Joint Bidding in Federal OCS Auctions

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Joint bidding is the practice of two or more firms submitting a single bid on a lease. Bidding consortia are common in auctions for offshore leases. The frequency of joint bidding increased markedly during the early 1970's, and became a matter of concern to policymakers. In late 1975, the Department of the Interior adopted regulations barring the eight largest crude-oil producers worldwide[1] from bidding with each other for outer continental shelf (OCS) leases. Congress passed a similar ban as part of the Energy Policy and Conservation Act, signed into law on December 22, 1975. The presumption was that joint bidding by major oil companies attempted to lower lease prices by reducing the level of competition.

Under U.S. antitrust laws, explicit price-fixing is prohibited. The government may permit joint bidding for oil and gas leases because of the large capital requirements to buy and develop OCS leases. It may be infeasible (for reasons unspecified) for many firms to bid solo. These firms must pool resources in order to participate in the market. From this perspective, joint ventures encourage competition. Similar arguments have been advanced for joint ventures in R&D activities.

Our objective is to evaluate joint bidding in auctions of leases on U.S. federal lands off the coasts of Texas and Louisiana for the period 1954–1979. Previous empirical studies of joint bidding by Walter J. Mead (1968), E. W. Erickson and R. M. Spann (1974), Darius Gaskins and Barry Vann (1976), Mead and P. E. Sorensen (1980), Alan Rockwood (1983), and Otis W. Gilley et al. (1985) have used similar data. A difference between these studies and ours is that we have computed a measure of the *ex post* value of tracts from production and costs records of individual leases that extend from 1954 to 1989. We study the relationship among joint ventures, the numbers of bidders, and profitability. We also disaggregate joint ventures by distinguishing between two types of firms: large firms, which bid either solo or jointly in over 20 percent of the auctions in our sample, and fringe firms.

We examine the hypothesis that joint ventures enhanced competition by facilitating entry of small or fringe firms. The participation rates of fringe firms increased markedly as the region established itself as a major producer of oil and gas. As expected, fringe participation was predominantly via joint, not solo, bidding. However, small firms usually bid jointly with a large firm, and not with each other. Moreover, they participated in auctions with relatively high bids and tract values. Their participation appears to be contingent upon large firms requiring capital to bid. The experience and knowledge that the large firms had acquired in the early development of the region seemed to prevent new firms from entering the market profitably on their own or jointly with other entrants. This suggests that, if joint ventures enhanced competition, they did so by allowing large firms to compete more vigorously on tracts where expectations of deposit sizes are high.

We then examine the possibility that large-firm joint ventures reduced competition and increased profits. There are (at least) two impediments to market-power

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[1]These are Exxon, Gulf, Mobil, Shell, Standard Oil of California, Standard Oil of Indiana, Texaco, and British Petroleum.

creation. First, joint ventures affect the entry decisions of rival firms. A number of studies (e.g., Larry M. DeBrock and James L. Smith, 1983) take the number of potential bidders as fixed when analyzing the effect of a joint venture on the pattern of returns. However, if returns to firms increase with the joint venture, entry rates are likely to respond accordingly. In the oil and gas lease auctions, entry is not difficult, and the pool of potential entrants is relatively large. A plausible hypothesis is that joint ventures have no effect on *ex ante* returns, because entry rates always adjust so that each firm expects to earn zero profits.

Second, (large) firms may have an incentive to bid solo. The gains from a joint venture include more information, less risk, and reduced competition. However, a cost that limits the size of a joint venture is the positive externality conferred on outside firms. For example, in Cournot models of market competition, a joint venture causes the collective output of the participating firms to fall (as long as costs do not fall too far), thereby increasing the market share and profits of outside firms. However, competition in auctions is in prices, not quantities, and in these cases, a joint venture may not be effective unless it includes all of the firms in the market. Many models would predict that every firm should join the venture and that no firm should bid on its own.

However, firms may bid solo in oil and gas lease auctions because they do not know which firms are their competitors. Prior to bidding, a firm has to invest in geophysical surveys and a staff of geologists to interpret the data, in order to learn which prospects are worth developing. These investments are essentially private information, so each firm does not know whether rivals are informed about particular tracts. An informed firm benefits from collusion with other informed firms on a tract, but it has no incentive to collude with uninformed firms, since they are not likely to bid in the auction on their own. Therefore, joint ventures involving exclusively large firms are more likely on tracts where expectations of a discovery are relatively high. This intuition is consistent with the data.

