Analysis of Relationship between Indicators of the Public Procurement Market and the Level of Perceived Corruption in EU Member States[1]

*Jan PAVEL – Sara RISTIČOVÁ**

Abstract

Post-communist states of the European Union traditionally score in various rankings of indicators that deal with the degree of (perceived) corruption significantly worse than most of the old EU member states. One of factors that strongly influence the unfavourable rating in these areas is a situation on the public procurement market. The presented paper aims by use of quantitative analysis to determine the extent to which are the level of corruption and public sector efficiency linked to selected indicators dealing with the situation on the public procurement market.

The paper deals with two main topics. Firstly we discuss the procurement market from the macro-perspective. Secondly we have prepared two econometric models, which are analysing the relationship between level of corruption/efficiency of the public sector and selected indicators of the situation on the public procurement market (e.g. average number of bids, intensity of the competitive effect). The results schow, that there is statistical significant relationship.

Keywords: *competitive effect, corruption, European Union, public procurement*

JEL Classification: H57, H11

Introduction

Post-socialist states of the European Union (EU) traditionally score in various rankings of indicators that deal with the degree of (perceived) corruption and public sector efficiency significantly worse than most of the old EU member

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states. One of factors that probably influence the unfavourable rating in these areas is a situation on the public procurement market. Most of analyses that deal with the issue of corruption, however, do not seek in any way to analyse this relationship in more detail and remain limited to a mere verbal notice of this connection. The presented paper aims to grasp this untreated issue and by use of quantitative analysis to determine the extent to which are the level of corruption and public sector efficiency linked to selected indicators dealing with the situation on the public procurement market. In the article we work with both indicators of corruption and efficiency. The reason is that we assume clear negative impact of corruption on economic efficiency. In this context it is possible to mention, for example work of Tanzi (1998): "The total economic and social effects of corrupt actions might be very costly and out of proportion to the bribes received by corrupt officials in terms of resources wasted, the opportunity cost of resources misused, and the inefficiencies introduced in the system."

Another starting point of the analysis is an assumption that the structure of the public procurement market and its size is in case of post-communist states different from that in the old member states, mainly because of need to reduce the infrastructure gap. This, however, has serious implications with respect to the extent of corruption opportunities in the given country, as expenditures directed towards public procurement are usually easier to exploit via corruption than most other types of public spending, Delavallade (2006). The structure of the presented paper is as follows.

The first section briefly summarises the current state of knowledge discussing contributions dedicated to the link between the level of corruption and the situation on the public procurement market.

In the next chapter we discuss the procurement market from the macro-perspective when we deal not only with its size but also with its structure. Based on the literature review, both parameters can significantly affect the extent of opportunities for corruption. We also try to analyse to what extent is the situation different in the old and new EU member states.

The third chapter discusses several indicators that describe the situation on the supply side of the public procurement market.

The following chapter provides an econometric analysis that aim is to identify the relationship between the level of corruption (respectively an indicator that monitors intensity of its perception), respectively, between efficiency of the public sector and selected indicators of the situation on the public procurement market.

The concluding part of the paper summarises lessons learned and discusses possible political implications.

1. Existing Research with Respect to the Relationship between the Public Procurement Market and the Level of Corruption

Although significant portion of the public sector's resources is allocated using the public procurement market (OECD and EC estimates range from 10 to 20% of GDP) and a huge amount of articles mentioned, that public procurement is one of the highest risk areas for corruption, this issue is given a relatively little attention. The issue of estimating a size of the public procurement market is essentially covered only by OECD and EC (Audet, 2002; OECD, 2011) that within their international comparative studies present calculations generally based on an application of the macro-approach (calculations based on the data from national accounts). A more detailed analysis of the impact of individual factors on the size of the market, differences between individual countries and implications with respect to the degree of corruption opportunities and efficiency of the public sector is, however, usually not carried out.

Nevertheless, the relationship between public procurement and the level of corruption has been identified in several publications. For example, according to Tanzi and Davoodi (1997) corruption grows with the volume of public investment, a fact they substantiated using regression of the share of public expenditure/GDP on the corruption index, real GDP per capita and the share of public revenue/GDP. They concluded that the economic growth is reduced by corruption through four channels. Corruption: 1) is increasing public investement while reducing its productivity; 2) is increasing public investement that is not accompaned by its recurrent expenditure; 3) is reducing the quality of existing infrastructure and 4) is lowering government revenue needed to finance productive spending. It is to be noted that public investments are for the most part implemented through public procurement. In their later paper Tanzi and Davoodi (2000) in particular highlight the larger impact of corruption on small and medium enterprises, which, although making up a smaller added value compared to large enterprises, employ globally the vast majority of population, have a greater potential for innovation and a key influence on the economic growth.

The relationship between the size of public procurement market and level of corruption is indirectly analysed by Goel and Nelson (1998). Based on data from the US they concluded that there is positive relationship between size of state-local governements and corruption and negative between government expenditure on salaries and corruption. They highlight that main part of the non-salaries expenditures are allocated through public procurement. Hessami (2013) analysed more deeply the relationship between corruption and budget composition in OECD countries. Her results show, that the corruption is associated with the

expenditure on health and environmental protection. In contrast, growth of social spending is inverse to the level of corruption. A similar approach has been introduced by Gupta, Mello and Sharan (2001), who, however, focused only on military spending. They found that it is possible to identify the positive relationship between their size and indicator of corruption perception index. Corruption also affects allocation of talent, as according to Murphy, Shleifer and Vishnu (1991) demonstrated by the growing share of law schools graduates over graduates of engineering disciplines that is traceable in countries with higher corruption. Therefore, *ceteris paribus* a more corrupt society needs more lawyers. Burguet and Che (2004) deal with the issue of corruption with respect to awarding public contracts, caused mainly through manipulation of qualitative criteria by persons in charge. However, they also understand this manipulation as another form of competition which *a priori* does not have to affect the allocative efficiency. The key role plays the power of the awarding officer to change outcomes of the competition (by influencing criteria), and the fact which of the candidates will tend to bribe (whether the efficient or inefficient one). Their results propose how to design benchmark criteria so that the distortion effect of corruption is suppressed. Prager (1994) congruently describes that the greater flexibility in the power of officials, the greater the scope for corruption, both in the area of outsourcing and in-house production.

