

# CHARLES UNIVERSITY IN PRAGUE

Faculty of social sciences

Institute of economic studies



Pavel Pucek

## Barriers to entry in public procurement: Evidence from the Czech Republic

*Bachelor thesis*

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Author: **Pavel Pucek**

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

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## **Declaration of Authorship**

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature. This thesis was not used to obtain any other academic degree.

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Prague, June 30, 2015

Signature

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## **Bibliographic record**

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## **Abstract**

A core subject of this study is to examine the effect of potential barriers to entry on a variation in profit margin of public procurement suppliers in electricity and gas sector in the Czech Republic. Furthermore, the thesis attempts to draw key determinants affecting the probability of SME to win a public contract. Findings have proven that Czech public procurement market works quite efficiently because the impact of barriers to entry on profit margin was not detected. Additionally, SMEs were not blocked by barriers to entry to compete for public tenders suggesting non-discriminatory practices of contracting authorities. Policy recommendation is to use tools promoting competitive environment such as electronic auctions, which in turn create a pressure on final prices and shrink profit margins. The success of SMEs in public tenders relies on institutional characteristics rather than standard procedural ones. Therefore a promotion of innovative tools such as specific legislative provision (e.g. set-asides) or workshops carried out for SMEs might represent effective small business support policy.

**JEL Classification**        H57, K4, D44, D73, C21

**Keywords:**                public procurement, SME, barriers to entry, qualification requirements

# Abstrakt

Hlavním cílem této studie je odhalit efekt potenciálních bariér vstupu na marži dodavatelů veřejných zakázek na trhu s elektřinou a plynem v České republice. Dále se tato práce pokouší odhalit klíčové determinanty ovlivňující pravděpodobnost úspěchu malého a středního podniku získat veřejný kontrakt. Výsledky prokázaly, že český trh s veřejnými zakázkami pracuje relativně efektivně, jelikož dopad potenciálních bariér vstupu na marži nebyl odhalen. Kromě toho malé a střední podniky nebyly blokovány těmito bariérami vstupu od soutěžení o veřejné kontrakty, což poukazuje na nediskriminující praktiky zadavatelů. Doporučující opatření tedy zní využívat nástroje podporující konkurenční prostředí jako například elektronická aukce, které stlačují finální ceny zakázek a smršťují marži dodavatelů. Úspěch malých a středních podniků ve veřejných zakázkách se odvíjel od institucionálních charakteristik spíše než od těch standardních procedurálních. Tudíž podpora inovativních nástrojů v oblasti veřejných zakázek, jakými jsou konkrétní legislativní opatření (např. vyhrazená část zakázek pro malé a střední podniky) nebo semináře pořádané pro tyto podniky, mohou být efektivním nástrojem podpory malého podnikání.

**JEL klasifikace:** H57, K4, D44, D73, C21

**Klíčová slova:** veřejné zakázky, malé a střední podniky, bariéry vstupu, kvalifikační požadavky

# Contents

Acronyms.....	X
Bachelor Thesis Proposal .....	XI
1 Introduction .....	1
2 Literature overview .....	3
3 Economics of public procurement .....	7
3.1 Basic terms in public procurement .....	8
3.2 Barriers to entry .....	10
3.3 Small business support policy .....	12
3.4 Hypotheses and motivation .....	14
4 Czech public procurement .....	17
4.1 Legislative framework.....	17
4.1.1 Acts and amendments.....	17
4.1.2 Controlling Institutions.....	20
4.2 Size of the market .....	21
5 Empirical analysis of public procurement data.....	24
5.1 Data description.....	24
5.1.1 Electricity.....	28
5.1.2 Gas.....	32
5.1.3 SME .....	36



5.1.4	Dataset including economic qualification criteria .....	38
5.1.5	Dataset including technical qualification criteria.....	41
5.2	Concretization of hypotheses and models.....	42
5.2.1	OLS .....	42
5.2.2	LPM.....	44
5.3	Results and discussion .....	47
5.3.1	OLS Regression.....	47
5.3.1.1	Dataset ECO .....	48
5.3.1.2	Dataset TECH.....	52
5.3.1.3	Hypotheses evaluation .....	55
5.3.2	Linear Probability Model.....	60
5.3.2.1	ECO Dataset - LPM.....	60
5.3.2.2	TECH Dataset – LPM.....	64
5.3.2.3	Hypotheses evaluation - LPM.....	67
6	Conclusion.....	71
	Appendix A – OLS Assumptions.....	I
	Appendix B - Logit .....	III
	Appendix C – Graphs on t tests .....	V

## Acronyms

<b>CA</b>	Contracting Authority
<b>CAE</b>	Centre for Applied Economics
<b>CNB</b>	Czech National Bank
<b>CR</b>	the Czech Republic
<b>CZK</b>	Czech Koruna
<b>GDP</b>	Gross Domestic Product
<b>ISVZUS</b>	Information System on Public Procurement
<b>LPM</b>	Linear Probability Model
<b>MRD</b>	Ministry of Regional Development
<b>OLS</b>	Ordinary Least Squares
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>OPC</b>	Office for Protection of the Competition
<b>OTE</b>	Czech Electricity and Gas Market Operator
<b>OTT</b>	Over-the-threshold Public Contract
<b>PP</b>	Public Procurement
<b>SME</b>	Small- and Medium-sized Enterprise
<b>SNA</b>	System of National Accounts
<b>SOE</b>	State-owned Enterprise
<b>ÚOHS</b>	Bureau for Protection of the Competition
<b>UTT</b>	Under-the-threshold Public Contract
<b>VAT</b>	Value Added Tax

# Bachelor Thesis Proposal

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<b>Author:</b>	<b>Pavel Pucek</b>
<b>Supervisor:</b>	<b>PhDr. Ing. Jiří Skuhrovec</b>
<b>Title:</b>	<b>Barriers to entry in public procurement: Evidence from the Czech Republic</b>

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## Characteristic of the topic:

The thesis will analyse what are driving factors for winning a public contract and which conditions the firms have to fulfil in order to get the public procurement (PP). The primary aim of the thesis will be to compare success in winning PP between bigger and smaller firms on the Czech market. As the most appropriate environment it seems to be the market of electricity and natural gas in the CR. The supply-side of the market can be described as oligopoly. Using the data from the Czech national informational portal for PP there are three companies supplying more than three quarters of the procurement volume in electricity and gas market. On the other hand using the same data, smaller firms on the electricity market won almost 65 % of the procurement cases. The goal of the thesis will be to analyse why smaller firms are not successful in competing for high-volume PP and what are the effects on the final prices per unit. The final prices per unit will be standardized as the research will be limited to the markets where benchmarks for resulting price exists – electricity and gas market. Here the market price should serve as benchmark. As a main source of the market price will be used the Czech electricity and gas market operator (OTE). This enables to measure the provision of public goods connected to PP in terms of quality and price.

## Methodology:

Primarily will be used a quantitative research. I will use as a source of the data the Czech national informational portal for public procurement ([www.isvzus.cz](http://www.isvzus.cz)), where every large public procurement since 2006 is listed. Here we can find the information concerning the final price of the PP, type of the PP, winner of the PP and so on. I will focus on the data covering procurement since 2008 till 2014 because both markets were liberalized only recently. There have been a monopoly over these markets till 2008 and therefore data are not relevant for the research concerning competitive PP. I will take these data and by using econometric tools like OLS regression I will test the following hypotheses:

- 1. The capability to compete was gradually increasing over time.*
- 2. The capability to compete of smaller firms was gradually increasing with low-volume PP.*
- 3. System of required references blocked effectively smaller firms to compete for high-volume PP.*
- 4. System of required references had adverse effect on final unit prices.*

## Outline:

1. Introduction
2. Theory of oligopoly from the perspective of microeconomics
3. Legislative requirements for entry of the firms in PP in the CR
4. Characteristic of the oligopoly on the Czech electricity and gas market
5. Empirical analysis of the PP on the Czech electricity and gas market
6. Conclusion

## Literature overview:

Soudek, J., Skuhrovec, J. (2013). "Public Procurement of Homogeneous Goods: the Czech Republic Case Study" IES Working Paper 05/2013. IES FSV. Charles University

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

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

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

Zákon č. 137/2006 Sb., o veřejných zakázkách, ve znění pozdějších předpisů, účinné od 1. ledna 2014

William E. Kovacic: Regulatory Controls as Barriers to Entry in Government Procurement. Policy Sciences, Vol. 25, No. 1 (Feb. 1992), pp. 29-42

APPELBAUM, Elie. The estimation of the degree of oligopoly power. Journal of Econometrics, roč. 19 (1982), str. 287-299.

Rasheed, Howard S. "Capital access barriers to public procurement performance: the moderating effects of ethnicity, gender and education." Journal of Developmental Entrepreneurship 9.2 (2004): 22-43.

# 1 Introduction

Public procurement (PP) represents a field of interest through which billions of Czech Crowns flow through every year. In the Czech Republic PP comprised 577 bn CZK representing 33% of public spending in 2014.<sup>1</sup> Although an increasing tendency towards the importance of the topic in public debate, very little research regarding PP has been conducted so far.

The key objective of this study will be to detect the impact of potential barriers to entry into PP on profit margin of suppliers. As depicted by Soudek (2012), more competitive environment tends to lower final prices of public deliveries and in turn squeeze profit margins. Given that barriers to entry might to some extent restrict competitive environment in public tendering. Our main goal will be to verify their positive effect on profit margin of suppliers.

The topic of promotion of small- and medium-sized enterprises (SMEs) in PP is increasing on importance within the EU. One of the objectives of this thesis will be to observe and evaluate potential barriers hindering smaller suppliers from competing for high-volume contracts.

Qualification criteria required by contracting authority in a contract proposal might represent potential barriers to entry into PP. Why do contracting authorities (CA) impose qualification criteria on public contracts? One can argue that they would like to ensure a firm is able to execute the procurement properly and therefore it imposes quotas for such purpose. In this thesis number of contracts and the amount of turnover will be used as the representatives of barriers to entry into PP. However, such quotas may effectively block the access of smaller suppliers to compete for higher-volume contracts or to win more procurement in quantity. Quantitative part of the thesis will be focused

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<sup>1</sup> MRD (2015). Retrieved 22 June 2015 from <http://www.portal-vz.cz/cs/Spoluprace-a-vymena-informaci/Vyrocní-zpráva-a-souhrnné-údaje-o-verejnych-zakazk/Statisticke-udaje-o-verejnych-zakazkach>

on assessing these restrictions on PP and the prime goal of this research is to find out whether there are significant features of discriminative behaviour towards SMEs. Using econometric tools, this research will examine data on electricity and gas PP in the Czech Republic administered from 2008 to 2014.

This thesis is structured as follows. In Chapter 2, existing literature on PP, barriers to entry and related topics are reviewed. In Chapter 3, theoretical background regarding specific definitions related to PP issues is summarized. Hypotheses and their motivation are outlined in the end of this chapter. Chapter 4 is devoted to specifics of the Czech procurement market. Legislative requirements are described and size of the Czech PP market is depicted. Chapter 5 takes a closer look on data collected in electricity and gas sector and division of suppliers on SMEs and non-SMEs is provided. Subsequently, the empirical part provides the discussion of results and the above noted hypotheses are tested. Finally, Chapter 6 concludes.

## 2 Literature overview

As mentioned above although the importance of the topic is tremendous, current literature strands are still very rare relative to comparable economic issues of similar importance. Nevertheless, growing tendency towards studies contributing to the topic of PP related to small- and medium-sized enterprises (SME) can be observed. The same tendency might be explored in the Czech Republic (CR) where several studies with regards to PP have been conducted and this topic has been of growing importance in the last 10 – 15 years. Most economists concentrate on efficiency and more specifically demand side of PP and only few of them focus on supply side of the PP market. Thus very little research has been conducted regarding barriers for suppliers willing to enter the market. In addition, this study contributes to relatively scarce field of interest which is the econometric approach applied in the area of PP.

This research contributes to four strands of literature. First, several studies have successfully proven that barriers to entry exist and unwillingness of national bodies to eradicate them represents a prime pitfall. Karakaya and Stahl (1989) are investigating six market barriers to entry in consumer and industrial goods among 49 major U.S. corporations. The study results prove that notable differences between barriers in consumer and industrial good markets exist with cost advantages of incumbents being the most salient. Nevertheless, it appears to be a very difficult job to eradicate restrictions on entry as a clear definition of barriers to entry is still missing. According to McAfee et al. (2004), barriers to entry are not defined precisely by economists as they are unable to reach the consensus and thus it impedes the work of antitrust policy.

What can be undoubtedly considered as a barrier to entry are legislative requirements imposed by national bodies. McKeivitt (2015) argues that SMEs often struggle with filling exaggerated paperwork and complexity of processes increasing their administration costs and therefore reducing their willingness to compete for such contracts. Similar results



have been found by Eadie et al. (2007) analyzing prime drivers and barriers of E-Procurement and E-Tendering for Roads Service Northern Ireland contracts. Costing and management issues were identified as key drivers, while the security of transactions and uncertainties surrounding legal issues of E-Procurement or alternatively legal and technical issues were labelled as main barriers. Rasheed (2004) revealed that when smaller firms' managers consider requirements on the amount of capital in PP very high, then it has a negative impact on number of applicants in a tender. Loader (2013) claims that public procurers lack priorities and clear objectives. Furthermore lack of supply data in the UK procurement is hindering improvement and thus barriers identified more than twenty years ago still remain. Preuss et al. (2011) provides different view being focused on psychological factors playing a key role in sustainability of development in PP processes. On the other side, Caldwell et al. (2005) assess the capability of CAs to maintain competitive environment in the wider public sector.

Second, relatively large part of studies has been dedicated to involvement and impact of SMEs on PP processes. Walker et al. (2008) argues that sourcing from SMEs can bring a wide range of benefits to public sector being cited a contribution to local development or help with public sector organisation. The same conclusion has been drawn by Loader (2007) who points out that involvement of SMEs can improve service delivery and therefore should be worth fostering by public policies. For one example we can head into Japan. Nakabayashi (2013) examined public policy in Japan which puts in favour firms designated as disadvantaged and sets aside a specific volume of PP determined for SMEs. The results of this study indicate that about 40% of SMEs would exit the market without the use of set-asides. Surprisingly, local government succeeded to reduce total costs because procurement costs stemming from production cost inefficiency would not exceed costs caused by a lack of competition. Furthermore Loader (2011) in her study states that SMEs have much higher probability to win the PP with lower-volume contracts in open competition. Different factors were examined by Karjalainen et al. (2008) who claim

that the lack of legal expertise and administration leads to lower involvement of SMEs in PP.

Third, several studies applying qualitative methods were conducted concentrating on the impact of various characteristics on price or quality of PP. One of the first papers using econometric approach was made by Domberger et al. (1995) who collected 61 cleaning contracts in Australia. The results show that employing competitive tendering reduced the price of procurement while the quality of services maintained or even improved. Next contribution comes from Italy where Bandiera, Prat and Valletti (2008) examined 6000 public contracts concentrating on the impact of specific public authorities on final price. One of their conclusions can be found as follows: “Price differences are correlated with governance structure: the central administration pays at least 22 % more than semi-autonomous agencies.” (Bandiera et al., 2008)<sup>2</sup>.

Last but not least, this study contributes to a stream of Czech procurement literature which has been relatively fertile in the last decade in comparison with international strands. For the purpose of this study it is very important the results from empirical research drawn by Vyklický (2013) outlining the most common barriers to entry into Czech PP according to the view of individual suppliers. As the prime restrictions are identified qualification requirements in the first place and then administration costs going in line with preparation of a bid. Soudek (2012) analyses how structural and procedural characteristics affect final unit prices in gas and electricity procurement market. He points out high rigidity of that particular market showing final unit price being more linked to estimated unit price created by individual public authorities than to market unit price. With regards to administration and transaction costs of the PP Reimarová

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<sup>2</sup> Bandiera, O., Prat, A. & Valletti, T. M. (2008). Active and passive waste in government spending: evidence from a policy experiment. *American Economic Review*, 99(4), 1278-1308.

(2011) assesses efficiency of in-house and outsourced administration and puts these two in comparison. Pavel (2008) highlights the impact of competitive bidding factors such as number of bidders on price. Chvalková (2012) investigates how the transparency of ownership structure and probability to win a PP contract are correlated. All these strands of literature deal with inefficiencies on the PP market and some of them find a space to subdue the passive waste producing by public authorities. Nonetheless, the field of restrictions to procurement have not been studied quantitatively yet. Thus it remains the prime goal of this thesis to fill in the gap in existing literature.

The Czech Republic boasts about one key convenience in this field. Every large<sup>3</sup> tender since 2006 is listed in the Czech National Informative Portal of Tenders ([www.isvzus.cz](http://www.isvzus.cz)). Nevertheless, the system is still far from perfect and exhibits inconsistent data stored in some sort of paper form making the digging for data much more complicated and time-demanding. Several institutions concentrating on PP in the CR can be found as well. For example, Centre for Applied Economics (CAE) whose data and results have been used while conducting research as well as their project zIndex<sup>4</sup> rating CA according to specific parameters. zIndex will serve as a proxy of good practice behaviour and to some extent it can be perceived as an indicator of corruption.