I. Joint Ventures: Classification and Incidence

We distinguish firms that have invested substantial resources in the exploration and development of oil and gas deposits on the federal lands off the coasts of Texas and Louisiana from those that have not. There are nine such individual firms: all those listed in footnote 1 except for British Petroleum, as well as Union Oil of California and Sun Oil. In three cases, we identified groups of firms that rarely bid against each other and usually bid jointly, either as a group or in subgroups. These are ARCO/Cities/Getty/Continental, Kerr/Marathon/Felmont, and LaLand/Hess/Cabot. We treat each of these groups as a single bidding unit. In what follows, we shall refer to these 12 bidding units as large firms. All other firms are called fringe firms.

We decompose bids submitted by large firms into three mutually exclusive and exhaustive categories: solo bids, joint bids with large firms exclusively (henceforward "large only" joint bids), and joint bids involving at least one fringe firm as well as (possibly) other large firms ("L&F" bids). The number of tracts in our sample is 2,510.

There was considerable variation in participation rates, ranging from the ARCO consortium bidding on 62 percent of the tracts, to Texaco on 18 percent. A substantial fraction of the bids submitted by each large firm were joint bids, although the frequency varied. Exxon bid jointly in only 13 percent of the auctions in which it bid, whereas the consortia of Kerr/Marathon/Felmont and LaLand/Hess/Cabot bid jointly in over 90 percent of the auctions in which they participated. There is also considerable heterogeneity among firms with respect to the form of the joint venture. For example, Shell rarely bid solely with other large firms, whereas Mobil bid more frequently with other large firms than with fringe firms.

II. Participation Rates

We hereafter aggregate large firms into a single group and compare them to fringe

TABLE 1—NUMBERS OF BIDS AND WINS OF LARGE AND FRINGE FIRMS

Firm size	Number of bids			Number of win bids		
	1954–1969	1970–1973	1974–1979	1954–1969	1970–1973	1974–1979
Large only						
Solo	2,168	763	936	717	130	404
Two	406	201	120	117	37	52
Three or more	119	120	33	30	6	23
Fringe only						
Solo	680	439	216	207	45	74
Joint	76	328	293	14	57	90
L&F						
One large	193	645	469	38	110	165
Two or more large	104	262	370	14	45	135

Note: Sample = 2,510 tracts.

firms as a group. Table 1 documents the frequency of solo and joint bidding by large and fringe firms. Joint ventures involving only large firms and those involving both large and fringe firms are decomposed into categories according to the number of large firms. We consider three different sample periods. The price of oil was quite stable until 1974, and it increased markedly several times thereafter. To highlight the impact of these changes, we isolate the subperiod 1974–1979. We also partitioned the sample at 1970, when joint venture activity between large and fringe firms accelerated.

Consider the 1954–1969 sample. During this period, large firms accounted for 80 percent of the bids, participating in 2,990 bids. They typically bid solo (73 percent of their bids) and, if they bid jointly, usually only with other large firms (17 percent of their bids). Joint ventures with fringe firms accounted for only 10 percent of the bids submitted by large firms. Fringe firms participated in 1,053 bids. Most (65 percent) were solo, but if a fringe firm bid jointly, it typically did so with large firms (28 percent).

The number of tracts sold during 1970–1979 was 18-percent higher than in the earlier period, but the participation rates of large firms were almost identical. They participated in 3,919 bids, accounting for 75 percent of all bids. However, the number of solo bids dropped by over 400, and the number of joint bids with fringe firms increased from 297 to 1,746 bids. These two categories respectively amounted to 45 percent and 46 percent of the bids in which large firms participated. The number of joint bids involving large firms only was almost identical in the two periods.

Fringe firms were much more active in the later period, nearly tripling their participation rate. As mentioned above, most of this increase took the form of bidding jointly with large firms. However, the number of joint bids involving only fringe firms also increased sharply, from 76 to 621. The number of solo bids by fringe firms was almost identical.

