

RESERVE PRICE ABOVE THE MARKET LEVEL DOES NOT ATTRACT MORE PARTICIPANTS TO PUBLIC PROCUREMENT AUCTIONS.

EVIDENCE FROM UKRAINE¹

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Based on the analysis of more than two thousand auctions conducted using electronic public procurement system ProZorro, we have shown that overestimation of the reserve price negatively affects the auction results: worsens the result of the zero round, does not improve competition during the auction and does not increase the number of participants.

1. Introduction

Since August 2016 majority of public procurements in Ukraine are conducted via electronic public procurement system ProZorro. When a ministry, state enterprise, school or any other public institution wants to buy something using the ProZorro system, it has to announce the reserve price of the procurement, that is, the maximum amount of money for which it is ready to purchase the good or service. Reserve price is a starting point for the online auction.

Currently, there is no officially approved methodology for calculating the reserve price of goods and services. At the same time, procurers are often criticized by state auditors and press for the high reserve prices. For example, the plans of Ukrainian railway monopoly Ukrzaliznytsia to purchase toilet cabins with the reserve price of USD 37 thou per unit (average price for a one-room apartment in the Ukrainian capital) were widely [ridiculed in the press](#). Obviously, if the reserve price is overestimated and the competition during the auction is weak, the resulting price will be above the market level. As a result, the state will suffer losses. Taking into account that public procurements accounted for 6.5% of Ukrainian GDP in 2016, this is a severe problem.

However, procurers have their reasons for putting the reserve price above the market level. In 2017, 3 out of 10 auctions were canceled because there were not enough participants. If we consider only "large" auctions², the statistics is even worse – 4.5 out of 10 auctions did not have at least two contenders and were canceled. In such environment, procurers are inclined to overestimate the price to attract more participants. If this plan works, the higher number of participants leads to a more intense competition during the auction and lower resulting price. According to this logic, the state is better off.

Existing literature does not provide a clear answer, whether it is harmful to put the reserve price above the market level. Moreover, Ukrainian public procurement auction is a "hybrid auction," its

¹ The Ukrainian version of the paper was published at analytical platform VoxUkraine in June 2017: [link](#)

² "Above threshold" auctions according to the Public Procurement Law definition

properties are yet to be explored by game theorists. Still, Myerson (1981) and Riley and Samuelson (1981) have shown that in the case of first-price sealed-bid auction and participants with independent private values it is profitable for the procurer to put the reserve price below the market level, thus lowering the number of participants but intensifying the competition between remaining ones. On the other hand, Levin and Smith (1996) have shown that if values that participants ascribe to procured good or service are interdependent, it is better to put such reserve price that all willing participants can join the auction. We believe that the interdependent values case is more suitable for the Ukrainian public procurement market. A significant share of procured goods is imported (thus their values depend on the exchange rate), also a lot of auction participants are intermediaries selling goods bought from the same producer.

This paper addresses the question of how reserve price affects the result of Ukrainian public procurement auction. Particularly, we considered the effect of the reserve price on:

- initial offers of the participants,
- behavior of participants during a dynamic phase of the auction,
- number of the auction participants.

To explore these relationships, we chose three widely traded homogeneous goods: natural gas (677 auctions in the sample), office paper A4 (1011 auctions) and chicken eggs (613 auctions). The characteristics of these goods do not have a significant variation. Thus the results of different auctions can be compared with each other.

The econometric analysis showed that increase in the reserve price on average prompts companies to submit higher bids in the zero round, but does not improve competition or number of participants. Using our results, we proposed a methodology of determining reserve price based on the average lowest bid in the zero round of comparable auctions. This method is accessible to all public institutions, including those that do not employ professional procurers.

2. Methodology

2.1 Ukrainian public procurement auction

The tender is initiated, when procurer (for example public enterprise) registers an announcement in the electronic procurement system. The announcement includes the description of all requirements and a reserve price of the contract. Before the deadline set by the system, auction participants download all the necessary documents and their initial offers into the system. Initial offer can be any value below or equal to the reserve price.

In the time and date determined by the system, all companies that submitted initial offers participate in the online auction. The initial offers of all companies are revealed and company with the highest initial offer makes the next bid. Company with the lowest initial offer moves last; it can observe the

bids of all other companies. This procedure is repeated three times. The company that offers the lowest bid in the third round wins the auction.

Thus Ukrainian procurement auction consists of four rounds: "zero" round when companies do not know the number of participants or their bids (a sealed-bid auction) followed by three rounds of dynamic "English" auction when companies know the number of participants and all the previous bids.

