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An Analysis of the Impact of an All Competitive Leasing System on Onshore Oil and Gas Leasing Revenue

John W. Sprague

Bernadette Julian

AN ANALYSIS OF THE IMPACT OF AN ALL COMPETITIVE LEASING SYSTEM ON ONSHORE OIL AND GAS LEASING REVENUE

JOHN W. SPRAGUE AND BERNADETTE JULIAN†

The objective of this article is to develop some indication of the extent to which the present onshore non-competitive leasing system provides the government with a fair return for the disposal of federally owned oil and gas resources. The article does not constitute a wide-ranging study covering all facets of a fair market value concept. Rather, it focuses more narrowly on the single aspect of leasing revenues. This is done on the basic premise that if the establishment of features more commonly associated with a competitive system of resource allocation in the present federal onshore leasing system results in a sizeable increase in leasing revenues of and by itself, then this fact becomes a basis on which to consider in more depth the ability of the non-competitive leasing system to yield a fair market value in the broader sense.

This article represents a first effort at evaluating the revenue effects of an all competitive leasing system. Using the distribution of the number of competitive and non-competitive leases issued in one year, this analysis attempts to project a range of bonus values based on limited statistical inputs. Further work is needed to arrive at firm conclusions. Failure to realize fair market value can lead to loss of socially justifiable revenue to the federal government and, under revenue sharing laws, to state governments as well. Included is an evaluation of the impact of the 1960 rent increase on non-competitively leased lands, using readily available data. The analysis covers the United States as a whole, and also treats the State of Alaska separately. The information developed in this section is later employed as a base for evaluating the impact of possible additional rental increases. In the analysis of the possible impact of an all-competitive leasing system, the flows of rental, royalty, and bonus income are evaluated separately under both the present onshore competitive leasing system and under various alternatives.

I
BACKGROUND

All oil and gas leases for federal lands, lying outside the boundaries

† Senior Economist and Economist, respectively, Branch of Mineral Economics, Division of Energy and Minerals, Bureau of Land Management, Department of the Interior. The opinions expressed are those of the authors and do not necessarily represent those of the Department of the Interior.

of areas determined by by geological survey to be a known geological structure of a producing oil or gas field, are presently issued on a non-competitive basis. Available Bureau of Land Management statistics indicate that this system of non-competitive leasing accounts for the overwhelming majority of all oil and gas acreage presently leased on public lands. Figures on total acreage leased on a competitive and non-competitive basis were published for the first time in Fiscal Year 1967 when almost nine million acres were leased on a non-competitive basis and about 60,000 acres on a competitive basis. In addition, all acreage leased on a competitive basis since 1960 (with no allowance for terminations) represents less than one percent of a total acreage under lease in 1967. Thus, the gross rental and acreage statistics available for analysis primarily reflect a non-competitive leasing system.

Likewise, most royalty revenue also originates from lands leased non-competitively. Only those lands which the Geological Survey has classified as lying within a known geologic structure of a producing oil or gas field are leased competitively. Consequently, when oil is discovered on lands outside of such structures, the lands are usually already under lease. The more desirable lands of such an area are usually leased non-competitively, either for brokerage purposes or to assemble acreage for drilling. Competitive leasing also often involves terminated leases which have been surrendered.[1] As royalty statistics are maintained on a gross basis, it is not readily possible to quantify any shifts in present royalty trends likely to result from the adoption of an all-competitive leasing system, because the present non-competitive system employs a flat royalty of 12½ percent, whereas the present competitive system employs a sliding-scale royalty ranging from 12½ to 25 percent keyed to average monthly production. To project royalty trends under an all-competitive system, it would be necessary to determine the present array of sliding-scale royalties on competitive leases and extrapolate this array to all wells on non-competitive leases. The extent of readily available data does not permit this undertaking to be performed in any meaningful way. As a result, the analysis in this paper of royalty income under an all-competitive leasing system is conducted on a qualitative basis.

