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INDICATORS OF CORRUPTION IN PUBLIC PROCUREMENT: THE EXAMPLE OF RUSSIAN REGIONS

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Corruption is widely spread across the world and is believed to affect economic growth negatively. It is most persistent in the developing countries. Russian economy is not an exception. Significant losses are also reported in public procurement in Russia due to corruption. Unfortunately, to measure corruption is very challenging. In this paper, using the data on procurement in one of the Russian regions as an example, we suggest and discuss different indicators of corruption that might have taken place during the procurement process. We also provide some preliminary estimates of how corruption influences the results of public procurement in this region.

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Introduction: Defining corruption and its consequences

Corruption is wide spread in real life and now also it is a popular topic in economic research. It is present in all the countries of the world, but developing countries with high degree of uncertainty, without free press, with an overregulated business and which depend on fuel export are said to be more corrupt (Treisman 2007; Shleifer & Vishny 1993). By corruption we usually mean "the misuse of public office for private gain" (Treisman 2007). This definition is widely used, and it speaks about corruption of the public officials, who are in charge of providing certain services to individuals or firms. The good example of corruption that corresponds to this definition would be "the sale of government property by government officials, kickbacks in public procurement, bribery and embezzlement of government funds" (Svensson 2005). Generally, corruption happens when the public and private sectors meet (Rose-Ackerman 1997) and "a private individual or organization bribes a state official with power over the distribution of public benefits or costs" (Rose-Ackerman 1996). In other words, we may speak of corruption when in return for a bribe from the private agent the public official provides either some service that the private agent is eligible to, but makes it faster/easier, or some service that he shouldn't have provided at all. Thus, the private agent receives the result, he would not be able to receive (the permit to build in the dangerous surroundings), or he could have received but only with some probability (the public contract or permit to use government resources), or he could have certainly received, but it would require more time and energy (permit to establish the firm).

In general, there are two views on the influence of corruption on economic performance. On the one hand, corruption may be a means to decrease transaction costs in the countries with heavy and rigid regulation, especially at the firm level. On the other hand, corruption is said to be negatively correlated with investment levels and economic growth at the country level (Wei 2000). The argument against the first line of reasoning might be the following. Rules and regulations are rarely exogenous. Thus public officials may intentionally erect barriers to be able to collect more bribes (Svensson 2005; Rose-Ackerman 1996; Shleifer & Vishny 1993). Also it is shown empirically that within a country "managers of the firms that pay more bribes on average waste more, rather than less, time negotiating with government officials" (Wei 2000), and at the country level "the strongest and most consistent finding of the new empirical work is that lower perceived corruption correlates closely with higher economic development" (Treisman 2007). The pioneering work in this field by Mauro shows that "the negative association between corruption and investment, as well as growth, is significant in both a statistical and an economic sense" (Mauro 1995).

Why corruption is so costly to development? It is not only the fact of bribes that makes corruption inefficient. There may be various mechanisms hiding beyond the empirical associations. Shleifer and Vishny find the reasons for that in the weakness of central government and in the necessary secrecy of corruption (Shleifer & Vishny 1993). They show that when there are several independent public agencies, with which you have to deal, and all of them can impose bribes, it may prevent many firms from investing. Moreover, bribing must remain secret, that is why the investment, if any, are transferred from the spheres, where they are most needed, to the spheres, where the corruption is more difficult to detect. Thus due to efforts to avoid punishment corruption creates distortions in resource allocation and slows down development (Shleifer & Vishny 1993). Another reason is the unproductive allocation of skills. In one extreme entrepreneurs may leave private sector to become public officials and to be able to collect bribes. In the other extreme entrepreneurs will change their investment decisions to depend less on public sector (Svensson 2005). In both cases the distortions will be substantial. Also Mauro (Mauro 1998) found «negative, significant, and robust relationship between corruption and government expenditure on education».

