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POLICY BRIEF
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PROPERTY RIGHTS FOR HYDRAULIC FRACTURING

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SUMMARY

Hydraulic fracturing ("fracking") increases production from oil and gas wells and has contributed to development of unconventional resources such as shales. It has also threatened to upset a century of regulation of oil and gas development. States have the primary authority to regulate oil and gas production activities. While historic problems of common pool trespass remain pertinent, new environmental and health concerns are not well addressed. Some states and dozens of localities have tried to prevent fracturing in specific and oil and gas development in general. This policy brief frames the challenges posed by fracking in historical context and suggests remedies.

MINERAL RIGHTS

Finding oil and gas below the surface of the Earth and producing it has always been a risky process. Not only is the location and richness of deposits uncertain, but the investments needed to drill wells are substantial. Even if oil and gas are produced, they are sold into potentially volatile markets that make the associated revenue quite variable.

Oil and gas resources are essential to the economy, and the rights to those resources are held by the owner of the mineral estate. Mineral rights are the first property right necessary to understanding hydraulic fracturing. Mineral rights are one of several economic rights included in a fee simple estate, which is often illustrated using the metaphor of a bundle of sticks.

Not all land is owned in a fee simple estate. Mineral rights can be owned separately from the surface, and often are. Such a situation is usually called a split estate. Split estate has become a controversial topic, especially in areas of the country that have experienced a boom in unconventional resources like shale.

Why Severance?

The United States is unique insofar as private individuals own a majority of the minerals. In most other countries, the government retains all mineral rights. In that sense, split estate is typical, not unusual. Surface owners often face uncertainty about mineral development as they try to make optimal decisions about surface use. However, it does beg the question of why mineral rights might be severed.

Severing minerals makes sense for a number of reasons. A primary reason is that developing minerals may require different skills and capital than using the surface does—therefore it might make sense to have them owned separately. Second, the separation of mineral rights is similar to other legal precedents treating property rights as a bundle of sticks, such as the ability to write a conservation easement. A third reason severance is valuable is that it gives landowners flexibility to divide the value of their estate and avoid estate taxes. A simple example is a farmer severing a fee simple estate to leave

the farm to one child who continues in agriculture while bequeathing the minerals to another child who has moved off the farm. Fourth, the ability to sever the minerals allows for differences of opinion about the value of minerals, and lets the highest-valued use control the minerals.

Mineral Leasing

Oil and gas developers do not usually own the minerals that they develop. Instead, they use leases to acquire an interest in the minerals. Leases share risk between the owner, who often lacks the technical knowledge necessary to develop oil and gas, and the developer, or operator, who brings that knowledge to the partnership. The risk is shared by making a royalty payment rather than just a fixed payment. If a mineral owner leases his or her property to an operator, and that operator can successfully develop a producing well, then the mineral owner becomes a royalty owner and gets a (variable) share of production revenues.

The lease creates two important rights in the mineral estate. One is the royalty interest, which is the portion of the mineral interest that the owner retains in exchange for leasing the minerals. Royalty interests can be divided; for example, an owner could split a royalty interest by selling one half and retaining the other. The other share is called the working interest, which is usually dominated by the operator of the well. The working interest can also be divided, such as between partners. It is also common for the working interest to carve off portions for subcontractors, for example geologists or landmen who help prepare the property for development.

The leasing contract creates more interested parties in the success of a well. The fee simple owner hopes to become a royalty owner, and shares with the working interest. In the event that minerals are severed, the surface owner may be interested in the outcome, but usually has no direct financial interest. The mineral owner hopes to become a royalty owner along with the working interest partner.

Mineral Trespass

A second important aspect of mineral leasing is that it helps prevent trespass of neighboring minerals. When an operator wants to drill a new well, it applies for a permit from a state agency—each state has its own agency. This regulatory oversight requires the operator to show that the location of the new well has in fact been leased by the operator. Additionally, a new well must be located away from other wells and property lines. This is to ensure that each well accesses oil and gas in a specific area, and that each area can only be accessed by one well. This regulatory oversight is intended to prevent "common pool" issues. Spacing wells according to the area they drain and requiring proof of leasing helps protect correlative rights, or the rights of adjacent mineral owners.

Valuing Mineral Rights

The initial allocation of rights and the contract structure make valuing mineral and royalty interests complicated—a fee simple estate is a different bundle of sticks than severed minerals or a royalty interest. Until a well is drilled, the exact location and richness of a deposit is not known with precision. One way of thinking about this geological risk is that there is a probability distribution of resource endowment in space and time. In some places there is little uncertainty about the resources in the ground, but in other areas there is considerably more. Over time, as some resources are discovered and others are depleted, the probability distribution may change.

The net present value of oil and gas production is the product of expected production and prices. Because of varying expectations for production and prices, the mineral value can vary widely.

