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INTRODUCTION

Numerous statutes exist which influence and constrain the development of petroleum resources. The purpose of this article is to explore the economic implications of one of the statutes affecting petroleum development in Oklahoma. Oklahoma was one of the first states to enact compulsory pooling legislation. Although the reasons for compulsory pooling primarily focus on conservation, this analysis suggests that there are increased incentives to develop petroleum as a result of Oklahoma's forced pooling law. At a time when the United States has been pursuing efforts to increase production such a statute may be especially useful. However, many owners of petroleum rights will not find this law to their advantage because the compulsion involved may result in a decrease in the wealth they can obtain from their petroleum resources.

THE FORCED POOLING LAW

The current Oklahoma forced pooling law was first passed in 1947 and has not been materially changed since then.[1] It allows the Oklahoma Corporation Commission, which is the state's oil and gas regulatory authority, to issue orders that require owners of separately owned tracts within a spaced drilling unit to pool their interests in the underlying deposit and operate as a unit. The owners may also pool voluntarily. This law is based on the doctrine of correlative rights and prevention of waste as

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1. The forced pooling law is found in OKLA. STAT. SUPP. tit. 52, § 87.1(e) (1985). Sections 87.1(a)-(d) deal with well spacing and drilling units. The first Oklahoma forced pooling statute was passed in 1935, 1935 Okla. Sess. Law Serv. Ch. 59, § 3; OKLA. STAT. ANN. tit. 52, §§ 85-87, 136-38. The Oklahoma Statute was found to be constitutionally valid in Patterson v. Stanolind Oil & Gas Co., 182 Okla. 155, 77 P.2d 83, *app. dismissed,* 305 U.S. 376 (1939); Croxton v. State, 186 Okla. 249, 97 P.2d 11 (1939).

established in a series of pioneer statutes and court cases in Oklahoma between 1909 and 1915.[2]

To understand pooling, it is first necessary to understand the spacing and drilling unit procedures.[3] The spaced drilling unit to which forced pooling may be applied is specified in a spacing order issued by the Corporation Commission upon proper application and a public hearing. The order also specifies the number of wells which may be drilled on the unit and their exact geographic location. The Commission has considerable flexibility but generally it specifies one well per unit, located at the center of the unit which is typically a square of 10 to 640 acres. Except for areas of the state with no previous drilling activity, the acreage specified follows that set for other units in the area. Over time the trend has been toward larger units because costs per well have increased.[4] Typically an oil well is given 160 or 320 acres, and a gas well 640 acres.

Once a spacing and drilling order is in effect, any individual or firm that owns any portion of the land within the unit or has the right to drill on any portion may apply for a pooling order.[5] The pooling order offers owners who have not already entered voluntarily into a drilling agreement a choice of either paying their proportionate share of the drilling and completion costs and receiving the same share as a percentage of the working interest or of receiving a bonus in lieu of the right to participate in the working interest. The pooling order lists the estimated cost of the well proposed and the bonus offered. The owners are given a specified

2. S.L. MCDONALD, PETROLEUM CONSERVATION IN THE UNITED STATES: AN ECONOMIC ANALYSIS (1971). A detailed description of the law and its implementation in Oklahoma is provided by Nesbitt, *A Primer on Forced Pooling of Oil and Gas Interest in Oklahoma*, 50 OKLA. B.J. 648 (1979) [hereinafter cited as Nesbitt, *Primer*], and Nesbitt, *The Forced Pooling Order: How Long? How Wide? How Deep?*, 52 OKLA. B.J. 2799, 2799-805 (1981).

3. In order to avoid a common misunderstanding, note that pooling is *not* the same thing as "unitization." Unitization is the joint operation and sharing of production from a complete reservoir or deposit by all owners and is often seen to be the solution to the so-called common property nature of petroleum, *i.e.*, the solution in the sense that unified operation results in allocatively efficient output. Pooling has no relationship to the reservoir since the spacing unit pooled is not defined with respect to the size of the reservoir.

4. MCDONALD, *supra* note 2, at 167-70.

5. Notice that the effect of this "one-owner" application is that one owner alone can force all others into a drilling operation. This owner need not actually be in full legal control of even a portion of the spaced drilling unit. For example, suppose a 120 acre unit is divided by ownership of the land into eight separately owned tracts not necessarily of equal size. Further, suppose one of those tracts is nine acres whose ownership is held by four siblings as the result of an inheritance. The siblings then have an undivided interest in the nine acres and are considered co-tenants in the mineral rights. The nine acres could not be sold, either in fee simple or just the subsurface mineral rights, unless all four siblings agreed. However, one of the four could lease her mineral rights to an oil and gas firm and that firm could apply for a pooling order. This would force the other three siblings as well as owners of the seven tracts to make a decision. Also, the lease itself can be sold or traded by the original lesee, opening up endless possibilities to the oil and gas industry for securing a toehold-control needed to facilitate drilling.

period, usually fifteen days, in which to elect to participate or to receive the bonus.[6] Note also that if an election choice is not received in writing within the specified period, the owner is deemed to have elected the bonus. Bonuses and well participation shares usually must be paid within thirty days from the end of the election period. Finally, the pooling order specifies a date by which drilling must begin, usually 120 days or less from the date of the order. The purpose of the public hearing for each pooling order is to give all interested parties an opportunity to present their concerns and evidence. The trial examiner expects to hear expert testimony substantiating the applicants' statements about the cost of drilling and completion, and the reasonableness of the bonus offered. Both claims are judged based on "going rates" for similar situations nearby. In fact, the bonus is usually required by the trial examiner to be equal to bonuses paid recently to owners of adjoining drilling units.

One more point that needs to be explained concerns designation of the operator of the well. This is the individual or firm that receives the payments for participation, pays the bonuses to nonparticipants, and actually makes the decisions to employ the factors of production to drill the well, complete it if it is successful, and operate it. Operation involves controlling the rate of output and selling the oil and gas produced. The operator also is responsible to divide the revenues received between the working and royalty interests. Usually the applicant for a forced pooling order wants to be the operator and will be designated as such in the order unless contested at the public hearing. In this case the owner of the largest share of the working interest is usually designated as operator, unless there is evidence of ongoing exploration or development activity by another owner. Operator status can be very important financially because the working interest of nonparticipating owners inures directly to the operator, unless other participants claim a share at the hearing and as a result it is divided by the order.

Without the forced pooling law, an individual or firm seeking to drill a well must have voluntary agreements with all the interests in the drilling unit before drilling is allowed to commence. The essence of Oklahoma's forced pooling law is that a single interest in a spaced drilling unit may choose to obtain voluntary agreements from all other interests, or it may choose to invoke the power of the state to compel all other interests to either participate in developing the petroleum resource in question or to grant a lease for development of the resource. It might seem that forced

6. The statute itself is very general and does not provide for these specific details concerning the way in which forced pooling is implemented. Such details were left to be provided by the Oklahoma Corporation Commission. Nesbitt, *Primer*, *supra* note 2, provides the details concerning the way in which the Oklahoma Corporation Commission has chosen to implement the forced pooling statute.

pooling would be so advantageous that all wells would be drilled through the compulsion of forced pooling orders. However, this has not been the case historically.

