CHARLES UNIVERSITY IN PRAGUE

FACULTY OF SOCIAL SCIENCES

INSTITUTE OF ECONOMIC STUDIES

Jan Soudek

Public procurement of homogeneous goods: Czech Republic case study

Rigorous thesis

Prague 2013

Author: **Mgr. Jan Soudek**

Supervisor: **PhDr. Ing. Jiří Skuhrovec**

Abstract

The goal of this thesis is to show that institutional and procedural characteristics are affecting the final price of the public procurement. In order to be able to compare the tenders among each other, only public procurement of homogeneous goods is analyzed. The presented model attempts to explain a variation in final price per one unit as a function of estimated unit price, market price and characteristic of procurement procedure – type of procedure, number of bidders and use of electronic auction.

In case of electricity and gas public procurement final price elasticity with respect to the estimated price tents to be higher than such elasticity with respect to the market price. This result suggests high rigidity in public procurement procedures. We show that such ineffectiveness is reduced by using open procedure, electronic auction or attracting more bidders.

Abstrakt

Cílem této práce je ukázat, že institucionální a procedurální charakteristiky veřejné zakázky ovlivňují její výslednou cenu. Aby bylo možné zakázky porovnávat, byly k analýze vybrány pouze veřejné zakázky na homogenní statky. Prezentovaný model se snaží vysvětlit variaci ve výsledných jednotkových cenách zakázky jako funkci jednotkové odhadované ceny, tržní ceny, a charakteristik výběrového řízení – jeho typ, počet nabízejících a použití elektronické aukce.

V případě elektřiny a plynu je výsledná cenová elasticita s ohledem na očekávanou hodnotu vyšší než cenová elasticita s ohledem na cenu na trhu, což naznačuje rigiditu veřejných zakázek. Výsledky ukazují, že neefektivita se snižuje při použití otevřeného řízení, elektronické aukce a při vyšším počtu nabízejících.

Bibliographical Record

SOUDEK,J. (2013): *Public procurement of homogeneous goods: Czech Republic case study* (Rigirous thesis). Prague. Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies. Supervisor: PhDr. Ing. Jiří Skuhrovec

Extent of the work: 86 pages

Declaration of Authorship

The author hereby declares that she compiled this thesis independently, using only the listed resources and literature.

The author grants permission to Charles University to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, September 7, 2013 _____

SIGNATURE

Table of Contents

Introduction

<u>Rigorous Thesis Introduction</u>

Compared to the original master thesis, the rigorous thesis underwent some significant changes incorporating formal and factual remarks of the opponents. Incorporating those changes into original text results in the IES working paper 05/2013 that is attached in the Appendix of this thesis.

The paper was completely restructured. We merge the subchapters of individual commodities in common tables and discussions. Second we present the motivation of our research together with hypothesis statement. We also revise the literate review and build up the motivation behind the hypotheses. Now they are align closely to current procurement and auction theories. We also add a paragraph in the text, discussing the estimated price and its implications in more detail.

<u>Introduction</u>

Public procurement (PP) became a highly monitored area recently. Through that institutional framework are processed purchases and investments from public sources which make about 15 % of annual GDP in developed countries[1]. At the same time PP as a purchases form public sources have several very important institutional characteristics that differentiate them from private purchases and they are affecting the overall efficiency of these public purchases.

Developed countries are currently facing financial difficulties and they are trying to reduce public deficits through both fiscal cuts and tax increases. Within such environment are states concerning more about inefficient purchases and wasting money that might result from inappropriately prepared PP.

Czech Republic is an extraordinary case: the size of the PP market is the second biggest of all OECD countries, the country has weak both formal and informal institutions[2]. Czech Republic is on the bottom of international rankings of corruption perception index[3], controlling and audit of public expenditures don't work properly and the threat

---

[1] OECD: Size of public procurement market, in OECD, Government at a Glance 2011, OECD Publishing.2011
[2] Schwab, K,: The Global Competitiveness Report 2011-2012, World Economic Forum 2011
[3] Transparency International (2011): Coruption perception index 2011, Transparency International

of unmoral behavior in Czech PP is considerable. The topic of PP is in Czech Republic even more important than in other countries.

At the same time Czech Republic provide a large unique dataset of PP. On the informational portal of PP are published all large tenders. Amount of information about each individual tender and number of tenders (about 10 000 tenders in a year) provides a very unique publicly available dataset. This dataset contains lots of errors and the data mining and purging is time demanding and expensive, but it still provide a very transparent set of information about PP that has no parallel in developed countries.

In the Czech Republic, PP is regulated by the Public Procurement Act[4], which determines rights and obligations of involved parties. The core goal of this act is to create institutional environment with highest possible openness, transparency, non-discrimination and efficiency. However the law leaves a space for discretion of officials who are making those tenders and therefore their objectives and motives of economic behavior are important determinants of outputs of PP process.

Recent studies and publications about PP in Czech Republic describe the procurement system as a whole and point out its crucial pitfalls and shortcomings. They give a broad overview of basic information. Their approach is good for some initial research; however it necessarily leads to a lot of generalization, because it describes the market where all kind of goods and services are purchased. Therefore we will move forward to more compact and unified market in order to be able to deliver more analytical and sophisticated study.

The core goal of this thesis is to identify the relationship between institutional and procedural characteristics of the PP and its final price. In order to be able to compare the tenders among each other, we decide to use only PP of homogeneous goods. Because of this homogeneity we are able to compute a price per one unit of purchased good. Additionally we are able to compare the unit price of PP with unit price of such goods purchased by private sector. This thesis will provide new unique results that will be relevant for both theoretical discussion and daily praxis of PP. Moreover, presented institutional settings are applied not only in Czech Republic, but across the whole European Union, so this research has a supranational relevance.

---

[4] Act no. 137/2006 Coll. On Public Contracts

The work is organized as follows: first chapter of the thesis introduces the PP of homogeneous goods by giving a brief description of the institutional framework which plays crucial role in tendering system. The chapter two describes the economic specifics and the literature review. Chapter three is designed as empirical case study of PP of homogeneous goods, where three different PP markets are analyzed. In summary we compare the empirical results with the theoretical framework and propose some policy recommendations.

1 Fundamentals of the Public procurement of homogeneous goods

PP is a procedure used for purchases financed from public budget. Such kind of purchases has a tremendous impact on the economy as a whole. At the same time PP process has several important distinctions from the ordinary consumer purchase.

This part of the thesis provides a definition of the subject of our interest and briefly describes the Czech legal framework[5] of such purchases. In particular it is aimed on basic terms and procedures used in PP processes. Moreover it describes various types of contracting authorities. The chapter ends with description of the controlling institutions of PP who are very important for the efficiency of the whole PP purchasing system.

1.1 *Legal framework in Czech Republic*

The Czech legislature, namely Act no. 137/2006 Coll. On Public Contracts (the PP Act), is generally the transcription of European directives (2004/17/EC & 2004/18/EC). These directives set up a common institutional framework and basic terms for all EU countries. The following part of the thesis describes the most important term that needs to specify in order to understand presented discussion in following chapters. Some of the exact formal definitions are placed in the appendix.

1.1.1 Definition

An actual legal definition used in the Czech legislative concerning PP is defined in the PP Act and it is written in the appendix. Unfortunately this definition is not optimal for

---

[5] Which is in compliance with legal framework of the European Union.

economic purposes and therefore we will rather use the definition used in Pavel (2009) as a starting point. His definition covers all the PP made not only by a state but also by various government bodies as well as utilities and state owned enterprises. Additionally presence of a contract between a purchasing institution (called contracting authority, see 1.1.2.) and a supplier give us a straightforward boundary for distinction between PP and a small common purchase from public sources. However this definition is way too broad for the purpose of this paper and therefore we need to modify it in a way that only the homogeneous goods are covered.

Homogeneous goods are goods that are uniform or standardized. There are no differences in products from the point of view of purchaser; therefore there is no space for product differentiation. Additionally such homogeneous good is perfectly divisible therefore the contracting authority purchases whatever precise quantity of these goods.

Definition: Public procurement of homogeneous goods
„Public procurement of homogeneous goods is any kind of order to purchase of homogeneous goods which is (mainly) financed from public sources and which is based on a contract between a contracting authority and a supplier. "

This definition specifies our subject of interest exactly. Moreover there are several important economic characteristics which will be described in chapter 2 of the thesis.

1.1.2 Basic terms in public procurement

Contracting Authority is any public office which has to use PP procedures when it wants to purchase goods or services. **Bidder** is anyone who offers the delivery of goods or services in PP procedure. The winning bidder signs a contract with contracting authority and becomes a **supplier** of desired products.

Award procedure is a legal process of selection the supplier of PP. Both Czech and European legislature propose a variety of procedures, different in terms of openness, formalities or transparency. General process of decision making can be illustrated as follows:

5

Figure 1: General concept of public procurement process

Need
- Assessment of needs of the contracting authority to purchase certain goods or services
- Realized within the organism of the contracting authority (preferentially bottom-up)

Form
- In this phase, the contracting authority materializes its identified needs into a formal PP documentations which sets requirements on what shall be purchased and who shall delliver it

Announcement (1)
- The PP is announced in a way required by law
- Bidders may start to prepare their offers and compete
- Office for the Protection of Competition control (upon bidders' request), public control

Evaluation of bids
- The bids are received by the contracting authority, which evaluates them and selects the winner of the public contract based on criteria stated in the PP documentation
- Possible control by the Office for the Protection of Competition

Announcement (2)
- The contracting authority announces the winner and publishes the winning price
- This enables ex post control of the procedure
- Possible ex post control –both public and by the Office for the Protection of Competition

Contract
- The public contract is awarded to the winner and starts to be fulfilled
- Potential changes solved between the contracting authority and winner

Source: Reimarová (2011)

As we said before, the most substantial institutional characteristic is an award procedure. Type of award procedure determines the openness and transparency of the process as well as time dimension, number of bidders and consequently, as we would like to prove, the final price of a contract. For the purpose of this thesis there are two most relevant basic types of award procedures:

- **Open procedure** is the most transparent. Everyone can bid in this tender. Contracting authority announce the intention to award a procurement on the internet and ask unlimited amount of potential suppliers who may bid for procurement after they show the fulfillment of qualification criteria.
- **Negotiated procedure** is the procedure whereby the contracting authority consults and negotiates the terms of contract with one or more of bidders. The use of this procedure is limited, contracting authority can use it only in some special cases, specify by the law (see appendix). This procedure may or may not be published. The procedure is usually

6

used when the previous open procedure was canceled or when contracting authority needs to discuss with the suppliers before it specifies the subject of PP. However this procedure might be abused to restrict the competition, because it allows contracting authority to award only those bidders who were asked for the bid in the tender.

These two procedures make a significant role in our empirical model, the motivation behind and the expected impact of various procurements on final price of the contract are discussed in chapter **Chyba! Nenalezen zdroj odkazů.**. Pavel (2008) shows that there are statistically significant differences among various procedures used in PP.

<u>Czech national informational portal</u> (www. isvzus.cz) is the source of our dataset. All the PP information are published there since 2006. On the web page there are information about the contracting authority, specification of the subject of purchase, important dates, qualification and evaluating criteria and estimated value of the contract. Moreover there are information about the winner, the winning price of the contract and number of bidders in the procurement. These two forms are a fundamental informational source for our research.

<u>Electronic auction</u> is a repetitive process of recessive auction that enables the bidders to cut down their offered prices in order to win the procurement. The auction ends in the moment where no one is willing to sell the goods for lower price. This tool became popular in case of procurement of homogeneous goods and other types of PP where evaluating is based on numerical values. Electronic auction can be used within any type of procedure, it is used only as a price setting device.

<u>Contracting authorities</u>

Since the PP Act leaves space for individual decision making and allows contracting authority to modify parameters of the tender, it is necessary to have a look on those contracting closely. There can be identified four basic groups of contracting authorities:

- **State authorities** such as ministries or national offices
- **Regional authorities** such as municipalities and regional offices
- **Bodies governed by public law** (public bodies) such as schools and hospitals

- **Profit seeking firms** such as state owned enterprises ("SOE") and utilities - entities operating in the water, energy, transport and postal services sectors

Each of these categories might have different attitude to excessive expenditures and wasting of sources. Such a different attitude is made by different connection to state budget, "softness" of its own budget (see chapter 2.3.2) - the possibility of being buy out or other sorts of financial help from state budget in case of financial difficulties. Bandeira et al. (2008) shows that there are statistically significant differences among various contracting authorities in PP system.

Qualification requirements

All bidders have to fulfill given qualification to be able to compete in the procurement. There are four kinds of qualifications: basic, professional, economic & financial and technical qualifications. Fulfillment of basic and professional qualifications is compulsory for all bidders. In case of economic & financial and technical qualifications is the contracting authority entitled to require various requirements on suppliers such as insurance policy, size of turnover or a reference list of the principal deliveries. According to PP Act, these requirements must be related to the subject of competition. However the PP Act keeps space for discretion and the qualifications are potentially usable for reducing the competition.

1.2 *Controlling processes*

The essential condition for effective procurement procedures are a controlling institutions which would be able to monitor (and punish the mistakes) the whole process, beginning with investment plan and post-contractual practices of all participants at the end. However Czech controlling system has several pitfalls which determine the inability to control the procurement processes. Very broad and complex analysis of Czech controlling processes in PP is those by Jurčík (2006) or Pavel (2009), we will just summarize their findings.

Controlling over tender should make a Bureau for protection of the competition (ÚOHS), but this institution can penalize only a formal mistakes and only on request of the firm, which loose in the competition. Therefore the ÚOHS cannot investigate any tender, where there is just a one bidder, or where the bidders are colluding in some

cartel or bid rigging agreement. According to its own annual reports, ÚOHS made around 300 controls in a year which is about 3 % of all published PP and give about 70 penalties[6]. But financial penalty for a bureau, which made a mistake, is pretty irrational punishment, because it just transfers sources from on bureau to another and does not punish the responsible person at all. Other controlling institution is Supreme Audit Office (NKÚ), an independent institution which audits the management of state property and the performance of the national budget. NKÚ makes only a few audits in a year, refers the results to a government and doesn't have any executive power.

As can be seen, the system of PP in Czech Republic does not have an effective controlling institution. Only a few tenders are audited and if so, there is no real punishment. Therefore the contracting authorities have higher discretion and therefore the threat of wasteful behavior is even larger.

This chapter summarizes the most important parts of legal framework of PP in Czech Republic that are necessary to understand for further discussion.

---

[6] http://www.compet.cz/informacni-centrum/vyrocni-zpravy/

2   Economics of the public procurement

Purpose of this chapter is to describe some of the most important economic aspects of PP covering both economic facts and theoretical concepts.

PP processes are not frequent topic in mainstream economics, although their impact on economy is tremendous. In economic policy perspective, when a government decides to boost an economy with fiscal stimulus, it means an increase in governmental purchases, which are processed through PP institute.

In first part of this chapter we show the size of PP market in developed countries. The literature review comes thereafter, describing an economic research, both theoretical and empirical that has been published so far. At last but not least we discuss economic specifics of PP process and we derive some assumptions resulting from those specifics for our empirical study.

2.1 *Size of the market*

From macroeconomic point of view, the institute of PP is significantly contributing to annual GDP. According to Eurostat PP cover about 3,5 % of the GDP in EU-27 (about €425 bn.) in the year 2009 (Eurostat (2010)). But these figures cover only those PP which were announced in the Official Journal of the European Communities (therefore over threshold PP (see appendix)), the overall national's values of PP are much higher.

OECD estimates the volume of PP market using methodology based on system of national accounts (SNA). According to their estimation PP purchased by central and local authorities represents about 17 % of Czech annual GDP. Additional 9 % is created by State owned utilities procurement, so in total OECD estimates the overall sum of all goods, works and services which are purchased through PP procedure as a 26 % of Czech annual GDP, which is the second biggest share within all OECD countries (see Figure 2:). However as OECD points out: *"The SNA data may provide an overestimation, as the above categories may include certain expenditures not carried out through government procurement."*(OECD (2011))[7]

---

[7] OECD: Size of public procurement market, in OECD, Government at a Glance 2011, OECD Publishing. 2011

Figure 2: General government and state-owned utilities procurement as a percentage of GDP, 2008
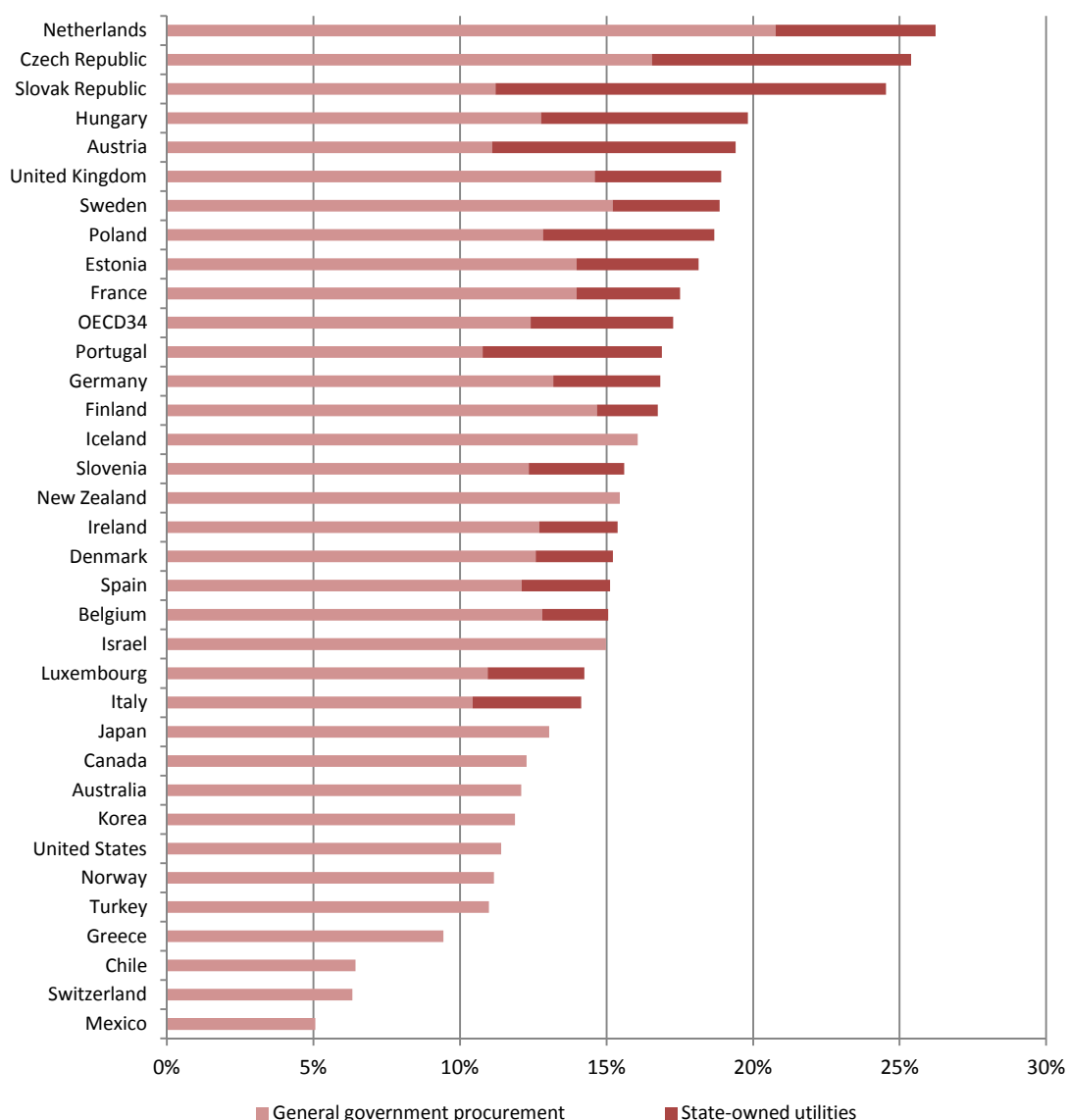
Source: Government at glance 2011, OECD

Previous graph presents the economic relevance of PP. Every improvement of institutional framework of these purchases has a significant impact on the whole economy.

