# ANALYSIS OF MARKET CONCENTRATION IN SELECTED SECTORS OF PUBLIC PROCUREMENT

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## Abstract

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The goal of this article is the analysis of influence of market concentration in selected areas of public procurement on chosen parameters of public procurement in years 2007 and 2011. Five concentration ratios and five parameters of contracts are calculated for each of five chosen areas of public tenders in 2007 and 2011. After this task, the correlation analysis between concentration ratios and parameters of contracts is done for finding out mutual relation between these two variables. Correlation analysis is then compared with four created hypotheses about the relationship between market concentration and parameters of public procurement The results of the analysis are surprising, because in most cases, the stated hypotheses were rejected, meaning that the correlations between the parameters of public procurement and market concentration were different than this study predicted based on economic theory. The possible reasons for this result, discussed in the article, are corruption and also poor quality of data from Information system of public procurement administered by the Ministry for Regional Development of Czech Republic.

Keywords: concentration ratios, public tenders, parameters of contracts, analysis, correlation

## INTRODUCTION

Public procurement is one of the most discussed economic topics nowadays. In the last decade, public procurement have become synonym for low transparency of functioning of public sector and corruption in the eyes of people living in Czech Republic. Spending on public procurement represents relatively significant amount of public expenditures. For example, spending on public procurement were 474 billion Czech crowns in 2007 (amount matching 12.9% of GDP that year) and 499 billion Czech crowns in 2011 (amount matching 13% of GDP that year) (Ministerstvo pro místní rozvoj, 2013).

Market of public procurement is quite specific and it is necessary to approach it that way when working with influence of market concentration. Influence of market concentration on public procurement's market can be different from influence, which we would be expecting from our knowledge of different markets. This statement is based on two assumptions. Firstly, Public procurement is part of public sector that follows public interest more than market principles and this may soften down the influence of market concentration. Second assumption is that already mentioned corruption and low transparency can cause major change of parameters of concluded public procurement like final price of procurement or amount of non-competitive selection methods.

The goal of this article is the analysis of influence of market concentration (determined by chosen concentration ratios) on selected parameters of public procurement in chosen areas of public procurement in years 2007 and 2011. The areas are: construction industry, informatics and telecommunications, automotive industry, waste management and education. This analysis tries to verify four created hypotheses about mutual link between market concentration and parameters of public procurement.

This article is divided into five parts. First part sums up current state of knowledge in this field. Second part sets hypotheses about the influence of market concentration on the parameters of public procurement. Third part describes methods used for measuring the market concentration via chosen indexes of concentration and process of making the analysis. Next chapter presents results of the analysis and final chapter concludes the whole theme of the analysis and adds recommendations and motives for further research in this area.

## Background Research

Influence of market concentration on functioning and parameters of market was already described by many authors (Peltzman, 1977; Mises, 2006; Friedman, 1993; Zemplinerová, 1999). Generally speaking, we can say that the higher market shares of a few companies, in comparison with rest of companies on the market are, the higher is market concentration and the more is market misaligned from the state of perfect competition towards imperfect competition market. From the view of national economy is high concentration seen negatively, because it indicates, that there are only a few companies on the market with high market share and dominant position on the market. Dominant position allows company to use monopoly behavior, which cause many unwanted effects like economical inefficiency or low quality of produced goods and services. On the other hand, from the perspective of the company itself, it is much desired to have high market share. In the most of cases, there is positive correlation between market concentration and company profits (Holman, 2002). Higher market share leads to bigger company profits from two reasons. First reason is in the area of costs as company gains savings from scale of production, because amount of fixed costs is divided by bigger volume of production. Also in the area of prices, it is quite possible for company with high market share to set prices higher than it would be done by market equilibrium.

In the past, some authors (Pavel, 2010; McKie, 1970; Bajari, 2001; Kuhlman and Johnson, 1983) or institutions (OECD, 2008) have already explored the influence of market concentration on the market of public procurement.

Pavel, same as Kuhlman and Johnson explored the influence of market concentration on the price of construction of big traffic infrastructure (e.g. highways) and in their conclusions they agreed that with lower market concentration, meaning higher number of applicants for public procurement, the final prices is lower. Interesting fact is, that based on the study of Kuhlman and Johnson, lowering of the price is not caused by potential competition but only real competition.

