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CORRUPT RESERVE PRICES

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Corrupt Reserve Prices*

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Abstract

We develop a methodology to identify favoritism in public procurement auctions with reserve prices and apply it to procurement of gasoline in Russia. As reserve prices are set prior to the auction, they are independent of the winning seller's identity in a fair and competitive auction. A procurer-seller pair with consistently higher unit reserve prices than the procurer's average displays potentially corrupt favoritism. In auctions with favoritist pairs procurers limit entry, so that their favored sellers face less competition, are more likely to win, and enjoy higher price markups. Open bid e-auctions with sufficient competition offset these effects.

Keywords: public procurement, favoritism, corruption, regulation

JEL Codes: H57, H83, K42

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1 Introduction

Procurement has been plagued by corruption in public and private sectors alike. It originates from a classical principal-agent problem that emerges when a principal delegates the authority to allocate funds to an agent in the presence of information asymmetries and private benefits. In this paper, we focus on a particular type of public procurement corruption where the public procurer has connections with a firm and seeks ways to favor this firm through the allocation of public contracts. Although this type of favoritism is a wide-spread phenomenon in public procurement, it is typically illegal and can therefore be labeled as a form of corruption. In the remainder of this paper we will therefore use favoritism and corrupt favoritism interchangeably. We show that reserve price manipulation is one of the mechanisms for this type of corrupt favoritism in public procurement and how this could be used for identify procurer-seller pairs that warrant further scrutiny from the supervisory authorities.

We specifically study auctions for the procurement of a homogeneous good by a public body,[1] because they are expected to achieve the best results in terms of saving public money (Tadelis, 2012) and are therefore widely used by governments around the world. We consider the purchase of a homogeneous good, as this allows us to use the good's local market price as the benchmark for public procurement contracts. We focus on reverse auctions with reserve prices. The reserve price is the highest price the procurer is willing to pay for the demanded goods, services or works. The procurer sets his reserve price before he publicly announces the auction. We propose a methodology to detect whether favoritist procurer-seller pairs manipulate reserve prices to extract rents from the government in this specific, though broadly applicable, setting. The main result of this paper is a generic methodology to identify potential favoritism in public procurement auctions with reserve prices, and in particular to identify agents who should receive priority attention from authorities investigating the presence

[1] Although public bodies can buy these goods directly on the market, procurement regulations prescribe public bodies to buy them through competitive procedures.

of corrupt relations in public procurement auctions.

In the empirical analysis we apply our approach to the detection of favoritism in the public procurement of gasoline in Russia, which is a close to perfect case of reverse auctions with reserve prices for the public procurement of a homogeneous good. The manipulation of reserve prices is relevant and salient in the context of Russian public procurement. Public bodies in Russia have to set reserve prices and make the level and the calculation public (Article 19.1 Federal Law No.94-FZ of 21/7/2005).[2] A few cases were taken to court where the participants accused procurers of failing to comply with the rules, claiming that the rationale for the reserve price was either inadequate or missing, like the case at the arbitration court of Altai Region on lacking justification of the reserve price for the supply of fuel oil[3], and the complaint at the arbitration court of Ural Region with regard to violation of Article 19.1 in the supply of medical products[4]. This anecdotal evidence ensures that the mechanism we study is relevant in the Russian context.

We start by estimating the reserve price per liter (further unit reserve price) as a function of the local market price per liter, contract characteristics, procurer characteristics, time controls and the procurer-seller pairs' fixed effects. In a fair auction, the winning sellers' identity within a given procurer should be uncorrelated to the unit reserve price because the procurer sets the reserve price and the contract volume prior to the announcement of the auctions. If, on the contrary, a seller is found to enjoy systematically higher unit reserve prices in auctions won from a given procurer than other sellers in auctions won from the same procurer, we interpret it as a signal of corrupt favoritism. Technically, a procurer-seller pair is labeled as potentially favoritist if its pair fixed effect in the unit reserve price estimation is significantly larger than the procurer fixed

[2]For its calculation a variety of sources can be used such as price data, market research and price quotations by firms.

[3]Case number A76-17508/2011 http://sudact.ru/arbitral/doc/TqFV8GobXAVL/

[4]Case number A03-5924/2012 http://sudact.ru/arbitral/doc/tdi28O6ZsUmN/

effect. We will refer to this potential favoritism at the level of a procurer-seller pair as reserve price overpricing. We find that 9.4% of the procurer-seller pairs (responsible for 15.3% of the auctions) exhibit reserve price overpricing. The resulting average mark-up per liter is 1.2 rubles or 3.9% of the average unit reserve price.

We evaluate the accuracy of the proposed identification of favoritist pairs by analyzing the impact of our favoritism indicator on auction competition, the odds of winning auctions and the final auction prices. The underlying hypothesis is that the suspicious procurer-seller pairs may transform the inflated reserve prices in higher contract prices and thus rents for the favored seller, by restricting auction entry in a number of intricate ways. Procurers may for example include different restrictive clauses in the contract for auction (mandatory opening hours, specific methods of payments, ownership of a minimal number of gas stations, maximal distance to the customer etc.) to deter competing sellers from entering the auction. This artificially limits the competition in the auction and makes the favored seller much more likely to win such auctions, allowing him to sell the goods at higher final prices to the public body. We indeed observe that sellers face less competition in auctions organized by procurers with whom they form a favoritist pair and have a higher probability of winning these auctions, despite the fact that these auctions are characterized by higher reserve prices and should ceteris paribus invite more competitors. Auctions won by favoritist pairs also exhibit higher contract price mark-ups.

Reserve price overpricing is eliminated by the competitive environment of open bid auctions. When the mechanisms to restrict auction competition fail though, and the auction turns out to be competitive, electronic reverse open bid auctions[5] are much more effective than sealed bid auctions in combating the inflationary effect of reserve price overpricing on contract price mark-ups.[6]

[5]In our specific context the electronic auctions are always electronic reverse open bid auctions. In the remainder of the paper, we will therefore simply refer to them as e-auctions.

[6]In previous studies along these lines, Compte et al. (2005) indicate that corruption inflates

In many case favoritist pairs succeed, however, in sorting themselves into sealed bid auctions to avoid this salutary effect of these competitive e-auctions on mark-ups. In total, favoritist pairs inflate reserve prices by 161 million rubles, which leads to a waste of 69 million rubles in terms of contract price mark-ups (three years, one product). To the best of our knowledge the joint impact of corrupt favoritism, competition and the auction procedure on contract price mark-ups has heretofore remained unstudied.

Since our method requires different sellers repeatedly winning auctions from the same procurer, it is only appropriate for standardized goods that are either consumed on a regular basis by the procurer, like gasoline or stationery, or peculiar for the type of services provided by the procurer, like bandages or syringes for hospitals. The method also implies we can only identify favoritist links between the contracting parties if procurers differentiate unit reserve prices across sellers. In case a corrupt procurer exhibits favoritism in all its public procurement auctions, we will only identify reserve price overpricing for those favored sellers with the highest unit reserve price mark-ups with this specific procurer. If a corrupt procurer does not differentiate unit reserve prices across her sellers, our method will by construction not identify any procurer-seller pair as favoritist.[7] Our estimates of the number of procurer-seller pairs and transactions that are subject to corrupt favoritism are therefore lower bound estimates of the true level of corrupt favoritism.

Our results are in line with most of the literature investigating favoritism in public procurement, as we also argue that favoritism raises prices and the odds of winning for favored firms (Vagstad, 1995; Naegelen and Mougeot, 1998; Baltrunaite, 2019), and therefore leads to inefficiency (Burguet and Perry, 2007, 2009)[8]. We complement Laffont and Tirole (1991), who argue the state should

prices and the literature on e-auctions suggests that prices are either lower or not significantly different from sealed bid auctions (Athey et al., 2011; Lewis-Faupel et al., 2016).

[7] This procurer behavior would however be very observable by just comparing average unit reserve prices across procurers and is therefore highly unlikely with rational agents.

[8] Even in the corner cases where favoritism is legally allowed as a mechanism for supporting

use non-manipulative monetary criteria to award the contract in order to prevent favoritism, by pointing to a potential loophole in reverse auctions with the price as sole criterion to select the winner. Klemperer (2004, p.138-9) claims that public officials often make the mistake of skipping the proper calculation of the optimal reserve price, leading to significant welfare losses for the government in the resulting auctions. We extend this by arguing that reserve prices may be purposefully set at a sub-optimal level, with the intention to support a sophisticated form of corrupt favoritism. This study also fits in a larger literature on the potential mechanisms of favoritism in public procurement. Milgrom (2004, p.212) states that if the price is the only award criterion in the auction, the procurer has incentives to outline detailed specifications of the goods to be procured to safeguard quality, even if this may somewhat restrict entry. But since detailed specifications and special contract clauses restrict auction entry, they could also be abused by corrupt public procurers desiring to restrict competition in auctions with a favored seller (Søreide, 2002; Boehm and Olaya, 2006; Ostrovnaya et al., 2018). In our sample, we find that entry restrictions, especially specifying the delivery method, are one of the main avenues to transform high reserve prices into higher odds of winning for the favored seller, and ultimately higher final prices.

With respect to the measurement of public procurement corruption, previous studies have studied tunneling during elections (Mironov and Zhuravskaya, 2016), compared physical public infrastructure with its procurement costs (Golden and Picci, 2005), exploited the variation in contract prices (Di Tella and Schargrodsky, 2003), and used procurement through centralized agency as a reference point for honest behavior (Bandiera et al., 2009) to find indications of public procurement corruption. This study complements the literature by providing a method to red-flag favoritism at the level of the contracting procurer-seller pairs. Our approach is not based on an experiment or event, but applies a simple algorithm on publicly available procurement data, rendering it generally

domestic firms or SMEs, it usually leads to inefficiencies (Marion, 2007; Nakabayashi, 2013).

applicable. In its simplicity, it is similar to the concept of red flags when indices are based on some observable features of tendering notices (Fazekas and Kocsis, 2020; Decarolis and Giorgiantonio, 2020).

The remainder of the paper is structured as follows. Section 2 describes the methodology to identify favoritism between public bodies and firms, and section 3 discusses the data and institutional background. The methodology is implemented and evaluated in section 4. Sections 5 and 6 provide an assessment of the robustness of our results. Section 7 concludes.

2 Methodology

Our methodology aims at identifying favoritist links between a public procurer and its favored seller. As favoritism is a pair characteristic, the methodology focuses on variation at the procurer-seller level. The gist of our argument is that favoritist procurer-seller pairs may agree on a unit reserve price in excess of the local market price, and then limit competition in the auction, to facilitate a higher final price for the favored seller. The rent extracted in this way from the government can then be shared in the form of a private benefit for the official to sustain the corrupt relationship.

2.1 Reserve prices

We consider a government procurer that organizes an auction to buy standardized homogeneous goods, and potential sellers who compete for the contract. We assume that the said goods are traded in the market and that it has a stable demand from different consumers. The legal timing is as follows:

1. The procurer sets the reserve price and the contract conditions (including the volume).

2. The procurer publicly announces the public purchase (the time of an auction, the reserve price and contract conditions).

3. The sellers decide whether to apply for participation.

4. The procurer decides which of the applying firms are allowed to participate.

5. The auction is held and the winning seller is announced.

In a competitive environment, the unit reserve price should depend on the market price (if available), the marginal costs of procurers and sellers (in as far they are known to the procurer) and on specific contract conditions. We define the unit reserve price r_{ijt} for contract t allocated by procurer i to seller j as follows:

$$\mathrm{r_{ijt}} = \boldsymbol{X}_{\mathrm{ijt}}\boldsymbol{\beta} + \sum \gamma_{\mathrm{s}}\mathrm{year_t} + \mu_{\mathrm{ij}} + \epsilon_{\mathrm{ijt}} \tag{1}$$

where $\mathbf{X}$ denotes contract and procurer observed characteristics, $\sum year_t$ denotes year effects and μ_{ij} are the procurer-seller fixed effects. As the unit reserve price also reflects market and contract characteristics, we include monthly local market prices of the goods and the contract volume. We add the natural logarithm of the awarded contract's volume to the regression to capture the effect of contract scale on reserve prices. To capture possible breaks in the market structure or the regulations, we include year effects. Furthermore, each procurer has its own private costs. To account for these, we include dummy variables for the government level of the procurer (federal, regional, local) and procurer fixed effects. The procurer fixed effects μ_i are constructed as the average[9] of the corresponding procurer seller fixed effects $\hat{\mu}_{ij}$ obtained from equation 1:

$$\mu_{\mathrm{i}} = \frac{1}{\mathrm{k}} \sum_{\mathrm{j}=1}^{\mathrm{k}} \hat{\mu}_{\mathrm{ij}} \tag{2}$$

[9]The unweighted average is calculated to weigh each seller equally and avoid the procurer fixed effects to be skewed by sellers that obtained most of the contracts. The favoritism indicator using the weighted average over sellers is strongly and significantly correlated to the indicator based on the unweighted average over sellers ($\rho = 0.7$).

2.2 Reserve price overpricing

We cannot interpret the procurer fixed effect μ_i as a measure of favoritism, because it may also capture procurer inefficiency, rendering it difficult to disentangle both kinds of waste at the procurer level in the absence of numerous sellers (Bandiera et al., 2009). Therefore our method relies on unit reserve price differences between multiple sellers within the same procurer. In a fair and competitive auction, the winning sellers' identity should be uncorrelated to the unit reserve prices set by a given procurer.[10] Non-favoritist procurers should not be found to have set different unit reserve prices for different winning sellers in a systematic way, since not only the identity of the winner of the auction, but also the identities of the participating sellers are unknown at the moment the procurer sets the reserve price, i.e. μ_{ij} should not be significantly different from μ_i for non-favoritist procurer-seller pairs. If, however, μ_{ij} turns out to be statistically significant and larger than μ_i, it raises the suspicion that the winner was known before the implementation of the auction, and that the excessive unit reserve prices therefore reveal potentially favoritist procurer-seller pairs. To test whether μ_{ij} is significantly larger than μ_i, a t-test is performed with variance of μ_i and degrees of freedom calculated using the estimate $\hat{\sigma}_{ij}$ from

[10] In the absence of favoritism, there should not be a correlation between the reserve price and winner identity as the reserve price is set before the auction. However, one could argue that a correlation appears in fair auctions when low-cost firms take part in both low and high reserve price auctions while high-cost firms bid in high reserve price auctions and therefore occur on average more as winner in those auctions. Higher reserve prices will attract more bidders and the high-cost firms will by definition have a lower probability of winning auctions. Yet, the empirical findings show exactly the opposite. In section 4 we show that auctions won by firms labeled as favoritist are characterized by lower competition and such firms are more likely to win auctions. Hence, if there is a correlation between the reserve price and winner identity it is driven by favoritism.

