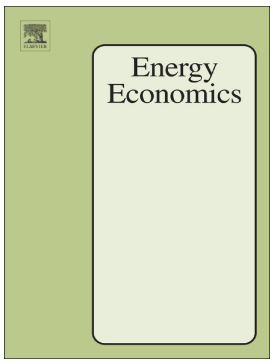

Can the US shale revolution be duplicated in continental Europe? An economic analysis of European shale gas resources

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Can the US shale revolution be duplicated in continental Europe? An economic analysis of European shale gas resources

by

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Abstract
Over the past decade, the rapid increase in shale gas and shale oil production in the United States has profoundly changed energy markets in North America, and has led to a significant decrease in American natural gas prices. The possible existence of large shale deposits in continental Europe, mainly in France, Denmark, the Netherlands and Germany, has fostered speculation on whether the U.S. shale revolution could be duplicated in Europe. However, a number of uncertainties, notably geological, technological, regulatory, and relating to public acceptance make this possibility unclear. We present a techno-economic model of shale gas production amenable to direct estimation on historical production data to analyze the main determinants of the profitability of shale wells and plays. We contribute an in-depth analysis of an extensive production dataset covering 40,000 wells and accounting for nearly 90% of shale gas production in the six main plays of the continental United States from 2004 to 2014. We combine this analysis with a discussion of the main differences between the American and European contexts to calibrate our model and conduct Monte-Carlo simulations. This enables us to estimate the distribution of breakeven prices for shale gas extraction in continental Europe. We find a median gross breakeven price before taxes and royalties of $10.1 per MMBtu. This would make extraction unprofitable in Europe in the current natural gas price environment, with less than 47% of the well distribution reaching breakeven at the mean 2011-2016 price. Sensitivity analysis reveals that the breakeven price is most sensitive to initial production rate, drilling and completion costs, and decline rates. We also find that the economic outlook would be slightly better if the productivity of European shale gas plays was comparable to that of U.S. plays of similar depth, but not significantly so. We conclude that under assumptions calibrated on existing shale gas production data, it is unlikely that the U.S. shale revolution can be duplicated in continental Europe.

Keywords: *shale gas, extraction cost, United States, Europe*