Another author, McKie, has done analysis about the influence of concentration on army public procurement market in USA. Results show, that correlation between market concentration and earnings of companies from contracts on army market is not clear. It is also mentioned, that results could be distracted by bad quality of data used for analysis.

Bajari in his study identifies only theoretical basis of influence of the market concentration on public procurement market. It is clear from his conclusion, that the more companies apply for public procurement, the better is the effectivity of their competition, because companies come up with more aggressive offers and it decreases the price of contract.

OECD recommends its members to fight against collusive cartels on the public procurement market. According to OECD, non-concentrated market with more competitors, who don't make secret, illegal price deals, ensures effective economy with public resources on public procurement market. Public procurement market is also more prone to cartelization and usage of illegal practices, because competing companies can make deals more easily than on other markets.

## Hypotheses About Market Concentration and Parameters of Public Procurement

Four hypotheses about mutual link between market concentration and parameters of public procurement were made based on general economical knowledge of how market and competition works (Rothbard, 2009; Mises, 2006; Holman, 2002) as well as on research of specificity of competition on public procurement market (Pavel, 2010), (Němec, Vítek, Meričková, 2005). Also further logical explanations are provided for each hypothesis bellow to show, how were hypothesis deduced. The hypotheses are:

1. **Increase of market concentration will lead to lower average number of offers.** It can be assumed, that if a market is more concentrated, there will be lower competition between contractors and this will lead to lower average number of offers. Therefore there should be indirect correlation between indexes of concentration and average number of offers.

2. **Increase of market concentration will lead to higher quotient of final and estimated price of public procurement.** If market is more concentrated, companies on this market should be able to use more their dominant position and set higher final prices of public procurement against estimations of contracting authority. Therefore there should be direct correlation between indexes of concentration and quotient of final and estimated price of public procurement.

3. **Increase of market concentration will lead to higher share of noncompetitive methods used for assigning public procurement.** This hypothesis can be spread into two parts. Firstly, if there will be only one or a few companies on the market (index of concentration will be high), we can assume, that contracting authority will be

more likely to choose noncompetitive method of assigning public procurement. Contracting authority will probably directly address chosen companies on the market. Secondly, there is a chance, that if there are only a few companies on the market, they will have power to enforce noncompetitive method in selection process. Therefore there should be direct correlation between indexes on concentration and share of noncompetitive methods.

4. **Market concentration will not influence final and estimated price of public procurement.** It is assumed, that there is no correlation between these two variables. Final and estimated price should be influenced by other factors like size, structure, development and capital intensity of industry. Not by market concentration. This assumption is in conjuncture with opinion of Hall and Tidemann, who wrote, that one attribute of concentration index should be independence of its value on size and structure of industry (Hall and Tideman, 1967).

## MATERIALS AND METHODS

Market concentration is measured by indexes of concentration. Concept and creation of concentration indexes is very widely debated theme in economical literature (Bikker, 2002; Hall and Tideman, 1967; Scitovski, 1955; Zemplinerová, 1999). There are many approaches to these indexes, yet it is possible to find general agreement in basic findings about its creation. Concentration indexes work with number of companies on a market and with shares of these companies. General form of concentration index CI is this:

$$CI = \sum_{i=1}^{n} s_i w_i .$$ (1)

Letter $s_i$ marks share of a company, $w_i$ is weight assigned to share of a company and letter $n$ determines number of companies on a market.

Concentration index can be classified according to the way it weights market share of a company or according to its structure. The way index weights individual shares determines its sensitivity to changes of distribution of low value market shares of companies (Bikker, 2002).

