

Examining the Impact of E-Procurement in Ukraine

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Abstract

This paper examines the impact of Ukraine's ambitious procurement reform on outcomes amongst a set of procurements that used competitive tendering. The ProZorro system placed all of the country's government procurement online, introduced an auction approach as the default procurement method, and extended transparency. The reform was introduced with a dramatic increase in the proportion of government procurement that was conducted competitively. This paper examines the impact of ProZorro and reform on contracts that were procured competitively both prior to and after the introduction of the new system. It finds some evidence of impact of the new system on increasing the number of bidders, cost savings, and reduced contracting times.

Keywords: E-procurement, Transparency, Competition

JEL: H57, D73

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1 Introduction

Over the last few years, Ukraine has undergone considerable procurement reform including the introduction of the Open Contracting Data Standard (OCDS). The country's experience provides the opportunity to measure the benefits of moving to a transparent e-procurement system using econometric techniques. Such an analysis would be useful to Ukraine, but also to other countries considering or implementing open digital contracting systems.

Public procurement in Ukraine is worth about 15 percent of GDP. Since 2015, the country has implemented reforms in its procurement system, introducing e-procurement through a platform called ProZorro. Beyond digitizing the procurement process and introducing e-auction as the default tendering type for all major procurements in all government entities, ProZorro and underlying legislative reform introduced considerably greater transparency by adopting the OCDS and ensuring information was available for small (below threshold) procurements which had previously been unrecorded. Additional impacts of reform were to considerably increase the proportion of small procurements bid competitively, to ban contract awards above estimated price, and to limit contract finalization times.

Data generated by the system is stored in a central database and is available to the public. Indicators about each contract are available in a machine-readable format: type of procedure applied, contracting authority identification, bidders identification, lot and tender identification, winner identification, expected price of the lot and the tender, final price of the lot and tender, contracted value, key dates, status of the tender and lot, claims and complaints, and classification of the good/service/work in the lot and tender.

The ProZorro platform began piloting electronic bidding in selected agencies in February 2015. From April 2016 all central executive bodies and state-owned enterprises began using the system and from August 2016 all public procurements were conducted exclusively through ProZorro. Out of the eight major procurement procedures available to public entities in Ukraine including open competitive bidding and negotiation, seven are now covered in ProZorro (the exception is competitive dialogue). A detailed estimate suggests the cost of the system was approximately 4.69 million Euros, from the inception of the program in 2014 through its implementation in 2017 ([Vissapragada, 2017](#)).

This paper examines if the introduction of ProZorro had an impact on competition and prices. We will compare outcomes in the pre-ProZorro period to post-ProZorro outcomes for the set of larger 'above-threshold' contracts procured using competitive bids in both periods. We use an OLS approach including time and a ProZorro dummy over a longer period. The

results suggest that for above-threshold procurements, the reform was associated with an increase in the number of bids, higher savings, and reduced procurement times.

2 Literature Review

[Laajaj et al. \(2017\)](#) study the impact of computerization of customs transactions on the growth of firm inputs, investments and value added. Using a triple-difference strategy they find that as computerization was introduced across firms, it was associated with less corruption, more imports declared and customs taxes collected as well as firm growth. [Okunogbe and Pouliquen \(2018\)](#) examine the impact of e-filing on compliance costs, tax payments and bribe payments using data from Tajikistan. They find heterogeneous effects, with firms previously likely to evade paying more in taxes while those who had previously been paying taxes paying less.

[Knack et al. \(2017\)](#) use enterprise survey data for 88 countries combined with a measure of transparency in procurement systems (where exceptions to competitive bidding must be explicitly justified) to find that more transparent systems see more firms in an economy participating in government procurement, and firms reporting that they pay lower bribes to procurement officials.

[Lewis-Faupel et al. \(2014\)](#) look at the introduction of e-procurement for public works in India and Indonesia, using staggered adoption in the two countries to measure price and quality impacts in road construction. They find no impact on price, but evidence of more diverse competition and improved quality of outcomes. [Lewis-Faupel et al. \(2014\)](#) estimate the following OLS specification for India:

$$y_{ist} = \alpha_s + \beta_t + \mu EPROC_{st} + X'_{ist}\gamma + \epsilon_{ist}$$

Where i is a contract, s is a state and t is a year, $EPROC_{st}$ is a dummy for adoption by state s as of year t , and controls X_{ist} are log estimated cost and road length. All of their regressions include state (α_s) and year (β_t) fixed effects. Because e-procurement may not be randomly assigned, the authors check whether, overall, the adoption of e-procurement is associated with the volume or structure of procurements in a given province and whether the year of adoption at the state level is associated with earlier trends in contract values.

