

Impact of Selected Factors Regarding the Efficiency of Public Procurement (the Case of the Czech Republic) with an Emphasis on Decentralization

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Abstract

This article examines the impact of selected factors of public contracts on the efficiency of public procurement with an emphasis on decentralization. We analyzed the influence of these factors using an econometric model applied to data on public procurement, specifically on public construction contracts for 2013 – 2014. To achieve a higher degree of assurance we have verified these results by analyzing public contracts for the purchase of gas for the years 2013 – 2014. In the context of the available data, this public contract procedure has a relatively homogeneous subject of performance. The research conclusions which have been reached are significant, partly for the considerations regarding the centralization vs. decentralization of purchases, but they also represent a valuable contribution to the empirical investigation of the decentralized production of public goods and services.

Keywords: public procurement, decentralization, efficiency

JEL Classification: H57, H72, H77

Introduction

Significant amounts of resources are utilized every year for public contracts. In the EU, the average volume is about 14% of GDP (EC, 2014). In the Czech Republic, the size of the public contract market in 2013 was around 493 billion CZK. (For a clear comparison, the total consumed on public contracts amounts to 42% of state budget expenditures.)

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Public procurement is therefore an important instrument of fiscal policy and thusly considerable attention is being paid to increasing its efficiency and transparency. Just a one percent increase in efficiency can lead to significant savings in public resources. It is therefore important to look for and examine factors that lead to increased efficiency in public procurement. The aim of this article is to analyze the impact of selected factors of public procurement on the effectiveness of public procurement with an emphasis on the factor of decentralization. We searched for the answer to this question with the help of an econometric model which was applied to data from public construction contracts awarded in the Czech Republic in 2013 – 2014. For confirmation of our conclusions, we verified the results obtained with the public contract procedures for the purchase of gas in 2013 – 2014. We discuss the results of this modeling with respect to the issue of decentralization.

1. Theoretical Background Examination

1.1. The Problem of Efficiency in Public Procurement in Contemporary Research

The basis for an analysis of efficiency in public procurement is represented in the debate surrounding the effective production of public goods and services (see e.g. Lundsgaard, 2002; Nemeč, Meričková and Štrangfeldová, 2010). Part of this debate is the issue of efficiency in public procurement (Strand, Ramada and Canton et al., 2011). Efficiency in public procurement has been analyzed under the context of various key factors such as competition in public procurement (Domberger and Rimmer, 1994; Milne and McGee, 1992; Walsh, 1991) and transparency in public procurement (Burget and Che, 2004). The problem of efficiency in public procurement has also been analyzed under the context of analyses of production costs (Bulow and Klempeter, 1996), transaction costs (Bajari and Tadelis, 2001) and the impact of contracting on the effectiveness of public procurement (Bolton and Dewatripont, 2005), as well as other factors. An analysis of the impact of decentralization on public procurement, as far as we know, still remains unexplored.

In the Czech and Slovak literature, research on public contracts can be divided into several branches. The first branch consists of studies on the theory of contracting, i.e. which public goods and services and should be contracted out and in which cases to choose which type of contracting (Nemeč, Meričková and Ochrana, 2008; Nemeč, Mikušová Meričková and Grega, 2014). To find information regarding building econometric studies which examine the impact of the openness of the selection process, the number of bids, evaluation criteria and

other factors on the difference between the expected value and the value actually tendered, we look to, for example Ochrana and Pavel (2013), Pavel (2014); Pavel and Kubík (2011). Their findings confirm the argument that the more open procurement process and the greater the competitive effect are, the greater the difference between the anticipated and actual tendered price ultimately is.

Another part of the studies explores the problem of efficiency in public procurement in various sectors, such as health care (Klazar and Maaytová, 2013), and construction (Pavel and Kubík, 2011). Another group of authors such as (Nikolovová et al., 2012; Kameník et al., 2011) deals with public procurement in terms of transparency. Transparency related to the effects of changes in the law on public procurement as such is shown by Jurčík (2015), and Pavel (2014). Scientific investigation has also focused on international comparisons of various aspects of public procurement. Most frequently noted are comparisons with Slovakia (Nemec, Pavel and Grega, 2015; Pavel and Sičáková-Beblavá, 2012; Jurčík, 2013) or with post-communist states (Pavel, 2012). Very few works addresses post-contractual behavior. The exceptions are Pavel and Sičáková-Beblavá (2012).

