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Chapter 10

EMPIRICAL ANALYSIS OF SUPPLIERS' NON-PERFORMANCE RISKS IN EXECUTION OF PUBLIC PROCUREMENT CONTRACTS IN RUSSIA

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INTRODUCTION

Intensive reforms of procurement in Russia during 2005-2008 were closely connected with active debate on corruption in public procurement. Russia inherited its inefficient procurement system from the planned economy. After the demise of the old Gosnab system, the Russian government continued with the direct financing of state enterprises and public entities (without competitive bidding). The lack of reforms in public procurement created strong opportunistic incentives for managers and officials that led to a high level of fraud and corruption. As result, Russia in the early and mid-1990s responded to a huge budget deficit with sizeable cuts in public spending and by regularly refusing to pay for public orders.

An understanding of these problems was the basis for the first reform of public procurement pushed by the Russian government in 1997. This attempt to reform the procurement system based on a model law on public procurement elaborated in 1994 by the UN Commission on International Trade Law. According to presidential Decree No. 305, competitive bidding became obligatory for all procurements above USD 35,000 in 1997 prices. The new regulation gave public entities the opportunity to use different types of internationally acceptable procurement procedures and also introduced the requirement to publish bid information as well as

obligatory training of procurement specialists for all public buyers (customers).

However in implementing the reform, government faced serious constraints. First of all Decree No. 305 did not spell out the enforcement rules. There were no real sanctions for abuse by suppliers, for failure to publish bid information or for other violations of the law. No unified information on public procurement was collected, and even basic statistical data were lacking at the time.

The second attempt to reform the public procurement system is closely associated with the activity of Igor Artemiev, who was appointed in 2004 to head the Federal Antimonopoly Service (FAS). Subsequently, the volume of government orders on goods and services placed with enterprises rose dramatically along with the expansion of Russia's fiscal revenues. The total volume of government procurements in 2002 was about \$12 billion, or 8.7% of consolidated budget expenditures, while in 2004 the corresponding figures shot up to \$22 billion or 11.7% of fiscal expenditures (World Bank, 2006). Unlike in the 1990s, the government began to fulfill its obligations under contracts for procurement of goods and services. As a result, government orders became an important source of revenue for many firms. However, at the same time the system of government procurement in the Russian Federation (RF) was notably affected by increasing corruption. For example, World Bank experts stressed the strong decline in the average number of contractors participating in public tenders (World Bank, 2006).

In 2004 the Russian government decided in favor of active industrial policy and a "developmental state" model. Public procurement was considered an important tool in this new political-economic agenda. Therefore the inefficient system of public procurement regulation and the high level of corruption (kickbacks) became a matter of growing concern to the Russian government and prompted radical changes to the legal framework for government procurements. FAS drafted a new law on public procurement, and in July 2005 this draft was adopted by the State Duma as Federal Law 94 FL "On the Placement of Orders to Supply Goods, Carry out Works and Render Services for Meeting State and Municipal Needs," which became law on January 1, 2006. To make public procurements more efficient, the following key ideas were to be implemented:

- Setting up conditions for competition – by way of securing free access to participation in public procurements for all economic agents, firstly small and medium size enterprises (SMEs). To ensure access for new participants, in the most cases it was prohibited to set for applicants in terms of references any qualification requirements (like qualification of staff or business reputation of potential performers). Only quality of proposal could be evaluated but with low weight in total score (20% or less). To foster SME entrance to the public procurement market, 94 FL set very low thresholds for making competitive purchase procedures for public customers obligatory (60,000 rubles or USD 2000 in 2006-2007, 100 thousand rubles or about USD 3.4 thousand in spring 2011).
 - Securing maximum transparency of procurements. Prior to 94 FL, information on tender might be published in a local newspaper almost without any standards, but with 94 FL all procurement information was unified and placed on a common official site <http://www.zakupki.gov.ru>. To make public procurements transparent and to limit bid manipulation by public customers, applications were selected in accord with the minimum price criteria.
 - Fighting corruption. Corruption during the period when 94 FL was being drafted and adopted was viewed as a key problem for public procurements. A completely formal and unified approach to all procurement procedures with strict limitations on the behavior of the government's purchasers, and on their procurement-responsible employees, together with transparency, was expected to deal with the problem and influence the selection of suppliers. Another important anti-corruption instrument was to build up simple control measures, implying simple procurement procedures with easier controls on the regulator's side.
- Implementation of these ideas was supported by a significant increase in specialized staff employees of FAS as well as by a set of sanctions stipulated in the Code for Administrative Violations. If 94 FL rules were not observed, the Federal Antimonopoly Service and its territorial bodies could cancel bid results and impose fines on procurement-responsible officials in public customer organizations. Later 94 FL was treated as a part of antimonopoly legislation and sanctions for breaking the 94 FL were expanded to the level of

criminal liability. Complaints of suppliers whose interests suffered in the bid process were reason enough to start a case and impose sanctions. In case of disagreement, controlling bodies based their actions on the presumption of supplier's good will and customer's unfairness.

Adoption of 94 FL was followed by significant increase in public spending for goods, works and services. However, the means chosen by the FAS to address corruption raised serious doubts among experts. International experts warned of the risks of simplified procedures and urged the introduction of a pre-qualification framework for suppliers and other "quality selection" procedures for all procurements of "complicated" products and services (World Bank, 2006).

Later practical use of 94 FL revealed numerous problems of an objective nature, making it hard for public customer organizations to perform their key functions. Manifestation of these problems at the time of implementing the new system of supplies brought about numerous changes to 94 FL. In all, 19 packages of amendments were made between July 2005 and end-2009. The legislative activity was building up with time: only 2 packages of amendments were applied to 94 FL in 2005-2006, and 7 in 2007-2008; in 2009 the law was amended 10 times (Yakovlev, Yudkevich & Yakobson, 2010).

But as shown in Yakovlev and Demidova (2011) all these political and administrative efforts have not helped to abate corruption. Strong focus on corruption has regrettably obscured the issue of "the right incentives" both for suppliers and public customers. Meanwhile, the latter issue if properly addressed can both enhance the efficiency of government procurement and restrain corruption. Broader understanding of this problem opened space for a new round of debate largely driven by a pursuit of higher efficiency of procurement procedures. The debate was structured around two key approaches.