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<sup>3</sup> Only smaller-scale contracts do not have to be posted on ISVZUS.

<sup>4</sup>For further explanation of zIndex please go to: <http://wiki.zindex.cz/doku.php?id=en:start>.

### 3 Economics of public procurement

Several reasons exist saying that private companies can provide services much efficiently, i.e. public entities are limited by tight budget constraint or the presence of principal-agent problem. In deciding between these two options state should bear in mind its prior criteria for procurement – lowest possible costs at the best possible quality (i.e. value for money). Al-Obaidan & Scully (1992) prove that public entities could use only half of their resources in fulfilling consumer demand simply by transition into private profit-seeking companies.

Although the price of the procurement appears to be easy to evaluate, quality of goods and services represents a demanding task to assess. Nonetheless, there are studies evaluating quality of goods and services primarily focused on homogenous goods.

In the case of public provider not being able to deliver the cheapest or the highest-quality performance, state faces a dilemma to choose between several private providers. Such situation is called competitive bidding for procurement and the whole process of PP should end up with the most efficient solution.

For the purpose of this study we will introduce a definition of PP of homogeneous goods. The reasons why we chose homogeneous goods are straightforward. Homogeneous goods are perfectly divisible hence public entity can demand whichever quantity of these products. Additionally, they are uniform and standardized which means that they cannot differ from each other from buyer's point of view thus there is no space for product differentiation.

Definition of homogeneous goods is as follows:

*„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.“<sup>5</sup>*

This definition covers subject of our study quite well. We will continue with extending of procurement topic with a brief overview over the basic terms used within PP field in the next section.

### 3.1 Basic terms in public procurement

One of the possible definitions of public procurement (PP) can be the agreement between contracting authority (CA) and supplier for the purpose of delivery public goods or services. CA is any public entity compelled to use the institute of PP in order to deliver goods or services to final consumers. As such CA might be divided into five different categories:

- **National offices** such as ministries or Czech National Bank (CNB)
- **Public bodies** such as universities or hospitals
- **State owned enterprises** or other entities providing water, energy or transport services
- **Municipalities** such as Litovel town
- **Regional offices**

Each of these features specific distinctions from the others especially in terms of attitude towards their budget constraint. Such position can be viewed on their excessive spending as they differs in level of importance and consequently the level of financial support they receive from the state in times of pecuniary difficulties. There exist studies confirming

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<sup>5</sup> Soudek, J. (2012). *Public procurement of homogeneous goods: Czech Republic case study*. (p. 5). Diploma thesis. Prague: Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies.

significant impact of various types of contracting authorities on the final price of procurement (Bandiera et al., 2008; Soudek, 2012).

To become a supplier, a firm has to first make a bid for the delivery of goods or services and therefore such firm is called bidder. If a bidder succeeds to win the competition for the procurement, it then signs the contract with appropriate contracting authority and becomes a supplier. Legal process of selection of a supplier is called award procedure. Such process complies with strict rules and follows specific steps which are well-described in Reimarová (2011). The legislative of either EU or CR propose various types of procedures in terms of openness and transparency. At the end of the day a type of award procedure has a real impact on number of bidders restricting the competition for the procurement and thus the rise of final unit prices which was proven by Soudek (2012). A few types procedures can be observed however in the interest of this study will be the following one:

**Open procedure** represents the most common and transparent tool the public entity could use in process of selecting the supplier. Any legal or nature person may submit a bid in a tender after the fulfillment of qualification criteria noted in a contract proposal. These proposals are disclosed on the internet well in advance whereby unlimited number of firms can apply for a contract.

Other types of procedures can be found as well. For example in **restricted procedure** CA itself decides how many applicants will be invited to a tender. If less than 3 or 5 (depends on the subject of procurement) applicants fulfill the qualification criteria, CA is coerced to use open procedure. **Negotiated procedure** leaves CA a space to invite one or more firms to a tender and negotiate with them about the conditions of the contract with no possibility of other parties to join.

Because the goal of this thesis is to identify main barriers to entry into PP, we will be focused on contracts where open procedure was applied. The reasoning behind is that

open procedure ensures competitive environment in public tendering and this is the only way how we might be able to determine and evaluate restrictions companies face once they have submitted a bid for a tender.

**Electronic auction** serves as another tool for public entities how they may increase competition in a bidding process and consequently cut prices for public contracts. The process seems to be quite straightforward as firms are making their bids online on the interactive platform where they can see the bids of other participants and the contest ends up when nobody is willing to offer a lower price than its counterparts. The presence of electronic auction has become a popular tool among public entities primarily in the environment of homogeneous goods where individual goods or services are precisely measurable and hence comparable. The usage of e-auctions significantly reduces final prices of PP (Soudek, 2012; Skuhrovec & Soudek, 2013) and therefore we will be using it as an indicator of competitive environment.

### **3.2 Barriers to entry**

In microeconomic theory restrictions preventing any firm on the market to exhibit free entry are called **barriers to entry** (Varian, 2005). A few reasons can be found what makes potential entrants discouraged. First of all they might consider fixed costs too high to enter the market or they do not possess sufficient capacity to compete for a share on the market against their counterparts. Secondly, competition on the market may be restricted by collusive behavior of incumbents whose objective is to hold current market share and do not let any company to grab a piece of this pie. However, such behavior is illegal and should be punished by supervising authorities. Several methods of this behavior are well-described in economic textbooks, predatory pricing, economies of scale or vertical agreements belong amongst them. Lastly, the competition on the market can be restricted by state regulation through licenses, quotas or patents. These regulations

used to be called artificial and natural barriers to entry and will be of primary interest of this thesis.

In the environment of PP both **artificial** and **natural** (or **structural**)<sup>6</sup> barriers can be observed. As mentioned above artificial barriers are most commonly created by state regulation. Each entity competing for a tender has to fulfill qualification criteria drafted by state institution and further requirements demanded by contracting authorities. These criteria feature basic and professional requirements which are obligatory and must be applied for each procurement. The aim of this criterion is to ensure that such entity is enabled to execute the contract legally.

Additionally there exist **economic and technical requirements** which can be imposed at discretion of any contracting authority. Economic and technical requirements can represent many forms all under the direction of particular contracting authority. The sole condition that has to be fulfilled is that qualification criteria have to be somehow related to the subject of the competition. The purpose of these requirements is to ensure that any applicant in a tender is eligible to execute the procurement properly. However, there might be strong incentives for a contracting authority to abuse the limits in order to create artificial barriers and split only those suppliers who are preferred. One would say that due to the usage of artificial barriers contracting authority lowers administrative costs because it does not need to deal with all bids but at the same time lower competition caused by smaller number of bidders in a tender results in higher prices of procurement (Soudek, 2012). The question is whether higher administration costs caused by evaluation of more bids exceed the amount of money saved by greater competition in a tender or not.

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<sup>6</sup> Structural barriers are those which the incumbents can exploit because they already naturally exist in the market, i.e. large scale production with lower costs or the presence of network



Furthermore, despite of the artificial barriers bidders in public procurement have to face structural barriers as well. One of the examples of natural barriers to entry might be **sunk costs**. Such costs cannot be recovered if the firm does not win a tender. Therefore potential bidders have to consider thoroughly their chances to win a contract. For example, in large tenders such as the completion of blocks in a Nuclear Power Station Temelín there was only limited number of participants because among other reasons the preparation of administrative side of the project discourage quite a few potential participants in terms of tremendous input costs.

Economies of large scale production might represent another potential barrier to entry into public contracts. In the field of PP **economies of scale** would mean that larger firms can offer to contracting authorities lower profit margin and thus lower final price because they can exploit abundance of resources and deliver commodities with lower costs.

All of these barriers either artificial or structural stated above are analysed in Chapter 5 where empirical part of the thesis is presented.

### **3.3 Small business support policy**

Small- and medium-sized economies (SMEs) are considered to be the backbone of any economy. Primarily, their importance is reflected in fields of job creation, economic growth or innovation. For example in 2013 the amount of SMEs in the Czech Republic accounted for one million firms employing almost two thirds of total working force.<sup>7</sup> Hence the impact of SMEs on the whole economy appears to be tremendous and therefore it is essential to provide them with supportive policies in order to keep the wheel of the economy running.

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<sup>7</sup> Ministry of Industry and Trade (2015). Retrieved 23 June 2015 from <http://www.mpo.cz/dokument151050.html>

Over the last ten fifteen years the environment of public procurement has gone through a number of changes amongst which a focus on the major objective of procurement can be classified. Contracting authorities are no longer concentrated primarily on value for money and efficiency of spending but a tendency towards pursuing social, economic or environmental goals can be observed. A support of development of SMEs clearly belongs among these objectives.

SMEs jointly recognize the lack of capacity as a main barrier to participate in a public procurement tender (Loader, 2011). The Code of Best Practices (European Commission; 2008) advise contracting authorities to sub-divide contracts into individual parts allowing SMEs to participate in more tenders.<sup>8</sup> The sub-division enables SMEs to acquire more contracts as they will better fit to SMEs' productive capacity and brings higher quality as smaller parts will better correspond to specialized sector of the SME.

Government can also facilitate the access of SMEs to procurement by putting in place legislative provisions in order to encourage their participation in tenders. Among such provisions set-asides imposed by local governments can be considered. Nakabayashi (2013) analysed Japanese procurement environment where local government sets aside substantial share of public tenders on behalf of SMEs. The results have proven that without these set-asides almost 40% of SMEs would exit the market. Additionally, local government succeeded to reduce total costs because procurement costs stemming from a lack of competition would exceed the costs caused by production cost inefficiency.

Finally, several pro-SMEs measures have been implemented only recently including simplification of administration procedures, guidance focused on SMEs online and most

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<sup>8</sup>Commission of the European Communities. (2008). *European Code of Best Practices Facilitating Access by SMEs to Public Procurement Contracts*. Retrieved June 21, 2015 from [http://ec.europa.eu/internal\\_market/publicprocurement/docs/sme\\_code\\_of\\_best\\_practices\\_en.pdf](http://ec.europa.eu/internal_market/publicprocurement/docs/sme_code_of_best_practices_en.pdf).

importantly training sessions and workshops aiming at improvement of knowledge in a preparation process (OECD, 2013).

### 3.4 Hypotheses and motivation

In this part of the thesis major hypotheses originated from the existing literature will be highlighted and motivation behind them will be discussed. As stated before the prime goal of the thesis is to determine the impact of barriers to entry on the final unit price and consequently the profit margin of suppliers. Further aim of the thesis will be to find out the effect of institutional and procedural characteristics on the probability of SMEs to win a public contract. For that purpose homogeneous goods will serve us as an objective measure because these goods are regularly purchased by both public and private entities hence a few disparities might occur. In the next section hypotheses will be outlined and in the empirical part these will be further concretized.

***Profit margin is a decreasing function of a size of PP.***

Profit margin is defined as final price divided by market price. In the environment of PP contracting authority has two possibilities to reflect the size of a contract. Either it can split a contract into separate parts as it is recommended by European Commission (2008) or it can announce a tender of a full size of procurement. However, in the second case there might be an economic concept called **economies of scale** present. For such large-scale contracts variable costs per one unit are decreasing and thus allowing potential suppliers to offer lower prices with reduced profit margins.

***Profit margin of suppliers is positively affected by qualification criteria imposed by contracting authorities.***

The impact of institutional and procedural characteristics on the final price of PP was analysed in Soudek (2012). The author proves that certain institutional or procedural characteristics such as type of contracting authority or number of bidders have resulted

in a substantial surge in final prices. Our aim is to look at **ex-ante** procedural characteristics which are represented by required **qualification criteria** set up by individual contracting authorities. Such qualifications might represent a barrier to entry restricting competition in a tender and thus increasing final prices and consequently profit margins of suppliers.

***Profit margin of suppliers is significantly reduced by a success of SME in a tender.***

Smaller suppliers are often constrained by lack of resources in a competition process with their counterparts. Consequently they do not always succeed in environment where broader competition is present. Hence they put their effort into such procurement where their chances to win a tender are considerably higher, i.e. smaller-scale contracts. However, these lower-volume contracts do not offer a wide space for tremendous profit margins. Soudek (2012) found out a substantial drop in final prices of procurement once a contract was awarded to a smaller supplier. We believe that involvement of SMEs in the PP should have identical effect on profit margins.

***Probability of SME to win a tender is a decreasing function of a size of PP.***

Lower probability of SME to win large-scale contract might be explained by a lack of capacity of these companies. The impact of size of a PP on the probability of SME was analysed by Loader (2011) being concentrated on how contracting authorities are able to procure from SMEs in the United Kingdom. She found out that these enterprises are most likely to succeed when it comes to smaller-scale tenders through open competition. Similar suggestions are stated in Code of Best Practices (EC, 2008) where European

Commission advises contracting authorities to divide large-scale contracts into sub-parts in order to facilitate the access of SMEs into PP.

***System of required qualifications effectively blocks capability of SMEs to win high-volume contracts.***

Research conducted by Rasheed (2004) outlines that if a manager of a smaller firm perceives a requirement on the amount of capital too high, the firm will not participate in a tender and thus qualification criteria have a negative impact on a market penetration. Our aim will be to find out to what extent these references are determining the capability of SMEs to win large-scale contracts.

***Probability of SME to win a tender is significantly affected by a specific type of contracting authority.***

According to Loader (2011) SMEs have a higher probability to thrive where local or regional authorities award a contract. Our goal will be to determine whether there exist significant differences in probabilities of SMEs to succeed depending on a specific type of contracting authority.

## 4 Czech public procurement

PP in the Czech Republic represents a substantial part of government spending. Consequently the efficiency of such spending may have a large impact on the economy as a whole. Czech environment provides similar conditions with respect to procurement procedures as the rest of countries in the EU. Nonetheless, several major distinctions can be pointed out. Czech procurement has undergone a few stages over the last decade and each of them brought certain specificities that ask for further clarification.

The aim of this part is to pass different stages of evolution of the Czech legislative framework regarding public contracts. Individual acts as well as amendments on public contracts will be discussed here and the chapter will be concluded by a brief look on the review of the Czech controlling institutions.

### 4.1 Legislative framework

This section will be devoted to legislative requirements and specificities of Czech public procurement.

#### 4.1.1 Acts and amendments

The field of PP had not been intensively regulated until the first act on public contacts came into effect in 1995 (**Act No. 199/1994 on Public Contracts**). Until 1995 the whole procurement market in the CR was managed solely by methodical instructions. Therefore the introduced act brought a wide spectrum of intentions which were aimed at improving transparency of processes, efficiency in public spending and competitiveness of the environment. Although this act possessed several pitfalls, it was one of the very first attempts to unify all previous legislation.

Following amendments were caused due to an anticipated accession to the European Union. **The Act No. 28/2000 Coll.** brought new guidelines for natural monopolies,

namely network industries, and introduced the first applicable electronic platform through which potential bidders could apply for a tender.

The next act came into effect on May 1, 2004, the day when the Czech Republic entered into the EU. **The Act No. 40/2004 Coll.** contained a vast number of clarifications which should ensure the Czech and European legislative framework to be harmonized. New act brought a few innovations. Classification of individual contracts on over-the-threshold and under-the-threshold belongs among them. Nevertheless, despite of minor difficulties stemming from complicated systematic of the process and problematic continuity of individual parts of the new act there still remained a number of cases that asked for better clarification. For example, the definition of contracting authority where one public entity falls into more than one category was ambiguous or the rigidity of the process in case of under-the-threshold contracts was highlighted as well.

In 2006 the former statute was replaced by **The Act No. 137/2006 Coll. on Public Contracts** (third in a row) and is still in force ever since. Three main goals were pursued by implementing of the new statute.

First, the government was in need to implement new directives coming from the EU (Halmová, 2008). Such directives consisted in implementation of electronic techniques in order to increase competition for tenders and consequently to bring savings in terms of time and money.

Second, public contracts were divided into three groups according to their size:

- **Over-the-threshold public contracts (OTT)** – the estimated value of a contract should be greater or equal to a financial boundary specified by law. In the field of goods and services the limit for national offices and public bodies was

3,256,000 CZK<sup>9</sup> until 2013 and 3,395,000 CZK since 2014.<sup>10</sup> For regional or local authorities this limit represents 5,010,000 CZK until 2013 and 5,244,000 CZK since 2014.<sup>11</sup>

- **Under-the-threshold public contracts (UTT)** – the estimated value of the contract should be greater than 2,000,000 CZK (for goods and services only) and less than a financial limit stated above.
- **Smaller-scale public contracts** – the estimated value of the contract should be less than 2,000,000 CZK for goods and services.