PP of homogeneous goods is a relatively small subset of the amount presented in Figure 2. We are not able to provide a precise number, however there is a place for estimation. According to Ministry of regional development of the Czech Republic (2011), public

supply tenders covers annually about 20 %[8] of the total volume of PP in Czech Republic[9]. The study for European Commission made by PriceWaterhouseCooper (PwC) (2011) estimates, that commodities (which are the most significant types of homogenous goods) represent more than 8 % of the total volume of European PP[10]. The combination of the estimations by OECD in figure 2 and by PwC above result in the very reasonable approximation that PP of homogeneous goods make almost 2,5 % of annual GDP in Czech Republic.

2.2 *Literature review*

The main stream of PP literature tries to explain the procedure by theory of auction and game theory. Most of these papers are trying to set up the optimal or sup-optimal strategies in procurement game, given several assumptions, such as McAfee and McMillan (1987), Bulow and Roberts (1989) or Maskin and Riley (1999). Only a few authors are explicitly dealing with problem of corruption, or other types of incentive failure. Rose-Ackerman (1975) argues that corruption can lead to inefficient contract allocation and inflated costs of procurement. Laffont and Tirole (1991) study the issue of favoritism in procurement. Burget and Che (2004) investigate the role of manipulative power of the contracting authority on final result of the competition. At last but not least, very innovative way of thought was proposed by Bös (2001), where is shown that the procurement game should be separated into an investment game and a project game in order to analyze the behavior of all players properly.

Few more theories are relevant for the purpose of this research, although they are associated with PP issues only partially. The first one is the theory of transaction costs, which has basis in foundations of new institutional economics and especially in Williamson (1981). The role of transaction costs in PP procedure was described by Smiley (1976), Bajari and Tadelis (2001) or in Czech Republic by Pavel (2009). For the purpose of this research is very important the work of Reimarová (2011) who estimates the administrative or transaction costs of the procurement procedure and evaluates the differences between an in-house administration and an outsourced administration in prices and efficiency.

---

[8] The rest of PP is divided into services (cca 30 %) and works (50 %).
[9] http://www.portal-vz.cz/Information-System-on-Public-Contracts/Statistical-Outputs-on-Public-Contracts/Souhrnny-statisticky-prehled-verejnych-zakazek, viewed on 3. 4. 2012
[10] PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011, page 45

The most important agent in PP process is the contracting authority. This person decides all the parameters of the tender and therefore it is crucial to depict how this agent behaves. Since the authority is a part of non-profit or state-owned organization, the theories that are able to describe authority behavior are those dealing with objective function of a non-profit seeking agent. Niskanen (1974, 1994) proposes a theory of bureaucrats, who does maximize his budget or discretionary budget. Hlaváček (1987, 2010) describes a model of an economic agent who (in general) maximizes his probability of economic survival.

Just a few econometricians have been engaged in PPs topic, although this institution has such a tremendous impact on the economy as we described above. The main reason for neglecting this topic is the lack of data. In previous years all countries were hiding their suppliers and society couldn't see where exactly are flowing their tax payments. The situation is changing currently when several states (mostly within EU) are increasing their transparency (accountability and data openness in decision making).

One of the first papers, which use econometrical approach on PP, was made by Domberger, Hall and Ah Lik Li (1995). They collected data about 61 cleaning contracts from public offices, schools and hospitals in Australia. Afterwards they found out that there are statistically significant differences in prices of contracts based on different tendering procedures and different submitters. Another paper by Bandeira, Prat and Valletti (2008) was based on 6000 procurement from Italy and authors concluded that "*price differences are correlated with governance structure: the central administration pays at least 22% more than semi-autonomous agencies.*"(Bandeira et al, 2008)[11]

Czech Republic has a comparative advantage in this field. Czech national informative portal for tenders (www.isvzus.cz) containing all large tenders since 2006. Unfortunately, this portal still has several pitfalls. The most important one from statistical point of view is that procurements are listed there in some sort of paper form and it's very hard and time-demanding to transform those data into a table. Pavel (2008) examined 62 tenders of infrastructure engineering works and he concluded that final price (as a percentage of estimated price) is affected by type of procedure and amount of applicants: "*Every additional applicant brings decrease of price in average by 4,4 % of*

---

[11] Bandeira, O.; Prat, A.; Valetti, T.: Active and Passive Waste in Government Spending: Evidence from a Policy Experiment, working paper, 2008

estimated price. On the contrary, negative impact has a restricted tendering procedure, because it causes increase of final price in average by 19,8 % of estimated price."(Pavel, 2008)[12] The results are however weak because of few issues. First of all, the estimated price is not really an accurate number representing authority's demand. Even though the legal framework sets the requisites of creating an estimated price on a basis of some market research, the regular daily praxis is different, those market researches are usually vague and the estimated prices are often far away from real market value. Moreover, the determined causality might be misleading, because we cannot say, whether these characteristics were affecting price directly, or whether there are some underlying causes (omitted variables such as goodwill of a contracting agency) that affected both optional characteristics and final price. At last but not least, if we accept the assumption about causality, we still cannot specify, whether this restricted procedure imply increase in final price or decrease in estimated price.

2.3 *Economic specifics of the PP of homogeneous goods*

PP has several very important characteristics, which make them different from regular purchases of consumers or firms. In addition these characteristics strongly affect the behavior of actors and thus the overall efficiency.

2.3.1 Principal – agent dilemma

One of the essential characteristics of PP procedure is that the contracting authority as a decision maker is not usually the final consumer of contracted goods, works or services. As a result of that, there is a difference in interests and asymmetry of information, features that were initially included in Agency theory.

Agency theory was initially founded in 1970s as a theory of risk bearing (e.g. by Arrow (1971)) and revised in late 1980s (e.g. by Rees (1986), Stiglitz (1987), Eisenhardt (1989) or Holmstrom and Milgrom (1991)). During this revision the terms Principal, agent and asymmetry of information were included into the concept.

---

[12] Pavel, J.: Veřejné zakázky v České republice, Studie Národohospodářského ústavu Josefa Hlávky, 2009

"*Agency theory is directed at the ubiquitous agency relationship, in which one party (the principal) delegates work to another (the agent), who performs that work.*" (Eisenhardt (1989)[13]

The differences between objectives of principal and agent are present often. Moreover with the asymmetry of information (having less information than agent) is really difficult for principal to monitor the agent's performance.

In case of PP is asymmetry of information present on three different levels (neglecting the asymmetry of information within the each institution), because between supplier and final consumers are public institutions (see figure below).

Figure 3: Principal – agent scheme in PP
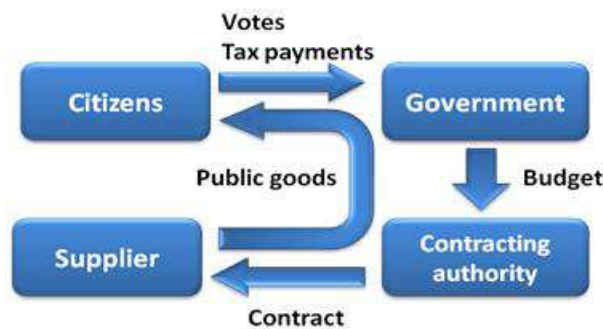
Source: own construction

Citizens (principals) are choosing their government (agent), paying taxes and they are expecting provision of public goods in exchange. Then government (as a principal) chooses contracting authority (agent) to provide such goods in exchange for a budget. Afterwards the contracting authority is signing a contract with a supplier about delivering the desired goods.

Principal – agent problem deals with different objectives. Contracting authorities as decision makers might not maximize the profit or the utility of the society, but their own interests. Niskanen (1974, 1994) presents a model of bureau (contracting authority) as follow: "*A bureau is defined as an organization with two following characteristics: the employees do not appropriate any part of the difference between revenues and costs as personal income, and some part of recurring revenues of the organization derive from sources other than the sale of output at a per unit rate.*"(Niskanen; 1994)[14] In addition,

---

[13] Eisenhardt, K. M. (1989). "Agency Theory: An Assessment and Review." The Academy of Management Review 14(1): 57-74.
[14] Niskanen, W. A.: Bureaucracy and Public economics, Edvard Elgar publisching co., 1994, page 15

a civil servant cannot enlarge his personal income by some sort of bribe or make other type of corruption, due to controlling or moral barriers. According to Niskanen, this kind of civil servant will not maximize the efficiency of the bureau (which would be the best option for the society) but he will rather maximize the discretionary budget of the bureau. This additional disposable income cannot be used as a net personal income; however it can be spent in order to serve official's interest (e.g. additional labor forces or equipments).

The similar conclusions we can reach by applying a general microeconomic concept of an economic agent who maximizes his probability of economic survivor. The concept was initially used in Hlaváček (1986) and extended in Hlaváček and Hlaváček (2006, 2010). Authors present an optimization model applicable in cases, where simple profit maximization is not relevant, such as altruism, non-profit organization, company in central planned economy. Reimarová (2011) applies the model of the maximization probability of economic survivor on PP and shows "*that the wealth of the official is equal or higher in case of outsourced administration independently on the consequences on the contracting entity. By outsourced administration is the official not responsible for possible problems with the public procurement contracts and simultaneously doesn´t personally bear the increased costs of the administration. It provides possible explanation, why large governmental entities hire external companies to administrate award procedures.*"(Reimarová (2011))[15] The officials are using their legal right to outsource the administration[16] more often than it would be effective.

Since the purchase is paid from state budget, the contracting authority doesn't bear any increased cost of such purchase as well. Once the contracting authority has got a budget, it operates in the process only as an intermediary and their objectives are not related with the final price of the PP. Hlaváček (1986) presents a model, where firm in central planed economy (CPE) is not profit maximizing (because it does not have any personal gains from that profit) but rather a reserve maximizing (the firm is maximizing the reserve between planed output and allocated sources to secure that it will be able to meet the plan). The basic characteristics of contracting authority and firm in CPE are identical.

---

[15]Reimarová, H.: Transaction Costs in Public Procurement (Diploma thesis), 2011 page 75
[16]Outsourced administration means that the contracting authority is represented in the procedure by other institution (usually private company) which is preparing the documentation and processing the whole procedure (see § 151 of the PP act).

- Both are getting some allocated sources in exchange of promises to deliver a specific amount of goods.
- Both have objectives that are not related with the potential profit of the organization but rather with the ability to meet the plan or expectation of budget dedicator.

Contracting authority has similar environment, similar objectives and therefore their behavior should be similar as well. It is not cost minimizing, but rather a reserve maximizing (for further discussion see Soudek (2009)).

The authority is not securing itself not only by possible outsourcing the administration but also by making sure that sufficiently large amount of public goods will be provided.

Moreover, if we say that contracting authority does not need to be such a moral person (as in Niskanen's model) and the controlling agencies do not serve their mission then the official can use his position to enrich himself at the expense of taxpayers. Therefore the potential abusing of information asymmetry is even larger.

2.3.2 Soft budget constraint

Another important characteristic of PP environment is the softness of the budget constraint which the contracting authority is facing. The concept of soft budget constraint was introduced in Kornai (1980) and revised in Kornai (1986) and it describes the situation "*when a strict relationship between the expenditure and the earnings of an economic unit (firm, household, etc.) has been relaxed, because excess expenditure will be paid by some other institution, typically by the state.*"[17](Kornai (1986)).

In case of contracting authority the conditions for soft budget are fulfilled completely. The contracting authorities are (more or less) dependent on the state budget, as stated in definition. The state budget will cover excess expenditure with no penalization of contracting authority (within given limits and under certain condition). Therefore the authority does not need to take care of budget constraint or final price of purchase and the decision making about procurement condition are not subject to cost minimizing. Such cost minimizing might appear in authority's decision making indirectly, when the

---

[17] Kornai, J.: The soft Budget Constraint. Kyklos, 1986, page 29

cost minimizing is sub-criterion of maximizing the probability of economic survival (described in section 2.3.1 and defined in Hlaváček (2010)), such as re-election of the official, keeping the managerial position in state owned enterprise or public body, etc.

To conclude a soft budget constraint, the contracting authority does not need to care much about final price of the procurement, because excess expenditure can be paid by other institution, typically by the state budget authority.

As it was described in section 1.2.1, there are various types of contracting authorities has various autonomy and various attitude toward excessive expenditure. Both central and local authorities are directly connected with the state budget. On the other hand, legal bodies that are subsidized from public sources are connected with state budget only partially and they might have difficulties to bargain about additional sources. SOE as profit seekers should be subject to a soft budget constraint an exceptionally in case of financial distress. However, as it is stated in EPS (2011), Pavel (2008) or OECD (2005), in case of Czech Republic is the financial support of SOE more frequent than in other developed countries, hence we can suppose sub-optimal behaviour linked with soft constraint as well.

2.3.3 Transaction costs

Transaction costs of PP can be divided into transaction costs ex ante (before the agreement is signed), continuous transaction costs (during the execution) and transaction costs ex post (after the delivery of goods). Continuous and ex post transaction costs are more or less the same in case of PP as well as in case of any regular purchases of given goods and therefore they won't be discussed. They are fully depending of terms and conditions in contract. However as Pavel (2009) points out, it is the excessive ex ante transaction costs that differentiate the transaction costs of PP from these costs of regular purchases of consumers or firms[18]. The size of such costs is much higher for both purchaser and supplier because of formal perquisites and conditions of the award procedure (see chapter 1.2.1 and the appendix). The process goes as follows:

- Before the procedure starts, the contracting authority needs to specify the subject of PP and the procedure.

---

[18] Pavel, J.: Veřejné zakázky v České republice, Studie Národohospodářského ústavu Josefa Hlávky, 2009, page 29.

- At the beginning of the award procedure the contracting authority has to create a tender documentation, send a request to participate or request to bid, announce the procurement on the internet and on the official notice board.

- The competing bidders have to create formally correct bid and approve the fulfillment of qualifications. For example the bidder has to prove that he has not been convicted of a criminal offence; that has not been subject to insolvency proceedings. There is a lot of additional paper works when the firm is bidding in PP and these paper works remarkably increase the transaction cost of the bid and, at the end of the day, the PP itself as well.

- Once the contracting authority have got all the bids, it has to set down and authorize the evaluation committee, check the fulfillments of qualifications of all bidders, evaluate bids according to evaluation criteria, choose a winner and make a report about the process and publish the result.

Merely after any other unselected bidder hasn't a formal objection, the contracting authority is obliged to sign the agreement with winning bidder. As you can see, the awarding procedure is really complex process and its transaction costs are significant on both sides of the market. These costs necessarily affect the decision making of all actors involved in the process. Since the transaction costs of the bidder are included in the final price of the contract[19], we will concentrate on the transaction costs of contracting authority.

Additionally, for the purposes of this thesis, the ex- ante transaction costs of PP contracts for the contracting authority can be approximated by the administrative costs of award procedure. In Reimarová (2011) is a variety of estimations of these administrative costs[20]. Presented average estimations are in the range from 30 000 CZK up to 300 000 CZK. The sources of variations are size and subject of the contract, type of the procedure, number of bidders and, as Reimarová demonstrated, the fact whether the administration is made in-house or outsourced.

The similar numbers are presented in PwC (2011) where authors had questioned about 5 500 contracting authorities and 1 800 businesses. Results presented in this study show

---

[19] Pavel, J.: Veřejné zakázky v České republice, Studie Národohospodářského ústavu Josefa Hlávky, 2009, page 30.

[20] Reimarová, H.: Transaction Costs in Public Procurement (Diploma thesis). Charles University in Prague, 2011, page 50

that the administrative costs vary significantly across the Europe. As you can see in Figure 4:, the biggest person-day costs for a median procurement procedure are in southern and eastern countries, such as Bulgaria, Greece or Slovakia. In the case of Czech Republic the presented results are below average: 15 person-days of administrative works for Czech median procurement procedure.

Figure 4: Person – day costs by country (median person-days costs*bids)
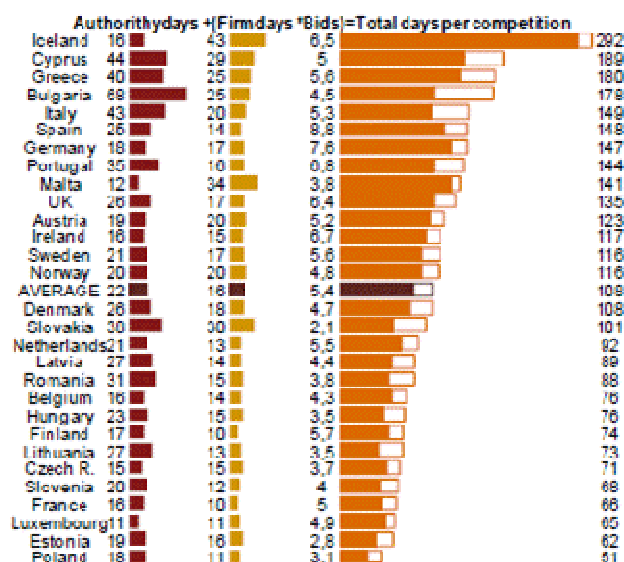
Source: PwC (2011)[21]

Another source of variation presented in PwC (2011) study is subject of the procurement. Their findings about administrative costs shows that contracting authority spent in average about 120 working hours (15 person-days times 8 hours) on processing the whole procurement process of commodity purchase[22]. Monetary expression of this administrative costs in the PwC (2011) is 1 600 € (about 40 000 CZK) per award procedure of commodity purchase. Moreover the commodities are relatively homogeneous, then commodity PP are standardized and the variation of administrative costs is not that dramatic as in case of sophisticated services or engineering works.

Theoretically, the overall administrative costs can be decomposed as follows:

---

[21] PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011, page 83
[22] PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011, page 81

Figure 5: Administrative costs of the award procedure

$$AdC_{AP} = FC_N + FC_O + C_V * N$$

Where

AdC_{Ap}	*Total administrative costs of the award procedure*
FC_N	*Mandatory fixed administrative costs (creation of tender documentation, announcing the procurement, preparation of the method of tender evaluation, establishing the evaluation committee)*
FC_O	*Fixed administrative costs arising from optional operations (negotiations with bidders, electronic auction, additional non-compulsory channels of announcing)*
C_V	*Variable administrative costs associated with number of bidders (checking the qualification, evaluating the bid, inform the bidder about the result of award procedure)*
N	*Number of bidders involved in the procedure.*

For the purpose of this thesis we are not much interested in the absolute value of administrative costs rather than on relative differences in these costs made by the different decisions of contracting authority.

Firstly the authority has to decide which procedure will be used. In open procedure the evaluating committee has to evaluate all bidding tenders. However, within negotiated procedure authority is evaluating only a few tenders which were asked to bid in procurement, but the authority is also negotiating with these bidders on terms of contract. PwC (2011) presents averages of administrative costs of given award procedure. The difference between median administrative costs of open and negotiated procedure is about 700 € (17 500 CZK)[23]. That figure is reasonable and consistent with estimations presented in Reimatová (2011).

Important determinant of the administrative cost is amount of bidders in the process. Every additional bidder means that the contracting authority has to check the fulfillments of qualification, to evaluate the tender according to evaluation criteria and announce to the bidding company the result of procedure and winning bidder. These variable costs per one tender are relatively low in the contrast of fixed administrative

---

[23] PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulative prepared for the European Commission, 2011, page 87

costs. An estimation based on Reimarová (2011) is that these transaction costs per additional bid in PP of homogenous goods are approximately 5 000 CZK[24].