The FAS responsible for regulation of public procurement in Russia would stress the possibility to save budget funds as a result of price reductions through tendering, achievable via formalized procurement procedures stipulated in Federal Law 94 FL. So in September 2011, FAS estimated the total savings as a result of the 94 FL at 1.2 trillion rubles or approximately 40 billion USD (Artemiev, 2011). Meanwhile, public customers would emphasize persistent problems with the quality of procurement, including execution of

contracts, inability of suppliers to meet deadlines, and low quality of goods, works and services delivered under government contracts by vendors selected in compliance with the 94 FL procedures ("Bringing Public Procurement," 2010; Kuznetsova, Trefilova, & Yeremenko, 2009; Rozhkov & Balaeva, 2009). The key problem with the 94 FL was perceived as its failure to take proper account of vendors' qualifications and business reputation. This deficiency results in problems for clients, as their operational and functional performance significantly depends on timely and adequate supplies under government contracts (Yakovlev, Yudkevich, & Yakobson, 2010). However, these debates had one peculiar feature: both parties tended to underpin their arguments either with aggregated data of Russian statistical agency (Rosstat) or with ad hoc "cases" describing a specific purchase.

Rosstat's aggregate data give an idea about cost savings through price reductions achieved in a bidding process, however, they do not provide any clue as to how realistic the initial prices were. These aggregate data also indicate declining shares of competitive procurements, and, moreover, highly marginal price reductions achieved in open auctions, which are, incidentally, seen by FAS as the most appropriate procurement procedure.

As regards performance of government contracts, FAS indicates that despite numerous client complaints, the number of their actual claims to vendors remains marginal, with a mere 4,815 companies listed as unreliable vendors as of March 2011 (See <http://rnp.fas.gov.ru>). FAS officials and experts, supportive of the 94 FL, also insist that to address vendor opportunism public customers can leverage financial guarantees as provided for in the legislation.

To get a rigorous answer who is right and who is wrong in this debate and why, one should undertake a formalized analysis of bidding and contract performance data, systematically collected by client agencies as required by Federal Law 94. In the international context, such data collected by regulators are available to researchers. Thus, for example, Crocker and Reynolds (1993) empirically studied tradeoff between the *ex ante* costs of crafting more complete agreements and the *ex post* inefficiencies associated with less exhaustive contract arrangement. For empirical analysis they used a panel dataset consisting of 44 contracts under which the Air Force procured jet engines from Pratt & Whitney and General

Electric for F-15 and F-16 fighters during 1970-1987. It may be worth emphasizing that this paper was about military supplies. However, as early as in October 1989, the results of the analysis were publicly presented at the RAND/OSD/PA&E Workshop in the Economics of Defense Procurement.

Another interesting example from international experience in analyzing government procurement is provided by Bandiera, Prat and Valletti (2009). They used data on government procurement by 208 Italian public bodies during 2000-2005. Overall, the analysis covered over 6 thousand contracts to buy standardized goods for a total of EUR 28.9 billion. They found that the average prices paid by different Italian public bodies vary substantially. The public body at the ninetieth percentile of the fixed effect distribution pays on average 55 percent more than the one at the tenth percentile. If all public bodies were to pay the same prices as the one at the tenth percentile, sample expenditure would fall by 21 percent. Differences across public bodies were correlated with institutional characteristics rather than geography or size. Semi-autonomous bodies (universities and health authorities) pay the lowest prices. Compared to these, the average town government pays 13 percent more. The difference increases further for regional governments (21 percent) and social security institutions (22 percent), while the average ministry of central government tops the list with 40 percent higher prices.

In Russia, one would think such data could be available from the zakupki.gov.ru web portal. However, regrettably, all our attempts throughout 2009-2010 to get access to these data, including official requests to the Ministry for Economic Development, have failed. The website's design allowed getting specific vendor/client/purchase information, but it did not allow simple analytical operations (including average price calculations for homogeneous goods). It did not allow uploading data on procurement conditions for product groups either. As Balsevich, Pivovarova and Podkolzina (2010) showed, regional government procurement websites may sometimes be more useful, providing more extensive data for analysis than the national portal zakupki.gov.ru. In early 2011, the redesigned website finally had the search functions working, but it still does not allow any systematic data analysis.

Given the above, in our analysis we used procurement data from just one large public entity that was willing to share its data in a

format suitable for econometric analysis. This dataset included information about roughly two thousand contracts awarded by this public entity in 2008-2010 for a total of 6.4 billion rubles (about USD 230 million).

We cannot say that this public entity is a typical case in Russian government procurement. However, an analysis of a large data set from this public entity over a long period of time allows identifying certain trends as regards both cost savings and contract execution problems. Moreover, this analysis provides a useful test case because it shows how these data (that are currently collected but in fact never analyzed) can be treated and utilized.

This paper proceeds as follows. After describing our primary data and an overall approach to analysis, we provide an overview of public entity's procurement and its specific features, also in comparison with the overall national data on government procurement, then we formulate our key hypotheses and describe the econometric methodology. After that we present and discuss regression results, and conclude with some policy implications.

DATA SOURCE AND GENERAL APPROACH TO ANALYSIS

This study uses data on 1,990 purchases made by the above mentioned public entity during 2008-2010. In terms of cost, these procurements amounted to 6.443 million rubles. This amount excludes low-value procurements (up to 100 thousand rubles a quarter), and one unusually large single source contract. The data under analysis covers contracts starting in 2008 and ending no later than in 2010.

Specifically, our procurement information includes the following primary data:

- Procurement method;
- Number of quotation, tender or auction, and contract number;
- Contract scope, including the code of procured goods (works, services) pursuant to the Economic Classification of Budget Expenditure (ECE);
- Procurement budget (pursuant to the bid data sheet);

- Number of bids, including number of bids qualifying for evaluation and consideration;
- Winning bid price;
- Name of vendor (supplier);
- Date of entering into contract;
- Contract fulfillment date; and
- Actual payments under the contract.

It may be of note that most of these data are part of reporting that all the public customers are supposed to publish at www.zakupki.gov.ru, while also submitting it to the Federal Treasury (responsible to control all contract payments). Therefore, these data should be basically available to any user at zakupki.gov.ru and, of course, these data are available to FAS, Ministry of Economic Development of Russia (MoED) and other government agencies, whose staff could be able (if desired) to undertake similar analysis using a much bigger data set.

The data we received had been arranged in Excel tables to allow on-going monitoring and control of financial documents and actual payments under the government contracts. It should be noted that such data bases (sometimes much more sophisticated) are maintained by many major government purchasers and key administrators of budget funds (KABF is special legal status category in the Russian system of public management provided to federal agencies and some other big public organizations subordinated directly to the Ministry of Finance and supervised procurements of ordinary public entities. In addition to the standard set of indicators, collected as required by FAS and the Federal Treasury, the procurement data base of analyzed public entity contained a few other important indicators.

First, alongside contract fulfillment dates, the procurement data base also reflects regularly recorded dates when final payment was reported. We found a significant number of delays in payments. Further interviews with procurement officers revealed that only 10-15 percent of such delays (largely short, up to one week) could be attributed to slow technical staff. In all the other cases were actual delays in contract performance, i.e. when the vendor failed to deliver the required quantities of acceptable quality in due time and the

client refused to sign acceptance acts until the vendor complied with the contract terms. Therefore, payment delays emerged as a mechanism to *adapt contractual frameworks* to any contingencies. Drawing on such data we produced first quantitative assessment of underperforming contracts.

