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Impact of competition on prices in public sector procurement

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Abstract

Efficient use of public resources should be supported by quality management of the tender procedure to achieve competitive tender prices. This paper examines the issue of competitive environment within public works contracts and explores the influence of the number of bidders on the tender results. A research sample of 256 public tenders was investigated in order to evaluate two research hypotheses. Data evaluation was supported by interval plot, scatter plot and correlation analysis. It has been found that the number of bidders in the tender depends on the type of the subject matter of the tender; however, this difference does not have a significant impact on the level of competition. Another research finding supports the assumption that the number of bidders influences the relative difference between expected price and award price. It was concluded that contracting authorities must not only require a sufficient range of qualifications, but should also take any steps required to motivate a sufficient number of applicants to participate in the tender procedure to achieve competitive prices.

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Keywords: competition; construction project; price; public procurement; structure.

1. Introduction

Efficient use of public resources is one of the main challenges related to public investment. This concerns the whole life cycle of buildings (structures), starting from the design documentation to the demolition at the end of the lifetime of the investment. The overall success of the project is significantly affected, among other factors, also by the

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technical, economical and professional capability of the contractor who is awarded the tender. For this reason, the tender procedure should pay due attention to the scope of required qualifications. On the one hand, the qualification criteria should be set so as to only allow the participation of properly qualified candidates; on the other hand, the criteria should at the same time facilitate the creation of sufficient competition in the tender.

This paper belongs to a wider research area concerning the effectiveness and transparency of public procurement in the construction sector. In particular, it aims to examine the competitive environment of public tenders and to establish 1) whether the type of the structure influences the number of bidders in the tender and 2) whether the difference between the expected price of the contract and the award price depends on the number of bidders in the tender.

The paper is structured as follows: firstly, research background and related hypotheses are presented; secondly, research methodology is outlined; thirdly, results are presented and discussed; and finally, conclusions, including recommendations for public authorities and contractors, are provided.

2. Research background, hypotheses and methodology

Public tenders are often faced with problems such as participation of unqualified applicants, manipulative settings of qualifications or inappropriate methods of evaluating the bids. These are some of the reasons why procurement agenda belongs to major sources of risk for construction projects[1,2]. Improper management of tenders may be the result of deliberate action or just a lack of experience on the part of the responsible personnel. In practice, public authorities often consider qualifying procedures to be time consuming and wasteful[3]. However, qualification, together with the evaluation criteria, significantly influences the outcome of the tender procedure and the success of the project as a whole, i.e. whether the customers gets the best value for their money. Scholarly literature systematically describes various aspects of qualification and stresses that qualification must be evaluated by determining and defining a set of appropriate criteria[4]. The selection of a group of contractors who are most suitable to execute a given project can be supported by various models and methods (see e.g. [5,6,7]) and in practice, different types of criteria are applied to evaluate the ability of contractors to perform the contract[8]. From this viewpoint, the prerequisite for a successful qualification procedure with the perspective of achieving a reasonable price is the participation of a sufficient number of capable contractors in the tender.

The creation of a sufficiently competitive environment is desirable, because it can be assumed that the prices achieved in the tender will decrease with the increase of the number of bids submitted in the tender[9]. However, it may be difficult to ensure a competitive environment, because the number of bidders depends on a variety of aspects, e.g. the type of the subject matter (type of structure) or the volume of the project[10].

Since the efficiency of the investment should be considered from the perspective of its life-cycle[11], operation and maintenance costs need to be taken into account as well as construction costs[12]. However, the use of life-cycle costs in construction sector is rather rare in many countries (as evidenced e.g. for the Czech Republic and Poland[13]) and contracting authorities often select the winning bidder simply on the basis of the lowest bid price rather than on the basis of the most economically advantageous tender (multicriteria evaluation)[13]. In recent years, a significant rise in the frequency of use of the lowest price award criterion was observed in some countries (specifically, the Czech Republic and Ireland[14]). This method is sometimes criticized, since awarding the tender solely on the basis of the lowest bid may result in the submission of unreasonably low bids[15] that have to be rejected, which is a major shortcoming. Nevertheless, even in the case of multicriteria evaluation, the criterion of the bid price often weights more than 70%[13]; it is therefore obvious that this criterion will have a very significant influence in the overwhelming majority of public construction projects and the number of bidders has, therefore, a high potential to affect the efficiency of the tender.