Contracting authority can also use an electronic auction. Such auction is non-compulsory action that increases the administrative costs of procedure, because it is a process that needs to be outsourced to a company with special auction software. In the mentioned PwC (2011) study is presented that e-auction increases the person day costs by approximately 6 person-days in average (in monetary units that is about 12 000 CZK). We got very similar figures when we were making a market research on electronic auction brokers in Czech Republic[25].

The transaction costs of the PP administration are enormous, but they seem substantially smaller once they are compared to the final prices of these PP. Moreover there are several optional steps in procurement procedure that increase the administrative costs. On the other hand they might lead to significant drops in final prices, as we would like to show in the chapter 3.

2.3.4 Barriers to entry the market

Usually in microeconomic theory of firm the barriers to entry the market refers to the situations when new potential supplier cannot enter the market because of lack of sources or high initial fixed costs that discourage him. Additionally such barriers of entry may come from the (sometimes illegal) practices of firms already operating on the market, such as predatory pricing, customer loyalty programs, vertical agreements or economies of scale. At last but not least, barriers of entry may be caused by the state as a market regulator.

In case of PP there is an additional barrier to entry the individual competition that is created by qualification criteria. As state in section 1.2.1., those criteria are partially defined by the PP Act and partially they are determined by the contracting authority.

---

[24] The evaluation committee needs roughly 2 hours to check the qualifications and 2 more for evaluating the tender according to given method and criteria. The committee has usually about 5 members. That gives us 20 hours of work. Other administrative costs, including announce to the bidding company the result of procedure or cost of carry and store tend to be negligible.
[25] Some of the prices can be found on http://www.e-aukce.cz/cenik or
http://www.e-tenders.cz/administratori-verejnych-zakazek

The legal compulsory qualifications are the basic and the professional qualifications. They just ensure that the bidding person has not committed a serious crime or that he has a legal right to supply desired goods.

On the contrary, the financial, economic and technical qualifications depend fully on the contracting authority. Various prerequisites may be required, the contracting authority can choose subject and scope of the qualifications and the only limitation is that these requirements must be related to the subject of competition. The goal of these qualifications is to ensure that the bidding firm is actually capable to deliver desired goods. However these financial, economic and technical qualifications can be easily abused by the authority to restrict the competition by creating an artificial barrier to entry the bidding competition.

Contracting authority might use such barriers to entry in order to lower its transaction costs, because then they evaluate fewer bidders. At the same time a smaller number of bidders results in smaller competition and consequently in higher price of PP, as we would like to show in empirical part of the thesis.

2.3.5 Bid – rigging

A very specific feature of PP is a bid – rigging, a unique kind of collusive behavior among competitors on the procurement market.

„Bid rigging (or collusive tendering) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods or services for purchasers who wish to acquire products or services through a bidding process."(OECD 2009)[26]

Since the PP (and some kinds of private purchases as well) are process through the bidding competition or other kinds of reverse auctions, any kind of collusion is making a tremendous losses in public sources.

According to OECD (2009), there are various different types of bid –rigging (Cover bidding, bid suppression, bid rotation, market allocation); however their common feature is an illusive competition. The bidders divide the market and then each one is

---

[26] OECD: Guidelines for fighting bid rigging in public procurement, 2009, page 2

creating only a pretended competitive bid on agreed tenders, or he refuses to bid at all. In exchange the bidder expects the same behavior from their partners in other bidding competitions.

As written in already mentioned OECD guideline, there are several important characteristics that increase the potential of collusive agreements. The most important features are:

a) High market concentration – only in case of few competitors is possible to create and enforce a bid rigging cartel.

b) High barriers to entry the market make cartel protected from possible entrance of new competitors.

c) Low substitutability creates the procurement more vulnerable to bid rigging, because the purchaser cannot escape to other type of product.

d) Homogeneity of products makes easier to agree the bid rigging, because the firms with identical or similar products have higher incentive to create a cartel than a firms who are differentiating their products.

e) Steady, expectable flow of demand and tenders makes easier to allocate contracts among each member of bid rigging cartel.

Although these conditions are not necessary for creating a bid rigging agreement, they increase rapidly the benefits of such agreement and therefore increase the potential motivation of such competitively harmful behavior.

Several empirical studies that identify the bid rigging collusion have been published recently; most of them come from United States, where anti-competition law and its empirical evidence have the longest tradition for more than hundred years. Moreover most of the studies are describing the collusion in construction and civil engineering works. Porter and Zona (1993) examine a bid rigging cartel in state highway construction contracts in the US between years 1982 and 1988. Pesendorfer (2000) analyses bid rigging cartels in school milk contracts during 1980s in staes of Texas and Florida. Jacobsen (2007) addresses the issue of bid rigging in the Swedish asphalt-paving sector.

Usually such papers are based on empirical evidence of already prosecuted bid rigging agreements. Moreover author obtained the data not only from the winning bid but from

other bidders as well. Only afterwards they were able to identify a collusive behavior in the bidding strategies.

Bid rigging is a serious threat in PP of homogeneous goods, because the markets are satisfying the features described above. In following empirical study we are trying to identify any abnormally high prices that might be result of such collusive behavior.

To conclude this chapter, PP and contracts have several highly important features that distinguish them from regular purchases. At the same time they are making the whole system much more vulnerable to the wasting of sources, ineffectiveness and unmoral behavior. These characteristics are amplifying each other and only their combination makes the system of PP, especially in Czech Republic, such ineffective in creating maximal value for taxpayer's money.

3 **Empirical case study**

This chapter compares the discussed theoretical framework with some empirical evidence. Previous chapters described the PP process and its economic characteristics. This case study attempts to identify the impact of these characteristic on the final price of the procurement. As can be seen in section 2.2, only a few of such kind of empirical studies have been published and none of them have done analysis with the same methodology. We believe that this study will provide new unique results that will be relevant for both theoretical discussion and daily praxis of PP. Moreover, presented institutional settings are applied not only in Czech Republic, but across the whole European Union, so this research has a supranational relevance.

The chapter starts with motivation of our research. Then hypotheses and the model are presented and discussed. Data description comes thereafter. At the end we are presenting the results of the research together with their discussion.

3.1 *Motivation*

The goal of our empirical case study is to show that institutional and procedural characteristics (described in chapter 2) are affecting the final price of the procurement. The primary issue is how we are able to compare all various procurements together. Or in other words how can we dismantle the differentiation in prices on basis of different subject of procurement. As we pointed out in section 2.2 – the literature review, some of previous authors compared tenders with respect to their estimated prices. We already discussed the pitfalls of such approach as well. Therefore we decide to use another methodology. In order to be able to compare the tenders among each other, we decide to use only procurement of homogeneous goods (see 0). Because of this homogeneity we are able to compute a price per one unit of purchased good (from quantity and total price of procurement). Additionally these examined goods are also purchased by a private sector and therefore we are able to compare the unit price of procurement with unit price of such goods purchased by private sector.

As can be seen in section 3.3 – data description, the unit prices of individual tenders of homogeneous goods vary significantly within given commodity purchases. The presented model attempts to explain such variation as a function of characteristics of

contracting authority – its institutional form and characteristic of procurement procedure – type of procedure, number of bidders, use of electronic auction.

A crucial specification issue that needs to be dealt with is the potential endogeneity bias resulting from omitted variable problem. PP might be subject of wasteful behavior which might through correlation with explanatory variables cause false significance. For the purpose of this thesis there is no need to create a distinction between active (e.g. corruption[27]) and passive waste (e.g. red tape[28]) as proposed in Bandeira, Prat and Valetti (2008). In general, the wasteful behavior might affect both procedural characteristics and final price of the procurement. In other words:

The final price of the procurement may be positively correlated with wasteful behavior:

$$corr(final\_price; wasteful) > 0,$$

Such wasteful behavior is unobservable in the dataset; therefore the correlation affects the errors of proposed model:

$$corr(errors; wasteful) > 0$$

At the same time usage of open procedure, electronic auction and number of bidders in the procedure should be negatively correlated with the unobservable wasteful behavior of contracting authority:

$$corr(procedural\ characterisitcs; wasteful) < 0$$

Hence the unobservable variable *"wasteful behavior"* which covers both active and passive waste will cause a correlation between explanatory variables and errors of the model:

$$corr(procedural\_characterisitcs; error) < 0$$

---

[27] Investigative reporting (E.g. Kudrna, O.; Spurný, J.: Do Srdce Temnoty, Respekt, 2010/3, p. 16-20 ; Sacher, T.: Korupčníci zasaženi, Respekt, 2010/10, p. 42-47 ; Spurný, J.: Hračka, Respekt, 2010/9, p. 14) and annual reports of Supreme Audit Office (http://www.nku.cz/en/publikace/annual-reports.htm) suggests that corruption is really a severe problem in public procurement in the Czech Republic.
[28] „Red tape" is term for all kinds of rigid and excessive regulation that is preventing an action or decision-making of public officials (see Kelman (1990, 2005) or Bozeman (2000).

This, unfortunately, leads to a negative bias of the ordinary least square estimators[29]. However such underestimation of betas means, that if the model would be able to identify a relationship between explanatory variables and dependent variables, the "true" betas will be actually higher and the relationship will be even stronger in case of such omitted variable bias.

Nevertheless, to tackle with this omitted variable problem, we decided to use proxy plug-in solution to the omitted variable problem[30]. As a proxy variable for this unobservable *"wasteful behavior"* we decided to use a *zIndex*, a composite index presented by Chvalskovská and Skuhrovec (2010) that rates contracting authorities according to quality and transparency of all their procurement competitions over given period of time. The index consists of ten individual ratios representing openness, competition or effective controlling processes in purchases of each contracting authority (see figure 6).

Figure 6: Components of zIndex

Openness:
1. PP share on total spending on purchases - punishes avoidance of PP (through portioning), or extending contracts beyond their limits.
2. PP openness - rates according to openness of legal regimes used for PP
3. Elementary violations of transparency - punishes failure to announce PPs or their price
Competition:
1. Winner's concentration - punishes repetitive PP awarding to one or few suppliers
2. Bidder count - measures average number of firms competing for PP
3. Deadlines - punishes setting unrealistically close deadlines for placing bids
Accountability:
1. Legal violations - measures number of erroneous PPs detected by regulatory office
2. Supplier rating - a supplier transparency measure composed of several sub-indicators
3. Data quality - counts mistakes in crucial published data (mainly company identification, preventing traceability)
4. Information provision - measures time and quality of an institution's response to information inquiries

Source: Zindex.cz

In general the zIndex is measuring a good practice behavior in public expenditures. Those authorities who follow all "good practice" guideline will reach a high level of zIndex and at the same time the space for wasting public money will be (or at least

[29] For further discussion and a proof see Wooldridge, J. M.: Introductory Econometrics, Fourth Edition, South-Western, 2009, page 90
[30] See Wooldridge, J. M.: Introductory Econometrics, Fourth Edition, South-Western, 2009, page 307

should be) much lower. Therefore the wasteful behavior, covering both active and passive waste should be minimized as well.

The zIndex as a good practice measure seems to be a good proxy variable for omitted wasteful behavior that might occurs in PP dataset.

As a result of previous discussion in this thesis and previous empirical evidence presented in literature review, we expect to find statistically significant differences in final prices of tenders purchased by different types of contracting authorities. The more autonomous the authority is, the more is concerning about unnecessary excess expenses and the more is looking after the procurement characteristics and the final price. Then authorities are divided into four different groups: national authorities, regional authorities, public bodies and profit seekers (see section 1.1.2. for further description).

Similarly the discussion about the supply side of the market in section 2.3.2 – bid rigging suggest that procurement market with homogeneous goods might be subject of some anti-competition behavior. As can be seen in section 3.2 – data description, the commodity markets has high market concentration, usually there are operating three of four big companies with total market share about 80 % and a bunch of smaller competitors operating on the rest of the market. Unfortunately the dataset does not contain the bidding structure, just a final result of the procurement. Therefore we cannot identify the bidding strategies of competitors, but we can try to find significant differences in final price based on winning supplier of the tender which would indicates a possible collusive behavior of biggest players on the market.

The institutional characteristics of individual procurement procedure are expecting to affect the final price as well. At first place is type of procurement procedure: within the open procedure is environment for competition most favorable and therefore the final price of such competition should be the lowest possible. On the contrary, the negotiated procedure is restricting competition and thus final price might be higher.

Similar logic is applicable is case of number of bidders: the more bidders are involved in the competitions, the stronger the price competition is and lower final price can be reached.

Currently, one of the most discussed tools in PP community is the electronic auction. This electronic auction allows bidders to adjust offered prices and therefore the competition ends only after no one is willing to bid lower price. Some current incidents in Czech Republic[31] demonstrate that the cost cuts caused by electronic auction might be tremendous. We believe in demonstration of statistically significant negative impact on final price of procurement of homogeneous goods as well.

3.2 *Hypotheses and a model*

As stated before, the aim of this empirical study is to identify the impact of institutional and procedural characteristics on the final price of the procurement. For the purpose of statistical comparison the final price is normalized per unit of purchased commodity. Formally the research question stated above might be decomposed into few hypotheses:

> *hypothesis H1: The final unit price of the procurement is affected by the type of the contracting authority.*

> *hypothesis H2: The final unit price of the procurement is affected by the type of the supplier.*

> *hypothesis H3: The final unit price of the procurement is affected by the type of procurement procedure.*

> *hypothesis H4: The final unit price of the procurement is a decreasing function of an number of bidders interested in the procurement.*

> *hypothesis H5: The usage of electronic auction is decreasing the final price of the procurement.*

Additionally, the model compares the final unit price with the estimated unit price and price on the commodity market as well. The estimated price is capturing authority's willingness to pay and also the potential heterogeneity of purchased commodity. The

---

[31] In the most famous current case the statutory city of Ostrava managed to decrease their mobile phone expenses from 22 mil CZK to 3 mil CZK (http://moravskoslezsky.denik.cz/zpravy_region/ostrava-usetri-miliony-za-volani20110810.html).

market price is capturing the opportunity costs and also potential time dependent changes in production costs of commodity suppliers.

Since we are not much interested in actual level of the final price but rather in its relative changes caused by other variables, we decided to use a natural logarithmic form of final unit price as a dependent variable. Similarly, both estimated and market prices are designed in natural logarithmic form. The last but not least variable in the model is a *zIndex* as an indicator of good practice in all PP of each individual contracting authority.

To conclude, the model is designated as follows:

Figure 7: Regression equation

$$log(final\ unit\ price) = \alpha + \beta_1\ log(estimated\ unit\ price) +$$
$$\beta_2\ log(market\ price) + \beta_3 DUMMY\ procedure + \beta_4 DUMMY\ electronic\ auction +$$
$$\beta_5 DUMMY\ authority + \beta_6 bidders + \beta_7 zIndex + \beta_8 DUMMY\ supplier + \epsilon$$

Where *DUMMY procedure* represents binary (dummy) variable for open procedure, *DUMMY electronic auction* represents binary variable for application of electronic auction. *DUMMY supplier* represents three dummies for 3 types of supplier – big dominant, small successful supplier and occasional supplier. *DUMMY authority* represents four dummies for different types of contracting authorities – central state authority, local authorities, public bodies and profit seekers. During the statistical analysis the interaction terms (e.g. *procedure*authority*) will be tested as well.

3.3 *Data description*

For the purpose of empirical research we took a group of PP of homogeneous goods. Such tenders have to fulfill the definition. Moreover it is necessary to have sufficiently large amount of comparable observations and the procurement must refer the amount of purchased good in order to be able to compute the unit price. We found three commodities that fulfill those requirements:

  a) electricity
  b) gas
  c) fuel

Within those cases we can get enough comparable tenders for statistical analysis.

The source of the dataset is Czech national informational portal for PP (www.isvzus.cz) where all the large procurements are listed since the year 2006. This database has some shortcomings resulted from the fact that no one is penalized for the incomplete or confusing fulfillment of the form. Initially we downloaded 342 procedures which cover 447 winning bidders (some procedures have more parts and therefore more winners) and 237 different contracting authorities. However in lots of cases the form was not filled completely. Therefore we decided to use the free access to information Act (Act n. 106/1999 Col.) and send questions to contracting authorities about missing information. Even though the contracting authority is obliged to answer, the response rate was only about 60 %.

Therefore our dataset shrank to about two thirds of initial amount. Next table presents the division of tenders by commodities in initial incomplete dataset and final dataset.

Table 1: Amount of tenders by commodity

	initial incomplete dataset		Final dataset	
	procedures	tenders	procedures	tenders
electricity	173	256	140	206
gas	108	124	45	53
fuel	61	97	24	49
total	342	447	209	308

Source: our computation based on CEA

As can be seen in previous table, the drop off rate is high, especially in case of gas and fuel PP. However we still have sufficiently large amount of observation to make a sound statistical analysis. Additionally we believe that this drop rate will not cause any bias of our results. There is a threat of endogenous sample selection bias[32] caused by the fact that these incomplete observations are correlated with our dependent variable or explanatory variables. This is however possibly not the case, as the most frequent missing variables are amount of unit purchased, estimated price or amount of bidders, thus information irrelevant for a formal revision or controlling. On the contrary, the core legal characteristics such as name of both the supplier and the contracting authority and the final price are present always. Therefore unobservable characteristics (such as

---

[32] See Wooldridge, J. M.: Introductory Econometrics, Fourth Edition, South-Western, 2009, page 323

corruption) are not affecting the absence of these information and we can consider the dataset to be a random sample of procurement purchasing given commodity.

As we already mentioned, we are comparing the final unit price also with a market price. In case of electricity and gas, we decided to use the Czech electricity and gas market operator (OTE) as a source of market price[33]. This company provides comprehensive services to individual electricity and gas market players and creates monthly and yearly reports on both the electricity and the gas market in the Czech Republic. OTE works as kind of commodity exchange and therefore the unit prices of commodities are much lower than in case household purchases. In order to avoid day-to-day volatility on the market, we decide to use monthly weighted average prices presented in OTE annual reports.

Since we could not find commodity exchange of fuel in Czech Republic, we decided to use the Czech statistical office as a source of market price of fuel (both petrol and diesel)[34]. We use monthly averages of diesel and petrol price that man can buy diesel at petrol stations.
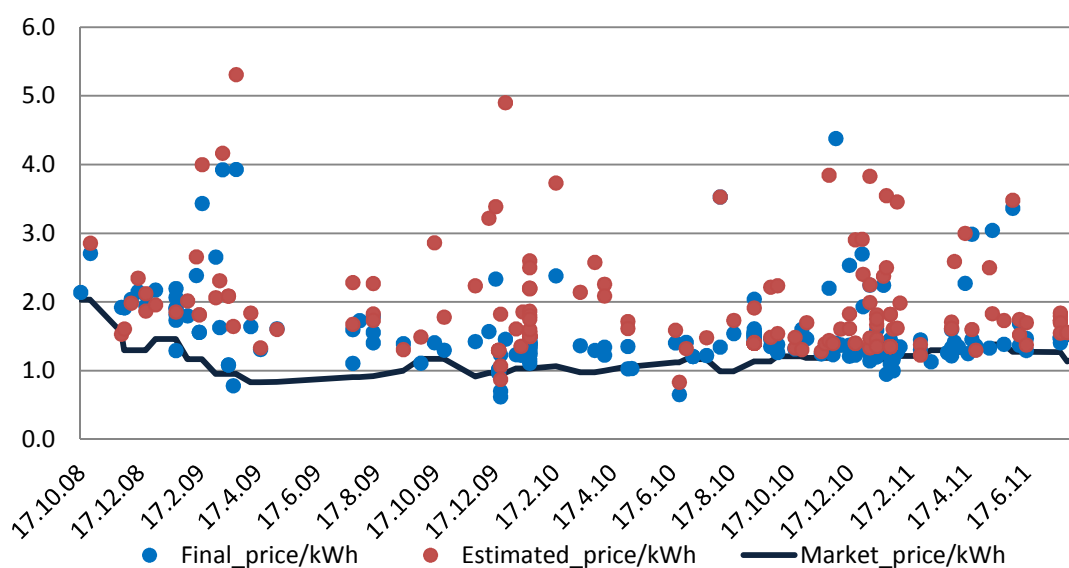
3.3.1 Electricity

The electricity dataset cover procurement from 2008 till 2011. The total amount of purchased electricity was over 7 000 GWh and summarized price of these tenders is over 10,5 bn CZK (over 420 M €).