Second, to capture budget spending and obligations to suppliers, the data base included information on the actual bottom-line contract cost. Contracts not fully performed on mutual agreement were treated separately, showing the value of outstanding obligations in such cases. Further interviews helped to single out contracts with incomplete deliveries that were formally closed out by mutual consent of the parties, but in reality *caused problems for the client*.

Indeed, the client, when faced with substandard performance of the vendor, would normally agree to close out the underperforming contract by mutual consent rather than go to court. Indeed, litigation does not in any way help to address the client's problems arising from the failed contract. Therefore, instead of wasting lawyers' time in court, the client needs to hold another tender to get the required goods, works or services. And for this purpose the client needs to have uncommitted budget funds. As a result, if the client wants to be able to proceed with its core activities, it is easier to close out the underperformed contract "by mutual consent" rather than go to court. As our interviews with procurement officers revealed, the client would normally go to court only if worst comes to worst, i.e. if the vendor disappears after getting an advance payment, or when the vendor is blatantly rigging the terms of the contract.

It should be emphasized, however, that incomplete fulfillment does not always imply actual breach of obligations. Frequently, the client finds it difficult to give an accurate upfront estimate of required volumes of goods or services for the year ahead. In this case, the client may break down the procurement into several procedures, holding a tender for every subsequent batch of goods when the required quantities are already known. However, this approach involves extra costs for the client, i.e. tendering, sourcing new suppliers, and so forth.

Thus, using data from in-house financial accounting of this public entity, we identified underperforming contracts. These problems were addressed either by delayed payments or by closing out such contracts by mutual consent even if the performance was incomplete.

If these mechanisms to adjust contract frameworks did not work, the client could go to court, and there is a record of such cases.

We should also mention two important issues discovered during the interviews. The first issue is that the Budget Code requires all the planned purchases to be completed during the calendar year. Any unspent resources allocated to a public entity for the year cannot be carried over, but should be refunded to the government budget. Meanwhile, if a public entity refunds its unused allocation, it may face reduced budget financing for the next fiscal year, because such failure to disburse allocated funds is usually seen by the higher budget authorities as an indication of inefficient management in this public entity.

In this context, managers of public agencies find it more reasonable to negotiate informal arrangements with the defaulting vendors, agreeing that government contracts will be closed out and paid for in the current year against the vendor's promise to finalize any outstanding works and deliver any outstanding items in the first months of the next year. Apparently, such informal arrangements breed corruption. The respondents referred to the above as "the IV quarter effect", because the fourth quarter is the time when the need to close government contracts undermines the capacity of bona fide clients to influence the performance of their vendors, while providing to mala fide vendors ample space for opportunistic behavior and pressuring the client.

The other issue is related to dumping practices in the course of tendering. Most respondents representing government clients say that a drastic price reduction during the bidding may in fact signal the vendor's acting in bad faith or being incompetent. Government procurement officers often cite cases of blackmail on behalf of small unfair vendors who would first excessively dump prices and then would squeeze money from the client for their withdrawal from the contract. In fact, this kind of withdrawal implies that the firm would be registered by FAS as a mala fide vendor with a subsequent barring from any tendering procedures for the next two years, but fly-by-night companies do not see any problem in this. Meanwhile, the existing legislation which prohibits application of business reputation criteria does not allow excluding such firms from eligible bidders.

To facilitate our analysis, we have supplemented the original basic breakdown into goods, works and services (according to

standard classification of the Russian government) with a further procurement classification, grounded in institutional economics. This classification, based on objective differences in quality assurance possibilities, differentiates between "search goods", "experience goods" and "credence goods" (Nelson, 1970; Darby & Karni, 1973; Tirol, 1988). Qualitative characteristics of the first search goods group can be established in the pre-contract period and verified at the point of delivery. Examples of such goods include cement or stationery. Qualitative characteristics of experience goods can be established in the pre-contract period, but normally they can be validated only during consumption, i.e. after the contract is made. Such goods will include, for example, foodstuffs or construction works. And, finally, the quality of the third group of credence goods cannot be validated by the client even in the process of consuming the goods, works and services received under the contract. Normally, it would require a special expert evaluation. Examples of such goods include medical or education services as well as research and development (R&D). Therefore, different types of goods should require different procurement procedures.

KEY PROCUREMENT FEATURES OF THE ANALYZED PUBLIC ENTITY

Before engaging in a detailed analysis of procurement operations of the analyzed public entity, we compared its data with Rosstat official reports for government procurement tendering and other methods of government procurement in the Russian Federation in 2008-2010.

Overall, 31,889 thousand government contracts were placed via tenders and other formats of government procurement over this period, for a total value of 10,894.4 billion rubles. Of those, 86 percent of the contracts were low-value procurement (up to 100 thousand rubles), accounting for about 5 percent of the total cost of procurement. Given that our data from this public entity excluded low-value purchases, we also excluded these purchases from Rosstat reports in our analysis. To ensure data comparability, we also excluded purchases through commodity exchanges (representing less than 0.1 percent of the total contracts and procurement cost; besides, they did not apply to the analyzed public entity) from Rosstat data.

A comparison of national procurement data and the data from the public entity suggests that single source procurement nationwide accounts for a considerably larger share both in terms of quantity and in terms of cost. Thus, during 2008-2010, the total share of single source contracts was as large as 51 percent in Russia, while it was only 29 percent in this public entity. In terms of cost, the difference was less significant, but still noticeable: 39 percent versus 25 percent respectively (See Table 1).

Single source procurement (as well as low value procurement) was of no interest for an analysis of price reduction and budget savings. Nor did this type of procurement cause any contract performance problems for our public entity. Therefore, we focused on competitive procurement in our further analysis, including requests for quotations (RFQ), auctions (including electronic auctions since 2010) and tenders.

