OPTIMAL ROYALTY RATES IN THE HAYNESVILLE SHALE

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Overview

The US shale boom is unique in the global context of oil and gas production because private individuals, not the government, own most of the mineral rights. Landowners usually lease minerals directly to firms in exchange for an up-front cash payment, called a bonus bid, plus a fixed share of revenues from oil and gas production, called royalty payments. Leases usually specify a limited primary term during which the firm must drill or forfeit the lease. Should the firm drill and produce hydrocarbons, it retains the right to drill during the secondary term, which persists as long as hydrocarbons flow. A growing literature has documented how increased oil and gas extraction generates jobs and increased wages for local economies. Royalty payments have been studied much less, yet they are a very important source of income for these communities. In fact, Feyrer, Mansur, and Sacerdote (2017) estimate that local royalty payments are one and a half times local increases in wages from oil and gas extraction. Brown, Fitzgerald, and Weber (2016) estimate that 2014 royalty payments from six plays were $39 billion.

Despite the economic importance of this source of income for consumers and a large literature on auctions for government-owned mineral rights, little is known about the market for private mineral rights. In this paper, I examine actual mineral leases and the associated revenue obtained by landowners in Louisiana’s Haynesville shale. My questions are three-fold. How well do landowners do at capturing resource rents? How close are actual lease terms to the revenue-maximizing terms, and what is the loss in economic efficiency from the distortions caused by mineral leases? Finally, would government-imposed restrictions in mineral leases, say, a minimum royalty rate, increase expected landowner income?

Leasing minerals is similar to a principal-agent problem in which the landowner is the principal monetizing mineral deposits, and the firm is the agent hired to produce the deposits. The landowner, however, faces both asymmetric information and moral hazard problems. Asymmetric information is present because firms know more about the profitability of the potential investment. Moral hazard is present because, landowners cannot force the firm to develop the minerals, and royalty payments actually reduce firms' incentives to do so. Governments reduce informational rents by fixing a royalty rate and holding formal auctions in which firms compete on bonus bids. They can mitigate moral hazard by asking firms to bid work programs that specify what investments will be made. Private landowners, on the other hand, must generally rely on less sophisticated mechanisms. Usually, firms seek out landowners and directly negotiate mineral leases with them. The finite primary term in a mineral lease mitigates moral hazard somewhat: either the firm loses a valuable option to drill or begins production, providing landowners with income. While a government's ability to extract information rents via auctions is relatively well understood, much less is known about how well landowners fare at monetizing their mineral resources through these direct negotiations.

All else equal, the probability of drilling should decrease with the royalty rate. This is not what we see empirically, even after conditioning on observable factors. This means that landowners are extracting some of firms’ private information through the negotiation process. To gain further insight into just how much information landowners are able to extract, I estimate a structural model of firms’ decision to drill that allows me to identify the distribution of unobservable valuations for land under the six primary royalty rates. With these estimates, I compare the observed royalty rates with the revenue-maximizing ones. The distance between actual and revenue-maximizing royalty rates captures the degree of information asymmetry. Some states like Pennsylvania impose minimum royalty rates. If royalty rates are generally far below revenue-maximizing rates, landowners might consider pushing state legislatures to impose stricter royalty rate minimums. However, if actual royalty rates are very close to revenue-maximizing ones, such policies could constrain landowners’ abilities to extract information rents.

Methods

Dynamic discrete choice model of firms' drilling decisions estimated with simulated maximum likelihood.

Results

My preliminary, reduced-form results reveal an interesting pattern. A higher royalty rate should, all else equal, reduce firms' incentives to drill and lower the probability of drilling. However, even after I control for geology and prices, higher royalty rates *increase* the likelihood of development. This suggests that the bargaining process between landowners and firms does allow the landowners to extract rents that are unobservable to the econometrician. What is not clear, however, is how well landowners are doing compared to the revenue-maximizing royalty rate. I am in the process of estimating the full structural model, which will allow me to fully answer this question.

Conclusions

Mineral royalties are a very important source of income for communities located in shale plays. However, when mineral owners sign leases, the firm knows much more about its own valuation of the lease. Furthermore, the firm decides whether to drill and, hence, if any royalties are paid at all. Landowners appear to be having some success in overcoming the asymmetric information and moral hazard through the bonus/royalty structure of the contract. The fact that higher royalty rates are associated with higher probability of drilling, even after conditioning on observable factors, suggests that landowners may not be achieving the revenue-maximizing royalty rate. A structural model of shale investments allows me to estimate the revenue-maximizing royalty rate and compare counterfactual policy scenarios that aim to increase landowners' share of mineral revenues.

References

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