[Schøll and Ubaydi \(2017\)](#) study the ProZorro case. They look at the variation between estimated and actual prices of goods procured under the ProZorro system and suggest goods were procured below estimated prices under ProZorro. Their analysis is limited by having

no data on pre-ProZorro outcomes.

Analysis of procurement trends by [Shapoval et al. \(2017\)](#) find that ProZorro had a dramatic impact on procurement reporting. They find that:

Compared with 2015, the volume of the public procurement market grew by 17% in 2016 (up to \$10.4 billion USD). The growth was mainly due to below threshold procedures (that became mandatory to display in the system)[. The] number of transactions increased by more than four times. Open and simplified access to the system has increased the inflow of bidders and suppliers and the diversity of suppliers has increased 3x... In 2016, the number of buyers who abused procurement procedures and signed contracts with only one supplier decreased significantly - 5% compared with 11% in 2015, and the average value of these purchases decreased by 70% (p.2).

[Open Contracting Partnership \(2017\)](#) reports baseline and updated estimates of competition and outcomes under ProZorro reported using the same dataset (see Table 1). The monitoring analysis suggests that there was a dramatic increase in the number of procurements and the proportion of Ukraine's government procurement budget that were awarded competitively, from 24.5 percent of procurement value in 2015 to 70.3 percent in 2017. This was associated with more bidders per lot, more unique suppliers recorded and a gap opening up between estimated and final contract price. The results need to be approached with some caution, however, given that the nature of procurements analyzed varies considerably between 2015 and 2017, with the 2015 sample limited to above-threshold (large) contracts while the 2017 results include a majority of smaller contracts. We use a cleaned and matched dataset from the same source as [Open Contracting Partnership \(2017\)](#) and [Shapoval et al. \(2017\)](#) to study the impact of ProZorro on competitiveness in greater detail.

Table 1: Results from Open Contracting Partnership Report

Measure	Baseline Feb 2015	July 2016	July 2017
Avg. bidders per tender lot	2.01	2.77	2.32
Avg. unique suppliers per procuring entity	1.71	9.4	11.4
% all tenders (quantity of lots) above threshold	100	4	37.3
% (number and value) of procurement contracts awarded by competitive procedures	2	84.7	59.2
% procurement value awarded by competitive procedures	24.5	28.4	70.3
Total % savings (diff. between value estimate and contract value)	0	14.1	9.13

Source: From Open Contracting Environment Assessment and Monitoring Program Outcome & ProZorro Impacts Indicators, section 4.1: Market Fairness, p.14.

Note that our approach differs from [Open Contracting Partnership \(2017\)](#) and [Shapoval et al. \(2017\)](#). We are comparing a subset of contracts that are “above threshold” (with an estimated value that mandates a competitive procurement process) in the pre- and post-ProZorro period and bid competitively. This ignores any impact of procurement reform and the introduction of ProZorro on increasing the proportion of tenders that use competitive processes under the threshold (which was apparently large). Instead we ask if reform increased competition, saved money, and saved time amongst the subset of larger procurements that were competitively bid both before and after ProZorro.

3 Data

3.1 Building the Dataset

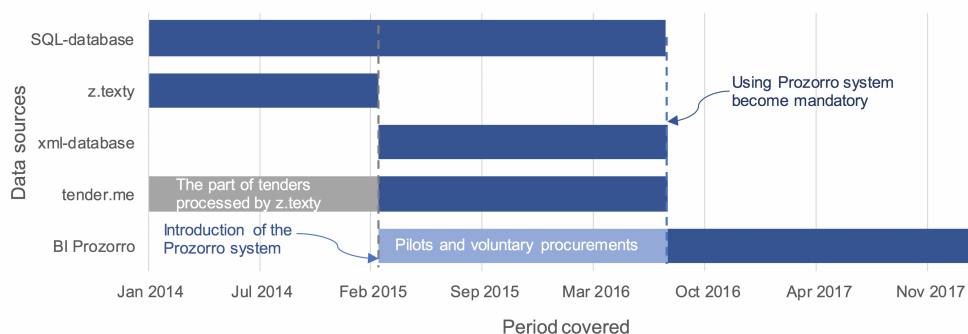
To collect information on procurements, data from multiple sources was used. A practical challenge with analysis was the limited data currently available for the pre-ProZorro period, which was also only available for above-threshold bids. Electronic data for 2015 is available in the database compiled by [Shapoval et al. \(2017\)](#) from the former system administrator, but it contains only monetary and quantity values for completed tenders over the threshold. Data for 2008-2015 procurements was available in PDF format on a government portal, including data about date of tender and contract, estimated cost, final cost, bids, identification of participants and purchasers, winners, type of goods and services classified using SCGS

