Asymmetric Information, Drilling Distortions, and Oil and Gas Leases

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ABSTRACT

During the last decade, the “fracking boom” has substantially increased U.S. oil and natural gas production. These resources are often owned by private landowners, who sign lease contracts with firms to extract the oil and gas. In this paper, we seek to estimate the impacts and explain the presence of two pervasive features of these contracts: the royalty and the primary term. The royalty is a percentage of hydrocarbon revenue (not profit) that is paid to the landowner, driving a wedge between the landowner’s and firm’s incentives. The primary term is the period of time granted to the firm to exercise its option to drill a well on the lease. If the firm does not begin production by the end of the primary term, it loses the lease, and the landowner is then free to sign a new contract with another firm. If, however, the firm does commence production, the lease enters a “secondary term”, which lasts until the firm ceases operations. This creates a strong, discontinuous incentive to drill at least one well before the deadline, thus distorting the firm drilling decision.

Using detailed data on lease contracts and the timing of drilling, we show empirically that primary term expiration dates have an economically significant impact on firms’ drilling decisions: a large share of wells are drilled just prior to expiration. This systematic pattern is difficult to fully explain with other factors such as information or common pool externalities. We then develop a model to explain why primary terms and royalties can help maximize the landowner’s expected revenue from a lease, despite the distortions they generate. In our model, firm has private information about the expected productivity of the well and the inputs used in drilling. Intuitively, the optimal contract strikes a balance between extracting the firm’s private information and distorting its incentive to choose the timing of and inputs into the well-drilling process. To achieve this balance, payments are tied to observable production outcomes and drilling timing decisions.

We have assembled a dataset of lease parameters, drilling and fracking inputs, realized natural gas production, and the timing of drilling for the Haynesville Shale in Louisiana. We are developing a structural model of firms’ drilling decisions to quantify the welfare impacts of these contractual provisions and evaluate alternative lease designs. We also plan to estimate the extent to which primary term-driven production may have exacerbated the recent prolonged U.S. natural gas price slump.