The Effects of Decentralization on Efficiency in Public Procurement: Empirical Evidence for the Czech Republic

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ABSTRACT The impact of decentralization on efficiency in the production of public goods and services has been described by the current scientific discourse in some detail. In this article, we focus on an analysis of the impact of the factor of decentralization as well as other selected factors on efficiency in public procurement. We view the term efficiency to be the ratio between the tendered and the estimated price, but also as procedural correctness and legality, as it is reflected in the administration of complaints, investigations, and findings regarding violations of the law by the supervising authority. We then describe the phases of bidding and post-bidding. For empirical research, we used linear regression and logistic regression. These methods are applied to data regarding public procurement for the years 2010-2014. The results show that, among the contracting authorities at the different levels of decentralization, there were statistically significant differences which we can explain through the different levels of accountability, economies of scale, as well as the qualifications of the workers of the contracting authority.

KEYWORDS: • public procurement • efficiency • decentralization • public sector • public savings • Czech Republic

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1 Introduction

The issue of decentralization is inextricably linked with Oates' theorem (Oates, 1978). Oates' decentralization theorem also shows the benefits which can arise from decentralization. We propose that there are two levels of government: central government and local government (Baldwin and Wyplosz, 2004). Local governments have a better overview of the preferences of their voters regarding the consumption of public goods. Were the decision making powers regarding the provision of public goods transferred to the local level, this could reduce inefficiency. This theory is further developed by e.g. (Mascollel, 1980) (Klibanhoff, Morduch, 1995). A part of public policy has become based on the theoretical concept of decentralization in various areas, which in addition to efficiency should bring even greater accountability and transparency to the provision of public services as well as in the implementation of public policies (DeMello, 2000). At the same time, empirical studies describing and comparing the real effects of decentralization in different areas of public policy have begun to appear. International comparisons of the impact of fiscal decentralization are offered by (DeMello, 2000), (Bardhan, Mookherjee, 2006), (Geis, Heinemann, Kalb, 2010), (Lockwood, 2002), (Matějová, et al. 2015), (Fingžar, Oplotnik, 2013). There are studies that point to the fact that the benefits of decentralization may not be as they are described by the theory of fiscal federalism. The problem lies not in deciding whether to decentralize generally, but rather in which functions to decentralize and in which sectors and in what regions to implement decentralization. In many cases it is not important whether the given service is provided by a central or local government, but how the provision of the service is coordinated (Prudhomme, 1995). The theoretical framework for these decisions has been defined by (Freille, 2009), who distinguishes between so-called market decentralization, which is associated with traditional fiscal federalism, political decentralization in terms of the transfer of decision-making powers to the citizens, constitutional decentralization in terms of creating federal institutions in the regions, and spatial decentralization which includes regional development outside major urban areas. Freille also defines the tools by which we can express the degree of decentralization. These are, for example, the percentage of expenditures and income of local governments compared to GDP, the number of individual levels of government and jurisdictions, the existence of autonomous regions, etc.

For our analysis, it is important to recognize the impact of decentralization on efficiency in public procurement as well as the impact of decentralization on corruption. In the area of public procurement, we can identify several comparative studies, for example. (Halásková, 2015), which utilize the theoretical-empirical model to evaluate the role of territorial self-governments connected with procuring local public services in fifteen EU Countries. We consider (Březovník, Oplotník, Vojinovič, 2015) to be the most important study which analyzes the current state of decentralization of public procurement in European Union countries. In

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addition to the typical benefits of decentralization, the authors also mention the importance of small and medium businesses. They also cite the impact of the economic crisis as a trigger for reflection regarding the transition towards a greater centralization in public procurement. This trend, of course, has been strongly influenced by modern electronic tools such as electronic auctions or systems to aggregate demand. From an economic perspective, the benefits of centralization lie in the achievement of economies of scale, which is reflected in lower prices and fewer transaction costs. The factor regarding the employment of a professional and skilled staff who ensure these activities is also key. However, the coordination of activities between the branches of government and the selection of the most appropriate way to organize public public partnerships (vertical or horizontal) so as to achieve the greatest possible efficiency remain problematic. Another study which deals with the centralization or decentralization of public procurement is OECD (2000, 2007). A complete overview of the issue, along with a description of current practice eg. in Denmark, Finland, France, Hungary, Italy, Sweden and the United Kingdom is offered by Sigma Paper No. 47: Centralized Purchasing systems in the European Union. The impact of decentralization on public procurement is dealt with in additional studies with regards to individual countries. We can cite, for example, Italy (Dametri, et. al. 2012), Serbia (Jovanovic, Benkovič, 2013), Slovakia (Pavel Sičáková-Beblavá, 2012) and the Czech Republic (Plaček, et. al. 2015).

Other studies such as (Jaško, Jovanović, Čudanov, 2015) highlight the benefits arising from the centralization of procurement for municipalities, but also highlight the potential risks which are specified in detail in the studies of (Spagnolo, Albano, Bianchi, 2007), (Pegnato, 2003) and also by (Albano, Spagnolo, Zanza, 2009). The following table summarizes the advantages and disadvantages of centralized versus decentralized procurement.