(State Classifier of Goods and Services) codes, and geographic region of procuring entity. In this section, we provide a brief description of data sources and the cleaning and merging techniques involved in creating the dataset.¹

We use several data sources for different time periods as displayed in Figure 1:

- *z.texty*²—The web portal shows the information extracted from the dump-file from the official web portal on public procurements. The database only includes data on one-lot tenders due to the high complexity involved in processing multi-lot tenders.
- *SQL* database—The database consists of information on tender results, buys and sellers, and contract value, but does not include tender estimated value or information on participants.
- *XML* database—A list of about 1,000 files, each of which includes some basic information on procurement contracts signed on a particular day.
- *tender.me.gov.ua*—Official web portal that was previously the main source of information on public procurements before the ProZorro system was created.
- *BI ProZorro*³—business intelligence module that consists of all the information on procurements conducted through the ProZorro system.

Figure 1: Data Sources and the Periods that They Cover



Source: Authors

¹Initial datasets and scripts for their processing are available in the replication files.

²For more details, see: <https://z.texty.org.ua/>

³Professional version available here: <http://bipro.prozorro.org>. Public version available here: <http://bi.prozorro.org>.

The main limitation of data on pre-ProZorro public procurements is the absence of information on smaller “below threshold” tenders, with a threshold of UAH 200 thousand. Moreover, collecting information on multi-lot tenders is particularly challenging. In order to address these issues, this study focuses only on above-threshold one-lot tenders.

The data collection and cleaning process is described below.

Previous system (Pre-ProZorro) There is no single source of information about public procurements in the pre-ProZorro period. Thus, the data collection process involved two different phases, one for the data till March 2015 and the other for the data from March 2015 onwards.

The pre-March 2015 data was collected from two sources. We extracted information on estimated value and number of participants for each tender from the database created by the z.texty team (column 1 in Table 2). This data was supplemented by information on procuring entities, contract value, winner and other variables from the SQL-database based on unique tender ID (column 2 in Table 2). We also created additional variables in this dataset of over 17 thousand observations for savings and a ProZorro dummy variable that for this period was set to 0.

The post-March 2015 data was collected through a more complex process that included several steps:

1. From the XML database for each procurement procedure we extracted information on procuring entities, type of procurement procedure, goods description, and link to the profile on the *tender.me.gov.ua* (column 3 in Table 2). We only kept observations for tenders with competitive procedures and due to the complexity of processing multi-lot tenders, we kept one-lot tenders only (33.7 thousand observations).
2. Next, using the links, we downloaded files with descriptions of the tendering procedure, including number of participants, for each tender from *tender.me.gov.ua* (column 4 in Table 2). Some of these files were excluded from the analysis because they were not in machine-readable formats (eg. scanned .pdf files) and it was not possible to process them. Only text files were kept for further analysis (30.1 thousand files). After converting all the remaining files into .docx format, we extracted information on number of participants for each tender (28.3 thousand observations).
3. Having the links to the tender profiles we were also able to extract the information on estimated value of each tender using web scraping techniques (33 thousand observations).

4. Finally, the received dataset was supplemented by information on winner (name and ID) and estimated value of the tender from the SQL database.

The table below summarizes the information on sources for each variable used in the analysis.

Table 2: Variable Sources

Period Covered	Jan 2014-Feb 2015			Mar 2015-Jul 2016	
Data source	z.texty (1)	SQL database (2)	XML database (3)	tender.me.gov.ua (4)	SQL database (5)
Variables extracted	<i>tender_id</i>	<i>tender_id</i>	<i>tender_id</i>	<i>tender_id</i>	<i>tender_id</i>
	<i>purchase_cost_uah</i>	<i>purchase_id</i>	<i>goods_code</i>	<i>purchase_cost_uah</i>	<i>date_contract</i>
Variables created	<i>partic_num</i>	<i>part_num</i>	<i>edr_buyer</i>	<i>partic_num</i>	<i>volume_uah</i>
		<i>lot_id</i>		<i>name_seller</i>	<i>edr_seller</i>
		<i>edr_seller</i>			
		<i>name_seller</i>			
		<i>date_contract</i>			
		<i>volume_uah</i>			
		<i>is_vat_included</i>			
		<i>goods_code</i>			
		<i>edr_buyer</i>			
	<i>prozorro_dummy</i>		<i>prozorro_dummy</i>		
	<i>lot_sav</i>		<i>lot_sav</i>		
	<i>lot_sav_perc</i>		<i>lot_sav_perc</i>		

Source: Authors.