Table 2 indicates that the distributions of government contracts by the procurement method (RFQ, auctions and tenders) nationwide and in this specific public entity are similar. However, their contract structures vary noticeably. The public entity shows 88 percent of the

TABLE 1
Government Procurement Structure: Nationwide versus Public Entity Wise (Excluding Low Value and Commodity Exchange Purchases)

	Single-source procurement	Competitive procurement	Total
Total contracts			
Russian Federation	2,249,509	2,204,523	4,454,032
Public entity	586	1,404	1,990
As a percentage of total contracts			
Russian Federation	50.5	49.5	
Public entity	29.4	70.6	
Contract value			
Russian Federation, RUBmn	4,065,876	6,270,336	10,336,212
Public entity, RUBmn	1,668	4,775	6,443
As a percentage of total procurement budget			
Russian Federation	39.3	60.7	
Public entity	25.9	74.1	

TABLE 2
Comparative Analysis of Competitive Procurement Nationwide (Rosstat Data) and Public Entity Wise in 2008-10

Indicators	RFQ		Auctions		Tenders		Total
	number	%	number	%	number	%	number
Number of procurement procedures							
Russian Federation	1,238,130	56	772,489	35	193,904	9	2,204,523
Public entity	806	57	542	39	56	4	1,404
Total value of awarded contracts and purchases (procurement budget)							
Russian Federation, RUBmn	313,289	5	3,856,346	62	2,100,701	34	6,270,336
Public entity, RUBmn	261	6	4,211	88	302.6	6	4,774.6
Average value of one contract							
Russian Federation, RUBth	253.0		4,992.1		10,833.7		2,844.3
Public entity, RUBth	3,23.8		7,769.4		5,403.6		3,400.7
Competitiveness of procurement procedures (average number of eligible bids per one procurement procedure)							
Russian Federation	2.6		3		2.3		2.7
Public entity	2.6		2.5		1.5		2.5
Terminated contracts and purchases							
Total							
Russian Federation	16,639	48	14,404	42	3,706	11	34,749
As a percentage of total number of contracts	1.3		1.9		1.9		1.6
Public entity	14	70	6	30	0	0	20
As a percentage of total number of contracts	1.7		1.1		0		1.4
By mutual consent							
Russian Federation	16,365	48	14,088	41	3,626	11	34,079
As a percentage of total number of contracts	1.3		1.8		1.9		1.5
Public entity	10	71	4	29	0	0	14
As a percentage of total number of contracts	1.2		0.7		0		1.0

TABLE 2 (Continued)

Indicators	RFQ		Auctions		Tenders		Total number
	number	%	number	%	number	%	
By judicial decision							
Russian Federation	274	41	316	47	80	12	670
As a percentage of total number of contracts	0.02		0.04		0.04		0.03
Public entity	4	67	2	33	0	0	6
As a percentage of total number of contracts	0.5		0.7		0		0.4
Savings through price reductions in the course of bidding, as a percentage of original price							
Russian Federation*	16.0		11.3		8.2		10.5
Public entity	15.9		7		13.7		7.9

Note: *) Due to changes in Rosstat reporting in 2010, the calculations for this year assumed the total cost of contracts made as the total value of winning bids.

total procurement budget falling on auctions, while it is only 61 percent in the Russian Federation, with tenders accounting for 6 percent and 34 percent respectively. The average contract price in this public entity is somewhat larger than the national average, especially in the auction bracket. However, in the tender bracket the national average contract price is twice as large as in the public entity.

Competitiveness of procurement procedures (average number of eligible bids per one procedure) was somewhat lower in the analyzed public entity than those across Russia, primarily in the tender and auction brackets. However, it should be noted that these figures are rather meaningless averages and need a more detailed analysis (to be provided below).

The share of terminated contracts is insignificant both nationwide and in analyzed public entity, at slightly above 1 percent. In both cases, a negligible number of contracts were terminated by a court decision.

Savings through price reductions in tendering are largely comparable nationwide and in the public entity. In both cases RFQs proved the most economical method of procurement.

General Characteristics of the Public Entity's Procurement

This public entity competitively awarded 1,404 contracts in 2008-10. Table 3 presents their key characteristics.

TABLE 3
Key Characteristics of The Public Entity's Competitive Procurement

Characteristics and values	Number of contracts		Procurement budget		Savings through price reductions	
	number	%	RUBmn	%	RUBmn	%
Total	1,404	100	4,774	100	377	8
Standard Russian classification						
Goods	480	34	526	11	71	14
Works	179	13	3124	65	191	6
Services	745	53	1124	24	116	10
Type of procurement under the Nelson-Darby-Karni classification						
Search goods	467	33	543	11	59	11
Experience goods	859	61	4019	84	284	7
Credence goods	78	6	212	4	34	16
Procurement method						
RFQ	806	57	261	6	41	16
Auctions	542	39	421	88	295	7
Tenders	56	4	303	6	42	14
By number of eligible bids						
N/a	48	3	331	7	109	33
1 bid	509	36	3257	68	39	1
2 bids	492	35	414	9	46	11
3 bids and more	355	26	773	16	184	24
By price reductions						
0%	347	25	2,988	63	0	0
Under 10%	541	39	728	15	12	2
10-30%	248	18	318	7	64	20
Over 30%	268	19	741	16	302	41
By year of procurement						
2008	336	23.9	2780.7	58	48.0	2
2009	421	30	847	18	163	19
2010	647	46	1147	24	167	15

TABLE 3 (Continued)

Characteristics and values	Number of contracts		Procurement budget		Savings through price reductions	
	number	%	RUBmn	%	RUBmn	%
By year of contract execution						
2008	287	20	604	13	42	7
2009	396	28	2566	54	47	2
2010	721	51	1605	34	289	18
Presence of delays						
Execution on time	1,016	72	2,036	43	159	8
Delayed by no more than days	159	11	275	6	31	11
Delayed by 8-30 days	136	10	204	4	45	22.2
Delayed by over 30 days	87	6	2,233	47	138	6.2
By nature of performance						
Contract fulfilled	1,175	84	1,993	42	31	15
Closed out, incomplete delivery, no problem for public customer	163	12	479	10	46	10
Closed out, incomplete delivery, with problems for public customer	60	4	2,275	48	22	0.9
Going to court	6	0.4	27.5	0.6	5.3	19

The competitive procurement of this public entity is composed as follows: of total contracts 34 percent fall on goods, 13 percent on works and 53 percent on services. It may be of note that some contracts combine delivery of goods and provision of related services (assembly, installation, etc.). Consistent with ECE codes and expert evaluations, such procurements were usually classified as goods. In terms of cost, the bigger share of the budget reflects works (65 percent), including inter alia costly new construction and capital repairs of buildings and structures.

A review of formal competitive features of procurement procedures shows that 25 percent of total procurements had at least three qualifying bidders. However, in terms of cost, such procurements accounted for only 16 percent of the total procurement budget, while 68 percent of the budget was spent in single tendering.

Three quarters of all competitive purchases incurred price reductions, with reductions over 10 percent in 37 percent of cases, over 30 percent in 19 percent of cases, and over 50 percent in 7 percent. Apparently, one can observe a certain relation of price reductions to the degree of competitiveness of procurement procedures. While one-bid procedures generated slightly more than 1 percent of the original procurement budget in savings, in case of two competing bidders the savings were as much as 11 percent, and in case of three and more bidders 24 percent. This suggests a positive correlation between competitiveness of procurement procedures and potential savings of government procurement budgets.

Total budget savings realized through price reductions in competitive procurement procedures amounted to about 377 million rubles or 8 percent of the total procurement costs of this public entity during the period under review. Further analysis will certainly benefit from a review of various problems with contract performance, including delays in documentation (indicator of contract performance delays) or unfinished performance. While commenting on the results, it may be noted that 27 percent of the total contracts showed delays in documentation, with 16 percent of the delays extending for over one week and 6 percent for over 30 days.