Table 1: The advantages and disadvantages of centralized procurement

Advantages of centralized procurement	Disadvantages of centralized
Better products	Creating barriers to the entry of small and medium sized suppliers
Lower prices due to economies of scale	The risk of collusive cartels
Fewer legal risks	Demanding implementation of central procurement system, giving rise to costs associated with coordination
Lower overhead costs	High investment and transaction costs in the first years of operation
Support for public policy goals	Applicable for the purchase of standardized commodities: common interest goods, furniture, travel and transport services, ICT goods
Easier procurement process	Benefits are usually greater for smaller

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	entities than for larger purchasing entities
	Advantageous for countries with a higher number of smaller purchasing entities
	Risk of centralized corruption

Source: Authors according to (OECD, 2011), (Březovník, Oplotník, Vojinovič, 2015), (Jaško, Jovanović, Čudanov, 2015)

In the case of the impact of decentralization on corruption, we did not find clear results. Part of the studies argue that decentralization actually leads to more corruption, for example (Goldsmith, 1999), (Treisman 2000), (Wu, 2005). In contrast, there are studies which state that decentralization means less corruption (Ames, 1994), (Barenstein, De Mello 2001), (Fishman and Gatti 2002). Only a few studies take multiple kinds of decentralization into account, e.g. (Enikopov, Zhuravskya, 2007). The most comprehensive view of decentralization was introduced in 2009 by (Freille, Haque, Kneller 2007), who, in their investigation, tested the full impact of decentralization on a sample of more than 100 countries using 20 indicators of decentralization on corruption perception index of TI and the World Bank. The main findings demonstrate that market decentralization (in terms of fiscal federalism) is associated with lower corruption. Constitutional decentralization having the meaning of the establishment of a federal institution within the country is associated with higher levels of corruption. This supports our given explanation.

In our study, we proceed from the idea of a hierarchical structure (see Simon, 1997). We examine the advantage of the hierarchical arrangement, in this case, the effect of decentralization. According to the ideas of the hierarchical structure, decentralization allows for more effective decisions. This is primarily due to the factors of communication and information flow. In the context of the idea of a hierarchical structure, it can be expected that decentralized procurement will be more efficient than centralized procurement.

The main objective of this article is an empirical analysis and evaluation of the territorial impact of decentralization on public procurement in the Czech Republic. Unlike previous approaches using an econometric model, we focus not only on the phase of bidding, but also on phases of pre-bidding and post-bidding. We establish auxiliary hypotheses based on this approach, whose verification will aid us in achieving the main objectives of the article:

Hypothesis no. 1: The type of contracting authority has no influence on achieving savings (calculated as the difference between the estimated and tendered value of the public contract)

Hypothesis no. 2: The type of contracting authority has no influence on the quality of public procurement (measured by the odds ratio that a petition for review will

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be filed regarding the public procurement by suppliers, or that a review of the public procurement will be commenced ex officio)

Hypothesis no. 3: The type of contracting authority has no influence on the odds ratio that violations of the law will be found by the regulator in the case of a public contract

2   Decentralisation in the Czech Republic

The Czech Republic's public administration is conceived as a three-tier entity which is comprised of the central government, the self-governing regions, and municipalities (Bakoš, Soukopová, Selešovský, 1995). This arrangement resulted from the gradual build-up of democratic structures after 1989 as a counterweight to the communist past, when the public administration was two-tiered and highly centralized, burdened by inefficiency, politicization, corruption, and nepotism. The establishment of higher territorial units defined by the Constitution of the Czech Republic (Article 99 and the following). The provision of higher self-governing units is regulated by Constitutional Law no. 347/1997 Coll., regarding the establishment of higher territorial units and amending the Constitutional Act of the Czech National Council no. 1/1993 Coll., Constitution of the Czech Republic. This law provided the names of regions and their definition by the enumeration of districts (districts defined by the Interior Ministry decree no. 564/2002 Coll.). The regions were finally formed on January 1, 2000 pursuant to the Act no. 129/2000 Coll., regarding regions (regional governments). The Act on Regions has been amended more than twenty times since its adoption. Regional elections are held according to law no. 130/2000 Coll. Basic information about the regions in the Czech Republic is provided in the following table:

Table 2:   Basic information about the regions in the Czech Republic

Name of Region	Number of Citizens	Area (km2)	Pop. Density per Square Km	Regional GDP per capita in purchasing power parity, EU27 = 100
Capital City Praha	1272690	496,10	2360	173,4
Středočeský	1274633	11014,97	104	77,2
Jihočeský	637460	10056,79	62	71,9
Plzeňský	574694	7560,93	73	80,3
Karlovarský	310245	3314,46	92	57,9
Ústecký	830371	5334,52	154	64,7
Liberecký	439262	3162,93	135	65,9
Královehradecký	555683	4758,54	115	74,4
Pardubický	505285	4519	112	68,5

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Olomoucký	639946	5266,57	123	65,8
Moravskoslezský	1236028	5426,83	227	70,6
Jihomoravský	1169788	7194,56	159	83,1
Zlínský	590459	3963,55	149	75,1
Region Vysočina	512727	6795,56	75	70,1

Source: ČSÚ (2014)

The following table shows the structure of municipalities in the Czech Republic:

Table 3: The size structure of municipalities in the Czech Republic and their population size until 31 December 2011 (Czech Statistical Office, 2013)