Another way of showing the negative effect of corruption on economic behaviour is to conduct an experiment. In (Bertrand et al. 2006) they study the behaviour of 822 people who apply for driving license in New Delhi, India. If the corruption only serves to speed up the process of obtaining the license, then there should be no difference in driving skills between people who pay or do not pay bribes. The applicants were divided into three groups. People in the first group were to receive a bonus, if they were able to get the license really fast. People in the second group were offered additional free driving lessons. And the third group was a control group. And all of the applicants passed a surprise driving test after they obtained a driving license. The highest probability of obtaining a license was in the first group, though their driving skills, determined during the surprise test, were not significantly better. As a rule public officials failed some share of applicants during the driving exam, and the probability to fail the exam did not depend on the driving skills. But there was an option to "hire" an agent who bribed the official to enable the applicant to obtain the license without passing the exam. That means that corruption produces unsafe drivers, and public officials create obstacles for applicants to extract more bribes, thus "corruption undercuts the primary social purpose of regulation" (Bertrand et al. 2006) and it adds up to the discussion on the harmfulness of corruption.

The focus in this paper will be on corruption in public procurement. And here there are also several reasons to pay bribes to public officials: to make procurer specify the required goods so that only the corrupt firm is able to deliver it, thus making competitors drop out, or to be

selected as a winner of a contract among all other bidders, or to provide goods of poor quality after winning the contract and make the procurer not to report on that. The consequences of corruption in public procurement are evident: it prevents efficient firms from participating in public procurement procedures (because some firms by paying bribes create entry barriers for them) and winning the contracts (because the competitive procedure is not competitive any more), consumers get the goods and services of poor quality, which sometimes may be even dangerous (for example, a firm cuts on quality to decrease expenses and buys building materials of inferior quality). Monte and Papagni study corruption in the government purchasing process and show that "this kind of corruption has a direct negative effect on the long-run opportunities of economic growth because governments can offer less inputs to private economic activities." (Monte & Papagni 2001)

Background in corruption measuring

It does not matter whether one would want to estimate the effect of corruption on economic growth, or determine the spheres, where there is more corruption, or to understand how to fight corruption and to see if it yields some results – the primary step for all these tasks is to be able to measure corruption. There is a certain belief that it is impossible to measure corruption. Kaufmann, Kraay and Mastruzzi claim that corruption can, and is being, measured in many forms (Kaufmann et al. 2007): by "gathering the informed views of relevant stakeholders", by "tracking countries' institutional features", and by "careful audits of specific projects". The first option is the most widely applied. It is possible to obtain the certain measure of corruption for most of the countries. The second option does not provide the exact measure of corruption, it rather helps to see whether the possibility or incentives for corruption exist in, for example, procurement practices, and thus to determine the indicators of corruption – whether it is present or not. The third option is most case-specific. Let us describe the first two options in more detail.

Main indexes measuring corruption

By gathering the informed views of relevant stakeholders one can obtain the so called subjective indexes of perceived corruption. The two most well-known and used today are the Corruption Perceptions Index constructed by Transparency International and a rating of control of corruption constructed by the World Bank. Corruption perception index was first measured in 1995 and continued annually since then. "The CPI scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination

of surveys and assessments of corruption, collected by a variety of reputable institutions[4]».
World Bank's Control of Corruption is one of the six dimensions of governance computed for
Worldwide Governance Indicators. They also "combine the views of a large number of
enterprise, citizen and expert survey respondents in industrial and developing countries"[5] to
capture whether "public power is exercised for private gain, including both petty and grand
forms of corruption, as well as "capture" of the state by elites and private interests"[6]. Both
indexes represent the perceived level of public sector corruption.

The good thing about these indexes is that they are measured for all the countries that
allow for cross-country comparisons, which was not possible before 1995. Also they are "highly
correlated with a variety of factors that are commonly believed to cause corruption" (Treisman
2007). "But it could also be that the widely used subjective indexes are capturing not
observations of the frequency of corruption but inferences made by experts and survey
respondents on the basis of conventional understandings of corruption's causes" (Treisman
2007). Moreover, "images of corruption might reflect generalised gossip about corruption, or
media scandals/allegations rather than anything more personal to the individual" (Miller 2006).
So first of all not corruption but opinions about corruption are measured. And second, these
opinions may vary among the countries due to the fact that different types of behaviour may be
considered as corrupt.

The important drawback of these indexes for our goals is that they are measured only at
the country level. There was an attempt to measure corruption in Russia at the regional level. In
2002-2003 Transparency International engaged in the research of "the relative amount of bribery
and characteristics of corrupt practices as well as an assessment of the degree of public
confidence in government institutions" (Panfilova 2006). The results show that Russian regions
vary a lot in the level of corruption perception: northern regions turned out to be less corrupt,
while eastern and southern parts of Russia together with capital cities were estimated to be more
corrupt. This study is very useful as it shows that the index of corruption perception for Russia as
a whole is not very informative. But it was estimated only once and only for a limited number of
regions. So it does not help to identify the most corrupted spheres inside the region.