These indexes were chosen for analysis in this article:

### Concentration Ratio – CR

Concentration ratio is the most widely used index due to its simplicity and low requirements for input. It is sum of shares of $n$ biggest companies on a market. The formula for calculation is this:

$$CR_k = \sum_{i=1}^{n} s_i .$$ (2)

Value $s_i$ is share of $i$-th company on a market and $n$ is number of biggest companies on a market that are used for calculating the index. Value of the index ranges from 0% to 100%. The higher the value is the higher is rate of market concentration on given market (Zemplinerová, 1999). For calculation in this article were used two concentration ratios:

- **CR1**. This is a market share of the biggest company on a market. This ratio is used to find out monopoly on a market.
- **CR4**. This ration is calculated as sum of share of four biggest companies on a market. Its value is used to analyze oligopoly structures.

### Herfindahl-Hirschman Index – HHI

Herfidahl-Hirschman index is also very widely used. Its principle is, that size of market share of company is also used as weight in the general formula for concentration indexes CI. Therefore this index is calculated as square sum of market shares of companies on the market. The formula is this:

$$HHI = \sum_{i=1}^{n} s_i^2 .$$ (3)

Value $s_i$ is share of $i$-th company on a market. Letter $n$ marks number of companies on a market. Value range of the index is from 0 to 10 000. Values under 1 500 points indicate non-concentrated market. Values between 1 500 and 2 500 indicate slightly concentrated market and values over 2 500 indicate highly concentrated market. Value 10 000 is for monopoly with only one company on the market (Horizontal merger guidelines, 2010).

### Hall-Tideman Index – HTI

Hall-Tideman index is based on principles, which were described by its authors as basic requirements for concentration index. Especially requirement to include number of companies into formula, because this reflects conditions for entry of new companies into industry. Formula of this index is following:

$$HTI = \frac{1}{(2\sum_{i=1}^{n} is_i - 1)} .$$ (4)

Value $s_i$ is share of $i$-th company on a market. This value is weighted by rank $i$, which was assigned to the company by setting up the ranking of companies according to their market shares from largest to smallest. The letter $n$ represents the number of companies on the market. The largest company gets the weight in the value of $i = 1$. Hall-Tideman index has values from 0 to 1, where value 0 indicates that there is an infinite number of equally sized companies on a market and value 1 means that a market is a monopoly. Hall-Tideman index should be used to calculate market concentration on markets, where there are several large companies,

but the market is influenced by a large number of companies with a small market share (Bikker, 2002).

### Gini Coefficient – GC

The Gini coefficient is used to detect uneven distribution of a quantity. In case of calculating the concentration index this quantity is market share. The Gini coefficient expresses the quotient between the area under the diagonal axis that forms a 45 degree angle with the horizontal axis of the graph, and the area that is under the Lorenz curve. Diagonal axis indicates the uniform distribution of the variable, while the Lorenz curve shows the actual distribution of values. If the Lorenz curve is identical to the diagonal axis, then the actual distribution of quantity will be uniform. Formula of Gini coefficient is this:

$$G = \frac{n+1-2\sum_{i=1}^{n} s_i}{n}. \tag{5}$$

Value $s_i$ is share of $i$-th company on a market. This value is weighted by rank $i$, which was assigned to the company by setting up the ranking of companies according to their market shares from largest to smallest. The letter $n$ represents the number of companies on the market (Latreille and Mackley, 2011).

Some economists dismiss the Gini coefficient as unreliable and misleading for the calculation of market concentration as it only indicates inequality in the distribution of market shares and is not affected by the total number of companies on the market. But total number of companies is relevant factor in terms of market concentration (Scitovski, 1955).

### Data and Analysis of Market Concentration Procedure

Data about public procurement for the analysis were obtained from Information system of public procurement administered by the Ministry for Regional Development (Ministry for Regional Development of Czech Republic, 2013). Public procurements below and above threshold were included in the analysis of market concentration in five selected areas of public procurement in the Czech Republic in 2007 and 2011. Relevant public procurements from these two years were selected into the areas according to its CPV code. These areas and assigned CPV codes in round brackets are: construction industry (45000000-7, 44000000-0, 43300000-6, 71000000-8), informatics and telecommunications (64200000-8, 32000000-3, 72000000-5, 48000000-8), automotive industry (34100000-8, 34200000-9, 34300000-0), waste management (90000000-7) and education (80000000-4).

