On the Shelf: exploring oil and gas production in the Gulf of Mexico

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Introduction

Producing oil and gas in the Gulf of Mexico (GOM) requires rights to extract these resources from beneath the ocean floor. Companies acquire the rights through government-held auctions for specific blocks in GOM. Sometimes top bids are significantly larger than the next highest bids without clear reasons.
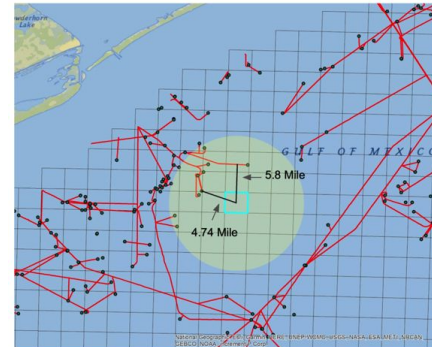
Objective

We will try to uncover the rationale behind abnormal bidding behavior with data collected from the Bureau of Ocean Energy Management (BOEM) and provided by ExxonMobil.

Raw Data

1. Bidding record

2. Well data

3. Infrastructure data
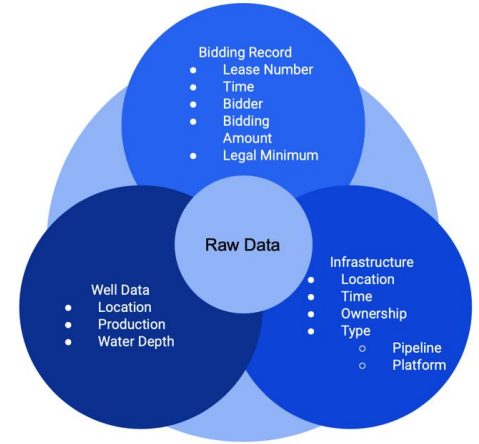
Variable Extraction

Distance from a block to:
1. Rich Well
2. Pipeline:
3. Platform
4. Block (same company)

Number of Blocks (same company as bidder) within 10 miles

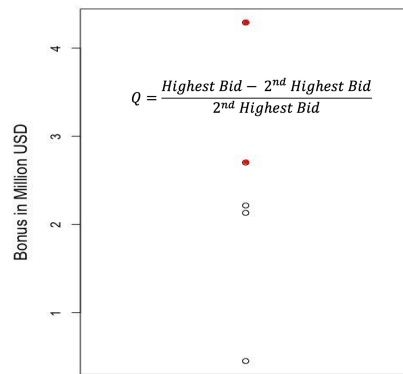- 10 Mile Radius from Block Centroid
- Platforms
- Pipeline
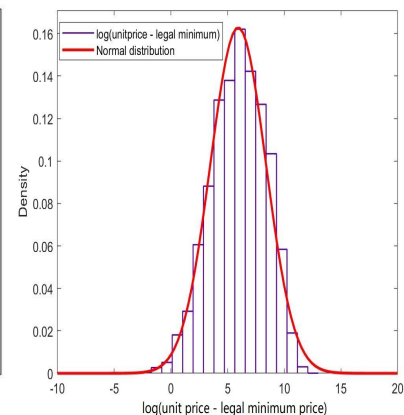- Blocks

Outlier Identification

We define outliers as overbidding that corresponds to a large difference between the highest and the 2nd highest bids measured by Q.