Table 1 presents information concerning the historical use of forced pooling in Oklahoma. Following enactment of the statute in 1947, the number of pooling orders issued per year has increased. Since the early 1970s, the number has grown at an accelerating rate. Perhaps it is more interesting to note that the percentage of total wells drilled each year which are drilled under forced pooling orders also has increased significantly over this time period. Table 1 shows that one-half percent of wells drilled at the beginning of the period were forced pooled and that this increased thirty to forty fold by the early 1980s. The largest percentage of wells pooled was about 39 percent in 1979. Certainly the total number of wells drilled annually will be determined by economic factors such as the price of petroleum, the cost of drilling, interest rates, and the general level of economic activity. Changes in such influences can also be expected to explain changes in the total number of wells drilled. It is not immediately clear how changes in these economic variables should be expected to result in such a significant increase in the percent of wells which are drilled under forced pooling orders. The analysis in the following section will provide some insight into a number of potential explanations for changes in the percent of wells which are forced pooled.

THE ECONOMIC IMPACTS OF FORCED POOLING

The economic effects of forced pooling are theoretically explored in this section. Simply stated, Oklahoma's forced pooling law operates in several specific ways to increase petroleum development and production activity. In order to understand the economic effects of forced pooling it is useful to begin with a discussion of the decisionmaking process generally involved in the development of petroleum resources. This process is described first without forced pooling and then as changed by forced pooling.

Figure 1 depicts the decisionmaking sequence, with sequence A representing the sequence without forced pooling and B the sequence with forced pooling. A displays a sequence of decisionmaking steps labeled 1 through 7, but no indication is intended concerning the time involved at each step.[7]

In step one the firm learns of a drilling possibility, either as a result of its own activities, or from information brought to it by another firm interested in putting together some type of joint activity. At this point the

7. *See* C.J. GRAYSON, DECISIONS UNDER UNCERTAINTY: DRILLING DECISIONS BY OIL AND GAS OPERATORS (1960).

Table 1. Use of Forced Pooling Orders in Oklahoma[a]

Year	Pooling Orders	Wells Drilled	Ratio of Orders to Wells
1948	18	4267	.0042
1949	21	4308	.0049
1950	27	5365	.0050
1951	34	5449	.0062
1952	34	5628	.0060
1953	35	7460	.0047
1954	50	8458	.0059
1955	66	8078	.0082
1956	68	7622	.0089
1957	70	5918	.0118
1958	72	6354	.0113
1959	89	5359	.0166
1960	97	4802	.0160
1961	89	5845	.0152
1962	82	5203	.0158
1963	94	4492	.0209
1964	161	4516	.0357
1965	212	4490	.0472
1966	286	4112	.0676
1967	246	3124	.0787
1968	218	2703	.0807
1969	273	2886	.0946
1970	279	2449	.1139
1971	279	2119	.1271
1972	358	2195	.1631
1973	538	2290	.2349
1974	708	3105	.2280
1975	921	3616	.2547
1976	1261	4164	.3028
1977	1576	4919	.3204
1978	1970	5589	.3528
1979	2444	6286	.3888
1980	2760	8932	.3090
1981	3943	11,699	.3370

a. Sources for these data are: Oklahoma Corporation Commission; personal letter from Paul M. Peterson, Oil-Law Records Corp, to Michael Mueller (June 23, 1982); III-3 AMERICAN PETROLEUM INSTITUTE, BASIC PETROLEUM DATA BOOK (1983).

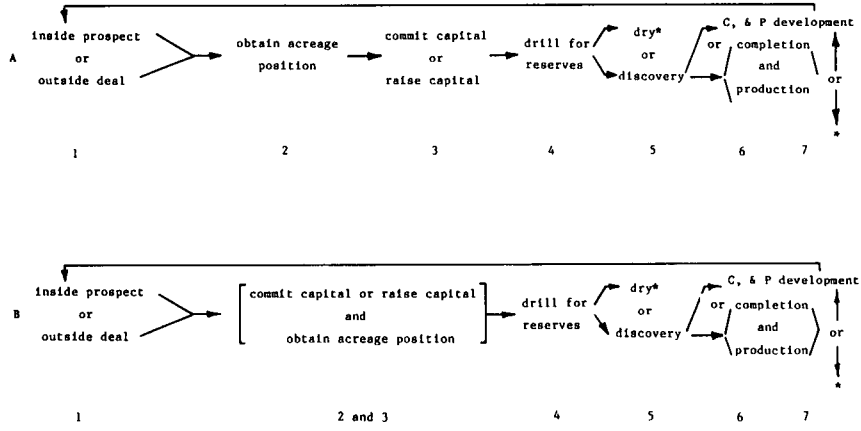

Figure 1: Petroleum reserves development decision and activity sequence diagrams. A is without forced pooling. B is with forced pooling. End of sequence indicated by *.

firm must evaluate the information and decide if the possibility of discovering petroleum looks probable enough to initiate a venture eventually leading to drilling a well. The second step is to put together ownership or control of drilling rights to the acreage needed. This may involve buying land and mineral rights, buying drilling leases, and/or entering into deals or trades with other firms that own land or leases on the needed unit. The firm may already have control of some or all of the unit, because of past purchases, leases, or deals undertaken to secure some acreage at favorable prices. Because acreage required for drilling may involve considerable expenditures or commitments to others, it necessarily follows upon a firm's positive decision in step one. The expenditures and commitment costs are referred to as bonuses.

After acreage control is acquired it is possible for the firm to raise capital for drilling. Usually this is a combination of internal funds and outside investment. Except for the large integrated energy companies, most firms operate so as to spread risk by using their own capital for only a portion of the investment cost even if they have sufficient resources to completely fund a venture. This means control of acreage must be in hand before others can be convinced to commit investment funds and the commitment is needed before drilling can be contracted. Steps two and three are dependent on step one in the sense that the type of prospect[8] helps determine the various types of acreage control and investment deals.

The next step is the actual drilling. The firm, according to its various

8. The type of prospect is determined by geological characteristics, expected size, and type of reservoir, etc.

agreements and deals, employs a drilling contractor who supplies a drilling rig and crew, and other various contractors as needed to drill and collect information. In step five, the firm evaluates information generated in drilling to determine if the well will likely prove to be sufficiently productive to treat it as a discovery and proceed with completion. If not, it is called a dry well. If the well is a discovery of some promise which is an indication that surrounding drilling units may also be productive, the firm may decide to move immediately to secure acreage control in order to exploit this information with further development. Of course other firms observing the drilling will also move as quickly as possible, but they do not have quite as accurate information. So step five may lead to step six, completion and simultaneous further development, or to step seven, completion only. Completion is the installation of equipment needed for eventual production, such as casing, valves, pipes, and stock tanks. After production has commenced, additional information about the reservoir is gained which may indicate whether further development in the area appears worthwhile. Either way, the well will be operated according to the dictates of petroleum prices and operating costs until decline eventually leads to abandonment.

