**SCORING AUCTIONS, INVESTMENT AND PRODUCTION OUTCOMES: THE CASE OF OIL AND GAS LEASES IN MEXICO**

[Igor Hernández, Rice University, 713-962-3087, ih12@rice.edu]

**Section 1: Overview**

Mexico recently used auctions to allocate oil and gas leases for onshore fields. Companies submit as their bid royalties they will pay the government in addition to what is required by law, and additional investment to a minimum work program. Bids are transformed into a score and the company with the highest score wins the auction. This paper analyzes the effect of changing the scoring rule on investment and the expected government revenue. One question is how can we compare the performance of scoring auctions in Mexico with other mechanisms such as price auctions with minimum bid requirements. In the case of auctions for oil and gas leases in Brazil, Sant’Anna (2017) compares the outcomes of the scoring auction against a first-price bid auction, where the exploration effort is fixed and the winner is the bidder with the highest signature bonus. The results showed that the scoring mechanism had higher average exploration than the fixed exploratory effort, while the offered bonuses were similar. This means that the scoring auction is no worse than the first-price bid auction with a fixed level of exploration. However, Ausubel and Cranton (2012) point out that the use of scoring auctions assumes that all criteria upon which the decision is based (the bid dimensions) are quantifiable and objective. This implementation also assumes, perhaps incorrectly, that governments fully understand the tradeoffs across all factors. Bidders possessing better information than the government may be able to exploit that to their advantage.

The results from my model allow me to perform counterfactual simulations where I compare alternative mechanisms to the original scoring auction. In one scenario, I assume that the government fixes the amount each company can invest, and allows them to compete only through higher royalties. I am also interested in looking at the effects of changing the scoring rule, initially for the case of mature fields onshore. These areas have less geological risk than shallow water or deep-water areas, and there is already infrastructure in place. However, given the high decline rates and the low size of the reserves, they do not have the highest rates of return. Mature onshore fields therefore mostly attract small local firms whose objective is to increase recovery rates. Initially, the scoring rule had a high weight assigned to the royalty component, but it later changed to a rule that placed more weight on the investment component.

**Section 2: Research approach and data**

To compare the effects of different scoring rules on entry probability of firms, bid results and investments from winning companies in Mexico, I model the problem in two stages: the auction stage and the investment and production stage, and then solve backwards. In the investment and production stage, I use data on production and investment forecasts from oil and gas companies in onshore fields in Mexico to model the value of oil and gas blocks as a function of expected production profiles, prices for oil, operational costs and taxation. My modelling follows the results on contingent payment auctions (Bhattacharya, Ordin and Roberts, (2018), Skrzypacz, (2013)). In the auction stage, I use the function for the value of a block, estimated during the production and investment stage, to estimate cost types for investment. For this, I derive necessary equilibrium conditions for the scoring auction game and identify the cost of investment using bid, production, investment, operational cost and taxation data. This extends previous work in the scoring auction literature (Hanazono, Hirose, Nakabayashi and Tsuruoka (2016), Lewis and Bajari (2011), Bolotnyy and Vasserman, (2018)). I then use the estimated distribution for the cost of investment to simulate the expected investment, additional royalties and oil and gas production under different scoring rules. First, I use a rule where the trade-off between bid dimensions is constant (used initially in Mexico for Round 1.3) and have different weights for additional royalties and investment. Then, I compare the results with the scoring rule used for Rounds 2.2 and 2.3, where bid dimensions are complementary (trade-off between bid dimensions is not constant). Unlike most of the literature on auctions for oil and gas leases, this is one of the first papers that studying the connection between auction design and bidder behavior not only at the moment of the auction but the implications in the following stages, and endogeneizes the value of a block (commonly assumed exogenous in the auction literature).
Section 3: Research results

The estimated distribution for the cost of investment follows an extreme value distribution, where the estimated median is of approximately $2,450/unit of investment, which suggests an approximated well cost between US$ 5.2 and US$ 7.5 MM, slightly higher than results obtained by Sant’Anna (2017). Regarding counterfactual scenarios, in the first scenario (Round 1.3 scoring rule), as the weight of investment increases, there are two opposite effects: increase in investment and production but lower royalties per barrel. Initially, the effect of increased investment is larger, and government revenues from royalties are highest when the weight on investment is between 25% and 30%, a larger weight than what was set initially in Round 1.3 (10% for investment). As the weight on investment increases, the effect of lower royalties per barrel becomes larger, and government revenue starts to decline. When I compare the scoring rule used in Round 1.3 against just a price auction (when the weight on investment is zero and companies only compete through additional royalties), the scoring auction increases government revenues by US$ 43 MM on average.

I also compare is between the original rule used by the Mexican government, and the new rule, used in Round 2.2 and 2.3, where bid dimensions are complementary (trade-off is not constant). In this case, adopting the new rule implied that revenues would increase by $150 MM approximately. Other simulations include different oil and gas price trajectories, so that changes of 10% in the mean of oil prices imply changes in government revenues between 15% and 24%, but the impact is much larger when volatility of prices increases.

Section 4: Conclusions and recommendations for further research

Initially, there is indication of nonlinearities in the weight government revenues from royalties change with changes in weights, which could allow us to think about a revenue-maximizing weight on investment, if the bid dimensions are considered as substitutes, as in Round 1.3. One natural question is regarding the use of royalties as bid dimension, instead of signature bonuses. One interpretation is that when including auctions using fixed payments such as bonuses, or investment commitments, the benefits come in the short-term, and the income for subsequent governments will come from the taxation and the increase in production. However, given that later there will be a high amount of sunk costs, the incentives maybe for other administrations to increase taxes. This may imply that if the weight on the investment component increases, investment by companies may be lower than what the model predicts, as they may risk to pay higher taxes in the future, when the investments are sunk. This also can explain why the CNH decided not to have a higher weight on investment for Round 1.3, even if could increase oil production and possibly government revenue. These questions are related to what is known in the literature as the “hold-up problem”, arising from a situation of weak contract enforcement. We would also need to further explore the effect of complementarities across bid dimensions, as results show that they could increase the tax base.

References