The 163 under-fulfilled contracts included 66 contracts causing problems for the client (less than 5 percent of the total). Of those, 66 contracts were closed out by mutual consent and only 6 contracts were taken to court by the client. However, in terms of cost, these "problem" contracts proved much more significant, accounting for 48 percent of the total public entity procurement costs.

In line with the above Nelson-Darby-Karni classification, 33 percent of the public entity's procurements (by number of contracts) can be categorized as search goods, 61 percent as experience goods and 6 percent as credence goods. Almost all search goods include goods proper plus related services for their assembly or maintenance; credence goods stand for services, and experience goods cover both services and most works (largely various types of maintenance and repairs). In cash terms, the group of experience goods is also the champion (accounting for 84 percent of the total procurement budget).

Key Characteristics of Procurement Methods Utilized by the Public Entity

The total competitive procurement of our public entity showed the following distribution in 2008-2010: RFQ accounted for 57 percent, auctions for 39 percent and public tenders for 4 percent. The overall competitive procurement budget for the period under review totaled about 4.77 billion rubles, with 5.5 percent falling on RFQ, 88 percent on auctions and 6.5 percent on tenders.

Throughout the three years of the period under review, the public entity's preferred procurement method was RFQ, accounting for 55-60 percent of procurement procedures. The share of auctions somewhat declined from 2008 to 2010 (from 46 percent to 38 percent), despite the introduction of on-line auctions since 2010, entailing obligatory use of auctions for a wider range of goods. Tenders increased their share from 1 percent to 4 percent during the period under review.

Types of procurement procedures considerably depended on the type of procured goods. Thus, search goods were largely procured through RFQs (72 percent of the total search goods procurement), experience goods through RFQs and auctions (50 percent and 46 percent of the total experience goods procurement, respectively), and credence goods via RFQs (45 percent) and tenders (37 percent). Search goods were never procured in tenders.

It may be noteworthy that RFQ proved the most competitive procedure, while more than half of the auctions, in contrast, had one single supplier.

A look at implications of the chosen procurement method for potential savings through price reductions, reveals that the largest price reductions were achieved via RFQ (16 percent), closely followed by tenders (14 percent), while auctions reduced costs only by 7 percent. In terms of volumes, most procurements through RFQ and tenders resulted in price reductions (93 percent and 75 percent of total contracts in these categories, respectively). In contrast, more than a half of auction procurements did not show any price reductions.

Most frequent delays are observable in the performance of contracts awarded through tenders. However, contracts made via auctions tend to produce longer delays (over 30 days).

Most "problem" contracts in this public entity were awarded via auctions. Moreover, the 7.4 percent of such auction-based contracts with disrupted deliveries accounted for over 54 percent of the total value of the auction-based contracts or almost 50 percent of the total procurement value of this public entity over the period under review. Most such contracts were related to incomplete construction and reconstruction, which are supposed to be procured via auctions pursuant to 94 FL.

Another feature of auction-based contracts in this public entity was initial overstatement of contract size. Almost 20 percent of the contracts awarded via auctions were closed out on incomplete delivery without causing problems for the client.

HYPOTHESES AND METHODOLOGY OF ECONOMETRIC ANALYSIS

Using available descriptive statistics and responses by procurement officers, we formulate the following hypotheses for our econometric analysis:

- Hypothesis 1. Cost savings through price reductions in competitive bidding:
- a. Price reductions will be more significant in a competitive bidding environment (measured by the number of eligible bidders participating).
 - b. The size of price reductions will depend on the method of procurement. Specifically, auctions may result in smaller price reductions due to wider possibilities for collusion among suppliers.
 - c. Price reductions through tendering will vary across different categories of procured goods. Since the price is always related to quality, a sizeable price reduction will normally result in lower quality of deliveries. However, in the case of search goods, the scale of such price reductions will be limited, because the quality of this type of goods is easily assured and the client can reject substandard supplies. In contrast, in the case of experience and credence goods, quality assurance is more difficult and vendors will have more possibilities for price reductions (including by compromising the quality).

Hypothesis 2. Problems with contract performance:

- d. Delays in contract performance will be less frequent for search goods and for line items, because in these cases the client will find it easier to check the quality of the delivery, besides, when there is a problem with the quality, it can be settled by mere replacement. In contrast, as regards experience and credence goods, and also works and services, the vendor will normally need some time to rectify the identified defects.
- e. Contract performance delays will happen more frequently for purchases that are to be delivered in the first three quarters of the calendar year. This problem stems from the Budget Code provision against carryovers of allocations to the next calendar year. Consequently, clients cannot prolong underperformed contracts in the IV quarter.
- f. Contract performance problems (as evidenced by data on underperformed contracts causing problems for the client, or terminated by a court decision) will be more frequent for contracts expiring in the IV quarter. This is also related to the same Budget Code ban on carryovers, which, naturally, narrows room for contract framework adjustments when there is a threat of defaulted deliveries.
- g. Both delays in contract implementation and other performance issues will be more typical for large procurements. This prediction stems from the following reasoning. *Ceteris paribus*, fair and competent suppliers will be seeking contracts that they are capable of performing. In contrast, incompetent or unfair vendors will be looking for larger value contracts, aiming for higher profits (misjudging their capacity to perform on the contract) or even knowingly expecting to gain from default. Therefore, *ceteris paribus*, bidders for larger contracts will include more incompetent and unfair suppliers. Given that 94 FL significantly restricts application of quality and reputation criteria for selection, winning bidders for larger value contracts will show more incompetent and male fide suppliers, resulting in performance problems.
- h. Due to restrictions on the use of quality and reputational selection criteria, contract performance problems will be more

frequently observable in cases of procurement via auctions and RFQ versus tenders.

- i. Contract performance issues will be more likely when there is a considerable price reduction as a result of tendering procedures, because such a reduction may be a result of price dumping and signal contract default or delay risks.

To test the above hypotheses, we ran a number of regressions. To analyze the size of price reductions through tender procedures, we used linear models with a dependent variable, measured as a percentage of price reduction in tendering versus the initial procurement price. The explanatory variables detail the number of eligible bids, the method of procurement (RFQ, auction, tender), and the year's quarter of delivery. To capture the specifics of the procured goods we used the Nelson-Darby-Karni classification and the goods-work-services breakdown (two respective model specifications were constructed). We controlled the results for the year of procurement (predetermined by the changes in procurement regulation and economic conditions in 2008-10), contract duration, the original procurement budget and the type of client structural unit initiating the procurement. To analyze contract performance problems, we estimated two types of models: linear and probit regressions. In the former regression, a delay (measured in days) in reporting contract closure to the client became the dependent variable. For the latter regression we used a binary dependent variable constructed from data about under-fulfilled contracts causing problems for the client or terminated by a court decision. In both cases, the models included the same explanatory and dependent variables that were used at the earlier stage while analyzing the scope of price reductions. Price reductions through tendering were added to both models as an independent explanatory variable in two modifications: as a continuous variable measured as a percentage of price reductions and as a binary variable (singularizing contracts that experienced a 30 percent or more decline in price as a result of tendering). The explicit forms of estimated models are given in Appendix. The above tests have revealed heteroscedasticity. Therefore, to avoid bias in estimates of standard deviations we used robust estimation of standard deviations. Thus, we tested the significance of the coefficients using these estimates. We present the results of models estimation and their interpretation in the next section.