Sequence B in Figure 1 displays the decisionmaking process with forced pooling available. The principal impact is to effectively combine steps two and three into parallel activities rather than sequential activities. The raising of capital no longer must be contingent on full control of drilling rights because they can always be secured through forced pooling if voluntary agreement is too expensive, involves too much time, or looks impossible. Furthermore, this means that the information generated by a discovery can be internalized to a greater degree because the firm can use its slight time advantage over observing firms to quickly initiate a pooling application on adjoining units. Of course a firm must have ownership of rights to some portion of a unit to apply for forced pooling. As explained, only a toehold is needed and is generally easily secured. Figure 1 suggests that a significant consequence of the forced pooling statute is the reduction in time and effort required to piece together all of the elements of a drilling venture.[9] That is, forced pooling reduces the transactions costs faced by firms in their efforts to develop additional reserves.

The primary economic effects of forced pooling can be described by examining three markets: the prospecting market, the well market, and

9. At the height of the record-setting rate of drilling wells per month in Oklahoma in 1982, it took approximately three months from application to issuance of a pooling order. In stark contrast, drilling must wait upon voluntary agreement of all unleased owners and all leaseholds in units not forced pooled. Negotiation of such agreements may take months to years, depending upon the location of owners and the complexity of ownership as well as the personality of the various owners. As a result, the time lag between the decision to drill and actual drilling may be considerable as may be the expenses of negotiating an agreement.

the capital acquisition market. The prospecting market is an input market that refers to the market for land acreage for use in the production of petroleum reserves. The well market is a second input market in which the demand and supply of wells drilled is represented.[10] The capital acquisition market is a market in financial capital which the firm uses to finance its payments for acreage and its investments in wells.

Figure 2 represents the prospecting market and characterizes two of the primary effects of forced pooling in this market. The quantity traded in this market is acres leased for drilling and the price should be thought

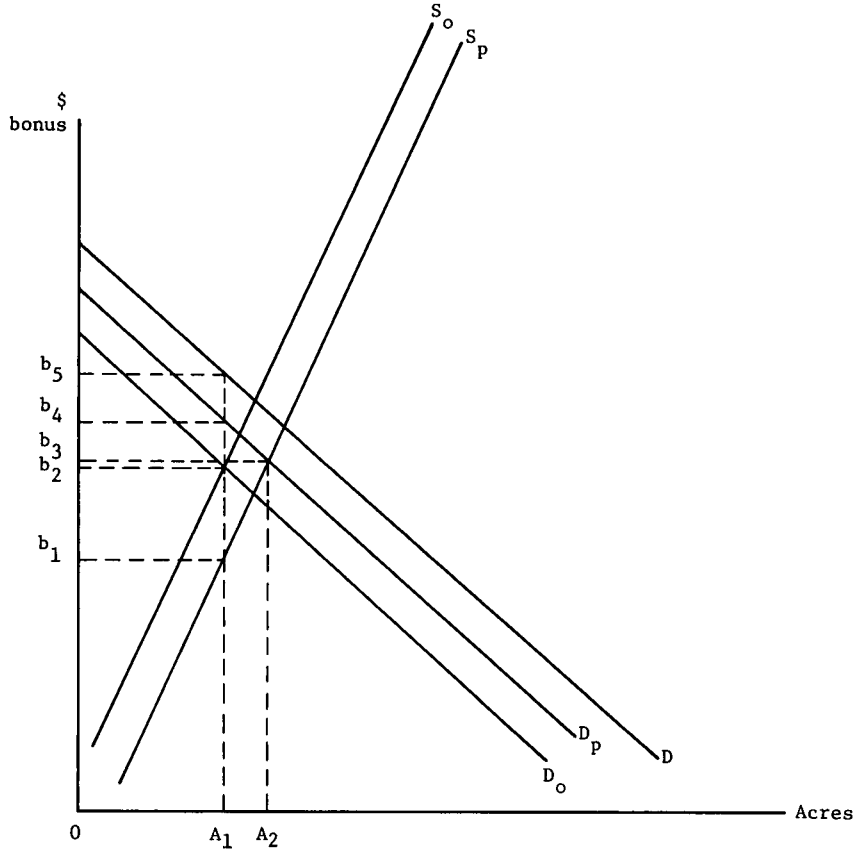

Figure 2: The Prospecting Market and The Effects of the Forced Pooling Law

10. In order to simplify the analysis, it is assumed that the cost or price of a well is measured in terms of the cost of drilling and completing, or drilling and plugging if dry. No explicit concern is given to labor as a separate input.

of as the "bonus" paid per acre to secure the drilling rights.[11] Since acres of land are inputs into the process by which reserves are produced, the demand for acres is a derived demand which reflects both the productivity of acres and the value of the reserves produced.

As the earlier discussion illustrates, acquiring acreage is a costly endeavor because it requires the petroleum producing firm to search out owners of mineral rights and to make contractual agreements with the owners in order to obtain the requisite mineral leases before production. Referring to such costs generally as transactions costs, Figure 2 illustrates the derived demand for acres as D and the derived demand minus the transactions costs as D_o. For simplicity it is assumed that transactions costs are a constant value per acre obtained. Therefore, D_o represents the willingness to pay by petroleum producing firms directly to acreage owners in order to acquire acreage, given that an amount equal to the distance represented by $(b_5\text{-}b_2)$ is paid in transactions costs to obtain each acre. D_o reflects the demand for acres without Oklahoma's forced pooling statute.

One of the major effects of Oklahoma's forced pooling is to decrease the transaction costs faced by the petroleum producing firm in acquiring an acreage position. Because of the forced pooling statute a firm need obtain only a single lease, rather than operating agreements or leases from all mineral interests in a spaced unit, in order to make an application for forced pooling and in effect obtain the right to drill. Figure 2 illustrates this effect of forced pooling as a shift in the derived demand for acres from D_o to D_p. The transactions cost with forced pooling is illustrated by $(b_5\text{-}b_4)$ which is smaller than transactions costs without pooling. Thus, an important result of forced pooling is an effective increase in the demand for acres.

A second impact of Oklahoma's forced pooling is illustrated in Figure 2 by a shift in the acreage supply curve from S_o to S_p. Prior to forced pooling, individuals with acres to supply for petroleum production operations had a bargaining advantage in negotiating leases that was associated with the requirement that a producer needed to have control over all acreage in a drilling unit before drilling activity could begin. Acreage suppliers would feel that they could "hold-out" in negotiations with any buyer, knowing that they might be the last to sell and thereby get a higher bonus per acre. This bargaining advantage is reflected by S_o in Figure 2 which represents the prices at which individuals would lease acres given

11. This is a useful simplification of common practice in forced pooling activities. Often the bonus is represented as a fixed payment per acre plus an "overriding" or "excess" royalty. In practice, then, the actual payment may vary according to whether the well is successful or not. The treatment here is a reasonable simplification and assumes the mineral owner being force pooled has expectations concerning the potential of the well that can be represented by an expected value.

that they take this bargaining power into account. Forced pooling limits the supplier's bargaining advantage. Because of forced pooling, acreage suppliers can no longer "hold-out" in an attempt to extract a higher bonus per acre. Suppliers now face the threat that the buyer will go to the Corporation Commission seeking a forced pooling order if the supplier refuses the buyer's offer. Forced pooling therefore effectively decreases the supply price schedule for acres, which is represented in Figure 2 by a shift from S_o, without forced pooling, to S_p, with forced pooling.[12]