2.2 Methodology

To test how the reserve price affects the initial offer of the companies we estimated the following regression:

$$\ln(\min R_0) = \beta_0 + \beta_1 * \ln(\text{reserve price}) + \beta_2 * \# \text{ of bidders} + \beta_3 * \text{Seasonality} + \beta_4 * \text{Procedure type},$$

Where $\min R_0$ is a "zero-round price" - lowest bid of the zero round divided by the quantity of procured good³.

We estimated the impact of the reserve price on the competition during the dynamic phase of the auction with the following regression:

$$\frac{\min R_3}{\min R_0} = \beta_0 + \beta_1 * \ln(\text{reserve price}) + \beta_2 * \ln(\# \text{ of bidders}) + \beta_3 * \text{Seasonality} + \beta_4 * \text{Procedure type}$$

Where $\frac{\min R_3}{\min R_0}$ is the ratio of the zero-round and third-round prices. It shows how much price of the procured goods and services decreased during the dynamic phase due to the competition between bidders.

Lastly, we modeled the impact of the reserve price on the number of participants:

$$\begin{aligned} \# \text{ of bidders} &= \\ &= \beta_0 + \beta_1 * \ln(\text{reserve price}) + \beta_2 * \ln(\text{procurement size}) + \beta_3 * \text{Seasonality} + \beta_4 * \text{Procedure type} \end{aligned}$$

³ The more detailed description of the methodology can be found in the full version of the paper (in Ukrainian): [link](#)

3. Results

3.1 Zero round of the auction

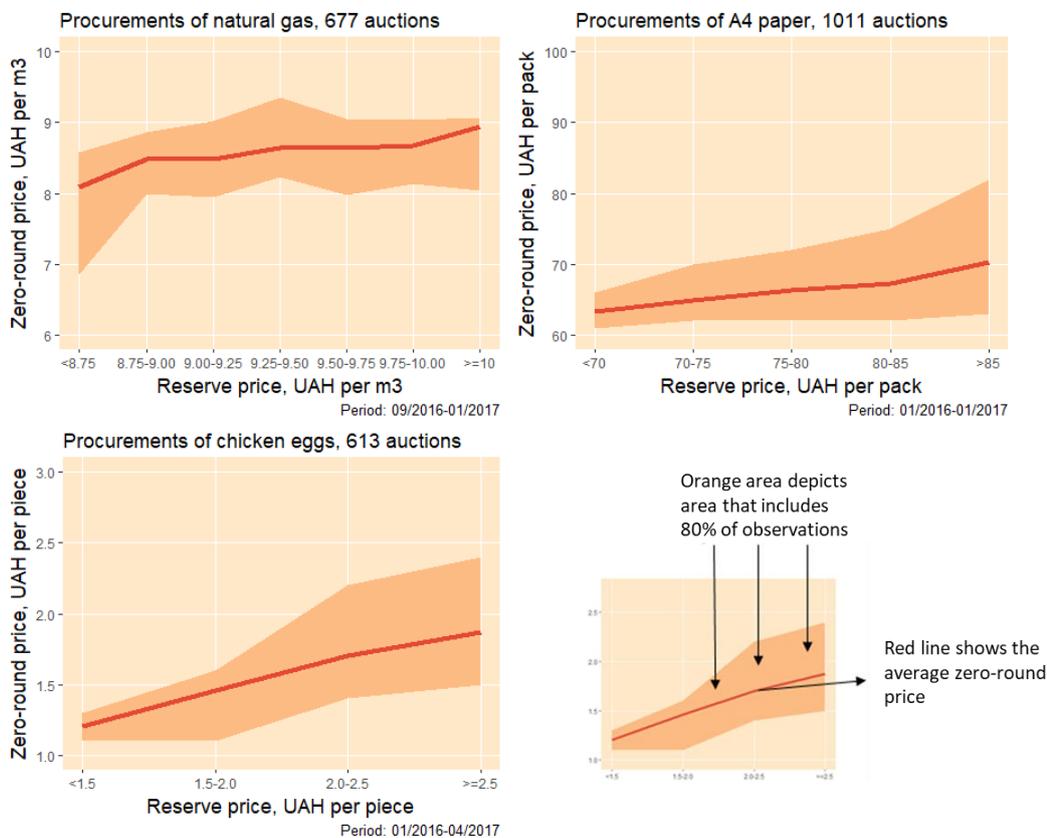
In the zero round, a participant can offer any bid in the range from the value of estimated costs to the reserve price. Companies are interested in putting the maximum available price to increase income. Therefore, it can be assumed that an increase in the reserve price will have a substantial positive impact on the zero-round price.

