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Client's Expectations vs Contractor's Pricing. Fair Prices or Bid Rigging

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Abstract. *The road construction sector is a specific part of the construction industry. It happens very rarely that a section of a road is financed also by a private entity. The other factor distinguishing it – is a significant value of road construction contracts. The Client's estimates of the value of the prospective contracts have to be based on the market prices in case of public procurement. However, this market is dominated by public orders. There is no comparison to the value of works ordered on the private part of the construction market, which is found more efficient by economists. Widely applied the "design and build" type of orders make the comparisons of the unit prices more difficult. The huge differences between the Client's estimates and the winning prices in the road construction public tender procedures are the bases of speculations about the fairness of the procedures. These differences can have a varied origin. There are several reasons for them e.g. varied contractor's risk, the size of the structure, type of order, the dynamics of the road construction market. Nevertheless, fraudulent practices can make the winning price much higher than the Client's estimate. The article is an attempt to finding the limit i.e. what part of these differences can be explained by fair, market reasons. If the found limit is exceeded, it should make the Client carefully consider the offers placed. The analysis is based on collected data concerning almost 400 tender procedures for the sections of roads in Poland in 2014-2017.*

Keywords: *Bid Rigging, Collusion, Road Construction Market, Bid Price, Client's Estimation.*

1 Introduction

Exceptionally high values of the construction contracts are observed in the road construction branch in Poland, Rynekinfrastruktury.pl (2019). Public procurements in the construction industry are specific. The Code (2004) enforced preparing a client's estimation of the contract value, before the announcement of a tender to enable a client to decide which type of tender procedure should be applied (as it is price dependent). Based on the ordinance (2004), that estimation should be based on market prices of construction works. The same base should be used for the "design and build" type of orders. The amount estimated by a client is announced together with disclosing the contractors' offers – not before. The extreme relation of the winner's price to the client's estimation (exceptionally low or high) usually becomes a base for suspicions and gossips about forbidden practices of offerors (dumping prices or collusion, bid rigging). The process of choosing the most attractive offer may lead to refusing the offer with exceptionally low price, not allowing – in the client's opinion – for executing all works on the subject, in the planned period. There is no such strong client's right for the case of exceptionally high prices given by all offerors. When the client's budget is short, insufficient to finance an unexpectedly expensive project, the tender procedure can be cancelled. This postpones the execution of the planned project for many months. If the prosecutor's office is informed, they can investigate if any illegal practice has accompanied certain tender procedure, OECD (2012). The choice of the most attractive offer (*i.e.* signing the contract with a contractor) with a very high price means indirectly acceptance of the offered price level. The paper concentrates on the

problem: how to distinguish high market offer prices in the tender for road construction works, from unrealistic high offer prices – pointing the illegal, collusive practices among offerors.

There are two opposite trends observed on contractors' offer prices. During economic growth, when the demand is increasing *(i.e.* the number of tenders being announced by clients increases), the contractors' means of production are fully utilized. Any new contract requires engaging the external forces on a much higher level. The new suppliers should be agreed to match this increasing demand. That makes offer prices higher. Oppositely, after the period of economic prosperity, the number of the tender procedures announced decreases. Partly, the contractors' means of production – after completing a contract – have no place of engagement. To manage them efficiently, contractors search for some new contracts by lowering the offer prices to make the chance of the win higher. The average number of contractors placing their offers in certain procedure increases then.

As every project is unique, to compare the price level between tender procedures the following – winner price to client's estimation (PtE) – ratio is defined (Anysz, 2019):

$$PtE = \frac{bid\ price\ chosen\ by\ a\ client\ as\ the\ best\ one}{client's\ estimation * 1{,}23} \quad (1)$$

It is required by Polish law to give the bid price including VAT but it is required to prepare a client's estimation in net values (excluding value-added tax) (code, 2004; ordinance, 2004). So, the denominator is corrected by the present Polish VAT rate for this type of construction works.

2 Price Level in Polish Road Construction Sector (2014-2017)

2.1 Database

Tender procedures completed by the choice of contractor for building or modernizing sections of roads are analysed. There were 388 tender procedures ended between Jun 2014 and Jul 2017 found, with winning bid price exceeding 10 million PLN. The following set of information about them is collected:

- bid prices of all (valid) tenders,
- names of clients and offerors,
- bid prices chosen by clients as the winning ones,
- the clients' estimated values of prospective contracts
- the dates of clients' decisions about choosing the contractors.

