

# Public Procurement and Corrupt Reserve Prices

Sümeyra Atmaca<sup>1</sup>, Koen Schoors<sup>1</sup> and Elena Podkolzina<sup>2</sup>

<sup>1</sup>Ghent University

<sup>2</sup>Higher School of Economics

11/5/2017

# Introduction

- ▶ Public procurement 10–30% of GDP
  - ▶ Corruption 10–25% of contract value
- waste and misallocation of public funds (TI)

## **Corrupt reserve prices**

Procurer has discretion over setting the reserve price  $R$

1.  $R$  too high, capture of public funds
2.  $R$  too low, limiting competition

## **Electronic auction**

Transparency and competition

# Literature on corruption in public procurement

- ▶ Detection of corruption
  - Tunneling around elections in exchange for procurement contracts (Mironov and Zhuravskaya 2016)
  - Comparing value of public infrastructure with procurement costs (Golden and Picci 2005)
- ▶ Implications of corruption
  - Less competitive auction procedures (Auriol 2016), welfare loss (Auriol 2006), inflated contract prices (Compte et al. 2005)
- ▶ E-auction
  - No price decrease but quality improvements (Lewis-Faupel et al. 2014), price reductions and less small bidders (Athey et al. 2011)

## Purpose

1. Detection of corruption (= reserve price manipulation)
2. Role of e-auctions in transmission of corrupt reserve prices to contract prices

# Data

Russian public procurement (Federal Law n.94 of 21/07/2005)

- ▶ Unified procurement system
- ▶ Federal, provincial and municipal level

2011

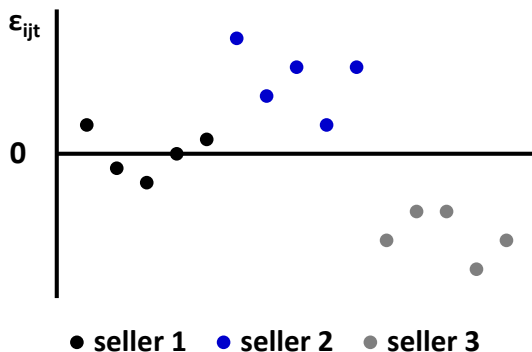
- ▶ Centralized online platform
- ▶ E-auctions introduced; required if
  1. Contract value > 500,000 RUB
  2. Procurement value > 500,000 RUB per quarter and procurer
- ▶ Reserve price published
- ▶ Lowest price as award criterion

# Data

- ▶ 67,114 auctions
  1. Sealed bid auctions 65%
  2. E-auctions 35%
- ▶ Homogeneous good gasoline, varying octane rating
  - ▶ Gasoline A-76 – A-80
  - ▶ Gasoline AI-92
  - ▶ Gasoline AI-95
  - ▶ Diesel
  - ▶ Other types
- ▶ 21 Russian regions
- ▶ Period 2011 – 2014

# Methodology

**Example** 1 procurer (public official) and 3 sellers (firms)



# Methodology

Estimate reserve price per liter of gasoline  $r_{ijt}$

$$r_{ijt} = \mathbf{X}_{ijt}\beta + \sum \theta_s \text{region}_{ijt} + \sum \gamma_s \text{year}_{ijt} + \alpha_i + \epsilon_{ijt}$$

$\mathbf{X}_{ijt}$	contract and procurer characteristics: market price, volume, govt level of procurer
$\sum \text{region}_{ijt}$	region fixed effects
$\sum \text{year}_{ijt}$	year fixed effects
$\alpha_i$	procurer fixed effects absorbs procurer unobservables such as inefficiency

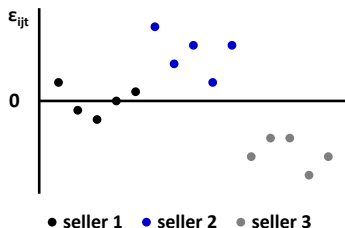
i procurer, j bidding firm, t time



# Methodology

Within procurer variation

1. **Non-corrupt**  $\equiv$  identity of seller irrelevant for  $r_{ijt}$
2. **Corrupt**  $\equiv$  systemic deviation in  $\epsilon_{ijt}$  on procurer seller level