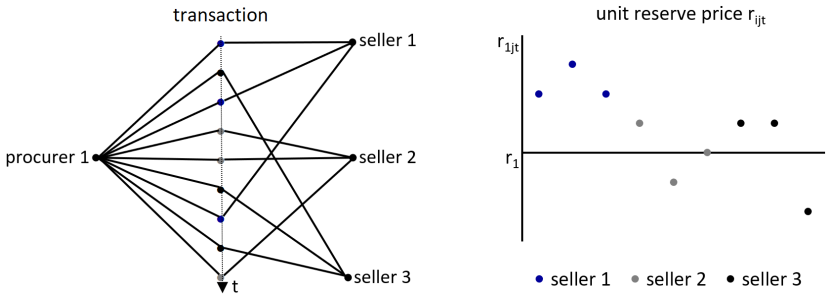
equation 1 (Satterthwaite, 1946):[11]

$$\sigma_{\mathrm{i}}^2 = \frac{\sum(\hat{\mu}_{\mathrm{ij}} - \overline{\mu}_{\mathrm{i}})^2}{\mathrm{n_i}} \tag{3}$$

$$\mathrm{df} = \frac{(\frac{\hat{\sigma}_{\mathrm{ij}}^2}{\mathrm{n_{ij}}} + \frac{\sigma_{\mathrm{i}}^2}{\mathrm{n_i}})^2}{\frac{(\hat{\sigma}_{\mathrm{ij}}^2/\mathrm{n_{ij}})^2}{(\mathrm{n_{ij}}-1)} + \frac{(\sigma_{\mathrm{i}}^2/\mathrm{n_i})^2}{(\mathrm{n_i}-1)}} \tag{4}$$

Thus, the method analyzes whether contractual terms, in particular reserve prices, may be influenced by procurers to favor certain firms.[12] A positive $\mu_{ij} - \mu_i$ identifies systematic overpricing at the procurer-seller level, which could indicate favoritist behavior. We illustrate the proposed methodology in figure 1.

Figure 1: Illustration of the methodology



Notes: On the left, we show a hypothetical network of transactions between procurer 1 and her selling firms j. The procurer allocates contracts to sellers through auctions, resulting in transactions $1jt$ between procurer 1 and a winning seller j. The vertical axis in the middle shows the order of the transactions over time (top to bottom).
On the right, the same transactions are ordered by winning firm j and the dots represent the unit reserve prices of each transaction. We observe how much the unit reserve prices of each transaction, grouped by winning seller j, deviate from the average unit reserve price of this procurer 1, calculated as $\mu_1 = \frac{1}{3}\sum_{\mathrm{j}=1}^{3}\hat{\mu}_{1\mathrm{j}}$). Procurer-seller pairs are labeled potentially favoritist if $\mu_{1j} > \mu_1$, which is the case for seller 1 in the example in the figure ($\mu_{11} > \mu_1$).

Favoritism definition. A procurer-seller pair is characterized by potential favoritism if the unit reserve price set by the procurer in contracts won by the

[11]The test assumes that μ_{ij} and μ_i are approximately normally distributed. The central limit theorem further renders the test robust to deviations from this assumption.

[12]Frontier analysis is not used as it assumes that inefficiency can only deviate in one direction.

seller is systematically higher than the average unit reserve price set by the same procurer: $\mu_{ij} - \mu_i > 0$.[13]

Since our method relies on reserve price differences between multiple sellers within the same procurer, it is not able to identify the favoritist relations of procurers that have transactions with mainly, or only one seller. Another related issue arises when procurers allocate all contracts with all sellers through favoritism. In this case, there is no set of honest pairs to which the favoritist pairs can be compared. Nonetheless, the degree of favoritism may differ across pairs within the same procurer, and our approach therefore still allows us to distinguish the highly favoritist pairs from the less favoritist ones in this specific case. Because of the aforementioned issues, some favoritist pairs are not detected by our method. Our estimates of reserve price-related favoritism are therefore lower bound estimates.

The proposed method is especially adequate in an environment where there are several procurers purchasing homogeneous goods on a regular basis and they have contracts with different sellers of these goods. Examples of such markets include all basic commodities, like paper, stationery, sugar, basic drugs, medical equipment, gasoline and so forth.

2.3 Testable implications

In the favoritism mechanism we have in mind, favoritist procurer-seller pairs agree on reserve price overpricing to ultimately achieve a higher final price for the favored seller and facilitate the corruption fee for the procurer needed to maintain the corrupt favoritism relationship. There is an evident problem for successfully executing this favoritism strategy. In a fair and open auction, higher unit reserve prices elicit the participation of sellers with higher production costs

[13] In this paper, we develop a statistical marker for favoritism but for the sake of convenience we will sometimes mention favoritism instead of potential favoritism.

in the auction. Transactions with higher unit reserve prices can therefore be expected to have more competition, ceteris paribus making the favored bidder less likely to win, and failing to deliver the desired higher final prices in case the favored seller does win. The reserve price overpricing strategy is therefore only feasible if corrupt procurer-seller pairs can limit competition in the auction so effectively that the favored seller is indeed more likely to win the auction at the elevated final prices. Our mechanism therefore entails the following testable implications:

1. Once we control for the unit reserve prices and other contract details, transactions involving potentially favoritist pairs should exhibit **lower competition**.

2. Sellers that constitute a favoritist pair with a procurer should, controlling for the level of auction competition, be **more likely to win auctions of this procurer**.

3. Although the reserve price should in theory not affect the final price in first-price auctions (Menezes and Monteiro, 2005; Krishna, 2009), auctions won by favoritist procurer-seller pairs should exhibit **higher final contract prices**.

In the absence of a mechanism to establish sufficiently high final contract prices through limiting competition and fostering the favored seller's likelihood of winning, favoritist reserve price overpricing would not be rational because it cannot guarantee favoritist procurer-seller pairs a rent from favoritism. If the empirical analysis on the other hand validates the proposed mechanism of higher unit reserve prices, lower competition, higher odds of winning and higher final prices, we may state that our methodology to detect reserve price overpricing is a reliable indicator of favoritism. In this case we will have found a simple metric to detect potentially favoritist pairs that only relies on the analysis of reserve prices that are part of the tendering procedure and are typically public information.

Since we exploit the seller variation within procurers and our proposed favoritism indicator is specific for a given procurer-seller pair, our measure disentangles **competence** from favoritism. A procurer that sets systematically high unit reserve prices due to a general lack of information or to incompetence is not identified as potentially favoritist by our methodology, because these higher average unit reserve prices are unrelated to the identity of the winning sellers. Our approach captures only those pairs where a procurer endows favored winning sellers with high unit reserve prices relative to other winning sellers of the same homogeneous product to the same procurer.

We also seek to distinguish favoritist pairs from classical **relational contracts**. If relational contracts were allowed by the regulator, then the procurer would not use a tendering procedure to find the seller in the first place. If such relational contracts are prohibited, as is the case in most countries for government contracts, the procurer may feel tempted to manipulate the level of competition to maintain the relation. In the context of this paper, the advantages of a long-term relationship are to be found largely in the reduction of search costs and information asymmetries, for example, about product quality or reliability of delivery. In this case the procurer will want to limit competition, while minimizing the risk of detection and breaking as few rules as possible. The most straightforward way to achieve this goal is to lower the reserve price rather than increasing it. The lower reserve price will at the same time reduce competition, increase the probability of maintaining the relation and lead to lower final prices. Relational contracts can support the lower final prices that may come with lower reserve prices, because their value hinges on the reduction of transaction costs and therefore does not require extra rents to finance a private benefit for the procurer. Since lower than average reserve prices for a procurer-seller pair are not labeled as favoritist by the proposed methodology, it is ensured that we did not wrongly identify this type of relational contracts as cases of corrupt favoritism.

Finally we also want to make sure that the higher reserve prices used in identifying favoritism doe not simply reflect **differences in product or service quality** across sellers. We take several steps to rule out the role of quality differences by choosing a very particular market for our study. First we choose a relatively homogeneous good, gasoline, as our object of study. Second, we limit our sample to public contracts for gasoline that have to be supplied through public gas stations according to the contractual details. Since we only consider contracts where gasoline is delivered to the private and the public market on the same infrastructure of public gas stations, sellers cannot sell some public clients gasoline of inferior quality without risking to loose their private clients to their higher quality local peers. This minimizes incentives and possibilities for quality manipulation and therefore allows us to steer clear from the possibility of substantial quality differences in sellers' public procurement deliveries.

3 Institutional background and data

3.1 Public procurement in Russia

The proposed method is potentially relevant for any procurement auction where the procurer has sufficient discretion to set the reserve price but it is probably more applicable to the public than to the private procurement sphere. First, public officials run auctions with public money and are only partially responsible for the results, exacerbating the classical principal-agent problem and leaving ample room for attempts to redirect some of this public money to their private pockets. Second, the regulation of public procurement creates additional barriers to firms and lowers competition, relative to private procurement auctions.

We employ the Russian public procurement sphere as the testing ground for our methodology, because the country scores relatively high in any corruption indicator available, suggesting that its general institutional environment is

relatively conducive to corrupt behavior. The Russian procurement system is regulated by the same law in all regions. We base our estimations on the period 2011-2013 when the Federal Law No. 94 (the Law) was in effect.[14] All public contracts offered by federal, regional and municipal authorities are subject to the law. In 2011, a single website for procurement announcements became obligatory for all levels of government.[15] Before 2011, this website was only used by federal authorities while regional and municipal purchases were advertised on regional websites. Since 2011, announcement requirements no longer differ across different levels of the government. Because since 2011 all official procurement information is equally available to all potential sellers in the market, announcement differences cannot longer influence sellers' entry decisions in a substantial way. The Federal Law No. 94 was replaced by the Federal Law No. 44 in 2014.

Under the said law procurers can choose among several public procurement procedures: single seller (for all contract values below 100,000 rubles and in a limited number of special cases); sealed bid auctions (for contracts below 500,000 rubles and in so far the total volume of these contracts does not exceed 500,000 rubles per quarter and per type of good); open bid auctions (public outcry before 2011, e-auctions thereafter); tenders with scoring rules (only for a limited number of goods). E-auctions were fostered by the government as one of the most transparent procedures with the lowest scope for corruption. The Federal Antitrust Service (FAS) highly recommended procurers to use auction procedures and even created a list of products that can only be bought through an auction procedure.[16] Gasoline is one of the products on this list.

In both types of competitive procedures accessible to gasoline procurers (sealed bid and e-auctions) the procurers have to set the reserve price and the

[14] Roudik, P. (2011, March). Government Procurement Law and Policy: Russia. Retrieved November 25, 2016, from http://www.loc.gov/law/help/govt-procurement-law/russia.php.

[15] http://www.zakupki.gov.ru

[16] Provided that the contract value exceeds 100,000 rubles.

contract conditions before the auction is announced. Federal Law No. 94-FZ of 21/7/2005 obliges procurers to make reserve prices public. In April 2011, the government issued an amendment of the law stating that procurers have to justify the level of these reserve prices (Article 19.1 Federal Law No.79-FZ of 21/4/2011). They could use several sources like price quotations from firms, market analysis and recommendations of regional authorities. The main change was the obligation to disclose this information about the source to the public.[17]

The main difference between these procedures is the way how they are organized – simultaneous bids for sealed bid auctions versus sequential bids for e-auctions. If there is only one bidder in an e-auction, the procurer can conclude a contract with the single bidder at the reserve price. This rule provides an easy mechanism through which high reserve prices in combination with restricted competition may lead to high rents from corrupt favoritism in the case of e-auctions.

3.2 Gasoline market

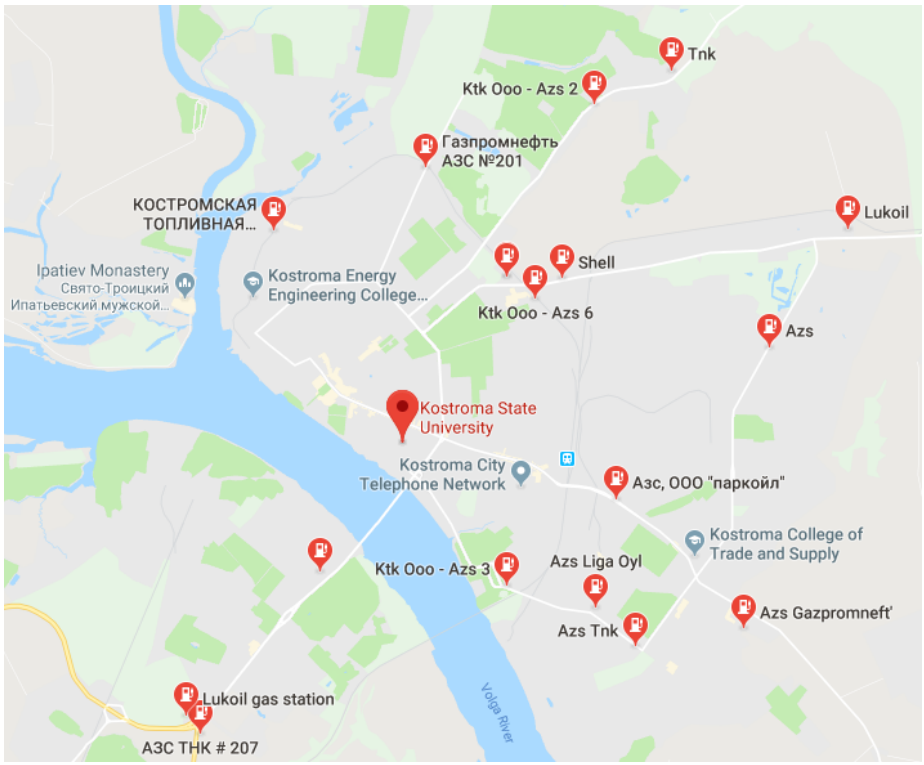
We use gasoline as the standardized and homogeneous good of our choice. Gasoline is procured by public bodies to fuel the vehicles used by employees for their work, for example, vehicles used by hospitals and the police. Although there are different types of gasoline (different octane rates) and contracts can contain multiple types, gasoline is a relatively homogeneous good and it is hard to manipulate its quality. To minimize any effect of remaining quality differences, we limit our sample to public contracts for gasoline that have to be supplied through public gas stations according to the contractual details (see higher Section 2.3). One additional peculiarity of this market is that potential sellers should be present on the private market before being able to enter the public procurement market. We have no cases where gas stations supply exclusively to

[17] We retrieved the sources used to determine reserve prices in the appendix. Most of the reserve prices are based on price quotations from firms.

the public market, even not in the case of subcontracting intermediaries. The private market is quite transparent and it is fairly easy to collect and compare prices of several sellers at a any given moment. Several firms even update their prices regularly on their websites. The gasoline market is also monitored systematically by the Federal Statistics Service (Rosstat). Rosstat collects, calculates and publishes monthly average prices of all types of gasoline by region.

To illustrate the market we study, consider the typical case of Kostroma State University (red dot on the map, see figure 2) that orders gasoline for the cars owned by the university a few times a year. During winter, the university purchased 9,000 liters of gasoline through sealed bid auctions. The reserve price was fixed at 360,000 rubles. This reserve price was established on the basis of price quotations from several firms. The conditions set in the procurement announcement included the quantity in liters (3,000 liters AI-92, 4,000 liters AI-95 and 2,000 liters diesel), the requirement to have several gas stations situated in the town Kostroma, 24-hours availability and payment by cards issued by the seller. Under the contract conditions the workers of the university would fuel their cars at the stations of the winning seller for a period of three months (contract duration). Figure 2 shows that several companies owned more than one gas station in Kostroma: Lukoil, KTK (Kostromskaya Toplivnaya Kompanya), TNK and Gazprom. All of these were potential participants in the auction. If the university would not have added the requirement to own several gas stations, more sellers could have participated in the auction. We observe, for example, Shell owned only one gas station in Kostroma. If, however, it would not have been obligatory to own a network of stations, Shell could have established an agreement with TNK to use its gas stations and in this way could have entered the auction and offered fuel through several stations.

