

Land Tenure Patterns and Unitization Legislation: Evidence from Texas and Oklahoma

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Abstract

During the production of an oil and gas reservoir the common pool problem asserts itself as multiple users have the right to withdraw hydrocarbons from the same source of supply. Unitization offers a private contractual solution to this problem. Texas and Oklahoma have both adopted legislation enabling the formation of unit operating agreements that allow for a private contractual solution to the common pool resource problem. Intriguingly Oklahoma has adopted the most liberal unitization statute of any major oil producing state and Texas the most restrictive. The difference between Texas and Oklahoma has traditionally been explained by assessing the relative influence of majors and independents in the two states at the time the legislation was adopted. However, this explanation while no doubt partially valid does not tell the complete story. An examination of land tenure patterns in the two states and an analysis of field characteristics from a random sample taken from each state indicates that the Oklahoma may have been facing a far greater problem in regard to the fracturing of the mineral estate and thus a more drastic solution was required.

Introduction

Among economists there is a widespread, though not universal agreement, that if property rights are allocated efficiently, market forces will lead to an efficient utilization of resources. If this is not the case and property rights are allocated inefficiently then an inefficient outcome is the likely result. One area in which an inefficient allocation of resources has led to inefficient outcomes is in the production of an oil or gas reservoir.

In the development of an oil field two or more operators commonly control mineral rights that allow them to both withdraw hydrocarbons from the same reservoir. This common pool resource problem coupled with the rule of capture¹, has created a situation in which one operator is able to impose the negative externality of uncompensated drainage on others who are withdrawing hydrocarbons from the same source of supply. An incentives for all of those operating from a common source of supply to withdraw as many hydrocarbons as possible as quickly as possible so as to minimize the amount of uncompensated drainage they experience from under their lease and to benefit as much as possible from uncompensated drainage they inflict on other leases is created. The inefficiencies this system creates are obvious and well documented.²

It is obvious that one possible solution to the common pool resource problem described above would be for the parties to negotiate a private contractual solution. However, without a special statutory provision allowing for the joint operation of an oil and gas reservoir such operations would be a violation of antitrust law.³ Both Texas and Oklahoma adopted laws allowing for unitization but the two states have adopted very different schemes. Of the states with significant production, Oklahoma probably has the most liberal unitization statute, and Texas the most stringent.

Traditionally the difference between Texas and Oklahoma has been explained by assessing the relative influence of major oil companies, thought to favor unitization and independents thought to oppose unitization.⁴ In all likelihood explaining the difference between Texas and Oklahoma based upon the political influence of majors and independents contains a great deal of validity, but it may fall short of telling the whole story. Ample evidence also exists that the fracturing of mineral interests was in fact a much greater problem in Oklahoma than in Texas and therefore more aggressive measures were required to deal with the issue of unitization.

The Texas and Oklahoma Unitization Statutes

The states of Oklahoma and Texas illustrate the two most extreme positions in the field of unitization. The Oklahoma statutes make unitization easiest because the lowest ownership percentages are required in order to get a plan of unitization approved, while Texas makes unitization the most difficult because of the requirement that 100% agreement must be obtained in order for a plan of unitization to be approved.⁵

The type of unitization agreement contemplated in this paper is a private contractual agreement either agreed to by 100% of the owners of an interest in an oil reservoir in Texas or by a minimum of 63% of the parties in Oklahoma. This type of agreement contemplates the merger of all or substantially all of the interests in a common source of supply such that the entire reservoir can be developed as a single entity. Such an agreement calls for the management, operation, and further development of a common source of supply for the purposes of pressure maintenance or secondary recovery. These operations are to be carried out by one of the working interest owners who will be designated as the operator, and the other working interest owners will simply receive a pro-rata share of the produced hydrocarbons.