Size category of municipalities (population)	Number of municipalities in category	% from total number of municipalities	Total number of population in category	% from total number of population
1-199	1,468	23,48	181,851	1,96
200-499	2,017	32,27	658,207	7,11
500-999	1,366	21,85	962,918	10,39
1,000-4,999	1,127	18,03	2,232,666	24,10
5,000-9,999	142	2,27	971,336	10,49
10,000-49,999	110	1,76	2,171,738	23,44
50,000-99,999	16	0,26	1,137,171	12,28
100,000-499,999	4	0,06	947,894	10,23

Source: Czech Statistical Office, 2013

The total number of municipalities in the Czech Republic is 6250. The largest changes regarding the growth in the number of municipalities from the original 4120 to the current 6250 were recorded during the 1990s, which has been connected with the building of democratic institutions as well as efforts to shift part of the political decision-making closer to the people. In comparison with other European countries, the Czech Republic is characterized by a very high number of small municipalities (Horňáková, Špaček, 2013). There are states which in the past experienced historical developments similar to the ones in the Czech Republic, i.e. Slovakia (Svidroňová, Vaceková, 2012), Austria, and Hungary. Similar structures can be found in some southern European countries - France, Spain and parts of Italy. An empirical analysis of decentralization in the Czech Republic is offered in several studies.

Matějová, et. Al., 2014, engaged in analyzing the economies of scale on the example of expenditures for primary and nursery schools and found an estimate of the optimal size of the municipalities where these costs are minimal. The same

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approach was applied in a study by Plaček, et. Al. (2015), which analyzes the costs of maintaining municipal properties. Both studies arrived at different values. For Matějová et. al, the optimum size of the municipality was about 200 thousand inhabitants, whereas Plaček et al. found the optimum size to be fifty thousand residents. Different methodological approaches were applied by Soukopová et. al (2014). They analyzed the costs of treating municipal waste. The result was that municipalities which had a population around 4000 had lower than average costs.

The expenditures of municipalities account for a significant part of GDP and it is very important to focus on efficiency when managing these resources. The following table presents a comparison of the Czech Republic, Slovakia, Hungary, and Poland.

Table 4:   Expenditures of local governments (as a percent of GDP)

Year	2012	2013	2014
Czech Republic	11,3	11,4	11,7
Slovakia	6,4	6,4	6,7
Poland	13,2	13,2	13,5
Hungary	9,3	7,5	7,9
EU 28	11,6	11,4	11,3

Source: Eurostat, 2015

The table shows that the share of expenditures of local governments to GDP varies according to the parameters of the model of fiscal federalism applied in individual countries and according to the extent of public goods and services which are provided by local governments. The Czech Republic and Poland are somewhat above the EU28 average while Slovakia and Hungary are below average. As is evident, this is not a negligible amount of public resources. It is therefore advisable to look for factors that affect the efficiency of public spending. One of these factors is the impact of decentralization or centralization. We examine this issue regarding the case on public procurement.

3   Current state of decentralization and centralization of public procurement

A significant volume of resources is awarded every year on public contracts. In 2014, the volume of the public procurement market in the Czech Republic was valued at 577 bn. CZK. In 2014, the public sector contracting authorities allocated 13.5% of GDP through public procurement. In 2015, this share was 13.7% of GDP (see the Annual Report of Public Procurement 2014, MMR, May 2015). In the EU – 28 in 2013, this amounted to (from the total expenditure on works, goods and services (excluding utilities)) 13.67% of GDP (EC, 2015). As is clear, there is a considerable amount of public funds to allocate through public procurement. It

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also follows that each streamlined process in public procurement will bring considerable savings in resources.

Public procurement in the Czech Republic faces the same problems as in other post-socialist countries. It is not just corruption (the Czech Republic in 2014 finished in 53th place in the CPI index published by Transparency International), but also other problems such as over-legislation (Nemec, et al., 2015) or the pursuit of bureaucratic safety (Nemec, et. al., 2015). Finally, there is also the limited ability (capacity) of public authorities to effectively implement the processes of public procurement. This capacity we can express by the zIndex.

The zIndex is the result of academic research at the Faculty of Social Sciences of Charles University in Prague. It is published by the association of the Centre for Applied Economics, o.s. The zIndex is a tool that indicates compliance with the awarding of public contracts and good practice, as it given by the Ministry of Regional Development and international institutions. The zIndex consists of eleven quantitative indicators (share of public contracts for total purchases, tendering, consistent negotiations, the concentration of suppliers, the number of offers, using tools that support competition, errors in the contest according to the OPC (the Office for Protection of Competition, the quality of data in the Bulletin on public procurement, the quality of data on the profiles, evaluation of suppliers, and the provision of information on request). The values of the zIndex are between 0 and 100, with 0 being the worst and 100 the best (zIndex, 2013). The zIndex is divided into three categories, namely state government, big cities, and small towns. Specific results including a detailed description of the methodology are available on the Internet (http://www.zindex.cz/).

In the category of large cities, 60 authorities were evaluated according to the zIndex. The average value based on the zIndex was 64. The highest value obtained was 76 and the lowest was 45. In the category of small cities, 121 authorities were evaluated which had an average value of 59 based on the zIndex. The highest value was 75 and the lowest was 27 (zIndex, 2013). The values of the index (which we consider to be unlike many other indices of indicators as it relatively faithfully describes the procurement market) shows that there is quite a lot of room for improvement within the system, but that also among the contracting authorities, there are quite significant differences. The situation in the category of small villages is very significant.