Data analysis confirmed this hypothesis:

- 1) **Natural gas:** an increase in the reserve price by 1% increases, on average, the zero-round price by 0.3%,
- 2) **Office paper A4:** an increase in the reserve price by 1% increases, on average, the zero-round price by 0.27%,
- 3) **Chicken eggs:** an increase in the reserve price by 1% increases, on average, the zero-round price by 0.5%.

This increase is explained by both non-price and price factors. Although we selected homogeneous products, procurements still differ in quality of goods, payment terms, and delivery method. Though we do not know which share of the estimated increase is explained by non-price factors, it can be claimed that an increase in the reserve price does not improve the result of the zero round.

Figure 1. Impact of the reserve price on the lowest offer of a zero round (zero-round price)



Source: Own calculations based on bipro.prozorro.org data

3.2 Competition during the dynamic phase

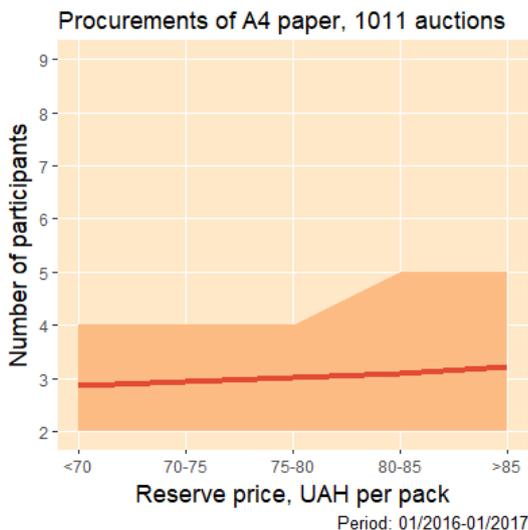
If the market is highly competitive, the increase in the zero-round price (due to an increase in the reserve price) will be compensated by the increased competition among suppliers during the dynamic phase of the auction. As a result, the price will drop to the average market level.

Unfortunately, this hypothesis is not supported by data. There is no statistically significant effect of the reserve price on the competition during the dynamic phase of the auction in the markets of natural gas and chicken eggs. In the A4 paper market, the impact of the reserve price on competition is statistically significant but surprisingly weak - an increase in the reserve price by 1% increases the savings of the third round compared with the zero round by 0.05 p.p.

3.3 Number of participants

The last hypothesis we tested was the positive impact of the reserve price on the number of participants. Contrary to our expectations, the increase in the reserve price does not lead to an increase in the number of participants in any of the three markets. For example, the impact of the reserve price on the number of participants in the A4 paper market looks like this:

Figure 2. Influence of reserve price on the number of auction participants



Source: Own calculations based on bipro.prozorro.org data

Regardless of the reserve price, the auction on A4 paper purchases is visited on average by 3 participants. Similarly, the reserve price does not affect the number of participants in the markets of natural gas and chicken eggs.

4. Conclusions and recommendations

Our calculations have shown that the overestimation of the reserve price worsens the auction results in the markets of natural gas, A4 paper, and chicken eggs (see Table 1). That is, state auditors and public activists are rightly criticizing procurers who set up exorbitant reserve prices. At the same time, there remains an open issue how to calculate an adequate reserve price.

Table 1. Summary of the results

		Natural gas	A4 Paper	Chicken eggs
If reserve price increases by 1%	Average zero-round price	increases by 0.3%	increases by 0.3%	increases by 0.5%
	Average dynamic phase savings	Does not change	increases by 0,05 p.p.	Does not change
	Average number of participants	Does not change	Does not change	Does not change