A. The Present Leasing System

The present leasing system for oil and gas leases is based on the Mineral Leasing Act of 1920. The act limits lease holdings to 246,000 acres per person, association, or corporation in any one

1. Bell Creek, located in Southeastern Montana, is a recent example of an area originally leased in large part on a non-competitive basis that later became productive.

state of which no more than 200,000 acres may be held under option. Somewhat higher acreage limitations are in effect for Alaska. As stated earlier, only lands classified in a known geologic structure are eligible for competitive leasing. By definition, the known geologic structure of a producing oil or gas field is the trap, whether structural or stratigraphic, in which an accumulation of oil and gas has taken place and is being produced or is producible. All acreage that is presumably productive is included within the limits of such a structure. A known geologic structure may, however, be more extensive than the pools of oil or gas it may contain. Only after evaluating all controlling factors is the known geologic structure defined. If, during development of several individual fields, it is determined that these separate fields are within the same geologic structure, such fields are consolidated into a single area and that area is defined as the known geologic structure of a single field.[2]

Non-competitive leases are obtained by application on a first-come-first-served basis. A $10.00 filing fee is required and is retained as a service charge even if the applicant's offer is rejected or withdrawn. In the case of multiple filings for the same lands, a drawing is held to determine the successful lessee. Rent on non-competitive leases (lands wholly outside of known geologic structures) is set by regulation at $.50 an acre or fraction thereof for each lease year.[3] If discovery results, the law sets royalty on production at 12½ percent. Non-competitive oil and gas leases may not be extended at the expiration of the initial ten year term except in the case of production; or by unitization, drilling, or partial assignment. Finally, if there is no well capable of producing oil or gas in paying quantities and the lessee fails to pay the required rent, the lease expires. Land included in leases so expired then becomes available for leasing again.

B. Past Trends in the Non-competitive Leasing System

Throughout the late 1940's and 1950's there was a steady and significant increase in total leases, total acreage leased, and total rent revenues from public lands. Much of this land was obtained for brokerage purposes, and much of the land so obtained was of a less desirable quality. Clawson and Held claimed that by the mid-50's, many gullible persons had been drawn into the non-competitive leasing picture, primarily to the benefit of the lease broker.[4]

In 1960, the rent on non-competitively leased acreage was raised

2. *The Definition of Known Geologic Structures of Producing Oil and Gas Fields*, Geological Survey Circular 419.

3. The law requires a rental of not less than $.50 per acre.

4. Clawson and Held, The Federal Lands 422 (1957).

to its present level of $.50 per acre and the initial lease period extended from 5 years to 10 years. Prior to this, annual fees had been $.50 per acre in the first year of the lease, no charge in the second and third years, and $.25 per acre in the fourth and fifth years. If the lease was renewed, for each succeeding year the annual rent was $.50 per acre. Thus, the increase raised the first five years rental fee for an acre of land from $1.00 to $2.50. Shortly after this rent increase, all indicators of leasing activities on the public lands began to decline for the first time in many years, as indicated in Table I *infra*.

Table I

UNITED STATES
ACREAGE LEASED, RENTS, AND LEASES IN EFFECT
FISCAL YEAR 1960-67
(000)

Year	*Acreage Leased*	*Estimated Rents*[a]	*Leases in Effect*
1960	113,675	$27,498	139.6
1961	101,717	40,495	132.9
1962	93,298	31,655	130.0
1963	75,504	38,113	114.0
1964	67,372	37,722	104.5
1965	64,157	35,529	100.4
1966	61,270	33,379	98.2
1967	54,855	31,217	91.3

a. Rents are estimated by deducting royalties and bonuses from total receipts from public lands. Royalty income from public lands on a fiscal year basis is included in the figures for total Geological Survey receipts deposited to the Bureau of Land Management and cannot be segregated from the total receipts figure. Therefore, calendar year royalty data for public lands was used in lieu of fiscal year data to ensure that all data applied strictly to public lands. Despite this, the rental figures shown above are considered valid in showing general trends.

Source: Bureau of Land Management and U. S. Geological Survey data.

From this table, it can be seen that the rent increase was followed by an immediate and fairly intensive shift away from non-competitively leased lands. Given the pattern of lease holdings at this time, some reduction in lease acreage was almost inevitable. The rent increase, along with other factors such as increased interest in offshore oil and a drop in drilling activity onshore, apparently provided the incentive for the shift. Acreage leased and leases in effect dropped steadily in all years shown in Table I. Rental income, on the other hand, actually increased between 1962 and 1963, and overall, the decline in rental has been far less severe than the drop in acreage and number of leases.