2.1. Hypotheses

Since it can be reasonably expected that the number of bidders is an important variable closely related to certain aspects of the tender, the following two hypotheses were defined:

H1: The number of bidders in the tender is dependent on the type of structure.

H2: The number of bidders influences the ratio between the award price and the expected price in the tender.

2.2. Methodology

In order to meet the objectives of this research, it was necessary to collect a data set of sufficient size for evaluation. The research sample consists of the records of 256 tenders related to the performance of construction works in the Czech Republic between 2014 and 2015 where the contractor has already been selected. The following information was collected: name of the tender, type of the tender, expected price, award price and number of bids in the given tender. The results presented in this paper are related to open-procedure tenders.

After the collection, the data was categorized on the basis of the type of structure to public buildings and facilities (schools, offices, municipal residential buildings, hospitals etc.), transportation infrastructure (roads, pavements etc.) and other structures. A more detailed categorization of the types of structures was not relevant, since the "other structures" category consisted of many different types of structures (technological equipment, utility infrastructure, water structures and so on) and the frequency of their occurrence was very small in the sample. In order to detect the difference between the numbers of bidders in the tender according to the type of structure, interval plot analysis has been employed on a 95% confidence interval.

Consequently, in relation to the H2 hypothesis, a scatterplot with regression line was applied to illustrate the relationship between the examined variables of the number of bidders and the ratio between the award price (*AP*) and the expected price (*EP*) in the tender. This ratio (AE_r) is computed using the following equation:

$$AE_r = \frac{AP}{EP} \tag{1}$$

so AE_r values lower than 1 indicate that the award price was lower than the expected price and vice versa. The data set examined in this part of the paper consists of 233 records, since outliers (with regard to the expected price variable) were excluded from the research sample. In addition, a correlation analysis has also been performed to describe the relationship between the examined variables. More specifically, the Pearson's correlation coefficient was employed to interpret the degree of linear dependence of the relative decrease in the contract price (*RDP*) on the number of bidders. Correlation analysis examined whether there was a positive correlation between these two random variables. The value of *RDP* is computed as:

$$RDP = \frac{EP - AP}{EP} = 1 - AE_r \tag{2}$$

hence positive correlation means that with increasing number of bids the *RDP* value increases as well. For negative values of *RDP*, the award price was higher than the expected price and vice versa. Outliers of the *RDP* variable were removed from the sample before correlation analysis was performed.

Data analyzed and presented in the paper are collected from the Bulletin of Public Procurement[16].

3. Results and discussion

The frequency of the occurrence of particular types of structures allowed for their division into three groups: public buildings and facilities, transport infrastructure and other structures. This categorization follows the fact that public authorities mostly invest money to repairs and maintenance of roads and building amenities, such as schools, hospitals, libraries etc. The prevailing share of the first category in the sample is mainly due to the fact that projects aimed at improving the energy performance of buildings have been intensively implemented in recent years. The absolute and relative proportions of different types of structures in the sample are presented in Table 1.

Table 1. Basic characteristics of the research sample based on the type of structure

Type of structure	Absolute frequency	Relative frequency
Public buildings and facilities	142	55.5%
Transport infrastructure	48	18.7%
Other structures	66	25.8%
Total	256	100.0%

3.1. Relation between number of bids and types of structures

The first hypothesis examined whether the type of structure affects the number of bidders in the tender. Since there are just 2 types of structures with sufficient number of records in the sample, the evaluation of this hypothesis is based solely on the comparison of public buildings and facilities (PBF) and transport infrastructure (TI). Figure 1 shows the interval plots for the above-mentioned variables.