Both the decreased transactions costs and the decreased bargaining power which result from forced pooling operate to increase the number of acres actually leased for petroleum production activity. Without forced pooling the equilibrium quantity of acres leased would be determined by equating demand (D_o) to supply (S_o) with the resulting leased acreage being A_1. In the presence of pooling, the economic effects result in A_2 being leased. Figure 2 shows a situation in which the bonus increases from b_2 to b_3 when forced pooling is possible, but this is only one conceivable qualitative result. It is also possible that the bonus might fall or even remain unchanged. The effect on price would be dependent on the relative shifts in demand and supply as a result of forced pooling. However, these conclusions are an incomplete analysis of the effects forced pooling has on the prospecting market. In addition to influencing the transactions costs of acreage demanders and the bargaining power of acreage suppliers, there is a third and very crucial aspect to the forced pooling law. The compulsion involved in forced pooling suggests that acreage suppliers, or mineral owners, are no longer entirely free to choose when to lease their mineral interests, nor are they entirely free to negotiate the price of the lease. In effect the Oklahoma Corporation Commission sets the price per acre, and requires that the mineral owner accept this price and essentially lease the acreage or participate in the operation of the well. Since few of the acreage suppliers are readily able to share in operating the well, a major effect of forced pooling is to compel mineral owners to lease their mineral rights at prices below their own supply prices. This is the effect of the forced leasing aspects of Oklahoma's forced pooling law.

This aspect of forced pooling is depicted in Figure 3 by supply curve $\bar{S}$. With forced pooling the quantity of acreage supplied is horizontal at $\bar{b}$, the price set by the Oklahoma Corporation Commission. Acreage suppliers would ordinarily be willing to supply the prospecting market with a quantity of acreage greater than A_2 only when the price is greater than b_3 per acre. The compulsory leasing aspect of forced pooling requires

12. It is being assumed that the decreased bargaining power can be represented by a constant per unit decrease in supply price which is equal to (b_2-b_1).

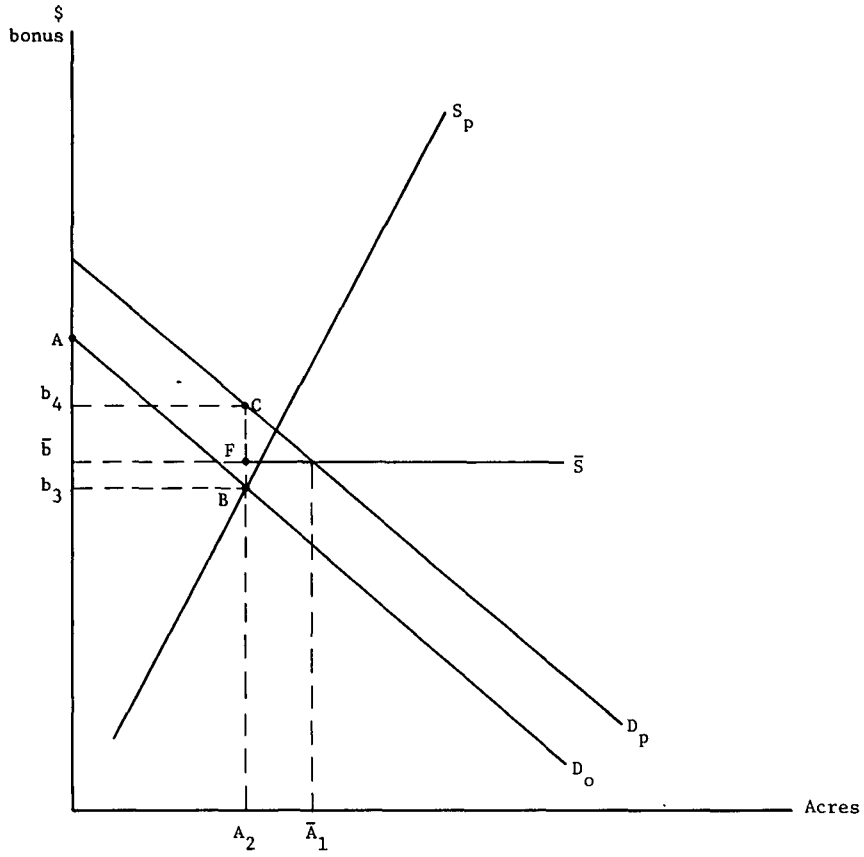

Figure 3: The Effects of Price Setting Aspects in Forced Pooling Law

acreage suppliers to supply the quantity of acreage that is demanded at the price set by the Corporation Commission.[13]

At first glance the effect forced pooling has on the transactions costs for acreage demands, along with the opportunity to face a horizontal supply curve, seems to be so advantageous that all acreage would be obtained for petroleum drilling activities by forced pooling. Yet, Table 1 shows that in any year never more than 39 percent of the total number of wells drilled have taken advantage of forced pooling. Since there are

13. Note the simplification embodied in this analysis. Forced pooling is applicable to single spaced units. As such the acreage suppliers directly impacted by forced pooling are only those who own acreage in spaced units which are actually forced pooled. As Table 1 illustrates, not all wells are drilled in forced pooled spacing units. The simplification that the market supply for acreage is horizontal at $\bar{b}$ is useful in that it depicts the fact that many suppliers will be compelled to supply more acreage than would otherwise be the case.

many acres obtained without forced pooling, the entire supply curve for acres will not be horizontal. Realizing that firms demanding acreage will not find it in their interest to lease acreage at a price that is higher than the price set by the Corporation Commission, and that it will also not be in their interest to pay $\bar{b}$ when the acreage could be obtained at a lower supply price, the supply curve with forced pooling is going to be discontinuous. This is depicted by the portion of supply S_p below point B in Figure 3 along with the horizontal supply curve $\bar{S}$, which begins with point F in the diagram.

It must be noted that since firms demanding acreage do not use forced pooling to obtain all acreage, the advantageous effects forced pooling has on transactions costs borne by demanders do not apply to all acres leased. Some drilling units will be obtained by firms negotiating leases for all acreage as would necessarily be the case without the forced pooling law. The demand curve for acres obtained in this way is presented by D_o in Figure 3. Of course, only part of this demand curve is relevant when forced pooling is available. The segment of D_o depicted by $\overline{AB}$, and which is above S_p, is relevant since firms demand prices exceed the supply prices of the acreage owners. Because some acreage must be obtained in the unconstrained market even under the forced pooling law, and given competitive forces, A_2 will represent the equilibrium quantity of acres obtained without use of forced pooling. Point B in Figure 3 represents the equality of the demand and supply for acres without resort to the involvement of the Corporation Commission and the forced pooling law. If any additional acreage is demanded it will be the result of a decrease in transactions costs occasioned by use of the forced pooling law. Therefore, the demand for the acreage which is located to the right of A_2 in Figure 3 will be depicted by that portion of D_p which lies to the right of point C.