Analysis of market concentration consisted of several parts. Firstly, collected data were purged and processed. Then, the selected parameters were calculated in chosen areas for both years. These parameters are: **the average number of bids, the average quotient of the final and estimated price of contracts, the average size of the contract, the average estimated size of the contract and the share of non-competitive methods** (calculated parameters, including number of procurements in each area, are listed in the attachment of this article). Then, concentration indexes were calculated for each of the chosen areas in both selected years. Concentration indexes were compared with the parameters of contracts by correlation analysis to determine whether market concentration has an effect on parameters of public procurement. These results were then compared with created hypotheses about the relationship between market concentration and parameters of public procurement. Verification of hypotheses was done separately for both observed years 2007 and 2011. The reason for this is because the shape of economy of Czech republic changed significantly between 2007 and 2011. While in 2007 there was conjuncture in Czech Republic. In 2011 the economy was still dealing with problems caused by recent global financial crisis (ČSÚ, 2014; Tomšík, 2011).

### RESULTS

#### Construction Industry

Concentration indexes calculated for the construction industry in 2007 and 2011 are shown in Tab. I.

I: *Concentration indexes for construction industry in 2007 and 2011*

| Concentration indexes | 2007 | 2011 |
|---|---|---|
| CR1 | 0.20 | 0.08 |
| CR4 | 0.42 | 0.26 |
| HHI | 623.27 | 279.54 |
| GC | 0.83 | 0.76 |
| HTI | 0.01 | 0.02 |

Source: own elaboration

For year 2007, all coefficients except for Gini coefficient indicate unconcentrated market. The strongest company has a market share of 20%; the combined market share of the four biggest companies is 42%. Values of Herfindahl-Hirschman index is well below the 1500 and Hall-Tideman index with value 0.01 indicates the smallest market concentration levels of all indexes. Conversely, the Gini coefficient refers to the concentrated market. As it turned out later, this index is not very suitable for the calculation of market concentration, when there are many companies on the market with a very small market share. Interpretation of the degree of market concentration according to this index is usually mismatched with other indexes. This confirms the view (Scitovsky, 1955), that the Gini

coefficient is inappropriate and misleading for the calculation of market concentration, because it only identifies unevenness in the distribution of market shares, but is not affected by the total number of companies in the market. The interpretation of market concentration for 2011 is similar to 2007.

## Informatics and Telecommunication (ICT Sector)

Concentration indexes calculated for the informatics and telecommunication sector in 2007 and 2011 are shown in Tab. II.

The situation with market concentration in this area is similar to construction industry. Indexes of the concentration can be interpreted the same way.

II: *Concentration indexes for informatics and telecommunication in 2007 and 2011*

| Concentration indexes | 2007 | 2011 |
|---|---|---|
| CR1 | 0.15 | 0.14 |
| CR4 | 0.40 | 0.43 |
| HHI | 526.60 | 643.98 |
| GC | 0.74 | 0.71 |
| HTI | 0.03 | 0.05 |

Source: own elaboration

## Automotive Industry

Concentration indexes calculated for the automotive industry in 2007 and 2011 are shown in Tab. III.

For year 2007, all coefficients except for Gini coefficient indicate unconcentrated market. The strongest company has a market share of 15%; the combined market share of the four biggest companies is 49%. Values of Herfindahl-Hirschman index and Hall-Tideman index indicate noncompetitive market. For 2011, the concentrations indexes indicate an increase in the degree of concentration on this market.

III: *Concentration indexes for automotive industry in 2007 and 2011*

| Concentration indexes | 2007 | 2011 |
|---|---|---|
| CR1 | 0.15 | 0.47 |
| CR4 | 0.49 | 0.77 |
| HHI | 792.75 | 2674.46 |
| GC | 0.77 | 0.79 |
| HTI | 0.05 | 0.16 |

Source: own elaboration

## Waste Management Industry

Concentration indexes calculated for the waste management industry in 2007 and 2011 are shown in Tab. IV.