Also corruption is a secret affair. In some countries it is less risky, in others it is not, but
in all the countries it is illegal. It means that all the corrupt transactions are carefully hidden. So
to derive a perfect measure of corruption seems to be impossible: corruption is not visible and no

one, participating in corruption, will be willing to share his experience (Fisman & Miguel 2007; Kaufmann et al. 2007). Is it possible to use objective data to estimate corruption?

Other ways of measuring corruption

As to measure actual corruption is impossible due to the secrecy, and while measuring subjective corruption we are likely to measure attitude or opinion, but not the corruption itself, the only thing left is to measure the outcomes of corruption (Duncan 2006). Especially, when we are looking for some special types of corruption, and not for the level of corruption in the country as a whole. For example, if spending of a certain public official are higher than income that he earns/saved, it can be an indicator of some corrupted activity. That means that in many cases it is relevant to use proxies that can indicate the presence of corruption[7].

During the last 10-15 years there were a lot of attempts to measure corruption in certain cases using some proxies. Some of them were not very persuasive. Like attempts to measure corruption as rates of prosecution or conviction for misuse of office, which were described in (Lambsdorff 2005; Treisman 2007). These measures are more likely to estimate the quality of monitoring and prosecution, than the extent of unlawful behaviour. But still there are many inventive and interesting proxies introduced for analysis of certain cases. For example, Sparrow studied administrative characteristics of Medicaid transactions (Duncan 2006). By determining the patterns in the payment claims he was able to pick out cases of deviance in patterns of administrative characteristics of transactions and thus to identify the cases of corruption. When the number of claims studied was rather high, it was possible to identify the links between different agents. The density of these networks also signalled of corruption.

The most famous examples of inventive measures of corruption are found in the works of Fisman and his co-authors (Fisman et al. 2012; Fisman & Wei 2009; Fisman & Miguel 2007; Fisman & Wei 2004). In (Fisman & Wei 2004) authors tried to measure tax evasion, which is not corruption in the sense we define it in this paper, but also the phenomena that is very difficult to observe. Fisman and Wei estimated the so called "evasion gap", the difference between the value of Hong Kong's reported exports to China and China's reported imports from Hong Kong. The first category was always higher than the second one, because if you do not want to pay taxes for something you bring in to the country, you will try not to declare it (and here corruption plays its role), but it makes no difference whether you declare it when you bring it out of the country. The estimation of evasion gap allowed to understand, how economic agents reacted to increase in

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[7] "As corruption often has a number of incommensurable outcomes, it is often considered prudent to balance quantitative measures with additional qualitative data" (Duncan 2006).

taxes. But also served as a measure of corruption. This approach was also used in (Fisman & Wei 2009), where the gap between value of imports of cultural property and antiques as recorded in United States' customs data and the value of exports of the same goods in reports of customs authorities in exporting countries was used as a measure of corruption in exporting countries and proved to be highly correlated with the corruption levels in these countries.

In (Fisman & Miguel 2007) the corruption was measured as a number of violations of parking rules by diplomats to UN missions working in New York. The violation of parking rules is very similar in its nature to the definition of corruption. Moreover, diplomats from different countries behave very differently, though they all live and work and park their cars in the same conditions. Authors call this measure "a revealed preference" measure of corruption, and suggest that the home country level of corruption is highly correlated with the corrupt behaviour of the diplomats. But the latter was much easier to measure than the former.

Another way to measure the corruption is to estimate the links between private and public sector, to explore the networks that exist, their density and stability, and to study the influence of these networks on economic performance of companies, whose members participate in these networks. By estimating the market valuations of personal connections between private and public sector, one can understand, whether the countries' institutions limit the corrupted and unlawful behaviour or not. If the situation at the stock market does not depend on the news about certain politicians, than the existing links are not corrupt, or corruption is controlled by the institutions (Faccio 2006; Fisman et al. 2012).