The public policy responses to this situation have been seen in legislation, particularly the Public Procurement Act. Changes to it occur almost annually. The most fundamental changes occurred in 2012, when the transparent amendment to the Act into effect, the main goal of which was to make further transparent and open the process of public procurement. On the other hand, this law has been

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criticized by public authorities for excessive complexity and high transaction costs.

In 2016, the next amendment to this Act will come into effect, where the main aim is to simplify the process of public procurement. When we focus on the issue of centralization vs. decentralization within the institute of public procurement, we have identified so far only one comprehensive policy. It is the effort of the Finance Minister regarding the centralization of purchases at the ministerial level. This effort corresponds to the philosophy of New Public Management, which the political party Yes, of which the Minister of Finance is chairman, supported during its election campaign. At present, a voluntary centralization of purchases at the level of individual entities is underway, where, for example, ministries can make purchases for their subordinate organizations, and this can also be conducted by individual regions or cities. The standardization of individual purchased products is the full responsibility of the individual purchasing entities. By centralizing purchases, the government promises low unit prices, a reduction of corruption and the unification of standards for individual ministries. This process was started about two years ago. To achieve the objectives, an interdepartmental working group was set up. It has the competence to standardize purchases. So far, there have been no published interim results of this policy. However, we can assume that it will be necessary to determine the optimum structure for cooperation across departments and also to solve the problem of high transaction costs, which will be caused by the coordination of activities. Last but not least, there is a risk of the institutionalization of corruption. The situation in the municipalities and regions is not being dealt with by government policy regarding centralized purchasing.

The issue of centralization vs. decentralization in public contracts in the Czech Republic has not exactly been on the front burner in the professional and scientific arenas. Most scientific studies have so far focused on demonstrating the positive impact of competitive effects and the effect of transparency on the tender price (Ochrana, Pavel, 2013; Pavel, 2014); (Pavel, Kubík, 2011); Nemec, Grega, 2015) and have dealt with the legal environment, Jurčík (2014,2015). In our research, we found only two studies that deal with the impact of the evaluation of the impact of decentralization on public procurement (Soudek, Skuhrovec, 2013) and (Plaček, et. al, 2016). Accordingly, the first study approaches this issue only marginally, and concludes that decentralization has no statistically significant effect on the efficiency of procurement. The study Plaček, et. al., 2016 explores the impact of decentralization on efficiency of the purchasing of homogeneous commodities in 2013-2014. The study concludes that the greatest efficiency is achieved by the regions as a result of a combination of economies of scale, pressure regarding accountability, and reasonable costs of coordinating purchases. The problem of this study is that it focuses only on the part of bidding in public procurement and works with a limited amount of data.

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Thus, we can conclude that there is a significant lack of knowledge which describes the impact of centralization vs. decentralization at all phases of the tender: pre-bidding, bidding, and post-bidding.

4   Data and methods

As we noted in the previous section, we can divide the course of public contracts into three phases: Phase 1 is called pre-bidding. This is the stage at which the award parameters are constructed such as defining the technical parameters, eligibility and criteria by which the bids will be evaluated, i.e. either by the lowest bid price or by the criteria of economic expediency. Consequently, the award is published. Phase 2 is called bidding; the point of which is to collect bids, their evaluation, and the subsequent selection of the winning bid. Phase 3 is called post bidding. At this stage, the unsuccessful competitors may appeal to the Office for the Protection of Competition, while the winning supplier signs a contract; and if necessary, it is at this stage that amendments to the original contract are concluded.

Due to the limited possibilities of econometric modeling and the availability of relevant data, we decided to combine the phases of pre-bidding and post-bidding. This connection falls from the following logic. The quality of managing the pre-bidding phase on the side of the contracting authority is found precisely in post-bidding phase when individual candidates have the possibility to file a petition regarding violations of the law to the Office for Protection of Competition. The authority may also ex officio initiate an investigation.
For each stage of the selection process, we used specific data and a regression model, so that we would be able to capture the effect of variables indicating the individual level of governments.

4.1   Data and methods used for analysis of the bidding phase, and testing of hypothesis no. 1

For the analysis of the bidding phase, we used data relating to public works contracts whose awarding was in the Journal of Public Procurement (www.vestnikverejnychzakazek.cz) published in 2013 and 2014. Altogether, there are about 10,043 records on public contracts or parts of contracts (§ 98 of the Act on Public Contracts). Of the examined group, we excluded incomplete records. For analysis, we used a linear regression model. Using the resulting model, we will test hypothesis No.1: The type of contracting authority has no influence on achieving savings (calculated as the difference between the estimated and tendered value of public contracts.)

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4.1.1 Response variable

The adjusted price
For the purpose of making possible comparisons among individual contracts with different volume orders, it is necessary to normalize the prices of the public contracts in some way. One such way is to divide their estimated value, thus obtaining a dimensionless quantity indicating the ratio of the final price to the estimated price. This will act as a response variable in the econometric model, from the data the average value is 0.79; the median 0.81.

