

The Takeaway

Policy Briefs from the Mosbacher Institute for
Trade, Economics, and Public Policy

How U.S. Patchwork Land Ownership and Regulation Affects Oil and Gas Drilling

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Unlike most other countries where the government owns the rights to all minerals, the United States has fragmented mineral ownership, where the rights to extract oil and gas can be owned by the federal government, state governments, and private owners. Different owners put different requirements and regulations on oil and gas firms, and these in turn affect the profitability and therefore the likelihood of drilling. These regulations can also lead to spatial spillover effects, where regulations on one plot of land can affect the profitability of drilling on nearby land. This report explores a setting in Wyoming to show how regulations on state-owned land affect the likelihood of drilling on nearby federal-owned land.¹

In the US, land and mineral rights are owned by the federal government, state governments, and private owners. As a re-



WHAT'S THE TAKEAWAY?

The US has a patchwork of land ownership and regulation.

Regulations that make drilling cheaper on state land also result in reduced drilling on nearby federal land.

Federal land that is close to state land also has lower probability of drilling than federal land that is far from state land.

Local policies designed to increase (or decrease) drilling may have the opposite effect on land nearby.

sult, the U.S. has a complicated patchwork of mineral ownership, with federally owned land, state-owned land, and privately-owned plots in close proximity—each under their own rules and regulations. Therefore, an important policy question is how plot-specific regulations affect both drilling on a given plot as well as how they affect drilling on nearby plots.

One reason why policies on one plot of land can affect the probability of drilling on nearby plots is because of how firms search for oil and gas. If a firm is interested in searching for oil and gas in a given region, it will first drill an exploratory well on one plot of land. Only if the exploratory well is sufficiently productive will the firm drill additional wells. All else being equal, the firm will typically drill the exploratory well on the plot with the lowest regulatory costs to the firm. As a result, the firm may end up having a lower probability of drilling on nearby plots with higher regulatory costs because those other plots are only drilled if the initial exploratory well is sufficiently productive.

At least anecdotally, state and private land is typically perceived as being easier for firms to drill on than federal land. This is due to a number of factors, including stricter environmental protection requirements as well as greater delays in processing applications for drilling on federal land. In addition, federal land often has higher rental rates as well as higher reserve rates in auctions than state lands. One dimension in which federal rules can be more favorable to firms is in royalties. For example, in Wyoming the roy-

alties for drilling on state land are higher than that of federal land.

One challenge in evaluating the effects of federal versus state and private policies is that the land that has remained in federal ownership tends to be more remote, rugged, and arid, which tends to make drilling more costly. Therefore, without some kind of natural experiment that holds land quality fixed while varying ownership, it is not possible to conclude that differences in drilling rates are due to regulations and spillover effects, or because of some other factors.

THE 16/36 NATURAL EXPERIMENT

The Land Ordinance of 1785 provided a natural experiment that helps to understand the effects of land regulations. This law mandated that certain regularly spaced plots of land be transferred to state ownership upon statehood. In Wyoming, this led to a pattern of state ownership where every 16th and 36th square mile section of land was transferred to state ownership, as illustrated in Figure 1.

Because the rule for assigning land to state ownership does not depend on the remoteness, ruggedness, or aridity of the land, this natural experiment provides a useful setting to examine how federal and state policies

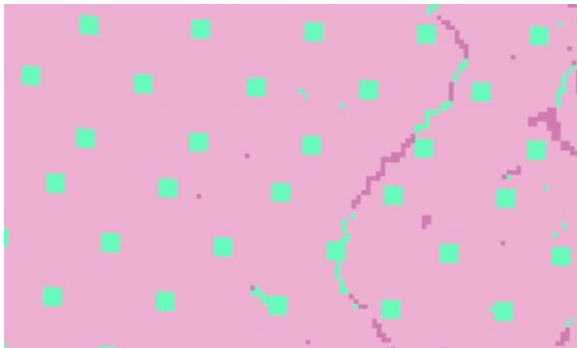
Figure 1: Assignment to State Ownership Rule

6	5	4	3	2	1	6	5	4	3	2	1
7	8	9	10	11	12	7	8	9	10	11	12
18	17	16	15	14	13	18	17	16	15	14	13
19	20	21	22	23	24	19	20	21	22	23	24
30	29	28	27	26	25	30	29	28	27	26	25
31	32	33	34	35	36	31	32	33	34	35	36

affect drilling. In particular, by examining drilling probabilities on the 16th and 36th sections with other sections, we can examine the overall effects of state policies with federal policies. In addition, by comparing land in federal ownership that is close to state land with land in federal ownership that is far from state land, we can explore how policies on state land lead to spillover effects on federal land.