Unitization Negotiations

Unitization negotiations are difficult, and protracted for several reasons. First, as pointed out above, generally one operator will have a dominant position in a field, and this particular operator will frequently stand to benefit far more than all other actors from the unitization of a field. While receiving a large benefit may spur the actor who stands to benefit greatly from the increased production that unitization will bring to bear the initial burden of completing the engineering study that will serve as the basis for unitization negotiations, this disproportionate benefit also presents the possibility for strategic behavior. In most oil fields a few companies will have extremely dominant positions. Clustered around these companies will be several companies that will have smaller tracts which represent a relatively small portion of the field.⁶ The owners of the small tracts, known as edge tracts, have the ability and perhaps the incentive to engage in strategic behavior. James L. Smith demonstrated that in a one shot game the owner of the edge tracts would have a clear incentive to engage in strategic behavior and insist on a substantial premium before signing on to a unitization agreement. Pride of ownership may also be a factor in many unitization negotiations. The pride of ownership position would particularly be an issue if two companies had fairly large positions in a field and the field was quite large relative to the other holdings of the company. Just such an issue presented itself when Prudhoe Bay was discovered. Neither Atlantic Richfield nor British Petroleum was willing to concede the prestige of operating North America's largest oil field to the other company.⁷ The ultimate result of this dispute was that each company operated part of the field, and did indeed result in inefficiency in the operation of the field.⁸ In the oil industry, if a company wishes to be considered a serious player, it must operate some wells. So giving up operational control can also be a contentious issue.

As can be seen from what has been stated above, the negotiations surrounding a unitization agreement have the potential to be quite fractious and the more parties that are involved in the negotiations the more difficult the negotiations will become. Therefore, one would hypothesize that the more fractured the interests in an oil or gas reservoir are the more difficult it would be to successfully conclude unitization negotiations.

Sample and Analysis

Two different data sets were compiled from each state. One data set was a random sample and one a population. Sampling was necessitated because of the size of the population. Texas has 31,438 oil fields and Oklahoma has 21,183.⁹ Compiling a list of all 52,621 oil fields in Texas and Oklahoma would be excessively time consuming and expensive.

The random sample was taken in the following manner. First, an alphabetical list of all the oil fields in the states of Texas and Oklahoma was used. Dwight's Petroleum Information Production Reports for Oklahoma and the Railroad Commission's Summary Production Report for Texas provided the lists which were used in this study. Both lists were current as of January 1999. The goal of the sampling was to acquire a list of 300 randomly selected fields from each state. Since the list of fields was in alphabetical order it was

possible to take a random sample in following manner. First, a random number was chosen from a random number table; this number presented the starting point. From that point, every 12th field was selected from Oklahoma and every 68th field was selected from Texas. Once the end of the list was reached, the selection process moved to the first field on the list until the sample was completed. A procedure such as that described above is a technically correct procedure for producing a random sample.¹⁰

Another list of fields in both states was compiled, a population composed of the largest fields from each state. This method is used because, as we have seen, the regulatory agencies devote special attention to the largest fields. Therefore, a list of the largest fields in each state was compiled. Using a list composed of the largest fields allowed the researcher to determine whether the special attention paid by the Railroad Commission to the largest field in the state actually produced a higher level of unitization among those fields than among the population at large. The data set for Oklahoma included every field that has produced more than twenty million barrels of oil, while the data set for Texas included every onshore field that has produced more than thirty million barrels of oil. These break points differ because in Oklahoma, any field that has produced more than 20 million barrels seems quite large in that population. However, most of the fields in West Texas have produced more than 20 million barrels, but a much smaller percentage of Texas fields has produced over 30 million barrels.¹¹ These four lists will constitute the data sets that will be examined.

After compiling the four lists of oil fields, the study necessitated the gathering and coding of information concerning key independent variables. The variables indicated for examination by prior research and theory are the following: a) whether the field is unitized, b) the age of the field, c) the size of the field, d) how fractured the royalty interests are, e) how fractured the working interests are. The study treated field age and size as continuous variables. The field-by-field summary of production contained in Dwight's Oklahoma Crude Production Report determined the ages and sizes of fields in Oklahoma. The Railroad Commission's 1999 Oil and Gas Annual Report provided the age and size statistics for fields in Texas.