The complexity of determining the present value of mineral resources can lead to considerable disagreement about the value of the resource. Sometimes such a disagreement prevents a mineral lease from being signed. Many landowners have difficulty valuing minerals and approach specialists to help them negotiate leases or broker sales of mineral interests.

INTRODUCING FRACTURING

After a well is drilled, a series of steps must be taken before it can produce oil and gas. Hydraulic fracturing is an optional step in the process of completing the well. Initial experiments with fracturing wells to increase production date back nearly 70 years. In the past 20 years the application of hydraulic fracturing has changed and become more widespread, to the extent that "fracking" is often credited with revitalizing the oil and gas sector.

How Fracturing Works

After a well is drilled into a geological formation containing oil or gas, the operator may want to enhance its productivity by trying to increase the amount of contact between the wellbore and the target formation. Hydraulic fracturing is a relatively inexpensive way to do this. Conventionally, the well accesses the formation through perforations blasted into the wellbore, and then relies on natural permeability and transmissivity of the rocks to allow oil and gas to flow to the wellbore. Fracking works by changing the natural properties of the formation. Injecting a slurry of water and sand at high pressure, cracks in the rocks are created, and then held open by the grains of sand. This increases the transmissivity of the formation and allows oil and gas molecules to migrate to the wellbore and thence to the surface.

Fracking has triggered controversy for at least three reasons. First, by giving developers a relatively inexpensive way to access rocks, it has made many more places promising for oil and gas development. This has pushed oil and gas into new regions of the country, where some unwilling neighbors have fingered fracking as an unacceptable hazard. Second, there is scientific uncertainty about the health effects of fracking, and considerable concern that chemicals in the injected slurry

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could find their way into groundwater. Even if the injected chemicals are not to blame, contamination with targeted oil and gas is a valid related concern. Evidence shows that exposure to water resources is a salient pathway for expected risk from fracking. Third, mineral owners have contemplated how this new technology might create a new set of property rights issues. This last point is the focus of the remainder of this piece.

Property Rights Issues that Arise

Above we considered the possibility of trespass. As a simple example consider two adjacent tracts of land with oil wells on them. Both wells tap into one petroleum formation. How do we determine which well, and thereby which mineral owner, gets the resources that underlie one particular tract? There is not an easy way to answer this question, and as a result the legal rule that has governed the extraction of oil and gas is the "rule of capture." This rule means that ownership is determined by which well produces the products. A simple way of thinking about this problem is two straws in a milkshake, where two people lay claim to the milkshake by trying to suck it through the straw first.

More abstractly, mineral rights are real property that is converted into private property in the form of oil or gas on the surface by the act of capturing them and bringing them up a well. The rule of capture has motivated the regulation of oil and gas wells, largely by ensuring spacing that prevents most claims of trespass. However, preexisting natural faults and other subsurface pathways leave the possibility that some oil and gas might move under the surface.

Hydraulic fracturing complicates the existing regime by introducing man-made fractures into the unknown subsurface. Could an operator fracture a well in a way to intentionally access resources from a neighboring property? When all fractures are natural, all participants face the same constraints. As soon as some fractures are introduced, the possibility of stealing neighboring resources arises. In 2006 a seminal case on the issue was decided in Texas—Coastal Oil v. Garza. The upshot of the decision is that the rule of capture dictates interactions between neighboring well operators in the subsurface.

Before resigning ourselves to rule of capture, it is worth considering the possibilities for verifying the location of fractures. Fracking jobs are designed to maximize well production, but the actual fracturing does not always go according to the plan. So there may be a difference between the intended and actual. Microseismic surveys are a way that petroleum engineers assess the outcome of a fracturing job. However, interpretation of that information is not universal. Engineers are constantly adjusting their well designs based on the outcome of earlier wells. Wells can be re-fractured, which potentially changes the area that an individual well drains. Because fractures are difficult to observe, the rule of capture is a feasible and functional alternative despite the possibility of trespass on correlative rights.

IMPLICATIONS FOR REGULATORY OVERSIGHT

Oil and gas development is already regulated, largely at the state level. Regulations are designed primarily to avoid common pool waste of resources, but also to avoid environmental and safety problems that could arise. Widespread use of hydraulic fracturing, along with complementary technologies like directional drilling and advanced seismography, has dramatically changed the supply outlook for oil and gas. The supply shift has increased calls for tighter regulatory oversight. Understanding the pertinent property rights is essential to effective regulatory reforms.

Despite the technological advances embodied in hydraulic fracturing, the familiar problems of common pool trespass remain pertinent. Unitization has historically been one remedy to common pool problems—all owners identify one operator to make drilling and production decisions for the whole pool. Defining pools is much harder when there is very limited natural transmissivity in a reservoir, such as a shale. Many states have defined units for each well. Some states have allowed multiple wells per spacing unit, a regulatory construct originally intended to avoid common pool problems.

Regulating well spacing was originally intended to protect correlative rights and prevent waste. Now well spacing requirements are being used to create one-operator units that may not be of optimal economic scale.

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