## Procedure

1. Estimate  $r_{ijt} = \mathbf{X}_{ijt}\beta + \sum \theta_s \text{region}_{ijt} + \sum \gamma_s \text{year}_{ijt} + \alpha_i + \epsilon_{ijt}$
2. Test and group pairs
  - ▶  $E[\epsilon_{ijt} | \text{procurer}=i, \text{seller}=j] = 0$
  - ▶  $E[\epsilon_{ijt} | \text{procurer}=i, \text{seller}=j] > 0$
  - ▶  $E[\epsilon_{ijt} | \text{procurer}=i, \text{seller}=j] < 0$

# Results

$$\text{Estimate } r_{ijt} = \mathbf{X}_{ijt}\beta + \sum \theta_s \text{ region}_{ijt} + \sum \gamma_s \text{ year}_{ijt} + \alpha_i + \epsilon_{ijt}$$

	r
market price	0.914*** (0.00880)
federal	0.710* (0.414)
municipal	0.239*** (0.0855)
Involume	-0.0947*** (0.0175)
Constant	6.499*** (0.485)
Procurer FE	Yes
Region FE	Yes
Year FE	Yes
Observations	36,924
R-squared	0.817

# Results

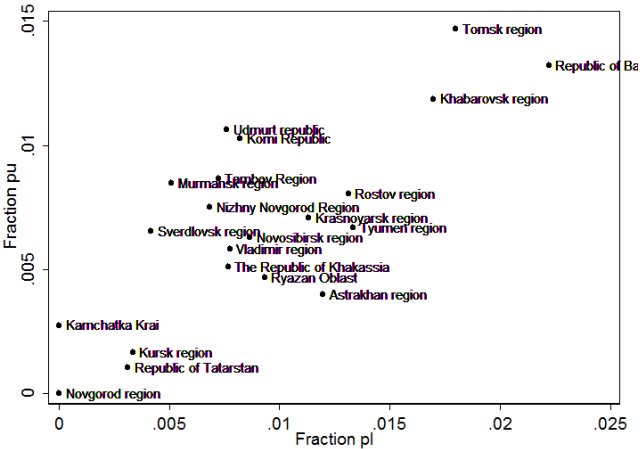
2 Test  $E[\epsilon_{ijt} | \text{procurer}=i, \text{seller}=j]=0$

	N	overpricing		underpricing	
		N	%	N	%
Auctions	67,114	1,132	.03	1,468	.04
Procurer seller couples	15,300	148		198	
Procurers	7,727	133		180	
Sellers	2,075	89		123	

# Results

$$\text{fraction overpricing}_{\text{region}} = \frac{\text{number of corrupt couples overpricing}_{\text{region}}}{\text{number of couples}_{\text{region}}}$$

$$\text{fraction underpricing}_{\text{region}} = \frac{\text{number of corrupt couples underpricing}_{\text{region}}}{\text{number of couples}_{\text{region}}}$$



# Evaluation

## Correlation with corruption indices

	fraction of couples	
	overpricing	underpricing
willingness to bribe given recent exposure	.12	.32
consumer assessment of everyday corruption	.24	.51
bribery exposed in regional media 2011	.13	.28
bribery exposed in regional media 2012	-.01	.01

# Evaluation

## Probability of winning the auction

Manipulation of reserve prices in order to tunnel money

$$P(\text{win}_{ijt}) = \beta_0 \text{overpricing}_{ij} + \beta_1 \text{underpricing}_{ij} + \beta_2 \text{competition}_{ijt} + \beta_3 \text{e auction}_{ijt} \\ + \sum \theta_s \text{region}_{ijt} + \sum \gamma_s \text{year}_{ijt} + \epsilon_{ijt}$$

overpricing<sub>ij</sub>

corruptly overpricing

underpricing<sub>ij</sub>

corruptly underpricing

competition<sub>ijt</sub>

number of bidders

e auction<sub>ijt</sub>

=1 if e auction, =0 if sealed bid auction

$\sum$  region<sub>ijt</sub>

region fixed effects

$\sum$  year<sub>ijt</sub>

year fixed effects

# Evaluation

## Probability of winning the auction

	(1) win	(2) win	(3) win
overpricing	1.591*** (0.0755)	1.412*** (0.0868)	1.489*** (0.100)
underpricing	1.625*** (0.0677)	1.288*** (0.0790)	1.378*** (0.0902)
competition		-1.771*** (0.0183)	-1.764*** (0.0213)
e auction			0.0911** (0.0321)
Constant	0.0744*** (0.00832)	2.548*** (0.106)	2.588*** (0.124)
Region FE	No	Yes	Yes
Year FE	No	Yes	Yes
pseudo $R^2$	0.016	0.230	0.224
$N$	60894	60894	49529



