Public procurement in collusive institutional settings: evidence from Russian gasoline market

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Summary

- Public procurement framework, reverse auctions
- Each procurer has discretion in setting the reserve price, R, i.e., the maximum price he/she is willing to pay
- Model: reserve price manipulation (underpricing, R_u) to set/ maintain a *(tacit) collusive agreement* between the procurer and a favored seller
- Empirical Analysis: Russian procurement data (gasoline)
- *Very preliminary results!!!*

Literature

1. **Corrupt reserve price**
   - Manipulated reserve prices: higher R leading to i) higher winning price; ii) private benefit for procurer *(Atmaca, Schoors and Podkolzina, 2020).*
2. **Dectection of corruption (and collusion)**
   - Tunneling around elections in exchange for procurement contracts (*Mironov - Zhuravskaya, AEJep, 2016*).
   - Comparing value of public infrastructure with procurement costs (*Golden - Picci, Economics and Politics, 2005*).
   - Statistical test to detect coordinated entry and bidding choice (*Conley - Decarolis, AEJmicro, 2015*).
   - Collusion from competition, when collusion not directly observed (*Bajari - Ye, REStat, 2003, Aryal - Gabrielli, IJIO, 2013*).
3. **Manipulations of the awarding mechanism.**
   - ex-ante manipulation, in SRAs (*Camboni, Valbonesi, Padova Wp 2018)*
   - ex-post manipulation (*Prabal Goswami and Wettstein, IJIO, 2016; Burguet, AEJmicro2017; Huang - Xia, EER, 2019).*

Our simple setting

- A local public procurer P adopts auctions for repeated (and regular) purchases of an item (i.e. sugar, gasoline, etc.)
- Market structure, in each local market:
  - n local small suppliers, $s_1 ... s_n$
  - (at least) one efficient supplier I, i.e. the incumbent
- On average, I is more efficient (i.e. lower marginal costs) than $s_1 ... s_n$
- Having observed previous tenders, by $s_1 ... s_n$, P has a precise information about each local supplier's marginal costs, I has not, or not so precise

Underpricing in a nuthsell

- Underpricing of reserve price $\rightarrow$ P's manipulation, i.e. P sets a R_u which is lower than the average local price.

- Ratio:
  1. P sets a reserve price R_u to signal I the marginal cost of the local most efficient small supplier s_e.
  2. Then, I will bid m, with $m < \min\left\{b^I, R_u\right\}$, and where $b^I = b\left(C(I)\right)$ is the "spontaneous" optimal bid by the incumbent

- in presence of R_u, the I's probability of victory is higher than the case without manipulation;
- such procurer-seller interaction could be repeated in the auctions which will follow, leading to a flow of collusive gains for both parts.

The model - Supply side

- Supply market
  1. θ is each bidder's private cost (private information)
  2. incumbent: type $\theta^I \sim F^I\left(\theta^I\right)$ s.t. $\theta^I \in \left[\underline{\theta}^I, \overline{\theta}^I\right]$.
  3. n "smaller" and local bidders of type $\theta_i \sim F\left(\theta\right)$ s.t. $\theta_i \in \left[\underline{\theta}, \overline{\theta}\right]$
  4. $\underline{\theta}^I < \underline{\theta} < \overline{\theta}^I < \overline{\theta}$