For year 2007, all coefficients except for Gini coefficient indicate unconcentrated market. The

IV: *Concentration indexes for waste management industry in 2007 and 2011*

| Concentration indexes | 2007 | 2011 |
|---|---|---|
| CR1 | 0.16 | 0.30 |
| CR4 | 0.53 | 0.68 |
| HHI | 886.87 | 1472.52 |
| GC | 0.71 | 0.67 |
| HTI | 0.07 | 0.12 |

Source: own elaboration

strongest company has a market share of 16%; the combined market share of the four biggest companies is 53%. The value of the Herfindahl-Hirschman index is below 1500. Hall-Tideman index is close to zero, it means that the market is unconcentrated. For 2011, the concentrations indexes indicate an increase in the degree of concentration on this market.

## Education Industry

Concentration indexes calculated for the education industry in 2007 and 2011 are shown in Tab. V.

In 2007, the market share of the largest company is 27%. The share of the four largest companies is 77%. Herfindahl-Hirschman index is in the range of 1500–2500 for moderately concentrated market. The Gini coefficient also points to moderately concentrated market. Only Hall-Tideman index indicates non-concentrated market. For 2011, the concentrations indexes indicate an increase in the degree of concentration on this market.

V: *Concentration indexes for education industry in 2007 and 2011*

| Concentration indexes | 2007 | 2011 |
|---|---|---|
| CR1 | 0.27 | 0.45 |
| CR4 | 0.77 | 0.83 |
| HHI | 1690.33 | 2641.94 |
| GC | 0.62 | 0.63 |
| HTI | 0.18 | 0.24 |

Source: own elaboration

## Comprehensive Correlation Analysis for 2007

This section focuses on the correlation analysis, in which were calculated and assessed the correlation coefficients between parameters of public procurement and concentration indexes for 2007. The aim of this analysis is to determine whether the results of the analysis are consistent with established hypotheses. Tab. VI. lists all the correlation coefficients of the parameters of public procurement and concentration indexes in 2007.

Below is comparison of the results of correlation analysis with established hypotheses:
- **Increase of market concentration will lead to lower average number of offers.** In three cases, the correlation coefficients are negative (for CR4,

VI: *Correlation coefficients between the concentration indexes and parameters of public procurement for 2007*

| Year 2007 | Avg. number of bids | Final/estimated price | Noncomp. methods | Avg. contract size | Avg. estimated contract size |
|---|---|---|---|---|---|
| CR1 | 0.015 | −0.044 | −0.321 | 0.196 | 0.178 |
| CR4 | −0.195 | −0.388 | −0.388 | −0.340 | −0.333 |
| HHI | −0.199 | −0.380 | −0.374 | −0.306 | −0.303 |
| GC | 0.412 | 0.604 | −0.053 | 0.634 | 0.603 |
| HTI | −0.298 | −0.493 | −0.265 | −0.459 | −0.448 |

Source: own elaboration

VII: *Correlation coefficients between the concentration indexes and parameters of public procurement for 2011*

| Year 2011 | Avg. number of bids | Final/estimated price | Noncompet. methods | Avg. contract size | Avg. estimated contract size |
|---|---|---|---|---|---|
| CR1 | −0.568 | −0.264 | −0.735 | −0.475 | −0.594 |
| CR4 | −0.563 | −0.263 | −0.683 | −0.612 | −0.711 |
| HHI | −0.589 | −0.302 | −0.722 | −0.500 | −0.617 |
| GC | 0.062 | 0.622 | 0.191 | 0.847 | 0.788 |
| HTI | −0.533 | −0.549 | −0.700 | −0.726 | −0.806 |

Source: own elaboration

HHI and HTI), and thus represents an indirect correlation between variables. According to the value, it is a low degree of correlation dependency. Correlation coefficient for CR1 indicates the relative linear independence of the variables and the correlation coefficient for Gini coefficient indicates a direct relationship between the observed variables. **This hypothesis can't be conclusively rejected or confirmed for data from year 2007.**

- **Increase of market concentration will lead to higher quotient of final and estimated price of public procurement.** In three cases, the correlation coefficients are negative (for CR4, HHI and HTI), and thus represents an indirect correlation between variables. Correlation coefficient for CR1 indicates the relative linear independence of the variables and the correlation coefficient for Gini coefficient indicates a direct relationship between the observed variables. **It is necessary to reject this hypothesis for data from 2007.**