4.1.2 Explanatory variables

Type of contracting authority
We take the type of contracting authority to be the main explanatory variable, which also expresses the degree of decentralization. This variable is therefore specified as follows:

- The State - Taken from the divisions set in the Journal of Public Contracts - Ministries or any other national or federal authorities, including their components or national or federal agencies / offices
- Regions – regions acting as a contracting authority (Prague is calculated as a city)
- Municipalities (contracting authorities which have the name of a municipality, city, town, or borough)
- Not included: other organizations established by the state, regions or municipalities, state enterprises, universities, subsidized or sectored contracting authorities

Table 5: Representation of the various contracting authorities within the sample

Type of Contracting Authority	Frequency in the sample
State	1551
Region	617
Municipality	4587

Source: Authors

The other explanatory variables are based on previously realized econometric studies dealing with efficiency in public procurement. Thanks to their inclusion in the model, there is an increase in the adjusted coefficient of determination. Additional explanatory variables which are included are:

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The number of offers
This is a variable which is expected to have a significant negative impact on the
standard bid price. In the monitored public works contracts, there was an average
of 5.98 bids submitted (median 5).

Type of award procedure
The following types of procurement procedures have been distinguished (there is
no special category for limited procedures nor negotiated procedures with
publication with shorter deadlines, which are listed in the Journal in a special
category, because the law doesn't address this division and additionally, there
were just a few of these shortened contracts), as well as a category for simplified
below-threshold procedures. Depending on the degree of openness, we have
distinguished the following types of procurement procedures: open procedures,
limited procedures, negotiated procedures with publication, negotiated procedures
without publication, simplified below threshold procedures, contracts awarded
without prior publication of a contract notice in the Official Journal of the
European Union.

The evaluation method
The law allows for the evaluation of tenders based on one criterion - the bid price,
or based on multiple criteria, the economically advantageous tender. 86.7% of
contracts were evaluated purely on the basis of the bid price in the examined
cases.

An additional explanatory variable is the weight of the bid price in the evaluation,
where if the evaluation is just the bid price, is has a weight of 100%.

Furthermore, dummy variables are used to represent: whether there is an
expectation of some fulfillment by a subcontractor (43.1% of the monitored
contracts), whether the contract is financed from the EU (47.2% of cases) whether
electronic auctions were used (1.4%), or whether the contract is awarded for other
entities (i.e. if it is a case of central procurement) (1.2% of cases). Dummy
variables express definite time factors acquiring a value of 1 for contracts
announced in 2014.

Data from the Czech Statistical Office on individual countries and regions is also
utilized, particularly data on the value of GDP per inhabitant, the population of
counties, the number of economic entities, and the number of economic entities
which have construction as their main activity. Indicators are calculated using the
data for individual counties (number of economic entities per 1,000 inhabitants
and the number of entities in the construction industry per 1,000 inhabitants in the
district), which indicates a certain degree of economic strength of the county as
well as the strength of competition on the given market.

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4.2   Data and methods used for the phases of pre-bidding, post-bidding, and testing hypotheses No. 2 and No. 3

In the empirical analysis, data was used on public procurement, whose publication or awarding was published in the Journal of Public Procurement in 2010 and 2014 (i.e. including canceled contracts). There were a total of 69,959 contracts, with contracts divided into parts being processed as a whole. These data were combined with information about the administrative decisions of the Office for the Protection of Competition (OPC) which were issued during the period January 2011 to March 2015. Data on decisions are published in the Collection of Decisions of the OPC, with 1965 being first instance decisions. Since this data contains more decisions on the same contract as well as some decisions related to contracts which are not published in the Journal (e.g. minor public contracts or cases where the contracting authority failed publish data about a contract in the Journal) or some concerning contracts which had reviews that started before reporting period, there were a total of 867 public contracts listed in the Journal of Public Procurement, of which the OPC held administrative proceedings. Of this total, 752 proceedings were initiated by the filing of petitions. From these, the OPC found that the contracting authority had violated the law in 258 of them. Given the nature of the response variables, logistic regression (logit) using a logistic function during parameter estimation. This model will be used to evaluate the following hypotheses set out in the objectives of the work:

Hypothesis no. 2: The type of contracting authority has no influence on the quality of public procurement (measured by the odds ratio that a petition for review will be filed regarding the public procurement by suppliers, or that a review of the public procurement will be commenced ex officio).

Hypothesis no. 3: The type of contracting authority has no influence on the odds ratio that violations of the law will be found by the regulator in the case of a public contract.

4.2.1   Response variable

Within the model, we seek a partial explanation of the probability that a contract will be subject to review by the Office for Protection of Competition (OPC), therefore, it is of interest to find contracts with such parameters which are relatively more subject to investigation. For this reason, an appropriate dummy variable was created which takes the value 1 when the OPC leads an administrative procedure regarding specific public contract and a value of 0 for other contracts.

Furthermore, we can apply the situation where the OPC has found a violation of the law regarding a specific public contract from the side of the contracting

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authority, and has issued corrective measures or fines as an additional explanatory variable. In this case applies, the variable will assume a value of 1. Otherwise, it is 0.