The average final price of the sample is 1.56 CZK per 1kWh (with standard deviation 0.6), the average estimated price is 1.90 CZK per 1kWh (SD 0.78) and average market price is 1.16 CZK per 1kWh (SD 0.16). On following graph is presented how are the electricity tenders scattered over time.

---

[33] The data for both electricity and gas are downloadable from www.ote-cr.cz/statistics/yearly-market-report/

[34] http://www.czso.cz/csu/2011edicniplan.nsf/publ/7101-11-m12_2011 for years 2010 - 2011; http://www.czso.cz/csu/2009edicniplan.nsf/publ/7101-09-za_prosinec_2009 for years 2008 - 2009

Figure 8: Electricity tenders in time

Source: our computation based on CEA

As can be seen, the final prices are usually on or above the market price. Hypothetically, if all contracting authorities would be able to buy electricity on the market, public budget would save about 1.4 bn CZK (13 % off). Of course, we actually cannot say that it's really some potential saving, but it indicates, that there is a space for possible cuts in electricity expenses. Another remarkable characteristic is that in most of the observations the unit estimated price is above the final price.

The dataset covers 157 competitions that were tendering using open procedure and 49 tenders processed by negotiated procedures (with or without announcement). Additionally, in 76 cases the contracting authority decided to use an electronic auction.

Following table shows the distribution of the dataset among various types of contracting authorities.

Table 2: Contracting authorities of electricity tenders

Authority	Profit seeking firms	Public bodies	Regional authorities	Central state authorities
Number of tenders	54	77	61	14

Source: Our computation based on CAE

The most frequent authorities of electricity procurement are public bodies. On the contrary, only a dozen of procurement was made by Central state authorities.

On the other side of the market is much stronger concentration. In our dataset are 13 electricity suppliers. The next table shows the distribution of electricity procurement among them.

Table 3: Electricity suppliers

| Supplier	Total value of PP (CZK)	Total share	Amount of tenders
ČEZ Prodej, s.r.o.	4 385 554 898	41%	19
United Energy Trading, a. s.	2 445 139 040	23%	24
E.ON Energie a.s.	1 382 817 052	13%	15
Pražská energetika a.s.	768 806 388	7%	15
Lumius, spol. s.r.o.	611 974 852	6%	41
CENTROPOL ENERGY a. s.	234 716 403	2%	34
7 other suppliers	803 179 880	8%	58
Total	10 632 188 514	100%	206

Source: Our computation based on CAE

Three companies supply 77 % of electricity procurement volume. The Herfindahl index measuring the market concentration equals 0.25 which indicates high market concentration of suppliers in our electricity dataset. As stated above, such a concentration is necessary condition for a bid rigging or any other kinds of antitrust behavior which might result in higher prices of electricity procurement. Therefore we decide to divide suppliers into three groups a try to finds significant differences in prices of their supply.

- First group contains the four big players on the market which together supply over 80 % of the volume within 77 tenders.
- Second group cover two small successful firms who together supply only 8 % of the market, however they were able to win over 75 tenders. Such firm are focused on smaller electricity supplies and they are successful in winning them (or the big 4 companies are not bidding for the small tenders and so these companies can win them)
- Last group called occasional suppliers covers seven remaining suppliers who win less than ten electricity tenders. Together they supply 8 % of the market and 58 tenders. If any kind of collusion is present in electricity PP, it is unlikely that those small bidders are participating.

Important determinant of the outcomes from the procurement procedure is the number of bidders. Next graph is a histogram of number of bidders in electricity procurement.

Figure 9: Histogram of bidders in electricity procurement
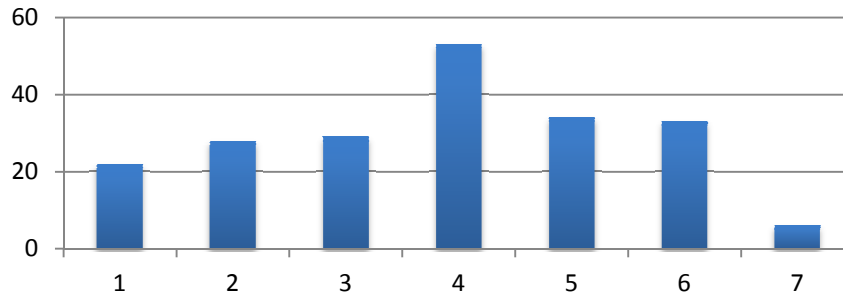
Number of bidders varies around four companies, which is a median number of bidders in the whole PP market (PWC (2011))[35]. So the electricity tenders are not standing out in this characteristic. Remarkable is the comparison of the number of bidders with the amount of players on the whole electricity market. As you can see in Table 2: there is only a 13 players on the market and in more than 60 % of cases are at least 4 bidders in the tendering procedure. Therefore the players have to meet and compete with each other on daily basis. At the same time, with more than half of procurements are number of bidders higher than amount of big players on the market and therefore the small players have to bid in these PP as well. The outcome of such competition might be a trend of decreasing the margins over market price in time. Unfortunately we do not have information about bidding firms and prices, but just the winning one and therefore we cannot explore this presumption thoroughly.

3.3.2 Gas & Fuel

The datasets for both gas and fuel are much smaller than in case of electricity. The cause is that bills for purchasing both gas and fuel are usually not that high to exceed the legal limit for PP (the expected price $\geq 2\,000\,000$ CZK). Therefore contracting authorities do not have to process a PP under the PP Act and do not have to announce the contract anywhere.
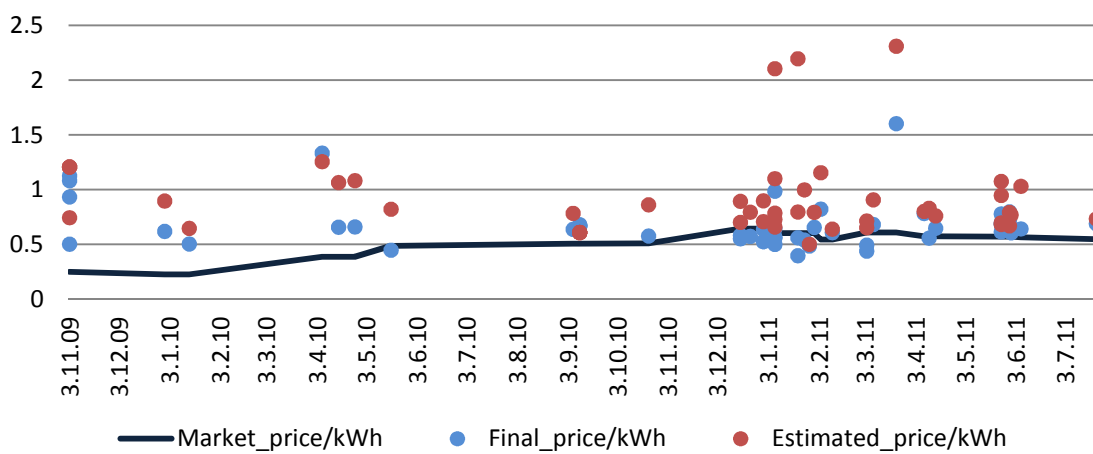
Additionally the rate of missing values was higher than in case of electricity. In about 50 % of cases we were not able to obtain all information needed for our statistical

---

[35]PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011, page 78

analysis. However we believe that even such a small dataset of 50 tenders pro each commodity worth to be analyzed.

The gas dataset covers 53 tenders from 2009 till 2011 purchasing 2 GWh of gas worth 1.6 bn CZK (64 M €). The average final price is 0.88 CZK/kWh (with standard deviation 0.64), the average estimated price is 1.13 CZK/kWh (SD 0.89) and average price on the commodity market was 0.52 (SD 0.12). Following graph shows the distribution of gas tenders in time.

Figure 10: Gas procurement in time

On the graph are visible similar trends as on Figure 8: – final price usually lays in between estimated price and market price. Moreover most of observations are from the turn of the year 2010 and 2011.

The fuel tenders are from 2009 till 2011 as well. Aggregate volume of these 49 tenders is almost 150 millions of liters of fuel, the total price is 3.4 bn CZK (136 M €). The average final price of fuel procurement is 22.39 CZK/l (SD 2.4), the average estimated price is 24.9 (SD 4.7) and average price on the market is 28.5 (SD 2.9). Following graph shows the distribution of fuel tenders in time.

Figure 11: Fuel tenders in time
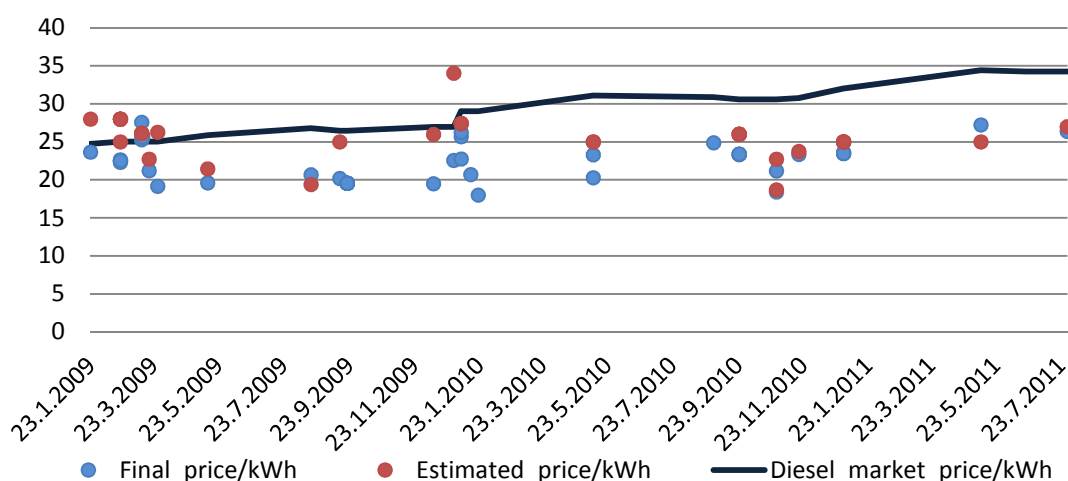
Source: own construction based on CAE

The difference between this graph and previous graph for both electricity and gas is obvious. The final price of procurement is usually lower than a market price. That's caused by different source of market price data – fuel market price is obtained from Czech statistical office and it is an average price at petrol stations which is necessarily higher than a price on the commodity market. Since the contracting authorities are purchasing fuel into their own tanks, they do not need to pay the storage and retail margins. However the market price works as a benchmark to compare the tenders with private sector over time. Nevertheless there is still remarkable gap between estimated and final price per one liter of fuel which indicates that contracting authorities pay less than they expected.

The fuel procurement dataset consist of 35 tenders purchasing only diesel oil, 2 tenders for just petrol and 12 tenders for both.

Institutional characteristics of procedure and contracting authority for both commodities are presented in following comprehensive table.

Table 4: Procedure and authority characteristics of gas & fuel tenders

	Open procedure	E-auction	Profit seeking firms	Public bodies	Regional authorities	Central state authorities
Gas	37	24	10	17	24	2
Fuel	43	0	17	17	0	15

Source: own construction based on CAE

The table shows that procurement characteristic vary for both commodities and we believe that these variation helps us to explain the variations in the final prices of purchased homogeneous product.

The analysis of supply side of the market gives us similar results as in case of electricity. On the gas procurement market there is 9 companies and three of them cover 80 % of market share. The Herfindahl index equal to 0.24 is indicating a gas market concentration to be as high as in electricity market.

Table 5: Gas procurement suppliers

Supplier	Total value of PP (CZK)	Total share	Amount of tenders
Pražská plynárenská a.s.	645 553 356	38%	10
ČEZ Prodej, s.r.o.	355 192 334	21%	2
Pragoplyn, a.s.	328 415 670	20%	15
VEMEX s.r.o.	116 732 124	7%	1
Lumius, spol. s.r.o.	104 494 697	6%	12
4 other suppliers	130 769 623	8%	13
Total	1 681 157 804	100%	53

Source: own construction based on CAE

At first sight, the fuel PP market seems to be the most competitive one. In our dataset are 15 winners within 50 tenders and also the final price is usually bellow the reported market price. However, the three biggest suppliers cover together 80 % of the market and the Herfindahl index equals to 0.23. The fuel PP market has similar structure as the gas and electricity one.

Table 6: Fuel procurement suppliers

Supplier	Total value of PP (CZK)	Total share	Amount of tenders
OMV Česká republika, s.r.o.	1 165 280 250	34%	13
Unipetrol RPA, s.r.o.	872 882 101	26%	4
ČEPRO, a.s.	645 306 100	19%	5
POPILKA, spol. s.r.o.	392 583 208	12%	6
10 other suppliers	332 779 016	10%	21
Total	3 408 830 675	100%	49

Source: own construction based on CAE

In both gas and fuel procurement market we use a division of all suppliers between two groups – Big three companies serving about 80 % of total market volume and the bunch of small suppliers serving the rest.

Average amounts of bidders are 3.3 (SD 1.7) for gas and 2.6 (SD 1.1) for Fuel. That is below the overall procurement average.[36] Nevertheless the high market concentration indicates that firms have to compete with each other frequently.

This part of the thesis described all three commodity datasets and their most important characteristics. Additionally it shows that these characteristics do not differ across commodities. Therefore the results of statistical analysis should be similar as well.

3.4 *Results and discussion*

As well as data description, the results consist of three regressions, each for given commodity. The regression analysis is based on the standard ordinary least square (OLS) method. The fulfillment of assumptions for OLS method is discussed in detail in the appendix. In all three cases the Breusch-Pagan test rejects the hypothesis of homoskedastic residuals and therefore robust standard errors needs to be used in order to be able to use a t-statistics and F-statistics for assessment of statistical significance. Moreover the Shapiro – Wilkinson tests imply that residuals of the models are not normally distributed (see appendix) and therefore there might exist some nonlinear unbiased estimators which will have a smaller variance. However, since the goal of this thesis is to test hypothesis state above, the simple OLS method is sufficient for that purpose.

3.4.1 Electricity

The empirical analysis of electricity procurement is based on more than 200 observations. Despite minor methodological issues described above, the results appear to be relatively strong. The coefficient of determination R-squared indicates that 63 % of the variation in the log (final price/kWh) is explained by variations in explanatory variables. The expectations about the significant differences in prices of various kinds of contracting authorities were not confirmed. On the other hand, all three important procedural characteristics seem to be significant determinants of final price of procurement, as can be seen in table 7.

Table 7: Electricity procurement results; dependent variable: log(final price/kWh)

---

[36] PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011, page 78

Explanatory variable	OLS[37]	
log (estimated price/kWh)	0.64	***
	(0.07)	
log (market price/kWh)	0.56	***
	(0.11)	
Open procedure	-0.07	***
	(0.02)	
electronic auction	-0.06	**
	(0.03)	
number of bidders	-0.012	*
	(0.006)	
Big 4 suppliers	0.04	
	(0.04)	
small successful suppliers	0.11	***
	(0.03)	
zIndex	0.05	
	(0.14)	
time	-0.00011	**
	(0.00005)	
constant	0.03	
	(0.1)	
R-squared	0.63	
F- test	26.82	

Source: own computation based on CAE, note: robust standard errors applied, dropped dummies are negotiated procedure and occasional suppliers

The Ramsey reset test indicates that no quadratic form is missing in the model. Moreover any interaction term was not found statistically significant. Thus we dare to say that the model is identified completely and the causalities have linear character. Rewriting the results into equation gives us figure 12:

Figure 12: Electricity equation

$$log(final\ price/kWh) = 0.03 + 0.64\ log(estimated\ price/kWh) +$$
$$0.56\ log(market\ price/kWh) - 0.07\ open\ procedure - 0.06\ electronic\ auction +$$
$$- 0.01\ number\ of\ bidders + 0.11\ Small\ sucessfull\ suppliers - 0.0001\ time + \epsilon$$

The interpretation of the equation is following:

- The second and third coefficients can be interpreted as elasticities: a 1 % rise in estimated price per kWh causes in average a 0.64 % rise in final price per kWh.

---

[37] Three stars indicates a 99 % level of significance, two stars indicates 95 % level of significance and ojne star indicates a 90 % level of significance.

Similarly, a 1 % rise in market price per kWh causes in average a 0.56 % rise in final price per kWh. The final price is therefore inelastic in both final and market prices, but their impact on the final price is undisputable. Additionally, the final price is more affected by changes in estimated price than in market price which might mean that the result of procurement competition is more based on authority's willingness to pay than the opportunity and production costs of bidders.

- Both open procedure and electronic auction are institutional characteristics of the procedure that are reducing the final price: one kWh costs in average by 7 % less when contracting authority decides to use an open procedure. Additional about 6 % off is caused by using an electronic auction.

- Number of bidders has similar implications: every additional applicant in the procedure causes in average a 1 % fall in the final price of the electricity procurement.

- Statistical analysis doesn't identify any additional markup of four big suppliers that would indicate a collusive behavior of those firms. Surprisingly, a dramatic increase of in average 11 % in final price per one kWh can be identified in cases where winning company is the small successful supplier[38] (as described in section 3.3.1.). This markup is significant in comparison to both big and occasional suppliers. These two small successful companies supply about 70 tenders, which is one third of the electricity dataset. At the same time those tenders were relatively small. The firms cover only about 8 % of the total volume of the dataset. There is neither any outlier, nor recognizable special features of those tenders. They are equally distributed among procedures, number of bidders, contracting authorities and time. The only reasonable explanation is that those firms are very successful in their bidding strategies.

- The beta for zIndex is insignificant in the model. This good practice indicator is designed as a proxy for wasteful behavior of contracting authority. The insignificance of the coefficient suggests that this good practice indicator does not provide any new information in the model. Therefore it indicates that the wasteful behavior is in electricity PP hampered by a price driven bidding competition.

---

[38] The suppliers dummies are jointly significant (F = 5.34; P > F = 0.005).

- The final price of the electricity PP is decreasing in time. Our results indicate that the final price of electricity PP is cheaper in average by 4 % every year (regardless of movements on the market). That might be caused by the fact that he electricity market in Czech Republic was liberalized recently (the liberalization process starts in 2002 and ends in 2007) and the analyzed period 2008 – 2011 is period of market consolidation.

To conclude – the more open and broad is the competition, the lower is the final price of the procurement. Other implications are presented at the end of this chapter and in summary.

3.4.2 Gas

The gas procurement dataset is relatively small, it contains only 52 observations. However the results are similar to those presented in previous section. The coefficient of determination is even higher, but that is given by smaller size of the sample.

The analysis did not detect any statistically significant differences in final price with respect to the different contracting authority or supplier. Results in table 8 describe the final model. Again any quadratic forms or interaction terms were not need to be added for better identification.

