

RIG RATES AND DECREASING PRODUCTIVITY

Kristin H. Roll, University of Stavanger and University College of Southeast Norway, +4799520657, kristin.h.roll@uis.no
Petter Osmundsen, University of Stavanger, +4751831568, petter.osmundsen@uis.no

Overview

Recently, we have seen falling oil prices combined with sticky costs at a high level in the petroleum industry. This causes project postponements, thus challenging reserve replacement of oil companies and potentially security of supply for consumers. Costs have been particularly high for drilling. High rig rates are obviously important. Rig hire and the cost of oil services are the dominant components in drilling expenses, as illustrated in Figure 1 by a representative well.

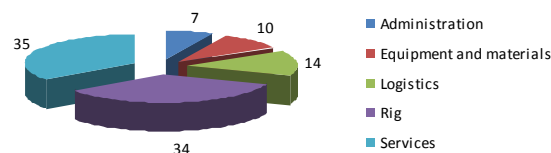


Figure 1. Typical composition of drilling costs. Percentage shares. Source: Data from rig contractors on the NCS.

Except for the latest months, rig rates have increased sharply in recent years. Oil operations on the Norwegian continental shelf - as in other petroleum provinces – have in the latest years been characterized by a shortage of rigs and very high rig rates. This reflects the oil industry boom sparked by the high price of crude oil, and the fact that few rigs were built over a fairly lengthy period. On the other hand, the last months have been characterized by falling oil price with has led to little activity and decreasing rig rates.

Beside rig rates, productivity of drilling significantly influences exploration costs; drilling expenses is the sum of the rig rate and the drilling time. An interesting question is hence what happened to drilling speed as rig rate increases (or decreases). One would expect that oil companies are trying to compensate the high rig rate by increasing the drilling speed, but is this possible? One would also expect, as in other sectors, that as the business cycle moves into negative territory productivity increase as marginal projects are put on hold.

Methods

We are in this paper studying how drilling cost are affected by the economic cycle. Our research is complementary to Aadnøy (1999) and extends Osmundsen et al. (2010). A unique dataset provided by the Norwegian Petroleum Directorate (NPD) allows us to apply econometric analyses to ascertain vital explanatory factors for variation in drilling productivity over time and between different wells at the Norwegian continental shelf. The model is specified as a Cobb-Douglas functional form, which means that the estimated parameters can be interpreted as elasticities. The dependent variable in our model is average meter drilled per day (m/d), and the explanatory variables include, *rig rate*, *drilling depth*, *well pressure*, *water depth*, the rig technology (*Tech*), the *well purpose*, *well area*, *technical change* and if the well is a discovery well or not. The relevant variables have been determined in cooperation with drilling experts, as factors that are likely affect drilling speed. By including as many relevant variables as possible, we try to separate each single effect to see how it affects m/d . Because rig rate is found to be endogeneity given, the model is estimated using an instrumentals variable technique.

Results

Table 1 reports the parameter estimates of the estimated model. Our main interest in this paper are rig rates influence drilling productivity.

Table 1: Economic results of the estimated model.

Variable	Parameter	Std. Err.	P>t
Rig rate	-0.4591	0.2273	0.0450
Drilling depth	0.4954	0.1047	0.0000
Well pressure	-1.5729	0.3180	0.0000
Water depth	-0.3617	0.0737	0.0000
Technical change	0.0361	0.0254	0.1570
Well purpose	0.1311	0.0925	0.1580
D _{Tech1}	-0.4450	0.1380	0.0020
D _{Tech2}	0.0394	0.1886	0.8350
D _{area1}	-0.0175	0.1465	0.9050
D _{area2}	-0.1121	0.1068	0.2960
D _{Discovery}	-0.2148	0.0823	0.0100
Constant	2.6775	0.9345	0.0050

According to Table 1 the mean elasticity of rig rate on drilling productivity is -0.459, or in other words a 1% increase in rig rate lead to a 0.459% decrease in drilling productivity. In time of economic booms drilling cost will hence increase because high rig rate, but also because of decreasing productivity that enhance the increasing costs. This may seem counterintuitive, but can be explained by a shortage of the most productive rigs in times of economic booms. High rig rates are associated with a strong business cycle for the oil industry. High activity levels imply scarcity of rigs. Thus, less adequate rigs are being used at the margin, reducing average productivity. Moreover, at a high business cycle for the oil industry there are more likely to scarcity of personnel and bottle necks at other crucial supply services in drilling, thus driving up the non-productive time. Opposite, in times of economic recession rig rate decreases while productivity increases, which both contribute to decrease drilling cost. The last result is particularly important at these times when many firms are struggling because of low oil price and little activity. The decreasing drilling cost can in these times be crucial for survival and continued operation.

Conclusions

We are in this paper studying how drilling cost are affected by the economic situation. By estimating a econometric model we find that in times of economic boom both high rig rate and decreasing productivity will contribute to increase cost, while in times of economic recession both decreasing rig rate and increasing productivity will keep the cost low.

References

- Aadnøy, B.S., 1999. *Modern Well Design*. Balkema, Rotterdam.
- Osmundsen, P., Roll, K., and R. Tveterås (2010), "Exploration Drilling Productivity at the Norwegian Shelf", *Journal of Petroleum Science and Engineering*, 73, 122-128.