Indicators and measurement of corruption in procurement

Following (Lengwiler & Wolfstetter 2006; Boehm & Olaya 2006; Søreide 2002) and a number of country specific papers[8] where authors analyze different corruption practices in particular in public procurement we outline three stages when corruption may occur and four main corruption practices. First stage is an arrangement of the procedure, all actions procurer performs before the bidding starts (for example, the procurer could choose the procedure and the way to specify the purchase). Second stage corresponds to bidding process including announcement of the winner. Third stage starts with the contract assignment. Main corruption practices are

- Manipulation by tender requirements in order to restrict competition (1st stage)
- Bid rigging (2nd stage)

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[8] See (Davis 2004) on South Asia, (Grødeland & Aasland 2011) on post-communist Europe, (Mahmood 2010) on Bangladesh, (Osei-Tutu et al. 2010) on Ghana, (Csáki & Gelléri 2005) on Hungary, (Pashev et al. 2006) on Bulgaria.

- Distortion of quality ranking (2nd stage)

- Manipulation by quality or quantity during contract fulfillment (3rd stage)

Manipulation by tender requirements (1st stage). It is a first chance for corrupt procurer to change competitive outcome of procurement. If he has a preferred bidder he could specify conditions of the tender in extreme case allowing only the desired firm to attend, or just decrease significantly the possibility of other firms to attend. The examples and discussions of such practices are presented in (Boehm & Olaya 2006), (Søreide 2002) and (Ahmed and Mahmood 2010a).

Bid rigging (2nd stage). Bid rigging includes all manipulation with bids that auctioneer could arrange: adjustment of bids during tender, inviting a bidder who is ready to make bids desired by auctioneer (procurer). It could be the use of power to adjust the bids of favored firm after receiving information about rival bids (Lengwiler & Wolfstetter 2006; Boehm & Olaya 2006; Compte et al. 2005; Dastidar & Mukherjee 2014; Koc & Neilson 2008; Menezes & Monteiro 2006). (Koc & Neilson 2008) show that such manipulations could have no impact on efficiency of the auction and expected payoffs if auctioneer and bidder agreed about bribe before the auction. (Dastidar & Mukherjee 2014) argue that kickback from the winning bidder leads to lower quality and lower prices in auctions, but prices could be high if auctioneer has a big bargaining power compared to bidders'. Compte, Lambert-Mogiliansky, & Verdier (Compte et al. 2005) show that corruption undermines competition and facilitates implicit collusion between potential bidders. In particular an auctioneer could be treated as an agent who could help to sunstain cartels. In such setting auctioneer doesn't have any preferred bidder, he is interested in rent creation for himself. He uses discretion to let firms readjust bids to punish cheater in cartels and gets payment for such action[9]. (Lengwiler & Wolfstetter 2010) model the behavior of an auctioneer who orchestrates bid rigging by inviting a bidder to lower or raise a winning bid[10]. In such case corruption distorts efficiency, in partucular they show that lower number of bidders leads to bigger loses in welfare.

Distortion of quality ranking (2nd stage). This practice is specific to the procedures that allow choosing winner on at least two parameters – quality and price. It is hard to estimate expected quality of the good that seller is going to supply. These estimations are usually based on expert surveys, so procurer is able to influence results of the survey by adjusting scores for quality in the interest of the seller who is ready to pay him a bribe. (Celentani & Ganuza 2002) showed that such type of corruption could be higher in highly competitive environmnet. And due

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[9] See in more detail model by (Lambert-Mogiliansky & Sonin 2006).
[10] (Ostrovnaya & Podkolzina 2013) show that such practice is widespread in Russian procurement.

to (Burguet & Che 2004) efficient firm could loose an action in such case. (Cai et al. 2013) show that two-stage auctions lead to lower prices in selling auctions.

Manipulation by quality or quantity during contract fulfillment (3rd stage). When signing the contract a procurer and the winning seller could agree to change contract terms. And even if the contract terms stay the same they could use lack of monitoring and deliver lower quality or low quantity for the initial price of the contact. Here procurer will get bribe after the contact has been fulfilled. In (Boehm & Olaya 2006) and (Søreide 2002) there is a description of such practices, and (Golden & Picci 2005) show that there is a serious gap in what has been paid and received after the contact was fulfilled for infrastructure construction in Italy.