Matching the field code for each unit listed in the Oklahoma Crude Production Report by Units contained in Dwight's Oklahoma Crude Production Report to the field code of the selected field determined whether or not a field was unitized in Oklahoma. According to the Production Report's criterion, if the field code for a unit matched the field code for a field, the field was unitized. Two data sources were used for Texas to determine whether a field was unitized. All units formed before 1982 can be found listed in Railroad Commission Bulletin 82; the field code assigned to the units listed in Railroad Commission Bulletin 82 were matched to the field codes listed in the sample. Once this was accomplished, the Railroad Commission Docket sheets from 1976 to July of 1999 were examined. The field code for all units approved will be matched to the field codes of the fields in the sample.

Once the determination is made as to whether a field has been unitized, the issue of the fracturing of the ownership interests was considered. Once again, the procedures for Oklahoma and Texas were different. A list of every lease in Oklahoma and every controlling operator or group of operators is given in Dwight's Oklahoma Crude Production Reports by Units. The field code for each lease is also listed. The field code for the lease indicates what field the owner of the lease is entitled to produce from. The field code for each lease was compared to the field codes of the fields in the various different data sets, and the number of leases in each field will be counted. This count was then entered and treated as a continuous variable. The Texas data is presented in a format that was easier to work with. In the listing of Crude and Casinghead Gas by Lease, each field is listed, and all of the leases in that field are listed under the field's name. Next the number of leases in each field was counted. One should bear in mind this measure is merely a proxy for the fracturing of the royalty interests. Possibly the royalty interest represented by the lease could be divided between several individuals, but it stands to reason that when there are more leases in a field, there are more interests to fracture; fewer leases mean that there are fewer interests to fracture. So fields with fewer leases will be less fractured and fields with more leases will be more fractured. Conducting an exact count of how many ownership interests exist is not practical without going to the courthouse in the county in which the lease is located and performing a records search. Having done some title work of this nature in the past, a fair estimate of the time involved in performing a full records search courthouse by courthouse would take a minimum of three years of full time work.

The fracturing of working interests is determined from the same lists found above, and the operator of the lease is listed next to the lease. Determining the number of operators required the counting of all of the

different companies owning leases in a particular field. The researcher entered this figure as a continuous variable. Again, this merely serves as a proxy for the degree of fracturing that has occurred to the working interest. In the industry, services are often performed by individuals or companies for what is called “bottom hole” money. Bottom hole money is an interest carved from the working interest that entitles the holder to the value of a percentage of the production. This is common type of fee arrangement for geologists, engineers, lawyers, and landmen. Tool pushers and service companies may also be given this sort of interest. Most likely some of the working interests considered here have had this type of interest carved out of them. As a proxy this measure is quite reasonable. The fewer operators there are in a field then the less likely it is that working interests have become highly fractured.

Descriptive Statistics

An examination of some percentages calculated from several of the key variables presented some interesting information. Though Texas experiences a far lower rate of unitization applications, some fairly strong evidence also indicates that less need for unitization exists in Texas. The data from the random sample clearly indicated that while unitization only occurs in 3.89% of the cases, in fully 65.44% of the cases only one operator controls all of the leases in a field. Whereas, in Oklahoma, a 25.08% rate of unitization existed in the random sample but in only 18.24% of the cases did one operator control all of the leases in a field. An examination of the data relating to the large fields in Texas and Oklahoma demonstrated that this pattern continues. Of Oklahoma’s larger fields, 91% are unitized; however, in no case does a single operator control the entire field. In Texas, however, a 45.87% rate of unitization exists and in 7.73% of the cases one operator controls the entire field. However, this is not necessarily indicative of the loss to efficiency that one might at first believe it to be. In Texas’ larger fields, fully 85.2% are undergoing some form of pressure maintenance of secondary recovery. While the percentage in Texas is less than the number (100%) of Oklahoma’s largest fields that are undergoing secondary recovery or pressure maintenance, it does indicate that these types of activities will occur in the absence of a unitization agreement. Engaging in Waterflooding or other types of secondary recovery if one does not control the entire field will often lead to the need to drill more injection wells than would otherwise be required, it also may prevent an operator from placing injection wells in the more efficient five spot pattern.¹² Another interesting distinction developed between Texas and Oklahoma. In Texas, 31.93% of the fields in the sample were undergoing pressure maintenance or secondary recovery, while in the Oklahoma sample 50.48% of the smaller fields were undergoing pressure maintenance or secondary recovery. Another interesting difference found between Texas and Oklahoma was that while there is more pressure maintenance and secondary recovery in Oklahoma, more exotic methods are found in Texas.

