CONTRACT STRUCTURE AND RIG RATES

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Overview

Rig costs in conjunction with oil and gas exploration and field development represent a substantial part of total costs in the oil and gas sector (EIA, 2011; Osmundsen *et al*., 2012). Thus, there is a need for empirical analyses of which factors that determine rig rates. However, probably because of lack of data, the empirical literature on rig rates seems rather scarce. Using data mainly provided by the private company RS Platou, we are able to quantify the effects of different explanatory variables on the rig rates of floaters in the Gulf of Mexico. In particular, we find strong, significant effects of capacity utilization and contract reserve.

Methods

We consider a nonlinear panel data model of rig rates of floaters involved in exploration and field development of oil (and to some extent gas) in the Gulf of Mexico. The rigs are the observational unit and the data are monthly. Unobserved rig-specific heterogeneity is represented by random effects (but we also look at the results when fixed effects are used instead). The (log-transformed) rig rates in constant prices are supposed to depend on several observed variables, of which some vary both across rigs and over time, some are time-invariant rig characteristics whereas some are common to all rigs observed at the same point of time. A smoothed deflated oil price, which is common to all observations from the same time period, is employed as one of the explanatory variables for the variation in (deflated) rig rates. Smoothed prices follow from adaptive expectation assumptions. The smoothing involves one unknown parameter, which makes the model non-linear. This parameter is estimated together with the other parameters of the model. Capacity utilization (lagged one period) and contract reserve for the floaters that are operating in the Gulf of Mexico, which are common for all observations from the same time period, are also assumed to influence the rig rates. The effect of capacity utilization is represented by two variables. When the capacity utilization is lower than 0.98, we use the log of spare capacity. However, when the capacity utilization is equal to or exceeds 0.98 the effect is captured by a dummy variable. Increased capacity utilization is expected to increase the rig rates.

Furthermore, the rig rates depend on the length of the contract and the lead time. The contracts are dated at the time of the signing. In a given month one may, for a specific rig, have signing of different contracts for disjunct time periods ahead. The contract length is the period of time the rig is used in a specific contract, whereas the lead time is the time elapsing from the period of signing to the rig is involved in the contracted project. Both contract time and lead time are two-dimensional variables, such that for at least a subset of the rigs the length of the contracts and the lead times vary for each observational unit. An increase in each of these two variables is supposed to increase the rig rates. The technical drilling depth and the building year of the rig enter as time-invariant explanatory variables in the relation. An increase in both these variables is supposed to increase the rig rates. Within floaters we distinguish between seven different rig types by using binary variables. Thus, we account for heterogeneity both related to (observed) rig types and (unobserved) heterogeneity according to the individual rigs.

20 April 2010 a major accident took place in the Gulf of Mexico involving one of the floaters (The Macondo incidence). We investigate whether this accident influenced the rig rates by adding a dummy variable that is zero for all the observations dated earlier than April 2010 and 1 for all the subsequent observations. Finally, we also allow for fixed year effects. In the start of the paper we provide some theoretical justification for our empirical model.

Our model may be viewed as a special case of the so-called non-linear mixed effects models, cf. e.g. Vonesh and Chinchilli (1997) and Davidian (2008), and may be estimated by maximum likelihood using PROC NLMIXED in the SAS software. Starting values for the maximum likelihood routine are obtained by carrying out a grid search for the single parameter involved in the smoothing of the (deflated) oil price. Given this parameter we have a model that is linear in the remaining parameters occurring in the systematic part of the relation. Such a model is a standard linear random or fixed effects model which can easily be estimated. Based on the estimates we derive oil price elasticities in the long- as well as in the short- and medium-run.

The data frequency is monthly and spans the period 1990M12 to 2012M6. However, for some of the months in the start of the sample there are no observations. Pooling data for all the seven rig types there are totally 1,425 observations. The number of observational units is 119. The number of observations on the observational units varies from 1 to 55.

Results

All the estimated parameters seem to have the correct sign and most of them are significant. The long-run response to a permanent increase in the oil price of 1 per cent is estimated to about 1.1 per cent. The estimate of the smoothing parameter is rather low and not significantly different from zero which means that it is important to involve long lags when calculating the smoothed oil price series. Not surprisingly, capacity utilization influences the rig rate positively and significantly and the effect is stronger the higher the capacity utilisation is. Also the contract reserve has a positive and significant effect on the rig rates. Increased lead time and technical drilling depth are also according to our results associated with significantly higher rig rates. In contrast, we do not obtain any significant effect of the contract length. Not surprisingly, higher rig rates are obtained for newer than for older rigs. We compare the results for floaters with those of jackups in the same geographical area; that is Gulf of Mexico. The smoothing parameter estimated for floaters is somewhat lower than the one found for jackups, but the long run responses of rig rates to an increase in the oil price are not very different, when one pays attention to the fact that for jackups also gas price plays a role. An interesting difference is that the elasticity with respect to drilling depth seems to be substantially smaller for floaters than for jackups. We are unable to find any significant effect of the Macondo incidence.

Conclusions

Our empirical analysis mostly provides results that seem reasonable. Several variables have been found to influence the rig rates in a significant way. Increases in the capacity utilization and the contract reserve both have a large positive effect on the rig rates. The long-run response to a 1 per cent permanent increase in the oil price is estimated to be 1.1 per cent. However, the adjustment to a permanent increase in the oil price goes on rather slowly. The immediate price effect is fairly small. Drilling costs account for a large share of overall extraction costs for oil and gas companies, and our results may provide improved knowledge about the driving forces behind these costs.

References

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