The mutual mix of internal and external production was investigated in the study by authors Kline and Buntz (1979). The main problem is seen in bringing many activities outside the public sector with the erroneous justification that the public sector would be in their provision ineffective. Commissioning especially expert opinions (à la how to improve something, reorganise) shall be considered a black box that without setting specific objectives does not lead to anything but corruption.

Deciding between internal and external production is touched upon also by Fearon (2009), when into account is taken the asymmetry of information and the possibility of hidden bribery. Bribes distort the quality of the provided public goods and direct the authority towards their outsourcing. In case that the bargaining power of the supplying firm is small and propensity of the awarding authority to bribery large, then increase in the integrity of the office may result in higher prices, since the supplying firm tries to maintain the office's preference for outsourcing. Respectively, higher prices imply necessarily incurred costs of bribes. In case the bargaining power of the supplying firm is large, then it is able to resist the demands for bribes and as a result provides lower prices for its goods.

Results of the above studies can be generally summarised that the use of the institute of public procurement (i.e. external production) represents an increase

in the risk of corruption within the public sector and does not always lead to an increase in the public sector's efficiency.

Neither of the above-discussed work focuses on the analysis of the relationship between the parameters of the public procurement market and the level of corruption. On this reacts this article that tries to fill this gap. The presented approach is unique in Central and Eastern Europe (CEE) countries, because of the studies here are dominantly contentrated on the sociological analysis of corruption or problems in the functioning of institutions (e.g. Guasti and Dobovsek, 2011).

2. Macroeconomic Importance of Public Procurement and its Structure

The institute of public procurement represents in its essence application of the external method of production, i.e. situation in which the public sector decides not to produce the given good using its own resources (staff, capital goods – so called in-house production), but instead hires an external subject (supplier). When applying economic perspective, this is rational in a situation where costs of external production are lower than the cost of internal production and simultaneously the outputs have the same quality. When comparing these two production methods, however, it is necessary to take into account risks associated with the external production. For example, Brown and Potoski (2003) point to a significant impact of two specific properties of goods-to-be-purchased on the success of external production. The first is the measurability of outputs and thus ability of the awarding body to precisely specify outputs in the contract. The second is the necessity to carry out specific investments on the side of suppliers, often in turn leading to a monopoly dependency. Underestimating these two areas in the procurement processes may lead to opportunistic behaviour on part of the contracted suppliers and to an overall price increase of the given public contract.

Apart from the above-discussed economic risks, potentially reducing the efficiency of the institute of public procurement, there is also a significant presence of corruption risks. Space for corrupt activity is therefore substantially larger in public procurement than in the case of in-house production, since it is very difficult to embezzle wage funds. It can therefore be assumed that the states that spend more on external production will be more vulnerable to corruption risk. The amount of funds expended on public contracts will be subsequently referred to as the public procurement market. Its size is generally dependent on two main factors: the size of the public sector and the assumption of representatives of the public administration that use of external production actually contributes to the reduction of public sector‘s costs.

The relationship between the size of public sector (measured by the ratio of public expenditure to GDP) and the size of public procurement market is at a first glance logical. Larger public sector employs more people and provides more services and for this it therefore needs to procure more goods (electricity, paper, etc.). In reality, however, this relationship is complicated by differences in the structure of public expenditure (e.g. representation of public investments) as well as the general approach of public administration. In the second case, that is the assumption of higher efficiency of the private sector, there can be expected a relatively strong link to application of approaches associated with the theory of New Public Management (see Peters, 2000; Nemec at al., 2012 or Merickova--Mikusova and Nemec, 2013). This approach to public expenditure management is in fact based on the assumption of a higher efficiency of the private sector compared to the public sector. Implications of this assumption may therefore be summarised in a simplified was as follows:

1. The state should carefully evaluate whether some of its agendas cannot be normally carried out by the market and if so, it should "get rid" of them (privatisation, deregulation).

2. For activities that cannot be performed by the market, the state should in the maximum possible extent adopt external production (outsourcing).

Size of the public procurement market is mostly calculated based on the data from national accounts. Data used in the next section are calculated based on the method presented in OECD (2001) that calculates the volume of external purchases as:

$$PPM = FCE - CFC - IT + SALES + GFCF - CE \quad (1)$$

where

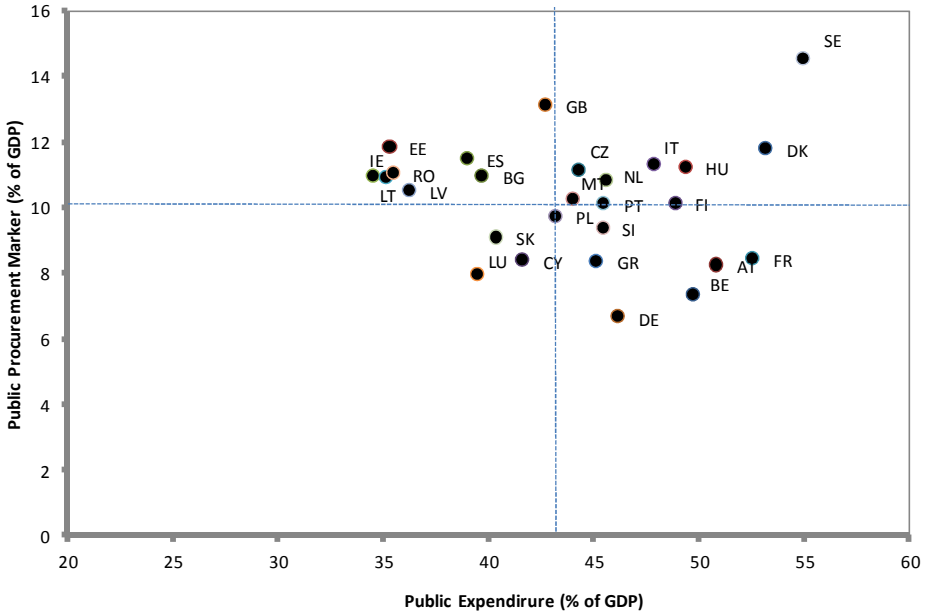
PPM – Public Procurement Market,
FCE – Final Consumption Expenditures,
CFC – Consumption of Fixed Capital,
IT – Indirect Taxes,
SALES – Government Sales,
GFCF – Gross Fixed Capital Formation,
CE – Compensation of Employees.