Summing up corruption practicies and their influence on outcomes, we outline four parameters that corruption should/could change: prices, number of bidders, supplied quality and quantity. Most of the works dealing with corruption measurement either use these indicators to measure corruption or control for them because there is no universal indicator to signal about corruption.

What have been already done in corruption estimations in public procurement? We can split all papers on several categories:

- Measurement based on price differences (Di Tella & Schargrodsky 2003; Bandiera et al. 2008; Cai et al. 2013);
  All this works are based on the assumption that corruption leads to higher prices. The main question – what could be treated like base price without corruption. (Di Tella & Schargrodsky 2003) compare prices before and after new monitoring policy. They show that increased monitoring forces public official to decrease corruption level and also prices after introducing monitoring are really lower. Bandiera et all (Bandiera et al. 2008) use involvment of special agency (Consip) to procurement process to clear up prices from corruption and possible inefficiencies. They show that corrupt agencies would not use Consip and would buy for higher prices than Consip. Cai et all (Cai et al. 2013) compare prices in two types of procedures arguing that price auctions are less sucseptible to corruption that two-stage auctions with scoring rules taking into acount both price and quality. Thay show that in China's land market prices in two-stage auctions are lower than in price auctions[11]. All these results are highly country specific.
- Measurement based on comparison of inputs and outputs (Golden & Picci 2005);

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[11] They examined auctions used for selling land rights in China.

Authors use the difference between the cumulative amount paid for public infrustructure construction and estimated price of the physical quantities of infrustructure that exists. They do not focus on procurement peculiarities but all construction works in Italy go through procurement proceedings. This measure allows to range different Italian regions depending on the level of corruption. It does not allow to measure purely corruption, it measures cumulative losses from corruption and inefficiency of public bodies, but we could not use this logic for cross-country comparison or to analyse other countries.

- Estimations based on the link between business and state (Mironov et al. 2014; Demidova & Yakovlev 2012);

Mironov et all use closed bank data to estimate the change in payment for one-day firm around election dates as a proxy for connection between government and business. They show that there is a significant link between probablity to get public contract and amount of payment. Main limition to use such metod is closed information. Usually it is treated as commercial secrets. Demidova and Yakovlev show that firms do not get any preferences in procurement proceedings when thay had connections with public officials. Their research is based on big survey of Russian firms where they have been asked about their connections with regional authorities and their experience in public procurement.

Indicators of corruption in Russian public procurement

Corruption in Russian public procurement: types and cases

In 2006-2013 public procurement in all the Russian regions was regulated by the single law, Federal Law #94, according to which the suppliers can be chosen only through a competitive procedure for all the procurements above 100000 rubles. The rules imply that information on forthcoming procedures is published online at the special centralized web site, the single one for all the regions and for all the procurements. After the procedure all the results (including names of bidders, most of the bids, winning supplier and the price of the contract) are also available at the same web site. For all the procedures the procurer sets a start price, which is the maximum possible price of the contract. In the course of procedure bidders make bids that are lower than the start price. The bidder with a minimum price offer wins the contract. To set the start price a procurer usually asks for the price quotations from a few arbitrarily selected firms in the market, which send him the price at which they would be able to perform the

contract. There are two major types of procedures available for procurers – sealed bid auctions[12] (for purchases below 500000 rubles) and open electronic auctions[13] (may be used for all the purchases but obligatory for most of the purchases above 500000 rubles). If only one supplier applies to participate in the open auction, he obtains the contract at the start price.

Before the Federal Law №94 was introduced, procurers were almost free to choose any supplier they wanted, to pay him any price, the higher – the better. After that the contract would be performed at the minimal possible costs. And everything that was not spent would be shared between the procurer and his supplier. Despite of the attempts to make the procedures more transparent, to increase the participation of private firms in public procurement and to fight corruption, there are still a lot of violations that limit the efficiency of public procurement. A procurer is still able to get round most of the limitations.

If a procurer was not benevolent, and wanted to enrich himself, he would try to negotiate with a single firm (we will call him insider) the shares on the surplus they receive from the procurement contract, and then to prevent outsiders from participating in the procedure. So, at the very first step he may set the start price higher, by choosing the highest price from the price quotations, or by choosing firms he is asking these quotations from. Then he may tune the specification of the goods so that only one firm is able to perform the contract. The other way to limit competition is to include special clauses of delivery that are not suitable to most of the firms, or make the contract very short so that outsider won't be able to make it. If nevertheless some outsiders applied to participate in the procedure, he may still exclude some firms from bidding in the open auction, referring to some gaps in the documents they provided. As procedure with the only bidder may be suspicious, in some cases, the procurer or the insider may call another firm to participate, but not to bid, at least not to bid aggressively. That will always result in repeated interactions between the procurer and insider in various procurement procedures.