4.2.2   Explanatory variables

The degree of decentralization among the contracting authorities
Detailed characteristics of the variables are listed in the following table:

Table 6:   The degree of decentralization among the contracting authorities

The degree of decentralization among the contracting authorities	Frequency	% Share
State	7 934	11,3
Region	4 390	6,3
Municipality	20 730	29,6
Other (unclassified)	36 905	52,8
Total	69 959	100

Source: Journal of Public Procurement, own categorization based the name of the contracting authority

Other explanatory variables are based on previously realized econometric studies dealing with the efficiency of public procurement. Thanks to their inclusion in the model, there is an increase in the adjusted coefficient of determination. Additional included explanatory variables are:

Estimated value of the public contract
The estimated value of the public contract serves as an explanatory variable for describing the size of the public contract, which is denominated in CZK without VAT. It is the sponsor's responsibility to determine the value prior to the commencement of a public contract and this value also determines whether the contracting authority is obliged to act according to specific sections of the law or not.

The obtained data reaches The estimated value from the obtained data had average 24 510 490.05 CZK and the median was 4.8 million CZK. The data regarding contracts which had values below 10 000 CZK were eliminated since they probably contained incorrectly entered values and unit prices.

Type of contract and type of award procedure
When specifying the type of public contract or the type of procurement procedure, the basic divisions according to the law were used. 23,509 contracts for goods, 19,326 service contracts and 27,124 contracts for construction work were

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represented in the analyzed data. Depending on the degree of openness, we have distinguished the following types of procurement procedures: open procedures, limited procedures, negotiated procedures with publication, negotiated procedures without publication, simplified below threshold procedures, contracts awarded without prior publication of a contract notice in the Official Journal of the European Union.

Administration by an external entity
Another factor which we anticipated as having a possible impact on the course of the procurement procedure was, in fact, whether the contract had been administered by the internal resources of the contracting authority or had used external administrators for public contracts (typically, the services of consulting companies or law firms). This information was found through the contact details on the administrator's contract specified in the Journal of Public Procurement. The analyzed data showed that external administrators were used in 14.5% of the cases.

Other explanatory variables:
   • whether the lowest bid price criterion was used - at 73.3% of analyzed orders
   • whether electronic auctions were used - in 3,4%
   • contract is financed from EU subsidies - 42.8%
   • contract is divided into parts - 10.7%
   • contract is awarded to another contracting authority (central procurement) - 3.2%

5   Results

5.1   The results of the bidding phase and testing of hypothesis no. 1

The results for the submission phase and evaluation of tenders are presented using an econometric model and are shown in the following table:

Table 7:   **Results of OLS**
Using observations 1-10043 (n = 9801), Missing or incomplete observations dropped: 242, Dependent variable: price norm, Heteroscedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
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	***
Limited 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

The model shows (with respect to econometric studies of similar nature) a relatively high coefficient of determination. If we look at the variables which express the degree of decentralization of the authority, we may conclude that this factor (statistically) significantly affects the standardized price. Therefore, we reject hypothesis no. 1. The biggest savings are achieved by the regions, behind them is the state, which achieves values 0.2% higher and finally the municipalities which achieve values higher by 0.5%. This result is consistent with a previous study (Placek, et. al., 2016) which examined the impact of decentralization on the purchase of homogeneous commodity gas where the biggest savings were realized by the regions. The study (Soudek and Skuhrovec, 2013), which analyzed historical data on purchases of energy as being statistically significant effect based on the type of contracting authority was proved.

In connection with decentralization, another interesting impact factor is the number of construction companies in the region, which gives us the size of the potential competition in the region. Within the theory, we may view decentralization as a positive factor which has an impact on the number of small and medium-sized businesses in the region (Březovník, Oplotník, Vojinovič, 2015) and, therefore, more competition, which should lead to lower bid prices. In our model, the influence of the number of economic entities had the opposite effect.

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In terms of fiscal federalism, the negative impact of EU subsidies on potential savings is certainly interesting. This situation can be explained by the lack of merit for using those resources and the greater potential for corruption.

5.2 The results for the pre-bidding, post-bidding phases and testing of hypotheses Nos. 2 and 3

As we stated in the section of the article dedicated to methods, we combine the pre-bidding and post-bidding phases for the econometric model. We evaluated the level of quality of the procurements by the contracting authority via a Logit model, which expresses the probability that competitors will file an appeal with the Office for Protection of Competition and further the probability that the OPC initiated an investigation ex-officio and, finally, the probability that the Office will find violation of the law by the contracting authority during its investigation.

The following table shows the results of the Logit probability that competitors filed an appeal with the Office for Protection of Competition, regarding a violation of the Act on Public Procurement. The table includes only variables that the model identified as being statistically significant.

Table 7: Chance of petition to the OPC by one of the suppliers
Model: Logit, using observations from 312 to 69,958 (n = 62,402), Missing or incomplete observations dropped: 7245, Dependent variable: Proposals, Standard errors based on Hessian

	Coefficient	Std. Error	Z	p-value
const	−4.44173	0.101436	-43.7887	<0.00001
For other contract is awarded on behalf of other contracting authorities	0.691596	0.183183	3.7754	0.00016
based on the lowest bid price	−0.428829	0.0795596	-5.3900	<0.00001
Estimated value	6.15475e-011	2.44042e-011	2.5220	0.01167
administrator	0.353212	0.096296	3.6680	0.00024
National or federal agency / office	0.456897	0.124685	3.6644	0.00025
Ministry or any other national or federal authority	0.317361	0.10802	2.9380	0.00330
Services	0.79605	0.101484	7.8441	<0.00001
Construction work	0.393486	0.107376	3.6646	0.00025
Limited	0.50095	0.128016	3.9132	0.00009
Negotiated procedure without publication	−3.40473	0.450627	-7.5555	<0.00001