Third, transparency of PP was improved by a requirement of each public contract to be published on the Czech national informational system (ISVZUS). Smaller-scale contracts featured the sole exception because they were excluded from the obligation to be published online and they are guided through internal instructions of given contracting authority instead. The other two types of public contracts are obligated to be published in the system. Additionally, OTT contracts have the obligation to be noted in the Official Journal of the EU.

On April 1, 2012, **The Amendment No. 55/2012 Coll.** came into effect bringing various tools to improve transparency and support anti-corruption measures in tender awarding. Newly, suppliers were asked to uncover their sub-contractor network and contracting authorities were obliged to publish all the information regarding procurement contracts online. The limits decisive for publication duty mentioned above were cut to 1,000,000 CZK for goods and services. One of the most important facts for the purpose of this study is that economic requirements were abolished and replaced by a declaration

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<sup>9</sup> In all values noted above VAT is excluded.

<sup>10</sup> MRD (2015). Retrieved 22 June 2015 from [http://www.portal-vz.cz/getmedia/ccb4c028-db55-4cc8-afca-baa0b4ab3317/Nove-financni-limity-pro-verejne-zakazky-a-koncesni-rizeni\\_2014-prehled.pdf](http://www.portal-vz.cz/getmedia/ccb4c028-db55-4cc8-afca-baa0b4ab3317/Nove-financni-limity-pro-verejne-zakazky-a-koncesni-rizeni_2014-prehled.pdf)

<sup>11</sup> In the interest of this thesis is to determine differences in between OTT and UTT and therefore we mention only those limits relevant to our data sample.



of bidder being able to execute that particular contract.<sup>12</sup> Moreover, contracting authorities were now obliged to cancel a tender once less than two applicants fulfilled conditions specified in the contract proposal. Finally in cases regarding public supply contracts contracting authorities had to carry out the evaluation process through e-auctions which can be labeled as an attempt to ensure more competitive and efficient environment.

Nevertheless, the Senate was concerned by a hike in administration costs and an increase of bureaucracy in such extent that it prepared **The Amendment No. 341/2014 Coll.** which stopped most of the regulation implemented in 2012 and return the limits of public contracts back to 2,000,000 CZK in case of goods and services. Furthermore, public contract now could be awarded even if only one bid was offered in a tender. However, economic requirements remained abolished since April 2012 and therefore we will be able to observe whether the abolition of economic barriers had an impact on procurement market in the CR or not.

## 4.1.2 Controlling Institutions

Institutional framework represents a necessary condition for well-functioning and effective procurement. The role of supervising institution is to monitor and control the process from the birth of contract proposal to post-contractual practices and punish potential shortcomings. However, the institutional framework in the CR faces several hurdles which were analysed in Jurčík (2006) or Pavel (2009). Some of their findings will be discussed here.

The surveillance in the CR is carried out by **Bureau for Protection of the Competition (ÚOHS)**. Although this institution is allowed to impose penalties to

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<sup>12</sup> Until April 2012, contracting authorities were allowed to use a tool of economic requirements in a way of the amount of turnover or the insurance contract that enabled them to evaluate whether these firms are able to execute the contract or in less positive manner to discriminate smaller bidders and restrict the competition.

offenders, it cannot investigate suspicious actions on its own impulse. It can take the matter in its hands solely on the request of any firm. Consequently, ÚOHS is rationally excluded from cases where there is only one bidder or collusive behavior is present. According to the Annual report of ÚOHS, in 2014 it undertook 981 initiated administrative procedures from the total number of 988 requests.<sup>13</sup> The nature of major pitfall of this supervising institution is in exacting personal responsibility. ÚOHS is restricted to imposing penalties over the failing entities however this results in redistribution of income from one institution to another. Finally, contracting authorities were imposing inadequate or even discriminatory qualification criteria which was identified by ÚOHS as the most common offense and served us as a motivation to conduct this study.

## 4.2 Size of the market

Representing an average of 14% of GDP (33% of government spending) public procurement forms a substantial part of national account in the CR from macroeconomic point of view.<sup>14</sup> Data collected by Ministry of Regional Development (MRD) shows that the share of PP on GDP fluctuates in between 12% and 15% since 2008 (see Figure 1). OECD summarizes the size of general government procurement spending using estimates from data collected through System of National Accounts (SNA). According to their statistics, procurement spending accounted for 13% of GDP (29% of government spending) amongst OECD member states in 2011.<sup>15</sup> This reflects the Czech Republic as

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<sup>13</sup> ÚOHS (2015). Retrieved 21 June 2015 from <http://www.uohs.cz/cs/informacni-centrum/vyrocnizpravy.html>

<sup>14</sup> MRD (2014). *Annual report on public procurement 2014*. Retrieved 21 June 2015 from [http://www.portal-vz.cz/getmedia/e404b766-77d0-488b-8809-6951c53c0eb9/Vyrocnizprava-o-stavu-verejnych-zakazek-v-Ceske-republice-za-rok-2014\\_final.pdf](http://www.portal-vz.cz/getmedia/e404b766-77d0-488b-8809-6951c53c0eb9/Vyrocnizprava-o-stavu-verejnych-zakazek-v-Ceske-republice-za-rok-2014_final.pdf)

<sup>15</sup> OECD (2013). *Government at a Glance*.(p. 130). Retrieved June 21, 2015 from [http://www.oecd-ilibrary.org/governance/government-at-a-glance-2013\\_gov\\_glance-2013-en](http://www.oecd-ilibrary.org/governance/government-at-a-glance-2013_gov_glance-2013-en).

a country with an average share of procurement spending on GDP and its general government spending.<sup>16</sup>

However, it should be mentioned here that only contracts over-the-threshold, i.e. those conducted according to the PP Act are reflected. The number of smaller-scale contracts might surge the total procurement spending by a significant amount. As can be observed from the table below there is an increasing tendency towards the share of contracts listed in the Czech national informational system (ISVZ). Such tendency remained despite of a rise in procurement limits (2 million CZK for goods and services, 6 million CZK for construction works) until which the procurement has to be posted in the system being in place since the first of January 2014.

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<sup>16</sup> However, OECD (2013) points out that the SNA may deliver overestimation, as the categories considered may include certain expenditures not carried out through government procurement.

**Figure 1:** Summary of the size of PP market since 2008 (values listed in billions CZK)

	2008	2009	2010	2011	2012	2013	2014
<b>GDP</b>	3848	3922	3954	4022	4048	4086	4266
<b>Government spending</b>	1584	1680	1658	1650	1712	1716	1769
<b>Total value of PP</b>	535	583	594	502	493	478	577
<b>Share of PP on GDP</b>	14%	15%	15%	12%	12%	12%	14%
<b>Share of PP on Gov Sp</b>	34%	35%	36%	30%	29%	28%	33%
<b>Value of PP listed in ISVZ</b>	359	346	315	283	325	300	450
<b>Share of PP listed in ISVZ</b>	67%	59%	53%	56%	66%	63%	78%

*Source:* Author based on data from Ministry of Regional Development of the Czech Republic (2015).

Procurement of homogeneous goods is always kind of specific. They fall into the group of deliveries which tend to grow in the last two years and in 2014 they reached the border of 44%<sup>17</sup> by volume.<sup>18</sup> A research conducted by PriceWaterhouseCooper (PWC) (2001) on request of the European Commission shows that commodities (in most case representatives of homogeneous goods) account for almost 8% of volume in total public procurement spending.<sup>19</sup> If we put these two sources together, we obtain that total procurement spending can vary in between 1–2% of GDP of the Czech Republic which accounts for 42–84 bn CZK.

<sup>17</sup> The rest remains for services (21%) and construction works (35%)

<sup>18</sup> MRD (2014). *Annual report on public procurement 2014*. (p. 26). Retrieved June 29, 2015 from [http://www.portal-vz.cz/getmedia/e404b766-77d0-488b-8809-6951c53c0eb9/Vyrocní-zpráva-o-stavu-verejnych-zakazek-v-Ceske-republice-za-rok-2014\\_final.pdf](http://www.portal-vz.cz/getmedia/e404b766-77d0-488b-8809-6951c53c0eb9/Vyrocní-zpráva-o-stavu-verejnych-zakazek-v-Ceske-republice-za-rok-2014_final.pdf).

<sup>19</sup> PwC, London Economics and Ecorys (2011). *Public procurement in Europe, Cost and effectiveness*. Retrieved June 29, 2015 from [http://ec.europa.eu/internal\\_market/publicprocurement/docs/modernising\\_rules/cost-effectiveness\\_en.pdf](http://ec.europa.eu/internal_market/publicprocurement/docs/modernising_rules/cost-effectiveness_en.pdf)

## 5 Empirical analysis of public procurement data

This chapter provides an intersection of previously discussed theoretical framework with empirical evidence based on Czech public procurement data. Previous chapters were devoted to a description of PP characteristics from the theoretical point of view and a closer look was taken at Czech legislative framework regarding public procurement and size of the market in the CR. As it was already mentioned in Chapter 2 little econometric research has been conducted in this particular field of interest. None of them has been concentrated on the involvement of SMEs in PP process using the same methodology. Consequently we truly believe that this study will bring unique outcomes relevant to theoretical and daily praxis of the PP. Due to the fact that Czech legislative framework is unanimously harmonized with the EU legislation, results obtained here might be hereafter applied across the whole EU.

This chapter starts with a description of data, further concretization of hypotheses and models will be presented and finally results of our empirical research will be discussed.

### 5.1 Data description

As stated before we were looking for a sector of homogeneous goods. Such goods are perfectly divisible (whichever amount CA desire can be demanded) and easily comparable (there exists a market benchmark). Furthermore the necessary condition was to find sufficiently large number of observations in order to be able to conduct econometric analysis. For such purpose we picked a sector of **electricity and gas** which has fulfilled all the above stated conditions.

The primary source of our dataset was the Czech national informational portal (ISVZUS) where all public contracts since 2006 fulfilling conditions of the PP Act are listed. A brief overview on this system with its biggest shortcomings is presented in Chapter 2.

Although every public contract is obligated to be posted on these websites, inaccurate and incomplete data appear regularly there without any penalisation.

More specifically we were looking for public contracts where qualification criteria are disclosed. Despite of professional criteria that all applicants have to fulfill in order to be able to compete for a tender, contracting authorities could impose either economic or technical requirements.<sup>20</sup>

Economic criteria were represented by the amount of turnover of an applicant in the previous three years or by the value of an insurance contract usually as large as the subject of procurement. However, because of the inconsistency of data on insurance contracts, we have decided to use the amount of turnover as the main representative of economic requirements.

On contrary number of contracts supplied in the past represented technical requirements imposed by CAs. Primarily their aim was to order a specific amount of contracts a firm must have been awarded in the past three years to be capable of competing for that particular tender. These previous contracts had to fit specific measures in terms of volume but again because of inconsistency of data we will be using a number of past contracts as an indicator of technical qualification criteria.

As a consequence two datasets will be used here one including data on economic requirements and the second including their technical peers. Our primary goal will be to examine whether these qualification criteria indeed form barriers to entry into PP.

Unfortunately, very often we found a public contract where qualification criterion, estimated price of procurement or at least one important variable is missing. Most commonly in the cell for qualification criteria it was written “published in a tender

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<sup>20</sup> Since April 2012 contracting authorities can impose only technical requirements. Economic qualification criteria were cancelled by amendment of The PP Act (see Chapter 4.1.1).

documentation” or the field simply remained blank with no information whether any qualification criteria are required. Thus the collection of data represented very tedious and time demanding job.

Finally from 2008 to 2014 the dataset of 365 observations from electricity and gas sector was collected. The division of contracts according to their commodity sector and nature of qualification criteria is following.

**Figure 2:** Amount of tenders by commodity and qualification criteria

Commodity	economic requirements	technical requirements
electricity	119	85
gas	21	35
Total	140	120

*Source: own computation.*

Though the drop rate seems to be quite substantial especially in the case of public contracts including technical qualification criteria, we still have a sufficient sample for sound econometric analysis.

Except for qualification requirements, there were plenty of other parameters missing in the contracts disclosed online. Among the most common ones belongs estimated price or quantity purchased. On the other hand, formal features such as name of contracting authority or number of a contract were published always. As a consequence these missing values should not cause any selection bias<sup>21</sup> because there is not supposed to be a link between those incomplete observations and our dependent and explanatory variables. In this way we can claim that our dataset was selected at random.

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<sup>21</sup> See Wooldridge, J. M. (2009). *Introductory Econometric*, second edition. (p. 48).

In order to avoid omitted variable bias<sup>22</sup> a proxy including both active and passive “wasteful behaviour” will be used in our models. This proxy will be represented by zIndex, a composite index developed by Chvalková, Skuhrovec (2010), rating contracting authorities according to good practices in PP suggested by European Commission. A contracting authority which proceeds in line with these guidelines of good practices should obtain a high value by zIndex in comparison to such authority which tends to be less economical in the case of public spending. Thus zIndex seems to be a good proxy of “wasteful behaviour” to subdue potential omitted variable bias in our models.

As stated before we will be using profit margin of suppliers which is defined as final price divided by market price. For the sector of electricity and gas such benchmark can be provided by Czech electricity and gas market operator (OTE). OTE operates as a commodity exchange thus unit prices may be traded much lower than for traditional private or public purchases. OTE summarizes its economic activity through monthly and annual reports which are publicly disclosed on their websites. As a source of market price in our datasets we used weighted prices originally stated in the annual reports in order to avoid day-to-day volatility.

In the next section we will briefly summarise two sectors of electricity and gas market, then we will introduce a division of suppliers according to their turnover and finally further look on our two datasets will be presented.

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<sup>22</sup> See Wooldridge, J. M. (2009). *Introductory Econometric*, second edition. (p. 295).



### 5.1.1 Electricity

Electricity will constitute vast majority of samples in our dataset. In total we were capable of collecting 280 tenders from 2008 to 2014. Amount of electricity purchased consisted of over 11,400 GWh and cost more than 15.1 bn CZK which represents almost 562 million EUR.

In the electricity market we were able to collect and compute final, estimated and market unit prices which was represented by a forward price<sup>23</sup> stated on the Czech commodity exchange. The average unit prices are presented in a table below which is followed by a graph summarising a track of all three unit prices since 2008.

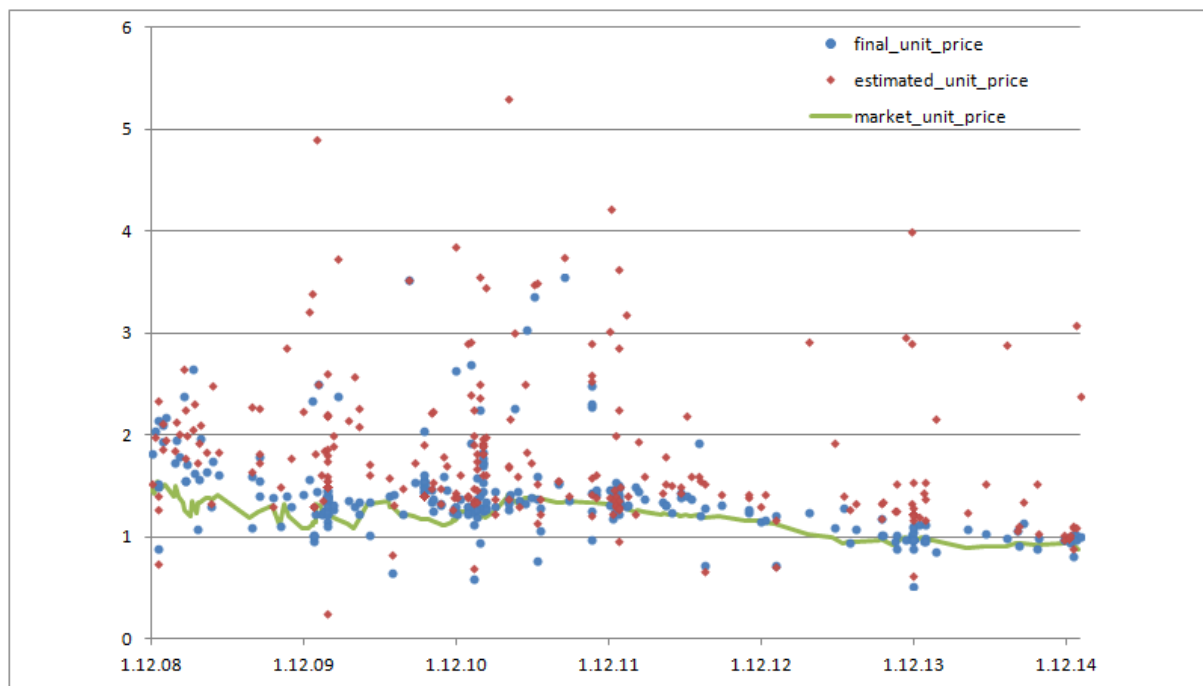
**Figure 3:** The average unit prices in electricity dataset

electricity	final unit price	estimated unit price	market unit price
Mean (CZK/kWh)	1,51	1,87	1,2
Standard Deviation	0,82	0,95	0,15

**Source:** own computation.

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<sup>23</sup> Forward prices were collected with respect to a number of months stated in the contract proposal.