- **Increase of market concentration will lead to higher share of noncompetitive methods of selection process.** All correlation coefficients are negative, and therefore represent an indirect dependence between the observed variables. The correlation coefficient for the Gini coefficient needs to be interpreted for its value approaching zero as the linear independence rather than indirect dependency between variables. **It is necessary to reject this hypothesis for data from 2007.**

- **Market concentration will not influence final and estimated price of public procurement.** According to the correlation coefficients, obviously there is some type of dependency between market concentration and final and estimated price of

contracts. But it is impossible to determine with certainty what type of correlation dependency it is, because the three correlation coefficients (for CR4, HHI and HTI) indicate an indirect dependency, but the two correlation coefficients (for CR1 and GC) indicate the direct dependency. **It is necessary to reject this hypothesis for data from 2007.**

### Comprehensive Correlation Analysis for 2011

The same correlation analysis was processed for data from 2011. Tab. VII lists all the correlation coefficients of the parameters of public procurement and concentration indexes for the year 2011.

Below is comparison of the results of correlation analysis with established hypotheses:

- **Increase of market concentration will lead to lower average number of offers.** Four correlation coefficients (for CR1, CR4, HHI and HTI) have a negative value, reflecting the indirect relationship between market concentration and the average number of bids. It is the average degree of correlation dependencies. The value of the correlation coefficient for the Gini coefficient indicates a linear independence between the studied variables. **The hypothesis of indirect dependencies between variables can be confirmed for data from 2011.**

- **Increase of market concentration will lead to higher quotient of final and estimated price of public procurement.** Four correlation coefficients (for CR1, CR4, HHI and HTI) have a negative value indicating an indirect dependency between variables. Only correlation coefficient for the Gini coefficient indicates a direct dependence. **It is necessary to reject this hypothesis for data from 2011.**

- **Increase of market concentration will lead to higher share of noncompetitive methods of**

**selection process.** Four correlation coefficients (for CR1, CR4, HHI and HTI) have a negative value indicating an indirect dependency between variables. Only correlation coefficient for the Gini coefficient indicates a direct dependence. **It is necessary to reject this hypothesis for data from 2011.**

- **Market concentration will not influence final and estimated price of public procurement.** The correlation coefficients indicate that there is some type of dependence between variables. Specifically, four correlation coefficients (for CR1, CR4, HHI and HTI) have a negative value, and thus suggest an indirect dependency between variables. The correlation coefficient for the Gini coefficient has a positive value indicating a direct relationship. **It is necessary to reject this hypothesis for data from 2011.**

### Analysis of Mutual Correlation of Concentration Indexes

This part of the article is comparing the interdependence of concentration indexes, or the extent to which different indexes are associated. This analysis was created mainly due to the Gini index, which usually differs in the evaluation of market concentration from other concentration indexes. The analysis was created for correlation coefficients of concentration indexes from both 2007 and 2011.

In Tab. VIII is a correlation analysis for 2007. The star above the number marks correlation coefficients that are statistically significant.

In Tab. IX is a correlation analysis for 2011. The star above the number marks correlation coefficients that are statistically significant.

Correlation coefficients above indicate that Concentration ratio, Herfindahl-Hirschman index and Hall-Tidemanův index are significantly related. There is a strong degree of correlation dependency. Conversely, the Gini coefficient differs from the other concentration indexes; it has various degrees of indirect linear dependency to other concentration indexes. Correlation coefficients for the Gini coefficient point out that if the value of other concentration index rises, the value of the Gini coefficient decreases and vice versa. This finding confirms the views of some economists that the Gini coefficient is not suitable for measuring market concentration, because it is unreliable and misleading.