Figure-A*

(Field Operation Characteristics)

	Texas Sample	Texas Large Fields	Oklahoma Sample	Oklahoma Large Fields
Unitized	3.98	45.87	25.08	91
One operator	65.44	7.73	18.24	0
Secondary recovery	31.93	85.2	50.48	100

**All figures are in percentage terms.*

An examination of the mean and median values was also instructive. Actually, for the most part, the median values were more instructive because the measure is far less influenced by outliers, which are frequently encountered in data surrounding oil fields. One field the size of East Texas or Cushing can make the average value of oil fields in a state appear unreasonably large. The average age of an oil field in the Texas sample was 31 years old while the average age of an oil field in the Oklahoma sample was 50 years old. The median age of an oil field in the Texas sample is 29 years old while the median age of an oil field in the Oklahoma sample

is 47 years old. Among the largest fields, the average age in Texas was 62 years while the median age was 59 years; in Oklahoma, the average age of the largest fields was 65 years while the median age was 47 years. The data above indicates that while oil fields in Oklahoma tend to be older than those in Texas, among the larger fields there is not much difference in age. All of the larger fields in both Texas and Oklahoma are old enough to be well past their years of peak production. The average number of leases covering a field in the Texas sample was 7.61, while the median number was 2. The average number of leases in the Oklahoma sample was 13 and the median was 4. The average number of leases among the large fields in Texas was 77.77, and the median number was 47. In Oklahoma the average number of leases covering a larger field was 132.2, while the median was 47. This trend continued when considering the working interests. In the Texas sample, the average number of working interests found was 2.89, with a median of 1. In the Oklahoma sample the average number of working interests was 6.19, with a median of 3. Among the largest fields in Texas the average number of working interests was 19.25 with a median of 6. Oklahoma's largest fields had an average of 37 working interests with a median of 21, demonstrating that the interests in an oil field in Oklahoma tended to be more fractured than those in Texas. Through the performance of one-tailed t tests evidence was developed demonstrating at the 99% level of confidence that there is evidence that the number of operators and the number of leases in a given field are greater in Oklahoma than in Texas.

Figure-B*

(Means and Medians of Key Variables)

	Texas Sample	Texas Large Fields	Oklahoma Sample	Oklahoma Large Fields
Size	5039169 (7811287)	154746424 (65466484)	5168017 (809289)	134132467 (53691417)
Age	31 (29)	62 (59)	50 (47)	65 (47)
Leases	7.61 (2)	77.77 (17)	13 (4)	132.2 (47)
Working Interests	2.89 (1)	19.25 (47)	6.19 (6)	37 (21)

**Median vlaues are presented in parentheses.*

Discussion of Results

The traditional interpretation of the difference between the Texas and Oklahoma unitization statutes has been that in Oklahoma the major oil companies, which were more favorably disposed towards unitization, had more political power and were therefore more able to get pro unitization regulations passed than in Texas where independents had relatively more political power.¹³ Undoubtedly much truth can be found in the traditional argument, however, independent oil producers were certainly not without power in Oklahoma, and majors were certainly not powerless in Texas. Wiggins and Liebcap very convincingly demonstrate that in Texas far more opposition to unitization existed than in Oklahoma.¹⁴ The fact that unitization was more readily accepted in Oklahoma could be because fracturing was a greater problem in Oklahoma than in Texas and for that reason more drastic measures to deal with the issue were accepted.