This fact is mainly due to the necessity of manual data collection. In our literature review, we found only two works that at least marginally mention the impact of decentralization on public procurement. Regarding the examination of post-contractual behavior, we have already mentioned Pavel and Sičáková-Beblavá (2012). For completeness, we have also listed the work published by Pavel (2013). In this case, however, it is not scientific literature, but a professional journal for municipalities.

2. General Model

2.1. Data and Selected Variables

For the construction of an econometric model, the data which was used related to public works contracts whose awarding was listed in the Journal of Public Procurement <www.vestnikverejnychzakazek.cz> published in 2013 and 2014. In total, the model includes 10 043 records on public contracts or parts of public contracts (§ 98 of the Act on Public Procurements), while public contracts with incomplete records were excluded. Another 303 entries were also excluded for the reasons of missing data on the estimated value of the public contracts, the tendered price, or the number of bids submitted. A lack of data on some of the other independent variables which were to be used in the model itself led to the disqualification of 242 public procurement records.

Dependent Variable: The Standardized Price

In order to compare individual contracts with different volumes, it is necessary to somehow scale the prices of the public procurements. For this reason, there is a standard for dividing the estimated value of the public contracts. Therefore, a dimensionless quantity is obtained which indicates the proportion of the final price which is derived from the expected price. This term appears in the econometric as a response variable. Utilizing the data, it is shown that the price of a public contract reaches an average of 0.79 times the expected value (median value 0.81).

Explanatory Variables

Number of Offers

The number of offers submitted is a variable that is expected to have a significant negative impact on the standard bid price. Among the monitored public works contracts, an average of 5.98 bids were submitted (the median number of bids amounted to 5).

Type of Authority (State, Region, Municipality)

Another variable for which we anticipate a possible impact on the bidding price is the type of contracting authority. In terms of the focus of this article, the contracting authorities were categorized as they are in the Bulletin of Public Procurement. This proved to be very useful. For this reason, we proceeded to categorize the authorities as being the state, county, municipality, and as other contracting entities. The groups of contracting authorities listed were assigned an appropriate dummy variable in the econometric model. The following rules were followed for the classification of the contracting authorities into categories: In order to designate contracting authorities, the divisions from the Bulletin of Public Procurement were used, namely the categories *Ministry or any other national or federal authority, including their components* and *National or Federal agency/office*. Dummy variables for the regions were designated as public contracts awarded in one of the regions within the Czech Republic, with the exception of capital, Prague, which was counted among the municipalities. Among the municipalities, contracting authorities containing the name of a village, town, township or district were included. Among the other contracting authorities included were (in the model, indication of none of the above additional variables), for example, other organizations established by the state, regions or municipalities, public enterprises, universities, subsidized or sector contracting entities.

Type of Award Procedure

Within the model, there are distinguishable types of award procedures which correspond to the Public Procurement Act. A classification of procurement procedures according to the Bulletin of Public Procurements is also used (with the exception of special unused subcategories for restricted procedures and negotiated procedures with publication and shortened deadlines). Beyond the categorization from the Bulletin, a category for a simplified below-the-threshold procedures was added.

Evaluation Method

The Public Procurement Act allows the evaluation of tenders on the basis of one criterion – the offer price, or based on multiple criteria, known as “economically advantageous tenders”. In the analysis of the data, it was found that 86.7% public procurements used an assessment purely based on the offer price. Further explanatory variables related to method of evaluating the submitted bids is the weight of the bidding price during evaluation. In the case where only the bid price is evaluated, the weight is then 100%.

Other Explanatory Variables

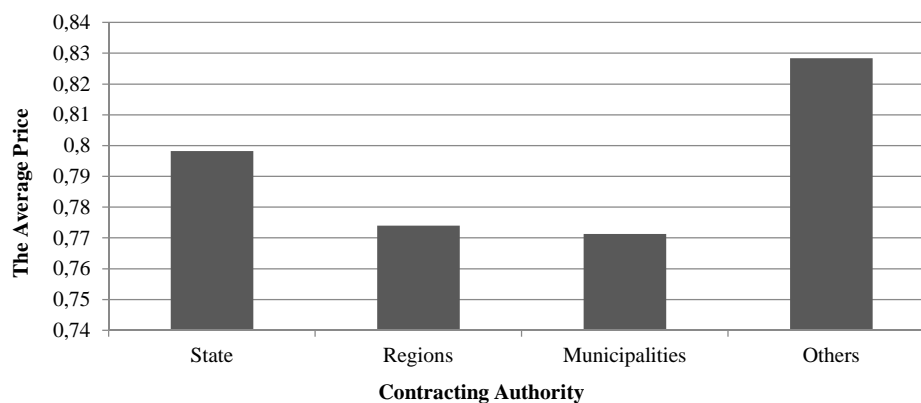
Furthermore, there are dummy variables which express whether: fulfillment by the subcontractor was expected (at 43.1% of the monitored contracts), whether the contract was financed by the EU (47.2% of cases) whether there was a use of electronic auctions (1.4%). As an additional explanatory variable is the indicator for whether the contract was awarded for other subjects, i.e., whether it is was a case of central procurement (1.2% of cases). Certain aspects of time express an artificial variable acquiring a value of 1 for contracts reported in 2014.