**Figure 4:** Electricity PP unit prices over time

*Source: extended version of Soudek (2012)*

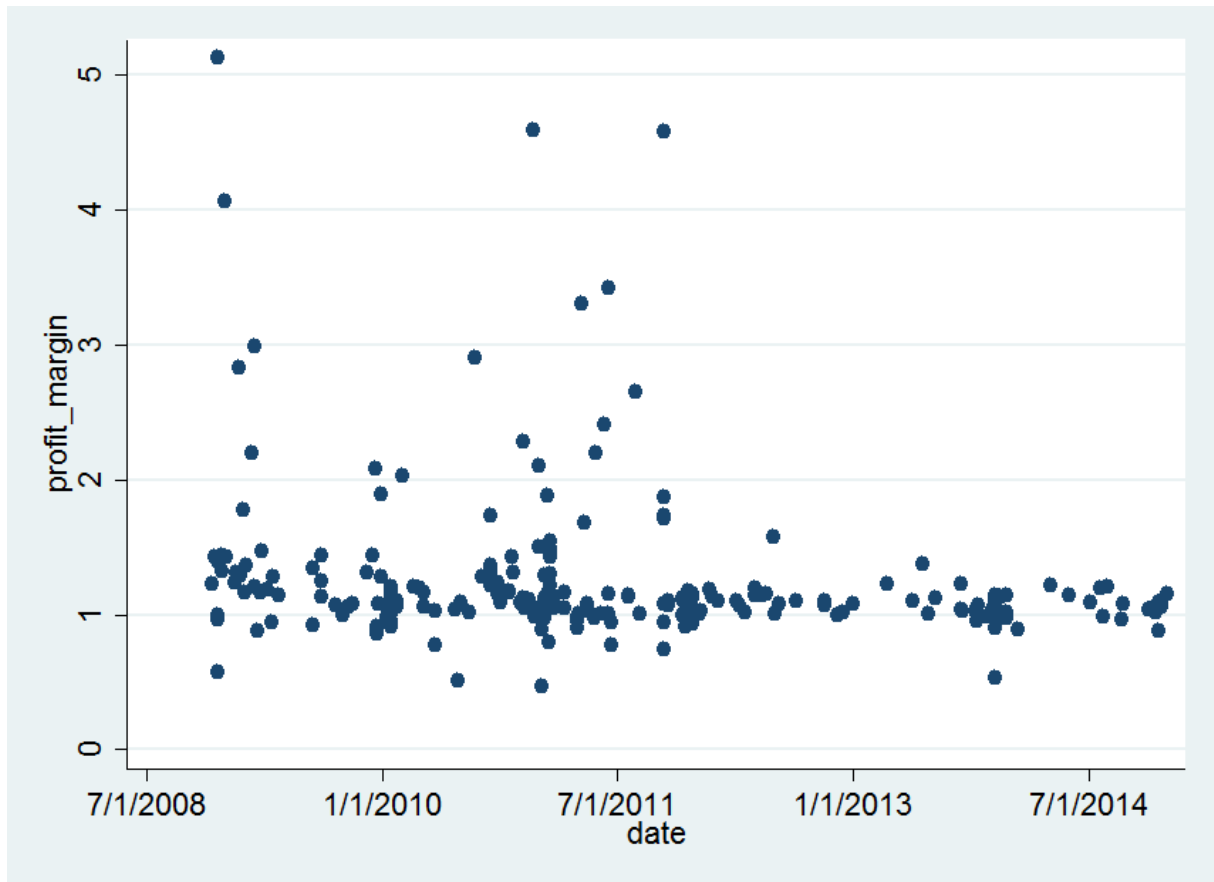
As can be observed from the graph above, final price is predominantly moving in between estimated and market prices. Logically market price in vast majority of cases represents the lowest possible price determined by a commodity exchange. Theoretically if all public entities could purchase electricity directly on the commodity exchange, contracting authorities would save about 16% (2.5 bn CZK) of their current costs. These claimed savings should be interpreted with caution but differences between final and market unit prices show that some space for potential savings exists.

What is worth paying attention here is the level of estimated prices. Except for the fact that in most cases estimated prices exceed its peers (which is quite expected), several jumps might be observed on the graph where market unit price of a tender awarded substantially drops below estimated price. There might be three explanations possible. First contracting authority suffers from information asymmetry and did not find out the actual price level on a commodity exchange market. Second contracting authority has

some additional information<sup>24</sup> which causes his expectations on final price to differ from the market one. And finally public entity boasts by large allocation of public resources and it is willing to pay for a homogeneous good more. As a consequence of such signalling final price of a contract might be higher and potential space for “wasteful behaviour” might be created.

Profit margin of suppliers will serve as an auxiliary indicator of the relationship between final and market price. In the electricity sector, the average value of profit margin moves around 24% (with SD of 0.55). All track since 2008 is presented in a graph below.

**Figure 5:** Profit margin of PP suppliers over time - electricity

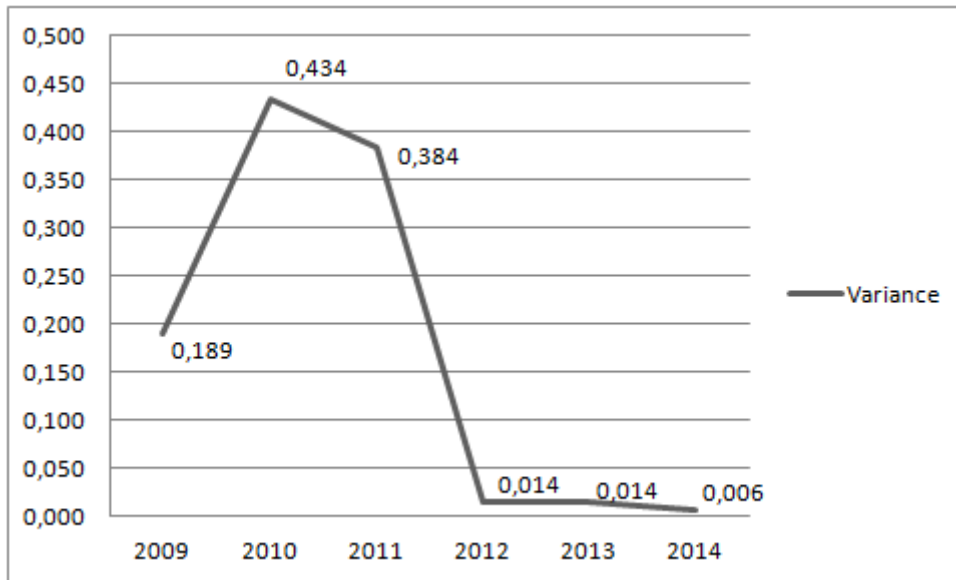


*Source: own construction.*

<sup>24</sup> Meaning that homogeneous good may fail in one of its characteristics because public entity may expect to purchase off-peak electricity or high-voltage energy and thus unit prices paid for certain amount of electricity does not have to be uniform.

On the graph a clear tendency towards converging profit margin over time is present. For bigger clarity, we decided to document this fact on a following graph highlighting variances of profit margin in particular years.

**Figure 6:** Variance of profit margin of PP suppliers over time - electricity



*Source: own computation.*

Wrong interpretation of this graph would be that profit margins declined in total since 2012. However, this graph only says that final prices were converging market ones and not many outliers in final prices were present anymore. As a consequence PP environment in electricity sector has stabilized at a certain level. One of our objectives will be to determine what stands behind this stabilization in final prices.

As the subject of this thesis is primarily focused on the supply-side of PP market, market structure should be closely evaluated as well. Following table shows four biggest suppliers, their share on PP volume and number of contracts awarded.

**Figure 7:** Supply-side structure of electricity PP market

Supplier	Total value of PP (CZK)	Total share volume	Amount of tenders	Total share of tenders
ČEZ Prodej, s.r.o.	7 634 404 123	58%	25	9%
E.ON Energie, a.s.	1 268 186 015	10%	24	9%
Pražská energetika, a.s.	1 071 715 742	8%	25	9%
Lumius, spol. s.r.o.	985 935 484	7%	34	12%
16 other suppliers	2 308 331 790	17%	166	61%
<b>Total</b>	<b>13 268 573 154</b>	<b>100%</b>	<b>274</b>	<b>100%</b>

*Source: own computation.*

The table suggests very high market concentration as one firm supplies almost 60% of total volume even though its market share on number of tenders awarded is identical or even less than shares of its counterparts. Herfindahl index being a sound measure of market concentration is equal to 0.36 indicating highly concentrated market. Such environment might be optimal for antitrust behaviour in form of collusive behaviour or bid rigging. As a consequence restricted competition caused by high market concentration might represent barriers to entry for SMEs.

### 5.1.2 Gas

The dataset for gas procurement is obviously not as large as the one for electricity. In the first place it is caused by a fact that bills for gas procurement contracts do not always exceed desired level of 2 million CZK determined by the PP Act. These contracts are not bolstered to be disclosed online and therefore it is almost impossible to collect them. Even so we were able to collect 85 public contracts on gas deliveries from 2009 to 2014

in the total quantity of 3.5 GWh. The aggregate bill for these purchases cost 2.3 bn CZK (more than 85 M EUR).

The average final, estimated and market prices are summarized in the table below.

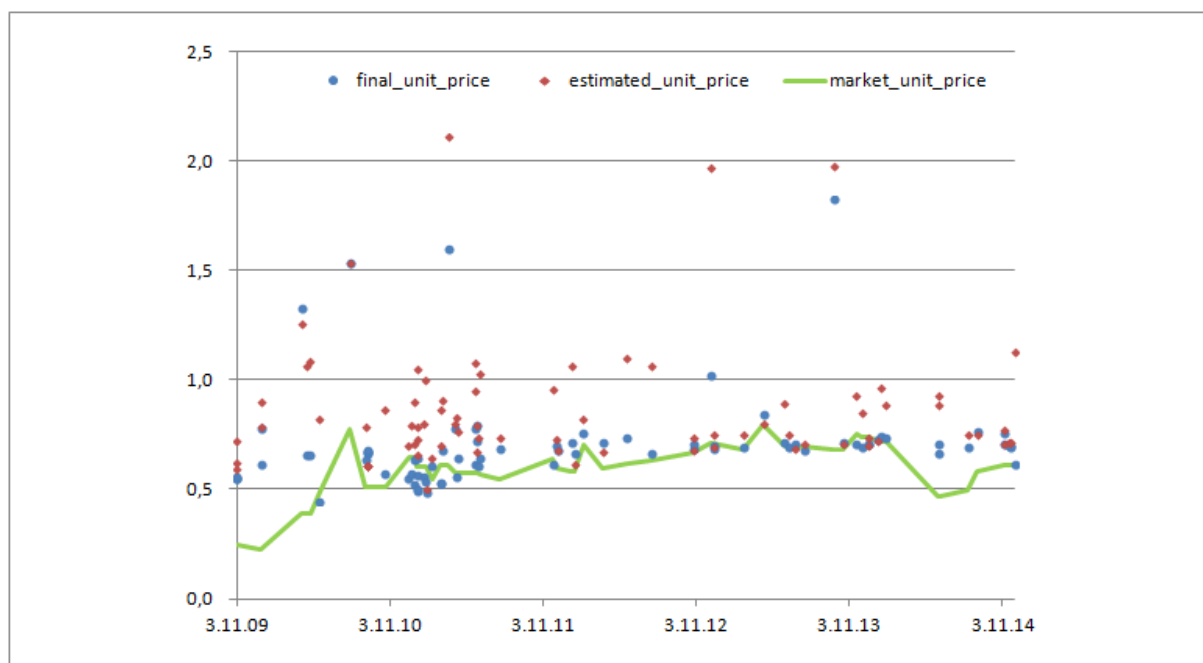
**Figure 8:** The average unit prices in gas dataset

gas	final unit price	estimated unit price	market unit price
Mean (CZK/kWh)	0,72	0,87	0,63
Standard Deviation	0,23	0,30	0,20

*Source: own computation.*

In the following graph, a track of all three unit prices since 2009 is presented.

**Figure 9:** Gas PP unit prices over time

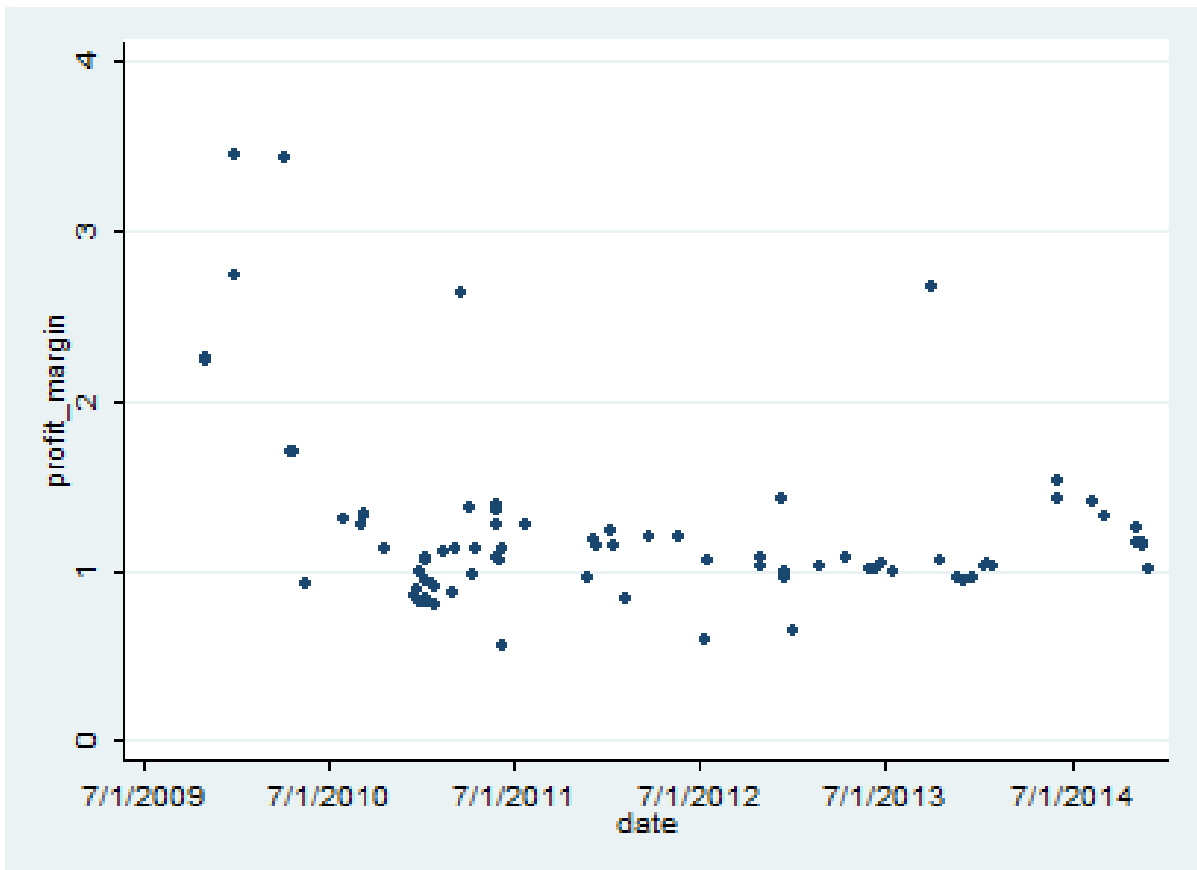


*Source: extended version of Soudek (2012).*

It can be seen from the graph that market price is characterized by much higher volatility than in the electricity sector. Otherwise the graph features similar trends as the previous one. Final price is always moving in between market and estimated price and jumps in the estimated price are present as well.

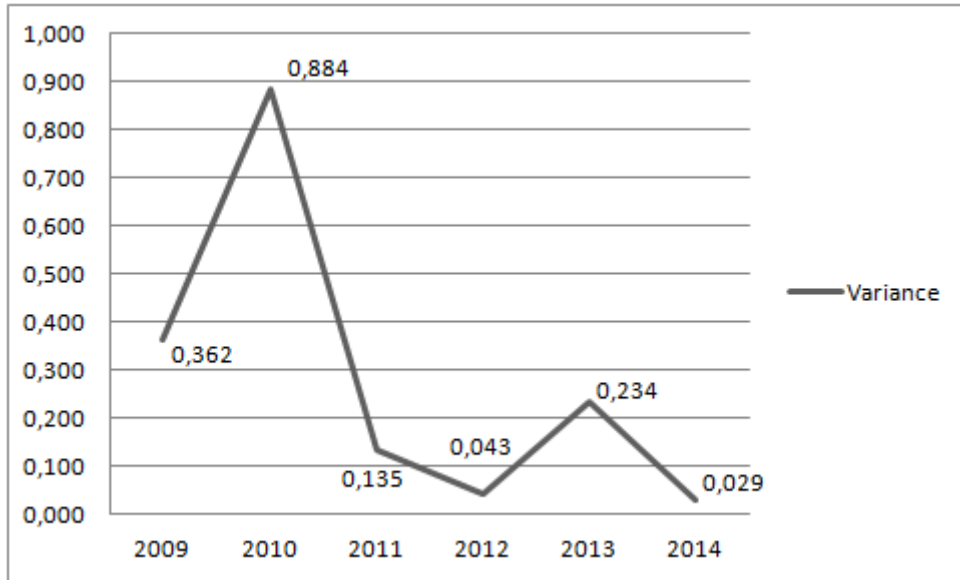
The average value of profit margin in the gas sector is almost identical to the one from electricity sector. The mean is 25% with standard deviation of 0.54. The following graph shows a distribution of profit margin in time.