Data sources are represented by the system of national accounts that divides the government sector into four sub-sectors (general government, state government, local government and Social Security Funds). The data presented further down do not include information for the sub-sector Social Security Funds, in most countries covered by the health system. Despite involvement of external production, organisation of Social Security Funds often differs from conventional public procurement (system of health insurance) and therefore within the following analysis we will abstract from it (there would not be ensured comparability of the data for individual countries).

Chart 1 analyses the extent of the public procurement market in the EU-27 countries with regard to size of the market and size of the public sector. Assumed were average values for the years 2000 – 2008. Boundary years of the monitored period were determined for the following reasons. During 1990s was in the post-socialist countries taking place process of economic transformation that significantly changed the structure of public expenditure. In contrast, after 2008 were European countries significantly affected by the economic crisis that also markedly altered public expenditure.

Chart 1

Relationship between the Size of Public Expenditure and Public Procurement Market



Legend: BE – Belgium, BG – Bulgaria, CZ – Czech Republic, DK – Denmark, DE – Germany, EE – Estonia, IE – Ireland, GR – Greece, ES – Spain, FR – France, IT – Italy, CY – Cyprus, LV – Latvia, LT – Lithuania, HU – Hungary, LU – Luxembourg, MT – Malta, NL – Netherlands, AT – Austria, PL – Poland, PT – Portugal, RO – Romania, SI – Slovenia, SK – Slovakia, FI – Finland, SE – Sweden, UK – United Kingdom.

Note: The dashed lines indicate average values of both monitored variables.

Source: Eurostat; own calculation.

In the Chart 1, we can identify three main groupings of states. First, there are countries that exhibit high (above average) volume of public spending, but a relatively small (below average) size of the public procurement market. This group is dominated by old continental Western European countries (France, Germany, Austria, and Belgium). The second group is made up by countries where both public expenditures and procurement markets are above average.

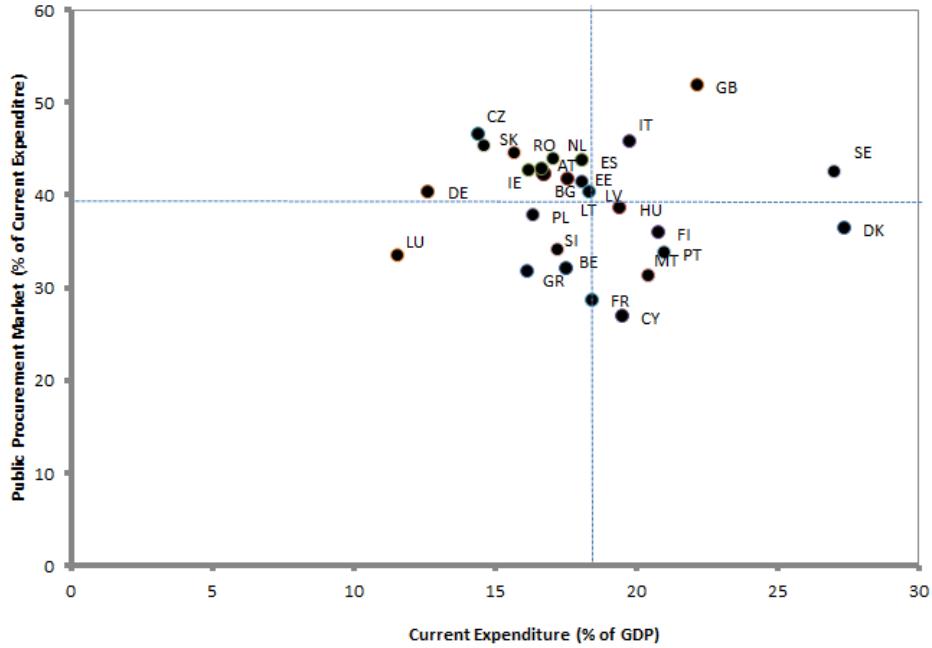
In this group are Scandinavian countries (Sweden, Denmark) joined by some post-socialist countries (Czech Republic, Hungary). The third group consists of countries with below-average range of public expenditure and, contrariwise, above-average sizes of the public procurement market. In this group, the Anglo--Saxon countries (Great Britain, Ireland) meet Baltic countries, Bulgaria and Romania. For these states it is thus possible to talk about application of the New Public Management approach, which led to reduction of the public sector and to growth in the importance of external production.

Based on the above it can be noted that compared to the EU average, most of the post-socialist countries show larger size of the public procurement market. This fact, however, has some serious implications with respect to the issue of corruption opportunities since as already mentioned expenditures on public procurement are significantly more sensitive to corruption than, for example, payroll expenses. However, the question stands to what extent is it caused by a general preference of external production over internal production and to what degree we witness an impact of the higher value of public investments. These investments are in post-socialist countries pulled by an effort to eliminate the infrastructure gap (over the monitored period, expenditures of old member states on public investment represented on average 2.8% of GDP while in case of the new states it was 3.6% of GDP). The public procurement market may still be further broken down into the part allotted to public investments and the portion attributable to outsourcing of routine activities of the public sector. Let us now focus on this second part, which to a large degree indicate the extent of preference of external production in securing common activities of the public sector. By expenditures on common agendas will be understood the sum of personal expenditures of the public sector (i.e. expenditures on employees) increased by purchases of goods and services, excluding public investments. In essence, therefore, it relates to public expenditures reduced by distributed subsidies, debt service and investments.

The following chart shows the position of individual countries in terms of the volume of public expenditures on common activities and the public procurement market. It can be noted that most post-socialist countries except Poland and Slovenia demonstrate an above-average preference of the use of external production in order to ensure the normal course of business, when the share of their expenditures on external production exceeds the average value 39% of current public expenditure. At the same time, however, these countries report below average current expenditures as % of GDP. In this case, however, it may partly be influenced by the Baumolov effect, i.e. the link between costliness of the public sector and economic maturity (Baumol, 1967).

