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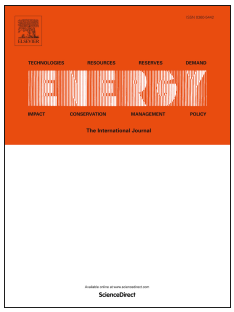

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Martin Berntsen, Kristine Skjong Bøe, Therese Jordal, Peter Molnár

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Determinants of Oil and Gas Investments on the Norwegian Continental Shelf

Martin Berntsen[1], Kristine Skjong Bøe[1], Therese Jordal[1] and Peter Molnár[2]

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Abstract.

This paper studies the investment decisions by oil and gas companies operating on the Norwegian Continental Shelf. We account for the heterogeneity across the fields by including field-specific variables, including geological and geographical variables. We find that the most important factors influencing the investment decisions are the size of the oil and gas reserves, geological variables, and the price of oil. The effect of oil price volatility is insignificant.

Keywords: oil exploration, investment timing, oil price

1 Introduction

Oil and gas exploration and field development have been subject to economic research for decades. In the existing literature, the main focus has been on the US and UK oil and gas data sets, because international data sets provide much less detailed information (Bøe et al., 2018). In this paper, we investigate the relation between investment activity and economic and field-specific variables on the Norwegian Continental Shelf from 1967 to 2015.

The decision to develop a natural resource asset such as oil and gas fields can be considered to be an irreversible investment. The process involves three separate but closely interrelated activities: exploration, development, and extraction. From a real options point of view, having a license for exploration drilling may be seen as owning an option. When a drilling decision is made, the exploration option is exercised and a development option is acquired. In most cases, the development decision requires a large investment, which makes this decision particularly interesting to investigate. Hurn and Wright (1994) argue that once the exploration stage is completed, economic factors are the main determinants of the development decision. Since new information should continuously affect an investment decision, we allow economic variables to vary over the appraisal time. The aim of this paper is to examine how the investment decision is influenced by the oil price and the oil price uncertainty while also accounting for field-specific variables such as the size of the oil and gas reserves. We study the appraisal lag (the time elapsed from discovery to development approval) for this purpose, using it as a proxy for the time spent waiting before investing.

Extensive empirical literature examining the uncertainty-investment relationship exists and a large proportion of these studies focus on natural resource industries. Moel and Tufano (2002) examine the impact of resource price volatility on gold mine openings and closings and find that real options models are useful for describing the decisions of mines by incorporating the effect of uncertainty, but claim such models fail to capture aspects of firm-level decision making. Dunne and Mu (2010) report the impact of price uncertainty on petroleum refinery investments and provide evidence of the wait-and-see response of investment to a rise in uncertainty, conforming to the standard predictions of the real options theory. Kellogg (2014) investigates well-level data on onshore drilling activity in Texas and find that firms reduce drilling activity under increased expected volatility. His findings agree with the predictions of the basic real options theory. However, Bar-Ilan and Strange (1996) provide a real options model in which the effect of price uncertainty on investment is weakened or even reversed in some cases. Similarly, Sarkar (2000) develops a model in order to demonstrate that an increase in uncertainty does not always have an inhibiting effect on investment. In some cases, particularly for low-risk and low-growth firms, he argues a higher level of uncertainty might actually have a positive effect on investment. Altogether, the real options theory provides mixed predictions regarding the impact of uncertainty on investments.

Duration analysis has become increasingly popular for testing the predictions of the real options theory and to generally analyze investment behavior empirically. Dunne and Mu (2010) apply hazard models in their study on petroleum refineries. The framework has also been applied to analyze oil and