Data from the Czech Statistical Office on individual districts and regions is also utilized, in particular, there is data on the value of GDP per inhabitant, the population of districts, the number of businesses, and the number of enterprises having construction as their main activity. Indicators have been calculated from the data for individual counties (the number of businesses per 1 000 population and the number of players in the construction industry per 1 000 inhabitants within the district), which indicate a certain degree of the economic level and strength of competition in the given market.

2.2. Results (General Model)

Initially, in the framework of our analysis we graphically compare the average price according to the bidders. The following chart shows the average price achieved/awarded according to the contracting authority.

Figure 1
The Average Price Achieved/Awarded According to the Contracting Authority



Source: Bulletin of Public Procurements; own calculations.

At first glance, a graphical inspection of the data seems to validate the assumptions which were made in the theoretical section: municipalities manage the lowest average standard rates, followed by the regions and finally, by the central government. We will try to authenticate these findings using an econometric model. Complete results of the model are listed in the Appendix 1.

The parameters given in the preferred model are, according to the respective t-tests, statistically significant at least at the 95% confidence level. The coefficient of determination reaches 0.36; indicating that the model explains 36% of the variance behavior of the adjusted price of the contracts.

The parameters relating to data regarding the type of authority suggests that the tendered price of the contracts when compared with the expected value are relatively low in the regions, at the state level it is 0.2% higher, and in the municipalities, the predicted values are about 0.5% higher than in the regions (which is still 1.3% less than the other group of contracting authorities). Regarding the parameters related to regional characteristics, the parameter describing the number of economic players in the construction industry for every 1 000 inhabitants within a region was shown to be statistically significant, with the respective value indicating a higher price for contracts in regions with more players in the construction industry. This result is at odds with our expectations as defined in the objectives of the work.

More substantially, we can consider the reaffirmation of the positive effects of competition on the standard price, i.e. that any additional offer further reduces the contract price by 3.4% against the expected value, while the effect of additional offers is gradually weakened. As for the effect dealing with the types of award procedures, other types were shown to lead to higher contract prices when

compared to an open procedure. Further, the data suggest that EU subsidies increased the contract price by 1%. The model also indicates that the evaluation of economic benefits may result in a lower bid price, but nevertheless, a higher share of the weighted price leads to a reduction in prices in the evaluation criteria. Given the values of the relevant parameters, this apparent contradiction can be explained this way: the greater weight of the price in the evaluation criterion affects a lower tendered price, but that relationship does not seem linear. Contracts awarded in 2014 compared to 2013 also exhibit higher prices.

3. Homogeneous Model (the Price of Gas)

3.1. Data and Selected Variables

A subject of interest is data on the procurement of gas supplies (CPV code 09123000-7), whose announcement was in the Bulletin of Public Procurement which was published in 2013 and 2014. Of these public contracts, or parts of contracts (of which there were 397 awarded in the reporting period) 120 public contracts were randomly selected, which were tracked on individual profiles of contracting authorities regarding the tendered unit price of gas and the estimated quantity demanded. Contracts for the supply of natural gas were chosen because they are a homogeneous subject of fulfillment, where the unit price is not influenced by the quality or technical requirements on the subject of fulfillment, which should significantly reduce the possible bias of the model results due to various parameters of the required fulfillment as well as different ways of determining the estimated value of the public contracts. At the same time, contracts with this subject are awarded according to law in sufficient quantities for the different types of contracting authorities.

Dependent Variable

The listed gas price (CZK without VAT per MWh) is the explained variable in this model. This is the price for gas supplied without regulated components of the price determined by the Energy Regulatory Office. In some contracts this price is also determined separately for retail customers (up to 630 MWh per place of consumption per year) and wholesale customers (or is still priced separately for middle-consumption). For such contracts or parts of contracts, where more sub prices were set, the average price was calculated (weighted average according to the expected amount). In the case of the analyzed data, the average unit price of gas corresponded to a value of 705.4 CZK/MWh (minimum value 614 CZK /MWh, maximum 784.9 CZK/MWh).