Chart 2

Importance of External Production in Ensuring Common State Activities



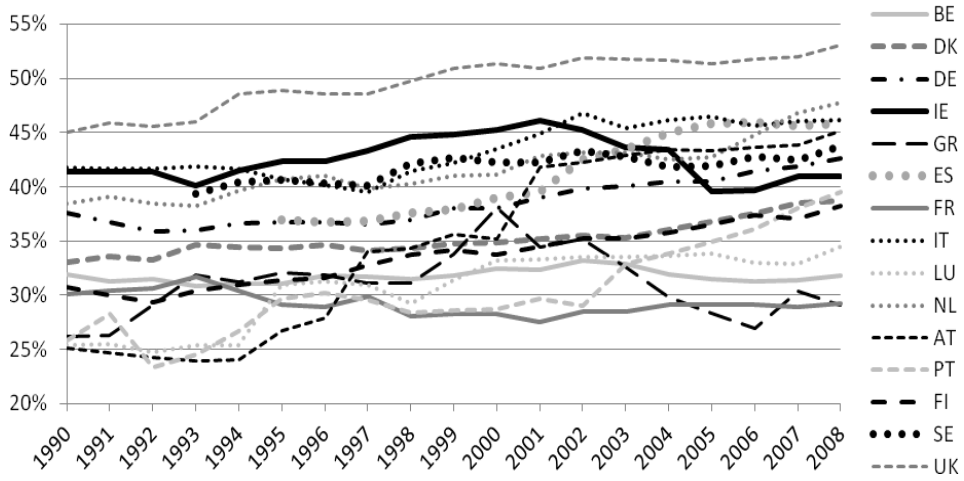
Source: Eurostat; own calculation.

It is interesting to follow the above relationship between the size of current expenditure and the public procurement market over the past 20 years. Generally it can be said that although the old member states over this period slightly reduced the overall extent of public spending on GDP, they also increased the share of current expenditure on total public expenditure. In other words, the cost of common activities of states gradually displaced social transfers and subsidies and public investments.

Both the level and dynamics of integration of the external production into regular state activities are different for the old and new EU member states. The following charts show evolution of the share of public procurement related to regular activities on total current expenditure of the public sector. The convergence of this ratio is over the monitored period clearly evident, when values for both the old and new states enter into the interval 25 – 50%. For old states, this ratio was initially 25 – 45% and then slightly increased to 30 – 50%. For new states the spread of initial values was considerable, but the ratio of the public procurement market to current expenditures also gradually converged to the values of 25 – 45%. Interestingly, the procurement market grew during the monitored period only in Cyprus, Malta and Poland (since 2000). Other new states mainly manifested a tendency to its decline.

Chart 3

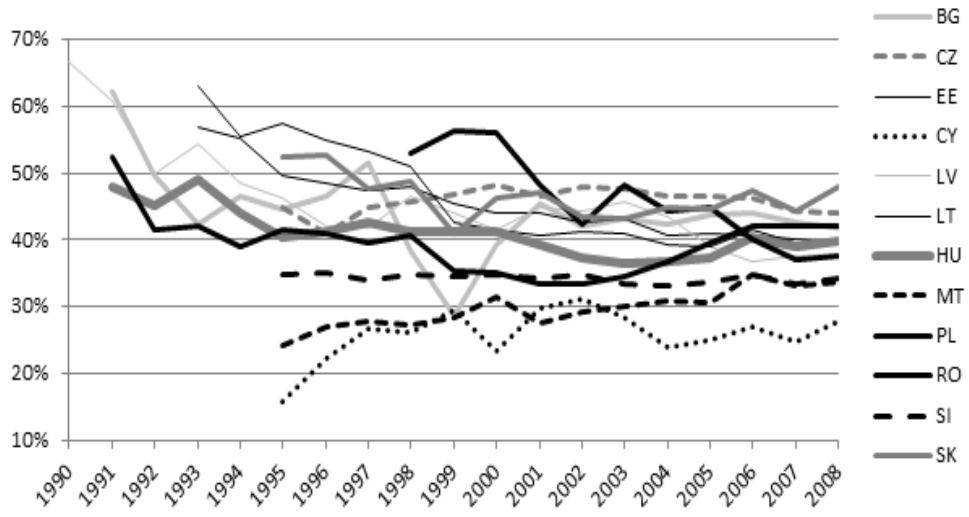
Ratio of the Public Procurement Market and Current Expenditure in 1990 – 2008 – Old EU Member States



Source: Eurostat; own calculation.

Chart 4

Ratio of the Public Procurement Market and Current Expenditure in 1990 – 2008 – New EU Member States

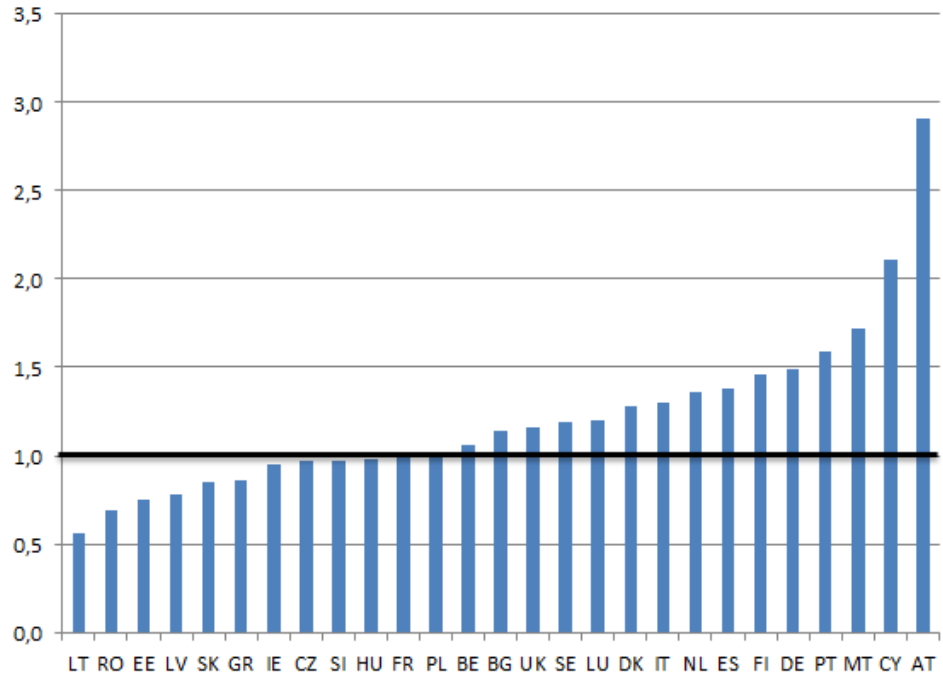


Source: Eurostat; own calculation.

