Balancing Rent Extraction and Project Execution: The Case of Auctions for Oil Leases in Marginal Fields in Mexico

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This research models government revenues and project completion under different scoring rules in auctions for oil leases in Mexico.

- Every oil lease has a minimum royalty and work program. Bidders make offers on top of this.
- A formula converts bids into a score. The highest score wins the auction.
- In 2014 (Round 1.3), the government used the following scoring formula:
  \[ S_{ij} = 0.9 \times 3.5 \times \phi_{ij} + 0.1 \times 50 \times (e_{ij})^{1/2} \]
  for block j.
- Change in scoring rule, had lower royalty and higher investment.
- By August 2019, 2 of 11 oil projects from Round 1.3 had moved to a development stage. The government wanted to stimulate participation with the high royalties bid at this auction.

First order conditions from the bidder problem

\[ \frac{\partial E}{\partial \phi_{ij}} = \frac{G(\phi_{ij}, e_{ij})}{\phi_{ij}} - \frac{1}{\phi_{ij}}\frac{\partial G}{\partial e_{ij}} + \frac{\partial \phi_{ij}}{\partial e_{ij}} \]

\[ \frac{\partial E}{\partial e_{ij}} = G(\phi_{ij}, e_{ij}) - I(\gamma_{ij}, \epsilon) \]

Figure 1: Timeline projects. Round 1.3

- Small onshore fields in Mexico, previously operated by PEMEX, open to small Mexican firms.
- In 2015 (Round 2.2 and 2.3), the government changed the formula and set a ceiling for the additional royalty.
- The government wanted to stimulate participation from local firms and avoid large (and potentially inefficient) investment obligations, which motivated the high weight on royalties.
- Auctions on contingent payments (such as royalties) can lead to aggressive bidding, since the project can be treated as a financial option (Kong, Perrigne, Vuong, 2019; Tufano, 1996)

Data

- Model and Structural Estimation
  - Small onshore fields in Mexico, previously operated by PEMEX, open to small Mexican firms.
  - In the evaluation stage, companies receive a shock \( e_{ij} \) (which is not known at the auction stage), that reflects infrastructure and geology conditions, for example, and decide whether to move to a development stage.
  - Model estimates the distribution of \( c_{ij}, \gamma_{ij} \) and \( e_{ij} \)
  - Change in scoring rule has an impact on royalties.

\[ \pi_{ij} = G(\phi_{ij}, e_{ij}) - I(\gamma_{ij}, \epsilon) \]

\[ \epsilon \sim \text{Univariate Gaussian} \]

Results

- Auction stage: companies learn the operating \( c_{ij} \) and investment cost \( \gamma_{ij} \).
- Under the new rules (ceiling on the additional royalty and the new scoring rule, the percentage of execution increases to 70%)
- Firms with lowest operating cost win between 20% and 30% of the blocks.
- Simulated government revenues and firm profits under the new rules are more than twice those under the old scoring rule.

Findings suggest limitations to the use of royalties or contingent payments as bid dimensions, but also understand better how expectations are formed for bidders. Other energy projects with uncertainty, where bids could be aggressive (low electricity prices, for example), also potentially face shocks that delay project execution.