The model - Supply side

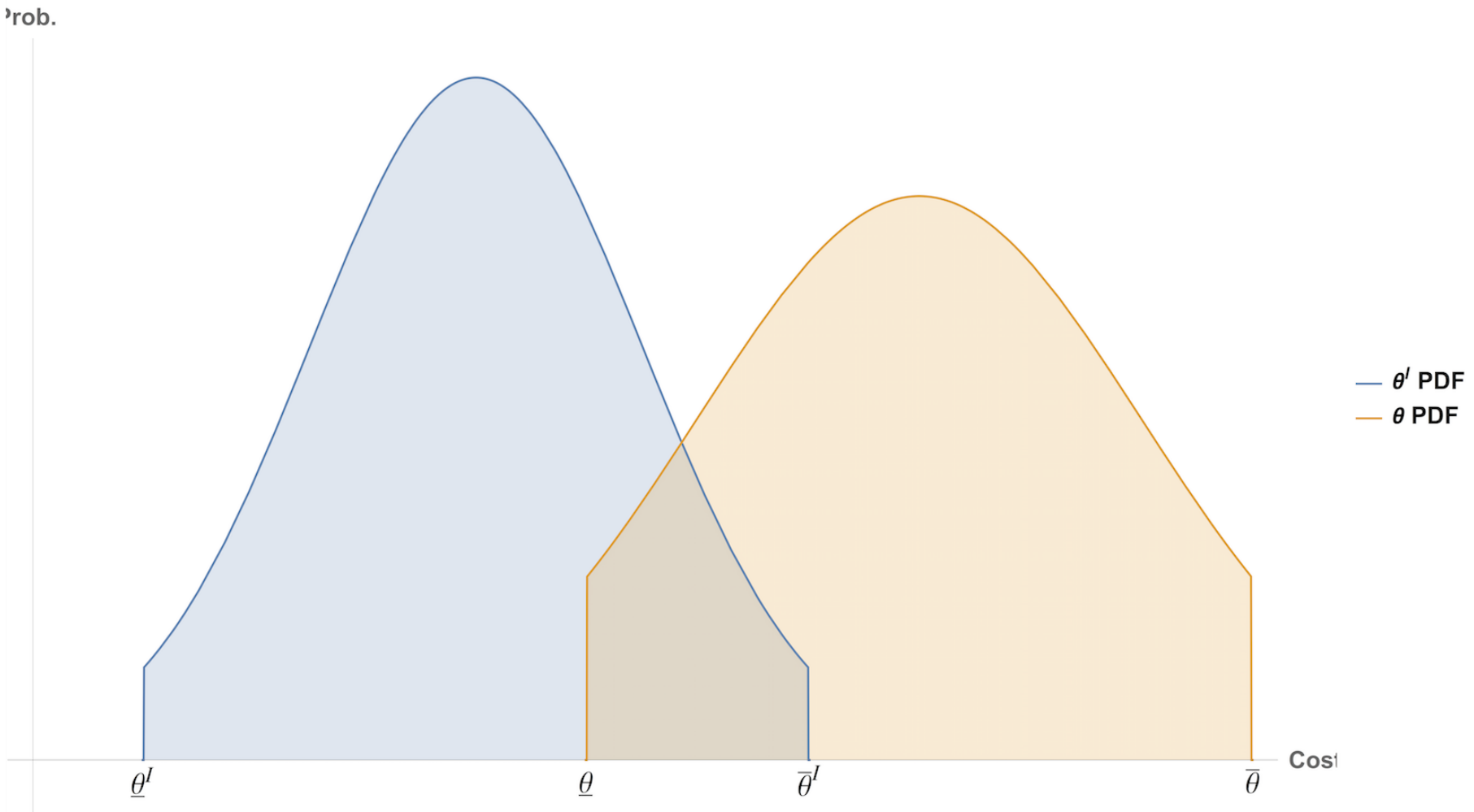

Figure: the cost assumptions of type θ^I and type θ_i

The model - Demand side

P receives a signal about the local suppliers' costs, s.t. $\widetilde{\theta}_i^B = \theta_i + \varepsilon$, with $\varepsilon \sim N(0, \sigma)$

P adopts a FPA auction, and sets a reserve price (R or R_u).

Underpricing. Suppose $\sigma = 0$. Then, P sets $R_u = min\left\{\widetilde{\theta}_i^B\right\} = min\{\theta_i\}$.
Thus, either:

- If $\theta^I > R_u$, a small bidder i wins, and buyer extracts all the surplus;
- If $\theta^I < R_u$, then I bids $m < R_u$, I wins and gets a weakly positive profit $\pi^I(m) = m - \theta^I$

RQ: In the underpricing setting, is m an equilibrium of an infinite horizon game?

The model - no underpricing

Standard FPA with asymmetric auction solved for a setting with two bidders, (Kaplan and Zamir, 2012), i.e. outside option.

- I's profits: $E[\pi^I] = \left(b\left(\theta^I\right) - \theta^I\right) \cdot \Pr\left(\theta^I < min\left\{\theta_i\right\}\right)$
- P's utility:
  1. $V - b\left(\theta^I\right)$, if $\theta^I < min\left\{\theta_i\right\}$
  2. $V - min\left\{\theta_i\right\}$, if $\theta^I > min\left\{\theta_i\right\}$

Equilibrium, underpricing setting

1. Is the Buyer better off?
   - YES, if $m < b\left(\theta^I\right)$
2. Is the winner (i.e. Incumbent) better off?
   - YES, conditional on bid m.
   - In equilibrium: $m < b\left(\theta^I\right)$, and $\Pr\left(\theta^I < min\left\{\theta_i\right\}\right) = 1$
   - Intuitively: I has a richer information set and therefore a higher likelihood of winning the auction (even getting lower profit in each auction, but collusive agreement sustains repeated winnings).
3. Incentive compatibility constraint
   - In a single shot game, I's best response in underpricing is to place a bid equal to R_u.
   - In a repeated game, assume δ is bidder's discount rate of the future. Then, ICC is: $\left(m - \theta^I\right)\frac{\delta}{1-\delta} > \left(R_u - \theta^I\right) + \frac{\delta^2}{1-\delta} \cdot E\left[\pi^I\right]$

Testable predictions

to highlight if evidence in our dataset can be explained with the above underpricing strategy:

1. *Stable pair*:
   R_u is a strategy employed by a stable (P, I) pair.

2. *Effect on competition*:
   in auctions with R_u, less than average number of bidders, and higher probability of having just one bidder (the Incumbent).

3. *Effect on auctions' outcome*:
   in auctions with R_u, the winning price is on average lower than the market price.

Public Procurement in Russia

- Unified procurement system (Federal Law No.94 of 21/07/2005)
- Federal, provincial and municipal levels
- In 2011 e-auctions introduced. Sealed bid auctions can be used only for $R < 500,000 RUB$
- In 2014 replaced by Federal Law No.44
- R : Tender notice/documentation contains information on level and rationale.