Table 8: Gas procurement results, dependent variable: log(final price/kWh)

Explanatory variable	OLS	
log (estimated price/kWh)	0.64 (0.04)	***
log (market price/kWh)	0.04 (0.10)	
Open procedure	0.11 (0.13)	
electronic auction	-0.26 (0.11)	**
number of bidders	-0.04 (0.021)	*
zIndex	0.3 (0.38)	
constant	0.2 (0.15)	
R-squared	0.71	
F- test	14.07	

Source: own computation based on CAE, note: robust standard errors applied, dropped dummy is negotiated procedure

As well as in the electricity market, good practice measure zIndex was not found significant in gas market. Moreover, relative changes in final price are not caused by changes in market price which is in contrast to our findings in electricity procurements. That might be caused by relatively small volatility in average monthly market prices on the gas market. Similar distinction can be observed in case of open procedure. Rewriting the results of gas procurement dataset into equation gives us figure 1:

Figure 13: Gas equation

$$log(final\ price/kWh) = 0.2 + 0.64\ log(estimated\ price/kWh) +$$
$$-0.26 electronic\ auction - 0.04 number\ of\ bidders + \epsilon$$

- The final price elasticity with respect to the estimated price is 0.64: a 1 % rise in estimated price per kWh causes in average a 0.64 % rise in final price per kWh. Since the changes in market price are insignificant, it seems that the changes final price is purely affected by changes in estimated price.

- A dramatic fall in prices can be seen when contracting authority is purchasing gas through electronic auction: in average by 26 % which is much higher coefficient than in electricity research.

- Similarly, every additional bidder brings in average a 4 % fall in final price per one kWh.

General trends on the gas procurement market are following the same path as in case of electricity. The elasticity of final price with respect to the estimated price is the same. The implications of electronic auction or higher number of bidders are even stronger.

3.4.3 Fuel

The fuel procurement dataset contains only 49 observations. At the same time, the results of the regression are the weakest. As can be seen in next table, the only explanatory variables that are relevant in the model are log (market price/kWh)[39], log (estimated price/kWh) and dummy variable for petrol.

Table 9: Fuel procurement results, dependent variable: log(final price/l)

Explanatory variable	OLS	
log (estimated price/l)	0.021	***
	(0.004)	
log (market price/l)	0.41	***
	(0.11)	
Open procedure	0.029	
	(0.023)	
number of bidders	-0.003	
	(0.012)	
zIndex	0.13	
	(0.16)	
petrol	0.050	**
	(0.025)	
constant	1.14	***
	(0.36)	
R-squared	0.63	
F- test	21.53	

Source: own computation based on CAE, note: robust standard errors applied, dropped dummies are negotiated procedure and diesel

The final price elasticity with respect to the market price is dramatically higher than with respect of estimated price: 0.41 vs. 0.02. This findings are in opposite of previous results for both electricity and gas. On the fuel market the estimated price tend to be almost irrelevant. As elasticities indicate that the relative differences in final unit price

---

[39] Market price associated with given tender is based on the type of fuel – in cases where both diesel and petrol is purchased we use a weighted average of average prices from www.czso.cz.

are determined by changes in market price, not by differences in estimated price. The explanation is that on petrol market is more tight competition and bidders cannot exploit the contracting authority's higher willingness to pay, because the competition pressures are too strong.

At the same time, petrol is in average about 5 % more expensive than diesel. Moreover, because petrol tenders were compared with average petrol prices, not diesel, the results indicates that petrol is purchased from public sources with higher margin than diesel.

The reason why the procedural characteristics are insignificant in fuel procurement model is small dataset and low diversity. In only seven cases was used negotiated procedure, standard deviation of number of bidders is only 1.1 and electronic auction was not used in fuel purchases.

3.4.4 Results comparison

The statistical analysis of the PP of homogeneous goods shows that procedural characteristics might affect the final price. Next table summarizes significant parameters in the models.

Table 10: Result comparison

log (final unit price)	Electricity (kWh)	Gas (kWh)	Fuel (l)
log (estimated unit price)	0.64	0.64	0.021
log (market unit price)	0.56	N/S	0.41
Open procedure	-0.07	N/S	N/S
electronic auction	-0.06	-0.26	N/A
number of bidders	-0.012	-0.04	N/S

Source: Own construction based on CAE. N/A – not available, N/S – not significant

In general the electricity model gives us the most accurate estimators, because of size of dataset. Results for gas are weaker; however there is still a statistically significant link between some PP features and final price. Fuel PP analysis was not able to find any statistical significance of procedural characteristics on the final unit price.

In case of electricity and gas results indicate final price elasticity with respect to the estimated price tends to be higher than such elasticity with respect to the market price. In other words, the relative differences in final price of PP are caused rather by relative differences in the estimated price than in market price. It is rational to assume that in the

long run the market elasticity should be equal to one, because suppliers must react to movement in market price consequently in their bids. However the estimated market elasticity for the dataset suggests high rigidity in PP market. The PP procedure takes usually several weeks to process, the contracts are signed for one year deliveries at least and therefore the adjustments cannot be as flexible as commodity market is.

Other explanation is that one round (sealed) bid auctions don't create sufficiently strong competition environment. Potential suppliers are bidding rather on the basis of willingness to pay of contracting authority (which is above the market price because of reasons described in chapter 2) than on the basis of opportunity costs on the commodity market. As can be seen in figure 8 and 10, the final unit price of both commodities lays usually somewhere between market and estimated price, which means that winning supplier is getting some additional margin from supplying PP. Such margin for the winning bid is higher when the estimated price is higher as well. As we believe that indicates the ineffectiveness of competition within PP procedures, because the bidders are able to win the PP by bidding above the market price with an extra profit. However, such ineffectiveness in competition decreases in case of using electronic auction or in case where higher amount of suppliers are competing for the PP. Moreover, in case of electricity is the final price of PP decreasing in time (as you can see in table 7), suggesting that the competitiveness on the market is increasing in time.

Other explanation might be that the estimated price is capturing the heterogeneity of the subject of PP which creates differences in both estimated and final prices[40]. The core reason of analyzing homogeneous goods was to eliminate such effect. However, such potential heterogeneity of the purchased goods cannot explain the statistical differences in procedural characteristics, because there is no reason to believe that there is a correlation between differences in purchased good and differences in procedures.

The core goal of this thesis was to identify the possible impact of various institutional characteristics on the final price of the procurement. Within that goal we stated five hypotheses (see section 3.2). The discussion of empirical verification of such hypotheses follows:

---

[40] If the heterogeneity takes place in the model, there will be a positive endogeneity bias in estimated price parameter.

hypothesis H1: The final unit price of the procurement is affected by the type of the contracting authority.

We didn't find any statistically significant differences in final unit price with respect to the different types of contracting authorities. Therefore we reject the hypothesis H1. National authorities purchase examined commodities with same prices as public bodies or state owned enterprises. Our expectations about different attitudes toward excessive spending with respect to different autonomy of institutions were not confirmed. Our explanation is that commodity PP are usually a price driven bidding competition where there is not that much space for discretions of different types of contracting authorities. Moreover, since the electricity, gas and fuel bills are only a relatively small part of the total contracting authority's budget, the differences in the softness of budget, in asymmetry of information and different attitudes toward excess cost are not that noticeable. We would have to analyze much larger part of budgets in order to analyze such differences properly.

hypothesis H2: The final unit price of the procurement is affected by the type of the supplier.

We didn't find any statistically significant differences in final unit price with respect to the different types of suppliers (with the exception of those small successful suppliers in electricity PP discussed in section 3.4.1). The four or three big suppliers, who usually supply about 80 % of total volume of the dataset, do not sell the commodities with some significant excess markup. Therefore those firms do not abuse their dominant position on the market by some excessive pricing which would be result of a bid rigging agreement. However those firms might profit from returns to scale, which should lower their costs down and therefore their biding prices should be lower as well. Therefore we cannot reject the collusive behavior in general; we can only say that those big firms don't sell their commodities above other supplier on the market.

hypothesis H3: The final unit price of the procurement is affected by the type of procurement procedure.

In the electricity dataset is present a significant decrease in final unit price of in average 7 % when the open procedure is applied. Therefore we cannot reject the hypothesis H3. Such a drop in final price is caused by the fact that open procedure provide more

competitive environment and therefore lowers the final price of PP. Any other type of procedure that is restricting the competition is causing a statistically significant increase in final price of electricity PP. In case of gas and fuel the insignificant results are caused by poor datasets. A policy implication arising from those results is that contracting authorities should use the open procedure as often as possible. We do not have enough data for identifying relative price differences within various procedures with competition restriction. However with following the same logic as in case of open procedure, the more restricting the competition is, the higher the final price might be expected. So if the contracting authority is purchasing goods through negotiated procedure without announcement, where only one supplier is typically asked to bid, it is probable that final price would be significantly higher than in case of negotiated procedure with announcement where five competitors are typically asked to bid.

hypothesis H4: The final unit price of the procurement is a decreasing function of an number of bidders interested in the procurement.

The electricity tenders are significantly sensitive to number of bidders: every additional bidder decreases the final price in average by 1 %. The gas tenders are even more bidders sensitive, average drop is by 4 % with an additional bidder. So we cannot reject the hypothesis H4. Number of bidders has a positive effect on competition and consequently negative effect on final price. Even though we were testing a potential quadratic form of relationship, the causality seems to be linear. However we cannot assume that such additional savings will be caused by 20th bidder. But within the range of amount of suppliers in our dataset the relationship is straightforward.

hypothesis H5: The usage of electronic auction is decreasing the final price of the procurement.

With usage of the electronic auction, the final unit price of electricity PP falls in average by 6 %. The gas PP using electronic auctions are in average by 26 % cheaper. We cannot reject the hypothesis H5. The enormous difference between electricity and gas electronic auction is probably caused by poor dataset of gas PP. However, such dramatic falls in prices (especially in case of gas) are caused by the fact that electronic auction allows bidders to adjust offered prices and therefore the competition ends only

after no one is willing to bid lower price. On the basis of these findings in seems to be very useful to use the electronic auctions as frequent as possible.

As can be seen, the procedural characteristics affect the final price of PP significantly. Contracting authorities can reach a lower price of the PP simply by bringing more competitive environment into a procedure. This might be done by using an open procedure, where everyone can bid for the procurement. The contracting authority cannot choose a number of bidders in the PP, but it might easily encourage or discourage potential bidders by qualification criteria or other barriers to entry (see section 2.3.4.). The very effective device (especially in case of Gas PP) seems to be an electronic auction, which might strengthen the competition allowing the bidders adjust their offers.

As we discussed in section 2.3.3., such additional and optional features of PP procedure can leads to increase of transaction cost of PP. However if we compare the estimations of these costs with the model estimations of their impact on final price, we find out that these optional features are used less frequent than it would be effective.

- The Open procedure is more expensive than a negotiated procedure by a 17 500 CZK in average. At the same time, the final price of electricity PP is in average about 7 % cheaper in case of open procedure. Therefore open procedure is better in terms of total costs in PP worth more than 250 000 CZK, because the savings coming from higher competition are larger than additional administrative costs resulting from open procedure. Since in the Czech Republic was the legal threshold for PP procedures equal to 2 000 000 CZK in case of supplies, we can say that this figure is highly overstated for homogeneous goods.

- With similar logic we can compare an average administration costs for contracting authority related to additional bid (5 000 CZK) and its average affect to final price of an electricity (1 %) and gas (4 %) respectively. From the perspective of total costs of PP for contracting authority it would be a cost-effective to encourage as many bidders as possible in case of electricity PP worth more than 500 000 CZK and in case of Gas PP worth more than 125 000 CZK.

- An electronic auction costs about 10 000 CZK. At the same time the final price is in average about 6 % cheaper. Therefore if the contracting authority want to

minimize its costs, it would be effective to use electronic auction in electricity PP worth more than 166 666 CZK.

This simple cost benefit analysis of these optional institutional characteristics is a bid misleading, because our dataset cover only procurements worth at least 2 000 000 CZK and we cannot say that the impacts would be the same for smaller PP. However it shows that for PP of homogeneous goods the additional administrative costs are negligible, but the potential savings are remarkable. Therefore it would be cost - effective to use open procedure and electronic auction as often as possible and encourage as many additional suppliers as possible.

Summary

PP is an important area because it concerns public spending and represents a significant share of GDP. At the same time PP as a purchases form public sources have several very important institutional characteristics that are affecting the overall efficiency of these public purchases. Yet they have almost not been studied by economic science.

Legal framework of PP in Czech Republic is similar to legal framework within European Union. Therefore the results of our analysis are relevant not only for PP in Czech Republic, but in the whole EU.

Contracting authority as a decision maker is not usually the final consumer of contracted goods. As a result of that, there is a difference in interests and asymmetry of information. Moreover the contracting authorities are (more or less) connected to the state budget and therefore they are subject to soft budget constraint. Since the PP is paid from state budget, the contracting authority doesn't bear any excessive cost of such purchases. Once the contracting authority has got a budget, it operates in the process only as an intermediary and their objectives are not related with the final price of the procurement.

The size of transaction costs is in case of PP much higher than in case of regular purchases because of formal perquisites and conditions of the award procedure. The most significant part of transaction costs are administrative costs related to award procedure which can be decomposed into mandatory fixed costs, additional administrative costs associated with optional actions (e.g. electronic auction) and variable costs associated with number of bidders. The optional and variable costs are relatively small part of total administrative costs.

The goal of our empirical case study is to show that institutional and procedural characteristics are affecting the final price of the procurement. In order to be able to compare the tenders among each other, we decide to use only procurement of homogeneous goods. Because of this homogeneity we are able to compute a price per one unit of purchased good (from quantity and total price of procurement). Additionally we are able to compare the unit price of procurement with unit price of such goods purchased by private sector.

The presented model attempts to explain a variation in final price (more precisely natural logarithm of final price per one unit) as a function of estimated unit price (in logarithm form), market price (in logarithm form), characteristics of contracting authority – its institutional form and characteristic of procurement procedure – type of procedure, number of bidders, use of electronic auction. PP might be subject of omitted wasteful behavior. We use the zIndex (good practice indicator) as a proxy variable for omitted wasteful behavior.

The analyzed dataset comes from Czech informational portal of PP and it covers 206 electricity tenders, 53 gas tenders and 49 fuel tenders from years 2008 – 2011. The summarized value of this procurement is 15 billion CZK. The data description shows that the general characteristics of those commodity tenders are the similar. The final price usually lies in between market and estimated price. The concentration of suppliers is really high. Tenders are distributed among various types of contracting authorities and procedures. Average amount of bidders is about 3.5.

The results consist of three OLS regressions, each for given commodity. The explanatory variables are able to explain more than 60 % of total variations in final unit price.

In case of electricity and gas results indicates final price elasticity with respect to the estimated price tent to be higher than such elasticity with respect to the market price. In other words, the relative differences in final price of PP are caused rather by relative differences in the estimated price than in market price. The estimated elasticity for the dataset suggests high rigidity in PP market. Other explanation is that one round (sealed) bid auctions don't create sufficiently strong competition environment. Potential suppliers are bidding rather on the basis of willingness to pay of contracting authority than on the basis of opportunity costs on the commodity market. As we believe that indicates the ineffectiveness of competition within PP procedures, because the bidders are able to win the PP by bidding above the market price with an extra profit. However, such ineffectiveness in competition decreases in case of using electronic auction or in case where higher amount of suppliers are competing for the PP. Moreover, in case of electricity is the final price of PP decreasing in time, suggesting that the competitiveness on the market is increasing in time.

We didn't find any statistically significant differences in final unit price with respect to the different types of contracting authorities as well as different type of suppliers. The three big suppliers, who usually supplies about 80 % of total volume of the dataset, do not sell the commodities with some significant excess markup. Therefore those firms do not abuse their dominant position on the market by some excessive pricing.

In the electricity dataset is present a significant decrease in final unit price of in average 7 % when the open procedure is applied. Such a drop in final price is caused by the fact that open procedure provide more competitive environment and therefore lowers the final price of PP. Similarly, number of bidders has a positive effect on competition and consequently negative effect on final price. Every additional bidder in the electricity tender decreases the final price in average by 1 %. The gas tenders are even more bidders sensitive, average drop is by 4 % with an additional bidder.

With usage of the electronic auction, the final unit price of electricity PP falls in average by 6 %. The gas PP using electronic auctions are in average by 26 % cheaper. Such dramatic falls in prices (especially in case of gas) are caused by the fact that electronic auction allows bidders to adjust offered prices and therefore the competition ends only after no one is willing to bid lower price.

The comparison of empirical result with estimated transaction cost shows that for PP of homogeneous goods the additional administrative costs resulting from optional actions are negligible, but the potential savings are remarkable. Therefore it would be cost - effective to use open procedure and electronic auction as often as possible and encourage as many additional suppliers as possible.

PP of homogeneous goods is relatively small but still remarkable part of public purchases. At the same time the unique features of PP of homogeneous goods allow us to identify relationships between institutional setting of procurement and its final price. Those relationships were suspected by practitioners and theorists, but they have never been precisely statistically proved. The main contribution of this thesis is that it estimates those relationships and proves that the more competitive environment of PP is formed, the less will the procurement cost.

Literature

Act no. 106/1999 Col. Freedom of Information

Act no. 137/2006 Coll. On Public Contracts.

Arrow, K.: Essays in the theory of risk bearing, Chicago Markham 1971

Bajari, P.; Houghton, S.; Tadelis, S.: Bidding for Incomplete Contracts: An Empirical Analysis, NBER Working Paper No. 12051, 2006

Bajari, P.; Tadelis, S.: Incentives versus transaction costs: a theory of procurement contracts, RAND Journal of Economics, Vol. 32, No. 3, 2001, pp. 387–407

Bandeira, O.; Prat, A.; Valetti, T.: Active and Passive Waste in Government Spending: Evidence from a Policy Experiment, working paper, 2008

Bös, D.: Bureaucrats and Public Procurement, CESifo Working Paper No. 515, 2001

Bozeman, B.: Bureaucracy and Red Tape, Prentice-Hall Publishing., 2000

Breton, A. and Wintrobe, R.: The equilibrium size of a budget-maximizing bureau: A note on Niskanen's theory of bureaucracy. Journal of Political Economy, 1975

Buchanan, J.M.: Rent Seeking and Profit Seeking, Texas A&M University Press, Texas 1980

Buchanan, J: Veřejné finance v Demokratickém systému, Computer press, 1998

Bulow, J. I.; Roberts, D. J.: The Simple Economics of Optimal Auctions, Journal of Political Economy. 97, P. 1060 – 90, 1989

Burget, R.; Che, Y.: Competitive Procurement with Corruption, RAND Journal of Economics, 35, pp. 50-68, 2004

Domberger, S., Hall, Ch., Ah lik Li, E. : The determinants of the price and quality in competitivwly tendered contract, The Economic Journal, 1995

Eisenhardt, K.: Agency theory: An assessment and review, Academy of Management Review, 14 (1): 57-74. 1989

Ekologický právní servis: Veřejná Kontrola Obchodních Společností S Majetkovou Účastí Státu A Samospráv: Analýza A Doporučení Pro Rozšíření Kompetencí NKÚ, Ekologický Právní Servis, Brno 2011

Hlaváček J.: Homo se assecurans, Politická ekonomie 34, 1987

Hlaváček, J., Hlaváček, M.: Zobecněná Mikroekonomie, nakl. Karolinum 2010

Hlaváček, J.; Hlaváček, M.: Morální hazard a nepříznivý výběr při maximalizaci pravděpodobnosti ekonomického přežití. IES Working Paper. Praha, I2006

Holmstrom, B.; Milgrom, P.: Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design, Journal of Law, Economics and Organization, Oxford University Press, vol. 7(0), pages 24-52, 1991

Chvalkovská, J.; Skuhrovec, J.: Measuring transparency in public spending: Case of Czech Public e-Procurement Information System, IES working paper 11/2010

Jakobsson, M.: Bid Rigging in Swedish Procurement Auctions, Department of Economics, Stockholm University, Sweden 2007

Johnson, R a Libecap, G.: Agency growth, Salaries, and the Protected Bureacrat; Economic Inguiry, 1989

Jurčík, R.: Podmínky provádění kontroly a vlastní kontrolní mechanismy zadávání veřejných zakázek, Transparency International Česká Republika, 2006

Kelman, S.: Unleashing Change: A Study of Organizational Renewal in Government. Brookings Institution, 2005.