**Figure 10:** Profit margin of PP suppliers over time - gas



*Source: own computation.*

The tendency towards convergence of profit margin to a lesser extent can be detected as well. For comparison we will provide a similar graph with respect to variance matched with individual years.

**Figure 11:** Variance of profit margin of PP suppliers over time - gas

*Source: own computation.*

This graph confirms the tendency observed in the same figure for electricity sector. Final prices are converging market prices even though at a slower pace than in the electricity prices.

The equality of profit margins between these two sectors will play a key role in our further research. It will enable us to deal with individual observations regardless of their commodity sector. And thus the issue on equality of profit margins in these two sectors will become the very first subject of our testing.

For the same reason as in the electricity sector we will provide a brief summary of supply-side structure in our gas dataset.



Figure 12: Supply-side structure of gas PP market

Supplier	Total value of PP (CZK)	Total share of volume	Amount of tenders	Total share of tenders
RWE Energie, a.s.	703 569 171	31%	4	5%
Pražská plynárenská, a.s.	616 849 026	27%	10	12%
Lumius, spol. s.r.o.	344 068 932	15%	17	21%
Pragoplyn, a.s.	299 265 220	13%	24	30%
10 other suppliers	284 715 690	13%	26	32%
<b>Total</b>	<b>2 248 468 039</b>	<b>100%</b>	<b>81</b>	<b>100%</b>

*Source: own computation.*

A dominance of leading supplier is even more evident here given that one firm being awarded solely four contracts is able to procure more than 31% of total volume. Market concentration slightly declined in comparison with electricity sector. Herfindahl index equals to 0.22 indicating moderate market concentration. Nevertheless, from the first four places in ranking might be deduced that certain suppliers knowing their position on the market apply solely for large-scale or highly-specified contracts where perspectives of higher profits seem to be appealing. Unfortunately, the Czech national informational system does not disclose a bidding structure in respect of individual tenders so we are restricted only on the names of winners and other applicants keep in secret.

### 5.1.3 SME

According to EU legislation, small- and medium-sized enterprise might be defined with respect to three following criteria – number of employees, amount of turnover or size of total balance sheet. For our purposes we will divide our sample of suppliers into two groups - SMEs and non-SMEs, according to their turnover.

Boundary which separates these two groups is determined by EU<sup>25</sup> on a limit of 50 million EUR corresponding to 1.5 bn CZK. Next figure splits our sample of suppliers into two categories according to their turnover.<sup>26</sup>

**Figure 13:** Division of PP suppliers according to their turnover

Supplier	Turnover Category
Pragoplyn, a.s.	1 500 000 000 Kč and more
Lumius, spol. s.r.o.	1 500 000 000 Kč and more
Pražská plynárenská, a.s.	1 500 000 000 Kč and more
Lama Investments, a.s.	1 500 000 000 Kč and more
E.ON Energie, a.s.	1 500 000 000 Kč and more
RWE Energie, a.s.	1 500 000 000 Kč and more
BOHEMIA ENERGY entity s.r.o.	1 500 000 000 Kč and more
SPP CZ, a.s.	1 500 000 000 Kč and more
United Energy Trading, a.s.	1 500 000 000 Kč and more
ČEZ Prodej, s.r.o.	1 500 000 000 Kč and more
CENTROPOL ENERGY, a.s.	1 500 000 000 Kč and more
MND a.s.	1 500 000 000 Kč and more
Pražská energetika, a.s.	1 500 000 000 Kč and more
Czech Coal, a.s.	1 500 000 000 Kč and more
Dalkia CZ	1 500 000 000 Kč and more
Teplárny Brno, a.s.	1 500 000 000 Kč and more
CZECH-KARBON, s.r.o.	1 500 000 000 Kč and more
Elektrárna Chvaletice a.s.	1 500 000 000 Kč and more
EP ENERGY TRADING, a.s.	1 500 000 000 Kč and more
MORAVIA ENERGO, a.s.	1 000 000 000 - 1 499 999 999 Kč
Amper Market, a.s.	1 000 000 000 - 1 499 999 999 Kč
Lumen Energy, a.s.	1 000 000 000 - 1 499 999 999 Kč
Europe Easy Energy, a.s.	500 000 000 - 999 999 999 Kč
BICORN, s.r.o.	500 000 000 - 999 999 999 Kč
V-Elektra, s.r.o.	500 000 000 - 999 999 999 Kč
ELIMON a.s.	200 000 000 - 299 999 999 Kč
Synergy Solution, s.r.o.	30 000 000 - 59 999 999 Kč

*Source: own construction based on CAE.*

<sup>25</sup> The definition of SME is stated in EU recommendation 2003/361.

<sup>26</sup> A supplier is marked as SME if its annual turnover did not exceed a limit of 1.5 bn CZK more than once since 2008.

The table depicts that 8 out of 27 PP suppliers are considered as SME according to their turnover. From all 365 observations collected contracting authorities were procuring from SMEs 56 contracts (15.34%) and 4.55% of the total volume. More specifically in our electricity dataset SMEs were delivering 18.98% of total number of contracts and 5.63% of total volume. Furthermore they reached 4.94% share on total number of contracts and 2.14% share on total volume in gas dataset. These values reveal that SMEs do not constitute a negligible part of public procurement in our dataset supplying rather more contracts of lower volume.

#### **5.1.4 Dataset including economic qualification criteria**

First dataset (ECO Dataset) contains all public tenders from 2008 to 2012 including requirements on amount of turnover. We selected only these data in order to avoid discrepancies from Czech informational system where all of relevant data might not be listed even though they were stated in an initial contract proposal.

However, there might exist a threat of endogenous sample selection bias due to excluding either incomplete or irrelevant observations from our sample.<sup>27</sup> Fortunately this is possibly not the case, as missing values in economic requirements do not represent information relevant for formal revision or controlling. Therefore unobserved

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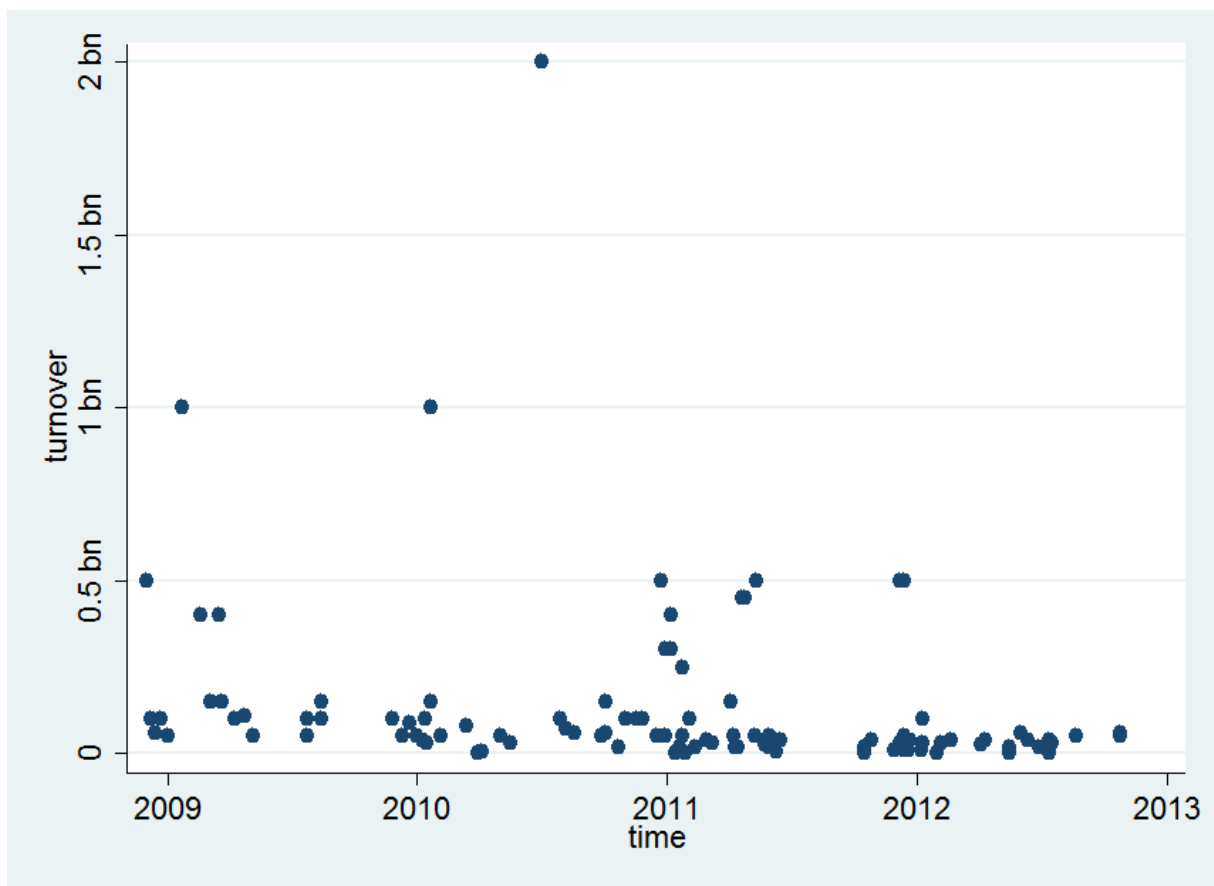
<sup>27</sup> See Wooldridge, J. M. (2009). *Introductory Econometric*, second edition. (p. 48.).

characteristics (e.g. “wasteful behaviour”) are not affecting the absence of such information. Hence we dare to claim that the selection of data was made at random.

Consequently only those data including relevant values will be analysed which gives us a good potential to found out whether economic qualification criteria represents barriers to entry into PP for SMEs or not.

Dataset is restricted to period until April 2012 when the amendment of PP Act abolishing the use of economic qualification criteria came into effect. As a result we obtained 119 and 21 samples from electricity and gas sector respectively. Detailed distribution of the amount of turnover required by CAs over time is depicted in a graph below.

**Figure 14:** Distribution of turnover requirements over time (values in CZK)



*Source: own construction.*

A few samples after April 2012 might be seen in the graph. The reason is that there exists a clear time lag between the announcement of a tender proposal and contract award notice. That means that those dates depicted in the graph are dates of contract award notice even though these tenders were announced before April 2012.

Additionally, it might be observed that in vast majority of cases, the amount of turnover required lays under the level of 500 million CZK. Given that 25 out of 27 suppliers were capable of participating in those tenders. Moreover, three outliers were detected. It comes to electricity deliveries for Czech railways in which it might be the case of heterogeneity. Except for high turnover requirements, other criteria in terms of technical specifications are expected.<sup>28</sup>

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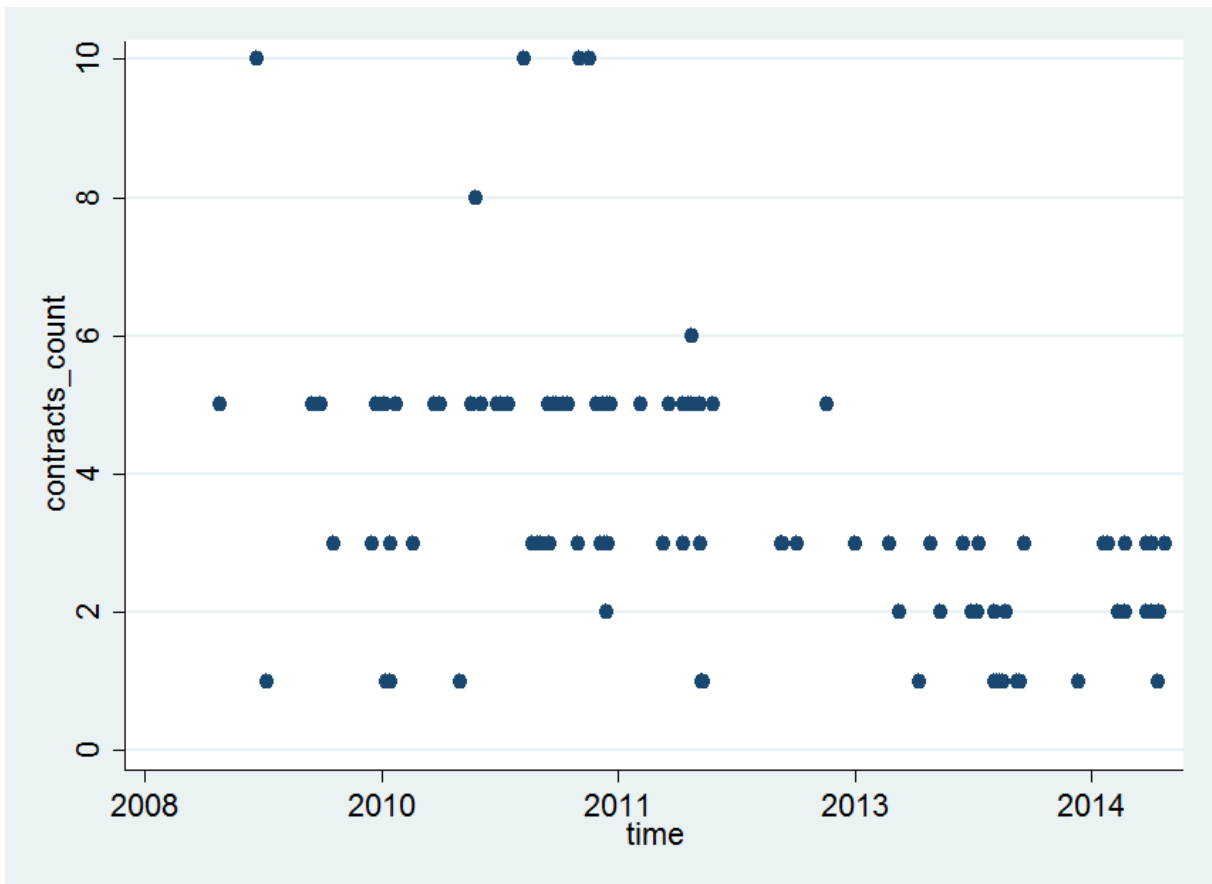
<sup>28</sup> In all three cases the contract was awarded to ČEZ Prodej, s.r.o

### 5.1.5 Dataset including technical qualification criteria

Following identical logic as in the previous dataset, only those tenders in which existed at least one requirement on previous contract performance were selected. We dare to say that a selection was arbitrary using identical arguments as in previous dataset.

All collected samples come from period 2008 to 2014 where we were able to collect 85 and 35 observations for electricity and gas deliveries respectively. Distribution of number of contracts required by CAs over time is presented in a graph below.

Figure 15: Distribution of contract requirements over time



Source: own construction.

A tendency towards convergence of number of contracts required over time seems quite apparent from the graph. One of possible explanations might be that the Amendment of PP Act from 2012 brought several transparency measures which might improve practices used by contracting authorities.<sup>29</sup>

## 5.2 Concretization of hypotheses and models

As mentioned earlier, primary aim of this study is to detect the impact of procedural and institutional characteristics on profit margin of suppliers and to found out factors affecting the probability of SME to win PP. The former will be examined by ordinary least square (OLS) regression on cross-sectional data using two datasets. The latter will be analysed due to linear probability model (LPM) employing both datasets as well. Furthermore results obtained by LPM will be compared to those obtained by Logit model for higher certainty.<sup>30</sup>

### 5.2.1 OLS

To determine what indicates changes in variation of profit margin OLS regression serves us an appropriate econometric tool. Profit margin representing dependent variable is defined as final price divided by market price of that particular commodity. However, first of all we have to check whether suppliers from both commodity sectors gain identical profit margins. The hypothesis follows:

***H1: Profit margin of PP suppliers from both commodity sectors is identical.***

This hypothesis is tested in order to be able to work with the whole datasets from both commodity sectors. For such purpose t-test with unequal variances is used.

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<sup>29</sup> For further explanation see Chapter 4.1.1

<sup>30</sup> Logit model will be introduced in the Appendix B.