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Negotiated procedure with publication	−1.16747	0.255237	-4.5741	<0.00001
Simplified below-threshold	−1.54523	0.165097	-9.3596	<0.00001

Mean dependent var	0.010977	S.D. dependent var	0.104196
McFadden R-squared	0.075928	Adjusted R-squared	0.072482
Log-likelihood	−3485.507	Akaike criterion	6997.013
Schwarz criterion	7114.551	Hannan-Quinn	7033.456

Number of cases 'correctly predicted' = 61716 (98.9%), f(beta'x) at mean of independent vars = 0.104, Likelihood ratio test: Chi-square(12) = 572.789 [0.0000]
Source: Authors

From the model results, it is obvious that the degree of decentralization has no statistically significant effect on the filing of petitions by applicants to the Office for Protection of Competition. Therefore, we cannot reject hypothesis no. 2. We can explain the strategies of competitors in this situation as having made rational calculations regarding the likelihood of success of a petition and from this the resulting gain from the awarding of the contract, which it compares with the potential transaction costs. "For another" seems to be a statistically important variable. It's a situation where small associations of municipalities do the contracting. This factor increases the likelihood of supplier petitions.

In another model, we focus on the probability that investigations will be started ex officio. The results are shown in the following table. The table includes only variables which the model identified as statistically significant.

Table 8: The odds ratio that investigations will be started ex officio
Missing or incomplete observations dropped: 7523, Dependent variable: OPC, Standard errors based on Hessian

	Coefficient	Std. Error	z	p-value
const	−4.27942	0.101962	-41.9706	<0.00001
For other contract is awarded on behalf of other contracting authorities	0.610558	0.180435	3.3838	0.00071
Based on the lowest bid price	−0.450411	0.0749061	-6.0130	<0.00001
Estimated value	6.45904e-011	2.4771e-011	2.6075	0.00912
Subsidy financed from EU	0.126724	0.0752031	1.6851	0.09197
Administrator	0.288759	0.0917356	3.1477	0.00165
National or federal agency /	0.422381	0.12032	3.5105	0.00045

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office,				
Ministry or any other national or federal authority	0.276597	0.104095	2.6572	0.00788
Services	0.673169	0.0951438	7.0753	<0.00001
Construction work	0.315438	0.0989271	3.1886	0.00143
Limited	0.584453	0.118905	4.9153	<0.00001
Negotiated procedure without publication	−2.78245	0.320757	-8.6746	<0.00001
Negotiated procedure with publication	−0.905703	0.214338	-4.2256	0.00002
Simplified below-threshold	−1.44764	0.14995	-9.6542	<0.00001

Mean dependent var	0.012475	S.D. dependent var	0.110994
McFadden R-squared	0.069007	Adjusted R-squared	0.065648
Log-likelihood	−3880.158	Akaike criterion	7788.316
Schwarz criterion	7914.833	Hannan-Quinn	7827.551

Number of cases 'correctly predicted' = 61348 (98.8%), f(beta'x) at mean of independent vars = 0.111, Likelihood ratio test: Chi-square(13) = 575.213 [0.0000]
Source: Authors

The results show that, like in the previous model, we cannot reject hypothesis no. 2. The variable of EU subsidies is situated among the important variables. The increased chances for the initiation of an investigation are linked to the policy of intensive monitoring requirements required to draw EU subsidies.

In the final model, we are focused on the probability of violations being found by the Office for the Protection of Competition. The results are shown in the following table. The table includes only variables which the model identified as being statistically significant.

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Table 8: **The odds ratio that the Office for Protection of Economic Competition finds a violation of the law.**

Model 36: Logit, using observations 312-69958 (n = 66702), Missing or incomplete observations dropped: 2945, Dependent variable: vilation of law, Standard errors based on Hessian

	Coefficient	Std. Error	z	p-value
const	−6.23522	0.225528	-27.6472	<0.00001
Regional authority	−1.06975	0.386785	-2.7657	0.00568
Based on the lowest bid price	−0.775813	0.128903	-6.0186	<0.00001
Subsidy	0.356535	0.129155	2.7605	0.00577
Regional or local agency	0.537669	0.197428	2.7234	0.00646
Others	−0.393259	0.205282	-1.9157	0.05540
Services	0.611102	0.133619	4.5735	<0.00001
Open	1.08972	0.203847	5.3458	<0.00001
Limited	1.78844	0.261327	6.8437	<0.00001
Negotiated procedure without publication	−0.815817	0.452713	-1.8021	0.07154

Mean dependent var	0.003763	S.D. dependent var	0.061228
McFadden R-squared	0.058613	Adjusted R-squared	0.052559
Log-likelihood	−1554.930	Akaike criterion	3129.861
Schwarz criterion	3220.941	Hannan-Quinn	3158.014

Number of cases 'correctly predicted' = 66451 (99.6%), f(beta'x) at mean of independent vars = 0.061, Likelihood ratio test: Chi-square(9) = 193.627 [0.0000]

In the most important model, which examines the odds ratio that a violation of the law by the contracting authority would be found, there were some crucial findings. When a region was the contracting authority, there was a significantly lower chance of a violation being found. Therefore, we reject hypothesis no. 3.