In Table II *infra*, separate figures for Alaska indicate that much of the decrease in total United States figures after 1960 was caused by a general decline in Alaska leasing activities. Following a very active period (1950-1960) in which the number of Alaska leases rose from

Table II

ALASKA
LEASES IN EFFECT, RENTS, AND ACREAGE LEASED
FISCAL YEARS 1960-67

Year	*Leases in Effect*	*Estimated Rents*[a] *(000)*	*Acreage Leased (000)*
1960	16,547	$2,784	34,908
1961	13,109	3,748	26,813
1962	10,655	6,082	21,188
1963	7,713	5,971	15,006
1964	6,186	6,321	11,006
1965	5,496	3,788	10,047
1966	5,456	4,917	9,777
1967	3,883	4,349	7,112

a. See n.a. Table I.
Source: Bureau of Land Management data.

9 to 16,547 and acreage under lease climbed from 19,000 to almost 35,000,000, activity in Alaska declined considerably.

Prior to 1960, rent on Alaskan leases was lower than rent on leases outside Alaska. The 1960 rent increase, then, was proportionately greater for Alaskan leaseholders. In the 1950's, with the then territory awaiting statehood, there was an unusual amount of interest in lease activity in Alaska. In addition, there was increasing optimism because of the discovery of the first commercial field in Alaska in 1956. Between 1960 and 1967, as shown in Table II, leases in effect in Alaska fell by over 75 percent, Alaskan acreage under lease fell by about 80 percent, and rentals showed sharp up and down movements, finally increasing about 20 percent between 1960 and 1967. Much of the decline in leases and acreage occurred in the first 3 years after the rent increase. Since 1963, the trends in leases and acreage in Alaska have been more in line with the overall United States trends, indicating that the higher level of leasing activity in Alaska in the 1950's was compensated for rather quickly after Alaskan rents were brought into line with rents for the rest of the nation. The moratorium placed on Alaskan leasing by the Secretary of the Interior and state selections have also had an effect on the decline in recent years. Table III *infra* shows the trend in acreage leased and leases in effect on public lands excluding Alaska. A comparison of the decline in the categories shown above with the same figures for Alaska in Table II shows the impact of Alaskan trends on overall United States figures. With Alaska included, total acreage leased declined almost 53 percent between 1960 and 1967; exluding Alaska, it declined 41 percent. Similarly, leases in effect including Alaska declined 35 percent; excluding Alaska the decline was 29 percent. In the case of rents, between 1961 and 1967 total rent including Alaska declined about

Table III

UNITED STATES EXCLUDING ALASKA
ACREAGE LEASED, ESTIMATED RENTS, AND LEASES IN EFFECT
FISCAL YEARS 1960-67
(000)

Year	*Acreage Leased*	*Estimated Rents*[a]	*Leases in Effect*
1960	78,767	$24,714	123.1
1961	74,904	36,747	119.8
1962	72,110	25,573	119.3
1963	60,498	32,142	106.3
1964	56,366	31,401	98.3
1965	54,110	31,741	94.9
1966	51,493	28,462	92.7
1967	46,743	26,868	87.4

a. See n.a. Table I.
Source: Bureau of Land Management and U. S. Geological Survey data.

23 percent; excluding Alaska, about 27 percent. This indicates that although acreage and leases declined faster in Alaska, the larger rent increase there helped minimize the decline in the total rental revenues.

Given the extent of leasing activity on public lands, both in Alaska and elsewhere, and the increased competition for capital provided by the Outer Continental Shelf (OCS), it seems likely that a decrease in total United States leasing activity would have occurred without the rent increase, although perhaps not to the same degree or over the same time span. However, it appears that the rental increase may have actually increased rental income over what would have existed in its absence, and served to minimize a decline in rental revenues which would have occurred in any case. In addition, the rent increase has, to some extent, placed lease-holding on a more rational basis by decreasing brokerage activity, (especially in Alaska) and, by so doing, may have provided additional incentive to oil exploration. It may be that the low rentals on non-competitive leases prior to 1960 favored the lease broker over the developer if these low rentals permitted the lessee to hold large quantities of land solely for the purpose of negotiating a fee for development rights. This fee would normally be paid in the form of cash and an overriding royalty, and in many cases could be large enough to more than offset any profit potential the lower rentals might have had to the developer.