The rest of hypotheses are related to the impact of structural and procedural characteristics on profit margin of suppliers. Formally the research question is decomposed into several hypotheses:

***H2: Profit margin is a decreasing function of estimated total price of PP.***

***H3: Profit margin of suppliers is positively affected by the amount of turnover required by contracting authorities.***

***H4: Profit margin of suppliers is positively affected by number of contracts required by contracting authorities.***

***H5: Profit margin of suppliers is significantly reduced by a success of SME in a tender.***

Furthermore, we will provide a statistical comparison of profit margin with estimated unit price and estimated total price as well. Estimated unit price serves us as a measure of CA's willingness to pay or potential heterogeneity of given commodity. Estimated total price stands for an indicator of size of public contract. Interaction term, electronic auction with estimated unit price, might eliminate potential signalling power of CA.

Type of contacting authority represents a demand-side mover with respect to profit margin. A measure of competitive environment in PP is taken by number of bidders. Variation in profit margin is obviously examined in time plus in TECH Dataset the impact of Amendment of PP Act and removal of economic qualification criteria on profit



margin is analysed. Last but not least, as a proxy of “wasteful behaviour” zIndex takes place in a model.

Summarizing all above stated we obtain an equation:

**Figure 16:** OLS Regression equation

$$\begin{aligned} \textit{Profit margin} = & \alpha + \beta_1 \textit{estimated unit price} + \beta_2 \textit{estimated total price} + \\ & \beta_3 \textit{auction*estimated unit price} + \beta_4 \textit{CA National Office DUMMY} + \beta_5 \textit{number of} \\ & \textit{bidders} + \beta_6 \textit{log(turnover required)} \textit{ (or } \beta_6 \textit{number of contracts required)} + \beta_7 \textit{SME} \\ & \textit{DUMMY} + \beta_8 \textit{zIndex} + \beta_9 \textit{time (or } \beta_9 \textit{date after April 2012 DUMMY)} + \varepsilon \end{aligned}$$

Where CA National Office DUMMY represents a binary (dummy) variable for National Office as an originator, SME DUMMY equals to one if SME succeeded in a tender and date after April 2012 DUMMY represents a binary variable for a period after the amendment of PP Act in 2012. Logarithmic term is used for required turnover in order to smooth differences caused by outliers. Terms in brackets represent the equivalents of particular explanatory variables used for TECH Dataset.

## 5.2.2 LPM

In order to identify factors having impact on probability of SME to win a tender we use linear probability model (LPM). Moreover the results stemming from this model will be compared with Logit model in the Appendix B to prove consistency of our findings. Nevertheless, as we are interested in causal impact of explanatory variables on our

dependent variable rather than forecasting its value we will prefer the LPM with robust standard errors.

Unfortunately, this time we have no choice to deal with individual sectors separately but because we did not collect sufficient number of samples for gas procurement to conduct sound statistical analysis, we will restrict our focus on electricity public contracts only.

Following hypotheses will be of interest:

*H6: Probability of SME to win a tender is a decreasing function of an estimated total price.*

*H7: System of required criteria on the amount of turnover effectively blocks capability of SMEs to win over-the-threshold contracts.*

*H8: System of required criteria on number of contracts effectively blocks capability of SMEs to win over-the-threshold contracts.*

*H9: Probability of SME to win a tender is significantly affected by a specific type of contracting authority.*

*H10: Probability of SME to win a tender significantly increased after the removal of economic qualification criteria in April 2012.*

Holding the structure of explanatory variables very similar to previously mentioned model we will move straight away to a description of equation concentrating on individual modifications.

**Figure 17: LPM equation**

$$\begin{aligned}
SME\ DUMMY = & \alpha + \beta_1 \text{estimated unit price} + \beta_2 \text{estimated total price} + \beta_3 \text{e-auction} \\
& DUMMY + \beta_4 \text{CA Municipality DUMMY} + \beta_5 \text{number of bidders} + \beta_6 \log(\text{turnover} \\
& \text{required}) * \text{over-the-threshold (or } \beta_6 (\text{number of contracts required}) * \text{over-the-threshold)} + \\
& \beta_8 \text{Index} + \beta_9 \text{time (or } \beta_9 \text{date after April 2012 DUMMY)} + \varepsilon
\end{aligned}$$

Vast majority of explanatory variables remained identical thus their interpretation keeps constant. Additionally, e-auction DUMMY equals to one if electronic auction took place and CA Municipality DUMMY represents binary variable for involvement of municipality. Last but not least interaction term  $\log(\text{turnover required}) * \text{OTT}$  (or  $(\text{number of contracts}) * \text{OTT}$ ) was added stressing the effect of qualification criteria on over-the-threshold contracts.

## 5.3 Results and discussion

As we already depicted in data description, two datasets are applied in two regressions. First a classical ordinary least square (OLS) regression examining the effect of explanatory variables on variation in profit margin (quantitative event) and second linear probability model (LPM) will be introduced to explain what factors may significantly affect the probability of SME to win a public contract (qualitative event).

The assumptions of OLS method will be verified later in the Appendix A. In all cases robust standard errors were applied to the models because Breusch-Pagan test rejected the hypothesis of homoscedastic residuals. Such step is essential in order to be able to use t- and F-statistics for evaluation of statistical significance.

Subsequently, the normality of residuals was accessed. The Shapiro-Wilkinson test rejected the hypothesis of normally distributed residuals in all of our models.<sup>31</sup> Hence there might exist nonlinear unbiased estimators in the models which will have smaller variance. Nevertheless, as the primary aim of this study is to evaluate hypotheses noted above, we will assume that a simple OLS method will suffice for that purpose.

### 5.3.1 OLS Regression

First we would like to introduce our dependent variable. This will be defined as the final price of awarded contract divided by market price given by OTE. Such variable will be called profit margin indicating a percentage of how much realized final price of the procurement exceeded the market price noted at the Commodity exchange. We assume that profit margin of suppliers should be identical on the both commodity

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<sup>31</sup> See Appendix A

sectors which should allow us to put all the samples from both sectors together into one dataset. In order to resolve so we will test following hypothesis.

***H1: Profit margin of PP suppliers from both commodity sectors is identical.***

For such purpose we use a two-sample t test with unequal variances<sup>32</sup> allowing us to determine whether significant differences between these two commodity sectors exist. The t test was applied on both datasets and the results might be seen from the table below.

**Figure 18:** t test with unequal variances

Commodity	Dataset ECO			Dataset TECH		
	Obs	Mean	SD	Obs	Mean	SD
electricity	119	1,28	0,58	85	1,14	0,36
gas	21	1,27	0,75	35	1,14	0,33
H <sub>0</sub> : diff !=0 P> t	0,9491			0,9944		

**Source:** own computation.

As can be observed from the table, both p-values reach very high levels and thus we cannot reject null hypothesis, i.e. profit margin of suppliers from both commodity sectors do not differ in both datasets and we are allowed to merge those samples into one single subset for each dataset.

### 5.3.1.1 Dataset ECO

An empirical model described in Chapter 5.2 was applied on the dataset including contracts where economic qualification criteria and other essential variables are present and stated in the contract proposal. In aggregate we obtained 140 observations from

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<sup>32</sup> See both graphs in the Appendix C – unequal variances can be observed from the graphs.

electricity and gas sector. Despite minor obstacles mentioned above our model provides statistically significant outcomes that were confirmed by joint statistical F-test whose p-value was well-below 1%. Additionally, our model succeeded to explain 49% of variation in profit margin of PP suppliers. The effect and significance of each variable is depicted in the following table.

**Figure 19:** OLS regression on ECO dataset; dependent variable: profit margin

Explanatory Variable	OLS	
estimated unit price (CZK/kWh)	0,41 (0,11)	***
estimated total price (CZK)	-0,01 (0,06)	
e-auction*estimated unit price (CZK/kWh)	-0,18 (0,05)	***
CA National Office dummy	-0,02 (0,16)	
number of bidders	-0,032 (0,018)	*
log (turnover required)	0,004 (0,009)	
SME dummy	-0,002 (0,075)	
zIndex	0,82 (2,23)	
time	-0,00006 (0,00012)	
constant	-0,36 (2,47)	
<b>R - squared</b>	0,4872	
<b>P &gt; F</b>	0,0001	

*Source: own computation; note: robust standard errors are applied; dummy variables skipped are the rest of CA and non-SME<sup>33</sup>*

<sup>33</sup> The level of significance is denoted by a number of stars: one star indicates 90% significance level, two stars indicate 95% significance level and three stars indicate 99% significance level

Any other interaction term was not found statistically significant. Furthermore Ramsey reset test does not indicate that any quadratic term is missing in the model. Hence we can consider causalities to have linear relationship. Accordingly, the equation looks as follows:

**Figure 20:** OLS ECO equation

$$\text{Profit margin} = -0.36 + 0.41 \text{ estimated unit price (CZK/kWh)} - 0.18 \text{ electronic auction} * \text{estimated unit price (CZK/kWh)} - 0.032 \text{ number of bidders} + \varepsilon$$

The interpretation follows:

- Profit margin is significantly affected by estimated unit price. Rise in estimated unit price of 0.1 CZK per kWh improves the profit margin of PP suppliers by 4.1%. Such positive effect confirms our expectations and possible causes will be introduced later in this chapter.
- An interaction term e-auction\*estimated unit price is trying to find out whether the use of e-auction somehow reduces the effect of signalling which is given by contracting authority at the moment when it announces a public tender with an initial estimated price on profit margin. The effect of cross product is very significant in our model; i.e. an additional 0.1 CZK per kWh decreases a profit margin of a supplier by 1.8% in the case of e-auction usage relative to other types of bidding procedures, e.g. sealed-bid auction. This fact gives us a sound argument that irrespective of how much an authority exceeds the market price in the process of estimation of the procurement value, the use of electronic auction will pull final price down and thus reduces authorities' signalling power. The reason is that in the electronic auction procedure the primary aim of this tool is stressed at value for money. E-auction allows bidders offer lower prices than its peers revealing willingness to pay of all participants. In this type of procedure the competition is focused in the

first place and therefore such race results in lower final prices and thus lower profit margins of PP suppliers.

- Number of bidders is often marked as an indicator of competition in PP. Higher number of bidders competing for a tender represents more competitive environment that pushes prices and margins down. This model confirms our expectations. i.e. profit margin declines by 3.2% once an additional applicant applies for a tender. These results are consistent with those introduced by Soudek (2012).
- Estimated total price was used in a model as a measure of quantity as this parameter and amount of electricity or gas purchased was almost 98% correlated. However, our model did not detect any effect on variation in profit margin of PP supplier. The expectations of economic qualification criteria and contracting authorities represented by national offices increasing the profit margins of suppliers were not confirmed neither (relative to the rest of CA). Anticipated negative impact of involvement of SME in a public contract on profit margin remained insignificant. For further discussion see the evaluation of hypotheses.
- The zIndex as an indicator of “wasteful behaviour” has not been proven to have a significant impact on profit margin. Finally profit margin has not been substantially declining in time as in fact can be observed from the graphs in Chapter 5.1.

To sum up, profit margins were not affected by measures of economic qualification criteria. Moreover two factors were proven to explain a variation in profit margin of PP suppliers. First more competitive environment in the form of number of applicants or the usage of electronic auction significantly decreased a profit margin. In the case of e-auction irrespective of signalling via estimated price imposed by contracting authorities it successfully reduces profit margin of suppliers. Second such signalling was proven to have a significant positive relationship with profit margins. Reasons behind and further implications can be found at the end of this chapter in the section related to hypotheses testing.



### 5.3.1.2 Dataset TECH

This dataset is considerably smaller which corresponds to statistical power of its outcomes. It consists of 120 observations from gas and electricity sector including information especially on technical qualification criteria and other important variables. The model remained almost identical as the previous one except for the change in type of criteria required by CA. Additionally, instead of time variable we will be using similar measure of time represented by a dummy variable, i.e. period before and after April 2012 when the important amendment on the PP Act came into force.<sup>34</sup>

This time our model explain a little bit less of a variation in our dependent variable (37%). F-test tells us that our model is jointly significant at 95% level which represents a little deterioration. However, this should still allow us to make a sound statistical analysis.

The results of regression follow.

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<sup>34</sup> For further description see Chapter 4.1.1

**Figure 21:** OLS regression on TECH dataset; dependent variable: profit margin

Explanatory Variable	OLS	
estimated unit price (CZK/kWh)	0,28 (0,09)	***
estimated total price (CZK)	-0,005 (0,019)	
e-auction*estimated unit price (CZK/kWh)	-0,146 (0,066)	**
CA National Office dummy	0,16 (0,14)	
number of bidders	-0,018 (0,015)	
number of contracts required	0,025 (0,027)	
SME dummy	-0,05 (0,05)	
zIndex	0,31 (0,46)	
date after April 2012 dummy	0,04 (0,08)	
constant	0,63 (0,30)	**
R - squared	0,3665	
P > F	0,0122	

*Source: own computation; note: robust standard errors are applied; dummy variables skipped are the rest of CA, date before April 2012 and non-SME<sup>35</sup>*

<sup>35</sup> The level of significance is denoted by a number of stars: one star indicates 90% significance level, two stars indicate 95% significance level and three stars indicate 99% significance level

Again Ramsey Reset test did not prove the need for quadratic relationship. Furthermore, we did not find any other interaction term to be significant. The equation thus looks like:

**Figure 22:** OLS TECH equation

$$\begin{aligned} \text{Profit margin} = & 0.63 + 0.28 \text{ estimated unit price (CZK/kWh)} \\ & - 0.146 \text{ electronic auction} * \text{estimated unit price (CZK/kWh)} + \varepsilon \end{aligned}$$

- As in the previous model estimated unit price has a significant impact on dependent variable, i.e. a rise of 0.1 CZK per kWh in estimated unit price uplifts profit margins by 2.8%.
- Again e-auction as a tool of competitive bidding plays a significant role in the variation in profit margins. The use of electronic auction reduces profit margins by 1.46% when an additional 0.1 CZK per kWh is estimated. This again proves the efficiency of such tool against signalling by contracting authority.
- This time an effect of number of bidders was not proven to be significant as well as technical qualification criteria.
- Binary variable standing for the legislative change in April 2012 were not detected to have a significant effect neither, i.e. the restriction of economic qualification criteria did not have any impact on profit margins of PP suppliers.
- All other variables remained insignificant as in the previous model and therefore we will come back to them in the part related to hypotheses testing.

Despite of slightly lower statistical power of the second model the results have proved a strong consistency between these two models.

### 5.3.1.3 Hypotheses evaluation

Previous section dealt with OLS regression models applied on two datasets. The goal of this section is to summarise the outcomes obtained from both of them and consequently to compare following implications.

**Figure 23:** Results comparison; dependent variable – profit margin

Explanatory Variable	ECO	TECH
estimated unit price (CZK/kWh)	0,41	0,28
estimated total price (CZK)	N/S	N/S
e-auction*estimated unit price (CZK/kWh)	-0,18	-0,146
CA National Office dummy	N/S	N/S
number of bidders	-0,032	N/S
qualification criteria	N/S	N/S
SME dummy	N/S	N/S
zIndex	N/S	N/S
time/date dummy 2012	N/S	N/S

*Source: own computation; N/S – not significant*

Even though TECH dataset showed a little less significant outcomes (according to R-squared and F-test), a strong consistency of results is present. Above that in the ECO dataset analysis a model detected number of bidders to have an impact on profit margin at 90% significance level. On the other hand, a constant was found to be significant at 95% level in the TECH dataset analysis.

In both models estimated unit price was shown to positively affect the profit margin of PP suppliers. Such effect goes in line with our expectations and we can provide a few possible causes.

Let us assume that estimated unit price is the best estimate considering the competitive market structure, i.e. authorities provide estimate that would be valid if the competitive

environment is sufficient and correct (so no pre-agreed contracts or bribes take place). If the estimation of CA is mechanical, i.e. guided by specific rules, for example price estimate is derived from market price or price of previous contracts, the high estimate of unit price as well as the realized final price are the factor of third variable, which could be some specifications of contract type, for example it might be costly to provide electricity for certain purposes as is the case of railways.

Thus contract characteristics drive the unit prices up. Given these specifications, not all providers may be capable of meeting them, which may in turn reduce competition. Such specifications thus will be negatively correlated with number of participants in a tender.<sup>36</sup>

To continue with previously given example, it may refer to volatile (within hours) electricity needs of railroads. This explanation seems plausible but those specifications are not disclosed in a contract proposal and thus it results in information asymmetry between CA and a supplier.

Given this fact, we cannot claim that homogeneous commodity is purchased. Differences in both estimated and final prices might be caused by heterogeneity<sup>37</sup> captured in the estimated price. Nevertheless, there is no reason to suspect that there is any correlation between differences in purchased commodity and differences in institutional and procedural characteristics. As a consequence statistical differences caused by above mentioned characteristics cannot be explained by heterogeneity stemming from information asymmetry.

Nevertheless, what if the assumption of honest estimates is not true and prices are overestimated intentionally in the beginning of the process. In that case, we would expect contracts whose originators has lower zIndex to estimate higher unit prices than those

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<sup>36</sup> Note that here we are talking about other specifications than quantity as estimated unit price and quantity are largely uncorrelated.