VIII: *Correlation analysis of concentration indexes for 2007*

| Index | CR1 | CR4 | HHI | GC | HTI |
|---|---|---|---|---|---|
| CR1 | x | 0.80617 | 0.83773 | –0.54823 | 0.74546 |
| CR4 | 0.80617 | X | 0.99819* | –0.86418 | 0.98804 |
| HHI | 0.83773 | 0.99819* | X | –0.85305 | 0.98342 |
| GC | –0.54823 | –0.86418 | –0.85305 | X | –0.9287* |
| HTI | 0.74546 | 0.98804* | 0.98342* | –0.9287* | x |

Source: own elaboration

IX: *Correlation analysis of concentration indexes for 2011*

| Index | CR1 | CR4 | HHI | GC | HTI |
|---|---|---|---|---|---|
| CR1 | x | 0.96537* | 0.99777* | –0.19919 | 0.93017* |
| CR4 | 0.96537* | X | 0.95671* | –0.40028 | 0.94077* |
| HHI | 0.99777* | 0.95671* | X | –0.20587 | 0.94176* |
| GC | –0.19919 | –0.40028 | –0.20587 | X | –0.49987 |
| HTI | 0.93017* | 0.94077* | 0.94176* | –0.49987 | x |

Source: own elaboration

## CONCLUSION

This article has mapped chosen parameters of public procurement in five selected areas in 2007 and 2011. Five concentration indexes were also calculated for these areas. The most concentrated areas were automotive industry and education, the least concentrated areas were construction industry and informatics and telecommunications. Between the parameters of public procurement and the calculated concentration indexes for selected areas of public procurement was made correlation analysis to determine the relationship between these variables.

The results of the analysis are surprising. In most cases, the stated hypotheses were rejected, i.e. the correlation between the parameters of public procurement and market concentration was different than this study predicted based on economic theory. There might be two reasons for this. Firstly, corruption. Selection of the best offer do not always follow only wishes and preferences of the final consumer of purchased good, but also various motives of the contracting authority that purchases the

good for the final consumer. State officials representing the contracting authority may be subject to corruption and can select contracts that are disadvantageous for the final consumer. So parameters of public procurement can be more influenced by other factors than market concentration in a given market. Second reason is connected with quality of the data from the information system of public procurement ISVZ. The data from this database has low quality, with lots of errors, missing data and inconsistent methodology of registering. Especially the influence of missing data may mean a relatively large distortion of the results of the analysis from reality. The quality of the data illustrates another problem of public procurement in the Czech Republic, which is lack of transparency. The main improvement of this database would be adding the missing information and unifying the terminology used in the system ISVZ and the Public procurement law. Both possible reasons for the results of analysis, low transparency and corruption in public procurements in Czech Republic, is well documented by Office for the Protection of Competition (ÚOHS, 2011).

It is also worth mentioning, that verification of hypotheses had same results for years 2007 and 2011, with slight exception for first hypothesis about relation between market concentration and average number of bids. While for 2011 the hypothesis was confirmed, for 2007 the hypothsis could not be conclusively rejected or confirmed as three correlation indexes had negative value and two had positive value (but one of them was Gini coefficient, which was later marked as inapropriate for this analysis).

In the past, there were some studies (Pavel, 2010; Kulhman and Johnson, 1983; Gómez-Lobo and Szymanski, 2001) which explored influence between number of bids and price of public procurement contract. These studies concluded that there is in fact indirect correlation between number of bids and price of contract. Higher number of bids leads to lower price. One of the hypotheses in this article was claiming that market concentration will not influence final and estimated price of public procurement, but this hypothesis was rejected as there is correlation between market concentration and price. Suprisingly, the correlation between these two variables is indirect, meaning the increase of the market concentration leads to lower final and estimated price of contract. So if we hypothetically assume, that higher concentration on market means lower number of competitors and therefore lower number of bids, result of this study is actually against the results of previously mentioned studies. Explanation for this could be that on highly concentrated market with only a few huge companies (or even just one) and many small ones, the huge companies can come with lower price offers, pushing small companies off the market, just because huge companies use their size, influence and economies of scale (Amir, 2000).

The partial result of this work is the finding that from five concentration indexes selected in this article for calculations of market concentration is one of them, the Gini coefficient, quite inappropriate. The Gini coefficient is in this context criticized because it cannot satisfactorily describe market concentration in a given market; it only describes the uneven distribution of market shares without taking into account the number of companies in the market. The results of this study confirm this.