Another interesting question is the extent of changes in the structure of current expenditure, i.e. whether there is an increase or decrease in the importance of external production. The answer to this question can be sought in the analysis of elasticities of the public procurement market size on the size of current expenditure. If the value of this elasticity exceeds 1, it means the current expenditure growth accelerates the growth in public procurement and its importance on overall current expenditures increases (i.e. external production relatively squeezes out internal production). On the other hand if the value of elasticity falls below 1, the opposite is true. Calculated results of these elasticities for EU countries over the monitored period are shown in the Chart 5. It clearly points at differences between the old and new member states. For the old member states, with the sole exception of Greece, the value of elasticity exceeds 1. This means that during the examined period there was a gradual increase in the importance of external production compared to the internal production. In contrast, the new member states (with the exception of Bulgaria) show the opposite tendency.

Chart 5

Elasticity of the Public Procurement Market on Current Expenditure



Source: Eurostat; own calculation.

The results of the presented analysis of the development of the size of the public procurement market and its structure show that its share in post-socialist countries was considerably higher than in the old EU member states. This is due to both a higher level of public investment, and higher preference for oursourcingu of current activities. Based on the results of discussed literature, we can assume, that it increases the risk of corruption in these states. But, another question is the quality of the public procurement market. It is analysed in the following chapter.

3. Indicators Describing Situation on the Public Procurement Market

Assessing functionality of the public procurement market in individual countries is a very difficult task. It is necessary to deal with the lack of "hard" data that would include information on the number of correctly awarded public contracts and, contrariwise, the number of problematic tenders. It should be noted that the scope of the public procurement market is huge and the same applies also for the number of procurement procedures that are carried out (e.g. in the Czech Republic, which is a representative of small states, there are annually carried around 10 thousand tender procedures).

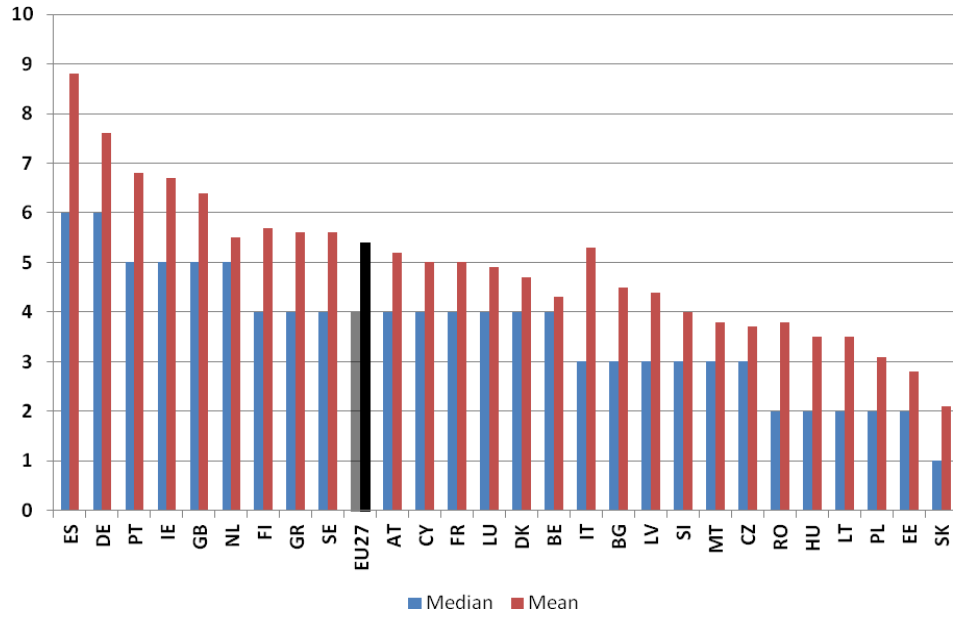
However, we believe that the situation on the public procurement market may be analysed based on the degree of competition on the supply side. This in turn can be approximated by the average (or median) number of submitted bids, listed for the individual member states in the Chart 6. It becomes unequivocally clear that in the new member states the average number of bids is lower than in the old ones. At the same time, this indicator is clearly not influenced by the size of individual countries, since even countries as small as Portugal or Ireland exhibit extraordinarily high values of this indicator.

The question is of course why is in the post-socialist countries (which are incidentally also countries with a higher level of corruption) this indicator so low. We believe the reason is mainly due to the following two factors. The first one is the high proportion of non-competitive methods, as shown in Chart 7. In the case of post-socialist states, such methods represent more than 10% of tender procedures while in the old EU countries these methods make up on average only 4.5%. It is necessary to emphasise that the use of non-competitive methods is strictly limited by relevant European Directives and this restriction applies the same to all EU countries.

In the post-socialist countries are thus likely applied unauthorised non-competitive methods that pose for a corruption behaviour substantially smaller barrier than traditional open tenders.