The final dataset on the pre-ProZorro period was created by appending the two datasets created in the above two phases.

Current System (ProZorro) The main source of structured information on public procurements conducted through the ProZorro system is the BI module. Even though that database consists of many variables for each procurement procedure, we downloaded only those that were in the dataset for the pre-ProZorro period as well. Also, only above-threshold tenders were considered. Moreover, in order to ensure comparability, we removed the data on multi-lot tenders as well. The dataset had 73.5 thousand tenders with total contract value 275.5 UAH billion.

Final dataset The final step involved merging two datasets (pre-ProZorro and ProZorro period). There are 4,669 distinct procuring entities in the dataset, of which 477 only appear in one of the periods. We include only open bidding and open bids published in English, and exclude bids that use negotiation procedures for defense contracts, resulting in 4,192 distinct

entities in our final dataset. There are 4,875 cases in the pre-ProZorro period lacking data on number of bids. We also excluded cases where only one bidder was recorded, a rare (less than 1 percent of tenders) occurrence which was against procurement rules and associated with poor data entry. All ProZorro observations include the number of bids.

3.2 Summary Statistics

In Tables 3 and 4, we report summary statistics for relevant variables, first by whether the procurement took place under the ProZorro system or not (Table 3) and then based on whether the procurement took place in 2017 (after ProZorro’s introduction) or in 2015 (before its introduction) in Table 4. Savings rate is calculated as $(1 - \frac{FinalPrice}{EstimatedPrice}) \times 100$. We dropped a small number of observations with extreme savings values of less than negative 50%. Looking at only entities with observations in both 2015 and 2017, the results are fairly similar to those reported in the tables. We also look at entity average results for entities with recorded procurements in the pre- and post- ProZorro period. We describe trends in total number of contracts and average price per contract for all contracts and by ProZorro status in Figures 2 to 7 and compare density of contract amounts for ProZorro and non-ProZorro contracts in Figure 8.

Table 3: All Contracts by ProZorro Status and Level

	Tender Level			Entity Level		
	Prozorro	Other	Total	Prozorro	Other	Total
Contract Amount (1000s)	4090.4 (32706.7)	3231.2 (17387.2)	3813.4 (28678.1)	2492.2 (10066.9)	2374.6 (9260.8)	2367.2 (7469.7)
Expected Value (1000s)	4460.8 (35227.2)	3563.2 (19469.6)	4171.4 (31035.7)	2776.1 (10644.6)	2752.4 (10527.8)	2688.5 (7990.4)
Savings Rate (%)	12.74 (17.76)	9.397 (18.14)	11.66 (17.95)	12.13 (11.10)	9.411 (11.60)	11.07 (8.756)
Bids	2.742 (0.994)	2.786 (1.039)	2.756 (1.009)	2.678 (0.643)	2.797 (0.828)	2.713 (0.561)
% Contracts with 2 bids	56.08 (0)	55.55 (0)	55.91 (0)	59.03 (32.74)	54.62 (39.06)	57.74 (27.84)
% Contracts with 3 bids	23.24 (0)	21.61 (0)	22.72 (0)	22.33 (26.20)	22.61 (31.57)	22.67 (21.73)
% Contracts with >3 bids	20.67 (0)	22.84 (0)	21.37 (0)	18.64 (25.65)	22.78 (33.26)	19.59 (21.95)
Time from Tender to Contract	44.69 (14.61)	49.10 (18.96)	46.11 (16.27)	40.90 (8.402)	44.44 (11.27)	42.59 (8.304)
Distinct Winners	13122 (0)	9844 (0)	18097 (0)			
Tenders Per Entity				12.75 (46.77)	8.241 (20.50)	19.97 (58.87)
Distinct Winners Per Entity				7.781 (20.77)	5.102 (10.18)	10.91 (24.82)
Winners/Tenders Per Entity				0.850 (0.199)	0.828 (0.222)	0.732 (0.219)
Observations	52,332	24,904	77,236	4,104	3,512	4,181

Notes: This table reports summary statistics for contract amount, expected value, savings rate in percentage terms (calculated by subtracting final price from estimated value and dividing the result by estimated value), percentages of contracts with bids at the tender and entity level, and time between tender and contract, by ProZorro procurement status. It also reports distinct number of winners at the tender level and tenders, distinct winners, and winners/tenders at the entity level. Statistics are calculated using only observations with no missing values for any of the variables summarized. All monetary amounts in this paper are in Ukrainian hryvnia (UAH).