Our data

- Russian data on gasoline, varying octane rating (a largerly homogeneous good)
- purchases through gas stations
- No outsourcing
- Lowest price as award criterion (FPA)
- 83 Russian regions, for the period 2011 – 2013
- 81,750 auctions (72% sealed bid and 28% e-auctions)
- Monthly regional market prices of gasoline types (Rosstat)

Underpricing as a stable pair

$$r_{ijt} = X_{ijt}\beta + \gamma_s year_{ijt} + \mu_{ij} + \varepsilon_{ijt} \tag{1}$$

$$\mu_i = \frac{1}{k}\sum_{j=1}^{k} \mu_{ij} \tag{2}$$

Underpricing if

$$\mu_{ij} - \mu_i < 0 \tag{3}$$

r_{ijt} reserve price per liter of gasoline
X_{ijt} market price, volume and govt level of procurer
$year_{ijt}$ year effects
μ_{ij} procurer-seller fixed effects on reserve price

i procurer, j seller, t time

Empirical definition of Underpricing

Definition

A Procurer P and a Seller I adopts an underpricing strategy iff reserve price set by P in contracts won by I is systematically lower than the average reserve price for auctions of similar characteristics. *Underpricing* $= 1$ *if* $\mu_{ij} - \mu_i < 0$, and 0 *otherwise*.

Underpricing	*Observations*		*Pairs* (P, I)	
	N	%	*N*	%
0	44729	78	9419	87.2
1	12613	22	1384	12.8
	57343	100	10803	100

Effect on Competition

	N° *bidders*		$Prob(n = 1)$	
	(1)	(2)	(3)	(4)
Underpricing pair	-0.0289***	-0.031***	0.103***	0.100***
E-auction	-0.419***	-0.420***	2.402***	2.400***
Underpricing pair * e-auction		0.007		0.009
Log(volume)	0.038***	0.038***	-0.176***	-0.176***
Reserve price	0.004***	0.004***	-0.029***	-0.029***
Sorting	0.017**	0.017**	-0.148***	-0.148***
Voluntary e-auction	0.019**	0.018**	-0.161***	-0.161***
Minimal application period	0.007	0.007	-0.065*	-0.065*
Constant	-0.235***	-0.235***	2.930***	2.930***
Region FE	x	x	x	x
Year FE	x	x	x	x
Obs.	50767	50767	50767	50767

Effect on auction price

	(1)	(2)
Underpricing pair	-0.009***	-0.012***
E-auction	0.003***	0.056***
Underpricing pair * E-auction		-0.007**
Log(volume)	0.0001	0.0003
Reserve price	0.016***	0.016***
Sorting to avoid e-auction	0.008***	0.007***
Voluntary e-auction	0.002***	0.001***
N° bidders	-0.021***	-0.014***
Underpricing pair * N° bidders		0.003***
E-auction * N° bidders		-0.037***
Underpricing pair * N° bidders * E-auction		0.001
Constant	0.455***	0.466***
Region & year FE	x	x
Obs.	49836	49836

probability of winning, underpricing pair

	(1)	(2)	(3)	(4)
Underpricing pair	0.275***	0.386***	0.224***	0.452***
E-auction	-0.196***	-0.065	-0.267***	-0.131**
N° bidders	-1.312***	-1.372***	-1.461***	-1.493***
Sorting to avoid e-auction	0.174***	0.109*	0.162***	0.098
Voluntary e-auction	-0.069	0.051	-0.074	0.050
Constant	4.098***		4.298***	
Region FE	x	x	x	x
Year FE	x		x	
Procurer FE		x		x
Obs.	68764	52645	52929	40087
n° of different procurers		3220		2647

Sample is restricted to firms that have won at least 1 contract of given procurers. Column 3 is restricted to firms that have won at least 45 contracts. The last column contains firms that have at least 1 corrupt relation.

Future Directions

- Suppose I pays a bribe to P in exchange of the information about marginal cost of the most efficient local supplier
- Then I will play R
- If Underpricing AND $b\left(\theta^{I}\right) = R$, then a bribe is required to justify the result of our model/empirical analysis.
- If Underpricing AND $b\left(\theta^{I}\right) < R$, then underpricing may be used to maintain a long term relation.

Winning rebate in underpricing pairs

Table: Winning rebate if underpricing

number of auctions with rebate =0 (bribe required)	7,283
number of auctions with rebate >0 (no bribe required)	5,385

Note: Sample restricted to underpricing pairs.

Conclusions

- A strategy of R_u can be used to maintain a long-term relation between a procurer and a favored bidder (i.e. Incumbent)
- This strategy leads to the reduction of competition and blocks entry of new/small firms in public procurement
- This form of favoritism may be implicit and does not require a bribe
- Our preliminary empirical analysis suggests that this strategy of exists.
- Neither model, nor data allow to disentangle good and bad relations: relational contract (+) or favoritism (-)?

Comments, questions, doubts, suggestions ...

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THANK YOU!!!