It was possible to collect the complete database concerning 382 tender procedures.

2.2 Price Level – PtE Distribution

The values of PtE ratio are calculated. Its basic statistics are presented in Table 1.

Table 1. Basic statistics of PtE.

Number of procedures	Mean average	Median value	Min	Max	St. dev.
382	0,607	0,578	0,195	1,793	0,216

It has occurred that in more than 82 % of tender procedures PtE value is over 0,4 and below 1,0. In approximately 14 % tender procedures winning bid price was very low ($PtE \leq 0{,}4$) and the chosen tender had the price over clients' estimates ($PtE \geq 1$) in 4 % of analysed procedures. The histogram of PtE values is presented in Figure 1.

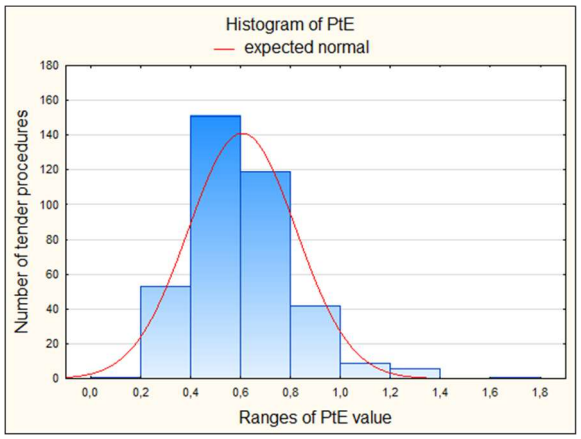

Figure 1. Histogram of PtE values in 382 tender procedures (Anysz, 2019).

2.3 Reasons for PtE Variations

The main reason for such significant variations of PtE value is the different aim of evaluations done by a client and a contractor. A client is obliged to apply market prices of different kinds of construction works i.e. average prices observed on the market. It is aimed to assess, which procedure of public procurement should be applied. Secondly, a client based on that can prepare a budget for the planned construction. A contractor calculates their bid price based on their costs, efficiencies of their brigades, etc. It is aimed at finding the price allowing for winning the contract, and for achieving the profit, which is necessary for a company to survive and business development. Taking into consideration the aims of evaluation, the contractor's bid price is unique, precisely adjusted to the company and market conditions. A client's evaluation is adjusted to the market conditions and based on average prices. Another reason also making PtE spectrum so wide is the fact that a client's estimation is prepared before the announcement of the tender procedure. The law limits the validity of such evaluation to six months. During this period, in a dynamically changing market, even average prices can change much. The next reason is an error of estimation. Finally – the standing of a national economy, and dynamics of the construction market influences the bid prices. Another group of reasons for PtE variations are illegal, collusive practices which makes bid prices vary from not abused market trends.

3 Market Phenomena Influencing the Bid Prices

Polish National Statistical Office (GUS) publishes on a monthly, quarterly or yearly basis much information collected on the market. One of the groups of published indicators is tendencies. The group of tendencies searched for this paper is "Business tendency survey in construction - current database - monthly data" (GUS, 2019). For 36 months analysed, the mean average of PtE in each month was calculated. Then, Pearson's correlations (Aczel, 1992) were checked

with different indicators of business tendencies (month to month; without any time shift). It has occurred that it is a quite high correlation coefficient – equals to 0,659 – between average PtE and the indicator "expected prices" assessed based on opinions of companies employing over 250 employees. It is the highest correlation among indicators published by GUS concerning the construction industry . Shifting the time of expectations one or two months haven't produced a higher correlation coefficient (see Figure 2).

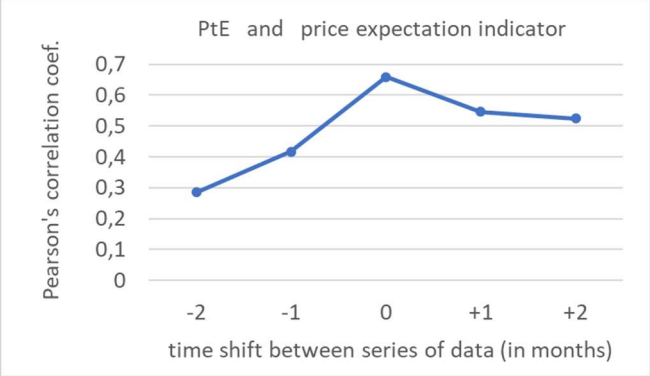

Figure 2. Pearson's correlation between PtE and price expectation indicator with time shifts.