Royalty revenue from public land oil and gas operations is shown in Table IV below for calendar years 1954-67. There was an unusually sharp increase in royalty income between 1960 and 1961, and then a small decline in 1962, the only such decline in the 1960-67 period. Overall, the absolute trend in royalty revenue since the rental increase shows no marked difference with the trend in the

Table IV

ROYALTY REVENUE, OIL AND GAS OPERATIONS ON PUBLIC LANDS
CALENDAR YEARS 1954-67

Year	*Royalty (000)*	*Year*	*Royalty (000)*
1954	$39,223	1961	$68,584
1955	41,508	1962	67,377
1956	46,402	1963	71,458
1957	54,874	1964	73,186
1958	54,607	1965	74,368
1959	57,760	1966	77,829
1960	60,531	1967	83,091

Source: U. S. Geological Survey, Mineral Production, Royalty Income and Related Statistics, 1967.

years just prior to 1960. Given the sharp increase in OCS activity in the 1960-67 period however, and its resulting impact on the competition for drilling funds, the steady increase in onshore royalty income during this period may be of some significance although the level of aggregation of royalty statistics precludes the drawing of definitive conclusions on the impact of the 1960 rent increase.

By the end of 1963, the major reaction to the rent increase apparently ended. Since that time, there has been a steady downward movement in rents and total acreage leased for the United States as a whole, apparently a continuation of the trend beginning at the time of the rent increase. This has likely been caused by continuing reaction to the heavy pre-1960 leasing activity and the sharp rise of OCS activity during the 1960's which downgraded the relative interest in the onshore public lands as a source of oil and gas. As can be seen in Table V, petroleum production on the OCS increased about 350

Table V

PETROLEUM PRODUCTION
PUBLIC LANDS AND OUTER CONTINENTAL SHELF
CALENDAR YEARS 1957-67
(Million bbls)

Year	*Public Lands*	*OCS*
1957	135	16
1958	137	35
1959	147	36
1960	156	50
1961	169	64
1962	171	90
1963	178	105
1964	180	123
1965	181	145
1966	187	189
1967	193	222

Source: U. S. Geological Survey, Mineral Production, Royalty Income, and Related Statistics, 1967

percent between 1960 and 1967, while production on the public lands increased by less than 25 percent. In absolute terms, the increased production from the OCS was almost five times as great as that from public lands.

The decline in total acreage leased in the United States as a whole has also been accompanied by an apparent shift into smaller individual holdings of land. Between 1960 and 1967, total leases issued declined about one-third, but total acreage leased declined by over 50 percent. As a result, the average acres per lease dropped from just over 800 in 1960 to under 600 in 1967. This decrease may have been partly caused by efforts to adjust total rental payments to the new rental fees and, in part, by the dropping of excess acreage previously held by developers in an attempt to guarantee future access to needed public lands. In addition, partial assignments by lease brokers increased the number of lease holders.

II
THE IMPACT OF AN ALL COMPETITIVE LEASING SYSTEM ON GOVERNMENT REVENUES

The following analysis treats the present onshore competitive leasing system first and evaluates the likely impact on bonuses, royalty, and rental revenue individually. Part B of this section then goes on to evaluate the impact of various competitive leasing features which might be substituted as alternatives to the present competitive system.

A. The Present Competitive Leasing System

1. The Bonus

Under the competitive system, bidding produces bonus revenue. Under the non-competitive system there is no bidding system but a unique source of revenue originates through the filing fee system. In converting to an all-competitive leasing system using bonus bidding, this current non-refundable $10 filing fee would be eliminated. Because of this, in evaluating the true increase in revenue from an all-competitive system, it becomes necessary to measure the tradeoff between bonus income and the loss of filing fee revenue. "Public Land Statistics" reports that an average of slightly over $3 million in fees and commissions has been received from the public lands in recent years.[5] It is estimated that the oil and gas filing fee is responsible for the greater part of this revenue, perhaps $2½ million,[6] which is the figure adopted for this analysis.

5. B.L.M., Public Land Statistics, Table 114 (1967).

6. Interior Department Ad Hoc Committee on Competitive Leasing on Federal Lands. *Report on Competitive Leasing of Federal Lands for Oil and Gas* 89 (1963).

In past years the non-competitive leasing system has also generated a much higher volume of administrative and legal expenses than the competitive system.[7] Much of this expense arises from the practice of multiple filings on individual lease sites and the subsequent assignments of leases; the same practice generates much of the filing fee revenues. Therefore, it appears that there is also at least a partial trade off factor between a reduction in filing fee revenues and a reduction in government legal and administrative expenditures, and perhaps even a savings if these expenses are actually greater than the revenue from filing fees.

