilling Depth retains its significance under all specifications when estimating it with MLE. In addition to this, Lead time seems to be statistically significant, yet economically negligible driver behind the day rates after estimating the model with MLE in contrast with GLS.

Conclusions

While previous empirical research on the determinants of rig rates typically has considered intra-regional rate formation in the offshore rig market we have in this paper explored rate determinants at the global level. We find that there are persistent regional differences in rates, even after controlling for technical specifications. However, we also find that inter-regional rig moves affect dayrates, which opens an avenue for further research on the trend towards globalization of the offshore rig market as well as barriers associated with it.

References

Osmundsen, P., Rosendahl, K. E., &Skjerpen, T. (2012). Understanding rig rates. University of Stavanger, working paper.