Table 4: All Contracts by Year and Level

	Tender Level		Entity Level	
	2017 (Prozorro)	2015 (Other)	2017 (Prozorro)	2015 (Other)
Contract Amount (1000s)	4216.5 (33921.1)	2717.6 (12666.6)	2668.5 (11037.6)	2177.9 (9753.9)
Expected Value (1000s)	4579.6 (36485.3)	3001.0 (14149.1)	2935.0 (11751.2)	2509.9 (11607.3)
Savings Rate (%)	12.24 (17.44)	8.729 (18.49)	12.13 (11.55)	9.258 (13.44)
Bids	2.706 (0.973)	2.761 (1.019)	2.675 (0.657)	2.758 (0.827)
% Contracts with 2 bids	57.53 (0)	56.20 (0)	58.89 (33.60)	55.39 (40.73)
% Contracts with 3 bids	23.11 (0)	22.09 (0)	22.81 (27.33)	23.54 (33.82)
% Contracts with >3 bids	19.36 (0)	21.70 (0)	18.29 (26.02)	21.07 (33.55)
Time from Tender to Contract	44.32 (14.37)	47.34 (16.76)	40.79 (8.468)	44.18 (12.39)
Distinct Winners	11086 (0)	6754 (0)		
Tenders Per Entity			10.35 (33.14)	5.991 (13.89)
Distinct Winners Per Entity			6.701 (16.51)	3.973 (7.591)
Winners/Tenders Per Entity			0.863 (0.193)	0.861 (0.213)
Observations	38,619	14,702	3,733	2,803

Notes: This table reports summary statistics for contract amount, expected value, savings rate, percentages of contracts with bids at the tender and entity level, and time between tender and contract, by year of procurement, excluding 2016. It also reports distinct number of winners at the tender level and tenders, distinct winners, and winners/tenders at the entity level. Statistics are calculated using only observations with no missing values for any of the variables summarized.