So, by corruption in public procurement we will mean some actions of a procurer that are aimed at receiving private gain from distribution of procurement contracts to private firms. As we already stated, it is quite impossible to measure corruption directly. So we are going to

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[12] In sealed-bid auctions bidders send to procurer their bids and the specification of the goods they are going to supply and a number of supporting documents if required. The bids are opened all together at the specified deadline, and the lowest bid (or the earliest bid in case there are two or more equal prices announced) wins.

[13] In open-bid auctions the procurer announces the specification of the good required, characteristics of the contract, reserve price, and two consecutive deadlines. By the first deadline all perspective bidders should provide a statement of interest, including a number of supporting documents and in some cases monetary deposits. Procurer may assess the statements of interest and exclude the firms that do not meet the basic legal requirements from the bidding stage. At the second deadline the surviving bidders show up at the auction and make descending open bids at special electronic platforms. The last remaining bidder wins the contract.

suggest several indicators that will show that something is going wrong with certain procurements. If most of the indicators point out at the unreasonable restrictions or other actions of a procurer that will point out at the probability of corrupt behavior in this procurement. After introducing indicators we will test whether they are right, and suspicious procurements result in relatively high prices.

Suggested indicators (description and explanation)

The first group of indicators concerns the setting of a start price for the procedure (table 1). We consider two facts to be the possible manifestation of corruption. The first one would be if a procurer set a start price as a maximum or average of price quotations, but not the minimum possible price that was suggested. The second one would be if the firm that participated in price quotations actually won the contract later. If it is the case, than this firm would intentionally send a higher price to a procurer to ensure a higher profit to itself. And if a procurer does not try to prevent it, it may not be a good sign.

Table 1. Indicators of corruption based on start price formation

Number	Name	Description	Estimation
(1)	Indicator 1	Increase of a start price due to a chosen way of computing it	= 1 for procurements where the start price was not computed as a minimum from price quotations
(2)	Indicator 2	When the firm that provided a price quotation also won a contract	= 1 for procurements where the firm that participated in price quotations actually won the contract

The second group of the indicators checks for the possible restrictions of competition (table 2). Here we look at the three types of behavior. First, we try to look at the restrictions for participation. As an example of such restrictions we take cases when contracts with high value had also very short duration. That usually means that a procurer has already chosen a supplier, who has already started to perform the contract, which is not very competitive in its nature. We may also look at other restrictions that procurers introduce but we will set it aside at the moment. Then we compare the number of firms that applied to participate and the number of firms that were allowed to participate by the procurer in each case.

Table 2. Indicators of corruption based on restrictions of competition

Number	Name	Description	Estimation
(3)	Indicator 3	When according to a contract a lot of work is to be done in unrealistically tight timing	= 1 for procurements where the volume to duration ratio is very high
(4)	Indicator 4	If the number of suppliers who applied to participate is higher than the number of suppliers that are allowed to bid	= 1 for procurements where some of the bidders were not allowed to bid

And the last group of indicators refers to the results of the procurement (table 3). The first one is about the competition. If there is more than one bidder, there should be some decrease in price of the contract relative to the start price. If the decrease is very little, than the competition may be not real. The second one is about the repeated interactions between a certain supplier and procurer. If there are, for example, ten procurements organized by a certain procurer, and seven of them are won by the same supplier, than this indicator will be 0.7

Table 3. Indicators of corruption based on the results of procurement

Number	Name	Description	Estimation
(5)	Indicator 5	When competition for the contract does not lead to the decrease in start price	= 1 for the procurements where number of bidders is higher than 1, but the price decrease is less than 5%
(6)	Indicator 6	When procurer and supplier often participate in the procurements together	= the share of the procurements of a procurer where a supplier and a procurer meet

We do not say that one single indicator proves the corrupt behaviour, but if many indicators suggest that something uncompetitive is going one, the probability of corruption is rather high.