As prices rise during the market growth, it can be said that PtE partly, positively reflects the trends on the market. Analysis of data collected does confirm findings of the number of tenders and their dependence on market prosperity proves that there are more tender procedures with the higher number of offerors when the market does not develop ($PtE \leq 0{,}4$). Procedures with more than 8 tenders almost don't appear (except 1 case) during the market growth – high bid prices dominate ($PtE \geq 1{,}0$). It can be observed in Figure 3.

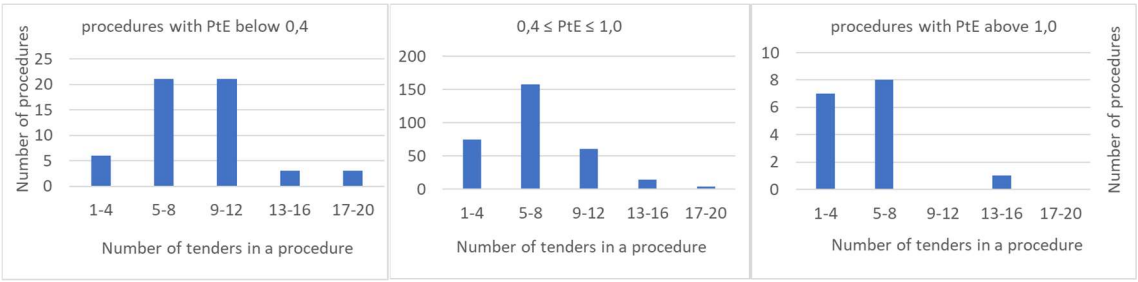

Figure 3. Histograms of the number of tenders for the procedures with different ranges of PtE (Anysz, 2019).

Moreover, the average PtE calculated monthly has the strong negative Pearson's correlation (-0,691) with an average number of tenders in a procedure. Described above dependencies are based on officially published (GUS, 2019) "expected prices" in the construction industry indicator (collected opinions of companies employing 250 and more persons) and collected real data concerning the tender procedures in the road construction sector. This is proof, that contractors observe the market tendencies and they adjust the bid price level to the market situation.

4 Fair Price or Bid Rigging

4.1 Fair Prices

As described above, differences between clients' estimation and the bid prices of the winners are natural. Clients are obliged to use market prices which are created in the cycle presented below – in Figure 4.

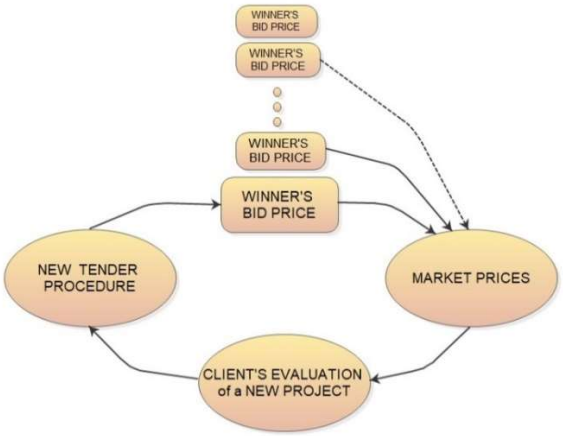

Figure 4. The mechanism of creating market prices.

As the winner of the tender procedure is chosen by a client, it can be understood, that the chosen contractor has fulfilled all formal criteria and their offer is the best (according to the criteria set by a client). The same refers to the price given by a winner – it creates one of the market prices. A certain client's estimation of a new project is based on unit market prices e.g. of 1 m3 of an embankment, 1 m3 of a concrete structure, etc.

