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Estimating fluctuations in oil and gas investment

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Overview

Governments in extraction countries are anxious to estimate expected investment in development projects, since they form an essential element of the macro economy. The overall level of activity is also crucial for oil companies, since the macro picture affects cost levels, the supplies market and recruitment opportunities. The paper analyses factors that explain fluctuations in investment in petroleum projects on the Norwegian continental shelf.

Methods

Unique data availability is an essential ingredient here. Through our cooperation with the Norwegian Petroleum Directorate, we have access to full details about historical investment on the Norwegian continental shelf.
Existing work on oil investment on the Norwegian continental shelf relates only to exploration. It has focused on the relationship between drilling activity and such investment drivers as the oil price, recoverable resources and licensed acreage (see, for example, Mohn and Osmundsen, 2008; 2011 and Mohn 2008). Drilling activity is modelled in terms of an error-correction model, where investment drivers are assumed to be uninfluenced by drilling activity. Using the concept of co-integration (Engle and Granger, 1987; Hendry and Juselius, 2000), the error-correction model has the benefit of explicitly separating short-run adjustments from the long-run equilibrium relationships. We will focus on extending this modelling framework by analysing total oil investments – in other words, the sum of exploration and development projects. We will examine how total investment depends on various investment drivers. This requires multivariate modelling, whereby dynamics and interactions between several variables are analysed simultaneously. This will allow us to capture important interactions between total investments, for example, recoverable resources and policy variables. The multivariate extension of the error-correction model is referred to in the economics literature as the vector error correction model (eg, Johansen, 1988). This model representation is an extension of the vector autoregressive models, which have a rich history in macro-economic modelling (eg, Sims, 1990). Carefully separating investment variables determined within the investment model from exogenous investment determinants will allow us to formulate a full structural representation of oil investments. The impact of oil prices, for example, on total investment can then be analysed using conventional statistical tools such as impulse response analysis and variance decompositions. This allows us to address important questions such as how total oil investment responds to oil price movements or other investment drivers, both in the short term and in the long run.

Results

Estimating total investment in the petroleum industry is a difficult task. The industry's cyclical nature is often forgotten – particularly at a time like the present, with an almost unprecedented boom which has lasted more than 10 years. On the other hand, cost increases are to large extent reversible, so that the investment effect of oil and gas price reductions will be modified. Moreover, the short-term effect is modified by the fact that on-going development projects are seldom halted.

Conclusions

Estimation of future investment levels in the petroleum industry is challenging. A rigorous econometric approach singles out key drivers for investment levels. These enable oil companies and governments to establish consistent plans in which the expected investment and cost level correspond with the expected oil and natural gas prices.

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