# Transmission to contract price

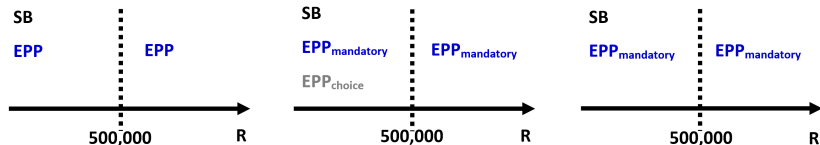
## Endogeneity of e-auction? (1)

Role of e-auctions in transmission corrupt reserve prices to contract prices

E-auctions obligatory

1. Contract value  $> 500,000$  RUB
2. Procurement value  $> 500,000$  RUB per quarter and procurer

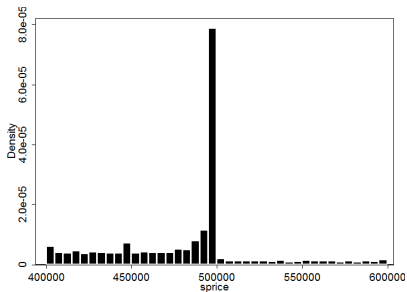
→ identification strategy: restrict sample to mandatory e-auctions



# Transmission to contract price

## Endogeneity of e-auction? (2)

**Manipulation of running variable** = sorting below threshold of 500,000 RUB to avoid e-auctions and use sealed bid auctions



→ identification strategy: drop observations just below threshold

# Transmission to contract price

## Manipulation of reserve price

Excess number of contracts below threshold (Pertold and Palguta, 2015)

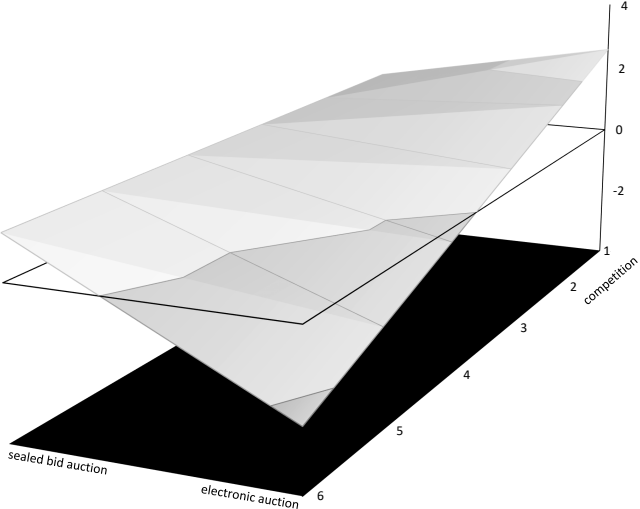
1. Actual number of contracts below threshold
2. Anticipated number of contracts below threshold
3.  $\frac{\text{actual} - \text{anticipated}}{\text{anticipated}}$ 
  - ▶ subsample without corrupt couples
  - ▶ **subsample with corrupt couples overpricing**
  - ▶ subsample with corrupt couples underpricing

# Transmission to contract price

$$p_{ijt} = f(\hat{r}_{ijt}, \text{overpricing}_{ij}, \text{underpricing}_{ij}, \text{competition}_{ijt}, e \text{ auction}_{ijt}, \sum \text{region}_{ijt}, \sum \text{year}_{ijt})$$

$p_{ijt}$	contract price per liter of gasoline
$\hat{r}_{ijt}$	predicted reserve price per liter of gasoline
$\text{overpricing}_{ij}$	corruptly overpricing
$\text{underpricing}_{ij}$	corruptly underpricing
$\text{competition}_{ijt}$	number of bidders
$e \text{ auction}_{ijt}$	=1 if e auction, =0 if sealed bid auction
$\sum \text{region}_{ijt}$	region fixed effects
$\sum \text{year}_{ijt}$	year fixed effects

Figure 1: Cost of corruption, partial effect of overpricing on contract price



# Conclusion

Methodology for the detection of corruption in public procurement

- ▶ Manipulation of reserve prices
- ▶ Indicators correlate with corruption indices
- ▶ Corruption increases probability of winning the auction

Transmission to contract price

- ▶ Sorting to avoid e-auction especially by couples that inflate reserve prices
- ▶ Competition is effective in reducing the impact of corruption on the contract price
- ▶ E-auctions with sufficient competition can even offset the effect of corruption and lower procurement costs