Kelman, S: Procurement and Public Management: The Fear of Discretion and the Quality of Public Performance. American Enterprise Institute, 1990.

Kornai, J.: Economics of Shortage. Amsterdam North-Holland, 1980

Kornai, J.: The soft Budget Constraint. Kyklos, 1986

Krueger, A.O.: The Political Economy of the Rent-Seeking Society, The AmericanEconomic Review, 1974

Laffont, J. J.; Tirole, J.: Auction design and favoritism, International Journal of Industrial Organization, Elsevier, vol. 9(1), pages 9-42, 1991

Maskin, E. S.; Riley, J. G.: Asymetric Auctions, Review of Economic Studies, 1999

McAfee, R. P.; McMillan, J.: Competition for Agency Contracts. Rand Journal of Economics, 18, p. 296 - 307, 1987

Migué, J. a Bélanger, G.: Towards a general theory of managerial discredition, Public Choise,1974

Niskanen, W. A.: Bureaucracy and Public economics, Edvard Elgar publisching co., 1994

Niskanen, W. A.: Bureaucrats and Politicans, American Economic rewiew, 1975

Niskanen, W. A.:The Peculiar Economics of Bureaucracy, American Economic rewiew, 1968

OECD: Corporate Governance of State-Owned Enterprises. A Survey of OECD countries. OECD Publications, Paris, 2005

OECD: Guidelines for fighting bid rigging in public procurement, 2009

Ochrana, F.:Hodnocení veřejných projektů a zakázek, 3. vydání, Aspi Publishing, 2004

Pardo, J. S.; Puchades-Navarro, M.: A critical comment on Niskanen's model, Public Choice, 2001.

Pavel, J.: Používání obchodních společností v České republice na příkladu krajských měst. Transparency Int., Prague, 2008

Pavel, J.: Transakční náklady a veřejné zakázky?, KVF VŠE, 2007

Pavel, J.: Veřejné zakázky v České republice, Studie Národohospodářského ústavu Josefa Hlávky, 2009

Pavel, J.: Vliv počtu nabízejících na cenu stavebních zakázek v oblasti dopravní infrastruktury 2004 – 2007, Transparency International Česká republika, 2008

Pesendorfer, M.: A Study of Collusion in First-Price Auctions, Review of Economic Studies, 67, 381-411. 2000

Porter, R. H.; Zona, D. J.: Detection of Bid Rigging in Procurement Auctions, Journal of Political Economy Vol. 101, No. 3 (Jun., 1993), pp. 518-538, 1993

PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011

Rees, R.: The Theory of Principal and Agent—Part I. Bulletin of Economic Research, 37(1), 3-26, 1985

Reimarová, H.: Transaction Costs in Public Procurement (Diploma thesis). Charles University in Prague, 2011

Rose-Ackerman, S.: The Economics of Corruption, Journal of Political Economy, Vol. IV, pp. 187-203, 1975

Smiley, R.: Tender Offers, Transactions Costs and the Theory of the Firm, The Review of Economics and Statistics, 1976

Soudek, J: Veřejné zakázky; Institucionální analýza procesu zadávání a výběrového řízení zakázek, Bachelor thesis, Charles University in Prague, 2010

Stiglitz, J. E.: Principal and agent, The New Palgrave: A Dictionary of Economics, v. 3, pp. 966-71. 1987

Stiglitz,J.: Ekonomie veřejného sektoru, 1. Vydání, Grada Publishing, 1997

Schwab, K,: The Global Competitiveness Report 2011-2012, World Economic Forum 2011

Transparency International: Coruption perception index 2011, Transparency International, 2011

Tollison, R.D. , Congleton, R.D. (eds):The Economic Analysis of Rent Seeking, 1995

Tullock, G.: Origin of the Rent-seeking Concept, International Journal of Business and Economics, 2003

Williamson, O.: The Economics of Organization: The Transaction Cost Approach, The American Journal of Sociology, 1981

Wooldridge, J. M.: Introductory Econometrics, Fourth Edition, South-Western, 2009

www.czso.cz

www.isvzus.cz

www.portal-vz.cz

www.zindex.cz

www.compet.cz

www.ote-cr.cz

APPENDIX

Appendix A - IES Working Paper 05/2013

Public Procurement of Homogeneous Goods: the Czech Republic Case Study

Jan Soudek[a]
Jiří Skuhrovec[b]

[a]IES, Charles University Prague
e-mail: honza.soudek@gmail.com
corresponding author

[b]IES, Charles University Prague

May 2013

Abstract

The goal of this paper is to show how institutional and procedural characteristics affect the final price of the public procurement. In order to get comparable prices, only public procurement of homogeneous goods is analyzed. Presented model attempts to explain the variation in unit price as a function of price estimated by the contracting authority, market price and characteristic of procurement procedure – type of procedure, number of bidders and use of electronic auction.

We find that the final price in the electricity and natural gas public procurement is more sensitive to purchaser's estimate than to actual market price. At the same time, we identify that the final price is reduced by using open procedure, electronic auction or attracting more competitors.

Introduction

Public procurement (PP) are processed purchases and investments from public sources which consist about 15 % of annual GDP in developed countries (OECD, 2011). PP has several very important institutional characteristics that differentiate them from private purchases and which highly affect their overall efficiency.

Despite the enormous importance of the topic, the volume of related economic literature is quite small. Besides poor data availability, the main problem with PP research possibly lays in variation of procured goods and services, resulting in low comparability of atomic procurement results. We try to overcome this obstacle by examining only a small subset of PP's, where subject of trade is well-defined, measurable and has solid price benchmarks coming from private markets. These are procurements of electric energy and natural gas.

The PP in the Czech Republic is an extraordinary case: the relative size of the PP market is the second largest of all OECD countries (OECD, 2011), whilst the country has weak both formal and informal institutions (Schwab, 2011). These two observations imply severe risk of inefficiency but also room for improvement. Recent studies and publications (e.g.: Pavel, 2009 or Nikolovová et. al., 2012) about PP in the Czech Republic describe the procurement system as a whole, pointing out its crucial pitfalls and shortcomings and giving a broad overview of basic information. While their approach is appropriate for initial research, their description of the market where all kind of goods and services are purchased leads to generalizations. We will move forward to more compact and unified market to deliver a more analytical and objective study. This paper will provide new results relevant for both theoretical discussion and daily practice of PP. Moreover, as the examined legal framework is present not only in the Czech Republic but across the whole European Union, our results should be applicable Europe-wide.

The work is organized as follows: first, we introduce the topic with a literature review. Then we present the motivation of our research together with hypothesis statement. Third, we show an overview of our dataset with a data description where two public procurement markets (electricity and natural gas) are analyzed. Finally, the results of

our empirical study are presented, followed by hypotheses discussion and summarizing conclusion.

Literature review

The majority of PP literature describes the process through auction theory. Most papers, such as McAfee and McMillan (1987), Bulow and Roberts (1989) or Maskin and Riley (1999), attempt to set up the optimal or sup-optimal strategies in procurement game with several assumptions given. Laffont and Tirole (1987) and Che (1993) discuss an optimal procurement process in terms of maximizing expected payoff of contracting authority and show that scoring auction provides such property. However, Asker and Cantillon (2010) show that scoring auctions are not necessarily optimal when the bidders' cost functions are multidimensional. Bolow and Klemperer (1996) discuss the pros and cons of competitive bidding (auctions) in comparison to negotiations, showing that under reasonable assumptions and interdependent signals the auction processes do maximize the expected revenues.

The role of transaction costs in PP procedure was described by Smiley (1976), Bajari and Tadelis (2001) or in the Czech Republic by Pavel (2009). In terms of policy making in the Czech Republic is important the work of Reimarová (2011) who estimates the administrative or transaction costs of the procurement procedure and evaluates the differences between an in-house administration and an outsourced administration in terms of prices and efficiency.

Domberger, et. al. (1995) wrote one of the first papers that uses an econometric approach on PP. They collected data on about 61 cleaning contracts from public offices, schools and hospitals in Australia. Their results suggest that while competitive bidding reduced the price of PP, the effect of ownership of contracting authority (private versus public) on price was negligible (Domberger, 1995). Another paper by Bandeira, Prat and Valletti (2009), based on 6000 procurement from Italy, concluded that final prices correlate with types of contracting authority: the central administration pays more than semi-autonomous agencies (Bandeira, 2009). Contrary to previously mentioned theories and empirical evidence, Bajari, McMillan and Tadelis (2008) show on the dataset of private sector building contracts that auctions may not maximize expected revenues when projects are complex and contractual designs are incomplete (Bajari, 2008).

Hattori (2010) shows that the amount of bidders in electricity PP in Japan is dependent on characteristics of the purchased good and geographical location.

In the Czech Republic, Pavel (2008) examines 202 tenders of infrastructure engineering works, concluding that final price (as a percentage of estimated price) is affected by the type of procedure and amount of applicants. The largest caveat of such approach lies in the dependent variable, which is after all determined by subjective estimate and/or strategic consideration of contracting authority. In this paper we would like address the issue by using market price as more objective benchmark.

Motivation & hypotheses

We now attempt to discuss and identify the impact of institutional characteristics on the final price of the procurement. Quantitative research on public procurement usually runs into trouble because of difficulties with any objective metric of success. The provision of public goods typically connected with PP is difficult to measure as PP prices usually lack any benchmark against which they could be compared – in terms of both price and quality. To overcome such difficulty, we limit our research to markets where benchmark for resulting price exists, i.e. to markets with natural gas and electricity. Here we can compare the price of PP purchases against the spot market price of these commodities. Consequently, this should enable us to measure the effect of various institutional settings on PP result. The market price should serve as sort of lower-bound price benchmark, as majority of suppliers either obtains the energy on the commodity market, or sells it here and therefore any bidder would hardly offer lower price, than they would get on the market. We will use it to examine how chosen procedure and criteria affect the price mark-up, and derive some conclusion regarding efficient behavior. Apparently, our findings will have only limited relevance outside examined markets. Most notably, they do not provide information on PPs where qualitative aspects of offered goods play significant role and the goal of PP is thus different from minimizing price of well-defined good or service.[41]

However, unfortunately even utilities markets are not as homogeneous as we would wish. Although base price for electricity is established on commodity exchange, the

---

[41] The procurements using the price as a single criterion typically ammount to 50-60% of annual procurement volume in Czech republic (own calculation). This outlines maximum applicability scope of our results.

final price for consumer (or in case of PP for the contracting authority) depends on the properties of consumed electricity (voltage level, length of contract, number of phases, distribution assigned rate, daily hour course taking of electricity). Similarly, the final price of gas reflects not only price on the spot market but also the total natural gas offtake, daily reserves and timing of the offtake. Nonetheless, examining these details would not only be tedious, but would also not be very interesting from the economic point of view. We will neglect such heterogeneity for two reasons:

1. Since our sample of contracting agencies are government offices with arguably similar consumption patterns, the differences in price schemes should be only minor relative to overall price

2. Contracting authorities should account for specific nature of their demand such as offtake time patterns, when producing estimated price (please see the legal definition in appendix A), which we use as an explanatory variable. Simultaneously, the estimated price reflects the authority's willingness to pay – it signals the amount of disposable money that authority budgeted for the procurement.

Nevertheless, when controlling for movements in the market price as well as the estimated price, the characteristics of individual procurement procedure are expected to affect the final price. On the basis of theoretical (e.g.: Bolow and Klemperer, 1996) and empirical (e.g.: Domberger, 1995) literature presented in previous section, we are expecting corresponding results related to the type of procurement procedure (please see description in appendix A): within the open procedure is a most-favorable environment for competition, bidders must shed their bids, pushing the final price as low as possible. On the contrary, the negotiated procedure restricts competition, allowing bidders to bid with an additional mark-up and thus raising the final price. Formally we will test following hypothesis:

hypothesis H1: The final unit price of the procurement is affected by the type of the procurement procedure.

Similar logic is applicable in the case of number of bidders: theory (e.g.: Bower, 1993 or Bolow and Klemperer, 1996) suggests that gains of increased competition outstrip the potential gains resulting from negotiations. Whereas number of bidders is certainly

affected by type of procedure, the competition within certain given procedure can have additional effect – the more bidders involved in bidding process, the lower final price can be reached:

hypothesis H2: The final unit price of the procurement is a decreasing function of a number of bidders interested in the procurement.

Currently, one of the most discussed tools in PP community is the electronic auction. The electronic auction allows bidders to repetitively adjust offered prices, therefore the competition ends only after no one is willing to bid a lower price. This implements the "English auction" features in a PP environment. According to the auction theory, in the model with interdependent values, the expected revenues from an English auction are at least as good as the expected revenue from a first price sealed bid auction – means a basic open procedure (for details see Krishna 2010). Some current incidents in the Czech Republic[42] demonstrate that the cost cuts caused by an electronic auction might be tremendous. We believe in demonstration of statistically significant negative impact on the final price of procurement of homogeneous goods as well:

hypothesis H3: The usage of electronic auction reduces the final unit price of the procurement.

As a result of previous empirical evidence (Bandeira, 2009) presented in the literature review, we will also test whether there are differences in final prices of tenders purchased by different types of contracting authorities. Their result suggests that the more autonomous the authority is, the greater the concern about unnecessary excess expenses and looking after the final price. The hypothesis is stated as follow:

hypothesis H4: The final unit price of the procurement is affected by the type of the contracting authority.

A crucial issue concerning specificity that must be dealt with is the potential endogeneity bias resulting from the omitted variable problem. PP might be subject of a wasteful behavior, which might, through correlation with the explanatory variables, cause false significance. For the purpose of this paper there is no need to create a

---

[42] In the most famous current case the statutory city of Ostrava managed to decrease their mobile phone expenses from 22 mil CZK to 3 mil CZK (http://moravskoslezsky.denik.cz/zpravy_region/ostrava-usetri-miliony-za-volani20110810.html).

distinction between wasteful behavior as a result of corruption and wasteful behavior as a result of carelessness and lack of interest in the cost minimizing (as proposed in Bandeira, 2009). In general, the wasteful behavior might affect both procedural characteristics (estimated price, type of procedure, number of bidders) and the final price of the procurement. This, unfortunately, would lead to a negative bias of the ordinary least square estimators. To tackle this omitted variable problem, we decided to use a proxy plug-in solution[43]. As a proxy variable for this unobservable *"wasteful behavior"* we decided to use a *zIndex*, a composite index presented by Chvalskovská and Skuhrovec (2010) that rates contracting authorities according to quality and transparency of all their procurement competitions over given period of time. The index consists of ten individual ratios representing openness, competition or effective controlling processes in purchases of each contracting authority (see appendix B for individual composites of zIndex).

In general, the zIndex measures good practice behavior in public expenditures. Those authorities who follow all "good practice" guidelines will reach a high level of zIndex. At the same time, the space for wasting public money will be (or, at least, should be) much lower than authorities without such good practices. Therefore the wasteful behavior should be minimized as well. The zIndex as a good practice measure seems to be a good proxy variable for omitted wasteful behavior that might occur in a PP dataset.

To conclude the motivation, the aim of this empirical study is to identify the impact of institutional and procedural characteristics on the final price of the procurement. For the purpose of statistical comparison the final price is normalized per unit of purchased commodity. Since we are not much interested in the actual level of the final price but rather in its relative changes caused by other variables, we decided to use a natural logarithmic form of the final unit price as a dependent variable. Similarly, both the estimated and the market prices are designed in the natural logarithmic form. During the statistical analysis, the interaction terms (e.g. *procedure*authority*) will be tested as well.

---

[43] See Wooldridge, J. M.: Introductory Econometrics, Fourth Edition, South-Western, 2009, page 307

Data description

We had several criteria for choosing examined markets – a sufficient number of PP observations, availability of purchased quantities for unit price computation, homogeneity of good for comparability and availability of market prices time series. We found two commodities that fulfill those requirements:

   d) electricity
   e) natural gas

The source of the dataset is the Czech national informational portal for PP (www.isvzus.cz), where every large procurement since the year 2006 is listed. This database has some shortcomings resulting from weak enforcement of data quality. However, we were still able to get a set of 259 procurements that have all the necessary information. For additional discussion on data gathering technicalities and connected issues please refer to Soudek (2012). As we already mentioned, we are also comparing the final unit price with the market price. We decided to use the Czech electricity and gas market operator (OTE) as a source of the market price. This company provides comprehensive services to individual electricity and gas market players and creates monthly and yearly reports on both markets in the Czech Republic. Since OTE works as a kind of commodity exchange, the unit prices of the commodities are lower than retail prices. OTE price is however the key determinant of retail prices, hence it can be used as a solid bottom-line benchmark. In order to avoid day-to-day volatility on the market, we decide to use the monthly weighted average prices presented in the OTE annual reports.

The dataset covers procurement from 2008[44] till 2011. The total amount of purchased electricity was over 7 000 GWh and summarized price of these tenders was over 10.5 bn CZK (over 420 mil. €). The gas dataset represents tenders purchasing 2 GWh of gas worth 1.6 bn CZK (64 mil. €). The table 1 presents the comparison of unit prices (final, estimated and market). The highest and most volatile is the estimated price in both electricity and gas procurement, which might be caused by the heterogeneity of our dataset. On the other hand, the average market price seems to be the smallest and least volatile (especially in the case of gas).

---

[44] Both markets have been liberalized only recently. Before 2008, they were almost fully monopolized, hence data are not relevant for our hypotheses, concerning competitive PP.

Table 11: Average unit prices

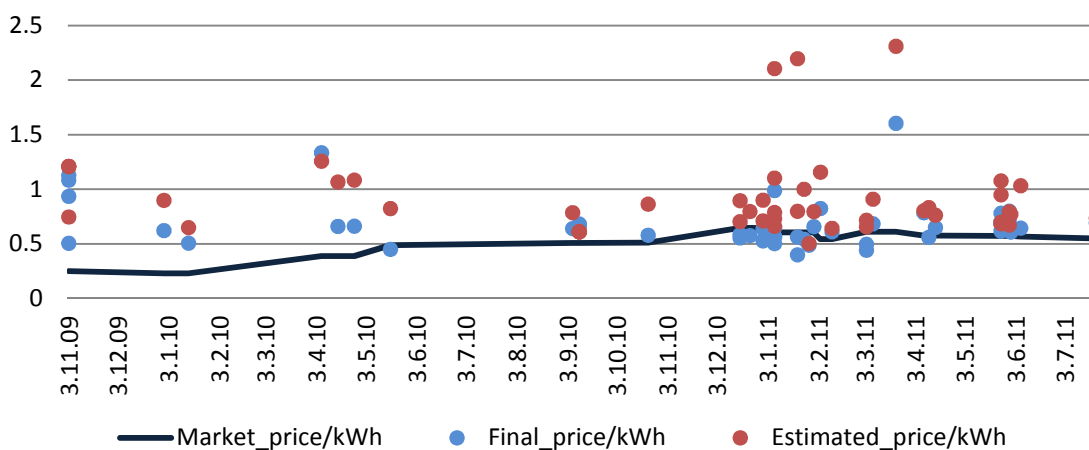| Price	Electricity CZK/kWh		Gas CZK/kWh	
	average	SD	average	SD
Final	1.7	0.42	0.74	0.45
Estimated	1.92	0.55	0.97	0.56
Market	1.16	0.14	0.52	0.12

On the following graphs is presented how the tenders are scattered over time.