The effect of the 1975 ruling which banned joint ventures among seven of the large firms is seen clearly in the joint bidding by large firms only. In 1970–1973, large firms submitted 321 joint bids of this kind on 430 tracts. Roughly half of these bids involved the seven firms affected by the ban. By contrast, in 1974–1979, large firms submitted only 153 such joint bids on 943 tracts, and most were submitted prior to 1976.

The increased incidence of joint ventures between large and fringe firms began well before the oil price increase of 1974, or the 1975 ban. The cumulative number of joint-venture bids involving both fringe and large firms was 297 by the end of 1969, and 1,204 at the end of 1973. Similarly, the cumulative number of joint ventures involving only fringe firms was 76 at the end of 1969, and 404 by the end of 1973.

Finally, note that win rates reflect participation rates. In the period 1954–1969, large firms owned shares in 916 of the 1,137 tracts sold, and most were either held by a single large firm (78 percent) or by a joint venture involving large firms (16 percent). Fringe firms shared ownership with large firms in only 52 tracts. Of the remaining 273 tracts, almost all were owned by a single fringe firm. In the 1970's, large firms had shares in 1,107 tracts, the same fraction as earlier. However, large firms no longer exclusively owned the tracts they won, but shared ownership with fringe firms in 455 tracts. The number of tracts owned by one or more fringe firms stayed roughly constant at 266,

TABLE 2—BID PATTERNS

Firm size	Mean bid 1954–1969	Mean bid 1970–1973	Mean bid 1974–1979	Mean winning bid 1954–1969	Mean winning bid 1970–1973	Mean winning bid 1974–1979
Large only						
Solo	1.77	5.53	4.91	2.26	7.23	4.65
	(0.07)	(0.26)	(0.28)	(0.18)	(0.64)	(0.49)
Joint	2.76	5.30	10.07	3.86	8.65	10.43
	(0.22)	(0.43)	(1.16)	(0.56)	(1.65)	(1.78)
Fringe only						
Solo	1.32	1.69	3.62	1.71	4.12	4.17
	(0.08)	(0.17)	(0.47)	(0.19)	(0.93)	(1.38)
Joint	2.46	6.64	5.34	2.08	15.42	5.00
	(0.49)	(0.55)	(0.49)	(1.13)	(2.06)	(0.87)
L&F	3.07	9.71	8.22	5.10	15.52	9.54
	(0.29)	(0.41)	(0.45)	(0.98)	(1.47)	(1.09)

Notes: All dollar figures are in millions of 1972 dollars. The numbers in parentheses are standard errors of the sample means. Sample = 2,510 tracts.

TABLE 3—PATTERN OF RETURNS

	Gross profits 1954–1973	Gross profits 1974–1979	Net profits 1954–1973	Net profits 1974–1979
Large only				
Solo	4.24	2.25	0.99	−3.00
	(0.62)	(0.63)	(0.64)	(0.63)
Joint	5.54	2.07	0.44	−9.29
	(1.53)	(1.50)	(1.62)	(1.96)
Fringe only				
Solo	3.28	−2.50	0.88	−7.82
	(0.88)	(0.44)	(0.86)	(1.47)
Joint	5.80	1.31	−13.16	−4.42
	(0.81)	(1.06)	(2.03)	(1.20)
L&F	7.03	3.76	−6.05	−7.38
	(1.81)	(1.56)	(1.86)	(1.50)

Notes: All dollar figures are in millions of 1972 dollars. The numbers in parentheses are standard errors of the sample means. Sample = 2,255 tracts.

but the number of single-owner tracts dropped from 207 to 119.

III. Bids and Profits

Table 2 considers the distribution of solo and joint bids. We aggregate joint ventures involving large firms only and those involving large and fringe firms (L&F) into separate categories. There were too few wins by joint ventures with three or more participants to consider them separately.

Joint bids and winning joint bids were on average much higher than corresponding solo bids. Fringe firms tended to seek partners at bid levels lower than those of large firms, as the solo bids of fringe firms were on average lower than those of large firms. More surprisingly, bids by joint ventures involving exclusively large firms were on average quite low during 1954–1973, and similar to the average solo bid by large firms. The average winning bid by this class of joint ventures was only marginally higher than the average winning solo bid by large firms. This pattern is not evident for 1974–1979, suggesting that the ban on joint ventures may have had an effect.