Figure 2: Gas stations in Kostroma



Source: https://www.google.com/maps/search/Gas+stations/@57.7609264,40.9281082,14.25z

3.3 Data

Our data comes from the official website containing information on Russian public procurement.[18] Our sample focuses on the procurement of gasoline through stations, because gasoline is a standardized commodity and the regional market price is provided on a monthly basis by Rosstat.[19] Gasoline cannot only be purchased through sealed bid auctions and e-auctions but also through single-source contracting.[20] We restrict our sample to sealed bid and e-auctions, because

[18]Thanks to Sergey Trunov and Anya Balsevich for data collection from https://zakupki.gov.ru/.

[19]https://eng.gks.ru/

[20]Single-source contracting is non-competitive and the contract price ought to be below 100,000 rubles. Also it can be implemented for goods and services produced by natural

we are interested in detecting favoritism in potentially competitive procedures. Contracts allocated through sealed bid or e-auctions are in principle awarded to firms with the lowest bid. In e-auctions with only one applicant, procurers can and often do conclude contracts at the reserve price, suggesting a simple way in which reserve price manipulation may affect outcomes.[21] Our data covers the name and address of the procuring public authority, the subject of the procurement, the volume, the reserve price, the procedure and the time and place of the procurement. Auction outcomes such as the identities of the bidders, the bids, the identity of the winner and the contract price are also reported.[22]

The dataset comprises the period 2011-2013 as data in unique structured format for all regions is available only since 2011 and further major amendments of law took place in 2014. The initial sample consists of 171,984 auctions for 83 regions. Procurement is outsourced to centralized agencies in 28.3% of the cases, leaving us with 123,325 observations of independent procurements. We exclude all procurements by centralized agencies including situations when these centralized agencies procured for themselves, because as an intermediary they have more connections with different procurers and sellers than the independent procurers in the sample. We drop auctions without seller identity, volume and reserve price per liter (unit reserve price),[23] leading to a final sample of 81,813 observations.[24]

Over 70% of the auctions in the final sample are conducted through sealed bid auctions and only 28.3% through e-auctions (table A.5 in annex).[25] Federal authorities represent 60% of the auctions, while 40% of the auctions are

monopolies, for the procurement of military or cultural goods, works or services and in case of emergency (Federal Law No.94 Art.55).

[21] 78.7% of the e-auctions has only one applicant.

[22] See table A.4 in the annex for an overview of the used variables.

[23] We drop observations with excessive outliers in the unit reserve price.

[24] Table A.2 in the annex shows the construction of the sample and table A.5 contains the summary statistics for the initial and reduced sample. Competition seems slightly higher in the latter but in general the statistics are comparable across the samples.

[25] This pattern is largely maintained at the regional level with the noteworthy exception of Tatarstan where gasoline is procured mainly through e-auctions.

organized by lower level government authorities. The average contract value is 510,177.5 rubles which amounts to approximately 12,448.3 euros.[26] Since procurers only need to post the total contract value, the unit reserve price is not directly available for the majority of cases. We calculate the unit reserve price by dividing the contract value by the contract volume. We arrive at an average unit reserve price of 29.4 rubles or about 0.72 euros over the sampling period. The auctions in our sample have a median of only 2 bidding firms, with a standard deviation of 0.7. Besides procurement data, we use monthly market prices of gasoline per Russian region (see figure 3). The average local market price in our sampling period is 27.9 rubles or 0.68 euros, which is below the average reserve price of 0.72 euros that acts as a price ceiling for the final contract prices.

4 Empirical evidence

4.1 Reserve price overpricing and favoritism

We begin this section with the estimation of reserve prices per liter of gasoline for decentralized purchases which are not outsourced to other institutions using equation (1) outlined in the methodology section. For contracts that contain multiple types of gasoline we construct the market price as a weighted average of the monthly regional market prices[27] with the volume of each type relative to the total contract volume as weights. Results are presented in table 1.[28] As expected, the monthly regional average market price per liter turns out to be a significant determinant of the contract-specific unit reserve price. The contract volume has a positive and significant effect on prices. Procurement at the municipal level exhibits higher prices per liter than procurement at the regional or

[26] Calculated at the average exchange rate over the considered period, 1 RUB = 0.0244 EUR.

[27] Quality differences will be reflected by the market price of each type of gasoline.

[28] The model is estimated using the Stata command by Nichols (2008).

Figure 3: Market price of gasoline

Notes: Average regional gasoline prices in the period 2011-2013 (Rosstat). The darker, the higher market prices. The regions are grouped into 4 classes: [24.7;26.9],]26.9;27.4],]27.4;28] and]28;42.7]. No data available for white colored regions.

federal level and mixed purchases[29] also have on average a higher unit reserve price.

To test for manipulation of reserve prices, we analyze the fixed effects for each pair of procurer and seller μ_{ij}. For notational convenience, *overpricing*=1 if $\mu_{ij} - \mu_i$ is significantly larger than zero at the 5% significance level.[30] Table 2 summarizes the results. 1,028 out of 10,932 procurer-seller pairs are identified as overpricing (potentially favoritist) pairs, representing 15.3% of the auctions.[31] The corresponding average size of the favoritism reserve price mark-up is 1.2 rubles per liter which should be related to the average price of 30.4 rubles for

[29] We focus on purchases of gasoline without any related products, but in a small number of cases related products were mentioned in the description of the purchase and were not reported as supplied goods in the contract stage. We marked these cases as mixed.

[30] *Overpricing* at the 1 and 10% significance level is provided in table A.1 part of the appendix. The correlation between testing at the 5% significance level and the 1% (10%) is 0.6 (0.8) and statistically significant.

[31] For 51,330 out of the initial 81,813 auctions we can tell whether the procurer-seller pair is characterized by potential favoritism. The remaining auctions mainly involve procurers who concluded contracts with only one seller. The summary statistics for the *overpricing* sample are part of table A.5 in the annex. Furthermore, we provide the histogram of the number of interactions between potentially favoritist procurers and sellers and the number of auctions per favoritist procurer (figure A.1).

Table 1: Unit reserve price

	(1) r
Market price	0.898***
	(0.00433)
Lnvolume	0.0613***
	(0.00774)
Federal	0.248
	(0.214)
Municipal	0.169***
	(0.0530)
Mixed	0.772***
	(0.110)
Constant	4.304***
	(0.205)
Year FE	Yes
Procurer-seller FE	Yes
Observations	81,813

Notes: The dependent variable r is the reserve price per liter of gasoline. *Market price* is the weighted average of monthly market prices of different gasoline types, *lnvolume* is the natural logarithm of contract volume, *federal* is a dummy equal to 1 if the procurer is at the federal level and *municipal* if at the municipal level. *Mixed* is a dummy variable equal to 1 if the procurement can contain other items. Standard errors in parentheses.

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

the overpriced subset of auctions, leading to a 3.9% mark-up per liter of gasoline (see figure 4).[32] If we multiply the mark-up at procurer-seller level with the procured quantity by pair, we obtain an average mark-up of 157 thousand rubles. Summing the mark-ups over all favoritist pairs yields a total of 161 million rubles waste in reserve prices. Figure 5 reveals large regional variation in both the average reserve price mark-up of favoritist pairs and the share of

[32]The identification of favoritist pairs is not driven by seller characteristics since we never label all procurer relations of a given seller as characterized by favoritism. Our method only captures systemic behavior at the procurer-seller level.

favoritist pairs in total regional pairs. The figure also reveals a positive association between these two variables. Regions with a higher share of favoritist pairs, that is, also exhibit higher average reserve price mark-ups.[33]

Table 2: Summary of reserve price overpricing

	Observations	Overpricing	%
Procurement by procurers			
Pairs	10,932	1,028	9.4
Procurers	5,542	840	15.2
Sellers	2,200	437	19.9
Auctions	51,330	7,855	15.3
Procurement by centralized agencies			
Pairs	3,644	212	5.8
Procurers	2,267	198	8.7
Sellers	919	133	14.5
Auctions	14,521	1,514	10.4

Note: Overpricing indicates whether reserve prices at the procurer-seller level are significantly higher than prices at procurer level.

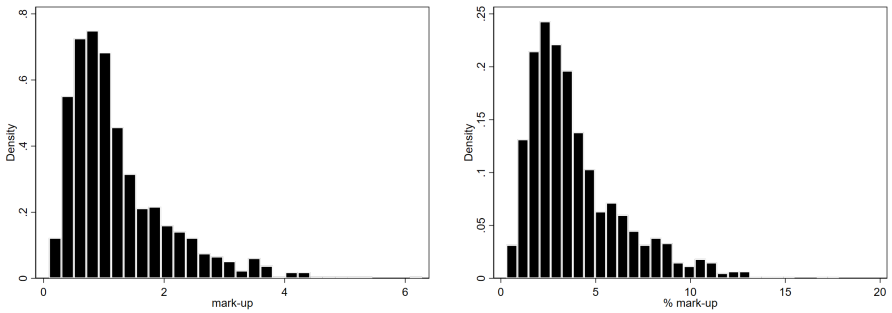
Comparing the number of favoritist procurers and favored sellers to the number of favoritist pairs, we can deduct that favoritist procurers have on average more than one favored seller and favored sellers are on average favored by more than one procurer. Overpricing sellers participate in significantly more auctions, confirming the repetitive character of favoritist transactions between two parties in the absence of formal enforcement mechanisms.[34] Moreover the number of unique procurers engaged in favoritist pairs exceeds the number of unique sellers engaged in favoritist pairs, implying that there must be a competition for corrupt sellers among the more ubiquitous corrupt procurers. As a sanity check, we run our method for detecting favoritist pairs on the sample of outsourced public procurements managed by centralized procurement agencies, which can be thought of as a placebo group in the context of the favoritism mechanism we study in this paper. The results in table 2 show that the share of favoritist pairs

[33]Not all regions are included in the figure because not all regions have favoritist pairs.

[34]Overpricing pairs have a higher number of interactions over three years than other pairs that are active over three years with on average versus 7.6 versus 4.4 interactions, at the 75% percentile 9 versus 5 interactions, and at the 90% percentile 13 versus 8 interactions.

and favoritist transactions is substantially lower in the sample of centralized procurements than in our sample of decentralized procurements, in line with the earlier findings of Bandiera et al. (2009).[35]

Figure 4: Histogram of the reserve price mark-up



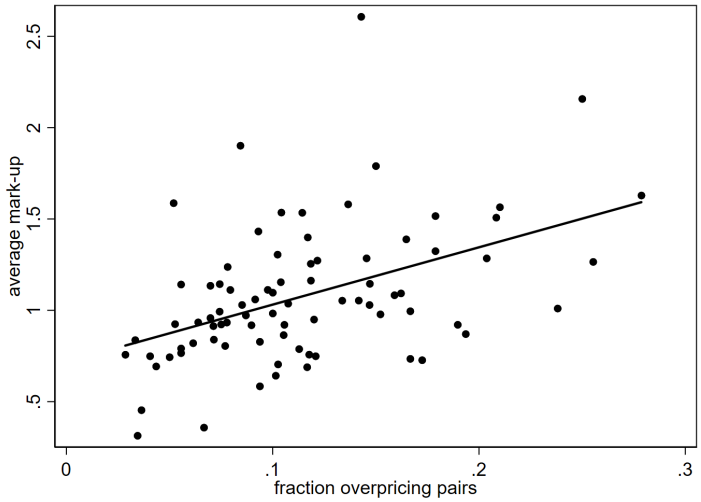
Notes: Sample is restricted to unique favoritist pairs. The reserve price mark-up is expressed in rubles.

Some may argue that reserve prices are manipulated by only the seller rather than the procurer-seller pair. It is hard to imagine how this kind of one-sided reserve price manipulation could work, since procurers set the reserve price. Still, we calculate the fraction of favoritist relations per seller and find that all favoritist sellers exhibit at least some non-favoritist relations too, in line with our interpretation of favoritism as a pair characteristic, rather than a seller characteristic.[36] In addition, one could argue that some sellers may poach for any auction with high reserve prices and potentially low competition. We checked if the favored sellers are more likely to show up as losing bidders in other auctions with high reserve prices. Concretely, we take the bottom and top quartile of the residuals from the unit reserve price regressions. Then we verify whether sellers in favoritist pairs are more likely to be among the losing bidders in the top quartile of residuals (high unit reserve price transactions) than

[35] We consider pairs between procurers and sellers, treat agencies as intermediaries and exclude their purchases for themselves from the dataset.

[36] The sample contains 2,200 sellers. 80% of the sellers are not in a favoritism relationship according to our measure, about 16% has both types of relations and 4% has only favoritist relations.

Figure 5: Regional variation



Notes: Sample is restricted to unique favoritist pairs. The reserve price mark-up is expressed in rubles per liter. The mean (median) market price in our sample is 27.9 (27.8).

in the bottom quartiles. We find a higher fraction of losing favoritist bidders in the bottom quartile, rejecting the poaching firm hypothesis.

4.2 Validity and accuracy

Given the non-trivial structure of our data, we want to make sure the results of our approach are not driven by randomness, but really capture a stable pattern of reserve price manipulation. Remind that reserve price overpricing is identified through our two-step procedure:

1. Estimate $r_{ijt} = \boldsymbol{X}_{ijt}\boldsymbol{\beta} + \sum \gamma_s year_t + \mu_{ij} + \epsilon_{ijt}$ (model 1)
2. Test if $\mu_{ij} - \mu_i > 0$

Validity First we verify that the share of pairs labeled as characterized by potential favoritism by our method is not driven by randomness. To this purpose we generate the unit reserve price r_{ijt} under the assumption of no favoritism and repeat the two-step procedure:

1. Calculate the linear prediction from model 1
2. Replace μ_{ij} by μ_i (imposing no favoritism at the procurer-seller level)
3. Employ the variance of error terms of model 1 to randomly draw errors
4. Generate r_{ijt} (left-hand side) using the elements obtained in step 1, 2 and 3 (right-hand side)
5. Reapply the two-step procedure to identify reserve price overpricing

Given that r_{ijt} is generated in the explicit absence of favoritism and tests are performed at the 5% significance level, the two step procedure should identify approximately 5% of the pairs as favoritist. Accordingly, the null hypothesis of no favoritism is rejected in 6.3% of the procurer-seller pairs. We can compare this to the results of the actual analysis (see Section 4.1) where the null hypothesis of no favoritism is rejected in 9.4% of the procurer-seller pairs, which is significantly larger than the approximately 5% we could expect by randomness. Our test therefore seems to be valid.

Accuracy Similarly, we want to verify to what extent our test is accurate in labeling the right pairs as favoritist. We test the accuracy or our method to identify reserve price manipulation by drawing the unit reserve price r_{ijt} from a distribution which assumes the presence of corrupt favoritism.

1. Calculate the linear prediction from model 1
2. Replace μ_{ij} by $\hat{\mu}_{ij}$ (imposing favoritism at procurer-seller level)
3. Employ the variance of error terms of model 1 to randomly draw errors
4. Generate r_{ijt} (left-hand side) using the elements obtained in step 1, 2 and 3 (right-hand side)
5. Reapply the two-step procedure to identify reserve price overpricing

Given that r_{ijt} is generated in the presence of favoritism and tests are performed at the 5% significance level, this two step procedure should retrieve most of the favoritist pairs. We find that 75% of the procurer-seller pairs labeled as characterized by potential favoritism (see Section 4.1) are again identified as being favoritist, testifying of the accuracy of the method.

These simulations ensure us that the pairs we label as favoritist are not just driven by randomness but capture a true pattern of upward reserve price manipulation.

