Clinton J. Levitt

ROYALTIES AND INVESTMENT: AN EMPIRICAL STUDY OF THE EFFECT OF ROYALTIES ON OIL AND GAS PRODUCTION

[1] Copenhagen Business School, Denmark, +45 38 15 56 36, cjl.eco@cbs.dk

OVERVIEW

I develop a structural model of exploration and extraction that can be used to estimate the effectiveness of different royalty schemes on various policy initiatives. I focus on four targets: (1) government revenue; (2) where firms explore for oil and gas; (3) volumes extracted from existing wells; and, (4) in-situ recovery rates (investment in enhanced recovery methods).

This study has the potential fill an important gap in the literature and be an important reference for policy makers. Indeed, there has been a renewed interest in understanding the effects of regulatory policy on investment decisions for a number of reasons. First, recent volatility in hydrocarbon prices combined with near-record high prices and record profits have motivated policy makers to reevaluate existing royalty schemes. Often, regulators want to ensure that they are earning a sufficient return on their ownership of the natural resource. Second, current debates about peak oil have sparked interest in understanding firms' exploration decisions over land with heterogenous characteristics. Third, the peak oil debate has also created the need to study how policy can encourage firms to extract more resources from existing pools and invest in enhanced recovery methods. Fourth, land-use policy has gained prominence because of concerns over environmental degradation of production sites.

METHODS

Investigating policy in the oil and gas industry requires modeling three interrelated decisions: (1) whether to explore; (2) where to explore; and (3) the volume hydrocarbons to extract. Previous empirical studies tended to model exploration or production, but not both. Ignoring the fact that firms can replenish their stock of resources, their estimates of the value of the in-situ resources as well as the opportunity cost of extraction are likely biased. Moreover, because exploration and extraction occur over long periods, to capture the intertemporal tradeoffs firms consider, the model must be dynamic. Studying firms' incentives to explore different areas and their incentives to increase extraction rates from existing pools, requires incorporating the heterogeneity that exists, in both production and cost characteristics, across large regions. modeling this heterogeneity is extremely important because it essentially represents the firms' choice set. For instance, if each location were treated as identical, in terms of drilling and extractions costs, then there is no choice concerning where to explore or from which well to extract oil because there is no opportunity cost for choosing one site over another. In fact, the choice is simply, to drill or not to drill, and how much to extract. But, the interesting questions involve the choices firms' make between different exploration sites and between different extraction possibilities and how policy influences these choices---these questions have not been addressed.

The parameters of the structural model will be estimated using general methods of moments (gmm). The theoretical model will produce, for each location, two Euler equations: one illustrating the intertemporal tradeoffs between exploring a field today versus waiting till next period, the other describing the intertemporal tradeoffs between extracting hydrocarbons today versus waiting till next period. From these Euler equations, I will be able to derive moment conditions that are used to construct the gmm estimator.

REFERENCES

1. Deacon, R. T. (1993): Taxation, Depletion, and Welfare: A Simulation Study of the U.S. Petroleum Resource," Journal of Environmental Economics and Management, 24(2), 159{187.
2. Eichenbaum, M. (1989): \Some Empirical Evidence on the Production Level and Production Cost Smoothing Models of Inventory Investment," American Economic Review, 79(4), 853{64.
3. Hall, A. R. (2005): Generalized Method of Moments. Oxford University Press.
4. Hendricks, K., and D. Kovenock (1989): Asymmetric Information, Information Externalities, and Efficiency: The Case of Oil Exploration," The RAND Journal of Economics, 20(2), 164{182.
5. Hendricks, K., and R. H. Porter (1996): The Timing and Incidence of Exploratory Drilling on O®shore Wildcat Tracts," The American Economic Review, 86(3), 388{407.
6. Hendricks, K., R. H. Porter, and B. Boudreau (1987): Information, Returns, and Bidding Behavior in OCS Auctions: 1954-1969," The Journal of Industrial Economics, 35(4), 517{542.
7. Kunce, M. (2003): Effectiveness of Severance Tax Incentives in the U.S. Oil Industry," International Tax and Public Finance, 10(5), 565{587.
8. Leighty, W., and C. C.-Y. Lin (2009): Tax Policy Can Change the Production Path: An Empirical Model of Optimal Extraction in Alaska," UC Davis Working Paper.