Perhaps the most surprising finding concerns the category of joint ventures consisting of both large and fringe firms. The average L&F bid was substantially higher than the average solo bid by large and fringe firms, and it was also much higher than the average bid of joint ventures involving exclusively large firms during 1954–1973. Thus, L&F joint ventures typically formed on tracts where bids were highest. Recall that 70 percent of the L&F bids were joint ventures consisting of *one* large firm.

Table 3 describes the pattern of returns for solo and joint ventures by large and fringe firms. The sample is the set of *accepted* bids.[2] Note that profits for the period 1974–1979 are seriously underestimated, since production flows from a lease were priced using prices prevailing at the sale date. (The returns calculations are described in our 1988 paper with Bryan Boudreau.) The implicit assumption of static expectations was reasonable prior to 1974, when prices were stable. It is not reasonable for 1974–1979, since prices increased markedly. Firms anticipated that increases would occur, and their expectations were reflected in their bids. Consequently, calculated net profits were frequently negative. However, the contemporaneous differences

[2]The government reserved the right to reject the high bid above the stated reserve price of $15–$25 per acre if it believed that the tract was worth more.

in profits across categories are important, rather than their levels.

There appears to be positive correlation between bids and gross profits. Mean gross profits were lower on tracts won by a solo bid than on joint-bid tracts, particularly for L&F joint bids. During 1954–1973, returns to large firms were substantially higher on solo ventures and joint ventures with other large firms than on joint ventures with fringe firms. During 1974–1979, returns to both types of joint ventures were similar and were substantially less than the returns to solo ventures. Fringe firms also earned substantially higher solo returns than on joint ventures with large firms during 1954–1973. Later in the sample, returns were similar. Returns calculated for joint ventures involving fringe firms only are subject to small-sample criticisms.

IV. Discussion

In the first 15 years of federal OCS sales off the coasts of Texas and Louisiana, large firms mostly bid solo but would bid jointly with each other some of the time. The average bid per tract rose steadily throughout this period, from $1.5 million in 1954 to $3.0 million in 1970. Sales in the early 1960's were particularly profitable, as many tracts contained substantial amounts of oil and gas. Thus, by the end of the 1960's, the region was established as a major producer of oil and gas.

During the 1970's, large firms bid solo almost half of the time, but they bid jointly with fringe firms almost as often. Ownership of oil and gas deposits in the region became less concentrated, but control of the deposits remained with the large firms. Average bids were substantially higher. The amount of oil and gas discovered per tract during the first half of the decade was comparable to the amounts discovered on tracts sold during the first 15 years. Discoveries declined somewhat in the last half of the decade.

Throughout the sample, solo bids were usually submitted on tracts perceived to have low value. The most profitable bids were from large firms bidding either solo or jointly with each other. The average *ex post* value of these tracts was lower than that of tracts won by L&F bids, but lower purchase prices more than offset this difference. Perhaps the most striking result is that participation by fringe firms, which increased dramatically in the 1970's, was not through solo bidding or joint bids with other fringe firms. Instead, they primarily bid jointly with a large firm, and typically on high-value tracts for which bids were high.

One explanation of these results is that joint ventures involving fringe firms are motivated primarily by capital constraints. Suppose firms familiar with a particular region believe that a tract located in that region is likely to possess an oil or gas deposit. After the firm has acquired additional information about the tract and its prior beliefs are confirmed, it wants to bid. However, to win the tract, it has to bid a relatively large sum, since competition is likely to be fierce. To reduce its outlay for that tract, the firm seeks financial help from other oil firms. It may not want to share its knowledge or expertise with firms that could use that information in bidding for other leases in that sale or in subsequent sales. Hence, the firm has an incentive to seek partners with no desire to explore the region themselves. We believe that most of the fringe firms did not engage in exploration, and that joint ventures between large and fringe firms were essentially exchanges of knowledge and expertise for capital.

This interpretation is consistent with several aspects of the data. First, it explains why the average bid is substantially higher for this class of joint bids than the average bid of joint ventures involving large firms only and the average solo bid. Second, it explains the size of the joint venture. Two or three partners is the number that is usually required to make the firm's share of the joint bid comparable to its solo bids. Third, it explains why net profits are lower on L&F joint bids than either solo bids or bids by joint ventures involving exclusively large firms. On the margin, the large firm is likely to "cream" off the most profitable tracts for itself. Fourth, the average share of large firms in L&F joint ventures is 40 percent. To attract capital, the large firm has to have an incentive to identify profitable tracts for

its financial partners. This implies retention of a substantive share, which is indeed the case.