The results of the forced leasing and price setting aspects of the forced pooling law are both a discontinuous supply curve and a discontinuous demand curve for acres. In Figure 3, the demand for acres that will not be forced pooled is depicted by that portion of D_o between and inclusive of points A and B, and the supply prices for the acres not pooled is represented by that portion of S_p including and to the left and below point B. Equating the demand and supply of acres not pooled results in the quantity A_2. Given the savings in transactions costs due to forced pooling and that $\bar{b}$ is the bonus set by the Corporation Commission, the actual quantity of acres leased for petroleum production will be $\bar{A}_1$, which equates the demand and supply of forced pooled acres. Note that the difference between $\bar{A}$ and A_2 will be the quantity of acres obtained through forced pooling. These aspects of the forced pooling law, like the impact

of the law on transactions costs and bargaining power, induce an increase in acreage for petroleum production beyond what would be the case without forced pooling.

Of course, $\bar{b}$ need not be the price chosen by the Corporation Commission. In order to depict the effects of forced pooling $\bar{b}$ was chosen somewhat arbitrarily, but not entirely so. It is possible to determine limits on the price set by the Corporation Commission, and these limits are depicted in Figure 4 by the bonuses b_4 and b_3. If the Corporation Commission set the bonus at b_4, the savings to demanders due to decreased transactions costs from forced pooling would just be offset by the increased price for the incremental acre beyond $\bar{A}_2$. As a result, there would be no use made of the forced pooling law if demanders expected the Corporation Commission to set the bonus at b_4 or higher. Competitive market forces will tend to drive the price on acres not pooled up to b_3. Of course, it would be to the advantage of firms to have a price set lower than b_3, but for this to occur there would have to be collusion between

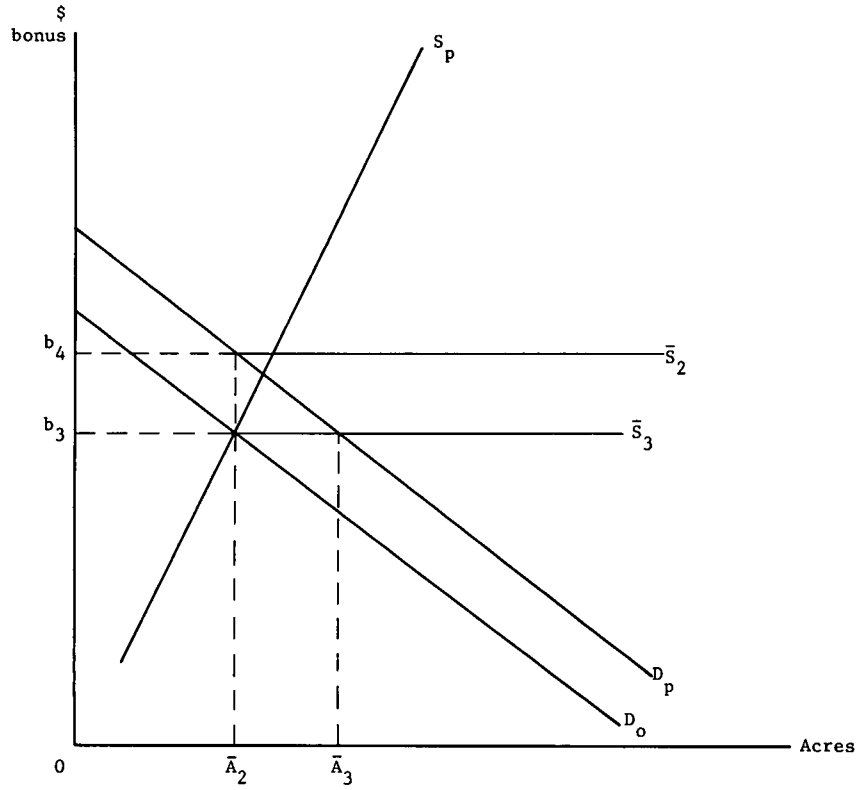

Figure 4: Limits on the Price Setting Effects of the Forced Pooling Law

acreage demanders to an extent that is unlikely given the larger number of buyers. This suggests that b_3 will be the lowest price that might be set by the Corporation Commission, and also that the largest quantity of acres obtained by forced pooling would be $\overline{A}_3$-$\overline{A}_2$.

Although there is no strong empirical information available at present which shows where the Corporation Commission generally chooses a bonus between b_4 and b_3, the procedures adopted by the Commission seem to allow the petroleum development firms the ability to influence the bonus which is chosen.[14] The intention of the Corporation Commission is to determine a price which represents the current fair market value of an oil and gas lease. The current fair market value is taken to be the price that would be paid, given the conditions, for a lease beteween willing parties, both of whom are under no compulsion. Typical practice by the Corporation Commission is to inquire as to the highest price which has actually been paid for a lease in the vicinity of the spacing unit being forced pooled.[15] The petroleum development firms also know this, and realize that the highest price which has been paid will represent a minimum price established by the Corporation Commission on a forced pooling order. Certainly this provides the incentive for the firms demanding acreage to make offers below their true demand prices. On this matter it has been written:

> While there is some true price competition for oil and gas leases, primarily in "hot" areas, far more often an operator who contemplates exploration will simply decide unilaterally the maximum bonus he is willing to pay. In negotiating for leases, he simply never offers more than this amount. Some, notably non-residents and owners of small interests, will accept the offer, and the rest will be pooled. At the hearing, these sales or offers are submitted as the bonus which should be paid to the remaining non-consenting parties.[16]

Although this discussion cannot empirically establish which price is set in a forced pooling order, it is suggestive that when a firm chooses to utilize the forced pooling law it probably expects to gain a price advantage as well as an advantage in terms of decreased transactions costs. Another way to interpret Figure 3, therefore, is to see petroleum firms making offers to land owners that would be no greater than b_3, finding a few sellers who will willingly accept such an offer (and S_p shows there are such acreage suppliers out there), but not spending much additional time negotiating contracts since a refusal to accept such a take-it-or-leave-it offer can always be secured through forced pooling.

14. The discussion of Corporation Commission practice relies on Nesbitt, *Primer, supra* note 2.

15. The "vicinity" is usually taken to be the eight section area adjacent to the section in question. *Id.* at 650.

16. *Id.*

It is appropriate while discussing Figure 4 to ask if this theoretical analysis can offer any explanation concerning the historical trend toward an increasing percentage of wells which are forced pooled. Referring to this figure it is clear that there are three means by which the proportion of wells forced pooled would be increased over time.[17] First, the price set by the Corporation Commission might be falling over time relative to market conditions. Suppose the first price is set at b_4 which results in no use of forced pooling. Assuming the demand and supply curves are constant, if the Corporation Commission lowers the set price over time, an increasingly larger share of acreage would be forced pooled as time passes. Of course, under the conditions of unchanging demand and supply, the largest proportion of acreage forced pooled would be represented by the difference $\overline{A}_3$-$\overline{A}_2$. Second, assuming a constant demand and set price, increases in supply prices which would cause the supply curve S_p to shift upward to the left would result in a larger quantity of acres forced pooled. What might lead to an increase in supply prices? One possible reason would be that supplier's expectations concerning future prices are such that suppliers are expecting higher future prices. For example, if OPEC activities are successful in pushing prices higher, acreage suppliers may begin to expect higher prices in the future and require a higher price if they are to lease their acreage willingly today. Third, transaction cost savings might decline over time causing D_p to be a greater distance from D_o in Figure 4. Given fixed supply and demand curves and the set price, the greater the distance between D_p and D_o, the larger will be the percentage of acres forced pooled. One possible explanation for the larger transactions cost savings from forced pooling over time might be "learning-by-doing."[18] After initial passage of the forced pooling statute, unfamiliarity with the statute, legal requirements, and Corporation Commission practices would probably mean greater transactions costs associated with pooling than would be the case after learning from the experience of several and then many efforts to use forced pooling to obtain acreage.