Explanatory Variables

Contracting Authority

Similarly, as in the previous econometric model as well as here, dummy variables act as explanatory variables indicating whether the contracting authority is the state, a region or a municipality. Unlike the previous case, the categorization is not according to the Bulletin of Public Procurement (which exhibits some errors) but instead, the authorities were manually sorted into appropriate groups. Among the municipalities and regions, associations of municipalities or regional organizations for central procurement have also been placed.

Type of Award Procedure

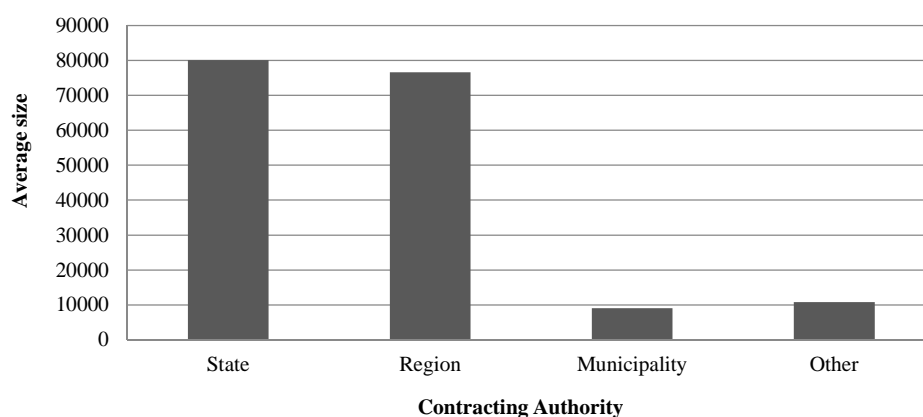
Another explanatory variable is the type of procedure according to the law. The possibility of using a negotiated procedure without publication pursuant to § 23 article 5 point c) of the Public Procurement Act, for contracts awarded on commodity exchanges is specific to the case of contracts for the purchase of gas (or commodities in general). For these contracts, there are competing bid prices, however, some data (such as the number of bidders) is not available.

Variables Indicating the Size of the Public Procurement

Additionally, we consider some of the variables expressing the volume of the public procurement suitable as response variables regarding the anticipation of the possible impact on the achieved price of gas. They could be the anticipated volume of gas purchased or the estimated value of the public contract.

Figure 2

The Size of the Contract According to the Contracting Authority



Source: Bulletin of Public Procurement, profiles of contracting authorities; own calculations.

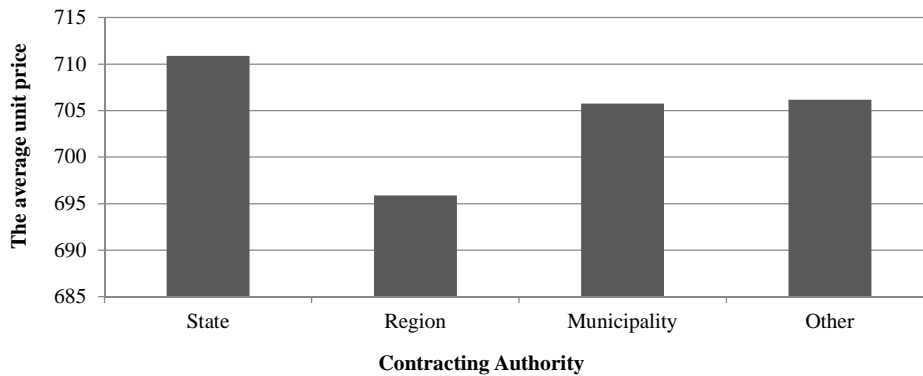
According to the analyzed data, the average volume demanded in a public contract, or in the relevant parts of the procurement amounted to 27 821.77 MWh and the anticipated value had an average of 28 835 538.95 CZK.

3.2. Results: Homogeneous Model – the Price of Gas

The following chart (Figure 3) shows the average unit price achieved/awarded according to the contracting authority.

Figure 3

The Average Unit Price Achieved/Awarded According to the Contracting Authority



Source: Bulletin of Public Procurements; own calculations.

According to the preliminary inspection of the graphical data, it is clear that there are differences among the various levels of the contracting authorities, the lowest unit prices were seen from the contracting authorities at the regional level, followed by the municipalities and finally, the central government. In order to clarify these conclusions, we used an econometric analysis. Complete results of the model are listed in Appendix 2.