Chart 6

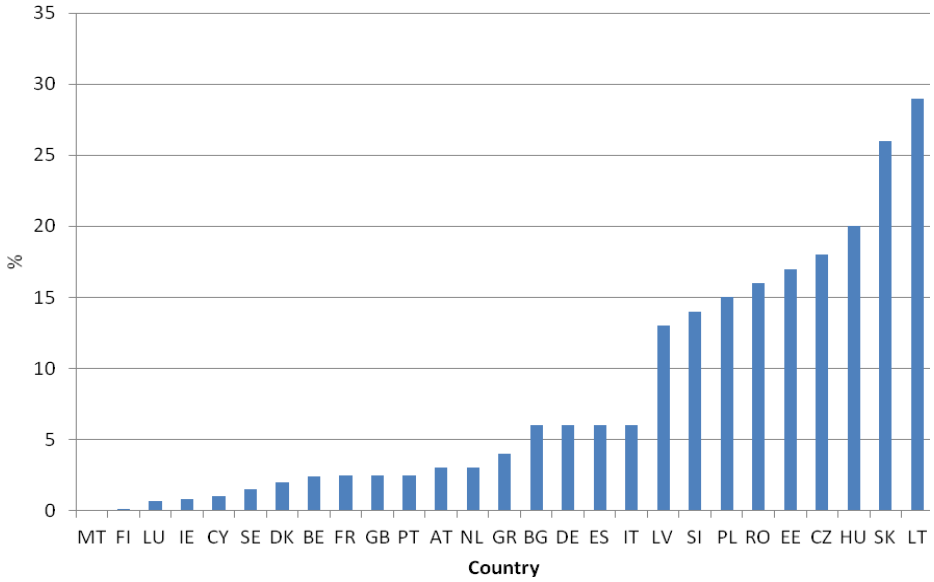
Number of Bids per Country (median/mean)



Source: EC (2011a).

Chart 7

Share of the Public Procurement Market Awarded in Negotiated Procedures without Publication in the EU

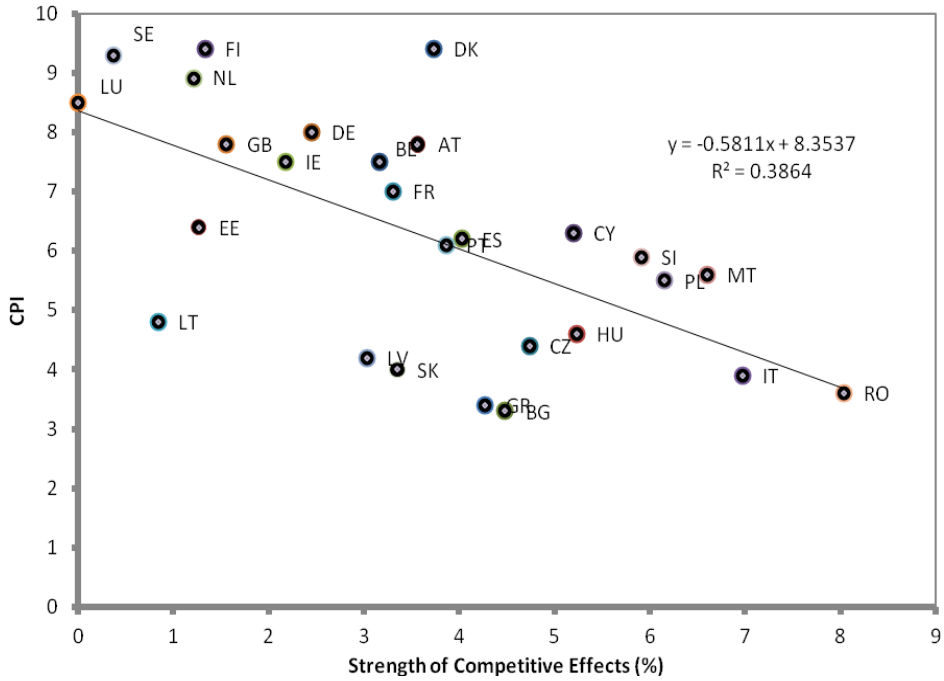


Source: EC (2011a); own calculation.

The second factor that may potentially reduce the average number of submitted bids in countries with a higher level of corruption is a distrust of business entities in the fairness of tenders. A company that wants to participate in a public procurement must outlay non-insignificant resources into preparation of its bid (ex ante compliance costs of public tender). However, if the company does not expect an objective assessment of tender bids, it believes that the probability of being selected is very small. Thus, it will not be too willing to spend resources on a preparation of its bid. The relationship between the average number of offers and the Corruption Perception Index (CPI) (see below) is exposed also by the value of the correlation coefficient, which is 0.42.

C h a r t 8

Intensity of the Competitive Effect and the Level of Corruption in the EU Member States



Source: TI (2010); EC (2011b); own calculation.

Another indicator that shows the situation on the supply side is intensity of the competitive effect. Under this term is understood an inversely-proportional relationship between the number of submitted bids and the tendered price. Its existence was identified by a number of empirical studies (e.g. Iimi, 2006; Kuhlman and Johnson, 1983, or Li and Zheng, 2006). As an intensity of this

effect may be considered the average percentage drop in tendered prices upon receiving an additional bid. Intensity of the competitive effect was estimated for the EU member states in EC (2011b). Within the following analysis we will assume its value for the second submitted bid. The existence of a relationship between this indicator and the level of corruption is illustrated by the Chart 8. Its value for countries with a low level of corruption is very small (e.g. Sweden, Luxembourg). In other words, the resulting tender price is only marginally influenced by the number of submitted bids. In contrast, in countries with a higher level of corruption brings an additional offer a significant decrease in the tendered price (even above 6% – Italy, Romania). If we link this finding with the previous indicator, i.e. the average number of bids, it appears that countries with a higher level of corruption, associated with low average numbers of bids, have likely significant gaps in efficiency of public spending. Provided they manage to increase the average number of bids, public tenders could result in substantially lower prices.

4. Econometric Analysis of the Relationship between the Level of Corruption and Indicators of the Public Procurement Market

From the previous chapters it is clear that public procurement markets in the old and new member states differ in terms of their size, structure and dynamics, as well as in terms of the degree of competition on the supply side. The question remains to what extent all this relate to the level of corruption in a given country. In order to clarify the outlined issue, there were designed two regression models dealing with the relationship between the level of corruption, respectively, efficiency of the public sector and some indicators of the public procurement market. The reason, why we use the indicator of efficiency of public sector as well, is widely shared criticism of the Corruption Perception Index (see bellow).