Figure 2: Tenders

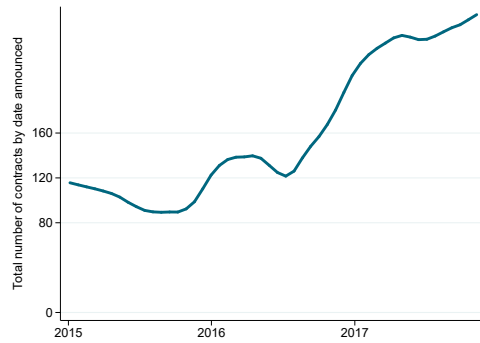


Figure 4: Contract Amounts

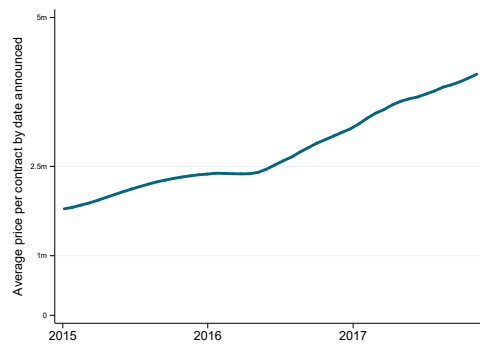


Figure 6: Savings Rates

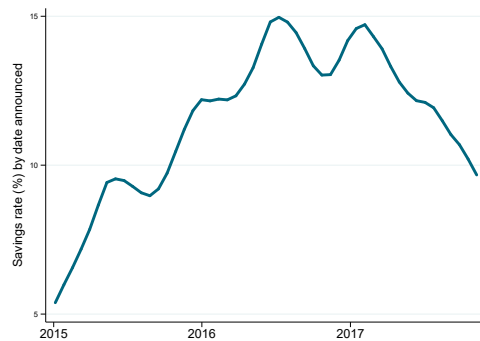


Figure 3: Tenders by Status

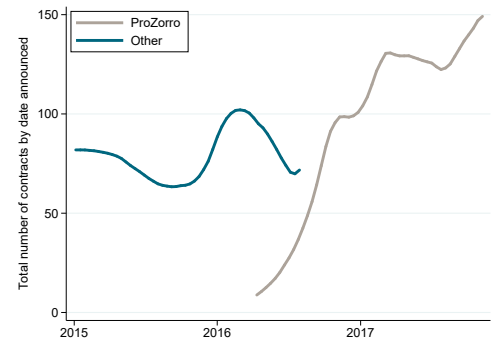


Figure 5: Amounts by Status

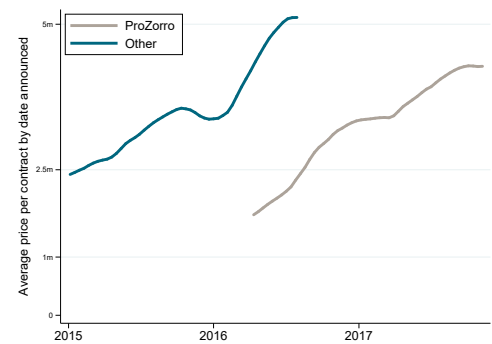
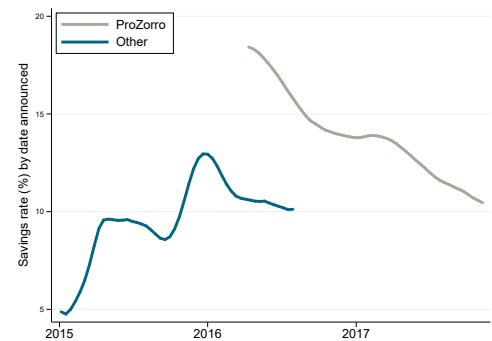
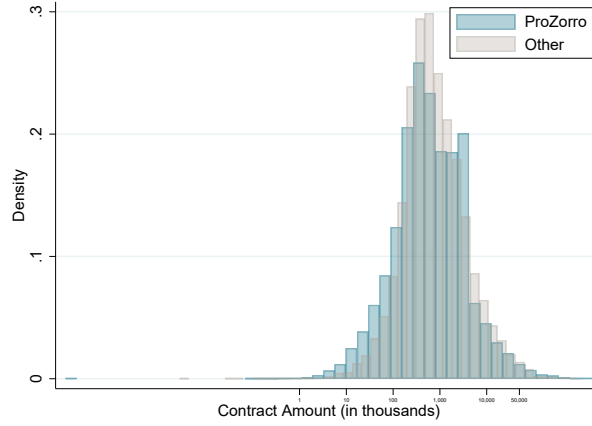


Figure 7: Savings Rates by Status



Notes: Figure 2 shows changes in total number of contracts on each day over time, Figure 4 show changes in average price per contract on each day over time, and Figure 6 shows changes in average savings rate per contract on each day over time. Figures 3, 5, 7 show these trends separated by ProZorro procurement status.

Figure 8: All Contracts



Notes: This histogram shows differences in density of contract amounts by ProZorro procurement status using a natural logarithmic scale.

As we can see from Tables 3 and 4 and Figure 8, ProZorro contracts values tend to be on average higher than non-ProZorro contracts, though this difference is not statistically significant and contract values have a similar density across the two procurement systems. There is a greater percentage savings rate in the ProZorro period than in earlier procurements, suggesting that there may have been greater savings under ProZorro. This does not, however, seem to be a result of more bidders for tenders, as most contracts in both periods had two bids. At the entity level, we see a higher number of tenders per entity under ProZorro, as well as a higher number of distinct winners per entity, the latter of which suggests that ProZorro may have been associated with an increase in the number of competitive firms bidding for a particular entity's tenders.

Trends in tenders and contract amounts are reflected in Figures 2 to 5. Figure 2 in particular seems to suggest that there is an element of seasonality to when tenders are announced, which could affect our results. There also appears to be an overall trend of increasing contract amounts throughout the period, which makes considering savings as a percentage of expected value rather than in absolute terms important. These preliminary descriptive results help inform our subsequent strategy for analyzing this data in greater depth.

4 Methodology

We had hoped to use a regression discontinuity (RD) design approach to measure the impact of ProZorro on outcomes. The RD design looks for a break (discontinuity) in the relationship between two variables at a particular value of one of those variables, termed the running variable. In the case of this analysis, the running variable would be time, the point of (potential) discontinuity would be the introduction of ProZorro and the outcome variable would be number of bidders, savings rate, and time between tender and contract.

There should be no reason to believe that the average contract issued one day before ProZorro should be different in a statistically significant manner from the average contract issued immediately after ProZorro was introduced except for the impact caused by the ‘treatment’—in this case the new procurement system (Lee and Lemieux, 2010). By measuring the magnitude of the discontinuity immediately around the date of ProZorro’s introduction, it would be possible to estimate the local average treatment effect (LATE) of the procurement system.