4.3 Restricted competition

Favoritist procurers can foster the odds of winning of their favored seller by restricting auction competition. The number of participants can be reduced, for example, by imposing requirements for participation such as a number of gas stations in the district or by shortening the application period. Atmaca (2020) shows that potentially favoritist procurers shorten the time firms get to apply for participation in auctions to limit competition and to allocate the contract to favored firms. Regardless of what precise mechanisms are used to restrict participants from entering the auction, we can analyze whether the presence of favoritist pairs in the auction affects competition by estimating the following model:

$$\begin{aligned} \text{Competition}_{\text{ijt}} = \alpha_1 \text{Overpricing}_{\text{ij}} + \alpha_2 \text{Lnvolume}_{\text{ijt}} + \alpha_3 \text{r}_{\text{ijt}} \\ + \mathbf{X}_{\text{ijt}} \boldsymbol{\beta} + \epsilon_{\text{ijt}} \end{aligned} \tag{5}$$

Our first measure of competition *applicants* is the number of applying firms. This variable measures to what extent firms choose not to participate in certain auctions (either through self-selection or because of unobserved pressure by the favoritist pair). Our second measure of competition *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction.

This measures the discretionary exclusion of certain bidders from the auction by public procurers. Indeed, procurers can exclude bidders from the auction by resorting to the argument that they are not fully complying with some technical details, clauses or conditions of the contract. The third measure *notbidding* is a dummy variable equal to 1 if at least one non-excluded applicant decides not to bid in e-auctions after all. Since the threat of explicit exclusion by the procurer is credible, it is to be expected that some sellers may refrain from participating in e-auctions for which they have come to the understanding their presence is undesired by a favoritist pair. Our fourth measure of competition *bidders* is the number of sellers that in effect place a bid in the auction. Our fifth and final measure of competition is a dummy equal to 1 if only one bidder remains in the auction.[37] The general interpretation is straightforward: auctions with fewer bidders and especially auctions with only one bidder are less competitive. We expect that procedures with only one bidder will be especially prevalent among favoritist pairs in e-auctions because in this case the law allows procurers to award contracts at the reserve price instead of the winning bid price, which provides an excellent opportunity to transform the inflated reserve price into higher final contract prices.

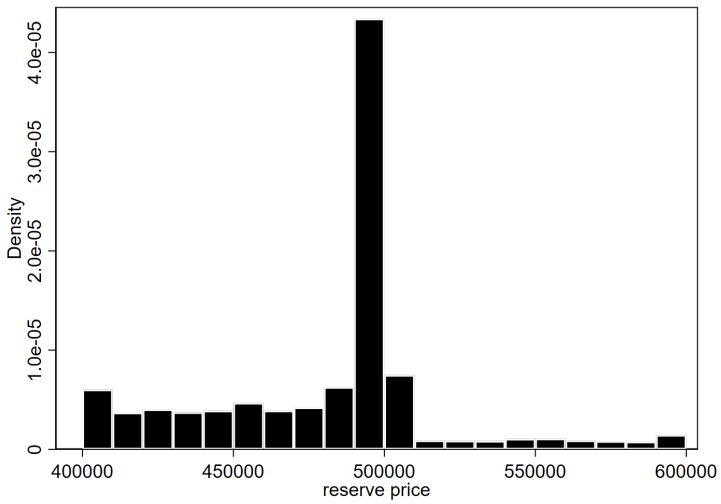
The main independent variable is our pairwise measure of overpricing. If auctions with overpricing favoritist pairs exhibit less competition, we regard this as evidence of our favoritism mechanism. The unit reserve price is included, because it will affect firms' willingness to participate in the auction. We further include the natural logarithm of the contract volume as it will determine firms' ability to deliver. $\mathbf{X}$ contains additional control variables: the auction procedure (sealed bid or e-auction), voluntary e-auctions, year and region fixed effects. The variable *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction. To identify a causal effect of the auction procedure, we rely on the aforementioned procurement rules regarding the mandatory use of

[37] We use a Poisson regression for the estimation of the number of applicants and bidders and logistic regression for *exclusion*, *notbidding* and *1 bidder*.

e-auctions. First, we distinguish between mandatory and voluntary e-auctions. Then, we compare mandatory e-auctions with sealed bid auctions by controlling for voluntary e-auctions.

Another challenge to the identification of causal effects of the auction procedures is that procurers tend to sort just below the threshold of 500,000 rubles to avoid mandatory e-auctions, as clearly indicated by the distribution of the reserve price in figure 6.[38] In line with Barreca et al. (2016), we deal with this by dropping auctions just below and above the thresholds to account for the manipulation of reserve prices.[39]

Figure 6: Sorting



The results in tables 3 and 4 shed light on the mechanisms to limit competition in auctions of favoritist pairs. In table 3, the overall effect of favoritism on the number of potential competitors in column 1 is negative and statistically significant at the 1% significance level implying auctions of favoritist pairs attract

[38]The McCrary (2008) density test rejects the null hypothesis of no discontinuity at the threshold.

[39]More specifically, we drop auctions with reserve price $\in$ [490,000;510,000] rubles.

fewer bidders wanting to participate in auctions. E-auctions are characterized by lower entry than sealed bid auctions which is in contrast with the theoretical prediction but in line with the interpretation that a substantial share of the procurers are inclined to exploit the rule that the contract can be concluded at the reserve price if there is only one seller in the auction. A higher unit reserve prices and a higher contract size attract more sellers. In column 2, the favoritist pair dummy is interacted with the auction procedure. The previous result that procurers tend to limit the number of applicants especially for e-auctions is even stronger for e-auctions with favoritist pairs. Similarly in column 3 we interact the favoritism indicator with a dummy indicating whether the procurer specified the required delivery method. Requiring a specific delivery method can function as an entry barrier, as not every firm will be able to comply with the requirement. This is exactly the mechanism discussed earlier in our example of Kostroma State University (see Section 3.2). Although the direct effect of *delivery* is small and statistically insignificant, we find that requiring a specific delivery method lowers the number of applicants significantly for favoritist pairs. In sum, favoritist pairs limit entry by imposing requirements on the delivery method.

In columns 4-6 we consider exclusion of sellers by procurers and we obtain significant effects of overpricing procurer-seller pairs, suggesting that the reduction of competition does also occur by actively denying applying bidders access to the auction on some technical ground. In column 6, the direct effect of *delivery* is significant and positive, implying that procurers in general use their discretionary power to exclude sellers on the grounds of delivery requirements. For favoritist pairs this effect is reversed, since sellers have in the case of delivery requirements already understood in the first phase of the process they will have no chance of winning and have self-selected out of the auction by not even applying (see column 3). The unit reserve price has a negative effect on the fraction of allowed applicants and the volume has a positive effect. In the last column, we estimate the impact of favoritism on the decision not to place a bid

Table 3: Mechanisms

	(1) Applicants	(2) Applicants	(3) Applicants	(4) Exclusion	(5) Exclusion	(6) Exclusion	(7) Notbidding
Overpricing	-0.0246***	-0.0148***	0.00299	0.130***	0.152***	0.234***	-0.0967
	(0.00521)	(0.00532)	(0.00836)	(0.0488)	(0.0531)	(0.0717)	(0.0768)
E-auction	-0.370***	-0.366***	-0.369***	-1.450***	-1.427***	-1.465***	
	(0.00760)	(0.00781)	(0.00768)	(0.0734)	(0.0767)	(0.0739)	
Overpricing * E-auction		-0.0299**			-0.138		
		(0.0123)			(0.131)		
Delivery			-0.00433			0.119***	
			(0.00424)			(0.0396)	
Overpricing * Delivery			-0.0508***			-0.183*	
			(0.0103)			(0.0955)	
Unit reserve price	0.00300***	0.00299***	0.00307***	-0.0270***	-0.0270***	-0.0276***	-0.0242
	(0.00107)	(0.00107)	(0.00107)	(0.00948)	(0.00948)	(0.00951)	(0.0158)
Lnvolume	0.0454***	0.0457***	0.0452***	0.132***	0.133***	0.135***	0.147***
	(0.00229)	(0.00229)	(0.00229)	(0.0208)	(0.0208)	(0.0208)	(0.0377)
Voluntary e-auction	-0.0137	-0.0130	-0.0143	-0.378***	-0.375***	-0.374***	-0.0513
	(0.00922)	(0.00923)	(0.00923)	(0.111)	(0.111)	(0.111)	(0.0970)
Constant	-0.251***	-0.255***	-0.246***	-3.830***	-3.843***	-3.914***	-3.466***
	(0.0552)	(0.0552)	(0.0552)	(0.708)	(0.708)	(0.709)	(0.820)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521	47,521	47,521	15,579

Notes: The first dependent variable is the number of applicants, *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction and *notbidding* is a dummy variable equal to 1 if a not excluded applicant decides not to bid. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary, *delivery* is a dummy variable equal to 1 if the delivery method is specified. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in column 7 is restricted to e-auctions. Robust standard errors in parentheses.

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

in e-auctions, despite being authorized to do so. The coefficient of our favoritist pair variable is insignificant and negative.

Table 4 presents the results for the number of sellers that actually place a bid in the auction. We observe that our favoritist pair dummy reduces the number of bidding companies and increases the likelihood that only one bidder finally shows up at the auction, which allows both parties to conclude the contract at the inflated reserve price. When we interact the auction procedures with the favoritist pair dummy, we observe again that favoritist pairs limit competition more in e-auctions than in sealed bid auctions. In sum, our results are in line with a mechanism by which the reduction of the number of bidding firms does occur through both explicit exclusion of certain bidders by favoritist procurers and credibly threatening unwanted bidders with this perspective, causing them to self-select out of the bidding process despite the attractive high reserve price. The effects of the control variables on the number of bidders are in line with the effects on the number of applicants.

4.4 Increased probability of winning

Our procedure detects systemic deviations in reserve prices at procurer-seller level and shows that these are inversely related to competition but to nail down the identification of favoritist pairs, we also need to confirm that winning bids indeed accrue to favoritist pairs. After all, reserve prices are overpriced in consultation with favored bidders to allocate contracts to those bidders in exchange for private benefits in kind or in cash (bribes). To finance these corrupt private benefits for favoritist procurers, the favored bidders need to be more likely to win the procedure and the final price has to provide enough rent to finance this private benefit. Here we analyze the former part of this assertion. The latter part is analyzed in the next section. In table 5 we estimate the probability of winning auctions as a function of our favoritism indicator *overpricing* using a

Table 4: Competition

	(1) Bidders	(2) Bidders	(3) 1 bidder	(4) 1 bidder
Overpricing	-0.0360***	-0.0266***	0.188***	0.0702*
	(0.00488)	(0.00586)	(0.0301)	(0.0377)
E-auction	-0.417***	-0.413***	2.413***	2.363***
	(0.00712)	(0.00734)	(0.0429)	(0.0438)
Overpricing * E-auction		-0.0296***		0.349***
		(0.0101)		(0.0645)
Unit reserve price	0.00550***	0.00549***	-0.0377***	-0.0375***
	(0.000973)	(0.000973)	(0.00591)	(0.00592)
Lnvolume	0.0363***	0.0365***	-0.164***	-0.167***
	(0.00223)	(0.00224)	(0.0131)	(0.0131)
Voluntary e-auction	0.0104	0.0110	-0.116**	-0.122**
	(0.00824)	(0.00824)	(0.0482)	(0.0482)
Constant	-0.292***	-0.295***	3.156***	3.201***
	(0.0526)	(0.0526)	(0.335)	(0.334)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521

Notes: The dependent variable in the first two columns is the number of bidders and in the last two columns a dummy variable equal to 1 if the number of bidders is 1. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter, *lnvolume* is the natural logarithm of the contract volume and *voluntary e-auction* is a dummy variable if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

logistic regression with procurer i, bidder b at time t:

$$\text{Win}_{\text{ibt}} = \alpha_1 \text{Overpricing}_{\text{ibt}} + \alpha_2 \text{Bidders}_{\text{ibt}} + \mathbf{X}_{\text{ibt}}\boldsymbol{\beta} + \epsilon_{\text{ibt}}$$

The results in table 5 show that bidding firms are much more likely to win if they form a favoritist pair with the procurer.[40] The odds of winning for

[40]For sealed bid auctions the sample contains the full set of bidders yet for e-auction we may have a subset of bidder identities as it is obligatory to publish information about only the last three bids. Since competition is rather low the sample will contain the bidder identities for most auctions. Still, we repeat the regression restricting the sample to auctions where the number of identities is equal to the number of bidders. The results remain robust.

overpricing in column 1 is 1.2 times that of no overpricing. The marginal effect, evaluated at the means of covariates, is 2 percentage points. These results are in line with the results by Baltrunaite (2019) who showed that corporate donors with favored connections had higher chances of getting public contracts. We also find that the probability of obtaining the contract is lower in e-auctions and when competition increases. The effect of reserve price overpricing (the favoritism indicator) does not vary with the auction procedure (columns 2, 4 and 6). In columns 3-6, region fixed effects are replaced by procurer fixed effects. Even within the subsample of sellers that have at least one favoritist relation (see columns 5 and 6), sellers are much more likely to win the auction if they form a favoritist pair with the procurer.

4.5 Higher contract price mark-ups

After having shown that our overpricing procurer-seller pairs face less auction competition despite the higher reserve price and are more likely to win auctions, we finally need to show that their auctions also lead to higher final prices. Without the rent provided by higher final prices, favored winning bidders would not be able to finance the private benefits promised to the procurer. Without higher final prices, that is, a crucial step in the favoritism mechanism would be missing. We can expect that the transmission of inflated reserve prices to higher contract prices also depends on competition and on the auction procedure. First, favoritist pairs may not be able or not want to completely control competition in all cases. In auctions of favoritist pairs with relatively high competition, we can therefore expect that final prices may be relatively lower. Still this behavior may make sense because allowing some competition some of the time reduces the odds of being caught, which has to be traded off against the lower final prices. Second, the auction procedure itself may also affect non-corrupt agents' incentives to participate. For the allocation of urban land in China for example, Cai et al. (2013) find that the auction procedure is exploited by auctioneers for corrupt deals, leading to lower competition. Therefore the specification below

Table 5: Probability of winning public contracts

	(1) Win	(2) Win	(3) Win	(4) Win	(5) Win	(6) Win
Overpricing	0.171***	0.142***	0.252***	0.228***	0.404***	0.375***
	(0.0360)	(0.0432)	(0.0489)	(0.0583)	(0.0580)	(0.0695)
E-auction	-0.195***	-0.207***	0.0116	0.000215	0.0231	0.00557
	(0.0356)	(0.0371)	(0.0632)	(0.0650)	(0.0751)	(0.0786)
Overpricing*E-auction		0.0920		0.0722		0.0822
		(0.0776)		(0.0971)		(0.108)
Bidders	-1.320***	-1.320***	-1.380***	-1.380***	-1.598***	-1.597***
	(0.0178)	(0.0178)	(0.0232)	(0.0232)	(0.0299)	(0.0299)
Voluntary e-auction	-0.0364	-0.0373	0.0165	0.0172	-0.0261	-0.0253
	(0.0475)	(0.0475)	(0.0671)	(0.0671)	(0.0779)	(0.0779)
Constant	4.193***	4.201***				
	(0.277)	(0.277)				
Region FE	Yes	Yes	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Procurer FE	No	No	Yes	Yes	Yes	Yes
Observations	56,816	56,816	42,171	42,171	29,249	29,249
Procurers			2,898	2,898	2,286	2,286