Estimation of the indicators

To make a rough estimation of the indicators we built the database that comprises all the public procurements of gasoline in one of the Russian regions in 2011-2013. There are 413 observations, each representing one procurement procedure for delivery of a certain amount of gasoline to a public body via gasoline stations. The descriptive statistics for the indicators is presented in table 4.

Table 4. Descriptive statistics for corruption indicators

Refers to indicator:	INDICATORS					
	Variable	Obs	Mean	Std.Dev.	Min	Max
1	**Indicator 1**	**413**	**0.883777**	**0320881**	**0**	**1**
2	**Indicator 2**	**413**	**0.363196**	**0.481504**	**0**	**1**
3	Price to duration ratio	413	10643.48	20401.11	0	210948.9
	Volume to duration ratio	413	283.1501	531.1715	0	5661.539
	Indicator 3s	**413**	0.096852	0.2961153	0	1
	Indicator 3c	**413**	**0.089588**	**0.28598**	**0**	**1**
4	Number excluded	413	0.072639	0.269037	0	2
	Share excluded	413	0.035109	0.128438	0	0.667
	Indicator 4	**413**	**0.070218**	**0.255824**	**0**	**1**
5	Price decrease	413	0.993454	0.041773	0.185895	1
	Indicator 5	**413**	**0.200969**	**0.401211**	**0**	**1**
	INDEXES					
	corrupt3i	413	1.44794	0.638815	0	3
	corrupt5i	413	1.60775	0.707888	0	3

To construct *indicator 3* we first measured the price to duration ratio and volume to duration ratio. The average volume per day is 285 litres. *Indicator 3s* equals 1, if the average volume per day is higher than 285 l., and if the *start price* per litre of gasoline in the contract is higher than the retail price of the most expensive type of fuel in the contract. *Indicator 3c* equals 1, if the average volume per day is higher than 285 l., and if the *contract price* per litre of gasoline in the contract is higher than the retail price of the most expensive type of fuel in the contract. To measure *indicator 4* we first measured the difference between the number of applications to bid and the number of bidders allowed to bid. Indicator 4 equals 1, if the number of excluded bidders is not zero.

We also estimated two combined indexes: *corrupt3i* and *corrupt5i*. Where corrupt 3i is the combined measure of 1, 2 and 5th indicators, and corrupt5i is the combined measure of all the 5 indicators.

To estimate the influence of corruption indicators on the results of public procurement we use the *relative price* of the contract. It is calculated as the ratio of contract price, which is available at the procurement websites, to the average retail price for the same amount of gasoline in the region at the time of the public procurement procedure. The retail price was calculated on the basis of the information on the average retail prices of the gasoline provided by FSSS and depends on the date of the corresponding auction and the volume of the public contract, i.e. we

estimated how much the same quantity of gasoline would cost in retail prices at the same period of time.

Pair wise correlations between the relative price measure and corruption indicators are presented in the table 5. We can see that most of the indicators are significantly and positively correlated with relative price, meaning that suspicious procurements also resulted in higher prices compared to market prices.

Table 5. Pairwise correleations between the relative price and corruption indicators

	relprice
Indicator 1	**0.1067****
Indicator 2	**0.3350*****
Price to duration	**0.2119*****
Volume to duration	**0.2106*****
Indicator 3s	**0.1665*****
Indicator 3c	**0.1634*****
Number excluded	-0.0095
Share excluded	**-0.4707*****
Indicator 4	0.0187
Price decrease	**0.9745*****
Indicator 5	**0.1815*****
corrupt3i	**0.3917*****
corrupt5i	**0.4143*****

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

One of the peculiarities of the selected region is very low level of competition in public procurements: the maximum number of bidders was 3. Variation is too small to use this variable in standard OLS or IV, so we compare procurements with only one bidder and with two or three (see Table 6). We build the OLS regression for relative price of the procurement contract. We see opposite influence of the same indicators on relative price in competitive and non-competitive tenders. In non-competitive tenders corruption risks have higher and significant influence. We also control for the type of the procedure and characteristics of the contract such as volume and duration.