RESULTS OF REGRESSION ANALYSIS

Our estimation of the price reduction models (Table 4) suggests the following:

- The most sizeable price reductions through tendering are observable for credence goods, by 7.9 percent more on average

TABLE 4
Estimation Results for Price Reduction Models (in Percent)

Model number		Model 1	Model 2
Model type		Linear	Linear
Procurement description	Set of variables included in the model	Dependent variable Price reduction	
Type of procured good according to the Nelson - Darby - Karni classification	Search goods	Reference category	
	Experience goods	1.91**	
	Credence goods	7.97***	
Type of procurement according to the standard Russian classification	Goods	Reference category	
	Works		3.23**
	Services		0.72
Method of procurement	RFQ	Reference category	
	Auctions ^{a)}	-2.99***	-3.44***
	Tenders	-1.58	1.14
Year of procurement	2008	Reference category	
	2009	1.94	2.09*
	2010	0.95	1.30
Quarter of delivery	I-III ^{b)}	Reference category	
	IV	0.53	0.38
Number of eligible bids	Number of eligible bids	4.59***	4.57***
Contract duration (days)	Days	-1.15·10 ⁻³	2.0·10 ⁻³
Budget of the bid	Thousand rubles	-3.6·10 ^{-9**}	-5.3·10 ^{-9**}
Self-supporting unit as internal customer		2.86**	4.34***
R ²		0.33	0.32
Number of observations		1356	1356

Notes: * the coefficient is significant at 10%, ** the coefficient is significant at 5%, *** the coefficient is significant at 1%.

- a) Including electronic auctions; b) Initially, the model included three dummy variables (for the second, third and fourth quarters, with the first quarter as a reference category). However, since the prediction that the coefficients on the second and third quarters' indicators will be simultaneously at zero was not discarded, this limitation was incorporated in the model with the 1-3 quarters becoming a reference category.

than for search goods, and by 6 percent more than for experience goods (*ceteris paribus*).

- Auctions result in lower price decline than other procurement procedures (roughly by 3 percent *ceteris paribus*).
- More competition, measured by the number of eligible bids, drives the price down.

To estimate the implications of contract characteristics for the length of delays in its fulfillment, we estimated the linear models 3-6 with "delay" as the dependent variable. To identify factors engendering "problem" contracts, we estimated the probit models 7-10 with "Problems" (including under-fulfilled contract closure with problems for the client and contract termination by a court decision) as the binary dependent variable. The results of the estimation are given in Tables 5 and 6.

TABLE 5
Public Procurement Contract Delay Models: Estimation Results

Model number	Model 3	Model 4	Model 5	Model 6
Model type	Linear	Linear	Linear	Linear
Procurement description	Dependent variable			
Set of variables included in the model	Delay	Delay	Delay	Delay
	Coefficient	Coefficient	Coefficient	Coefficient
Type of procured goods according to the Nelson-Darby-Karni classification				
Search goods	Reference category			
Experience goods	4.63***	4.6***		
Credence goods	3.24	3.26		
Type of procurement according to the standard classification				
Goods	Reference category			
Works			3.96*	3.95
Services			2.76	2.75*
Method of procurement				
RFQ	Reference category			
Auctions	2.15	2.11	2.09	2.03
Tenders	1.56	1.54	1.47	1.47
Year of procurement				
2008	Reference category			
2009	-6.1**	-6.1**	-6.17**	-6.16**
2010	-6.1**	-6.1**	-5.86**	-5.87**

TABLE 5 (Continued)

Model number	Model 3	Model 4	Model 5	Model 6
Quarter of delivery	Reference category			
I-III ^{b)}	Reference category			
IV	-4.48***	-4.47***	-4.8***	-4.79***
Number of eligible bids	-0.21	-0.18	-0.24	-0.22
Duration of the contract in days	-2.41·10 ⁻⁵	-4.51·10 ⁻⁵	3.6·10 ⁻³	3.53·10 ⁻³
Budget of the bid in thousand Rubles	3.29·10 ^{-8***}	3.29·10 ^{-8**}	3.2·10 ^{-8***}	3.2·10 ^{-8***}

TABLE 5 (Continued)

Model number	Model 3	Model 4	Model 5	Model 6
Model type	Linear	Linear	Linear	Linear
Self-supporting unit as internal customer	-0.85	-0.82	-0.46	-0.43
Price reduction	0.02		0.02	
Price reduction of more than 30 percent		0.68		0.85
R ² ^{c)}	0.025	0.025	0.023	0.023
p-value for F-statistics ^{d)}	0.000	0.000	0.000	0.000
Number of observations	1350	1350	1350	1350

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%.

^a Including electronic auctions.

^b Initially, the model included three dummy variables (for the second, third and fourth quarters, with the first quarter as a reference category). However, since the prediction that the coefficients on the second and third quarters' indicators will be simultaneously at zero was not discarded, this limitation was incorporated in the model with the 1-3 quarters becoming a reference category. By creating a dummy variable only for the fourth quarter, we avoided multicollinearity.

^{c/d} While the models (3)-(6) are adequate, they do not quite perfectly fit to the data. This deficiency may be addressed by prior contract clustering or by using robust or semi-parametric estimation methods (to be explored in our further research).