In order to estimate the amount of bonus revenue the government would receive, two systems of measurement can be used. In the first, a hypothetical is set up, based on an average lease case. Because no precise data was available, the necessary inputs to our analysis are estimates supplied by the Geological Survey and the Bureau of Land Management. The two inputs to determine revenue are price per unit and quantity supplied. Using a unit price of $2.90 a barrel for oil and 23 barrels a day as average quantity supplied, annual revenue per well is estimated at $24,000. On the average, one productive lease contains about 2.5 wells, giving an annual revenue figure per productive lease of $61,000. In addition, a twenty-five year lease life is assumed allowing two years for development. Next, to serve as a proxy for potential government bonus income, an average overriding royalty figure was determined. Although no precise statistics are available in this area, a rate between two and four percent was suggested by knowledgeable Bureau of Land Management personnel. Using this range to establish a 3 percent average overriding royalty, we can then discount at 8 percent,[8] the rate used here to equal the opportunity cost to the government of accepting this money on a present value basis. The results indicate that a 3 percent average overriding royalty has a value of $1,826 per annum and when distributed over a period of 25 years, has a present value of almost $17,000, as shown below:

$$V_p = \frac{A\,(R^n - 1)}{R^n\, r}$$

$$= A \times TF^{27} - A \times TF^{2\ 9}$$

$$= \$1{,}826\,(10.9352) - \$1{,}826\,(1.7833)$$

$$= \$16{,}711$$

7. Nugent, *Federal Mineral Leasing: A Study of Rule Making and Market Realities*, 2 Department of Justice, Land and Natural Resource Division J., 18 (1964).

8. *See* Baumol, *On the Social Rate of Discount*, 58 The American Economic Review 788 (1968).

9. The formula used is based on the present value of an annuity of $1 per year at compound interest. The percent value of $1,826 per year at compound interest for years 3 to 27 was calculated by determining the present value for years 1 to 27 minus the present value for years 1 and 2.

Revenue for the total number of productive leases can then be calculated by applying an average of the percentage of productive non-competitive leases to the number of such leases issued in 1967. This average is 7 percent and when applied to the approximately 11,000 leases issued in 1967, we get a total of 785 productive leases.[10] The 785 leases, when multiplied by our average lease value of $16,711 yields a total bonus value of $13,113,135 for 1967. In terms of the increase over lost filing fee revenues of $2½ million, additional revenue earned is in excess of $10 million.

The other system that can be used to estimate possible bonus income foregone is to apply the average bonus paid per acre for lands leased competitively under the present onshore system and apply it to the additional acreage that might have been leased under an all competitive system. Statistics were published for the first time in 1967 showing the number of acres leased on a competitive basis, and also total bonus income received. Total bonus income was $735,000 for 80,000 acres leased, or an average of $12 per acre. In the same year 8,693,000 acres were leased non-competitively. If we assumed that all the acreage leased non-competitively in 1967 would also have been leased under an all competitive system and had received the same average per acre bid, the total bonus income to the government from this land would have been just over $104 million. This figure, of course, must be qualified by two significant factors, as follows:

(1) Under an all competitive leasing system the total acreage leased would have undoubtedly decreased. Based on our earlier analysis of the 1960 rent increase we saw that acreage under lease declined about 50 percent. If we assumed that a shift to bonus bidding brought about the same approximate impact, acreage leased in 1967 would have dropped from roughly 8,700,000 acres to 4,350,000 acres, and the bonus income would have been about $52 million.

(2) Our earlier analysis also stated that, in many cases, only the less productive lands tend to be leased competitively under the present system. If this is true, then it can be assumed that much of the additional acreage that would have been leased competitively in 1967 under an all competitive system would have received considerably higher per acre bonus bids than the average reflected in the 1967 figure for actual competitive leases. If 4,350,000 acres had been leased, and if the higher bids were sufficient to increase the average

10. This figure assumes no change in the number of productive leases due to the existence of an all competitive leasing system. While later discussion assumes the total number of leases issued might decline under such a system, it is felt that productive leases will remain fairly constant in number, and in fact might increase.

to $24 per acre, then total bonus income in 1967 would have still been $104 million.

If it were assumed that the impact of items one and two above were offsetting, our original estimate of $104 million in bonus income foregone would still be accurate. Thus, our two alternative systems of calculating bonus income foregone because of the non-competitive leasing system sets up a possible range from about $10 million to about $100 million.

It should be pointed out that the bonus figures developed above represent only a rough calculation to provide a wide range. In addition, they are based only on 1967 figures, which may or may not be representative of long term leasing trends. In line with our original thesis, however, the figures do provide a reasonable basis for at least calling into question the ability of the present non-competitive leasing system to ensure the government fair market value for the disposal of its oil and gas resources.