Therefore, in the case of regions, there seems to be higher level of quality when it comes to public procurement than in the cases of municipalities or the central government. Březovník, Oplotník, Vojinovi (2015) reported a benefit from centralization regarding improved public procurement, as the central authorities have more qualified personnel. In the Czech Republic, the regions are on the middle level of centralization / decentralization. We can therefore assume that they have qualified personnel. At the same time, however, the effect of accountability that is described by (Frei, 2009) seems to be more effective than at the level of the central authorities. In the case of municipalities, the shortage of

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qualified personnel is a limiting factor regarding public procurement. This problem is particularly pronounced for populations below 1,000.

6   Discussion and Recommendations for Public Policy

At the beginning of our recommendations, we must conclude that our empirical analysis does not cover the entire spectrum of public contracts, but only selected aspects of public procurement. In the area of evaluating efficiency in these, we have public works and the purchase of gas. In evaluating procurement quality, we have the purchases of goods, services and public works. Nevertheless, we believe that our conclusions are valid for public policy.

As part of our comprehensive analysis of the impact of decentralization on the efficiency of public procurement, there were surprising, but in a way, logically coherent conclusions. The regions implemented the greatest efficiency while simultaneously maintaining procedural and formal correctness in public procurement. If we perceive the centralization of public procurement as the formation of a vertical structure of public public partnership, the region appears to be optimal degree of centralization. Our results also partially confirmed the potential problematic creation of horizontal structures of public public partnerships, such as the associations of small municipal units of the same level, which is reflected particularly in the quality of the implementation process of public procurement.

The authors are aware of the benefits of central procurement which could be very significant as the Czech Republic is characterized by having a large number of small purchasing entities, creating a large space for the realization of economies of scale, for more information see (OECD, 2011). In our opinion, there is too much emphasis placed on the effect of economies of scale and an underestimation of the additional costs associated with the coordination of purchases and aggregation of demand in the context of the design of public policies in the Czech Republic in this area, which can influence the net balance of benefits and costs to the detriment of centralization. In the Czech Republic, these costs are multiplied by a large number of municipalities with small populations. Another factor that speaks to the detriment of centralization is the higher accountability associated with fiscal decentralization. The factor which needs to grow in importance is the pressure placed on the responsibility of the politicians via Western countries and greater roles played by civilian society as a control mechanism along with gradual changes in society and approaches within the Czech Republic. We view the issue of municipalities having lesser qualified staffs as a negative for decentralization in public procurement. This assumption is confirmed by the evaluation of the quality of public procurement through the Z index. The responsible authority in this area (i.e. the Ministry for Regional Development) should focus on training and methodological support for authorities at the level of smaller communities. This

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situation may be facilitated by the use of various auction software solutions for public procurement which could speed up and simplify the process of public procurement.

When, however, a public authority opts for any level of centralization in public procurement, it will have to solve several potential problems that will affect the future success of the whole project such as voluntary vs. mandatory participation in the central purchase, which commodities to purchase (usually indicated by goods of common interest, but according to the OECD (2011,) savings can even be achieved on IT services,) which kind legal form the central organization conducting the purchasing should have, and how the central purchasing will be funded. Perhaps the most problematic part of the process undoubtedly will be reconciling the interests of all the major stakeholder, e.g. politicians at the central and local levels.

7 Conclusion

The article provides a comprehensive look at the issue of centralization vs. decentralization of public procurement in the Czech Republic. To analyze the problem, we use data for the years 2013-2014, to which we have applied linear and logistic regression. Using econometric models, we have tried to analyze all phases of public procurement; pre-bidding, bidding, and post-bidding. In terms of efficiency and the quality of process in public procurement, the regions were the best performers. We may seek the cause in the optimal ratio from the effect of the economies of scale, accountability and low losses resulting from the necessity of the coordination and aggregation of bids.

In the section devoted to recommendations for public policy, we dealt with recommendations regarding the creation of vertical and horizontal structures of public public partnership, which we recommend to be centralized at the regional level. The findings also hint at the untapped potential of accountability. The synergies of accountability and decentralization also remain open to investigation. Increases in quality can also be found by improving the professional preparation of staff. In small towns, which are the majority of the Czech Republic, public procurements are usually prepared by one (typically unskilled) person. The preparation of tender documentation in the form of outsourcing does not seem to be taken into account. Additionally, small municipalities have very limited budget resources.

Finally, we must note the work concerned with examining the influence of centralization and decentralization on public procurement, as well as the results of our research which lead to unambiguous conclusion regarding the influence of decentralization on efficiency in public procurement. The reasons are mainly as follows: the lack of empirical data, changing market conditions, the lack of appropriate methods, how seriously to quantify the savings due to the

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centralization vs. decentralization of purchasing. Another problem involves the gradual rise of centralized procurement systems, the full effects of which will be generated in up to 4 years (OECD, 2011). The vectors for future research are namely the creation of a single interface for the empirical analysis of the effects of decentralization vs. decentralization of public procurement, a closer analysis of transaction costs and, ultimately, how to reconcile the interests of different stakeholders.

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