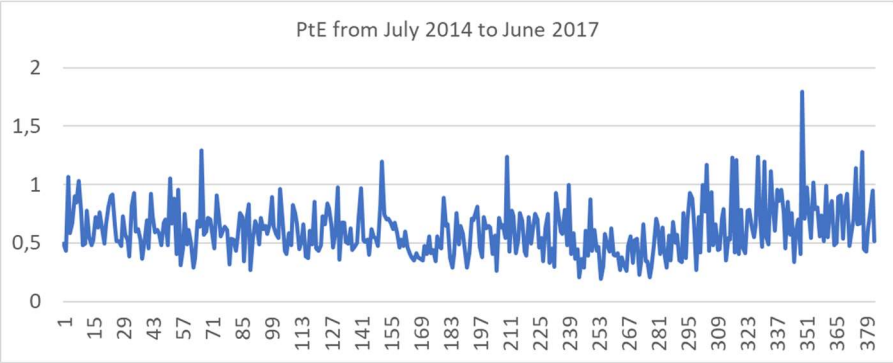

Figure 5. PtE values. Procedures from the year 2015 start from procedure No 71, 2016 from procedure No 163. 2017 from procedure No 311 (Anysz, 2019).

However, the market unit prices are created by previous orders. So, if any tendency could be observed on the market, the bid prices have to differ from the client's evaluations. Collected data allows presenting PtE for all examined 382 tender procedures. They are sorted by date

starting from July 2014 (see Figure 5).

4.2 Indicators of Collusive Practices

4.2.1 Low number of the tenders

Many sources are pointing the low number of tenders as an indicator of possible collusion (OECD, 2012; UOKiK, 2017; Huber and Imhof, 2018). It is also consistent with common sense, as it is much easier to keep the secret – illegal collusive agreement – among a few its participants that among several of them.

4.2.2 Narrow range of the bid prices

Another important factor that can pay a client's attention to the possibility of bid rigging is the range of the prices offered. The range R was defined (Foremny and Anysz, 2018) as:

$$R_{\mathrm{i}} = \frac{(V_{\mathrm{av\,i}} - V_{\mathrm{min\,i}})}{V_{\mathrm{av\,i}}} * 100\ \% \tag{2}$$

where:

R_i – the range for procedure i

$V_{min\,i}$ – the lowest value of an offer in procedure i

$V_{av\,i}$ – the mean average value of offers in procedure i

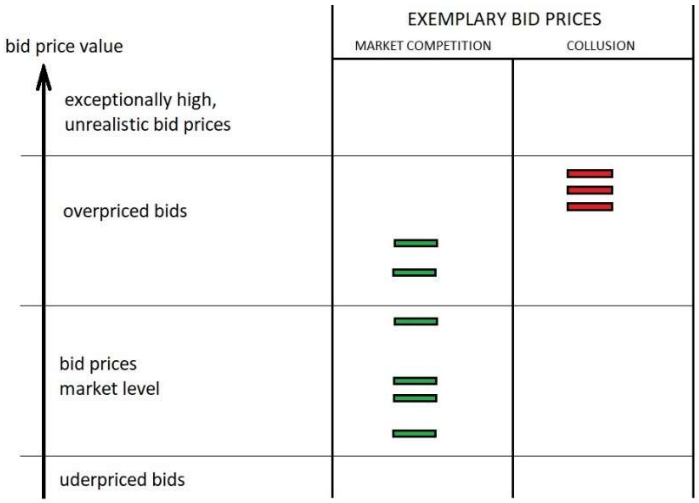

Figure 6. Exemplary bid price levels in case of market competition and collusion

The average R for examined 382 procedures is 13,5 %. In the case of collusion, where every bid price is over the market level, involved offerors increase their bid prices over the market level. However, their prices can't be recognized irrationally high. That makes the space for their bid prices much more narrow than in the case of market competition (see Figure 6). The range R is low then.

4.2.3 Other indicators

There are many more indicators (Ferwerda *et al.*, 2017; OECD, 2013; International Competition Network, 2010) of possible collusion, bid rigging (*e.g.* location distance of an offeror's enterprise vs location of offered services, simultaneous attendance in procedures of the same set of offerors, frequency of interaction through trade associations, staff moving between companies, market transparency, e.g. in bid rigging where openness makes it easier to monitor for cheating, excess capacity and inventories, ending of a price war and/or concerted moves to "discipline the market", existence of joint ventures etc.). Nevertheless, they are not so obvious, intuitive as indicators presented in the two previous sub-chapters. Moreover, they are more dependent on the specifics of a certain branch or market sector. Then the result of a tender in the road construction industry are announced, and the winner's price is high, it becomes the subject of many newspaper articles, controversies and speculations if the price is fair. These were an inspiration to verify what level of extremely high prices (chosen by clients as the best ones) can indicate the possibility of collusion or bid rigging.