A clean RD design would only work, however, if there is continuity in the running variable. We tested for continuity using the McCrary (2008) test for a discontinuous change in the density of the running variable at the threshold, and these results are reported in Figures A.1 and A.2 in the appendix. Both tests suggest a significant drop-off in the number procurements begun immediately in the aftermath of ProZorro use becoming a legal requirement for an entity, and a discontinuous change in the density of the running variable at the threshold.

There are several possible reasons for this discontinuity. Because system implementation was known about in advance, procuring agencies may have altered procurement plans (moving bids below thresholds or bringing forward some contracts). The system may also be “gamed” by splitting procurements in different lots under different goods and services classifications. But rather than seeking to “game” the system by avoiding listing contracts under ProZorro, entities may simply not have been issuing contracts around introduction due to the disruption caused by switching procurement systems.

Instead of using an RD design, we rely on OLS regressions of the following form:

$$Y_i = \alpha + \beta ProZorro_i + \gamma X_i + \theta_i + \epsilon_i \quad (1)$$

where Y_i is the procurement outcome of interest, here number of bids received, savings, or time between contract announcement and signing for contract i ; X_i is a vector of contract

characteristics including the log value of the contract, implementing agency, type of goods, and geographic location; θ_i is time; and *ProZorro* is a dummy for the procurement occurring under the ProZorro system.

5 Results

We report regression results in Tables 5, 6, and 7. Table 5 reports the impact of using ProZorro on the number of bids for above-threshold procurements. Larger (estimated) procurements attract more bidders, there is no time trend and ProZorro appears to have a positive effect on bids. However, this statistically significant effect of ProZorro on bids is no longer present after adding fixed effects for the type of good being procured and the procuring entity. Restricting procurements to repairs (goods code 33, which refers to services in repair and mounting of machines and equipment and which is the most common code in the dataset) suggests a negative relationship between ProZorro and bids, although looking only at procurements that involved entities in the capital Kyiv does not change the results. Table 6 repeats the analysis using savings (where a positive coefficient would be a sign of cost saving). ProZorro procurements appear to see a larger gap between estimated and actual prices. The coefficients can be read as suggesting a ProZorro procurement saw final prices 3.5 to 5.8% lower than a pre-ProZorro procurement in terms of estimated compared to final price. Note, however, we would expect price estimates to change in response to factors including the consequences of underestimating costs and the procurement reforms banned contracts where final price exceeded estimated price. Furthermore, when observations are limited to cases where final price is less than estimated price in both periods the result loses statistical significance. Finally, Table 7 looks at the time between bid announcement and contract signature. Here, effects are significant, with ProZorro procurements completed around 5 to 6 days more rapidly than pre-ProZorro procurements. Again, note procurement reforms tightened time limits for procurement processes.

Table 5: Number of Bids

	(1) OLS Model	(2) +Entity IDs	(3) +Types of Goods	(4) Repairs Only	(5) Kyiv Only
ProZorro	0.059* (0.032)	0.016 (0.028)	0.029 (0.029)	-0.231*** (0.081)	0.118** (0.054)
ln(Estimated Value)	0.023*** (0.005)	0.039*** (0.006)	0.044*** (0.006)	-0.013 (0.012)	0.052*** (0.010)
Time	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)
Entity F.E.s	No	Yes	Yes	Yes	Yes
Goods Codes F.E.s	No	No	Yes	Yes	Yes
Obs.	78,038	77,787	74,519	5,965	20,760
R-squared	.002818	.1365	.1587	.2511	.1462

Notes: This table reports results of an OLS regression (see Equation 1) with number of bids as the dependent variable. Column 2 adds entity fixed effects; Column 3 adds goods code fixed effects; Column 4 includes only cases with goods code 33; and Column 5 includes only cases in the Kyiv region.

Table 6: Savings Rate

	(1) OLS Model	(2) +Entity IDs	(3) +Types of Goods	(4) Repairs Only	(5) Kyiv Only
ProZorro	4.290*** (0.594)	4.857*** (0.467)	5.305*** (0.497)	3.739*** (1.217)	3.515*** (0.792)
ln(Estimated Value)	-1.306*** (0.112)	-1.170*** (0.109)	-0.919*** (0.094)	-0.964*** (0.238)	-1.002*** (0.147)
Bids	6.238*** (0.127)	6.013*** (0.122)	6.044*** (0.119)	6.805*** (0.428)	6.032*** (0.207)
Time	-0.002* (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.002)	-0.000 (0.001)
Entity F.E.s	No	Yes	Yes	Yes	Yes
Goods Codes F.E.s	No	No	Yes	Yes	Yes
Obs.	77,307	77,045	73,863	5,954	20,549
R-squared	.1423	.2587	.2826	.2984	.2713

Notes: This table reports results of an OLS regression with the savings rate as the dependent variable. Column 2 adds entity fixed effects; Column 3 adds goods code fixed effects; Column 4 includes only cases with goods code 33; and Column 5 includes only cases in the Kyiv region.