Under an all competitive leasing system most of the increase in bonus income would likely occur in areas where new drilling interest had developed and leasing activity was initiated on and around the prospective structure. Under the present system, most of the desirable lands in such a case are leased on a non-competitive basis before the lands can be classified as lying within a known geological structure. As shown above, this may result in a sizeable loss of income to which the government is entitled and which it would stand a better chance of obtaining through competitive leasing on a cash bonus system.

In addition, bonus bidding, by requiring cash outlays to obtain access rights to more desirable lands, might tend to reduce the incidence of overriding royalties. This, in turn, might allow developers, even with sizeable bonus payments required, to develop these lands more efficiently if the cash bonus payments were equal to or less than the present value of the overriding royalties which might otherwise be paid.[11] To the extent that present overriding royalties are excessive, then the developer would actually pay less (on a present value basis) to the government under a cash bonus system. Under the present system the leaseholder may at times exact excessive payments. The bonus-bidding system could minimize the presence of the overriding royalty and transfer much of the income which goes to the non-competitive leaseholder under the present system to the government in the form of cash bonuses. In addition, the cash bonus, as

11. This would be true in the case of equal payment because the bonus does not add to marginal costs.

a "sunk cost" to the winning bidder, would provide an additional incentive to early development.

Cash bonus bidding, on the other hand, raises capital barriers and could eliminate, in part, one of the advantages of the present system—minimal capital requirements for citizens desiring to lease the public lands. Lease brokerage, however, already eliminates some of this advantage to the actual developer to the extent the developer has to pay the broker a cash bonus for the lease. Even if a bonus payment were required, however, in those vast areas of the public lands where no structures are presently known, citizens lacking large cash assets could still gain access to the public land, for the expected resource value of tracts in these areas would be nominal due to the very high degree of uncertainty associated with such properties. This would enable them to perform such functions as they now perform, obtaining payment for these services in the form of cash and overriding royalties.

2. Rent and Royalty

A change to the competitive leasing system would, in most cases, increase the rent on lands lying outside of known geological structures from $.50 to $2 per acre if the present competitive leasing specifications were retained. It appears probable that this rent increase would result in an increase in total rent revenue, although a lack of statistical data prevents empirical verification of this fact. At a $2 per acre rent, it would take a decline of more than 75 percent in leased acreage to bring total revenue below that under the present $.50 per acre fee. The only available data for estimating the likely impact of such a rent increase is the trend in acreage under lease since the 1960 rent increase. In the seven years since this rent increase, acreage under lease has declined just over 50 percent. While the 1960 increase was considerably smaller than the one envisioned here, based on earlier analysis in this report, it is believed that the present pattern of land holdings may be far more stable than in 1960, and therefore, the reaction to a given rent increase is likely to be far less volatile. Therefore, it is reasonable to believe that the imposition of an annual rental of $2 per acre will not create a decline in acreage under lease sufficient to decrease total revenue.

A switch to an all competitive leasing system would also involve the imposition of a sliding scale royalty on production in lieu of the present flat rate of 12½ percent if present competitive leasing specifications were retained. The sliding scale royalty ranges from 12½ percent to 25 percent and is based on average monthly oil production. It seems certain that this sliding scale royalty would increase

royalty income to the government over and above that received under the present 12½ percent rate.

B. Alternatives to the Present Competitive Leasing Terms

1. Rents

Instead of the $2 per acre rate required by the present system, there are other options open, including,[12] (1) a general rental increase to a rate less than $2 per acre; (2) a general rental increase up to $2 per acre but with provisions to offset the rental increase against exploration costs incurred in the same year; and (3) a sliding scale rent, starting from a relatively low per acre change in the earlier years, and gradually increasing to $2 or more in the later years of the lease.

A general rental increase to less than $2 would not raise revenues unless it was set high enough to just offset the impact of two factors which will likely serve to decrease total acreage under lease. The first is the decline in acreage which will inevitably occur as marginal lessees react to the requirements for obtaining leases under a competitive system. This reaction will occur independently of any rental action and the government will lose this rental revenue which it would have retained under a non-competitive system. The second decline will occur as a result of a decline in rental revenues from that acreage which would have been leased competitively in any case and which, if a new rate of less than $2 is set, will actually experience a decline in rental fees. In addition, any given rental increase will, of its own accord, create an offsetting decline in acreage under lease. As stated earlier, the 1960 rental increase was followed by a decline of just over 50 percent. Although other factors were present, this is the only factual evidence available on the impact of a rent increase. Therefore, to be conservative we have assumed any future declines in leased acreage will be at least this large. If we assume a drop of at least 50 percent in acreage under lease, a rental rate in excess of $1 per acre would be required to increase total revenues. A $1 rate would be needed to offset the 50 percent decline in acreage caused by the increase, and an additional increase of some amount would be needed to offset acreage losses resulting from increased administra-