The distribution of all bidding prices should be log-normal, as the value of the blocks measured by oil and gas production follows lognormal distribution. We try to remove the outliers to recover lognormality for Deep Water Group and Shallow Water Group separately. The grouping is necessary because companies have different bidding strategies at different water depth.
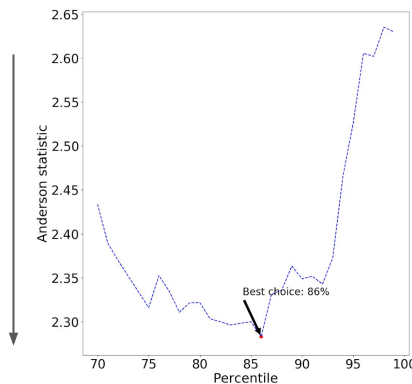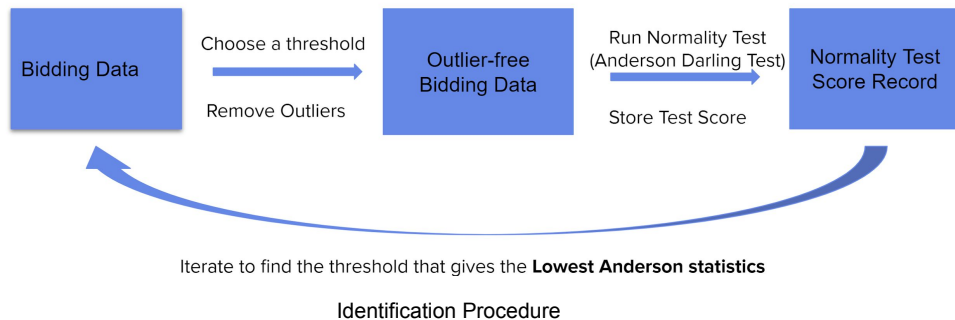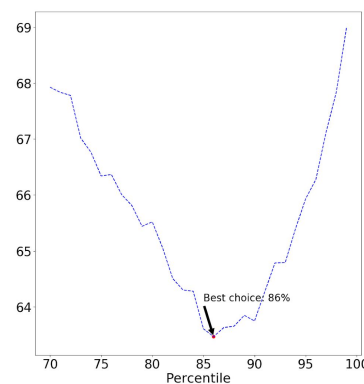

All Bids Placed

$$Q = \frac{Highest\ Bid - 2^{nd}\ Highest\ Bid}{2^{nd}\ Highest\ Bid}$$

Lease Number = G16310

All Bidding Prices Distribution

- log(unitprice - legal minimum)
- Normal distribution

log(unit price - legal minimum price)

Shallow Water

Best choice: 86%

Shallow Water

Best choice: 86%

Bidding Data → Choose a threshold / Remove Outliers → Outlier-free Bidding Data → Run Normality Test (Anderson Darling Test) / Store Test Score → Normality Test Score Record

Iterate to find the threshold that gives the **Lowest Anderson statistics**

Identification Procedure

Regression Analysis

A logistic regression analysis is performed on deep water group and shallow water group separately to examine the relationship between the predictors and overbidding behavior.

Conclusion

- Number of Competitors, Number of Blocks (Same Company) and Number of companies sharing a bid seem to have the biggest effect on the overbidding behavior.
- Companies do seem to have different bidding strategies in the two groups as shown by predictors having opposite values in different groups. For example, number of blocks owned each company has a positive effect on shallow water group, while it else has a negative impact on deep water group.
- Continuous Variables are much less statistically significant which might be addressed with better variable extraction algorithm

Regression Result
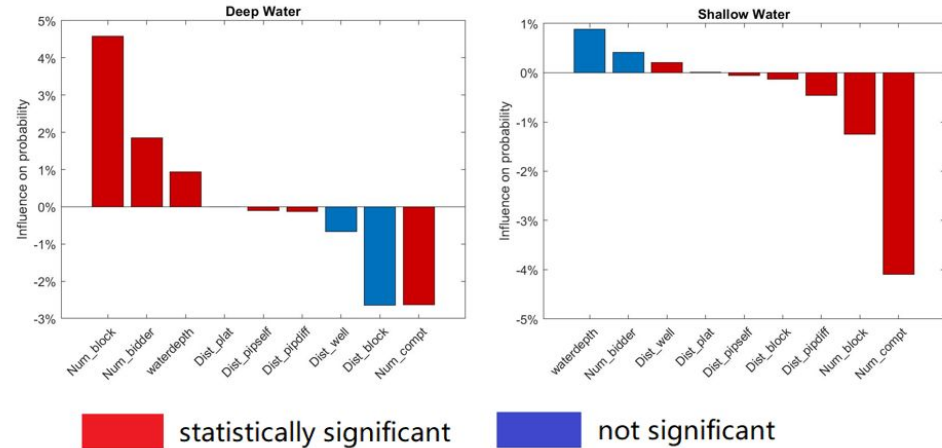
Variable Description

Num_block	Number of blocks in 10 mile radius (same company)
Num_bidder	Number of companies sharing one same lease
Num_compt	Number of competitors
Dist_plat	Distance to the platform (10 miles)
Dist_pipself	Distance to the pipelines belonging to the company itself (10 miles)
Dist_pipdiff	Distance to the pipelines belonging to the different companies (10 miles)
Dist_well	Distance to rich well (10 miles)
Dis_block	Distance to closest block of same company (mile)