Notes: The dependent variable *win* is a dummy variable equal to 1 if the bidder is the winner of the auction. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *bidders* is the number of bidders, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in the last two columns is restricted to sellers who have at least one corrupt relation. Standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

regresses the relative difference between the contract price[41] and the monthly regional market price per liter of gasoline p on the same independent variables as before, accounting for the interaction effects between favoritist procurer-seller pairs, auction competition and auction procedure:

$$\begin{aligned} \mathrm{p_{ijt}} &= \alpha_1 \mathrm{Overpricing_{ij}} + \alpha_2 \mathrm{r_{ijt}} + \alpha_3 \mathrm{Lnvolume_{ijt}} + \alpha_4 \mathrm{Bidders} \\ &+ \alpha_5 \mathrm{Overpricing_{ij}} * \mathrm{E\,auction_{ijt}} + \alpha_6 \mathrm{Overpricing_{ij}} * \mathrm{Bidders_{ijt}} \\ &+ \alpha_7 \mathrm{Overpricing_{ij}} * \mathrm{E\,auction_{ijt}} * \mathrm{Bidders_{ijt}} + \mathbf{X_{ijt}}\boldsymbol{\beta} + \epsilon_{\mathrm{ijt}} \end{aligned} \tag{6}$$

Table 6 reveals that *overpricing* has the expected sign: favoritist pairs indeed also enjoy the higher contract price mark-ups they need to finance favoritism fees. The regression results without interaction terms are provided in column 1. The price increases by 1.73 percentage points.[42] Both the unit reserve price and the contract volume significantly and positively affect prices. As expected, the mark-ups are also significantly affected by competition[43] and by the auction procedure. While competition is related to relatively lower contract price mark-ups, e-auctions unexpectedly do not exhibit by themselves lower mark-ups. The negative and statistically significant coefficient of the interaction between competition and the auction procedure however reveals that e-auctions become effective in reducing contract price mark-ups once there is sufficient competition (column 2). The coefficient of the interaction between favoritist pairs and competition (*overpricing*bidders*) is negative and significant, indicating that corrupt favoritism is less effective in inflating mark-ups in the presence of several bidders. The interaction term *overpricing*auction* has a significant and positive coefficient while the effect of *overpricing*auction*bidders* is significant and negative. The adverse effect of favoritism on higher contract price mark-ups is therefore larger for e-auctions than for sealed bid auctions in the case of one bidder but this relation is reversed once competition increases. Figure

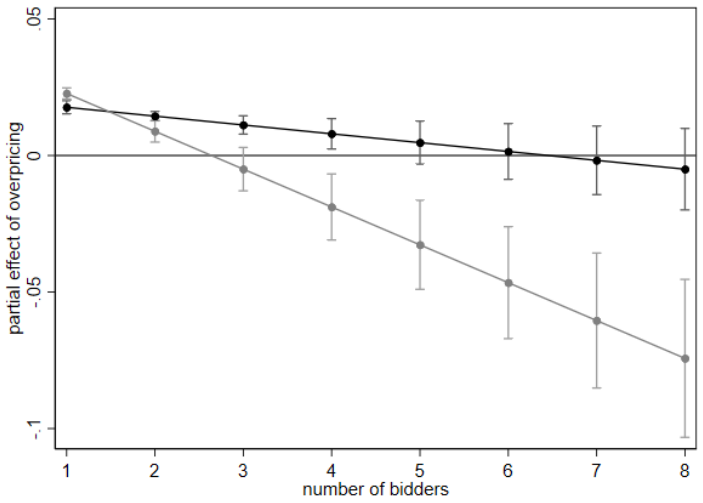
[41] The contract price per liter is corrected for outliers.

[42] If we replace the relative mark-up by the absolute contract price mark-up the coefficient of overpricing is about 0.45. Multiplying this effect with the total volume of contracts by favoritist pairs results in 69 million rubles waste.

[43] The number of observations by auction procedure and number of bidders is shown in table A.3 part of the appendix.

7 visualizes the partial effect of favoritist pairs on contract price mark-ups for sealed bid and e-auctions, conditional on the number of bidders in the auction. We may conclude that competition is an effective tool to combat this type of corrupt favoritism and especially so in open bid e-auctions. This finding partially results from the procurement rule that permits procurers in e-auctions with only one bidder to conclude the contract at the reserve price, which implies a large downward marginal effect on the mark-up from securing at least three real competitors in the e-auction.

Figure 7: Partial effect of overpricing on the contract price mark-up



Notes: Black (gray) line shows partial effect and the 95% confidence interval of favoritism in sealed bid auctions (e-auctions) based on table 6.

5 Robustness

This section provides corroborating evidence for our overpricing indicator and gives an overview of the robustness checks. A more elaborate discussion of the robustness results can be found in annex.

Table 6: Contract price mark-up

	(1) p	(2) p
Overpricing	0.0173***	0.0209***
	(0.000642)	(0.00228)
E-auction	0.000488	0.0480***
	(0.000808)	(0.00144)
Bidders	-0.0211***	-0.0121***
	(0.000357)	(0.000364)
Overpricing * E-auction		0.0157***
		(0.00355)
Overpricing * Bidders		-0.00324***
		(0.00121)
E-auction * Bidders		-0.0341***
		(0.000954)
Overpricing * E-auction * Bidders		-0.0106***
		(0.00248)
Unit reserve price	0.0155***	0.0156***
	(0.000152)	(0.000149)
Lnvolume	0.000882***	0.000970***
	(0.000252)	(0.000246)
Voluntary e-auction	0.00314***	0.00125
	(0.000877)	(0.000834)
Constant	-0.511***	-0.525***
	(0.00706)	(0.00693)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	46,437	46,437

Notes: The dependent variable p is the winning bid per liter minus the market price divided by the latter. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, *bidders* is the number of bidders, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

5.1 Simulations

To make sure our results are not driven by random variation in the setting of reserve prices, we conduct a set of straightforward simulations. We start from the sample of pairs for which we could tell whether there is overpricing. We then randomly label pairs of procurers and sellers as favoritist pairs engaged in reserve price overpricing. The fraction of randomly defined favoritist pairs is restricted to the fraction of pairs labeled as favoritist in our empirical results (9.4 %). We then use these randomly generated favoritism pairs to estimate the effect of being a favoritist pair on the number of bidders, the probability of one bidding firm, the probability of winning and contract price mark-ups. We iterate this procedure 5,000 times.

The regression coefficients of these 5,000 simulated random sets of favoritist pairs are plotted in figure A.2 in the annex. The coefficients of the simulations are not skewed to the left (right) of zero in the estimation of the number of bidders (probability of one bidding firm, probability of winning, contract price mark-up). Since the effects of the randomly defined favoritism indicators is on average zero we rest assured that our approach of detecting reserve price overpricing is not driven by randomness.

5.2 Evidence from corruption perception indices

In this part we correlate our favoritism indicator with existing indicators that capture similar forms of corruption as a back of the envelope sanity check of our approach. We make use of the Georating survey from the Public Opinion Foundation, commonly referred to as FOM.[44] The survey from 2008 (but not later surveys unfortunately) includes questions on corruption that are particularly relevant for our research. As corruption is relatively persistent we expect that the 2008 responses still largely reflect the variation in corruption in our sampling period. For each corruption indicator outlined in the annex, we take the

[44] https://fom.ru/

mean per region to construct a regional corruption index. Then, we calculate the regional amount of favoritist overpriced auctions and overpricing procurer-seller pairs to correlate with the subjective corruption indices. In short, there are significantly more transactions by reserve price overpricing pairs in regions where people are more likely to report to have given a bribe to an official, which is precisely the type of unconditional willingness to bribe required for favoritist corruption. The fact that our approach detects more favoritist pairs in regions where individuals are more likely to bribe officials provides some comfort about the general validity of our approach.

5.3 Unit reserve price and auction outcomes

The first set of sensitivity analyses relate to the unit reserve price regression. We control sequentially for the auction procedure and the time until first delivery. Subsequently, we account for the legal amendment on the publication of the reserve price (No.94-FZ on 21/4/2011). Overall, the overpricing indicators are highly and significantly correlated with our initial index.

The second part of the robustness focuses on the auction outcomes. We begin with interacting all independent variables with the auction procedure. Next, standard errors are clustered at procurer level. We further drop sellers with uniquely favoritist relations. Since the auction procedure is dependent upon a threshold we run regressions including the running variable which is the reserve price. We take the natural logarithm of this variable and drop the contract volume from the regressions due to multicollinearity. Finally, we control for the number of interactions between procurers and sellers. In general, results remain robust.

6 Conclusion

We propose a generic and objective data-driven method to identify corrupt favoritism in auctions with reserve prices and apply it to Russian public procurement auction of gasoline in the period 2011-2013. We identify favoritist procurer-seller pairs by exploiting the variation in reserve prices. More specifically, we estimate unit reserve prices as a function of the local market price, contract, procurer characteristics, time controls and procurer-seller fixed effects. We identify a procurer-seller pair as characterized by potential favoritism if its procurer-seller pair fixed effect is significantly larger than the average fixed effect of the procurer concerned. Since the reserve price is set before the public procurement auction, it should not be dependent on the winning seller within the same procurer but still we observe this is the case in 9.4% of procurer-seller pairs, representing not less than 15.3% of the transactions.

After ensuring the favoritist pairs are not driven by randomness, we document that favored sellers face less competition in auctions organized by procurers with whom they form a favoritist pair and have a higher probability of winning these auctions. This suggests potential competitors are successfully discouraged from applying to high reserve price auctions with favoritist pairs. We identify some of the ways in which competition is limited in favoritist auctions, such as the specification of particular delivery methods and the exclusion from the auction of certain bidders. Finally, auctions won by favoritist pairs also exhibit higher contract price mark-ups, indicating there is a substantial welfare cost from this type of reserve price inflation. The good news is that the negative effect of reserve price manipulation on contract price mark-up is mitigated by higher competition and can even be fully offset by e-auctions with sufficient competitors.

All this evidence is in line with a mechanism whereby corrupt procurers succeed in allocating public procurement orders to favored sellers at inflated prices,

creating a private benefit for themselves at the expense of the government's budget. We believe therefore it would be useful to integrate our straightforward approach in anti-corruption efforts as a low cost and automated effort to find some good first indications of which favoritist pairs deserve further inspection. Although corrupt agents could react to such policy measure by abandoning reserve price overpricing and switching to other forms of corrupt favoritism, the policy measure would still reduce the general scope for corrupt favoritism as reserve prices have a strong effect on final prices and therefore largely determine to what extent money can be tunneled from the public to the private sphere. Favoritist pairs could also try to prevent the detection of reserve price manipulation by randomly assigning some contracts with inflated reserve prices to non-favored sellers, yet this strategy is costly to them. Even if they successfully circumvent exposure, our proposed corrupt favoritism measure can still be applied ex post on past public procurement transactions by governmental or non governmental organisations to provide insights into relevant patterns of reserve price manipulation.

The method examines repeated interactions between procurers and sellers. Since our method relies on reserve price differences between multiple sellers within the same procurer, it is not able to identify favoritist relations of procurers that have transactions with mainly or only one seller or only transact with favored sellers. In these cases our method will underestimate the degree of favoritism. Our estimates of reserve price-related favoritism are therefore to be considered as lower bound estimates of the true level of favoritism.

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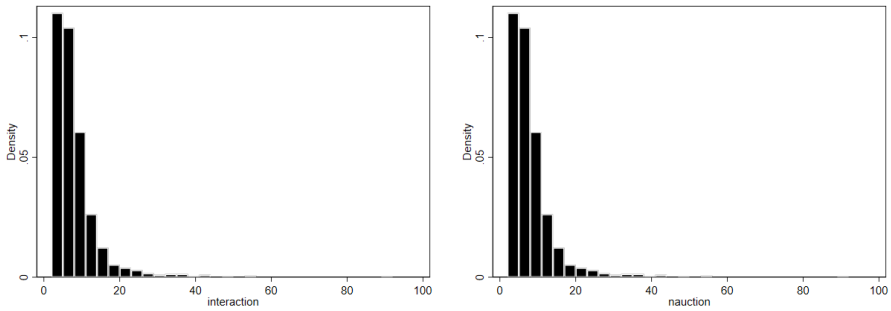
7 Appendix

Table A.1: Significance level

Significance level	Observations	Overpricing	%
1	10,932	402	3.7
5	10,932	1,028	9.4
10	10,932	1,659	15.2

Figure A.1: Histogram of the number of interactions and auctions



Note: The figure on the left shows the number of interactions between potentially favoritist procurers and sellers and the number of auctions per favoritist procurer is plotted on the right.

Table A.2: Sample

	Observations
Initial sample	171,984
- Outsourcing	48,659
- Missing seller identity	18,441
- Missing volume	14,232
- Missing reserve price per liter	8,838
Reduced sample	81,813

Table A.3: Number of bidders by auction procedure

		Bidders							
	Observations	1	2	3	4	5	6	7	8
Sealed bid auction	30,870	10,716	16,755	2,851	445	78	20	4	1
E-auction	15,567	12,273	2,705	495	82	10	1	0	1

Note: The number of observations by auction procedure and number of bidders is based on the estimation sample of the contract price mark-up (table 6).

Table A.4: Variable description

Variable	Description
1 bidder	Dummy variable equal to 1 if the number of bidders is 1
Applicants	Number of applicants
Bidders	Number of bidders
Delivery	Dummy variable equal to 1 if the delivery method is specified
E-auction	Dummy variable equal to 1 if electronic open bid auction and 0 if sealed bid auction
Exclusion	Dummy variable equal to 1 if the procurer excludes at least one applicant from the auction
Federal	Dummy variable equal to 1 if the procurer is on federal level
Lnvolume	Natural logarithm of the contract volume
Market price	Weighted average of monthly market prices of different gasoline types
Mixed	Dummy variable equal to 1 if procurement can contain other items like engine oils or greases
Municipal	Dummy variable equal to 1 if the procurer is on municipal level
Notbidding	Dummy variable if a not excluded applicant decides not to bid
Overpricing	Dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level
Contract price mark-up (p)	Winning bid per liter of gasoline minus the market price divided by the latter
Unit reserve prices (r)	Reserve price per liter of gasoline
Voluntary e-auction	Dummy variable equal to 1 if e-auction is not mandatory but voluntary
Win	Dummy variable equal to 1 if bidder is the winner of the auction