TABLE 6
Public Procurement "Problem" Contracts: Estimation Results

Model number	Model 7	Model 8	Model 9	Model 10
Model type	Probit	Probit	Probit	Probit
Procurement description	Dependent variable			
Set of variables included in the model	Problems	Problems	Problems	Problems
	Marginal effect	Marginal effect	Marginal effect	Marginal effect
Type of procured goods according to the Nelson-Darby-Karni classification	Reference category			
Search goods	Reference category			
Experience goods	0.003	0.003		
Credence goods	-0.02	-0.02		
Type of procurement according to the standard classification	Reference category			
Goods	Reference category			
Works			0.03	0.03
Services			-0.02	-0.02
Method of procurement	Reference category			
RFQ	Reference category			
Auctions	0.02*	0.02*	0.01	0.01
Tenders	-	-	-	-
Year of procurement	Reference category			
2008	Reference category			
2009	0.02	0.02	0.02	0.02
2010	0.009	0.009	0.01	0.01
Quarter of delivery	Reference category			
I-III ^{b)}	Reference category			
IV	0.03***	0.03***	0.03***	0.03**
Number of eligible bids	0.001	0.002	0.0006	0.002
Duration of the contract Days	4.3·10 ⁻⁵	4.4·10 ⁻⁵	0.0001**	0.0001**
Budget of the bid Thousand Rubles	1.38·10 ^{-9***}	1.36·10 ^{-9**}	1.01·10 ^{-9**}	9.9·10 ^{-10**}
Self-supporting unit as internal customer	-0.01	-0.01	-0.003	-0.002
Price reduction	0.0001		0.001	
Price reduction of more than 30 percent		-0.01		-0.01
Pseudo R ²	0.083	0.083	0.094	0.094
Number of observations	1356	1356	1356	1356

Notes: * the coefficient is significant at 10%, ** the coefficient is significant at 5%, *** the coefficient is significant at 1%.

The results suggest the following conclusions:

- Both delays and other problems are more frequently observed in case of larger contracts. Therefore, both client authorities and regulators should focus on those.
- Contracts awarded through auctions are likely to cause more problems with contract performance. This difference of auctions from tenders and RFQs may be accounted for as follows. While the RFQ is used for lower-value procurements, with small potential gains from vendor opportunism, and tenders have the quality assurance mechanism for the client to protect its interests, auctions are for larger contracts, plus there is a statutory ban on the use of quality assurance and business reputation criteria in auctions. Therefore, auctions provide more room for opportunistic behavior of unfair suppliers. However, as regards delays, simulation does not reveal any significant differences between these various methods of procurement.
- A significant contributor to contract performance problems is the "IV quarter effect", caused by the impossibility to carry over undisbursed balances of budget funds to the next year. Regression results indicate that if performance problems arise for contracts expiring in the first three quarters, the client can informally prolong the contract and make the supplier meet its contractual obligations. Meanwhile, the fourth quarter is less flexible for such adjustments of contract terms, resulting in much more "problem" contracts.
- For this sample, our analysis of the "price factor" did not reveal any statistically significant correlation between price reductions and contract performance delays or problems.

DISCUSSION AND POLICY IMPLICATIONS

This paper provides an analysis of the Russian government's procurement structure across various microeconomic aspects, using an unique empirical dataset on contracts to procure goods, works and services, made by a large public entity in 2008-2010. Regression analysis revealed determinants of price reductions through tendering, delays in deliveries and problems in contract performance.

Our structural analysis supports certain trends observable in Rosstat data (high share of single source procurement, leading role of auctions in government procurement, largest price reductions achieved through RFQs, negligible number of officially terminated contracts). However, micro level comparisons suggest even more interesting results, - keeping in mind the specifics of individual government contracts. These data indicate that price reductions in tendering, routinely pointed out by FAS, are currently pervasive. The public entity under analysis, in 2008-10, showed reduction in 75 percent of all the competitive procurement procedures, which is clearly a positive outcome of the 94 FL that encourages competition among suppliers. However, our analysis also indicates that competition in government procurement is highly heterogeneous. Indeed, while a quarter of all the bidding procedures had at least three bidders, two thirds of the total procurement budget represent procedures with only one bidder. Therefore, larger procurement basically remains non-competitive.

For the first time ever, the analyzed data allow a quantitative estimate of current government contract performance problems. Specifically, over a quarter of all the contracts were performed with delays, including 6 percent of contracts showing long delays of 30 days and more. Serious problems, potentially leading to defaulted deliveries, were observable in only 5 percent of awarded contracts. However, these "problem" contracts represented almost half of the total procurement value of this public entity. These problems were largely restricted to auction-based procurement.

Further on, for the first time ever the collected data made it possible to look at government procurement from the perspective of search, experience and credence goods - a breakdown from the institutional economic theory. In the public entity under review, government procurement was overwhelmingly dominated by search goods (84 percent in terms of cost and 61 percent in terms of number of contracts), whose quality can be validated only in use. However, theory predicts for this kind of goods that vendor selection on the basis of the least price criterion can create strong incentives for vendor opportunism, which is, regrettably, quite a pervasive practice in Russia.

The regression analysis shows that price reductions achieved through bidding procedures are a direct function of the number of

qualifying bids. Price reductions were most frequently observed in credence and experience goods procurement (versus search goods), and also in procurement of works. On the other hand, auctions produced significantly fewer price reductions (compared to RFQ and tender procurements).

Delays in deliveries were more frequent for experience goods procurement, and also for larger procurement and for contracts to be performed in quarters I to III of the current year. More serious performance problems, potentially leading to default on deliveries, were observed in larger procurement and contracts expiring in the fourth quarter. Meanwhile, despite repeated references by government purchasers to the negative impact of price dumping, our analysis did not reveal any connection between price reductions through bidding and contract performance problems. We also didn't reveal significant difference between different types of "problem" contracts.

Any interpretation of the results, obviously, should recognize the limited nature of the sample. While the overall number of observations is quite large, they are restricted to just one major public entity. This public entity has a special department responsible for procurement procedures pursuant to the 94 FL requirements. This department is staffed with top notch professionals, suggesting that this public entity may be facing fewer problems than most other government purchasers in Russia. Other biases in the results may be related to the specifics of its core activities, reflected in the range of procured goods, works and services.

However, while recognizing these limitations, we would still argue that the trends identified and results obtained may suggest the following policy implications and recommendations to enhance government procurement regulation in Russia. They are as follows:

- Focusing regulatory controls on "risk envelopes", i.e. larger contracts and contracts with steep price reductions in the course of bidding.
- Obligatory application to all larger value procurements (e.g., starting from 10 million rubles) of such vendor selection criteria as a record of success in similar deliveries of comparable volumes, skilled staff, equipment, and so forth.

- Legislative amendments to implement legal mechanisms for adapting contractual framework to the changing environment; this statutory flexibility will help to take these objective processes out from the informal "grey area", which inevitably breeds corruption.
- Amending the Budget Code to allow and regulate carryovers of undisbursed allocations to the next year (some experts estimate that this single move would have halved corruption in government procurement).
- Scaling down the use of auctions in government procurement, restricting them largely to search goods, because their procurement on the basis of the least price criterion produces the best possible results.
- A wider public access to government procurement data and putting in place IT capacity for an expert analysis of government procurement results and efficiency.

Our microeconomic analysis provides further evidence that the current government procurement system in Russia is far from being perfect, while its participants face multifaceted problems and risks. Efforts to address these problems and mitigate the risks should be grounded in a pragmatic analysis of the efficiency of various government procurement methods and channels. We believe such an analysis may benefit from the approaches suggested in this paper, and we hope that our research will contribute to further progress in this area.