As explanations of the data reported in Table 1, one tends to believe all three changes probably have occurred over the relevant time period. Specifically, it appears that the increasing usage of forced pooling during the first ten-year period after passage of the statute is likely to be explained by learning-by-doing and economizing on transactions costs associated with forced pooling itself. The latest dramatic increase in usage of forced

17. Although the quantity in Figure 4 is acres, and the analysis suggests the number of acres forced pooled and not forced pooled, the analysis also relates to the number of wells forced pooled because there is a determinate relationship between acres and wells. *E.g.*, an increase in the number of wells forced pooled would tend to result in an increase in the acres obtained with forced pooling.

18. Arrow, *The Economic Implications of Learning by Doing*, 29 REV. ECON. STUD. 155-73 (1962).

pooling seems related to OPEC's ability to control prices in the decade of the 1970s, and the desire of suppliers to hold back their acreage in the hope of larger prices in the future. Of course, this reflects only speculation as there are no reports of any explicit empirical tests of such hypotheses.

Forced pooling also has an effect on the wealth of acreage owners in two fundamental ways. First, the decreased bargaining power of acreage suppliers due to the forced pooling law, which has been depicted in Figure 2 as a decrease in the supply price for each acre, implies that each supplier perceives a loss in wealth. It is no longer possible to exploit a bargaining advantage to obtain a higher price per acre which means each acre is worth less than without forced pooling. Second, the forced leasing and price setting aspects result in some acreage being leased below its voluntary supply price. This implies an additional loss in wealth to some acreage suppliers, which is depicted in Figure 5 by the shaded triangle bounded by the points ABC. Note that there may also be a wealth gain associated with some of the acreage obtained through forced pooling which is depicted by the shaded area in the triangle bounded by the points FEC in Figure 5. This wealth gain results if the Corporation Commission sets a bonus greater than b_3, and is due to some acreage that would have been leased voluntarily at a price between $\bar{b}$ and b_3 being paid $\bar{b}$ by order of the Corporation Commission.

Forced pooling also has direct effects on the capital acquisition market. These effects occur primarily through two mechanisms. The first of these is suggested by Figure 1 and the associated discussion. Forced pooling makes it possible for the petroleum development firm to decrease the number of distinct actvities necessary to initiate drilling activity. Because of forced pooling less time and expense is needed before attempting to raise monetary capital. This impact implies an outward shift or increase in the demand for monetary capital which is depicted in Figure 6 by a shift from demand curve D to demand curve D′. Note that this increase in demand is supplemented by an indirect effect of forced pooling on the prospecting market. Firms use monetary capital to finance payments to inputs and to spread the risk faced in developing petroleum reserves. An increase in the demand for acreage therefore induces an increase in the demand for capital. This effect is also illustrated in Figure 6 by the shift from D to D′. The implication of these effects of forced pooling is an increase in price and in the amount of financial capital demanded and supplied to the petroleum industry.

The second mechanism by which forced pooling has an impact on the capital acquisition market is associated with what may amount to a forced partnership. A firm making a forced pooling application probably does

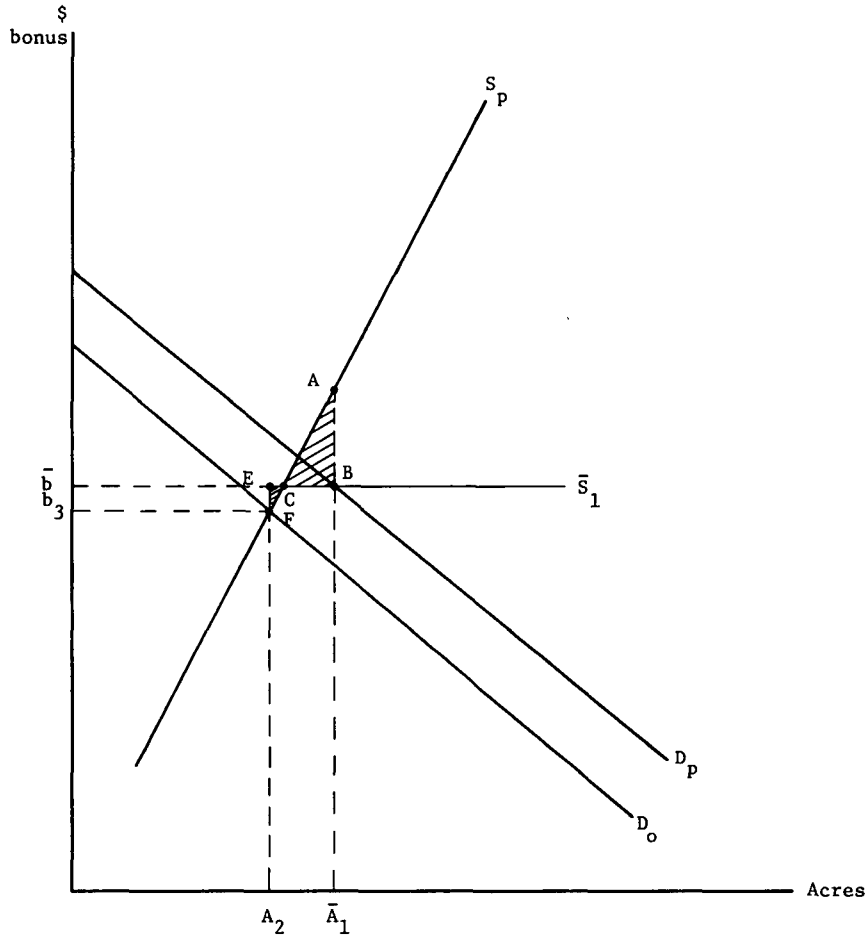

Figure 5: Potential Wealth Loss and Gain to Mineral Owners Who Are Forced Pooled

so because of the advantages in acreage acquisition due to decreased transactions costs and/or the price by which most of the acreage can be obtained. But the legal process of forced pooling allows the nonconsenting mineral owner the opportunity to elect to participate in the well and to share in the well's risk of failure and opportunity for profitable production. The nature of this effect is not immediately clear. The firm invoking the forced pooling statute may not want partners in its production activities and, therefore, perceive a risk in forced pooling itself. Of course, the firm asking for forced pooling might also see the opportunity to spread the risk of the development activity to other parties who elect to participate