Table 7: Time Between Tender and Signing

	(1) OLS Model	(2) +Entity IDs	(3) +Types of Goods	(4) Repairs Only	(5) Kyiv Only
ProZorro	-5.726*** (1.156)	-6.386*** (0.726)	-5.745*** (0.745)	3.096** (1.355)	-5.522*** (1.726)
ln(Estimated Value)	2.531*** (0.215)	2.637*** (0.160)	2.637*** (0.161)	2.373*** (0.206)	2.921*** (0.381)
Time	0.003** (0.001)	0.002*** (0.001)	0.002** (0.001)	0.002* (0.001)	0.001 (0.002)
Entity F.E.s	No	Yes	Yes	Yes	Yes
Goods Codes F.E.s	No	No	Yes	Yes	Yes
Obs.	82,821	82,747	78,787	6,108	21,937
R-squared	.08332	.3941	.3899	.3189	.3828

Notes: This table reports results of an OLS regression with time between contract tender and signing (in days) as the dependent variable. Column 2 adds entity fixed effects; Column 3 adds goods code fixed effects; Column 4 includes only cases with goods code 33; and Column 5 includes only cases in the Kyiv region.

6 Conclusion

We have looked for an impact of transparency where we would expect it to be smallest—amongst larger procurements that were already competitive and already fairly transparent. That said, there is evidence of a greater number of bids, higher savings, and greater participation in provision of contracted goods and services (more unique winners per tender in each entity), as well as strong evidence of reduced time to procure goods and services. And it is important to emphasize the effects of ProZorro and reform that are not captured by our analysis but have been suggested by earlier work: a significant increase in the proportion of all procurements that were made using competitive approaches associated with cost savings and greater competition.

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A Appendix

We report here the results of a McCrary test measuring changes in the number of contracts around cutoffs of August 1, 2016 (Figure A.1) and the deadline for each entity (Figure A.2). In both cases, we see a discontinuity around the cutoff suggesting a drop in procurements immediately after the introduction of ProZorro, and in test using the entity deadline, we see a spike in contracts right before the deadline, which would contradict the RD assumption of entities not potentially seeking to “game” the system by bringing forward contracts.

Figure A.1: McCrary Test: August Cutoff

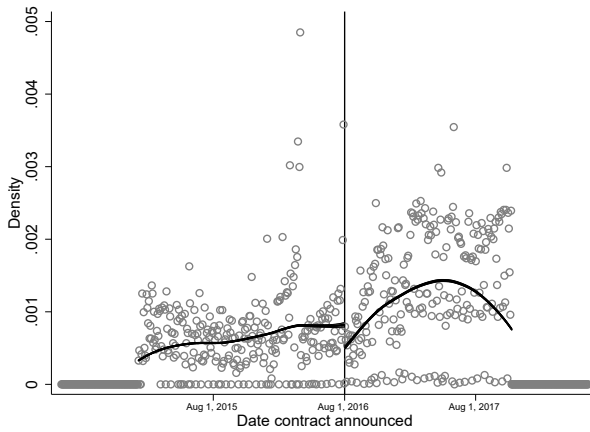
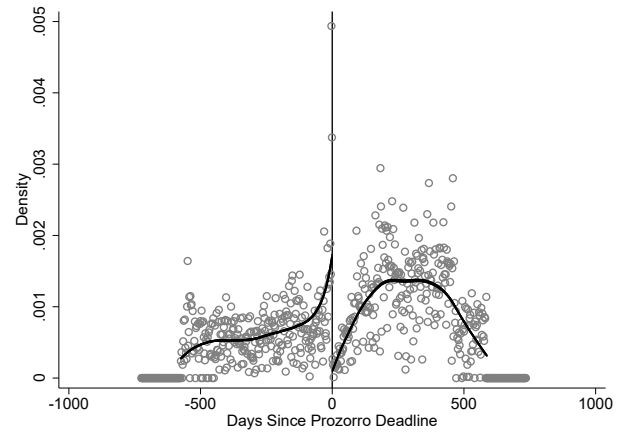


Figure A.2: McCrary Test: Entity Deadline



Note: Calculations based on [McCrary \(2008\)](#). Figures A.1 and A.2 use cutoffs of August 1 and entity deadlines.