Table A.5: Summary statistics by sample

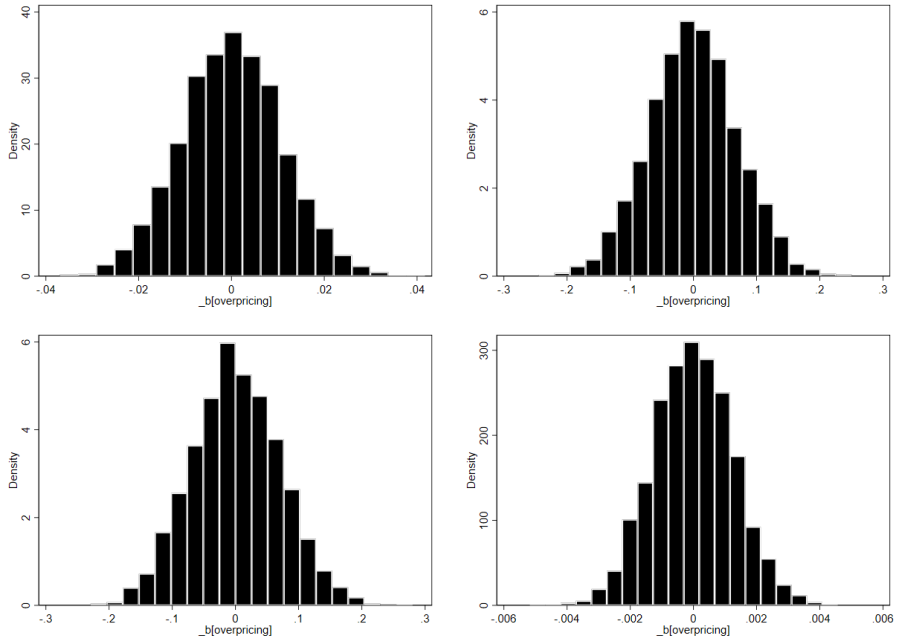
	No outsourcing			Unit reserve price			Overpricing		
	Observations	Mean	SD	Observations	Mean	SD	Observations	Mean	SD
1 bidder	123,325	0.4	0.5	81,813	0.5	0.5	51,330	0.5	0.5
Applicants	123,325	1.5	1	81,813	1.8	0.8	51,330	1.7	0.8
Bidders	123,325	1.4	0.9	81,813	1.6	0.7	51,330	1.6	0.7
Contract price mark-up (p)	80,709	0	0.1	79,810	0	0.1	50,183	0	0.1
Delivery	123,325	0.6	0.5	81,813	0.6	0.5	51,330	0.6	0.5
E-auction	123,325	0.3	0.5	81,813	0.3	0.5	51,330	0.3	0.5
Exclusion	123,325	0.1	0.3	81,813	0.1	0.3	51,330	0.1	0.3
Federal	123,325	0.6	0.5	81,813	0.6	0.5	51,330	0.6	0.5
Lnvolume	106,294	9	1.5	81,813	9	1.2	51,330	8.9	1.2
Market price	109,169	27.9	2.8	81,813	27.9	2.4	51,330	27.9	2.3
Mixed	123,324	0	0.1	81,813	0	0.1	51,330	0	0.1
Municipal	123,325	0.2	0.4	81,813	0.2	0.4	51,330	0.2	0.4
Notbidding	123,325	0	0.2	81,813	0	0.2	51,330	0	0.2
Unit reserve price (r)	98,064	29.5	3.2	81,813	29.4	2.8	51,330	29.3	2.8
Voluntary e-auction	123,325	0.1	0.3	81,813	0.1	0.3	51,330	0.1	0.4
Win	170,450	0.6	0.5	133,286	0.6	0.5	82,968	0.6	0.5

Notes: The first sample is without outsourced procurement. The second sample – used for the estimation of the unit reserve price – is without missing seller identity, volume and unit reserve price. The third sample contains the observations without missing values for *overpricing*.

Robustness

Simulations

Figure A.2: Simulations



Notes: Random labeling of pairs of procurers and sellers used in the estimation of the number of bidders (upper left panel), the probability of one bidding firm (upper right panel), the probability of winning controlling for procurer fixed effects (lower left panel) and contract price mark-up (lower right panel). Coefficients of 5,000 simulations are plotted.

Evidence from a corruption perception index

The first relevant survey question (q39) from the Georating survey related to the fight against corruption by regional governments provides the following response options: 1) the regional government is willing and able to deal effectively with corruption, 2) the regional government wants, but cannot effectively fight corruption, 3) the regional government may, but does not want to fight corruption effectively and 4) the regional government does not want and cannot effectively

Table A.6: Correlation with corruption indices

	q39 Fight against corruption	q42 Bribes demanded by civil servants	q46 Willingness to bribe
Overpriced transactions			
ρ	0.1780	-0.0954	-0.1815
p-value	0.1464	0.4390	0.1385
Observations	68	68	68
Overpricing pairs			
ρ	0.1878	-0.0830	-0.2042
p-value	0.1250	0.5011	0.0949
Observations	68	68	68

Notes: The variables are at regional level. The corruption indicators are correlated to the number of overpriced transactions in the first panel and the number of overpricing pairs in the second panel. *Q39*, *q42* and *q46* are from the Georating survey and measure respectively the fight against corruption, civil servants requesting informal payments and the willingness to bribe. The lower the values of *q42* and *q46*, the higher corruption. The correlation coefficient, p-value and number of observations is provided for each variable.

fight corruption. Higher values reflect a lower willingness of the regional authorities to fight corruption. The next question (q42) is 'Have you personally experienced in the last year or two that any civil servant requested or expected an informal payments in return for their service?' which can be replied on a four point scale ranging from 1) certainly and 4) definitely not or 5) difficult to answer. Lastly, the question 'Have you ever given a bribe to an official?' (q46) with the same set of possible answers as the previous question is considered. The regional averages of each corruption indicator are correlated with the regional amount of favoritist overpriced auctions and overpricing procurer-seller pairs. All correlations in table A.6 have the correct sign but only the last question on the willingness to bribe officials significantly correlates with our favoritism indicator.

Unit reserve price

Control variables

Procurers who agree with firms to manipulate reserve prices may simultaneously select a procedure to determine the allocation of the contracts. For this reason, we additionally control for the auction procedure in the estimation of the unit reserve price. The correlation between the resulting favoritism indicator and our baseline is 0.97 and significant. The inclusion of the auction procedure therefore hardly affects the identification of pairs with overpriced reserve prices. The choice of the auction procedure varies with the procurer instead of the combination of procurer and seller. More than 80% of the procurers made use exclusively of either sealed bid or e-auctions. The rest of the procurers implemented both procedures.

Then, we control for the time until first delivery. The risk premium will increase with the time between the publication of the auction and the day of first delivery. By applying text analysis, we can deduct the day of first delivery and calculate the duration for 67,285 auctions after correcting for outliers and obvious errors. By including duration as a control variable, we keep a fifth of the procurer-seller pairs. Our methodology is robust for including the duration of contracts. The resulting favoritism indicator is highly correlated to our initial index. The correlation is 0.75 and statistically significant.

Sampling period

As mentioned in the previous section, the government amended Federal Law No.94-FZ of 21/7/2005 on 21/4/2011 by obliging procurers to disclose information on the calculation of reserve prices. The change in law might influence procurers' behavior in setting the level of these prices, which could lead to a structural break in prices. To account for this, we drop auctions that were announced before 21/4/2011 and repeat our analysis. *Favoritist overpricing* in

the restricted sample is highly correlated to our baseline *favoritist overpricing* variable. The correlation is 0.89 and statistically significant.

Auction outcomes

The competition, probability of winning and price regressions only include interactions between the favoritism indicator and the auction procedure. It follows that our baseline estimates only provide the average effects of the control variables but we cannot exclude these effects may also vary with the procedure. Therefore we test whether our results are robust to interacting all covariates with the auction procedure. In line with the baseline findings, *overpricing* has a significant effect on *applicants* and *exclusion* (table A.7). Yet, the interaction term *overpricing*auction* in column 2 has not a significant effect anymore. The variable *delivery* remains robust while the interaction with the auction procedure indicates that the delivery method matters in e-auctions. Likewise, *overpricing*delivery* is not significant and *overpricing*e-auction*delivery* is significant and negative. The direct and indirect effect of *overpricing* in the tables A.8 and A.9 stay in line with the baseline. Table A.10 presents the price regressions. The coefficient of *e-auction* becomes negative in both columns. Furthermore, the results show that the unit reserve price has a stronger positive effect on the contract price mark-up in e-auctions.

The regressions are repeated clustering the standard errors at procurer level. The effect of *overpricing* remains for the number of applicants as dependent variable while it is no longer significant for *exclusion* (table A.11). The direct effect of *overpricing* is still present in table A.12. In column 2, *overpricing*e-auction* is no longer significant but the sign of the coefficients stays in line with baseline estimate. Except for *overpricing*bidders* in column 2 of table A.14, the probability of winning (table A.13) and price regressions remain robust.

We then drop sellers with only favoritist relations and keep sellers without

favoritist relations and sellers with both types of relations. In columns 3 and 7 of table A.15, *overpricing* becomes significant while it is the other way around for columns 4 and 5. The interaction terms remain robust. In column 4 of table A.16, *overpricing* is no longer significant but other than that the findings are similar to the baseline. The probability of winning and the contract price mark-up are further not affected (tables A.17 and A.18).

In line with regression discontinuity design, we include the running variable as explanatory variable. The natural logarithm of volume is replaced by the natural logarithm of the reserve price. Since both variables are highly correlated we do not expect major changes in the empirical estimations, which is also what we retrieve (tables A.19-A.22).

Finally, the number of interactions between procurers and sellers (bidders in case of the probability of winning) is introduced as a control variable. The number of interactions has a negative and significant effect on competition and surprisingly the probability of winning auctions (tables A.23, A.24 and A.25). In column 2 of table A.23, *overpricing* is not significant anymore. The contract price mark-up has a positive relation with the number of interactions (table A.26). In general, the variables have qualitatively a similar effect.

Table A.7: Mechanisms, fully interacted model

	(1) Applicants	(2) Applicants	(3) Exclusion	(4) Exclusion
Overpricing	-0.0194***	-0.0119	0.150***	0.207***
	(0.00531)	(0.00752)	(0.0536)	(0.0793)
E-auction	-0.416***	-0.375***	-8.851***	-8.711***
	(0.143)	(0.142)	(1.716)	(1.722)
Overpricing * E-auction	-0.0175	0.0297	-0.182	-0.0220
	(0.0127)	(0.0224)	(0.137)	(0.195)
Delivery		0.00461		0.136***
		(0.00442)		(0.0425)
Delivery * E-auction		-0.0520***		-0.217*
		(0.0119)		(0.123)
Overpricing * Delivery		-0.0138		-0.0939
		(0.0102)		(0.105)
Overpricing * E-acution * Delivery		-0.0870***		-0.341
		(0.0263)		(0.272)
Unit reserve price	0.00447***	0.00445***	-0.0388***	-0.0399***
	(0.00104)	(0.00105)	(0.0103)	(0.0104)
Lnvolume	0.0352***	0.0353***	0.0933***	0.0976***
	(0.00237)	(0.00238)	(0.0216)	(0.0217)
Voluntary e-auction	0.0384***	0.0394***	0.159	0.167
	(0.0137)	(0.0137)	(0.163)	(0.162)
Unit reserve price * E-auction	-0.00479	-0.00485*	0.0638**	0.0644**
	(0.00295)	(0.00293)	(0.0275)	(0.0275)
Lnvolume * E-auction	0.0355***	0.0357***	0.243***	0.240***
	(0.00612)	(0.00611)	(0.0621)	(0.0622)
Constant	-0.278***	-0.281***	-2.790***	-2.883***
	(0.0570)	(0.0570)	(0.729)	(0.731)
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Observations	47,521	47,521	46,038	46,038

Notes: The first dependent variable is the number of applicants, *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction and *notbidding* is a dummy variable if a not excluded applicant decides not to bid. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary and *delivery* is a dummy variable equal to 1 if the delivery method is specified. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

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

Table A.8: Competition, fully interacted model

	(1) Bidders	(2) 1 bidder
Overpricing	-0.0299***	0.0864**
	(0.00590)	(0.0385)
E-auction	-0.283**	-0.941
	(0.121)	(0.700)
Unit reserve price	0.00680***	-0.0458***
	(0.00111)	(0.00720)
Lnvolume	0.0311***	-0.159***
	(0.00255)	(0.0154)
Voluntary e-auction	0.0288**	-0.103
	(0.0117)	(0.0696)
Overpricing * E-auction	-0.0210**	0.309***
	(0.0104)	(0.0677)
Lnvolume * E-auction	0.0191***	-0.0367
	(0.00539)	(0.0315)
Unit reserve price * E-auction	-0.00345	0.0173
	(0.00227)	(0.0134)
Constant	-0.373***	4.628***
	(0.0602)	(0.386)
Year FE	Yes	Yes
Region FE	Yes	Yes
Observations	47,521	47,519

Notes: The dependent variable in column 1 is the number of bidders and in column 2 a dummy variable equal to 1 if the number of bidders is 1. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer-level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter, *lnvolume* is the natural logarithm of the contract volume and *voluntary e-auction* is a dummy variable if e-auction is not mandatory but voluntary. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.9: Probability of winning, fully interacted model

	(1) Win	(2) Win	(3) Win
Overpricing	0.160***	0.239***	0.386***
	(0.0424)	(0.0574)	(0.0683)
E-auction	1.138*	1.343***	1.574***
	(0.587)	(0.348)	(0.417)
Bidders	-1.069***	-1.134***	-1.289***
	(0.0201)	(0.0262)	(0.0342)
Voluntary e-auction	-0.104*	-0.0448	-0.109
	(0.0547)	(0.0720)	(0.0840)
Overpricing * E-auction	0.0722	0.0167	0.0605
	(0.0839)	(0.101)	(0.113)
Bidders * E-auction	-0.951***	-0.867***	-0.992***
	(0.0451)	(0.0534)	(0.0668)
Constant	3.874***		
	(0.357)		
Region FE	Yes	No	No
Year FE	Yes	Yes	Yes
Procurer FE	No	Yes	Yes
Observations	56,734	42,171	29,249
Procurers		2,898	2,286

Notes: The dependent variable *win* is a dummy variable equal to 1 if the bidder is the winner of the auction. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *bidders* is the number of bidders, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in the last column is restricted to sellers who have at least one corrupt relation. Standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.10: Contract price mark-up, fully interacted model

	(1)	(2)
	p	p
Overpricing	0.0166***	0.0219***
	(0.000807)	(0.00226)
E-auction	-0.0732***	-0.0745***
	(0.0147)	(0.0147)
Bidders	-0.0117***	-0.0113***
	(0.000360)	(0.000370)
Overpricing * E-auction	-0.000300	0.0115***
	(0.00124)	(0.00354)
Overpricing * Bidders		-0.00305**
		(0.00120)
Overpricing * E-auction * Bidders		-0.0109***
		(0.00251)
Unit reserve price	0.0143***	0.0143***
	(0.000184)	(0.000184)
Lnvolume	0.000802***	0.000815***
	(0.000292)	(0.000292)
Voluntary e-auction	0.00275**	0.00288**
	(0.00114)	(0.00113)
Bidders * E-auction	-0.0388***	-0.0370***
	(0.000930)	(0.000988)
Unit reserve price * E-auction	0.00370***	0.00368***
	(0.000313)	(0.000313)
Lnvolume * E-auction	0.000498	0.000516
	(0.000553)	(0.000553)
Constant	-0.483***	-0.483***
	(0.00895)	(0.00896)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	46,437	46,437

Notes: The dependent variable p is the winning bid per liter of gasoline minus the market price divided by the latter. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, *bidders* is the number of bidders, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.11: Mechanisms, clustered standard errors

	(1) Applicants	(2) Applicants	(3) Applicants	(4) Exclusion	(5) Exclusion	(6) Exclusion	(7) Notbidding
Overpricing	-0.0246**	-0.0148	0.00299	0.130	0.152	0.234	-0.0967
	(0.0117)	(0.00980)	(0.0212)	(0.0939)	(0.106)	(0.163)	(0.132)
E-auction	-0.370***	-0.366***	-0.369***	-1.450***	-1.427***	-1.465***	
	(0.0154)	(0.0145)	(0.0157)	(0.105)	(0.108)	(0.104)	
Overpricing*E-auction		-0.0299			-0.138		
		(0.0297)			(0.206)		
Delivery			-0.00433			0.119*	
			(0.00860)			(0.0626)	
Overpricing*Delivery			-0.0508**			-0.183	
			(0.0233)			(0.192)	
Unit reserve price	0.00300*	0.00299	0.00307*	-0.0270**	-0.0270**	-0.0276**	-0.0242
	(0.00182)	(0.00182)	(0.00180)	(0.0136)	(0.0136)	(0.0137)	(0.0250)
Lnvolume	0.0454***	0.0457***	0.0452***	0.132***	0.133***	0.135***	0.147***
	(0.00585)	(0.00580)	(0.00579)	(0.0343)	(0.0344)	(0.0341)	(0.0491)
Voluntary e-auction	-0.0137	-0.0130	-0.0143	-0.378**	-0.375**	-0.374**	-0.0513
	(0.0181)	(0.0183)	(0.0181)	(0.172)	(0.173)	(0.172)	(0.124)
Constant	-0.251**	-0.255**	-0.246**	-3.830***	-3.843***	-3.914***	-3.466***
	(0.107)	(0.107)	(0.106)	(1.028)	(1.028)	(1.024)	(1.108)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521	47,521	47,521	15,579

Notes: The first dependent variable is the number of applicants, *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction and *notbidding* is a dummy variable equal to 1 if a not excluded applicant decides not to bid. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary, *delivery* is a dummy variable equal to 1 if the delivery method is specified. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in column 7 is restricted to e-auctions. Clustered standard errors in parentheses.