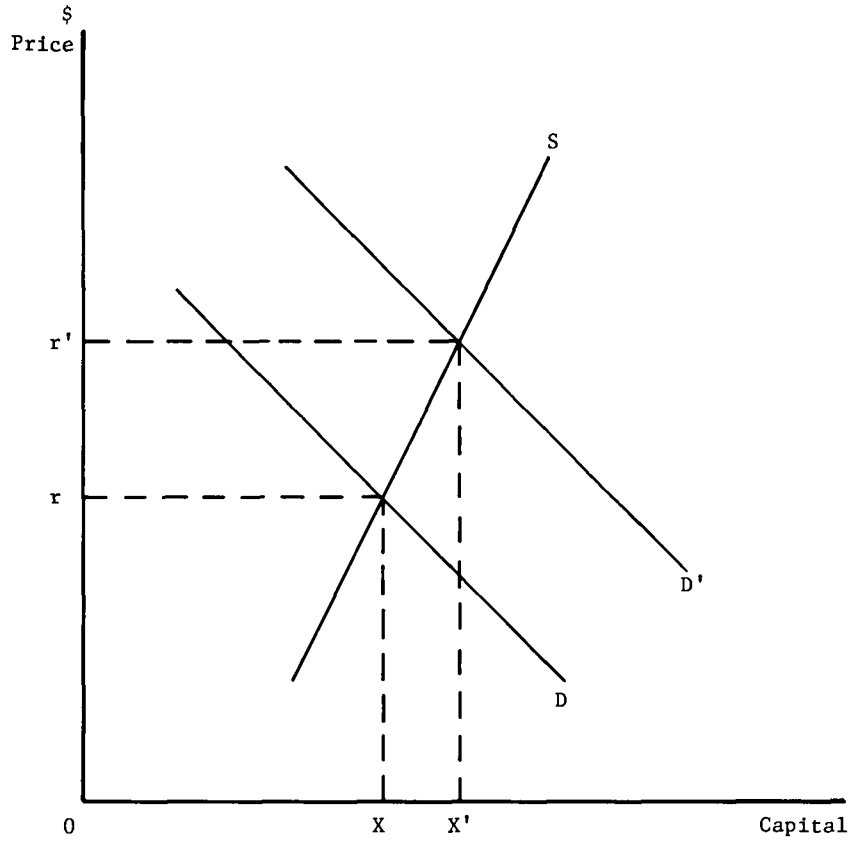

Figure 6: Forced Pooling and the Capital Acquisition Market

rather than to accept the bonus under the forced pooling order. In this case the development firm may economize on the transactions costs associated with acquiring the financial capital that allows it to spread its risk because it tends to decrease its time and effort to search out partners and lenders. Such a situation would also be depicted in Figure 6 by a shift from D to D'.

Although there is no empirical evidence to suggest which of these alternatives is correct, one of the reasons used to justify forced pooling seems to favor the risk spreading alternative. In Oklahoma owners of mineral rights in a spacing unit are treated as co-tenants. As such, any mineral owner may develop the petroleum underlying the spacing unit subject to the obligation to pay the co-tenants their respective shares in the production minus production costs. If the developing co-tenant drills a dry hole, it would not be legally possible to obtain payment from the

other co-tenants for their share of the cost. It is different in the case of forced pooling, as pointed out: "Thus, a major purpose of forced pooling is to equalize the risk of loss by forcing non-consenting co-tenants to choose in advance whether they will share in both the benefits and the risks of oil and gas exploration."[19] Thus, many firms asking for forced pooling orders may desire the risk-spreading opportunities afforded by forced pooling, in addition to its other advantages.

Forced pooling, through its effects on the prospecting market, will have an indirect impact on the well market. Specifically, wells are inputs into the production of reserves that are complimentary to acres as inputs. An increase in the quantity of acres leased for petroleum development implies an associated increase in the demand for wells. This is depicted in Figure 7 as a shift from D to D'. As a result of forced pooling the demand for wells increases, *ceteris paribus,* which leads to a higher price per well

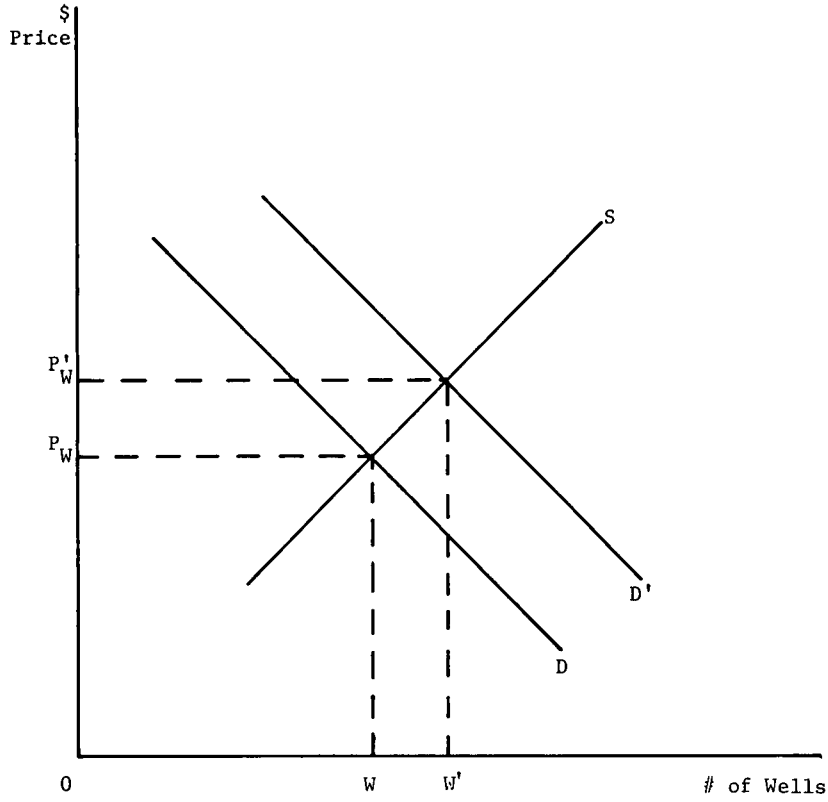

Figure 7: Effects of Forced Pooling on the Market for Petroleum Wells

19. Nesbitt, *Primer, supra* note 2, at 85.

and a larger number of wells demanded, supplied, and in operation at any point in time.

There seems to be another effect of forced pooling which may not be as obvious as the effects which have been discussed above. Activity which produces petroleum also produces information that is of relevance to other potential production activities. The information which is produced when a firm drills for petroleum may generate a beneficial externality to other petroleum production firms. One of the effects of forced pooling appears to be at least a partial internalization of this externality.

The information spillover at issue here results from the normal production activities of firms while drilling for petroleum. Individual drilling activities produce information about the likelihood of a successful well nearby. Certainly the firm which is engaged in the drilling gains much precise and specific information about formations and productive potential such as the possible rate of production from a well. Nonetheless, the fact that a well is successful or even unsuccessful provides information to other drilling enterprises concerning the probability that other drilling ventures on surrounding spacing units will or will not be successful. Such information is certainly of value to the firms that are only observing from a distance. The firm producing this information cannot exclude these other firms from obtaining such information, and therefore is unable to appropriate the value of the information it generates for the other firms. This set of circumstances represents a beneficial externality which is produced by one firm and provided without payment to other firms.