12. The first two options use a cutoff point of $2. This figure is used because the present competitive leasing system uses a rent of $2 and the fact that acreage is leased at this rate indicates a willingness to pay such a rent on the part of lessees. This fact-of-life can lend some empirical support to an analysis involving rental rates at or below the $2 rate, and as there is insufficient data to analyze the effect of a rental in excess of $2, we have used this figure as the cutoff point. Option 3, the sliding scale rental, allows the possibility of a rental in excess of $2 per acre but implicitly assumes that the average rental over the life of any lease would not exceed $2.

tive requirements and rental losses from lands which would have otherwise been competitively leased at $2 per acre. Therefore, the range of demand elasticity is narrowed to between some amount in excess of $1 per acre up to $2 per acre. In view of the fact that the extent of slippage in rental due to the non-rent increase factors is highly uncertain as well as the possibility that the rent-associated reduction in acreage may exceed 50 percent, it seems that the optimum rent under this alternative would be just under, or equal to, $2 per acre.

Under a rental increase system which included a provision to offset the rental increase against exploration costs, we would need to first disaggregate lessees into two groups—lease brokers and developers—in order to fully evaluate the subsequent impact on rental revenues. No precise figures are available as to the percentages of total non-competitively leased acreage held by lease brokers and developers respectively. However, it is believed that lease brokers hold the majority of such acreage (either directly or indirectly), and a 75-25 percent split in favor of lease brokers can be accepted as reasonable. It is also believed that present holdings of development groups are more in line with their short term requirements for legitimate exploration activity than in 1960, when excess lands may have been leased as a hedge against exclusion from needed lands by the intensive leasing activity of the 1950's. This provision should allow development groups to approximately trade off increased rentals with exploration costs and should result in their land holdings remaining constant after any given rent increase. Lease brokers, on the other hand, would feel the full impact of any rent increase because they would incur no offsetting exploration costs. This should cause a drop in acreage held by them, with the actual amount involved being a function of the magnitude of the rent increase. However, under the previous assumption of lease brokers holding 75 percent of non-competitively leased land, the drop in acreage will probably not be sufficient to cause a decline in total revenues. For example, if rental fees were increased to $2 per acre, a decrease in land held by lease brokers of about 75 percent would be necessary to decrease total rental revenue if holdings of exploration groups remain constant. Again, a minimum rate somewhat in excess of $1 would be necessary to offset the decline in acreage from the rent and non-rent factors, and again, our range of elasticity would be narrowed. Therefore, it appears that the optimum rental rate for this alternative would also be just under, or equal to, $2 per acre. The optimum rental rate under this alternative would not likely yield as much revenue in total as would a flat rate with no exemptions. However, the lower rentals

envisioned under this alternative might be more than offset by the additional incentives provided to development groups, which might result in the more efficient utilization of the public lands over the long run.

A sliding scale rental, starting at a fairly low rate, and increasing gradually each year until it equalled or exceeded $2 per acre would probably result in the greatest slippage in rental revenue, at least in the short run. However, graduated rental fee would likely curtail long-term holdings of land for purely speculative purposes although it could increase short term holdings.[13] Thus, it would create some of the same benefits as would the system providing exploration cost offsets against rentals.

In summary, it appears that the greatest rental increase could be achieved by imposing a flat $2 per acre rental with no provision for offsetting exploration costs. After that, the options appear to require the taking of less rental revenue in return for increasing incentives to explore and develop oil and gas properties on public lands.

2. Royalty Bidding

Given the conditions of substantial uncertainty associated with exploration on much of the land lying outside of present known geological structures, a system of royalty bidding might be more likely to yield higher government revenues from the bidding process. This is so because under conditions of substantial uncertainty, future rent payments will be heavily discounted for this factor, and such a process will very often result in a bonus payment far short of the present value of actual future economic rents. Royalty bidding permits the government to share some of the risk with the explorer by predicating payments on actual future oil production which minimizes both discounting for risk and potential windfall profits. In addition, royalty bidding avoids the creation of capital barriers and thereby allows retention of one of the major advantages of the present non-competitive system—minimal capital requirements for access to the public lands.