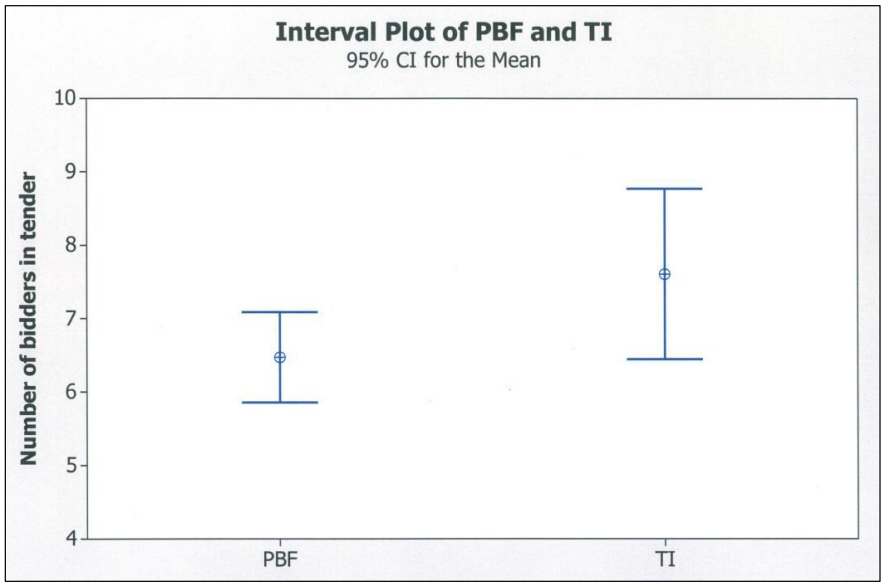

Fig. 1. Interval plots for the number of bidders in the tender in relation to the type of structure.

The mean value for PBF is clearly lower than for TI – 6.47 and 7.60 respectively. The 95% confidence intervals for the PBF and TI means are (5.86, 7.09) and (6.44, 8.77) respectively. Based on the data obtained, it is obvious that there is greater competition in certain segments of the construction market and thus larger numbers of applicants submit their bids. On the other hand, when comparing the mean values, the number of candidates seems to be sufficient to promote competition in the tender in both categories. Although in the case of comparison of PBF and TI categories no significant impact on the level of competition according to the type of the structure has been detected, it is apparent that the type of the structure influences the number of bidders in the tender. Accordingly, **hypothesis H1 can be confirmed**. These research results support findings presented in[10].

A larger data set will certainly allow for a more detailed analysis including the examination of other types of structures, such as water structures, water supply and sewerage facilities, and a separate examination of constructions of road and rail infrastructure or hospitals, schools and administration facilities.

3.2. Relation between the number of bids and the tender price decrement

The second part of the analysis focused on the influence of the number of bidders on the ratio between the award price and the expected price in the tender. Figure 2 presents the results showing the relation between these two variables in a scatterplot. The data shows a relatively high variability of results with extreme positions for the AE_r value, such as $AE_r = 1.52$ for 2 bidders in the tender or 3 records with $AE_r < 0.3$. In the first case, the contract shows potential signs of a cartel; in the second case, the estimated expected price was probably too high. The inaccuracy in determining the expected price often results from incomplete/poor project documentation[17] or from the use of inappropriate pricing databases. Despite all the deviations, the data layout shows an apparent tendency to achieve a lower award price (compared with the expected price) with a higher number of submitted bids.

The number of bids in the tender and the amount of relative price decrement (*RDP*) were examined within the correlation analysis. The results show that the value of Pearson's correlation coefficient is equal to 0.509; therefore, a moderate positive correlation between the examined variables was determined.

Hypothesis H2 claimed that the number of bidders influences the ratio between the expected price and the award price in the tender. Based on the results presented in Figure 2 and on the output of the correlation analysis, **hypothesis H2 was confirmed**. The achieved results are consistent with findings presented in[9].