<sup>37</sup> Be aware that if heterogeneity is present in the model, it will create a positive endogeneity bias on our dependent variable.

with high zIndex value. So, more honest authorities having lower zIndex prefer fair competition and thus estimate unit prices go in line with their real expectations.

However, explanatory variable for zIndex was not found to have a significant effect on profit margin in neither of our models (nor interaction term with estimated unit price) suggesting that no unfair or dishonest practices towards excess public spending and “wasteful behaviour” were detected.

Another possible explanation of this positive correlation between estimated and final unit price might be provided given existing literature. Soudek (2012) points out that one round (e.g. sealed bid) auctions do not provide sufficient environment for public tendering. In those types of auctions CA reveals its willingness to pay in the very beginning. Subsequently bidders might select their offer on the basis of revealed willingness to pay of CA rather than on the basis of their opportunity costs. Consequently awarded suppliers always end up with some extra profit margin because the following logic holds – higher estimated price is set up by CA, higher offer by a bidder can be made and thus higher margins relative to the market price suppliers will receive.

However, this logic does not hold in the case of e-auctions. The principle applied under the use of electronic auction is to show the willingness to pay of potential suppliers. Thus the value for money is stressed in the first place. This argument goes in line with our results, i.e. any unit price increase in estimated price decreases profit margin of a supplier in the case of electronic auctions in comparison with other types of auctions (e.g. sealed bid).

Additionally, anticipated fact suggested by Bandiera et al. (2008) that national offices pay for public deliveries significantly more in aggregate than other types of CAs was not confirmed.

Our primary goal of this part of empirical analysis is to identify the impact of SMEs and possible barriers to entry on profit margin. The evaluation followed by discussion of our findings is provided here.

***H2: Profit margin is a decreasing function of estimated total price of PP.***

Estimated total price substitutes the size of PP. The reason is that both these variables are almost 98% correlated and therefore we decided to use the pecuniary value instead of amount of kWh. However, we did not find out a significant statistical evidence of the effect of the size of PP on profit margin of suppliers in neither of our datasets. Our expectations on potential economies of scale reducing the scale of margins were not confirmed. One of the possible explanations could be that in the area of high volume procurement only few participants able to meet certain quantity demand might exist. Thus the effect of economies of scale might be counterbalanced by smaller competitive environment releasing the stress on value for money.

***H3: Profit margin of suppliers is positively affected by the amount of turnover required by contracting authorities.***

Economic qualification criteria represented by the amount of turnover required by contracting authorities did not show a significant impact on profit margin of suppliers. Our expectation of positive impact on profit margin was not confirmed. To some extent it could be very low levels of these barriers that stand for such insignificant effect. As can be observed from our dataset only one contract contained a turnover requirement higher than the actual limit for SME's turnover (1.5 bn CZK).

Another point of view is that smaller suppliers do not tend to be limited by turnover requirements as they can always expose bigger share to retail services which enables them to grow in terms of turnover size. Consequently economic qualification criteria did not represent barriers to entry and thus did not restrict competitive environment which in turn did not affect final prices with profit margins.

***H4: Profit margin of suppliers is positively affected by number of contracts required by contracting authorities.***

This time number of contracts supplied in previous years required by CA represents technical qualification criteria. The result was identical to the previous one as no effect of these criteria on profit margin was found. Again we cannot confirm our expectations on positive relationship between these two variables. One argument could be that smaller suppliers were capable of succeeding in either low-scale contracts or in contracts where heterogeneity was not present (discussed above). Apparently they could collect sufficient number of contracts which allowed them to compete for more demanding tenders. Unfortunately we could not measure the size of these contracts required by CA as the data on this issue provided by Czech national informational portal are not solid. Nevertheless, we can reject the hypothesis saying that profit margins were affected by restricted competition stemming from technical requirements.

***H5: Profit margin of suppliers is significantly reduced by a success of SME in a tender.***

Based on findings of Soudek (2012), the hypothesis saying that involvement of smaller successful suppliers in PP decreases final prices and thus profit margins was tested. The results did not end up in line with our expectations because no significant effect was proven. Here another interpretation can be offered. Electronic auctions being always concentrated on the value for money do not represent a fertile environment for success of SMEs. Larger firms with abundant resources might exploit their resources and use for example predatory pricing in order to win a competitive bidding. This argument can be supported by the empirical evidence from Japan. If the set-asides for SMEs in Japanese PP were removed, more than 40% of these firms would exit the market (Nakabayashi, 2013). This implication says that if SMEs were not able to succeed in PP procedures which significantly reduce profit margins of suppliers (e.g. electronic auctions), then it



might be reasonable that the negative impact of the involvement of SME in PP contract on profit margin is insignificant.

### **5.3.2 Linear Probability Model**

In order to detect key determinants affecting probability of SMEs to win a public contract we would need to conduct a regression with qualitative event in dependent variable. For such purposes a linear probability model (LPM) serves as an appropriate tool. In the Appendix B we will introduce Logit model in order to prove correctness of our approach and to compare obtained results. LPM was applied on our two datasets. Their outcomes are analysed and discussed in the next sections.

#### **5.3.2.1 ECO Dataset - LPM**

First of all, since we are not explaining the variation in profit margins anymore, we will be using data solely from electricity sector. The main reason is that we were not capable of collecting sufficient amount of samples on gas procurement to fulfil all necessary conditions. Nevertheless, we still believe that we will be able to conduct sound statistical analysis even with such restricted sample size. Thus we have collected 119 observations from electricity sector including the information on economic qualification criteria.

According to the R-squared, our model succeeds to explain more than 18% of variation in probability of SME to win public contract. At first glance such value might look negligible but this is a sign of ongoing competition where it is impossible to detect 100% of variation in probability of a particular firm to succeed in a tender. The p-value of F-test indicates that the model is jointly significant at 95% level. For complex table including all values see below.

**Figure 24:** LPM on ECO dataset; dependent variable: SME dummy

Explanatory Variable	$\beta$	
estimated unit price (CZK/kWh)	-0,010 (0,019)	
estimated total price (CZK)	-0,005 (0,005)	
e-auction dummy	0,086 (0,068)	
CA Municipality dummy	0,21 (0,09)	**
number of bidders	0,014 (0,015)	
log (turnover required)*over-the-threshold	0,001 (0,004)	
zIndex	1,029 (1,074)	
time	-0,0002 (0,00009)	***
constant	4,463 (1,658)	***
R - squared	0,1828	
P > F	0,0174	

**Source:** own computation; note: robust standard errors are applied; dummy variables skipped are the rest of CA and other types of procedures<sup>38</sup>

No other interaction terms were unveiled significant and the model seems to have all causalities linear as Ramsey test did not reveal any quadratic term to be missing in the model.

**Figure 25:** LPM ECO Dataset equation

$$SME\ dummy = 4.463 + 0.21\ CA\ Municipality\ dummy - 0.0002\ time + \epsilon$$

<sup>38</sup> The level of significance is denoted by a number of stars: one star indicates 90% significance level, two stars indicate 95% significance level and three stars indicate 99% significance level

Implications stemming from the table above are stated here.

- As the model points out, distinct chances of SMEs to succeed in a PP tenders among various types of CAs exist. It reveals that a tender announced by any municipality increases chances of SME to win this contract by 21% in comparison with the rest of contracting authorities. Such effect was found out very statistically significant (at 95% significance level) and its implications will be discussed in the part devoted to hypotheses testing.
- Surprisingly, the success rate of SMEs was declining over time. Since the beginning in 2008 to April 2012 where our ECO dataset terminates because of the amendment on PP Act, a probability to win dropped by 7% as another additional year passed by. Such finding is worth attention and therefore we will take a closer look at it.

Soudek (2012) concluded that final prices in the electricity sector were declining over time. Predominantly it was argued that this happened due to higher competitive environment representing by procedural characteristics such as use of electronic auction and elevated number of bidders.

Our expectations were as follows – higher competition for procurement should lead to broader access of SMEs into these tenders and thus enhanced chances to succeed.

Nevertheless, neither of these two procedural characteristics was found to have a significant effect on probability of SME to succeed.

E-auction is the most effective tool how to reduce final price because it unveils the willingness of bidders to pay. Thus the principle of value for money is prioritized. Given those facts, there often appears at least one strong competitor who can exploit its resources and use the benefit of economies of scale.

A similar argumentation holds for the case of number of bidders where the tool of e-auction was not applied. Although the competitors cannot know offers of other competitors in advance, it can emerge at least one stronger opponent exploiting its position and size especially with regards to those contracts where broader competition is expected.

As our model unveiled, SMEs might be to some extent dependent on contracts announced by municipalities. Since 2009 Czech government applied several austerity measures in order to mitigate consequences of recession. This trend can be observed on data on public spending where from 2009 to 2011 public purchases have been stagnating or even slightly falling.<sup>39</sup> As a consequence of tighter budget constraints and increased uncertainty in management of smaller and more autonomous entities public purchases on regional level decreased as well. This fact might provide an answer on the effect of time on a probability of SME to succeed in PP.

- Estimated unit price apparently do not affect the probability of SME to succeed. It may be caused by two inverse effects. First when heterogeneity of purchasing commodity comes into place then certain potential applicants are excluded because of specifications on contract type<sup>40</sup> (i.e. not qualification criteria nor size of a contract). For this reason we would expect that estimated unit price should have a negative effect on probability of SME to win. Nevertheless, if we consider that for vast majority of contracts the assumption of heterogeneity does not hold then higher unit prices might be explained by greater allocation of money to specific CA and thus higher willingness to pay. For example municipalities have no reason to use specifications in their contracts and therefore homogeneity of a commodity is guaranteed. Furthermore if we take into consideration lack of specialisation and expertise of municipal officials, we can firmly understand why unit prices estimated

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<sup>39</sup> See Figure 1

<sup>40</sup> For further explanation see previous Chapter 5.3.1.3, an example of railways is used.

by municipalities strikingly differ from unit prices on the commodity exchange. Now if we put this argument together with our results then it should be obvious why estimated unit price was not proven to significantly affect the probability of SME to win.

- A measure of “wasteful behaviour”, zIndex, has not a significant impact on our dependent variable despite of firmly positive correlation between these two. This proxy of honest practices in PP stresses transparency and especially competition in public tenders. Thus result obtained from our model goes in line with our findings on other variables such as number of bidders and use of electronic auction discussed above.

The rest of explanatory variables were not proven to have any significant impact on our dependent variable. Detailed discussion on these findings might be seen in part related to hypotheses testing.

### **5.3.2.2 TECH Dataset – LPM**

LPM applied on TECH dataset contains only 85 observations and therefore the results of regression might be distorted by smaller sample size. Nevertheless, we strongly believe that powerful statistical analysis might be provided.

The value of R-squared suggests that explanatory variables explain more than 28% of variation in our dependent variable. Furthermore the F-test proves a joint significance even at 99% level. These two figures might be to certain extent influenced by smaller sample size. The results are summarized in a table below.

**Figure 26:** LPM on TECH dataset; dependent variable: SME dummy

Explanatory Variable	$\beta$	
estimated unit price (CZK/kWh)	-0,048 (0,035)	
estimated total price (CZK)	-0,006 (0,007)	
e-auction dummy	-0,108 (0,087)	
CA Municipality dummy	0,32 (0,10)	***
number of bidders	0,044 (0,030)	
(number of contracts required)*over-the-threshold	-0,011 (0,019)	
zIndex	1,191 (0,454)	***
date after April 2012 dummy	0,111 (0,117)	
constant	-0,742 (0,338)	**
R - squared	0,2866	
P > F	0,0001	

*Source: own computation; note: robust standard errors are applied; dummy variables skipped are the rest of CA, date before April 2012 and other types of procedures*<sup>41</sup>

**Figure 27:** LPM TECH Dataset equation

$$SME\ dummy = -0.742 + 0.32\ CA\ Municipality\ dummy + 1.191\ zIndex + \varepsilon$$

<sup>41</sup> The level of significance is denoted by a number of stars: one star indicates 90% significance level, two stars indicate 95% significance level and three stars indicate 99% significance level

No quadratic nor other interaction term was found out significant. Again strong consistency of results is observed thus only few important facts are stated below.

- The impact of municipality as CA on probability to succeed is even stronger. The explanatory variable is significant even at 99% level. The probability rises by 32% once a tender is announced by any municipality.
- An explanatory variable for zIndex seems to have substantial impact on dependent variable. It says that enhanced assessment by 0.1 on the scale of zIndex should improve chances of SME to succeed in a tender by almost 12%. This result seems quite reasonable as zIndex, a measure stressing transparency and competition in PP, might improve chances of SMEs to bid in more tenders. However, expectations suggesting higher chances of SMEs in competitive environment were disproved. One of possible arguments might be that zIndex includes advices of “Code of Best Practices in PP” made by European Commission<sup>42</sup> (e.g. whether CA sub-divides individual contracts on smaller parts or whether it facilitates initial administration process to avoid high sunk costs etc.). Nonetheless, these are only minor components of zIndex and therefore we assume that such a significant effect is caused by poor dataset rather than structural composition of zIndex.

The rest of explanatory variables remained insignificant, i.e. they do not influence chances of SME to succeed in a tender. Most of them turn out to be in line with results from the first model and thus the interpretation remains identical. Those variables which are of major interest of this study are highlighted and discussed in the following part.

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<sup>42</sup> Commission of the European Communities. (2008). *European Code of Best Practices Facilitating Access by SMEs to Public Procurement Contracts*. Retrieved June 21, 2015 from [http://ec.europa.eu/internal\\_market/publicprocurement/docs/sme\\_code\\_of\\_best\\_practices\\_en.pdf](http://ec.europa.eu/internal_market/publicprocurement/docs/sme_code_of_best_practices_en.pdf).

### 5.3.2.3 Hypotheses evaluation - LPM

Primary aim of this part of study was to detect factors influencing the probability of SME to win a public contract. For this purpose LPM was applied on our two datasets and following results were obtained.

**Figure 28:** Results comparison; dependent variable – SME dummy

Explanatory Variable	ECO	TECH
estimated unit price (CZK/kWh)	N/S	N/S
estimated total price (CZK)	N/S	N/S
e-auction dummy	N/S	N/S
CA Municipality dummy	0.21	0.32
number of bidders	N/S	N/S
(qualification criteria required)*over-the-threshold	N/S	N/S
zIndex	N/S	1.19
time	-0.0002	N/A
date dummy 2012	N/A	N/S

**Source:** own computation; N/S – not significant, N/A – not available.

Except for the impact of zIndex (discussed in the previous section) the results of our models seem to be firmly consistent. As our prime objective is to evaluate the impact of various institutional and procedural factors on probability of SME to succeed, following hypotheses will be verified and their implications will be discussed here.

***H6: Probability of SME to win a tender is a decreasing function of an estimated total price of PP.***

Size of PP represented by estimated total price was not proven to have a significant impact on chances of SME to succeed. Basically the results are saying that SMEs are not restricted by lack of resources in the area of electricity and gas deliveries when it comes to homogeneous goods. If heterogeneity is present than certain SMEs might be constrained by specifications of deliveries imposed by CAs (as in case of railways



supplies). However such specifications remain uncovered in a contract proposal thus creating an information asymmetry between expectations of CAs and bidders. Subsequently saying that unobserved specifications of a contract reduce chances of SME to succeed in a tender rather than its size, we have to reject our expectations based on Loader (2011).<sup>43</sup>

***H7: System of required criteria on the amount of turnover effectively blocks capability of SMEs to win over-the-threshold contracts.***

Primary aim of this hypothesis is to examine whether the amount of turnover required in the contract proposal represents a barrier to entry into high-volume contracts for SME. Apparently our results did not confirm Rasheed's study (2004) on the amount of capital required by rejecting the impact of economic qualification criteria on chances of SME to win procurement contract. According to explanation given in Chapter 5.3.1.3 this might be caused by low levels of requirements on the amount of turnover. Additionally smaller suppliers are able to catch up in the field of retail deliveries where the essential part of their budgets is stemming from.

***H8: System of required criteria on number of contracts effectively blocks capability of SMEs to win over-the-threshold contracts.***

Technical qualification criteria represented by number of contracts required by CA could potentially restrict the ability of SME to compete for a tender. Hence negative relationship was expected and tested here. However, our model did not prove a significant impact of these requirements on a probability of SME to succeed. One possible explanation might be that smaller firms were able to succeed in greater number of small-scale contracts or contracts without further specification (e.g. as is the case of railways). Consequently, a number of contracts required by CA do not feature a barrier to entry

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<sup>43</sup> For further discussion see Chapter 3.4 Hypotheses and motivation

into such tenders for SMEs. What would be exciting to measure is to examine specific amount of these contracts required by CA. Unfortunately as we mentioned earlier, Czech informational portal does not provide solid data with respect to volume or size of contracts required by CA.