Figure 1: Electricity tenders in time
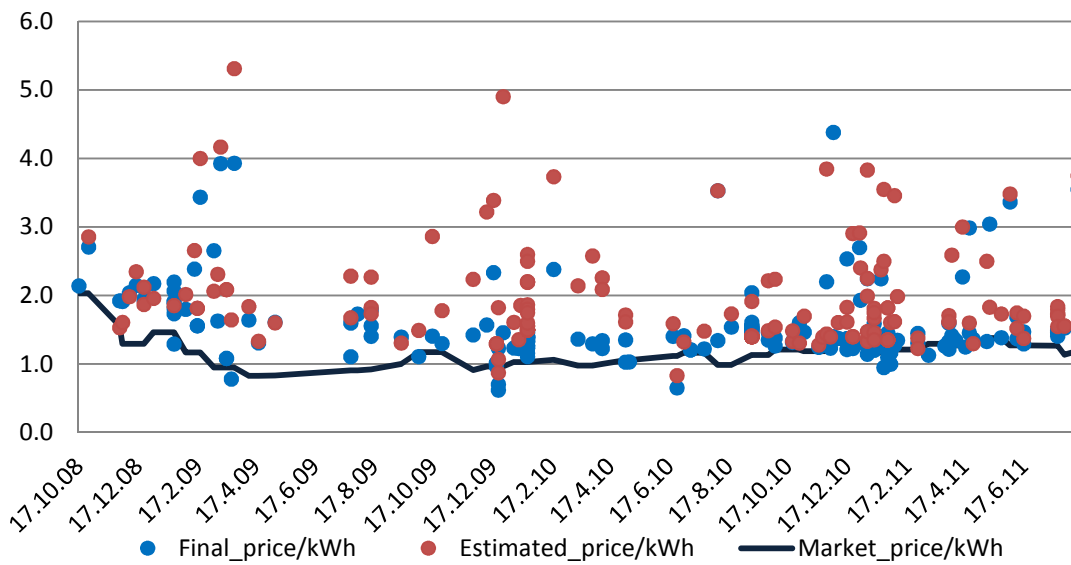
Source: own computation

Figure 2: Gas procurement in time

Source: own computation

As can be seen, the final prices are usually on or above the market price. Hypothetically, if all contracting authorities would be able to buy electricity at the market price, the

public budget would save about 1.4 bn CZK (13 % off). Of course, we actually cannot say that this 1.4 bn CZK is the potential savings, but it indicates, that there is a space for possible cuts in electricity expenses. Another remarkable characteristic is, that in most of the observations the estimated unit price is above the final unit price, indicating that the contracting authorities are consistently overestimating the actual price of the procurement.

The following table shows the distribution of various institutional characteristics within the dataset. The dataset covers the 194 competitions that were using open procedure and the 65 tenders processed by negotiated procedures (with or without an announcement). Additionally, in 100 cases the contracting authority decided to use an electronic auction. The most frequent authorities of both electricity and natural gas procurement are public bodies and regional authorities.

Table 12: Contracting authorities of electricity tenders

	Total	Open procedure	Negotiated procedure	e-auction	Profit seeking firms	Public bodies	Regional auth.	Central state auth.
Electricity	206	157	49	76	14	61	77	54
Gas	53	37	16	24	10	17	24	2

Source: Our computation based on CAE

The supply side of market can be described as oligopoly. We have 13 electricity and 9 gas suppliers (please see the Appendix C for detailed table of suppliers) in our dataset. Three companies supply more than 77 % of the procurement volume in both cases. The Herfindahl index measuring the market concentration equals to 0.25, which indicates high market concentration of suppliers in our dataset. The whole dataset of suppliers can be divided into three groups of similar companies in terms of their position and success on the market:

- The first group contains the big players on the market. In the case of electricity, four big players won 84 % of the total procurement volume, but only 35 % of the procurement cases. On the gas procurement market, three big suppliers cover 79 % of the volume, but 51 % of competitions. Those companies are highly

successful when bidding for the largest contract, but they are usually not winning the smaller ones'[45].

- The second group encompasses small successful firms who supply lots of low-volume PP. The companies supply a relatively small share of the procured volume: 8 % of electricity and 6% of gas, but were able to win over 36 % of all electricity and 22 % of all gas PP cases in our dataset.

- The last group, called occasional suppliers, covers remaining suppliers who won only a few tenders. Together they supply 8 % of the electricity volume (15 % of gas volume) and 28 % of electricity PP cases (26 % of gas PP cases).

Potential differences in prices with respect to different types of suppliers might suggest some interesting features of examined procurement markets. Lower average prices of PP won by the big suppliers would suggest that suppliers are able to exploit some economies of scale. On the other hand, higher average prices might indicate that those big companies abuse their dominant positions[46]. At the same time, the group of small, successful firms should have (ceteris paribus) lower prices on average, as winning a procurement means offering the lowest price. Therefore if those companies win often, they should bid prices lower than others. Based on the discussion above, we decided to assess the fifth hypothesis:

> *Hypothesis H5: The final unit price of the procurement is affected by the type of the supplier.*

The important determinant of the outcomes from the procurement procedure is the number of bidders. The number of bidders varies around four (with SD of 1.7), which is similar to the average of the number of bidders in the whole PP market within EU (PWC, 2011). The average amounts of bidders for gas is 3.3 (SD 1.6). So both the electricity and gas PP do not stand out in this characteristic. The comparison of the number of bidders with the amount of players on the whole electricity market is remarkable. As we discussed above, there are only 13 (9 in the case of gas) winners of PP and at least 4 bidders in the tendering procedure in more than 60 % of the cases.

---

[45] Since we do not have the information about bidders but only about winner of the procurement, we cannot say, whether the big companies are not winning the smaller procurement because they are not bidding in those procurement or whether they are bidding too high.
[46] Without sufficient track record, a company may not be able to compete in large PP's. Therefore competition in those might be limited to big players.

Therefore, the players must meet and compete with one another on a daily basis. At the same time, more than half of procurements have number of bidders higher than amount of big players on the market, therefore the small players are bidding in these PP as well. The outcome of such a competition might be a trend of decreasing the margins over the average market price in time. As we said already, both markets have been liberalized only recently, so the market is in consolidation period. Therefore we expect that final price will decrease over time, regardless of movements on the market. Thus we decide to assess the sixth hypothesis:

Hypothesis H6: The final unit price is decreasing over time.

Results and discussion

The results consist of two regressions, each for a given commodity. The regression analysis is based on the standard ordinary least square (OLS) method. The fulfillment of assumptions for the OLS method is discussed in detail in Appendix D. In both cases, the Breusch-Pagan test rejects the hypothesis of the homoskedastic residuals. Therefore, robust standard errors must be used in order to be able to use t-statistics and F-statistics for assessment of statistical significance. Moreover, the Shapiro – Wilkinson tests imply that the residuals of the models are not normally distributed (see appendix D). This might indicate that some nonlinear unbiased estimators might have a smaller variance. However, for the sake of simplicity, we prefer OLS as it already provides reasonably robust results.

The empirical analysis of electricity procurement is based on 206 observations (53 in the case of gas). Despite the minor methodological issues described above, the results appear to be relatively strong. The coefficient of determination (R-squared) for electricity dataset indicates that 63 % of the variation in the log (final price/kWh) is explained by variations in explanatory variables. The expectations about the significant differences in prices with respect of various kinds of contracting authorities were not confirmed (please see appendix D for the table of results including dummies for contracting authorities). On the other hand, all three important procedural characteristics seem to be significant determinants of the final price of the procurement, as can be seen in the Table 13:.

Table 13: Electricity & gas procurement results; dependent variable: log(final price/kWh)

Explanatory variable	Electricity OLS ß	Electricity Robust SE	Gas OLS ß	Gas Robust SE
log (estimated price/kWh)	0.64	(0.07) ***	0.41	(0.07)***
log (market price/kWh)	0.56	(0.11) ***	0.07	(0.12)
Open procedure	-0.07	(0.02)***	0.11	(0.13)
electronic auction	-0.06	(0.03)**	-0.17	(0.09)*
number of bidders	-0.012	(0.006)*	-0.04	(0.01)**
Big 4 suppliers	0.04	(0.04)	0.05	(0.08)
small successful suppliers	0.11	(0.03)***	0.16	(0.07)*
zIndex	0.05	(0.14)	0.3	(0.48)
Time	-0.00011	(0.00005)**	0.0006	(0.00035)
Constant	0.03	(0.1)**	0.2	(0.15)*
R-squared	0.63		0.71	
F- test	26.82		14.7	

Source: own computation based on CAE, note: robust standard errors applied, dropped dummies are negotiated procedure and occasional suppliers

The Ramsey reset test indicates that no quadratic form is missing in the model (see appendix D). Additionally, any interaction term was not found statistically significant. Thus, we dare to say that the causalities have linear character. The simple conclusion is, that the procedural characteristics do significantly affect the final price of the electricity PP. Results for gas are weaker; however there is still a statistically significant link between some PP features and the final price. The similarity of results for both markets also suggests that the findings may be in some sense general and have relevance also in other PP markets.

In both cases, the results indicate that the final price elasticity, with respect to the estimated price, tends to be higher than such elasticity with respect to the market price. In other words, the price expectation[47] of contracting authority does predict final price better than actual market price at the time, when bids are placed. The resulting market elasticity below one suggests high rigidity in the PP market. As the PP procedure usually takes several weeks to process and the contracts are signed for at least one-year, deliveries and the adjustments cannot be as flexible as the commodity market.

---

[47] The expected price is typically calculated 40-60 days prior to bidding process. Arguably it uses past prices of given authority as the most relevant input.

As we discussed above in the motivation, the estimated price captures the heterogeneity of the subject of PP, which creates differences in both estimated and final prices[48]. The core reason for analyzing homogeneous goods was to eliminate such effect. However, such heterogeneity of the purchased goods should not explain the statistical differences in the procedural characteristics as there is no reason to believe that there is a correlation between differences in purchased good and differences in procedures.

Another explanation of higher estimated price elasticity might be that first price sealed bid auctions do not create a sufficiently strong competition environment. Potential suppliers are bidding on the basis of the willingness to pay of the contracting authority (equals to estimated price) rather than on the basis of the opportunity costs on the commodity market. However, such ineffectiveness in competition decreases in the case of an electronic auction or in where higher amounts of suppliers are competing for the PP.

The coefficient for the zIndex is insignificant in the model. This good practice indicator is designed as a proxy for wasteful behavior of contracting authority. The insignificance of the coefficient suggests that this good practice indicator does not provide any new information in the model, as the most important decisions (e-auction, procedure type, estimated price) are already explicitly present in the model.

The discussion of our empirical verification of such hypotheses follows:

> ***hypothesis H1: The final unit price of the procurement is affected by the type of the procurement procedure.***

A significant decrease in final until price, 7% on average, is present in the electricity dataset, when the open procedure is applied. Therefore, we cannot reject the hypothesis H1. Such a drop in final price is caused by the fact that open procedure provides a competitive environment, lowering the final price of PP. Any other type of procedure that restricts the competition causes a statistically significant increase in final price of electricity PP. In the case of gas, the insignificant results may be caused by poor datasets.

---

[48] If the heterogeneity had significant effect, there would be be a positive endogeneity bias in estimated price parameter.

hypothesis H2: The final unit price of the procurement is a decreasing function of a number of bidders interested in the procurement.

The electricity tenders are significantly sensitive to number of bidders: every additional bidder decreases the final price in average by 1 %. The gas tenders are even more sensitive, their price drops on average by 4 % with an additional bidder. Consequently, we cannot reject the hypothesis H2. The number of bidders has a positive effect on the competition thus negative effect on the final price. Even though we tested for a potential quadratic form of relationship, the causality seems to be linear. Although we can hardly assume that the same effect would be caused by, for example, a 20th bidder. Nonetheless, within the plausible range, the relationship seems to be straightforward.

hypothesis H3: The usage of electronic auction reduces the final price of the procurement.

With usage of the electronic auction, the final unit price of the electricity PP falls in average by 6 %. On average, the gas PP using electronic auctions are 17 % cheaper. We cannot reject the hypothesis H3. The enormous difference between the electricity and gas electronic auction is again probably caused by poor dataset of gas PP. However, such dramatic falls in prices are caused by the ability of the electronic auction to allow bidders to adjust offered prices, therefore ending the competition only after no one is willing to bid a lower price. On the basis of these findings, utilizing the electronic auctions as frequent as possible seems to be very useful.

hypothesis H4: The final unit price of the procurement is affected by the type of the contracting authority.

We didn't find any statistically significant differences in the final unit price with respect to the different types of contracting authorities. Therefore we reject the hypothesis H4. The expected difference in prices, as presented in Bandeira (2009), were not confirmed (see table 5 in appendix D). National authorities purchase examined commodities with same prices as public bodies, regional authorities or state owned enterprises. Our expectations about different attitudes toward excessive spending with respect to different autonomies of institutions were not confirmed. Our explanation for this

occurrence is that the commodity PP are usually a price driven bidding competition with not much space for discretion of different types of contracting authorities.

hypothesis H5: The final unit price of the procurement is affected by the type of the supplier.

We found statistically significant higher prices when small successful suppliers win the PP. We cannot reject the hypothesis H5. The higher prices are in contrast to our expectations. Since we do not find any characteristics that would distinguish the PP won by those firms from the rest, our explanation is that those firms are extremely successful in their bidding strategies. The four or three big suppliers, who supply about 80 % of total volume of the commodities, do not sell them with some significant excess markup.

Hypothesis H6: The final unit price is decreasing over time.

In the case of electricity, the final price of PP decreases in time (as you can see in table 3), suggesting that the competitiveness on the market is increasing in time. We cannot reject the hypothesis H6. The results are consistent with our expectation that, as time goes by, the winners' mark-ups are falling.

Conclusion

The procedural characteristics affect the final price of PP significantly. Contracting authorities can reach a lower price of the PP by bringing a more competitive environment into the procedure. This might be achieved by using an open procedure that allows everyone to bid for the procurement. The contracting authority cannot choose a number of bidders in the PP, but it might easily encourage or discourage potential bidders by qualification criteria or other barriers to entry. The most effective device seems to be an electronic auction, which might strengthen the competition allowing the bidders adjust their bids. For PP of homogeneous goods, the additional administrative costs of e-auction are negligible (as estimated by Reimarová (2011) or PWC (2011)), but the potential savings are remarkable. Therefore it would be cost-effective to use the open procedure and the electronic auction as often as possible and encouraging as many extra suppliers as possible.

Our results are consistent with the academic literature (e.g. Bower (1993) or Bulow and Klemperer (1996)) and at the same time, they would be hardly a surprise for PP practitioners, to whom straightforward effect of the electronic auction or the open procedure is anecdotally known. Thus question arises – why do they stick with negotiated procedures, which objectively waste public money? Answer is open to further research, and may consist of their special requirements, corruption or plain rigidity.

The PP of homogeneous goods is a relatively small but still remarkable part of public purchases. At the same time, the unique features of PP of homogeneous goods allow us to identify relationships between the institutional setting of the procurement and its final price. Those relationships have been suspected by practitioners and theorists and the main contribution of this paper is its estimation of those relationships and the proof that the more competitive environment of PP is formed, the less will the procurement cost.

Appendix B – elements of legal framework

The Czech legislature, namely Act no. 137/2006 Coll. On Public Contracts (the PP Act), is generally the transcription of European directives (2004/17/EC & 2004/18/EC). These directives set up a common institutional framework and the basic terms for all EU countries. The following part of the appendix describes the most important term that needs to specify in order to understand presented discussion in the paper.

Contracting Authority is any public office which has to use the PP procedures when it wants to purchase any goods or services. **Bidder** is anyone who offers the delivery of goods or services in the PP procedure. The winning bidder signs a contract with the contracting authority and becomes a **supplier** of desired products.

Award procedure is a legal process of selection the supplier of PP. Both Czech and European legislature propose a variety of procedures, different in terms of openness, formalities or transparency. General process of decision making can be illustrated as follows:

Figure 3: General concept of public procurement process
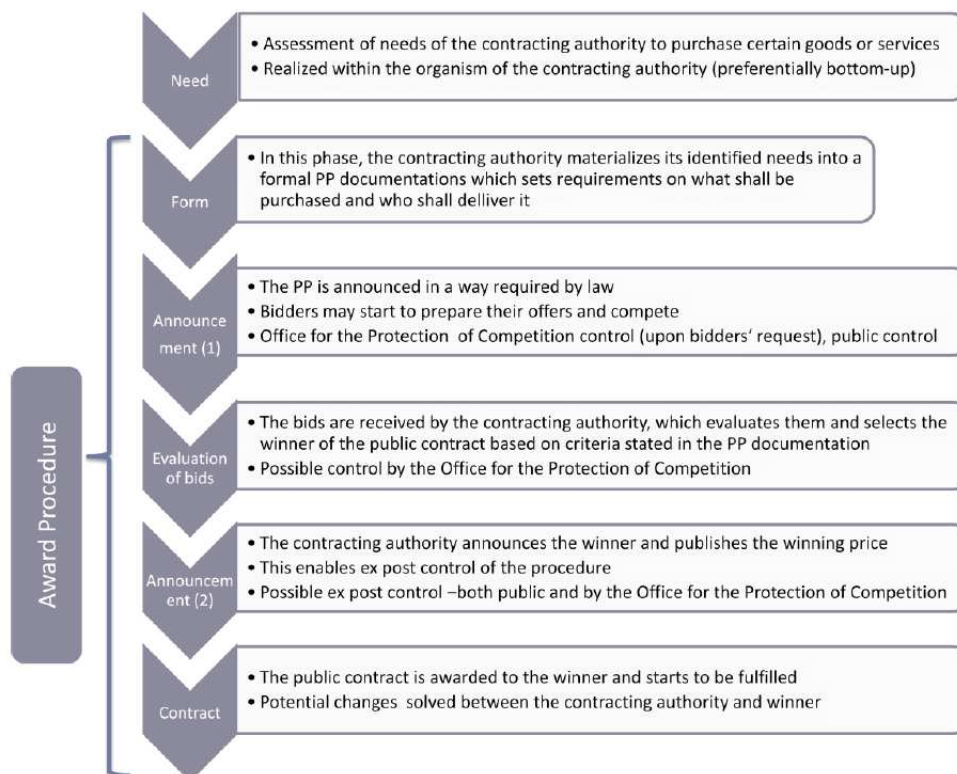
Source: Reimarová (2011)

As we said before, the most substantial institutional characteristic is an award procedure. Type of award procedure determines the openness and transparency of the process as well as time dimension and the number of bidders. For the purpose of this paper there are two most relevant basic types of award procedures:

- **Open procedure** allows everyone to bid in the tender. Contracting authority announce the intention to award a procurement on the internet and ask unlimited amount of potential suppliers who may bid for procurement after they show the fulfillment of qualification criteria.
- **Negotiated procedure** is the procedure whereby the contracting authority consults and negotiates the terms of contract with one or more of bidders. The use of this procedure is limited; contracting authority can use it only in some special cases, specified by the law. This procedure may or may not be published. The procedure is usually used when the previous open procedure was canceled or when the contracting authority needs to discuss with the suppliers before it specifies the subject of PP. However this procedure might be abused to restrict the competition, because it allows the contracting authority to award only those bidders who were asked for the bid in the tender.

Estimated price shall be understood as an amount of financial liability estimated by the contracting entity and ensuing from the performance of the public contract. The contracting entity shall calculate the estimated value on the basis of data and information on contracts of equal or equivalent subject-matter; where such information is not available, the contracting entity shall establish the estimated value based on data and information obtained by means of market research of required performance, or, if appropriate, on the basis of data and information gained in another suitable manner.

Electronic auction is a repetitive process of recessive auction that enables the bidders to cut down their offered prices in order to win the procurement. The auction ends in the moment where no one is willing to sell the goods for lower price. Electronic auction can be used within any type of the procedure, it is used only as a price setting device.

Contracting authorities

There can be identified four basic groups of the contracting authorities:

- **State authorities** such as ministries or national offices

- **Regional authorities** such as municipalities and regional offices
- **Bodies governed by public law** (public bodies) such as schools and hospitals
- **Profit seeking firms** such as state owned enterprises ("SOE") and utilities - entities operating in the water, energy, transport and postal services sectors

Each of these categories might have different attitude to excessive expenditures and wasting of sources. Such a different attitude is made by the different connection to the state budget, the "softness" of its own budget - the possibility of being bought out or other sorts of financial help from the state budget in the case of financial difficulties.