5 Extremely High PtE as Collusion Indicator

5.1 Proposed model

It is, hereby, proposed to observe extreme deviation of PtE from its average value – especially in a case where – in a certain procedure – PtE is extremally high. As it was described above (*i.e.* in chapter 3), the state of the market influences the bid prices level. Thus, referring PtE to its average based on a long time is irrelevant. The simple moving average (SMA) (Gençay and Stengos, 1998; Elder, 1992) is presented in Figure 7 (yellow line) based on the following formula:

$$SMA(PtE) = \frac{\sum_{i=1}^{n} PtE_i}{n} \tag{3}$$

where:

PtE_i - the value of PtE in i tender procedure (one of the procedures completed in 30 predeceasing days),

n - the number of procedures completed in 30 predeceasing days.

Within random 30 days periods (chosen from July 2014 – June 2017) the number of completed procedures varies, so n varies for SMA calculated for different days. The 30 days period is chosen to calculate SMA according to the fact – described above, in chapter 3 – that the highest Pearson's correlation (PtE and "expected prices") was achieved for 30 days period (from 30, 60 and 90 days periods). Similarly to analysis of stock exchange prices with Bollinger bands (Baiynd, 2011; Lento *et al.*, 2007), the band around SMA is created by upper (L_U) and lower limit (L_L) defined as:

$$L_U = SMA + k \tag{4}$$

$$L_L = SMA - k \tag{5}$$

where: k - constant, greater than 0

When it is assumed that if for the chosen (by a client) bid price

$$PtE > L_U \tag{6}$$

in a given tender procedure, that may imply collusion existence, then there is a problem of choosing the value of the constant k. When it is set too small (close to 0), collusion can be expected in almost every tender procedure where

$$PtE > SMA \tag{7}$$

When k is too high, in none of bidding procedures PtE exceeds the upper limit – it means that the market is perfectly competitive.

Let's analyze one of the reasons, why bid prices differ from a clients' estimations – mistakes in contractors calculations of their bid prices. If the lowest bid price (mistakenly calculated so low) is chosen by a client as the best one and it is below SMA, the mistake can be done in only one offer. When a client chooses the bid price for which PtE is high above SMA, and it is the lowest bid price in a certain procedure, it means that all offerors made mistakes in their bid price calculation (if a mistake caused exceptionally high bid price). Moreover, the reasonable assumption can be made that the size of underpricing and overpricing made by mistakes in the bid prices calculations are statistically the same.