4.1. Source Data and Hypotheses

In the first model, as a dependent variable was used value of the (CPI). This indicator, presented annually by Transparency International, includes subjective assessment of corruption perception of selected respondents, especially entrepreneurs and macroeconomic analysts (unlike e.g. Eurobarometer which addresses the wider public). This index takes the value from 0 for the most corrupt environments through to 10 for the healthiest ones and allows comparisons among individual states at a given time. Wilhelm (2002) in his study proves the validity

of this index both by a high correlation with e.g. the index of the black market size as well as with real GDP per capita.

Naturally even despite all the efforts put into a qualified estimate of the level of corruption, this indicator will remain at the level of a subjective evaluation based more or less on responses to a wide set of questions, such as: "Does corruption represent a problem in your country?" CPI is also not suitable for time comparisons. This deficiency is rooted in the way CPI is conceived, since the scale is determined by the position of a given state with respect to its peers (in total around 197) and thus small changes are caused by the improvement/ deterioration of the position of other countries as well as by changes in the perception (e.g. the condition may remain unchanged though after a various periods of time perceived differently) or refining/changing the methodology used. To these problems point even the authors themselves, external observers, on the other hand, also criticise the use of a research conducted by third parties (specifically 13 different surveys, 10 independent institutions, where e.g. different methods are used, not all states are included, etc.).

The second model uses as a dependent variable value of the institutional pillar of Global Competitiveness Report (GCR).[2] It includes assessment of property rights (protection of intellectual property and property rights), ethics and corruption (diversion of public funds, public trust of politicians, dishonest payments and bribes), undue influence (judicial independence, favouritism in decisions of government officials), government inefficiency (wastefulness of government spending, burden of government regulation, efficiency of legal framework in dispute resolution, efficiency of legal framework in challenging regulation, transparency of government policymaking), security (business costs of terrorism, crime and violence, organised crime, reliability of police services), ethical behaviour of firms, accountability (strength of auditing and reporting standards, efficacy of corporate boards, protection of minority shareholders, degree of investor protection). The evaluation is conducted for all indicators by World Economic Forum (WEF, 2008) through the Executive Opinion Survey with the exception of the assessment of investor protection, which is taken over from the World Bank study *Doing Business*. Therefore, once again we deal with a set of questions focused on the aforementioned areas, but within the in-house survey by WEF (2010) and in a far more complex concept.

[2] This annual report assesses the overall competitiveness of countries in the world and altogether provides 12 main pillars that map in the given country: institutions, infrastructure, macroeconomic stability, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market sophistication, technological readiness, market size, business sophistication, innovation. Each of these pillars furthermore includes other sub-indicators.

For these variables, we assume that there will be possible to idenfify statistical significant relationship to the indicators that describe the situation on the public procurement market (i.e. the poor situation on the public procurement market can be an indication of corruption as well as low efficiency of the public sector). With respect to the models presented below, we will focus on testing of the following hypotheses.

There is direct relationship between level of corruption (or inefficiency of the public sector, respectively) and:

- HP1: Low level of competition on the supply side (measured in models by the following variables: average number of submitted bids, percentage of non--competitive methods used and strength of the competitive effect).
- HP2: Volume of public investments.
- HP3: Representation of public tenders in current expenditures of the state.
- HP4: Administrative burden of tender processes.

The first hypothesis is based on the assumption that corruption is largely made possible through a low degree of competition among firms. This occurs either directly, through administrative interventions (i.e. by using negotiated procedures without publication that directly address only one company) or indirectly, via low participation of companies in procurement procedures. This can be explained, as mentioned above, by a mistrust of companies in the fairness of the tender procedure or by highly restrictive conditions for participation in tenders. Other possible indicators of competition on the supply side are the representation of non-competitive methods and intensity of the competitive effect.

The second hypothesis is based on the assumption that corruption is positively correlated with the monetary volume outlaid on a public procurement and therefore also the size of public investment. We are coming out from the already discussed assumption that funds for public contracts are riskier with respect to corrupt practices than e.g. wages and social transfers. A similar logic is also attached to the third hypothesis, this time however with respect to the representation of public tenders on current expenditures.

Finally, the last hypothesis is related to the issue of administrative burden. It can be assumed that corruption opportunity will be greater along with a higher administrative burden. Processes will thus become less transparent and allow corruption to hide. In this case, however, it is possible to consider also the reverse causality, where corruption in public procurement leads to an increase in administrative burden with the aim to avoid it. Administrative complexity is measured by the number of men-days necessary for the implementation of procurement procedure by the public sector (administrative costs) as well as, from the perspective of the tender participant, on the preparation of its tender bid

(compliance costs). Values were taken from EC (2011a); unfortunately more recent data are not available for all variables available. Because of the situation on the procurement market and corruption change only in the longer term, the results of the analysis can be considered relevant to the current situation.

The presented models consider the following variables:

- *CPI* – value of the corruption perception index,
- *GSR* – value of institutional pillar quality indicator,
- *BID* – average number of bids in tenders of the given state,
- *NCP* – share of non-competitive methods on the total number of procurement processes of the given state,
- *CE* – strength of the competitive effect,
- *PI* – volume of public investment as % GDP,
- *PPCE* – representation of public procurement on current expenditure,
- *AC* – administrative costs of public procurement,
- *CC* – compliance costs of public procurement.

Standard descriptive statistics of the variables listed above are summarised in the Table 1. Assumed were data for all EU member states (i.e. 27 countries).

T a b l e 1

Summary Statistics

Variable	Mean	S.D.	Min	Max
CPI	6.27	1.96	3.3	9.40
GSR	4.74	0.86	3.28	6.18
Bid	4.87	1.53	2.10	8.80
NCP	8.08	8.30	0.10	29.00
CE	3.59	2.11	0.00	8.03
PI	3.10	0.92	1.18	4.50
PPCE	0.39	0.06	0.27	0.51
AC	25.6	12.5	11.0	68.0
CC	17.3	6.30	10.0	34.0

Source: Own calculation.

4.2. Results of Models

In general, examined models may be specified in the following form:

$$y_i = \beta \; X_i' + \varepsilon_i \tag{2}$$

where X captures the vector of potential variables that affect the dependent variable. The general form will be further applied on two basic models, where in the first model the dependent variable is represented by the indicator of perceived corruption and in the second one by the value of the institutional pillar.