Follow-up research could focus on comparing the state of public procurement in the Czech Republic with the situation abroad. It would be very useful to perform the same analysis of market concentration in selected sectors of public procurement in some of the countries of the European Union and compare the results of both analyzes. The main objective would be to find out whether the results of the analysis of the public procurement market in a foreign country are more in agreement with the stated hypotheses about the relationship between market concentration and parameters of public procurement. There is also the idea of whether it would be possible to use the analysis of market concentration in the public procurement market to express the effective functioning of this market (and determine the amount of corruption in public procurement). The aim of public procurement is in fact to mimic the market mechanism, which is in economic theory considered as the most effective way of exchange. In theory, the more is functioning of the public procurement market in terms of imitating market mechanisms closer to other markets, where these market mechanisms are perfectly applied, the more effective public procurement market is. And since one of market mechanisms is the effect of market concentration on the parameters of deals in the market (such as price or volume of traded goods), there may be a link between efficiency of public procurement market and the results of correlation analysis between the parameters of public contracts and concentration indexes on given market. The more are the results of correlation analysis consistent with the hypotheses formulated based on theoretical assumptions about the relationship between market concentration and parameters of public procurement, the more should be public procurement market effective and vice versa.

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# Attachments

X: *Parameters of public procurement for construction industry in 2007 and 2011*

| Parameter | 2007 | 2011 |
|---|---|---|
| Number of public procurements | 1770 | 366 |
| Avg. number of bids | 5.22 | 6.02 |
| Average quotient of the final and estimated price of contracts | 1.14 | 0.85 |
| Average size of the contract | 33 607 100 Kč | 28 912 402 Kč |
| Average estimated size of the contract | 33 088 506 Kč | 34 519 168 Kč |
| Share of non-competitive methods | 0.07 | 0.2 |

Source: own elaboration based on data from ISVZ

XI: *Parameters of public procurement for informatics and telecommunication in 2007 and 2011*

| Parameter | 2007 | 2011 |
|---|---|---|
| Number of public procurements | 267 | 101 |
| Avg. number of bids | 1.84 | 2.09 |
| Average quotient of the final and estimated price of contracts | 0.98 | 0.94 |
| Average size of the contract | 15 006 999 Kč | 14 370 353 Kč |
| Average estimated size of the contract | 15 878 614 Kč | 17 708 175 Kč |
| Share of non-competitive methods | 0.54 | 0.49 |

Source: own elaboration based on data from ISVZ

XII: *Parameters of public procurement for automotive industry in 2007 and 2011*

| Parameter | 2007 | 2011 |
|---|---|---|
| Number of public procurements | 284 | 44 |
| Avg. number of bids | 2.32 | 2.11 |
| Average quotient of the final and estimated price of contracts | 0.98 | 0.93 |
| Average size of the contract | 13 569 977 Kč | 23 051 035 Kč |
| Average estimated size of the contract | 13 780 260 Kč | 23 554 273 Kč |
| Share of non-competitive methods | 0.02 | 0.05 |

Source: own elaboration based on data from ISVZ

XIII: *Parameters of public procurement for waste management in 2007 and 2011*

| Parameter | 2007 | 2011 |
|---|---|---|
| Number of public procurements | 94 | 29 |
| Avg. number of bids | 5.26 | 4.83 |
| Average quotient of the final and estimated price of contracts | 1.09 | 0.9 |
| Average size of the contract | 18 810 643 Kč | 17 372 269 Kč |
| Average estimated size of the contract | 21 022 146 Kč | 20 273 758 Kč |
| Share of non-competitive methods | 0.07 | 0.07 |

Source: own elaboration based on data from ISVZ

XIV: *Parameters of public procurement for education in 2007 and 2011*

| Parameter | 2007 | 2011 |
|---|---|---|
| Number of public procurements | 20 | 47 |
| Avg. number of bids | 2.4 | 2.47 |
| Average quotient of the final and estimated price of contracts | 0.97 | 0.75 |
| Average size of the contract | 15 623 617 Kč | 1 691 498 Kč |
| Average estimated size of the contract | 16 305 389 Kč | 1 936 904 Kč |
| Share of non-competitive methods | 0.1 | 0.02 |

Source: own elaboration based on data from ISVZ