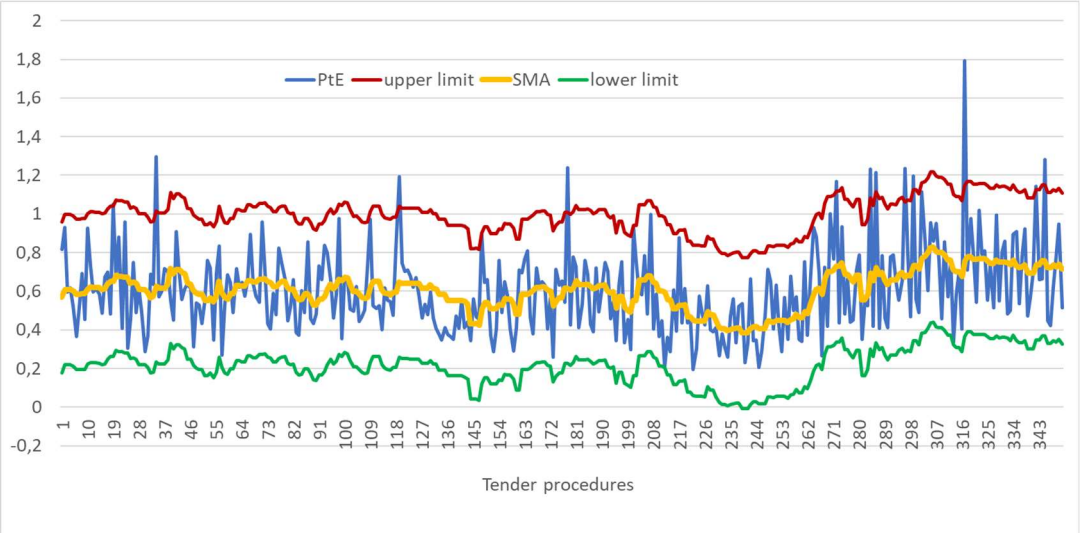

Figure 7. SMA, symmetric SMA band for $k = 0{,}39$ with PtE on the band

Making a mistake by one offeror is much more probable than by all offerors. As the mistake of only one offeror can push the bid price to the very low level, the following value of k can be set:

$$k\colon\ \forall SMA(PtE)\ \ L_L < PtE \tag{8}$$

For the data collected $k = 0{,}39$ made inequation (8) satisfied. Four lines are simultaneously presented in Figure 7, PtE, SMA and its band limits for $k = 0{,}39$.

It can be expected that the peaks of PtE exceeding the upper limit haven't been caused by mistakes in offerors' price calculations. The band is symmetric around SMA. The cases where

all bids are mistakenly highly overpriced (the lowest bid price, chosen by a client creates PtE) are very rare or even don't exist. Therefore, the collusion can be expected in all these PtE peaking tender procedures.

5.2 Verification of the Model

The best possible verification – the sentence of a court punishing collusive behaviors – is unavailable. There are 4 tender procedures found (among the analyzed set) which were a subject of such court procedure but all investigations dropped due to lack of collusion evidence. There are 11 tender procedures peaking above the upper limit – constructed from SMA increased by 0,39 (see Figure 7). It is possible to check, if other indicators of possible collusion i.e. low range of bid prices (calculated according to (2)) and the low number of offerors, confirm the possible non-concurrent character of offerors' behaviors in these procedures.

Table 2. Tender procedures with PtE exceeding the upper limit.

PtE peaking procedures	PtE	Number of offerors	Range R [%]	Possibility of collusion
1	1,295	8	13,4	low
2	1,195	1	0,0	high
3	1,239	15	20,9	low
4	1,168	5	4,5	high
5	1,233	6	16,8	low
6	1,213	6	25,0	low
7	1,236	1	0,0	high
8	1,196	4	6,7	high
9	1,793	5	3,8	high
10	1,143	1	0,0	high
11	1,281	5	15,5	moderate

Taking into consideration the average range R for all analyzed tender procedures (equal to 13,5 %) and the average number of participants in a tender procedure (6,9), the level of possibility of a collusion is assigned. The assessment is "high" for less than six offerors and the range R lower than 7 %. If there is only one offeror, there is no range of bid price values but the range equal to 0,0 is presented in Table 2. There are 6 tender procedures where collusion possibility is high, out of 11 tender procedures pointed by the model. There is no such an upper limit other than $1{,}295 < L_U < 1{,}793$ above which, all tender procedures would have a high level of possibility of collusion. Even for so high upper limit, there is only one tender procedure and its level of possibility of collusion is high – procedure labeled as 9 in Table 2. Nevertheless, as it is the only case, it can't be named the rule.

6 Conclusions

The model built for the real database of Polish tender procedures in the road construction industry, aimed at collusion finding, couldn't be verified directly. The indirect verification – through other indicators that usually accompany bid rigging, shows that comparison of PtE ratio with upper limit L_U (based on SMA) can't be the single collusion indicator. None of the

described bid rigging cases in the literature support the statement that in case of collusion all indicators have to point the collusion existence. The very high bid price level, defined here as PtE exceeding a single moving average of PtE increased by 0,39, is a separate indicator of unusually bid prices. One of the possible reasons can be collusion or bid rigging. It is proposed to observe it along with other factors i.e. the number of offerors and bid price range in each tender procedure. These three indicators are easily obtainable i.e. they don't require any advanced analytics (as other indicators). So, they can be applied easily by clients, who make decisions about spending public financial resources. The road construction contract values are one of the biggest and the type of construction works comprised by them is homogenous. The proposed model can be applied in other branches. However, it is to remember, that the data – the base for SMA calculation - should be collected within one branch to provide relevant information. A client's analysis done before the choice of a contractor may lead to successful price negotiations and finally to lowering the price. This means higher efficiency of spending public financial resources.

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