The design of models and tests carried out (with respect to the OLS assumptions) were performed based on the findings and recommendations presented in Gujarati (1995) and Wooldridge (2009).

The following table shows the results of the first model; presented result is a reduced model in which were retained only variables whose regression coefficients showed statistical significance at least at the 5% significance level. During the testing of the model there were found no problems with heteroscedasticity (White test), collinearity or normality of residuals (goodness of fit test).

Values of the regression coefficients confirm the validity of hypotheses 1, 2 and 4. It turns out that there is a relationship between the level of corruption and the situation on the supply side of the public procurement market. Higher corruption affects those states in which the low level of competition on the supply side is caused by excessive involvement of negotiated procedures without publication. Statistical significance of the coefficient for the competitive effect in turn points at the fact that small number of submitted bids unambiguously results in losses for the public sector; additional offer brings to more corruption-ridden countries greater decrease in tendered prices. As statistically insignificant has proven the regression coefficient for the average number of submitted bids. However, this may be partly due to the relatively significant correlation between this indicator and the variable "representation of non-competitive methods" (correlation coefficient is –0.64).

In terms of macro-indicators related to the public procurement market, confirmed has been the relationship between the size of public investment and the level of corruption, in correspondence with conclusions of Tanzi and Davoodi (1997). In contrast, importance of the representation of public procurement to ensure common state activities has not been confirmed. Thus it may be indirectly inferred that the public procurement of infrastructure projects is more corrupt--sensitive than outsourcing of conventional agendas. These results are also consistent with study of OECD (2007) that mentions a greater incidence of corruption in the sectors of energy, construction, telecommunications and defence. Exactly these sectors are more capital intensive, involve new technologies and their needs are met with unique solutions associated with involvement of many experts. Transparency of such projects is low and hiding of bribes easier.

Finally, it appears that there is a relationship between the values of transaction costs of public procurement, specifically among their part carried out by the public sector. Confirmed thus was the hypothesis 4 that countries with higher corruption have public procurement processes more administratively demanding. At this place, however, it should be noted that the administrative complexity may be both a cause of corruption as well as a response to it.

Similar results were brought also by the second model which as an explanatory variable assumes efficiency of the institutional pillars. Direction of the influence by individual variables is the same as in the previous case except for public investments whose influence proved statistically insignificant. This is logical, since public investment should increase the overall economic efficiency and towards efficiency of the public sector act neutrally or slightly positively. Once again, during testing of the model there were found no problems with heteroscedasticity, collinearity or normality of residuals.

T a b l e 2

Models 1 and 2 – OLS, Used Observations 1 – 27

Model	**1**	**2**
Dependent variable	*CPI*	*GSR*
const	11.4679 *** (0.7646)	6.4277 *** (0.2131)
NCP	–0.1013 *** (0.0231)	–0.0548 *** (0.0098)
CE	–0.3845 *** (0.0923)	–0.1807 *** (0.0407)
PI	–0.4445 ** (0.2095)	
AC	–0.0632 *** (0.0154)	–0.0232 *** (0.0068)
F test (p-value)	0.000	0.000
Adj R2	0.78	0.77

Note: The significance stars mean: ** $p < 0.05$; *** $p < 0.01$; Standard deviations in parentheses.
Source: Own calculation.

Conclusion

Results of the above presented econometric models show that there is relationship between the situation on the public procurement market and both the level of corruption and efficiency of the public sector. In both cases is the relationship brought mainly by the insufficient level of competition on the supply side, in the case of corruption also by the value of public investment. The conclusion about the relationship between corruption and the size of public investment is consistent with the results of many studies (Tanzi and Davoodi, 1997; Hessami, 2013). Assotiation of parameters of public procurement market and level of corruption has not yet been investigated. But what do these findings mean? Primarily it has been shown that despite the criticism by numerous authors, indicators of perceived corruption and public sector efficiency really could indikate problems in the public sector. In terms of the public procurement market it is also possible to infer its quality by a system of several indicators (representation of non-competitive methods, strength of competitive effect, etc.) that can be

relatively easily measured and their development monitored over time. For example, should we want to monitor the situation in individual countries and assess whether there came to an improvement or deterioration, it is appropriate to address the above-mentioned indicators. In case one of the countries reports an increase in the level of competition, it is clearly a positive phenomenon. Subjective methods of corruption and efficiency assessment are therefore tied to objective indicators of public procurement and can be replaced by them. We think that it is main findings of our research.

The results indicate that the infrastructure spending represents potentially greater risk of corruption than other government purchases. In the first place, confirmed are thus studies (OECD, 2007) which see greater potential for corruption in capital-intensive industries. Secondly, on large investment projects usually participating prominent market players able to secure the necessary capital. At the same time, however, they have at their disposal financial resources to manipulate the market and stakeholders (both procurement officials as well as competitors in terms of cartel agreements). This may lead to a concentration in sectors and squeezing of medium and small businesses out, as accurately defined in the study by Tanzi and Davoodi (2000). Dissatisfaction from unequal opportunities of squeezed out entities (as employers of the majority of economy's population) is then projected also to the dissatisfaction of general public and perception of corruption and efficiency in the given state.

Countries faced with a high level of corruption should with respect to the public procurement market focus on its larger opening and sharpening of competition. It is necessary both to increase the market's credibility as well as to remove all unnecessary barriers. As an absolutely necessity seems to limit the scope of non-competition methods. In this respect, however, we are likely also witnesses of a failure from the side of the European Commission which is unable to ensure observance of the uniform regulation of the public procurement market in the EU member states.

At the same time, the public procurement market hides more risks than the conventional in-house production. Example of old EU member states, perceived as less corrupt, has demonstrated that rising scope of this market may be a significant aid in reduction of the volume of public expenditure. For new member states this does not necessarily always hold true. Mismanagement of the institute of public procurement has a major impact on economic development. An increase in the size of the public procurement market may result both in savings and waste. That is to say, a crucial role is played by the quality of the controlling – public – sector (its institutions and authorities) that the institute of public procurement uses.

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