The major disadvantage of royalty bidding is that it adds to marginal costs and thus can cause premature abandonment of otherwise economic properties, unless the royalty rate may be appropriately adjusted. In theory, royalty bidding also does not ensure that the most efficient producer will always obtain the lease and may encourage lease brokerage.

13. This is comparable to the reaction to the 1960 change in fee structures. Many who were willing to hold a lease 3 years for $.50, i.e., about $.17 per year, would not keep it for the fourth year ($.25) or take a lease for even one year at $.50.

Royalty bidding also permits the government to take its bidding revenue over time and thus increases the amount of dollars the government will receive over the productive life of a tract as opposed to what it would receive in a lump sum payment of equal present value. This difference in dollars received is a reflection of the time value of money. In the previous bonus bidding examples (see text following note 10, *supra*), it was shown that the government would have received over $13 million in income in 1967 if it had issued all its leases competitively, using a social discount rate of 8 percent. However, if it had issued these leases competitively under a royalty bidding system, those same bids would have yielded almost $36 million over the next 25 years because of the additional time value of money. Theoretically, the decision to take a lump sum payment as opposed to a royalty payment over time would be dependent on associated social costs. For example, if the social cost of foregoing present receipts was greater than 8 percent the government would be better off taking the money in a lump sum. However, the determination as to what the relevant social costs are at any given point in time is basically a function of federal fiscal policy, and as such, places these considerations beyond the scope of this article.

3. Royalties On Production

The royalty on oil and gas production could be set as a flat percentage of value rather than on a sliding scale rate keyed to monthly output, if a bonus bidding system were utilized on the public lands. Royalty bidding would, of course, preclude the necessity of administratively establishing royalty rates, as they would then become a function of the bidding process and be determined by a competitive process.

A flat royalty rate could be set at 12½ percent (the legal minimum and the present rate on non-competitive leases) or at some higher rate deemed equitable, possibly a rate believed to approximate the average royalty that would be realized under a sliding scale system. This reduces uncertainty, transfers more emphasis to the bonus, and increases the chances of a buyer realizing windfall profits. On the other hand, a sliding scale royalty tends to freeze production from a well just below the output level necessary to bring on the next increase in the royalty rate, unless the maximum efficient rate will ensure a level of output high enough to justify payment of the higher royalty rate. As such, a sliding scale royalty may create a barrier to efficient production.

A flat royalty also creates a barrier to full recovery of an economic resource as it adds to marginal costs. At present, this cost may only be lowered when the producer petitions the government to do so.

This adverse effect of a flat royalty may be mitigated, however, through a system of somewhat automatically declining royalty rates timed to become effective at those output levels where marginal costs may be expected to approach, or equal, marginal revenues. If this were done, it would also seem equitable to attach the same provisions to any overriding royalties placed on production.

It should be remembered, however, that a system of flat royalties with sliding scale provisions to ensure maximum resource recovery represents nothing more than a modified form of the full sliding-scale system. The modified system would tend only to lower the maximum permissable royalty rate, thus requiring the government to bear the costs necessary to ensure production at the relatively inefficient end, but permitting no increasing share of any revenues arising from greater than anticipated production rates.

CONCLUSION

On the basis of the measurement system used in this article, an all competitive leasing system would have increased government bonus revenues anywhere from $10 million to $100 million in 1967, less a loss in filing fee revenues of approximately $2½ million.[14] In addition, if rental fees had been increased in line with the rates analyzed in this article, an increase in total rental revenue would have likely resulted.

We believe that the basic assumptions used in developing our two bonus income estimates are essentially valid and that the results point out two basic facts:

(1) that the present non-competitive system is not providing the government with a fair return for the disposal of its onshore oil and gas resources;

(2) that the actual amount of revenue foregone has not been identified with any great degree of accuracy in this report.

In addition, based on our analyses in this paper we feel that a fairly accurate identification of revenue lost under a system confined to bonus bidding might still not measure the time loss of revenue. It may be that because of the high levels of risk and uncertainty in much of the public domain land the optimum leasing system might include a combination of royalty and bonus bidding. That is, bonus bidding with a fixed royalty in those areas exhibiting relatively favorable geological probabilities and royalty bidding on rank wildcat acreage.

14. This deducts the entire filing fee revenue with no offset for associated expenditures to obtain a net bonus figure. Inclusion of such expenditures would, of course, increase the figures used above, and if expenditures actually exceeded filing fee revenues, the low and high points of the range in government bonus revenue shown above would increase.