An analysis of the composition of joint ventures provides additional evidence to support our explanation. The distribution of shares in joint ventures involving exclusively large firms was much more symmetric than the distribution in L&F joint ventures. The equal-division rule was used in 1,171 of the 1,747 large-only bids, but in only 571 of the 1,530 L&F bids. We also computed a modified Herfindahl index for each joint bid, defined by

$$H = \sum_{i=1}^{n} [s_i - (1/n)]^2$$

where s_i denotes the share of firm i in the joint bid and n is the number of participating firms. The average value of H for joint bids involving only large firms is 0.0306. The corresponding value for L&F bids is 0.0926, indicating more inequality.

A final piece of evidence is the frequency with which joint ventures bid against other joint ventures. The number of tracts with only one L&F bid was 529, whereas the number with more than one L&F joint bid was 470. The corresponding numbers for joint bids involving large firms only are 580 and 146, respectively. If one of the large firms is capital-constrained in bidding for a tract and seeks financial partners, other large firms are likely to be in a similar situation. This correlation is not likely to hold for joint ventures involving large firms only.

We believe that joint ventures among large firms cannot be interpreted solely in terms of capital constraints. This is so because the average bid by joint ventures involving large firms is only marginally higher than the average solo bid by these same firms during 1954–1973. The motivation may have been to lower lease prices by reducing the amount of competition.

In his 1976 testimony before the Subcommittee on Monopolies and Commercial Law, Gaskins argued that, in the process of forming a joint venture and selecting the tracts on which to submit a joint bid, the participating firms may reveal their bidding intentions on *all* of the tracts under discussion. This knowledge could allow the firms to win at least some tracts on their own at more favorable terms. We intend to explore these issues in more detail in future research.

REFERENCES

DeBrock, Larry M. and Smith, James L., "Joint Bidding, Information Pooling, and the Performance of Petroleum Lease Auctions," *Bell Journal of Economics*, Autumn 1983, *14*, 395–404.

Erickson, E. W. and Spann, R. M., "An Analysis of the Competitive Effects of Joint Ventures in the Bidding for Tracts in OCS Offshore Lease Sales," in Special Subcommittee on Integrated Oil Operations of the Senate Committee on Interior and Insular Affairs, *Market Performance and Competition in the Oil Industry*, Washington, DC: U.S. Government Printing Office, 1974.

Gaskins, Darius and Vann, Barry, "Joint Buying and the Seller's Return: The Case of OCS Lease Sales," in Subcommittee on Monopolies and Commercial Law of the Committee on the Judiciary, *Energy Industry Investigation*, Part 1, House of Representatives, Ninety-Fourth Congress, Washington, DC: U.S. Government Printing House, 1976, pp. 207–35.

Gilley, Otis W., Karels, Gordon V. and Lyon, Randolph, "Joint Ventures and Offshore Oil Lease Sales," *Economic Inquiry*, April 1985, *24*, 321–39.

Hendricks, Kenneth, Porter, Robert H. and Boudreau, Bryan W., "Information, Returns, and Bidding Behavior in OCS Auctions: 1954–1969," *Journal of Industrial Economics*, June 1987, *35*, 517–42.

Mead, Walter J., "The Competitive Significance of Joint Ventures," *Antitrust Bulletin*, Fall 1968, *12*, 819–49.

_____ **and Sorensen, P. E.,** "Competition and Performance in OCS Oil and Gas Lease and Lease Development, 1954–1969," Final Report to U.S. Geological Survey, Reston, VA, Contract No. 14-08-0001-16552, 1980.

Rockwood, Alan, "The Impact of Joint Ventures on the Market for OCS Oil and Gas Leases," *Journal of Industrial Economics*, June 1983, *31*, 453–66.

References

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The Journal of Industrial Economics, Vol. 35, No. 4, The Empirical Renaissance in Industrial Economics. (Jun., 1987), pp. 517-542.

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The Impact of Joint Ventures on the Market For OCS Oil and Gas Leases

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