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APPENDIX

Functional Forms of Estimated Models

Model 1

$$\begin{aligned} Price_reduction_i = & \beta_0 + \beta_E Experience_good_i + \\ & + \beta_C Credence_good_i + \beta_A Auction_i + \beta_T Tender_i + \\ & + \beta_{2009} Year2009_i + \beta_{2010} Year2010_i + \beta_{IV} QuarterIV_i \\ & + \beta_N Number_i + \beta_D Duration_i + \beta_B Budget_i + \\ & + \beta_{Cost} Cost_Center_i + u_i, i = 1, \dots, n \end{aligned}$$

Model 2

$$\begin{aligned} Price_reduction_i = & \beta_0 + \beta_W Work_i + \beta_S Services_i + \beta_A Auction_i + \\ & + \beta_T Tender_i + \\ & + \beta_{2009} Year2009_i + \beta_{2010} Year2010_i + \beta_{IV} QuarterIV_i \\ & + \beta_N Number_i + \beta_D Duration_i + \beta_B Budget_i + \\ & + \beta_{Cost} Cost_Center_i + u_i, i = 1, \dots, n \end{aligned}$$

Model 3

$$\begin{aligned} Delay_i = & \beta_0 + \beta_E Experience_good_i + \beta_C Credence_good_i + \\ & + \beta_A Auction_i + \beta_T Tender_i + \\ & + \beta_{2009} Year2009_i + \beta_{2010} Year2010_i + \beta_{IV} QuarterIV_i + \beta_N Number_i + \\ & + \beta_D Duration_i + \beta_B Budget_i + \\ & + \beta_{Cost} Cost_Center_i + Price_reduction_i + u_i, i = 1, \dots, n \end{aligned}$$

Model 4

$$\begin{aligned} \text{Delay}_i = & \beta_0 + \beta_E \text{Experience_good}_i + \beta_C \text{Credence_good}_i + \\ & + \beta_A \text{Auction}_i + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction_more30}_i + u_i, i = 1, \dots, n \end{aligned}$$

Model 5

$$\begin{aligned} \text{Delay}_i = & \beta_0 + \beta_W \text{Work}_i + \beta_S \text{Services}_i + \beta_A \text{Auction}_i + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction}_i + u_i, i = 1, \dots, n \end{aligned}$$

Model 6

$$\begin{aligned} \text{Delay}_i = & \beta_0 + \beta_W \text{Work}_i + \beta_S \text{Services}_i + \beta_A \text{Auction}_i + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction_more30}_i + u_i, i = 1, \dots, n \end{aligned}$$

Model 7

$$\begin{cases} \text{Problem}_i = 1 \text{ if } \text{Problem}_i^* \geq 0, \\ \text{Problem}_i = 0 \text{ if } \text{Problem}_i^* < 0, \end{cases} \text{ where}$$

$$\begin{aligned} \text{Problem}_i^* = & \beta_0 + \beta_E \text{Experience_good}_i + \beta_C \text{Credence_good}_i + \\ & + \beta_A \text{Auction}_i + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction}_i + u_i, i = 1, \dots, n, \\ u_i \sim & N(0, \sigma_u^2) \end{aligned}$$

Model 8

$$\begin{cases} \text{Problem}_i = 1 \text{ if } \text{Problem}_i^* \geq 0, \\ \text{Problem}_i = 0 \text{ if } \text{Problem}_i^* < 0, \end{cases} \text{ where}$$

$$\begin{aligned} \text{Problem}_i^* = & \beta_0 + \beta_E \text{Experience_good}_i + \beta_C \text{Credence_good}_i + \\ & + \beta_A \text{Auction}_i + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction_more30}_i + u_i, i = 1, \dots, n \\ u_i \sim & N(0, \sigma_u^2) \end{aligned}$$

Model 9

$$\begin{cases} \text{Problem}_i = 1 \text{ if } \text{Problem}_i^* \geq 0, \\ \text{Problem}_i = 0 \text{ if } \text{Problem}_i^* < 0, \end{cases} \text{ where}$$

$$\begin{aligned} \text{Problem}_i^* = & \beta_0 + \beta_W \text{Work}_i + \beta_S \text{Services}_i + \beta_A \text{Auction}_i + \\ & + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction}_i + u_i, i = 1, \dots, n \\ u_i \sim & N(0, \sigma_u^2) \end{aligned}$$

Model 10

$$\begin{cases} \text{Problem}_i = 1 \text{ if } \text{Problem}_i^* \geq 0, \\ \text{Problem}_i = 0 \text{ if } \text{Problem}_i^* < 0, \end{cases} \text{ where}$$

$$\begin{aligned} \text{Problem}_i^* = & \beta_0 + \beta_W \text{Work}_i + \beta_S \text{Services}_i + \beta_A \text{Auction}_i + \\ & + \beta_T \text{Tender}_i + \\ & + \beta_{2009} \text{Year2009}_i + \beta_{2010} \text{Year2010}_i + \beta_{IV} \text{QuarterIV}_i + \beta_N \text{Number}_i + \\ & + \beta_D \text{Duration}_i + \beta_B \text{Budget}_i + \\ & + \beta_{\text{Cost}} \text{Cost_Center}_i + \text{Price_reduction_more30}_i + u_i, i = 1, \dots, n \end{aligned}$$

$$u_i \sim N(0, \sigma_u^2),$$

Where i is a number of the contract, n – number of observations,
Price_reduction_i is price reduction for i -th contract (in percent),
Price_reduction_more30_i is an indicator of price reduction more than 30 percent for i -th contract,
Delay_i is a delay in i -th contract implementation (in days),
Problem_i is indicator for “problem” contracts (1 if i -th contract was with problems and 0 otherwise),
Experience_good_i is indicator for experience good (1 if i -th good is experience and 0 otherwise),
Credence_good_i is indicator for credence good (1 if i -th good is credence and 0 otherwise),
Work_i is indicator for work in the standard classification (1 if i -th good is work and 0 otherwise),
Services_i is indicator for service in the standard classification (1 if i -th good is service and 0 otherwise),
Auction_i is indicator for auction (1 if auction was the method of procurement for i -th contract and 0 otherwise),
Tender_i is indicator for tender (1 if tender was the method of procurement for i -th contract and 0 otherwise),
Year2009_i is indicator for 2009 year (1 if i -th contract expiring in 2009 and 0 otherwise),
Year2010_i is indicator for 2010 year (1 if i -th contract expiring in 2010 and 0 otherwise),
QuarterIV_i is indicator for the IV quarter (1 if i -th contract expiring in the IV quarter and 0 otherwise),
Number_i is the number of eligible bids for i -th contract,
Duration_i is the duration of the contract (in days),
Budget_i is the budget of the bid,

Cost_Center_i is indicator for profit centers of analyzed public entities
 β -s are estimated coefficients and u_i are disturbance terms,
 $i=1, \dots, n$.