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

Table A.12: Competition, clustered standard errors

	(1) Bidders	(2) Bidders	(3) 1 bidder	(4) 1 bidder
Overpricing	-0.0360***	-0.0266**	0.188***	0.0702
	(0.00940)	(0.0113)	(0.0622)	(0.0806)
E-auction	-0.417***	-0.413***	2.413***	2.363***
	(0.0138)	(0.0138)	(0.0768)	(0.0777)
Overpricing*E-auction		-0.0296		0.349***
		(0.0196)		(0.131)
Unit reserve price	0.00550***	0.00549***	-0.0377***	-0.0375***
	(0.00144)	(0.00144)	(0.00888)	(0.00889)
Lnvolume	0.0363***	0.0365***	-0.164***	-0.167***
	(0.00557)	(0.00558)	(0.0281)	(0.0280)
Voluntary e-auction	0.0104	0.0110	-0.116	-0.122
	(0.0147)	(0.0148)	(0.0824)	(0.0825)
Constant	-0.292***	-0.295***	3.156***	3.201***
	(0.101)	(0.102)	(0.620)	(0.619)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521

Notes: The dependent variable in the first two columns is the number of bidders and in the last two columns a dummy variable equal to 1 if the number of bidders is 1. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter, *lnvolume* is the natural logarithm of the contract volume and *voluntary e-auction* is a dummy variable if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Clustered standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.13: Probability of winning public contracts, clustered standard errors

	(1) Win	(2) Win
Overpricing	0.171***	0.142*
	(0.0652)	(0.0757)
E-auction	-0.195***	-0.207***
	(0.0432)	(0.0455)
Overpricing * E-auction		0.0920
		(0.140)
Bidders	-1.320***	-1.320***
	(0.0265)	(0.0266)
Voluntary e-auction	-0.0364	-0.0373
	(0.0533)	(0.0532)
Constant	4.193***	4.201***
	(0.216)	(0.216)
Region FE	Yes	Yes
Year FE	Yes	Yes
Procurer FE	No	No
Observations	56,816	56,816

Notes: The dependent variable *win* is a dummy variable equal to 1 if the bidder is the winner of the auction. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *bidders* is the number of bidders, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in the last two columns is restricted to sellers who have at least one corrupt relation. Clustered standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.14: Contract price mark-up, clustered standard errors

	(1)	(2)
	p	p
Overpricing	0.0173***	0.0209***
	(0.00134)	(0.00452)
E-auction	0.000488	0.0480***
	(0.00139)	(0.00216)
Bidders	-0.0211***	-0.0121***
	(0.000634)	(0.000524)
Overpricing * E-auction		0.0157***
		(0.00582)
Overpricing * Bidders		-0.00324
		(0.00220)
E-auction * Bidders		-0.0341***
		(0.00128)
Overpricing * E-auction * Bidders		-0.0106***
		(0.00346)
Unit reserve price	0.0155***	0.0156***
	(0.000269)	(0.000265)
Lnvolume	0.000882*	0.000970*
	(0.000536)	(0.000526)
Voluntary e-auction	0.00314**	0.00125
	(0.00151)	(0.00145)
Constant	-0.511***	-0.525***
	(0.0125)	(0.0122)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	46,437	46,437

Notes: The dependent variable p is the winning bid per liter minus the market price divided by the latter. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, *bidders* is the number of bidders, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Clustered standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.15: Mechanisms, favoritist sellers

	(1) Applicants	(2) Applicants	(3) Applicants	(4) Exclusion	(5) Exclusion	(6) Exclusion	(7) Notbidding
Overpricing	-0.0365***	-0.0154***	-0.0224***	0.0334	0.0455	0.136*	-0.231***
	(0.00499)	(0.00553)	(0.00746)	(0.0522)	(0.0571)	(0.0774)	(0.0823)
E-auction	-0.375***	-0.366***	-0.374***	-1.449***	-1.438***	-1.463***	
	(0.00757)	(0.00783)	(0.00764)	(0.0740)	(0.0770)	(0.0745)	
Overpricing * E-auction		-0.0626***			-0.0707		
		(0.0110)			(0.137)		
Delivery			-0.00425			0.114***	
			(0.00425)			(0.0396)	
Overpricing * Delivery			-0.0256***			-0.178*	
			(0.00971)			(0.103)	
Unit reserve price	0.00384***	0.00382***	0.00388***	-0.0232**	-0.0232**	-0.0240**	-0.0210
	(0.00106)	(0.00106)	(0.00106)	(0.00961)	(0.00961)	(0.00964)	(0.0160)
Lnvolume	0.0432***	0.0436***	0.0431***	0.137***	0.137***	0.140***	0.134***
	(0.00227)	(0.00227)	(0.00226)	(0.0211)	(0.0211)	(0.0211)	(0.0383)
Voluntary e-auction	-0.00981	-0.00833	-0.0102	-0.373***	-0.371***	-0.369***	-0.0502
	(0.00916)	(0.00916)	(0.00917)	(0.111)	(0.111)	(0.112)	(0.0986)
Constant	-0.256***	-0.265***	-0.252***	-3.977***	-3.984***	-4.055***	-3.430***
	(0.0552)	(0.0552)	(0.0553)	(0.710)	(0.710)	(0.711)	(0.832)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46,962	46,962	46,962	46,962	46,962	46,962	15,437

Notes: The first dependent variable is the number of applicants, *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction and *notbidding* is a dummy variable equal to 1 if a not excluded applicant decides not to bid. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary, *delivery* is a dummy variable equal to 1 if the delivery method is specified. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Sellers with only favoritist relations are left out. The sample in column 7 is restricted to e-auctions. Robust standard errors in parentheses.

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

Table A.16: Competition, favoritist sellers

	(1) Bidders	(2) Bidders	(3) 1 bidder	(4) 1 bidder
Overpricing	-0.0341***	-0.0198***	0.178***	0.0326
	(0.00501)	(0.00608)	(0.0310)	(0.0395)
E-auction	-0.418***	-0.412***	2.411***	2.355***
	(0.00715)	(0.00737)	(0.0432)	(0.0440)
Overpricing * E-auction		-0.0438***		0.414***
		(0.0102)		(0.0668)
Unit reserve price	0.00596***	0.00595***	-0.0412***	-0.0410***
	(0.000981)	(0.000981)	(0.00597)	(0.00598)
Lnvolume	0.0351***	0.0354***	-0.156***	-0.159***
	(0.00225)	(0.00225)	(0.0132)	(0.0132)
Voluntary e-auction	0.0111	0.0121	-0.114**	-0.123**
	(0.00829)	(0.00828)	(0.0485)	(0.0485)
Constant	-0.297***	-0.303***	3.213***	3.262***
	(0.0528)	(0.0528)	(0.337)	(0.336)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	46,962	46,962	46,962	46,962

Notes: The dependent variable in the first two columns is the number of bidders and in the last two columns a dummy variable equal to 1 if the number of bidders is 1. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter, *lnvolume* is the natural logarithm of the contract volume and *voluntary e-auction* is a dummy variable if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Sellers with only favoritist relations are left out. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.17: Probability of winning public contracts, favoritist sellers

	(1) Win	(2) Win	(3) Win	(4) Win	(5) Win	(6) Win
Overpricing	0.171***	0.144***	0.247***	0.231***	0.406***	0.388***
	(0.0366)	(0.0452)	(0.0496)	(0.0594)	(0.0587)	(0.0707)
E-auction	-0.197***	-0.208***	1.47e-05	-0.00755	0.00649	-0.00403
	(0.0359)	(0.0375)	(0.0635)	(0.0652)	(0.0756)	(0.0789)
Overpricing * E-auction		0.0849		0.0501		0.0514
		(0.0762)		(0.0983)		(0.109)
Bidders	-1.318***	-1.318***	-1.381***	-1.381***	-1.603***	-1.603***
	(0.0203)	(0.0203)	(0.0233)	(0.0233)	(0.0301)	(0.0301)
Voluntary e-auction	-0.0330	-0.0339	0.0212	0.0216	-0.0227	-0.0222
	(0.0449)	(0.0449)	(0.0673)	(0.0673)	(0.0782)	(0.0782)
Constant	4.210***	4.216***				
	(0.263)	(0.263)				
Region FE	Yes	Yes	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Procurer FE	No	No	Yes	Yes	Yes	Yes
Observations	56,381	56,381	41,772	41,772	28,858	28,858
Procurers			2,889	2,889	2,270	2,270

Notes: The dependent variable *win* is a dummy variable equal to 1 if the bidder is the winner of the auction. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *bidders* is the number of bidders, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in the last two columns is restricted to sellers who have at least one corrupt relation. Sellers with only favoritist relations are left out. Standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.18: Contract price mark-up, favoritist sellers

	(1)	(2)
	p	p
Overpricing	0.0168***	0.0190***
	(0.000653)	(0.00234)
E-auction	0.000168	0.0475***
	(0.000807)	(0.00144)
Bidders	-0.0209***	-0.0121***
	(0.000356)	(0.000364)
Overpricing * E-auction		0.0168***
		(0.00360)
Overpricing * Bidders		-0.00265**
		(0.00123)
E-auction * Bidders		-0.0340***
		(0.000953)
Overpricing * E-auction * Bidders		-0.0111***
		(0.00253)
Unit reserve price	0.0154***	0.0155***
	(0.000152)	(0.000149)
Lnvolume	0.00105***	0.00114***
	(0.000251)	(0.000245)
Voluntary e-auction	0.00373***	0.00196**
	(0.000875)	(0.000832)
Constant	-0.507***	-0.522***
	(0.00707)	(0.00694)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	45,893	45,893

Notes: The dependent variable p is the winning bid per liter minus the market price divided by the latter. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, *bidders* is the number of bidders, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Sellers with only favoritist relations are left out. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.19: Mechanisms, running variable

	(1) Applicants	(2) Applicants	(3) Applicants	(4) Exclusion	(5) Exclusion	(6) Exclusion	(7) Notbidding
Overpricing	-0.0246***	-0.0148***	0.00299	0.130***	0.152***	0.234***	-0.0966
	(0.00521)	(0.00532)	(0.00836)	(0.0488)	(0.0531)	(0.0717)	(0.0768)
E-auction	-0.370***	-0.366***	-0.369***	-1.450***	-1.427***	-1.465***	
	(0.00761)	(0.00781)	(0.00768)	(0.0734)	(0.0767)	(0.0739)	
Overpricing * E-auction		-0.0298**			-0.138		
		(0.0123)			(0.131)		
Delivery			-0.00435			0.119***	
			(0.00424)			(0.0396)	
Overpricing * Delivery			-0.0508***			-0.183*	
			(0.0103)			(0.0955)	
Unit reserve price	0.00145	0.00144	0.00153	-0.0315***	-0.0316***	-0.0323***	-0.0291*
	(0.00107)	(0.00107)	(0.00107)	(0.00947)	(0.00947)	(0.00950)	(0.0158)
Lnreserveprice	0.0454***	0.0456***	0.0452***	0.132***	0.132***	0.135***	0.146***
	(0.00229)	(0.00229)	(0.00229)	(0.0208)	(0.0208)	(0.0208)	(0.0377)
Voluntary e-auction	-0.0138	-0.0131	-0.0144	-0.379***	-0.375***	-0.374***	-0.0526
	(0.00922)	(0.00923)	(0.00923)	(0.111)	(0.111)	(0.111)	(0.0970)
Constant	-0.358***	-0.363***	-0.352***	-4.141***	-4.156***	-4.232***	-3.807***
	(0.0573)	(0.0573)	(0.0573)	(0.720)	(0.721)	(0.722)	(0.869)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521	47,521	47,521	15,579

Notes: The first dependent variable is the number of applicants, *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction and *notbidding* is a dummy variable equal to 1 if a not excluded applicant decides not to bid. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter of gasoline, *lnreserveprice* is the natural logarithm of the reserve price, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary, *delivery* is a dummy variable equal to 1 if the delivery method is specified. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in column 7 is restricted to e-auctions. Robust standard errors in parentheses.

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

Table A.20: Competition, running variable

	(1) Bidders	(2) Bidders	(3) 1 bidder	(4) 1 bidder
Overpricing	-0.0360***	-0.0266***	0.188***	0.0701*
	(0.00488)	(0.00586)	(0.0301)	(0.0377)
E-auction	-0.417***	-0.413***	2.412***	2.362***
	(0.00712)	(0.00734)	(0.0429)	(0.0438)
Overpricing * E-auction		-0.0295***		0.349***
		(0.0101)		(0.0645)
Unit reserve price	0.00427***	0.00425***	-0.0321***	-0.0318***
	(0.000974)	(0.000974)	(0.00590)	(0.00591)
Lnreserveprice	0.0362***	0.0365***	-0.164***	-0.167***
	(0.00223)	(0.00224)	(0.0131)	(0.0131)
Voluntary e-auction	0.0104	0.0110	-0.115**	-0.122**
	(0.00824)	(0.00824)	(0.0482)	(0.0482)
Constant	-0.377***	-0.382***	3.543***	3.594***
	(0.0547)	(0.0547)	(0.347)	(0.346)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521

Notes: The dependent variable in the first two columns is the number of bidders and in the last two columns a dummy variable equal to 1 if the number of bidders is 1. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter, *lnreserveprice* is the natural logarithm of the reserve price and *voluntary e-auction* is a dummy variable if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.21: Probability of winning public contracts, running variable

	(1) Win	(2) Win	(3) Win	(4) Win	(5) Win	(6) Win
Overpricing	0.174***	0.148***	0.252***	0.228***	0.404***	0.375***
	(0.0359)	(0.0441)	(0.0489)	(0.0583)	(0.0580)	(0.0695)
E-auction	-0.277***	-0.287***	0.0599	0.0486	0.0101	-0.00702
	(0.0492)	(0.0501)	(0.0768)	(0.0782)	(0.0922)	(0.0949)
Overpricing * E-auction		0.0849		0.0732		0.0820
		(0.0753)		(0.0971)		(0.108)
Bidders	-1.324***	-1.324***	-1.377***	-1.377***	-1.599***	-1.598***
	(0.0204)	(0.0204)	(0.0233)	(0.0233)	(0.0301)	(0.0301)
Lnreserveprice	0.0364**	0.0358**	-0.0250	-0.0252	0.00683	0.00664
	(0.0147)	(0.0147)	(0.0226)	(0.0226)	(0.0280)	(0.0280)
Voluntary e-auction	0.0359	0.0339	-0.0186	-0.0181	-0.0163	-0.0157
	(0.0536)	(0.0537)	(0.0742)	(0.0742)	(0.0877)	(0.0878)
Constant	3.775***	3.789***				
	(0.310)	(0.311)				
Region FE	Yes	Yes	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Procurer FE	No	No	Yes	Yes	Yes	Yes
Observations	56,816	56,816	42,171	42,171	29,249	29,249
Procurers			2,898	2,898	2,286	2,286