Appendix C – components of zIndex

Openness:
1. PP share on total spending on purchases - punishes avoidance of PP (through portioning), or extending contracts beyond their limits.
2. PP openness - rates according to openness of legal regimes used for PP
3. Elementary violations of transparency - punishes failure to announce PPs or their price
Competition:
1. Winner's concentration - punishes repetitive PP awarding to one or few suppliers
2. Bidder count - measures average number of firms competing for PP
3. Deadlines - punishes setting unrealistically close deadlines for placing bids
Accountability:
1. Legal violations - measures number of erroneous PPs detected by regulatory office
2. Supplier rating - a supplier transparency measure composed of several sub-indicators
3. Data quality - counts mistakes in crucial published data (mainly company identification, preventing traceability)
4. Information provision - measures time and quality of an institution's response to information inquiries

Source: Zindex.cz

Appendix D– PP Suppliers in dataset

Table 14: Electricity suppliers

Supplier	Total value of PP (CZK)	Total share	Amount of tenders
ČEZ Prodej, s.r.o.	4 385 554 898	41%	19
United Energy Trading, a. s.	2 445 139 040	23%	24
E.ON Energie a.s.	1 382 817 052	13%	15
Pražská energetika a.s.	768 806 388	7%	15
Lumius, spol. s.r.o.	611 974 852	6%	41
CENTROPOL ENERGY a. s.	234 716 403	2%	34
7 other suppliers	803 179 880	8%	58
Total	10 632 188 514	100%	206

Source: Our computation based on CAE

Table 15: Gas procurement suppliers

Supplier	Total value of PP (CZK)	Total share	Amount of tenders
Pražská plynárenská a.s.	645 553 356	38%	10
ČEZ Prodej, s.r.o.	355 192 334	21%	2
Pragoplyn, a.s.	328 415 670	20%	15
VEMEX s.r.o.	116 732 124	7%	1
Lumius, spol. s.r.o.	104 494 697	6%	12
4 other suppliers	130 769 623	8%	13
Total	1 681 157 804	100%	53

Source: own construction based on CAE

Appendix E – OLS assumptions

OLS must satisfy classical linear model assumptions to provide the best unbiased estimator.

At first, the model must be linear in parameters – that's determined by the model described in *Motivation & hypotheses*. In similar way the randomness of data sample was discussed already in Data description. To repeat the conclusion: the dataset covers all public contracts within given type of the commodity minus those incomplete observations. Since we do not find any reason why the incomplete observations should be correlated with final unit price, we dare to say that the dataset is a random subsample of the initial procurement sample.

First tested assumption is the homoskedasticity of residuals (same variance given any value of the explanatory variable). As can be seen in the table below, the Breusch-Pagan test rejects the hypothesis of homoskedastic residuals in both cases.

Table 1: Breusch – Pagan test, H0: constant variance of residuals

	Electricity	Gas
χ^2	53.29	16.42
$P > \chi^2$	0	0

However, heteroskedastic residuals do not cause any bias in the estimations. Nothing but the robust standard errors need to be applied in order to be able to use a t-statistics for assessment of statistical significance.

Next tested assumption is normality of residuals in the model. As can be seen in table below, the Shapiro – Wilk test rejects the hypothesis of normally distributed residuals in both cases.

Table 2: Shapiro - wilk test, H0: normal distribution of residuals

	Electricity	Gas
z	4.39	2.98
P > z	0	0

There might exist some nonlinear unbiased estimators which will have a smaller variance. However, since the goal of this paper is to test hypothesis state above, the simple OLS method is sufficient for that purpose. The dataset is sufficiently large enough to conclude that the OLS estimators satisfy asymptotic normality and using the t- and F- statistics is possible for testing the hypotheses[49].

Another assumption that needs to be tested is the absence of the multicollinearity. We use variance inflation factor (VIF) as an indicator of the potential multicolinearity and it does not indicates such threat.

Table 3: Variance inflation factor

	Electricity	Gas
Mean VIF	1.33	1.22

---

[49] For further discussion on this topic see Wooldridge, J. M.: Introductory Econometrics, Fourth Edition, South-Western, 2009, page 173

At last but not least a correct model specification needs to be tested. As can be seen in table 4, squares of the fitted values are insignificant, suggesting, that no squared of explanatory variables are missing and therefore the relationships seem to be linear.

Table 4: Squares identification: (fitted of log(final unit price))[2]

	Electricity	Gas
t	1.07	-1.24
P > t	0.287	0.222

Classical linear model assumptions were tested; the eventual issues were discussed and resolved. Therefore the OLS estimators can be applied for our empirical study.

The following table shows our results including insignificant variables.

Table 5: Electricity & gas procurement results – including contracting authorities; dependent variable: log(final price/kWh), 259 observations

Explanatory variable	Electricity		Gas	
	OLS ß	Robust SE	OLS ß	Robust SE
log (estimated price/kWh)	0.66	(0.07) ***	0.42	(0.06)***
log (market price/kWh)	0.55	(0.11) ***	0.21	(0.23)
Open procedure	-0.09	(0.03)***	0.11	(0.13)
electronic auction	-0.08	(0.03)**	-0.24	(0.13)*
number of bidders	-0.013	(0.007)*	-0.04	(0.017)**
Big 4 suppliers	0.06	(0.04)	0.1	(0.07)
small successful suppliers	0.13	(0.04)***	0.24	(0.08)*
zIndex	0.09	(0.14)	-0.5	(0.36)
Time	-0.00013	(0.00005)**	0.0003	(0.0004)
SOE	-0.06	0.04	-0.05	0.12
Public bodies	-0.09	0.05	-0.12	0.09
National auth.	-0.11	0.07	0.23	0.15
Constant	0.09	(0.11)	-0.8	(0.35)**
R-squared	0.64		0.71	
F- test	23.20		14.7	

Source: own computation based on CAE, note: robust standard errors applied, dropped dummies are negotiated procedure, occasional suppliers and regional authorities

The joint F-test for contracting authorities induces us to reject hypothesis H4 (p=0.26 for electricity, p=0.19 for natural gas).

Institut Ekonomických Studií UK FSV   **Teze RIGORÓZNÍ práce**   Tyto teze tvoří přílohu „Přihlášky ke státní rigorózní zkoušce"

TUTO ČÁST VYPLŇUJE ŽADATEL:

Informace o žadateli:	**Razítko podatelny:**
Příjmení a jméno: **Jan Soudek**	
E-mail: **Honza.soudek@gmail.com**	
Telefon (nejlépe mobilní)**:** **774103480**	
	katedra: k rukám:

Předpokládaný název rigorózní práce v češtině: **Veřejné zakázky na homogenní statky: empirická studie z ČR**
Předpokládaný název rigorózní práce v angličtině: **Public Procurement of Homogeneous Goods: the Czech Republic Case Study**
Předpokládaný termín předložení práce: **21.9.2013**
Pedagog, s nímž byly teze konzultovány :   **PhDr. Ing. Jiří Skuhrovec**   **Doc. Ing. Pavel Mertlík, Csc.**

Charakteristika tématu a jeho dosavadní zpracování žadatelem (rozsah do 1000 znaků)**:**

Veřejné zakázky představují formální způsob nákupu zboží a služeb z veřejných prostředků, které tvoří kolem 15 % ročního HDP ve vyspělých zemích (OECD, 2001). Zároveň mají veřejné zakázky několik velmi podstatných institucionálních charakteristik, které je odlišují od soukromých nákupů a které velmi významně ovlivňují celkovou efektivitu procesu (např. zvýšené transakční náklady, rigidita, asymetrie informací a incentiv).

Česká republika je v této oblasti extrémní případ: trh s veřejnými zakázkami je zde druhý nevětší mezi rozvinutými státy (ve vztahu k HDP) a zároveň má ČR velmi slabé formální i neformální instituce (Schwab, 2011). Tyto dvě skutečnosti implikují významné riziko a zároveň velký prostor pro zvyšování efektivity procesu. Předchozí práce o veřejných zakázkách v ČR (např. Pavel, 2009; Kameník a kol., 2011 nebo Nikolovová a kol., 2012) popisují systém jako celek a rozebírají jeho největší problémy a nedostatky. Zatímco jejich přístup je příhodný v případě počátečního výzkumu, jejich popis trhu s veřejnými zakázkami, kde jsou zahrnuty všechny druhy zboží a služeb, vede k velké míře generalizace a tedy i dílčím nepřesnostem. Tato práce se pokusí posunout ke kompaktnějšímu a jednotnějšímu trhu, abychom byli schopni poskytnout detailnější a rigoróznější analýzu procesu.

Žadatel na téma veřejných zakázek již úspěšně obhájil bakalářskou práci (*Soudek, J.: „Veřejné zakázky: institucionální analýza procesu zadávání a výběrového řízení zakázek", Univerzita Karlova, 2010*) i diplomovou práci (*Soudek, J.: „Public Procurement of homogeneous goods: Czech Republic case study", Charles University in Prague, 2012*), která byla následně vydána jako IES working paper (*Soudek, J., Skuhrovec, J. (2013). "Public Procurement of Homogeneous Goods: the Czech Republic Case Study" IES Working Paper 05/2013. IES FSV. Charles University*).

Vedle těchto akademických prací se žadatel podílel na projektu *Zlepšení systémů veřejných zakázek v ČR a SR* spolu s CERGE-EI a Oživení, o.s., který vyústil ve dvě publikace:

Kameník a kol.: „Transparentnost systému veřejných zakázek v ČR“, Oživení, 2011

Kameník a kol.: „Otevřenost zadávacích řízení v ČR“, Oživení, 2011

Předpokládaný cíl rigorózní práce, původní přínos autora ke zpracování tématu, případně formulace problému, výzkumné otázky nebo hypotézy (rozsah do 1200 znaků):

Cílem této práce je ukázat, že procedurální charakteristiky veřejné zakázky ovlivňují její výslednou cenu. Aby bylo možné zakázky porovnávat, byly k analýze vybrány pouze veřejné zakázky na komodity. U těchto zakázek jsme schopni spočítat jednotkovou cenu za komoditu a tu poměřovat nejen mezi jednotlivými veřejnými zakázkami, ale i proti aktuální ceně na komoditním trhu, která slouží jako identifikátor, za kolik tuto komoditu nakupuje soukromý sektor. Prezentovaný model se poté pokusí vysvětlit variaci v jednotkové ceně pomocí institucionálních charakteristik veřejné zakázky – druh řízení, forma aukčního procesu a počet uchazečů.

Z pohledu ekonomické teorie je veřejná zakázky specifickým typem aukce, kde vítězem není ten, kdo zaplatí nejvíc, ale ten, kdo si nechá zaplatit nejmíň. Teoretická literatura o veřejných zakázkách vycházející z teorie aukcí (např. Bower, 1993 Bulow a Klemperer, 1996, Laffont a Tirole, 1987) formuluje několik poznatků, které bychom rádi otestovali na souboru veřejných zakázek z ČR:

1. Vysoutěžená cena zakázky je závislá na druhu použitého řízení (otevřená soutěž vs. vyjednávání).
2. Vysoutěžená cena zakázky je závislá na formě aukčního procesu (obálková aukce vs. elektronická – anglická aukce).
3. Vysoutěžená cena zakázky klesá se vzrůstajícím počtem uchazečů.

Tyto tři základní hypotézy bychom rádi otestovali. Tato studie poskytne nové poznatky relevantní jak pro teoretické diskuse, tak pro běžnou praxi zadávání veřejných zakázek. Zároveň vzhledem k tomu, že Evropská Unie má společný právní rámec, tak naše výsledky by měli být aplikovatelné na evropské úrovni.

Předpokládaná struktura práce (rozdělení do jednotlivých kapitol a podkapitol se stručnou charakteristikou jejich obsahu)**:**

Práce nejprve uvede do tématu skrze revizi literatury teoretického i empirického charakteru. Poté popíše motivaci, hypotézy a postup identifikace. Následovat bude popis a analýza dat a představení empirických výsledků spolu s diskusí o hypotézách.

Vymezení podkladového materiálu (např. analyzované tituly a období, za které budou analyzovány) **a metody (techniky) jeho zpracování:**

Práce je koncipována jako empirická studie. Zdrojem datového souboru bude internetový portál *Věstník veřejných zakázek*, ve kterém jsou zaznamenány údaje o všech zakázkách v režimu zákona od roku 2006. Jak již bylo uvedeno, budeme analyzovat veřejné zakázky na homogenní statky. Pro potřeby empirické analýzy musí daný soubor veřejných zakázek splňovat několik podmínek: dostatečný počet pozorování, (alespoň rámcová) homogenita dané komodity, dostupnost kupovaného množství pro výpočet jednotkové ceny a dostupnost časové řady cen z komoditního trhu. Identifikovali jsme dvě komodity splňující naše požadavky: elektřinu a plyn. Analyzovaný dataset zahrnuje 259 zakázek na elektřinu nebo plyn z let 2008 – 2011 s celkovou cenou přesahující 12 miliard korun.

Regresní analýza bude provedena standardní metodou nejmenších čtverců, aplikovanou na každou komoditu zvlášť. Vysvětlovaná proměnná v rovnici bude konečná cena zakázky, znormalizovaná na jednotku kWh. Vzhledem k tomu, že předmětem našeho zájmu není absolutní výše této ceny, ale její relativní změny způsobené charakteristikami výběrového řízení, bude finální cena v rovnici ve formě přirozeného logaritmu. Vedle zmíněných charakteristik výběrového řízení (druh řízení, forma aukce, počet uchazečů) bude jako vysvětlující proměnná použita aktuální cena na trhu (za kWh) jako identifikátor, za kolik komoditu nakupuje soukromý sektor, a dále očekávaná cena (za kWh) zadavatelem, která identifikuje, kolik je zadavatel za zakázku ochoten zaplatit, a taktéž bude fungovat

jako kontrolní proměnná pro potenciální heterogenitu komodity.

Základní literatura (nejméně 10 nejdůležitějších titulů k tématu a metodě jeho zpracování; u všech titulů je nutné uvést stručnou anotaci na 2-5 řádků)**:**

Bajari,P., McMillan, R., Tadelis, S.: Auctions Versus Negotiations in Procurement: An Empirical Analysis Journal of Law Economics and Organization, 2008
   Autoři porovnávají dva základní druhy výběrových řízení: aukce a vyjednávání s dodavateli a identifikují jejich výhody a nevýhody. Jako poklad pro jejich empirickou analýzu posloužil datový soubor zakázek na stavební práce ze soukromého sektoru v Kalifornii v letech 1995 -2000. Autoři uvádějí, že vyjednávání se jeví výhodnější v případě, že předmět zakázky je komplexní, kontrakt je nedokonalý anebo v případě nedostatečného počtu potenciálních uchazečů.*Bandeira, O.; Prat, A.; Valetti, T.: Active and Passive Waste in Government Spending: Evidence from a Policy Experiment, American Economic Review , 2009*
   Autoři na Veřejných zakázkách z Itálie ukazují, že některé typy státních institucí platí systematicky více než jiné a identifikují korelaci mezi strukturou správy úřadu a těmito rozdíly. Dále představují rozlišení mezi aktivním a pasivním plýváním při zadávání veřejných zakázek a ukazují, že pasivní plýtvání tvoří významnou většinu z celkově identifikované neefektivity.

Bower, A. G.: Procurement policy and contracting efficiency, International Economic Review, 1993
   Článek na numerických příkladech ukazuje, že otevřená konkurence při výběru uchazeče je nejúčinnější způsob dosažení efektivity, ve srovnání s dalšími formami kontraktilních instrumentů. Dále autor dokazuje, že výběrové řízení s n+1 uchazeči má v očekávání alespoň tak dobrý výsledek jako výběrové řízení s n uchazeči.

Bulow, J., Klemperer, P.:Auctions Versus Negotiations, American Economic Review, 1996
   Autoři ukazují, že (za rozumných předpokladů) je aukce výhodnější než vyjednávání. Článek zároveň vytváří spojení mezi teorií akcí a teorií monopolu.

Chvalkovská, J.; Skuhrovec, J.: Measuring transparency in public spending: Case of Czech Public e-Procurement Information System, IES working paper, 2010
   Autoři analyzují klíčové identifikátory při zadávání veřejných zakázek, které určují míru transparentnosti procesu a otevřenosti řízení potencionálním uchazečům. Dále vytváří kompozitní index, který agreguje identifikátory a dává tak rychloý přehled o tom, jak byla zakázka zadána.

Domberger, S., Hall, Ch., Ah lik Li, E. : The determinants of the price and quality in competitively tendered contract, The Economic Journal, 1995
   Článek identifikuje vliv otevřené soutěže na kvalitu a cenu zakázek na úklidové služby v Austrálii. Výsledky indikují, že otevřená soutěž snížila cenu zakázky, zatímco kvalita služeb zůstala zachována.

Laffont, J. J.; Tirole, J.: Auctioning Incentive Contracts , Journal of Political Economy, 1987
   Článek spojuje teorii aukci s teorií incentiv. Článek dále ukazuje, že optimální aukce může být implementována při zohlednění první a druhé nejnižší nabídky.

Pavel, J.: The Analysis of the Relationship between the Rate of Competition and the Prices of Large Transport Infrastructure Buildings. Politická ekonomie, 2010
   Autor na souboru veřejných zakázek na velké pozemní stavby v české republice ukazuje, že podíl vysoutěžené a očekávané ceny klesá v případě použití otevřeného říze a v případě vyššího počtu uchazečů v řízení.

PwC, London Economics and Ecorys: Public procurement in Europe, Cost and effectiveness, A study on procurement regulativ prepared for the European Commission, 2011
   Studie porovnává veřejné zakázky napříč státy Evropské unie. Nejprve ukazuje základní statistiky, odhady objemu zakázek, využití různých forem řízení, průměrné počty uchazečů a podobně. Dále na základě dotazníkového šetření s více jak 7000 respondenty identifikuje transakční náklady na zadávání veřejných zakázek v Evropě.

Reimarová, H.: Transaction Costs in Public Procurement (Diploma thesis). Charles University in Prague, 2011

Práce je analyzuje, zda se zadavatelé chovají racionálně pokud outsourcují zadávací řízení. Výsledky ukazují, že menší zadavatelé se chovají racionálně, protože při interní administraci dělají více formálních chyb a proto je z jejich strany racionální outsourcovat zadávací řízení. Naopak u velkých dodavatelů se ukázalo, že se chovají neracionálně protože outsourcují zadávací řízení, přestože ho podle stanovených indikátorů provádějí interně lépe.

Diplomové a disertační práce k tématu (seznam bakalářských, magisterských a doktorských prací, které byly k tématu obhájeny na UK, případně dalších oborově blízkých fakultách či vysokých školách za posledních pět let)

Lacka, J.: Veřejné zakázky:Dokáže transparentnost zabít korupci?, IES FSV, Univerzita Karlova, 2009

Soudek, J.:Veřejné zakázky : institucionální analýza procesu zadávání a výběrového řízení zakázek, IES FSV, Univerzita Karlova,2010

Počarovský, J.:Veřejné zakázky ve zdravotnictví, IES FSV, Univerzita Karlova, 2011

Paulus, M.:Public Procurements as a Corrupting Sector in RBC Model, IES FSV, Univerzita Karlova, 2012

Soudek, J.:Public Procurement of homogeneous goods: Czech Republic case study, IES FSV, Univerzita Karlova, 2012

Pospíšil, M.:Veřejné zakázky v municipalitách, IES FSV, Univerzita Karlova, 2012

Reimarová, H.:Transaction Costs in Public Procurement, IES FSV, Univerzita Karlova, 2012

Datum / Podpis studenta

9.7.2013   **………………………**