Even in this case, our model explains a relatively strong variability in gas prices. It also confirms the initial assumption that when the central government is the buyer, the unit prices are higher. The influence of the contracting authority at the level of municipalities and regions is approximately the same. The number of units demanded and the estimated value have the same effect on the unit price, indicating a lower unit price for large orders (volume discounts).

The number of bids in this case have been proved to be statistically insignificant, which may be partly due to the fact that this parameter is present in only half of the contracts, since contracts awarded through a negotiated procedure without publication on the commodity exchange are not included. The price is also lower in the case of the open procedure or for contracts awarded on the commodity

exchange than for contracts awarded under the simplified below-the-threshold procedure. The contracts awarded in an open procedure or on the commodity exchange achieved similar prices. Also, the model has not rejected the hypothesis that there is no difference between the prices in the open procedure and prices on the commodity exchange in negotiated procedures without publication.

4. Discussion

Our study showed that both in the case of construction work which is characterized by considerable heterogeneity, as in the case of contracts for the purchase of gas, which can be described as homogeneous, the central government achieved lower levels of efficiency; by contrast, regions gained higher savings when contracting than the central government and municipalities. In the case of municipalities, the results are not so conclusive for construction work where municipalities performed worse than the central government. We can search for the cause of that fact in the large number of contracting authorities on the side of the municipalities, where one can clearly find better and worse contracting authorities, but also in the causes that we will mention in the conclusion.

When searching for the causes of this situation, we must consider the fact that the awarding of public contracts affects the result of many often contradictory phenomena. The example of buying electricity was dealt with in a similar manner in a study (Soudek and Skuhrovec, 2013). However, a statistically significant correlation between the final price and the type of contracting authority was not identified. Assessing the effectiveness of the management of hospitals in Czech Republic (Luhan and Novotná, 2014) and Slovakia regarding this topic was dealt with by (Nemec, Meričková and Štrangfeldová, 2010). Hospitals run by municipalities have a lower trend in the growth of debt than hospitals established by the state. The quality of care, however, according to the authors' opinion, is not influenced by the type of property. Our model, even when compared with other already published models achieves a high coefficient of determination, and does not cover the whole behavior of the variability of the final price. Therefore, by the relatively good results of regions compared with other levels of government, we can explain the optimal level of decentralization towards the accountability of responsible officials, efficient allocation (Horňáková and Špaček, 2013), and also the optimum range of economies of scale. Regarding the example of purchasing gas we demonstrated that the size of the contract has a significant impact on the achieved price, while the size of the contract depends on the type of client. In theory, the economies of scale should have a U-shaped curve. We can therefore assume that when regions are a sponsor, we will have reached a peak. A shift at the level of government, either above or below, will mean a reduction in value of

economies of scale. In the case of the transition to a higher level, we must also take into consideration the increased costs of the coordination and harmonization of requirements for all entities. On the other hand, move down one level, i.e. at the level of municipalities, and this represents greater heterogeneity on the part of the suppliers, while awarding various sizes of contracts from small to large. The potential for achieving economies of scale is smaller. This fact is confirmed by inspection of the data, since the contracting authorities have often been associations of smaller municipalities. Diseconomies of scale, however, compensate with higher accountability within the municipalities. This assertion is supported by the studies (Freille, Haque and Keller, 2007), who in their research tested the full impact of decentralization on a sample of more than 100 countries utilizing 20 indicators of decentralization on the Corruption Perception Index (CPI) Transparency International (TI) and The World Bank. According to this, market decentralization, in terms of fiscal federalism is associated with lower corruption.

Another important factor is the administrative costs of the implementation of the tender, which might favor centralization. The authors are not aware of any study in which the costs among various levels of government have been compared. The problem of administrative costs, however, was compared by Pavel (2014), who argues that savings achieved by greater transparency are greater than the administrative costs of the tenders. For these reasons, we believe that a centralization of public procurement, e.g. in the form of the creation of a special office which would be responsible for ensuring the provision of its acquisition of certain services or commodities, may not always achieve higher savings.

Conclusion

Analyzing the problem of efficiency of public procurement in the context of the idea of decentralization has shown that this is a neglected problem in contemporary economic theory. This study is one of the rare exceptions that addresses this problem. The study confirms that Oates' general conclusion about self-government units, which can make effective decisions, applies to the field of public procurement. Empirical data analysis also shows that the problem of decentralized decision-making in the public arena also has some new findings. On the municipal level there is likely to be a lower degree of information asymmetry and greater opportunities for local authorities for the flexible selection of appropriate means to provide public goods and services. This was positively reflected in a higher level of efficiency in public procurement compared to the central government. This is indicated by the results of empirical research comparing the

estimated price and the final price of public contracts awarded at the level of regions, municipalities and the state.