Notes: The dependent variable *win* is a dummy variable equal to 1 if the bidder is the winner of the auction. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *bidders* is the number of bidders,*lnreserveprice* is the natural logarithm of the reserve price, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in the last two columns is restricted to sellers who have at least one corrupt relation. Standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.22: Contract price mark-up, running variable

	(1) p	(2) p
Overpricing	0.0173***	0.0209***
	(0.000642)	(0.00228)
E-auction	0.000474	0.0480***
	(0.000808)	(0.00144)
Bidders	-0.0211***	-0.0121***
	(0.000357)	(0.000364)
Overpricing * E-auction		0.0157***
		(0.00355)
Overpricing * Bidders		-0.00324***
		(0.00121)
E-auction * Bidders		-0.0341***
		(0.000954)
Overpricing * E-auction * Bidders		-0.0106***
		(0.00248)
Unit reserve price	0.0155***	0.0156***
	(0.000152)	(0.000149)
Lnreserveprice	0.000888***	0.000974***
	(0.000252)	(0.000246)
Voluntary e-auction	0.00316***	0.00126
	(0.000877)	(0.000834)
Constant	-0.513***	-0.528***
	(0.00729)	(0.00715)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	46,437	46,437

Notes: The dependent variable p is the winning bid per liter minus the market price divided by the latter. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, *bidders* is the number of bidders, r is the reserve price per liter of gasoline, *lnreserveprice* is the natural logarithm of the reserve price, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.23: Mechanisms, pairwise interactions

	(1) Applicants	(2) Applicants	(3) Applicants	(4) Exclusion	(5) Exclusion	(6) Exclusion	(7) Notbidding
Overpricing	-0.0159***	-0.00464	0.0138	0.176***	0.200***	0.293***	-0.0497
	(0.00528)	(0.00542)	(0.00843)	(0.0497)	(0.0538)	(0.0722)	(0.0770)
E-auction	-0.359***	-0.353***	-0.357***	-1.399***	-1.374***	-1.413***	
	(0.00771)	(0.00793)	(0.00779)	(0.0740)	(0.0771)	(0.0744)	
Overpricing * E-auction		-0.0340***			-0.147		
		(0.0123)			(0.131)		
Delivery			-0.00350			0.123***	
			(0.00423)			(0.0396)	
Overpricing * Delivery			-0.0543***			-0.205**	
			(0.0103)			(0.0953)	
Unit reserve price	0.00262**	0.00260**	0.00268**	-0.0285***	-0.0286***	-0.0293***	-0.0281*
	(0.00107)	(0.00107)	(0.00107)	(0.00946)	(0.00946)	(0.00948)	(0.0157)
Lnvolume	0.0415***	0.0417***	0.0412***	0.116***	0.117***	0.119***	0.125***
	(0.00231)	(0.00230)	(0.00230)	(0.0210)	(0.0211)	(0.0211)	(0.0380)
Voluntary e-auction	-0.00953	-0.00873	-0.0101	-0.358***	-0.354***	-0.354***	-0.0318
	(0.00920)	(0.00921)	(0.00921)	(0.110)	(0.110)	(0.110)	(0.0964)
Interaction	-0.00205***	-0.00207***	-0.00208***	-0.0105***	-0.0105***	-0.0107***	-0.0146***
	(0.000187)	(0.000187)	(0.000187)	(0.00225)	(0.00225)	(0.00226)	(0.00303)
Constant	-0.198***	-0.203***	-0.193***	-3.587***	-3.600***	-3.666***	-3.066***
	(0.0553)	(0.0553)	(0.0554)	(0.709)	(0.709)	(0.710)	(0.822)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521	47,521	47,521	15,579

Notes: The first dependent variable is the number of applicants, *exclusion* is a dummy variable equal to 1 if the procurer excludes at least one applicant from the auction and *notbidding* is a dummy variable equal to 1 if a not excluded applicant decides not to bid. *Overpricing* is a dummy variable equal to 1 if reserve prices at procurer-seller level are significantly higher than prices at procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary, *interaction* is the number of pairwise interactions and *delivery* is a dummy variable equal to 1 if the delivery method is specified. Sealed bid auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in column 7 is restricted to e-auctions. Robust standard errors in parentheses.

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

Table A.24: Competition, pairwise interactions

	(1) Bidders	(2) Bidders	(3) 1 bidder	(4) 1 bidder
Overpricing	-0.0305***	-0.0201***	0.160***	0.0368
	(0.00493)	(0.00595)	(0.0304)	(0.0382)
E-auction	-0.410***	-0.405***	2.373***	2.321***
	(0.00721)	(0.00746)	(0.0434)	(0.0444)
Overpricing * E-auction		-0.0323***		0.360***
		(0.0101)		(0.0647)
Unit reserve price	0.00526***	0.00525***	-0.0364***	-0.0362***
	(0.000973)	(0.000973)	(0.00591)	(0.00592)
Lnvolume	0.0337***	0.0339***	-0.150***	-0.152***
	(0.00225)	(0.00226)	(0.0134)	(0.0134)
Voluntary e-auction	0.0131	0.0138*	-0.127***	-0.134***
	(0.00823)	(0.00823)	(0.0481)	(0.0481)
Interaction	-0.00130***	-0.00131***	0.00692***	0.00706***
	(0.000179)	(0.000180)	(0.00108)	(0.00108)
Constant	-0.258***	-0.262***	2.959***	3.002***
	(0.0527)	(0.0527)	(0.336)	(0.335)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	47,521	47,521	47,521	47,521

Notes: The dependent variable in the first two columns is the number of bidders and in the last two columns a dummy variable equal to 1 if the number of bidders is 1. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, r is the reserve price per liter, *lnvolume* is the natural logarithm of the contract volume and *voluntary e-auction* is a dummy variable if e-auction is not mandatory but voluntary and *interaction* is the number of pairwise interactions. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.25: Probability of winning public contracts, pairwise interactions

	(1) Win	(2) Win	(3) Win	(4) Win	(5) Win	(6) Win
Overpricing	0.268***	0.245***	0.324***	0.312***	0.446***	0.427***
	(0.0368)	(0.0450)	(0.0501)	(0.0595)	(0.0589)	(0.0706)
E-auction	-0.182***	-0.192***	0.00594	0.000233	0.00488	-0.00597
	(0.0360)	(0.0376)	(0.0633)	(0.0652)	(0.0753)	(0.0788)
Overpricing * E-auction		0.0735		0.0363		0.0509
		(0.0764)		(0.0979)		(0.109)
Bidders	-1.324***	-1.324***	-1.402***	-1.402***	-1.614***	-1.614***
	(0.0204)	(0.0204)	(0.0234)	(0.0234)	(0.0301)	(0.0301)
Voluntary e-auction	0.0780*	0.0772*	0.0271	0.0275	-0.0165	-0.0159
	(0.0461)	(0.0461)	(0.0671)	(0.0671)	(0.0779)	(0.0780)
Interaction	-0.0135***	-0.0135***	-0.0149***	-0.0149***	-0.0126***	-0.0125***
	(0.000832)	(0.000833)	(0.00151)	(0.00151)	(0.00206)	(0.00206)
Constant	4.217***	4.223***				
	(0.263)	(0.263)				
Region FE	Yes	Yes	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Procurer FE	No	No	Yes	Yes	Yes	Yes
Observations	56,816	56,816	42,171	42,171	29,249	29,249
Procurers			2,898	2,898	2,286	2,286

Notes: The dependent variable *win* is a dummy variable equal to 1 if the bidder is the winner of the auction. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *bidders* is the number of bidders, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary and *interaction* is the number of pairwise interactions. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. The sample in the last two columns is restricted to sellers who have at least one corrupt relation. Standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

Table A.26: Contract price mark-up, pairwise interactions

	(1)	(2)
	p	p
Overpricing	0.0170***	0.0208***
	(0.000651)	(0.00229)
E-auction	0.000180	0.0478***
	(0.000817)	(0.00145)
Bidders	-0.0211***	-0.0121***
	(0.000357)	(0.000364)
Overpricing * E-auction		0.0158***
		(0.00356)
Overpricing * Bidders		-0.00321***
		(0.00121)
E-auction * Bidders		-0.0340***
		(0.000955)
Overpricing * E-auction * Bidders		-0.0107***
		(0.00248)
Unit reserve price	0.0156***	0.0156***
	(0.000152)	(0.000149)
Lnvolume	0.000988***	0.000999***
	(0.000255)	(0.000250)
Voluntary e-auction	0.00305***	0.00122
	(0.000877)	(0.000835)
Interaction	5.19e-05***	1.45e-05
	(1.74e-05)	(1.71e-05)
Constant	-0.512***	-0.526***
	(0.00706)	(0.00693)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	46,437	46,437

Notes: The dependent variable p is the winning bid per liter minus the market price divided by the latter. *Overpricing* is a dummy variable equal to 1 if reserve prices at the procurer-seller level are significantly higher than prices at the procurer level, *e-auction* is a dummy variable equal to 1 if e-auction and 0 if sealed bid auction, *bidders* is the number of bidders, r is the reserve price per liter of gasoline, *lnvolume* is the natural logarithm of the contract volume, *voluntary e-auction* is a dummy variable equal to 1 if e-auction is not mandatory but voluntary and *interaction* is the number of pairwise interactions. Auctions with reserve price $\in$ [490,000;510,000] RUB are dropped because of manipulation of the reserve price. Robust standard errors in parentheses.

*** p<01, ** p<05, * p<0.1

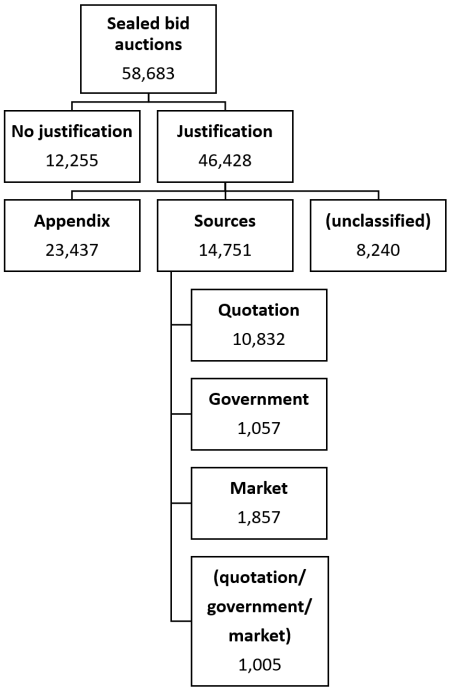
Determination of reserve prices

Since the amendment of 21/4/2011 procurers have to explain the level of reserve prices of both sealed bid and e-auctions in tender documentation. From October 2011 onward, they also have to report the calculation for sealed bid auctions in the tender notice. The on-line notices contain an additional field 'justification of reserve price' where procurers can explain how they established the reserve price and/or refer to the appendix. In October 2011, the field is not always filled out but since November 2011 it is. To analyze the determination of reserve prices, the sample is restricted to sealed bid auctions for which the procurers justified reserve prices in the tender notice. Given this information, we will distinguish between three main groups: *quotation*, *government* and *market*. The information does not have a standardized format but is instead a piece of text which we have to clean before we apply text analysis. Reserve prices based on price quotations from firms are detected by the words (in Russian): *запрос*, *котиров*, *предложен* and *оферты*. Public institutions such as the Rosstat, Federal Anti-Monopoly Service, Federal Tax Service, Ministry of Economic Development and also regional departments are captured by: *федеральной службы государственной статистики*, *gks*, *уфас*, *уфнс россии*, *минэкономики*, *министерства экономики*, *письму министерства экономики*, *письмо министерства экономики*, *департамента экономического развития*, *бюллетень рекомендуемых*, *бюллетень предельных цен*, *дцт*, *департаментом цен и тарифов*, *департаменте цен и тарифов* and *департамента цен и тарифов*. Finally, prices from the Internet, petrol stations and register of contracts are related to market research by the procurer. For the subclass Internet we have to exclude state websites and search: *интернет*, *www.*, *http* and *сайт*. For petrol stations – *станциях*, *станциям*, *азк* and *азс* – we have to make sure that these do no coincide with quotations. The last subclass register of contracts refers to prior procurements: *реестр* and *контрактов*. Through binary variables we can state which sources are used for the price level. Besides identifying sources for setting reserve prices, we can also distinguish auctions that refer to

tender documentation for the calculation. *документ*, *приложени* or *файл* are indicative words.

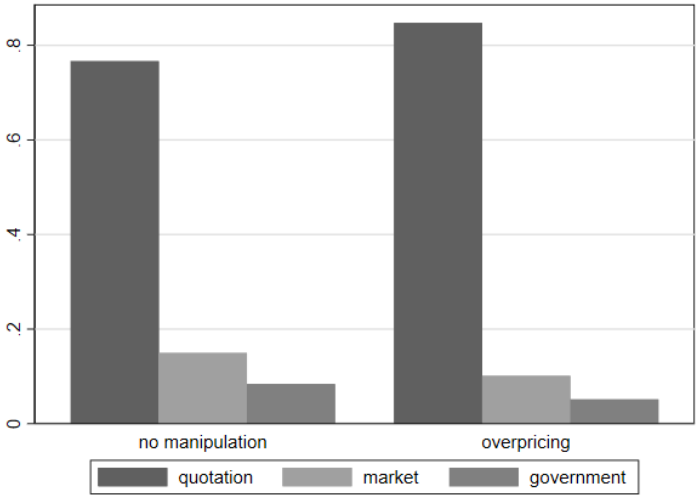
Departing from the information provided in tender notices of sealed bid auctions, we first identify the distinct sources used for the determination of reserve prices and subsequently group these sources. Given our estimation sample, the prices are justified for 46,428 sealed bid auctions and 12,255 auctions do not have a rationale as most took place before the reform (figure A.3). In 50.5% of the cases procurers refer to the tender documents and do not explain the price level in the on-line notices. We are able to identify the source in 31.8% of the cases and the rest remains unclassified. The sources are divided in three main groups: *quotation*, *government* and *market*. In general, authorities request price quotations. Procurers may also rely on statistics provided by state institutions such as the Rosstat, Federal Anti-Monopoly Service and Ministry of Economy. Besides obtaining information on prices from the government and firms, procurers may conduct market research by monitoring prices at filling stations, accessing information on the Internet or register of prior contracts. According to our classification, 10,832 reserve prices out of 14,751 are based on quotations only. *Government* and *market* account for respectively 7.2 and 12.6%. Finally, procurers may use several sources simultaneously (6.8%). If we investigate the sources used for the calculation of reserve prices by *overpricing*, we observe in figure A.4 that overpricing pairs rely significantly more on price quotations than procurer-seller pairs that do not manipulate prices.

Figure A.3: Justification of reserve prices



Notes: Tender notices of which the sources are identified may also include documents regarding the calculation of reserve prices. *Quotation*, *government* and *market* are disjoint sets.

Figure A.4: Determination of reserve prices by link type



Notes: Tender notices of which the sources are identified may also include documents regarding the determination of the reserve price. *Quotation*, *government* and *market* are disjoint sets.