An examination of the land tenure system in the two states demonstrated the sense of this finding. Large parts of Oklahoma were transferred from the government to private hands during the Oklahoma Land Run. The land was parceled out during the land run in 160 acre plots. In Texas, land was often transferred

from the state to private hands in much larger blocks. Exxon has the right to explore on the entire King Ranch in Texas.¹⁵ Assuredly other arrangements where one operator has the mineral lease to an entire large ranch exist. An examination of the 1997 census of agriculture demonstrates that the average farm in Texas is slightly over 600 acres while the average farm in Oklahoma is just under 200 acres. In Texas, land is held in much bigger blocks than in Oklahoma meaning that the ownership interests in any oil or gas field will most likely be far more fractured.

This pattern of holding larger blocks of land compared to smaller blocks of land would naturally tend to cause greater fracturing of the right to explore for and produce oil. Understanding the difference between land tenure patterns in Texas and Oklahoma is important because it sheds light on the often-murky issue of why the two states took such differing positions on the issue of oil field unitization. Traditionally this difference has been explained as a result of political differences between the two states.¹⁶ However, part of the explanation may well also be that unitization was looked upon far more favorably in Oklahoma than in Texas because the fracturing of the right to produce from a reservoir was a much greater problem in Oklahoma than it was in Texas. For this reason, the state of Oklahoma was willing to adopt far more drastic measures than the state of Texas.

End Notes

¹ Elliff v Texon Drilling Co., 210 SW 2d 558 561(1948).

² Wiggins, Stephen N. and Libecap, Garry D., "Oil Field Unitization: Contractual Failure in the Presence of Imperfect Information." *American Economic Review* 75 no. 3 (1985): 368-385, Weaver, Jacqueline L., *Unitization of Oil and Gas Fields in Texas*. Washington D.C.: Resources for the Future, 1986, McDonald, Stephen L., *Petroleum Conservation in the United States: An Economic Analysis*, Baltimore, Maryland: Johns Hopkins Press, 1971.

³ Williams, R.M., "The Negotiation and Preparation of Unitization Agreements." *The First Annual Institute on Oil and Gas Law and Taxation as it Affects the Oil and Gas Industry*, New York: Matthew Bender, 1949.

⁴ Wiggins, Stephen N. and Libecap, Garry D., "The Influence of Private Contractual Failure on Regulation: The Case of Oilfield Unitization." *Journal of Political Economy* 93 no. 4 (1985): 690-714.

⁵ Technically Alaska and Washington state have statutes that are more favorable to unitization than Oklahoma, but Washington state has very little production, and Alaska has very little production of off-state land, so an examination of these two states would not be particularly illuminating. Another reason to avoid a study of production on state land in Alaska is that the lease which must be signed with the state of Alaska requires unitization of a field in which hydrocarbons are discovered.

⁶ An examination of the unitization agreements for many units tends to indicate that this pattern holds. For example the pattern is evident in Prudhoe Bay, West Edmond Hutton Lime, Katy Gas Field, Seeligson, Conroe, West Cement Medrano, Block 31, and numerous other unitization agreements on file with the author.

⁷ "Best News for Alaska," *Los Angeles Times*, April 19, 2000 17 C.

⁸ "Best News for Alaska," *Los Angeles Times*, April 19, 2000 17 C.

⁹ See Railroad Commission of Texas 1997 Oil and Gas Annual Report Vol. I, Oil and Gas Division, Austin, Texas, 1997, B-406, and Dwights, Oklahoma Crude Production Reports Northeast, Dwight's Petroleum Information, Houston, Texas, March 1999, 1-48, Summary Production by Field.

¹⁰ Grummond R. Iversen, and Helmut Norpoth, *Analysis of Variance*, (Beverly Hills and London: Sage) 16-17.

¹¹ The East Texas Field was excluded from this list because it is a complete anomaly, truly in a class by itself.

¹² Willhite, *Waterflooding*, 27.

¹³ Wiggins and Liebcap, "Oil Field Unitization," *Journal of Political Economy*, p.368.

¹⁴ Wiggins and Liebcap, "Oil Field Unitization," *Journal of Political Economy*, p.368.

¹⁵ Yergin, *Prize*, 432.

¹⁶ Wiggins and Liebcap, "Oil Field Unitization," *Journal of Political Economy*, p.368.

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