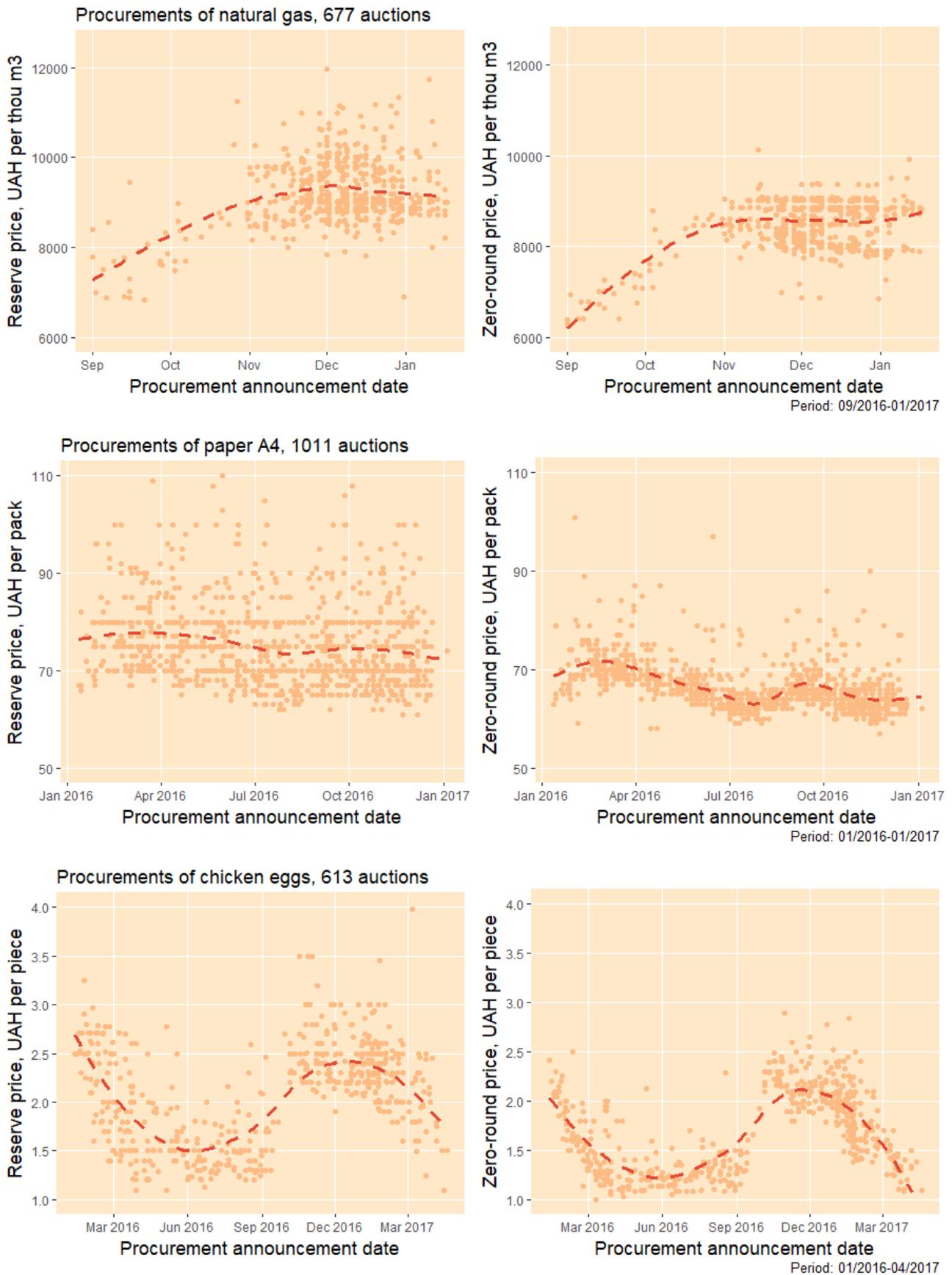
Source: Own calculations based on bipro.prozorro.org data

To bring the reserve price closer to the average market level, the procurer can improve the methods that are already in use. For example, if a company uses the indexation method⁴, more precise index can be developed, taking into account changes in the prices of each component of the production cost. Alternatively, the data that has recently become available through the ProZorro system - zero-round prices from similar auctions held in the past may also be applied to estimating the reserve price.

The variation of the zero-round prices is much lower than the variation of the reserve prices (see Figure 3). In the natural gas market, the standard deviation of the zero-round price is 20% less than the standard deviation of the reserve price. In the A4 paper and chicken eggs markets, the standard deviation of the zero-round price is lower than the standard deviation of the reserve price by 30% and 16%, respectively. Consequently, the zero-round price is much less subjective and closer to the "market" price than the reserve price. Therefore, the average zero-round price of previous similar procurements is a good benchmark for determining the reserve price.

⁴ That is, the reserve price is calculated with the formula: Reserve price = Price of the previous similar procurement * Adjustment index

Figure 3. Change of the average reserve price and the average zero-round price over time



Source: Own calculations based on bipro.prozorro.org data

References

Levin, D., and J. Smith (1996): "Optimal Reservation Prices in Auctions, *Economic Journal*, 106(438), 1271–1283.

Myerson, R. (1981): "Optimal Auction Design," *Mathematics of Operations Research*, 6(1), 58–73.

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Data and R code

https://github.com/oleksastepaniuk/reserve_price