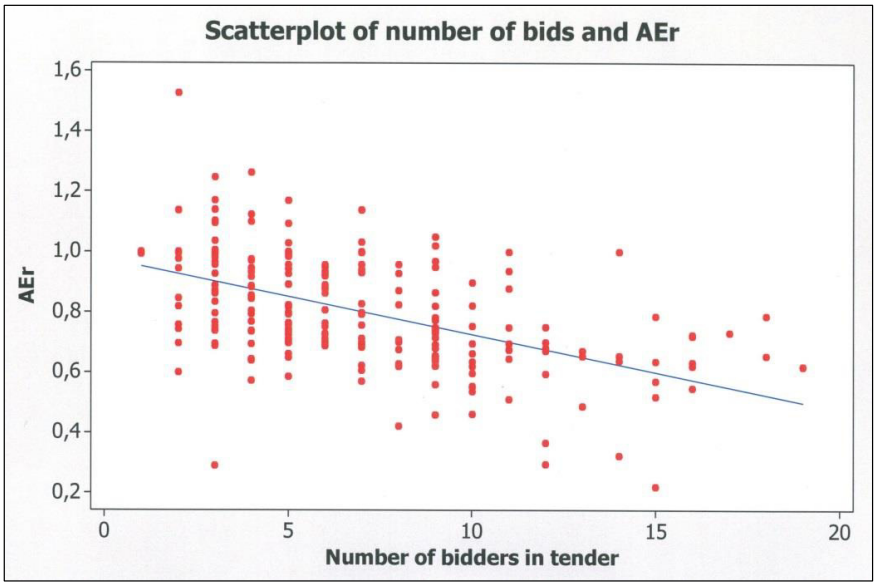

Fig. 2. Analysis of the dependence of the RPD on the number of bidders.

3.3. Research implications

The evidence of a positive impact of the level of competition on the difference between the expected and award prices highlights the need for public authorities to use the open procedure involving a sufficient number of applicants as a primary option whenever possible. Making the information about tenders sufficiently publicly available as well as directly addressing (potentially) qualified contractors through a call for participation in the tender will certainly have a positive effect on the competitive environment. Nevertheless, the interest in the level of competition in the tender should not be to the detriment of an adequate level of required qualifications: this should prevent the participation of ineligible contractors. It should be noted that the Czech legislation in force[18] does not allow requiring detailed information related to the economic and financial capability of the applicant. Due to this restriction, there is a significant risk that companies with poor financial standing will participate in the tender. It is also not unusual that

this situation results in the bankruptcy of the company[19], which may have a negative impact on the successful completion of the project. Furthermore, a more detailed research in this area should identify 1) specific public authorities, 2) geographical locations and 3) critical segments of the construction market with a low number of bids in tenders or with unfavorable value of the AE_r parameter. There is also room for improvement of expected price calculation to achieve more reliable information on final cost of the investment[20]. In the future, a database of information on qualified contractors, the actual quality of the supplies, prices and additional work (cost and time overruns) should be created to facilitate the sharing of such information. At present, this information is not easily accessible and it is therefore very difficult to identify the constraints and drivers related to competition and efficiency of public contracts. In this respect, this paper contributes to a better insight into the examined issues and outlines further research directions.

4. Conclusions

Competitive environment in the tender is one of the factors that affect the overall efficiency of public work contracts. The research presented in this paper examined the number of bids in relation to the type of subject matter of the tender and the difference in tender prices (award vs. expected prices). It was found that there is a disparity in the number of bids between contracts for transport infrastructure and contracts for public buildings and facilities, which, however, does not have a significant impact on the level of competition. This research has also revealed a positive moderate correlation between the number of bids and the amount of relative price decrement measured between award and expected prices. Based on these findings, both research hypotheses were confirmed.

It can therefore be concluded that the number of bids in a tender plays a significant role in the context of the overall efficiency of the project. Contracting authorities should encourage active participation of the largest possible number of bidders in the tender while maintaining sufficient qualification requirements. Such approach leads to a greater probability of achieving lower award prices. On the other hand, suppliers should be aware of the anticipated competition in the tender and adjust their bid prices accordingly to increase their chances of winning the contract.

This study has two main limitations. Firstly, even though the research examines a sample containing data on 256 public works contracts, the types of structures represented in the sample did not allow for a detailed examination of more categories of structures. Therefore, research findings related to the H1 hypothesis are based solely on the comparison of contracts in two categories: traffic infrastructure and public buildings and facilities.

Secondly, this research did not explore the actual prices related to the performance of construction work. This would add another interesting dimension to the discussion with regard to the performance of additional work. Therefore, future research should also focus on the examination of potential relations between the variables of expected price, award price and actual price.

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