Table 6. Relative price and corruption indicators (OLS)

	(1)	(2)	(3)	(4)
	Number of bidder =1		**Number of bidder >1**	
VARIABLES	relprice	relprice	relprice	relprice
auction	**-0.0361*****	**-0.0345*****	0.143	0.143
	(0.0128)	(0.0128)	(0.0872)	(0.0876)
duration	-6.74e-05	-4.55e-05	-2.63e-05	-2.83e-05

	(1)	(2)	(3)	(4)
	(8.54e-05)	(8.50e-05)	(9.40e-05)	(9.43e-05)
volume	**3.13e-07**	**2.50e-07***	**-4.90e-06***	**-4.91e-06***
	(1.39e-07)	(1.40e-07)	(1.73e-06)	(1.74e-06)
corrupt3i	**0.0272**		**-0.00798**	
	(0.0106)		(0.0139)	
corrupt5i		**0.0219**		**-0.00176**
		(0.00882)		(0.0135)
Constant	1.030***	1.031***	1.067***	1.054***
	(0.0167)	(0.0167)	(0.0318)	(0.0315)
Observations	295	295	78	78
R-squared	0.053	0.052	0.108	0.104

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We do not have the exact measure of links between procurers and sellers at the moment, but we have some interesting cases that show the importance of such links. We collected information on two sellers: seller 1 has won 78% of all the procured contracts and seller 2 has won 9,2% of all the procured contracts, together taking almost 90% of gasoline contracts in the selected region. Seller 2 has won several contracts from several procurers, and there is only one procurer with whom he seems to have the repeated interaction: he won 7 out of 9 contracts that is 78% of the total number of contracts of this procurer.

Table 7. Specific features of some contracts – 1

The procurer	Total number of procedures	Number of contracts won by seller 2	Share of seller's 2 won contracts	Comments
12	9	7	18%	In one of the two procedures, where Seller 2 didn't win, he did not participate. In the other he participated, but Seller 1 won the contract. In others he won, but there was competition for the contract

The information on seller 1 is presented in the table below. There are a lot of cases when seller 1 got all of the contracts of some procurers. Moreover, among these cases there are many examples when a procurer did not provide the calculation of start price or, if provided, did not choose the minimum price offered as the start price, but chose maximum or average price instead.

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Table 8. Specific features of some contracts – 2

The procurer	Total number of procedures	Number of contracts won by seller 1	Share of seller's 1 won contracts	Comments
1	29	29	8,98%	This procurer very often didn't provide the calculation of the start price; If he did provide the calculations for the start price, in most cases it was not the minimum price from the price quotations; In 10 cases out of 29 Seller 1 won the contract where he also made the price quote. In these cases the start price was not determined as a minimum from price quotations.
2	15	13	4,02%	
3	12	12	3,72%	This procurer in 9 out of 12 procedures didn't provide the calculation of the start price
4	13	11	3,41%	
5	11	10	3,1%	
6	10	9	2,79%	This procurer in 9 procedures that seller 1 won, didn't provide the calculation of the start price
7	9	9	2,79%	
8	8	8	2,5%	This procurer in all of the procedures didn't provide the calculation of the start price
9	8	8	2,5%	
10	8	8	2,5%	
11	8	8	2,5%	

These cases show some specific features of the relations between procurers and sellers. First of all, some procurers are always dealing with the same seller. Secondly, procurers quite often do not explain how they set the start price or do not choose the minimum prices as a start price (it is not forbidden by the law, but it is not efficient). Thirdly, in many cases sellers, who make price quotes that are used by the procurer to set the start price, later win the contract (and that means that they may quote higher prices to receive higher revenue later). And moreover, there are cases, when all these conditions meet in one procedure.

Conclusion

In this paper, using the data on procurement in one of the Russian regions as an example, we suggested several indicators of corruption that might have taken place during the procurement process. It is an important question because, on the one hand, corruption has a great

negative influence on procurement, and, on the other hand, there are no other ways to measure the corruption at the single procurement level. We defined three groups of such indicators – based on how the start price was set, on whether the competition was restricted, and on some of the results of the procurement. We also provide some preliminary estimates of how corruption influences the results of public procurement in this region. We showed that when indicators suggest the presence of corruption the relative price of the procurement contract tends to be higher especially for the procedures with no competition. Some of the indicators – like links between a procurer and a seller – we were not able to measure, so we provided some cases, describing the idea. As the selected region has some specific features that may influence the results of the procurement, the next step would be measuring the same indicators for other regions and comparing the results.

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