In Wyoming, this land ownership pattern has remained particularly persistent. Figure 2 shows a snapshot of current ownership from one part of Wyoming, with federal land in light pink, private land in dark pink, and state land in green. Therefore, Wyoming is a particularly good place to examine how these land ownership patterns affect oil and gas drilling.

Figure 2: Current Land Patterns



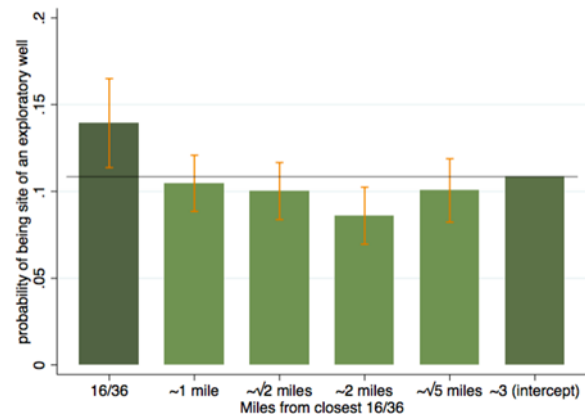
Source: Bureau of Land Management

DRILLING PATTERNS OVER SPACE

Examining drilling data shows that whether land was a 16/36 section or close to a 16/36 section has a significant effect on drilling. Figure 3 graphs the probability of exploratory drilling. There we find that the probability of exploratory drilling is highest on those 16/36 sections. We also find that the second

highest probability of drilling is on those sections of land that are furthest away from the 16/36 sections.

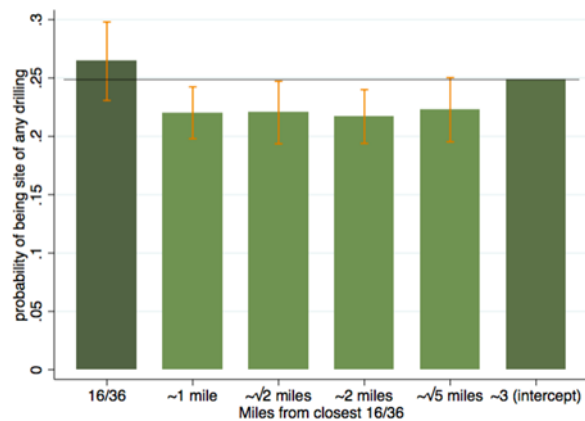
Figure 3: Exploratory Drilling



Source: Multiple sources and author’s calculations²

Figure 4 graphs the probability of any drilling. There we find that the probability of any drilling is again highest for those 16/36 sections, and is next highest for those parcels of land that are the furthest away from the 16/36 sections. Figure 4 also shows that overall, drilling is highest on state land (the 16/36 sections), consistent with anecdotes that federal land has higher regulatory costs for firms than state land.

Figure 4: Any Drilling



Source: Multiple sources and author’s calculations²

WHAT'S THE TAKEAWAY?

The exploratory and overall drilling graphs in Figures 3 and 4 show that land ownership has a significant effect on drilling patterns. In particular, the drilling patterns show that state land seems to be preferred for drilling. In addition, the drilling data show that state ownership seems to discourage drilling on nearby federal land, as federal land that is furthest from state land has the highest probability of drilling of all federal land.

These findings are consistent with how oil and gas firms search for oil and gas. If a firm is interested in searching for oil and gas in an area that includes both state and federally owned parcels, then it will likely begin exploratory drilling on state land, and then only proceed to drill on federal land if it finds oil on the state land. In contrast, if it is searching for oil and gas in an area far from state land, its only options are to drill on federal land. Therefore, federal land that is close to state land will tend to have lower probability of exploratory and overall drilling than federal land that is far from state land.

These findings also suggest the need for caution when evaluating federal and state oil regulations. Local policies designed to increase drilling by decreasing the costs of drilling may also have the effect of reducing drilling on nearby land. Similarly, local policies that increase the costs of drilling may also have the impact of increasing drilling on nearby land.

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Notes:

¹This takeaway is based on: Lewis, E. (2019). Patchwork Policies, Spillovers, and the Search for Oil and Gas. *American Economic Journal: Economic Policy*. 11(1), 380-405. doi: [10.1257/pol.20160373](https://doi.org/10.1257/pol.20160373)

²The data for the figures can be found in the appendix of the author's paper at <https://assets.aeaweb.org/asset-server/files/8911.pdf>.

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