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INVESTMENT AND UNCERTAINTY IN THE INTERNATIONAL OIL AND GAS INDUSTRY

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Overview

This paper presents a study of the impact of uncertainty on oil and gas investment in a period of market turbulence and industrial restructuring. Investment theory is combined with modern econometric procedures to test the impact of industrial upheaval on total investment expenditures in the oil and gas industry. A Q model of investment (Tobin 1969) is derived and augmented with measures for both financial market risk and industry-specific risk. Applying modern panel data estimators on a data set covering 170 companies over the period 1992-2005, our approach draws on recent micro-econometric research of the relation between investment and uncertainty.

One of our key results is that Q is a poor indicator of investment in the oil and gas industry. In our econometric specification, the Q ratio does not offer the exhaustive explanation for capital formation predicted by theory. The naïve Q model is improved by the inclusion of oil price volatility and stock market volatility. Our results are not clear-cut on the sign of the investment/uncertainty relationship. General financial market risk is negatively related to investment among the companies in our sample. On the other hand, oil price volatility variable takes a highly significant and positive parameter value. This suggests that the positive convexity effect of uncertainty on investment (e.g., Abel 1983) is dominating for our industry-specific uncertainty indicator, whereas the negative irreversibility effect (e.g., Dixit and Pindyck 1994) is most relevant for overall uncertainty.

Methods

The vast body of theoretical literature on investment under uncertainty is not conclusive on the sign of the investment/uncertainty relationship. The traditional view stressed that convex profits would give rise to a positive relationship (Abel 1983), standard theories of irreversible investment (e. g., Dixit and Pindyck 1994) suggest that the relationship is negative, whereas modern contributions have shown that increased uncertainty may spur investment also with irreversibility (e. g., Bar-Ilan and Strange 1996). Thus, empirical studies are required to determine the impact of uncertainty on capital formation.

The purpose of our research design is twofold. First, we set out to establish empirical relations for investment behaviour in the international oil and gas industry, based on the simple Q theory of investment. This implies econometric testing of the validity of our theoretical model on micro data for a range of companies. Second, we study if and how the simple Q model can be improved to provide a better understanding of the investment process. To this end, we augment the simple Q model with various uncertainty indicators. Overall (extrinsic) uncertainty is captured by a volatility indicator for the US stock market, whereas a corresponding measure for oil price volatility is derived to grasp industry-specific (intrinsic) uncertainty. A dynamic representation of the model is specified to account for autoregressive structure of the error-term, and the model is estimated by modern system GMM techniques for panel data (Blundell and Bond 2000). The models

perform well, in terms of parameter significance, specification tests, and general model diagnostics.

Results

The simple Q model does not offer a satisfactory empirical explanation for oil and gas investments. The estimated coefficient has the expected sign and a plausible magnitude, but is not significant in statistical terms. Thus, our results suggest that the Q ratio is a poor indicator for investment in the international oil and gas industry. The theoretical prediction of Q as a sufficient investment indicator is therefore not supported for our data set.

Our results also establish a robust link between investment and two sources of uncertainty. General financial market risk is negatively related to investment among the companies in our sample. On the other hand, oil price volatility takes a highly significant and positive parameter value. A possible interpretation of this result is the revitalisation Oi's (1961) argument for "the desirability of price instability . . .". This argument stems from the convexity of the profit function, implying that risk-neutral competitive firms will be able to exploit any of uncertain price outcomes to increase profits compared to a situation with full information on future prices.

Conclusion

At current market conditions, oil plays a crucial role for the prospects of the world economy. Security of supply at acceptable prices is vital for political stability and for continued economic growth – in developing countries as well as in the industrialised part of the world. Accordingly, general public interest in the factors behind oil price formation has increased. Capital formation in the oil and gas industry is important for supply side dynamics of the oil market. This study explores the economic, financial and industrial upheaval in the late 1990s, and their effects on capital formation (and production capacity) in the oil and gas industry. Our study may also be looked upon as an empirical test of the different strands of the theoretical literature on fixed investment. Contrary to the majority of empirical studies of investment under uncertainty (Carruth et al. 2000), we find that oil price volatility has actually stimulated oil and gas investments over the last 15 years.

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