***H9: Probability of SME to win a tender is significantly affected by a specific type of contracting authority.***

More specifically we were investigating a change in probability of SME to succeed if it is a municipality who announces a tender. As Loader (2011) suggests SMEs are more likely to thrive where local and regional authorities are purchasing public goods or deliveries through PP. Such positive effect was confirmed in both our models. In average chances of SME to win a public contract might be enhanced by 20-30% when it comes to municipal PP. We consider these findings reasonable being in line with our previous results. Number of bidders in tenders announced by municipalities is relatively smaller, i.e. environment in these tenders is less competitive. Nevertheless it does not necessarily mean that those contracts are smaller in size (e.g. large-scale contracts announced by cities have to be taken into account as well). The point is that large incumbents on the market concentrate on highly specified large-scale deliveries rather than incur administration costs associated with entry into procurement in every single municipality. This leaves space for SMEs to be successful on regional procurement level.

***H10: Probability of SME to win a tender significantly increased after the removal of economic qualification criteria in April 2012.***

Since April 2012 economic qualification requirements were forbidden to be imposed by CAs. The amendment of PP Act from April 2012 replaced economic criteria by affidavit regarding the ability to supply. Our expectations on positive impact of this event on probability of SME to succeed in a tender were not confirmed and thus we reject the

hypothesis. Such result documents a futility of this tool as the amount of turnover required has not been proven to affect chances of SME to succeed neither.

## 6 Conclusion

First model attempted to explain prime determinants of variation in profit margin of public procurement suppliers. Estimated unit price by contracting authority significantly affects profit margin of PP suppliers. Such effect might be interpreted as a heterogeneity of delivered goods, i.e. information asymmetry between contracting authorities and bidders, or greater allocation of public resources resulted in higher willingness to pay of particular contracting authority. However, this effect was successfully refuted by an application of electronic auction. Such tool completely cancelled out signalling power of contracting authorities by revealing willingness to pay of potential suppliers, and in turn squeezed their profit margins.

Anticipated positive effect of qualification criteria as representatives of possible barriers to entry on profit margins was not confirmed. Qualification criteria were represented by the amount of turnover and the number of contracts previously supplied imposed by contracting authorities. Amount of turnover did not feature a key obstacle to smaller suppliers because they were able to catch up in the field of retail deliveries where the essential part of their budgets is stemming from. Similarly, those firms were able to succeed in greater number of lower-volume contracts and thus they could participate in tenders where higher number of contracts was required.

The impact of another potential barrier to entry, economies of scale, on profit margin was not found out neither. Economies of scale might represent barriers to entry when an incumbent with abundance of resources can exploit its large-scale production to lower final price and consequently profit margin. However, such effect might be offset by lesser competitive environment (because only few market players have the capacity to deliver such amounts) releasing the stress on value for money.

Similarly the involvement of SMEs in fulfilment of public deliveries did not significantly reduce profit margin of suppliers. This goes in line with findings that SMEs were not

able to succeed in procedures where competitive tools and value for money were stressed, e.g. electronic auctions.

In fact profit margin of PP suppliers was successfully reduced by fostering competitive environment primarily through procedural characteristics such as the use of electronic auction. This view was supported by negative impact of higher amount of bidders involved in a tender on profit margin.

Second model addressed the effect of institutional and procedural characteristics of public procurement on probability of SME to win a tender.

This time positive effect of more competitive environment represented by the use of electronic auction and the involvement of greater number of bidders was not detected. The reason might be that in more competitive environment where value for money is prioritised, it can always appear at least one strong competitor who is able to exploit its size and resources to offer lower price for a contract. Consequently chances of SMEs in such environment tend to decline.

On contrary chances of SMEs grew when it was a municipality who announced a tender. Such effect was estimated on 20-30% increase in probability to succeed. The explanation is that large incumbents concentrate on specified large-scale deliveries rather than incur administration costs associated with entry into every public tendering. Hence it leaves space for SMEs to be successful on regional procurement level.

Probability of SMEs to win a public contract was declining from 2009 to 2011. Such decline might be caused by austerity measures implied by Czech government in 2009. Those measures had a substantial impact on decision-making of municipalities which tend to be more autonomous than the rest of contracting authorities and thus behave more economically in terms of public spending. As discussed above the success of SMEs

in public tendering was significantly linked to municipalities. Such decline in spending on public purchases noticeably deteriorated a probability of SMEs to succeed over time.

Furthermore, results did not prove improved chances of SMEs while competing for low-volume contracts as suggested by Loader (2011). In fact SMEs were successful in competing for higher-volume contracts as well. Nonetheless, their chances were restricted by unobserved specifications of contracts, i.e. heterogeneity, rather than their size.

The impact of potential barriers to entry on probability of SMEs to win a tender was of primary interest. Qualification criteria imposed by contracting authorities representing artificial barriers and economies of scale representing structural barriers were tested but none of these potential barriers to entry has been detected to restrict chances of SME in the competitive process. Consequently we dare to say that neither qualification criteria nor economies of scale represent barriers to entry into public procurement in the Czech Republic.

This thesis has shown that ensuring more competitive environment in a bidding process by bolstering specific procedural characteristics might reduce profit margins and in turn decrease final price of procurement. Promotion of SMEs is not an easy task to employ as their success relies on institutional characteristics rather than procedural ones. Nevertheless, there is still a wide space for implementing supportive tools like set-asides, facilitated administration or workshops carried out for SMEs to foster their chances in public procurement.

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## Online sources

<https://www.pxe.cz/>

<http://cae.zindex.cz/>

<http://www.centralniadresa.cz/cadr/>

<http://www.isvz.cz/>

## Appendix A – OLS Assumptions

To provide best linear unbiased estimators OLS regression must satisfy following assumptions.

First, randomness of data must be checked – see Chapter 5.1.4. To repeat the conclusion: The dataset consists of public contracts within given commodity minus incomplete observations. There is no reason to assume that these missing observations are somehow correlated with profit margin or success of SME. Thus we can say that our datasets are random sub-samples of our initial sample.

Second, models have to be linear in parameters. This is designated by regression equations in chapters devoted to model specifications - see figures 16 and 17.

Third, homoscedasticity<sup>44</sup> of residuals needs to be tested. Breusch-Pagan test was used in order to detect homoscedastic residuals but it was rejected in all three cases.

**Table 1:** Breusch - Pagan test;  $H_0$ : constant variance of residuals

	OLS ECO	OLS TECH	LPM ECO	LPM TECH
$\chi^2$	43,54	109,27	50,68	18,94
$P > \chi^2$	0	0	0	0

*Source: own computation.*

Nevertheless, heteroscedastic residuals do not cause any bias in our estimators. To be able to use t and F tests to assess statistical significance robust standard errors need to be used.

In order to make OLS regression work properly the presence of multicollinearity has to be rejected. For such purpose variance inflation factor (VIF) needs to be applied. Any

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<sup>44</sup> Equal variances of all random variables.

value below 5 indicates no multicollinearity presence in the model which was confirmed in all our models.

**Table 2:** Variance inflation factor

	OLS ECO	OLS TECH	LPM ECO	LPM TECH
Mean VIF	1,16	1,37	1,30	1,43

*Source: own computation.*

Last but not least, normality of residuals needs to be tested. Shapiro-Wilk test represents a test of normality residuals and it rejects normality in all our models.

**Table 3:** Shapiro – Wilk test; H0: normal distribution of residuals

	OLS ECO	OLS TECH	LPM ECO	LPM TECH
z	6,877	5,102	6,499	3,265
P > z	0	0	0	0,00055

*Source: own computation.*

It basically means that there might possibly exist nonlinear unbiased estimators with smaller variance. Nonetheless, we dare to say that our datasets are sufficiently large enough that our estimators satisfy asymptotic normality and we are able to use t and F-test for hypotheses testing.<sup>45</sup>

Eventual issues on classical linear assumption were discussed and resolved thus we are able to use OLS estimators in our models.

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<sup>45</sup> For further discussion see Wooldridge, J. M. (2009). *Introductory Econometrics*, second edition. (p. 167).

## Appendix B - Logit

For comparison of LPM we enclose the results of Logit models applied on both datasets.

**Table 4: Logit applied on ECO dataset; dependent variable: SME dummy**

Explanatory Variable	$\beta$	
estimated unit price (CZK/kWh)	-0,40 (0,46)	
estimated total price (CZK)	-0,58 (0,74)	
e-auction dummy	0,77 (1,04)	
CA Municipality dummy	2,03 (0,84)	**
number of bidders	0,298 (0,199)	
log (turnover required)*over-the-threshold	0,02 (0,05)	
zIndex	13,84 (17,53)	
time	-0,0030 (0,0012)	**
constant	50,36 (20,52)	**
Pseudo R - squared	0,2697	
$P > \chi^2$	0,0003	

*Source: own computation; note: robust standard errors are applied; dummy variables skipped are the rest of CA, date before April 2012 and other types of procedures*<sup>46</sup>

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<sup>46</sup> The level of significance is denoted by a number of stars: one star indicates 90% significance level, two stars indicate 95% significance level and three stars indicate 99% significance level

**Table 5:** Logit applied on TECH dataset; dependent variable: SME dummy

Explanatory Variable	$\beta$	
estimated unit price (CZK/kWh)	-0,70 (0,62)	
estimated total price (CZK)	-5,78 (5,45)	
e-auction dummy	-0,68 (0,92)	
CA Municipality dummy	2,58 (0,95)	***
number of bidders	0,406 (0,195)	**
(number of contracts required)*over-the-threshold	0,003 (0,175)	
zIndex	12,45 (7,36)	*
date after April 2012 dummy	0,50 (0,84)	
constant	-11,07 (5,11)	**
Pseudo R - squared	0,3719	
$P > \chi^2$	0,0234	

*Source: own computation; note: robust standard errors are applied; dummy variables skipped are the rest of CA, date before April 2012 and other types of procedures <sup>47</sup>*

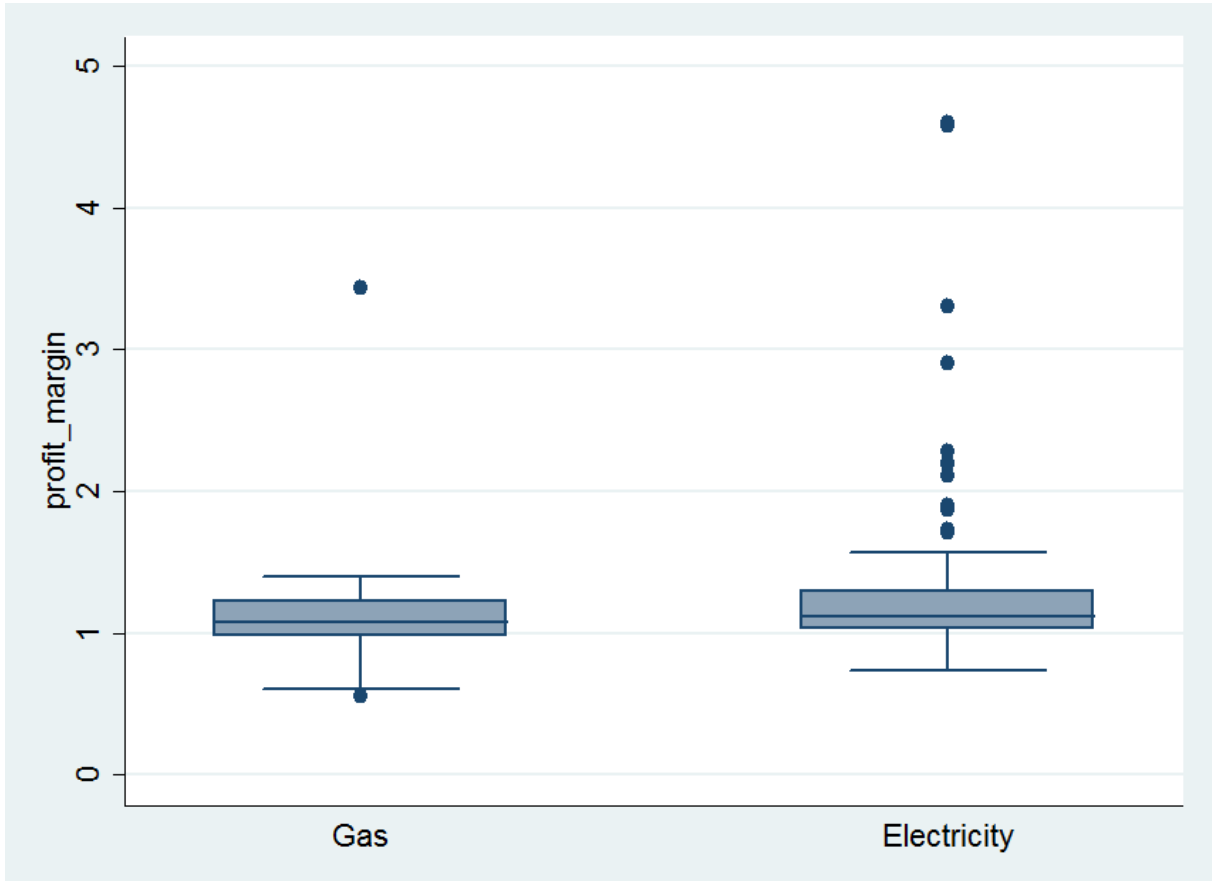
Tables above prove consistency between results obtained by LPM and Logit.

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<sup>47</sup> The level of significance is denoted by a number of stars: one star indicates 90% significance level, two stars indicate 95% significance level and three stars indicate 99% significance level

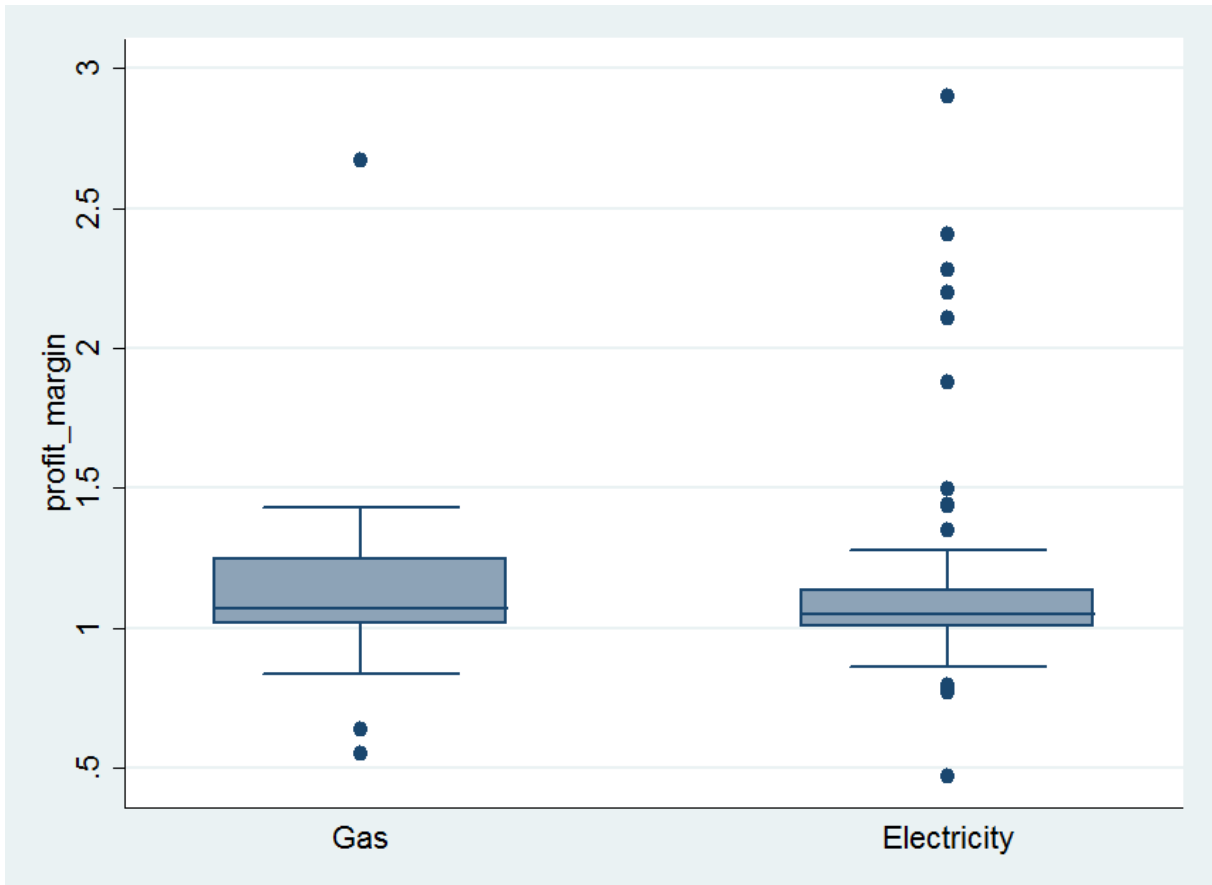
## Appendix C – Graphs on t tests

Figure 29: t test with unequal variances applied on ECO Dataset



Source: own construction.



**Graph 2:** t test with unequal variances applied on TECH Dataset

*Source: own construction.*