Such beneficial externalities are certainly of importance to evaluating the social optimality of resource uses. Traditional wisdom on such externalities is that since the externality generating firm cannot appropriate the full social value of its activities, it will not utilize the resources at its command in a socially efficient manner. Specifically, it will produce too little of the good which results in the beneficial externality. In the case under discussion, the suggestion is that too little development and production activity which is producing information concerning the presence or absence of economic quantities of petroleum reserves is being undertaken.

If the firm engaged in petroleum development or exploration activities could appropriate the value of the information it generates then it would tend to increase its production of such information, which is the appropriate thing to do from the point of view of using society's resources efficiently. Because forced pooling decreases the time and resources that a firm must devote to getting a drilling activity underway, the firm may have gained, at least to some extent, an increased ability to exclude other firms from appropriating the value of the information it is producing.

Certainly the above discussion of the effects of forced pooling suggests that forced pooling increases petroleum development and production activity, which is desirable when evaluated from the perspective of the information externality and social efficiency.

However, it is not clear, at least in a theoretical discussion, how far forced pooling actually goes in internalizing the information spillover. Forced pooling does not allow the producing firm to actually exclude other firms from information it produces; it only allows the firm producing the information to be better able to utilize the information itself. The producing firm has more complete information on which to act than will the firm observing its activity from afar. The firms which are the receptors of the information spillover may learn that it might be beneficial to consider production nearby, but they will not have as much precise information that would describe how good a prospect nearby production might be. Forced pooling allows the firm generating the information to act quickly and secure its gains when it learns it would be profitable to drill on an adjacent spacing unit. Therefore, the firm which generates the spillover may effectively exclude other firms from utilizing the information it has generated by acting quickly. Yet forced pooling does not really result in the ability to exclude others from using the information generated; rather, it only allows the firm perhaps to be more successful in making its own use of the information it has generated.

RECENT DEVELOPMENTS

There are two recent developments in Oklahoma Corporation Commission policy of special interest to the discussion presented above. The Corporation Commission now requires that the party attempting to force pool must make a good faith effort to obtain voluntary agreements before applying to the Commission to invoke the compulsion of forced pooling.[20] The test of whether the applying party has made a good faith effort results in essentially the requirement that the information that will be provided to the nonconsenting owner by the forced pooling order be provided in writing by the applying party to the mineral owners prior to application for forced pooling. It is also required that a reasonable period of time must elapse before a forced pooling application can be filed. The effect of this change in policy would be represented in Figures 2-5 by an inward shift in the demand for acres obtained by forced pooling (D_p), since this change in policy decreases the savings in transactions costs associated with forced pooling. This policy change will have no effect on the demand

20. OKLAHOMA CORPORATION COMMISSION, ESCO EXPLORATION (1984) (CD 108743, Order No. 264785).

for acres not forced pooled. As a result, there will be both a decrease in the total number of acres forced pooled and in the total number of acres in petroleum development activities. This change in policy also decreases the ability of the producing firm to utilize the information it produces in a timely fashion.

The second policy change is that it has now been made explicit that the nonconsenting mineral interest being forced pooled can make two elections, rather than one. It is possible to elect both to participate in the working interest of the well and to take the bonus on a selective portion of the acreage being forced pooled.[21] This apparently means that the individual being forced pooled and owning 100 acres, for example, could elect to take the bonus on 99 acres and participate in the well with only one acre or, perhaps, even less. This would allow the individual, as a working interest, to obtain all of the information produced by the drilling activity. Certainly this implies that such information can be obtained at a modest expense, and it also functions to minimize the ability of the development firm to exclude others from information it produces. Of course, this policy results in the firm being able to appropriate part of the value of the information it provides for others, but this appropriated payment seems likely to be less than what would be the market value for the information.[22] It will be interesting to observe the number of small acreage participation elections in the future, and the implied cost of obtaining well information. It should perhaps be noted that this policy change seems to confirm the relevance of the above discussion of information spillover, as it shows that one aspect of forced pooling that the petroleum industry has found important is its impact on information production and availability.

CONCLUSION

Often economic policy analysis neglects a specific analysis of institutions affecting resource allocation when exploring the implications of public policy. While this inattention to institutional detail may not always lead to a weak or incomplete analysis, there are cases in which institutional details are quite relevant. This article has examined such a case, that of Oklahoma's forced pooling of oil and gas interests. Oklahoma allows a single individual to initiate the drilling of a well, although many separate interests are involved, and even though many of the interests may not voluntarily consent to such development. Certainly the legal system seeks

21. Apparently it has always been possible to make this variable election. However, Corporation Commission practice prior to 1984 did not explicitly inform the party being forced pooled of this possibility on the pooling order itself. This practice was changed in 1984 as a result of a review and revision of the form used for pooling orders. The revised form used in establishing the pooling order now explicitly recognizes the possibility of the variable election.

22. Assuming a spacing unit of 640 acres and a completed well cost of $2 million, participating with one acre implies a cost of $3,127 to obtain this information.

to protect the interests of the nonconsenting mineral owner. But the theoretical analysis presented above shows clearly that the wealth of mineral owners is likely to be decreased because they may be forced to lease their mineral interests for development at a value below the minimum value they would accept without the compulsion of the forced pooling statute.

One popular theme in public policy debates concerning energy policy is that the public sector, and especially the federal government, should get out of the energy marketplace. Such arguments seem to rely on general arguments concerning the virtues of the private marketplace and private enterprise. However, analysis of Oklahoma's forced pooling law suggests that such arguments may be superficial and that, in any case, there are legal institutions that pervade energy markets even on a local, state, or regional level. Perhaps abstract economic theory can sensibly represent a "free" market, but what an actual "free" market in petroleum would consist of is not clear.

Historically, Oklahoma's forced pooling law is just one part of a long and continuing process by which the public sector has attempted to respond to allocational problems arising in a free market for petroleum development. Basically, the public sector in its role of defining and enforcing property rights has become an integral part of the oil and gas market in order to protect its definition of appropriate property interests in petroleum. In this system, a basic definition of property has been modified and constrained to account for "problems" arising at various points in time. Early in the development of petroleum the problem was waste and conservation; more recently the problem has been perceived as too little petroleum development. It is the latter problem to which Oklahoma's forced pooling statute responds.

As this discussion argues, forced pooling through decreases in transactions costs, decreased bargaining power of landowners, and price setting, induces an increase in petroleum development, with other things remaining constant. Forced pooling will increase the number of acres and the number of wells used to produce petroleum. As the historical view of forced pooling indicates, the use of forced pooling has increased, particularly in the 1970s when America faced several energy crises. Although the analysis of forced pooling in Oklahoma presented here has suggested clear implications about the direction of changes in economic variables, little information exists concerning the quantitative magnitude of these effects of forced pooling.[23]

23. The quantitative magnitude of forced pooling is the subject of continuing research. Mueller & Eubanks, *Institutional Effects on an In Situ Natural Resource Market: Forced Pooling in a Petroleum Reserves Market*, 53 S. ECON. J. (forthcoming Oct. 1986) present an empirical investigation of forced pooling in Oklahoma. It is hoped that future research can examine the impact of forced pooling in other states as well as in Oklahoma.