Random Reservation Prices and Bid Disclosure in OCS Wildcat Auctions

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1. Introduction

• Background:

Gulf of Mexico is rich in oil and gas: Oil and gas found off the coast of Texas, Louisiana, Florida, Cuba, …

Production Oil OCS = 12 % US Oil production

Production Gas OCS = 25% US Gas production

Between 1954 and 1990, on average 125 tracts were sold in 98 auctions.

Those auctions generated huge sums of money (average winnig bid > 4 million dollars)

- The auction mechanism

First-price sealed bid auction followed by bid disclosure,

Random reservation price

- Post-auction drilling

Cost of drilling an exploratory well = 1.5 million dollars

22 percent of all wildcat tracts were allowed to expire without any wells being drilled

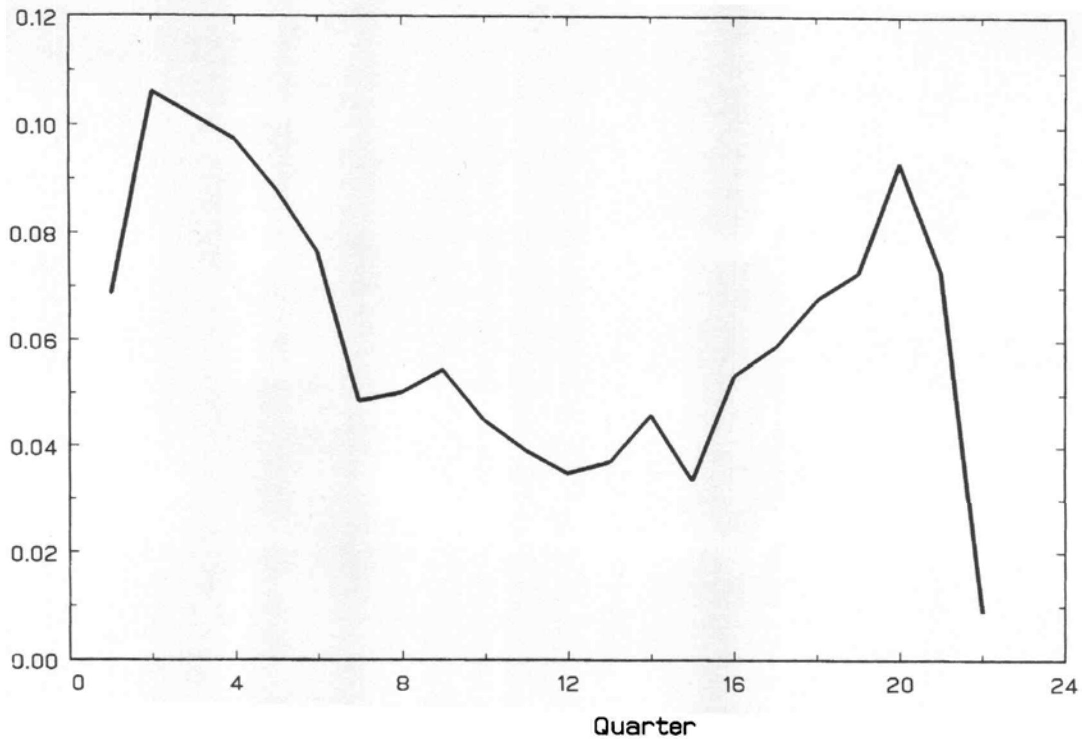

FIGURE 1.—Hazard rate for exploratory drilling on wildcat tracts, 1954–1979.

So far, no paper studied the interaction between the auction mechanism and subsequent drilling decisions. This is surprising because:

• A lot of money is involved,

• The insights present in this paper are not solely valid for off-shore drilling.

• Oil fields are still (and will be) auctioned off (Gulf of Mexico, Libya, Russia?, Caspian sea?, …)

$\Rightarrow$ This paper represents a first step towards filling this void.

2. The Model

2 risk-neutral players, 2 tracts.

State of the world $\in \{H,L\}$, $\Pr(H) = ½$

If H, value of Oil (underneath A and B) = 1.

If L, value of Oil (underneath A and B) = 0.

Each player possesses an imperfect signal concerning the state of the world

$$Pr(s_i = h \mid H) = Pr(s_i = l \mid L) = p \in (1/2,1)$$
$$Pr(s_i = l \mid H) = Pr(s_i = h \mid L) = 1 - p$$

Cost of drilling = c

A1: $1\text{-}p \leq c \leq p$

Reservation price = $r \sim U[0,1]$

Due to bidding constraints, player 1 only bids on Tract A while player 2 only bids on Tract B. (Palfrey (1980))

3. Bid disclosure

In this section we analyse the following game:

-1) State of the world is realised and players receive their signals,

0) Player 1 bids on tract A, player 2 on tract B,

½) Bids are disclosed,

1) Players 1 and 2 simultaneously decide whether to drill or wait,

2) Player 1 (2) observes the action (+ outcome) taken by player 2 (1) and decides whether to drill or not.

3) End of the game.

δ = discount rate

Propositon 1 If bids are disclosed, there exists a separating equilibrium

(i) if signals are sufficiently precise, or

(ii) if δ is sufficiently high, or

(iii) if δ is sufficiently low.

Intuition: Suppose $c < ½$

Optimists know that, independently of the other player's bid, a war-of-attrition will start at time one. They bid ½ *(p-c)*.

Pessimists bid ½ 2p(1-p)(½ − c)

- In war-of-attrition λ^* is determined such that

(opportunity) cost of waiting = gain of waiting

The higher $Pr(H|s_{-i},b_i)$, the higher the LHS, the higher λ^*

$\Rightarrow$ Pessimist has an incentive to bid ½ (p-c) to make her neighbour more optimistic and increase λ^*

Observe also that *½ (p-c)* - ½ 2p(1-p)(½ − c) is increasing in p and
⇒ For sufficiently high p, gain of bidding like an optimsist ≤ cost.

- If $\delta = 1$, no (opportunity) cost of waiting, $\lambda^* = 0\ \forall\ Pr(H|s_{-i}, b_i)$ and gain of bidding like an optimist = 0

- If $\delta = 0$, a pessimist never waits ⇒ no incentive to bid like an optimist to induce neighbour to drill.

Propositon 2 If $p \leq \bar{p}$, if $c = ½$ and if $\delta \in [\underline{\delta}, ½]$ and if bids are disclosed there exists a pooling equilibrium in which both player's types bid ½ (p-c).

4. No Bid disclosure

Timing of the game is the same as before except that we delete stage ½.

Proposition 3 If $c \leq 1/2$ *and if bids are not disclosed there exists a perfect Bayesian equilibrium in which*

(i) optimists bid ½ (p-c) and invest at time one with probability λ^* *if the other player also won her tract.*

(ii) pessimists bid $\frac{1}{2} p(1-p)\lambda^* \delta (1-c)$ *and wait.*

5 Efficiency and Revenue Comparison

Proposition 4 If private signals are sufficiently precise and if $c \leq \frac{1}{2}$, $\exists$ $[\underline{\delta}, \overline{\delta}]$ *such that* $\forall \delta \in [\underline{\delta}, \overline{\delta}]$ *, not disclosing bids generates more welfare and revenues.*

Intuition:

- As signals are sufficiently precise, $\exists$ separating equilibrium.
- Optimists are indifferent between disclosing and not disclosing bids. They always bid $\frac{1}{2}(p\text{-}c)$.
- Pessimist knows that the divulgence of her bad private information will make her neighbour less willing to drill. This hampers her free-riding possibilities $\Rightarrow$ pessimist values the tract less (with bid disclosure) and bids less agressively.