Among the more surprising results was the finding that there are higher costs for public procurements in regions with more players in the construction industry (per 1 000 inhabitants in the region). A possible explanation is that with public contracts at the regional level, the individual tenderers know each other very well already from previous contests. This information on the production capacities of the individual rivals (candidates) can be used in their strategic decisions of where „to target their bidding price“. This does not exclude the possibility that the higher price is due to the effect of bid rigging. Companies from the region, which „turn on Public Procurement“, may more readily agree to an agreed offer (bid rigging), than in the case of the central government level. This may also explain why municipalities perform worse than the central government. We intend to empirically examine these hypotheses in further research.

Another identified factor influencing the efficiency of public procurement are the economies of scale. In theory it should work that the greatest economies of scale would be achieved by the central government. The findings show, however, that in the case of public procurement it does not automatically work that centralized buying lead to higher savings. The consequence we denote as „depreciating effects of centralized procurement“. We understand them as additional cost implications due to the need for coordinating bodies who are involved in the system of centralized procurement, including additional costs such as identifying the demands of individual subjects after being centrally purchased by the state, as well as related administrative costs.

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Appendix 1

Model 1: OLS, using observations 1 – 10043 (n = 9801)

Missing or incomplete observations dropped: 242

Dependent variable: price_norm

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	1.0939	0.0621716	17.5948	<0.00001	***
Number of bids	-0.0344101	0.00221762	-15.5167	<0.00001	***
Sq # of bids	0.000724534	0.000109251	6.6319	<0.00001	***
Municipality	-0.0133152	0.00394122	-3.3785	0.00073	***
Region	-0.0187947	0.00634695	-2.9612	0.00307	***
State	-0.0164741	0.00566754	-2.9067	0.00366	***
Subsidy	0.0100965	0.00348461	2.8975	0.00377	***
Economic advantage	-0.0339909	0.0127821	-2.6593	0.00784	***
Price weight	-0.00241775	0.000617802	-3.9135	0.00009	***
Awarded_2014	0.0307012	0.00343198	8.9456	<0.00001	***
Number of construction entities per capita	0.00228852	0.000385936	5.9298	<0.00001	***
Restricted procedure	0.0876381	0.00798099	10.9809	<0.00001	***
Negotiated procedure without publication	0.0861388	0.00730012	11.7996	<0.00001	***
Negotiated procedure without publication	0.0276343	0.00972011	2.8430	0.00448	***
Simplified below the threshold procedure	0.0139296	0.00434608	3.2051	0.00135	***

Mean dependent var	0.790583	S.D. dependent var	0.205050
Sum squared resid	261.7668	S.E. of regression	0.163552
R-squared	0.364712	Adjusted R-squared	0.363804
F(14, 9786)	607.9400	P-value(F)	0.000000
Log-likelihood	3 846.445	Akaike criterion	-7 662.890
Schwarz criterion	-7 555.036	Hannan-Quinn	-7 626.346

Source: Authors.

Appendix 2

Model 2: OLS, using observations 1 – 120

Dependent variable: price per unit

White's test for heteroskedasticity

Null hypothesis: heteroskedasticity not present

Test statistic: LM = 17.5867

with p-value = $P(\text{Chi-square}(14) > 17.5867) = 0.226257$

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	731.174	6.16558	118.5896	<0.00001	***
State	12.1998	6.38155	1.9117	0.05842	*
Number of units	-8.90577e-05	3.83627e-05	-2.3215	0.02204	**
Awardet 2015	-15.4152	4.30963	-3.5769	0.00051	***
Open tender process	-16.5914	6.70012	-2.4763	0.01474	**
Negotiated procedure without publication	-19.4764	6.54078	-2.9777	0.00355	***

Mean dependent variable	705.4312	S.D. dependent var	25.23322
Sum squared residuals	58 629.42	S.E. of regression	22.67803
R-squared	0.226210	Adjusted R-squared	0.192271
F(5, 114)	6.665345	P-value(F)	0.000018
Log-likelihood	-541.7626	Akaike criterion	1 095.525
Schwarz criterion	1 112.250	Hannan-Quinn	1 102.317

Source: Authors.