Impacts of a Mandatory Shift to Decentralized Online Auctions on Revenue from Public Land Leases in Ukraine

Klaus Deininger[1] Daniel Ali[1] Roman Neyter[2]

[1]World Bank
Development Research Group

[2]Kyiv School of Economics

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Motivation

- Population growth, urbanization, and the demand for environmental services are driving an increasing demand for public land, elevating its value.
- This development has transformed communal land, once considered marginal, into a valuable asset for private parties, including agri-businesses and urban development.
- The increasing value of public land holds significant implications for local revenue generation and sustainability.
- However, ensuring that local communities benefit from public land transfers remains a major challenge, hindered by limited local capacity, elite capture, and corruption.
- This paper thus aims to address this gap by examining the 2021 legal reforms in Ukraine, which mandate decentralized and transparent electronic auctions, and their implications for public revenues and sustainability.

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Context

- **Ukraine's public agricultural land:** With over 10 million hectares, Ukraine's public agricultural land exceeds the total agricultural land of many European countries, presenting governance challenges.

- **Inefficiencies in previous auctions:** Previous centralized mechanisms, including in-person and pilot SETAM e-auctions organized by SGC, often lacked collusion-proof measures and resulted in below-market value transactions.

- **2021 legal reforms:**
  - The 2021 legal reforms shifted from centralized to decentralized online auctions on the Prozorro Sale platform.
  - These reforms also involved the transfer of public land ownership to local councils, with the aim of maximizing public benefits.

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Key differences: SETAM vs. Prozorro Sale

- **Centralization vs. Decentralization:** SETAM centralized control under SGC, while Prozorro Sale empowers local councils for decentralized auctions.
- **Transparency:** SETAM lacked transparency, whereas Prozorro Sale ensures it through real-time monitoring and disclosure of participants' identities.
- **Competition:** SETAM's monopoly reduced competition, whereas Prozorro Sale promotes competition through multiple trading platforms, and separation of system administration from auction organizers.

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Summary of main findings

- **Impact of Prozorro Sale transition:**
  - Lease prices surged by approximately 175%.
  - Robust results across various tests underscore the efficacy of the new auction system in promoting competition.

- **Cost of delayed governance reforms:**
  - Estimated annual cost exceeds US$500 million, emphasizing the need for timely reforms.

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Data sources

- SGC's website: Data on 31,483 auctions of public agricultural land initiated before November 2021.
- Prozorro Sales website: Information on 2,752 auctions conducted between November 2021 and March 2022.
- Control variables: Land use classifications based on remotely sensed data since 2019 & cadaster and OSM to calculate distance to public infrastructures.

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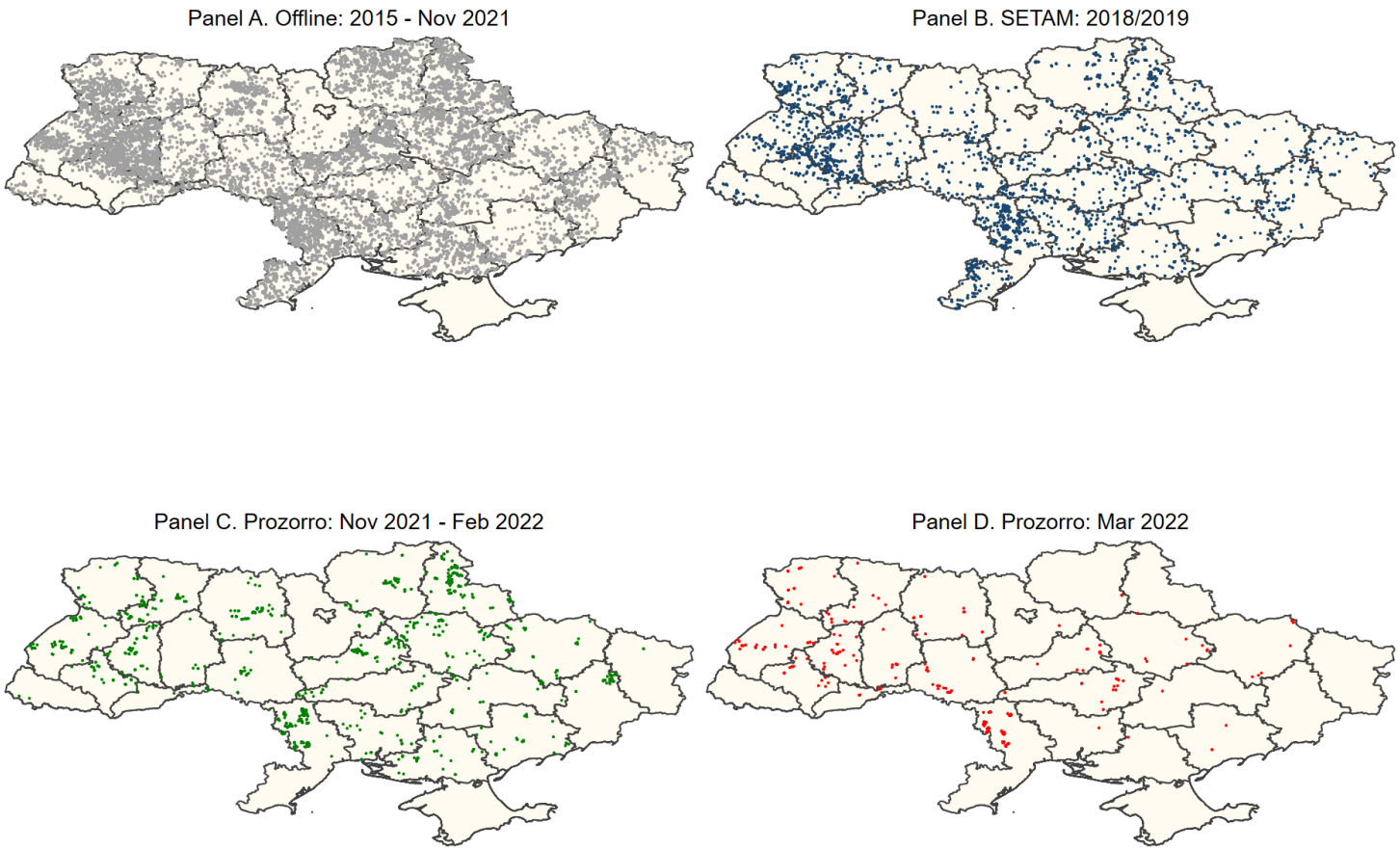
Spatial distribution of online and offline auctions



Summary of data and timing of policy reforms

	No. of auctions		Transferred	Share of auctions..	
	Total	Successful	area (ha)	..online	..org. by SGC
2015	1,935	1,530	28,345	0	0.54
2016	2,817	1,916	42,754	0	0.87
2017	3,388	2,139	43,358	0	0.84
2018	5,108	3,519	65,859	0.06	0.85
2019	8,710	5,327	83,269	0.51	0.69
2020	2,431	847	13,408	0	0.5
2021	7,805	5,232	58,442	0.09	0.38
Pre-reform	7,094	4,774	54,425	0	0.41
Post-reform	711	458	4,017	1	0
2022	2,041	1,043	9,964	1	0
Total	34,235	21,553	345,399	0.22	0.61

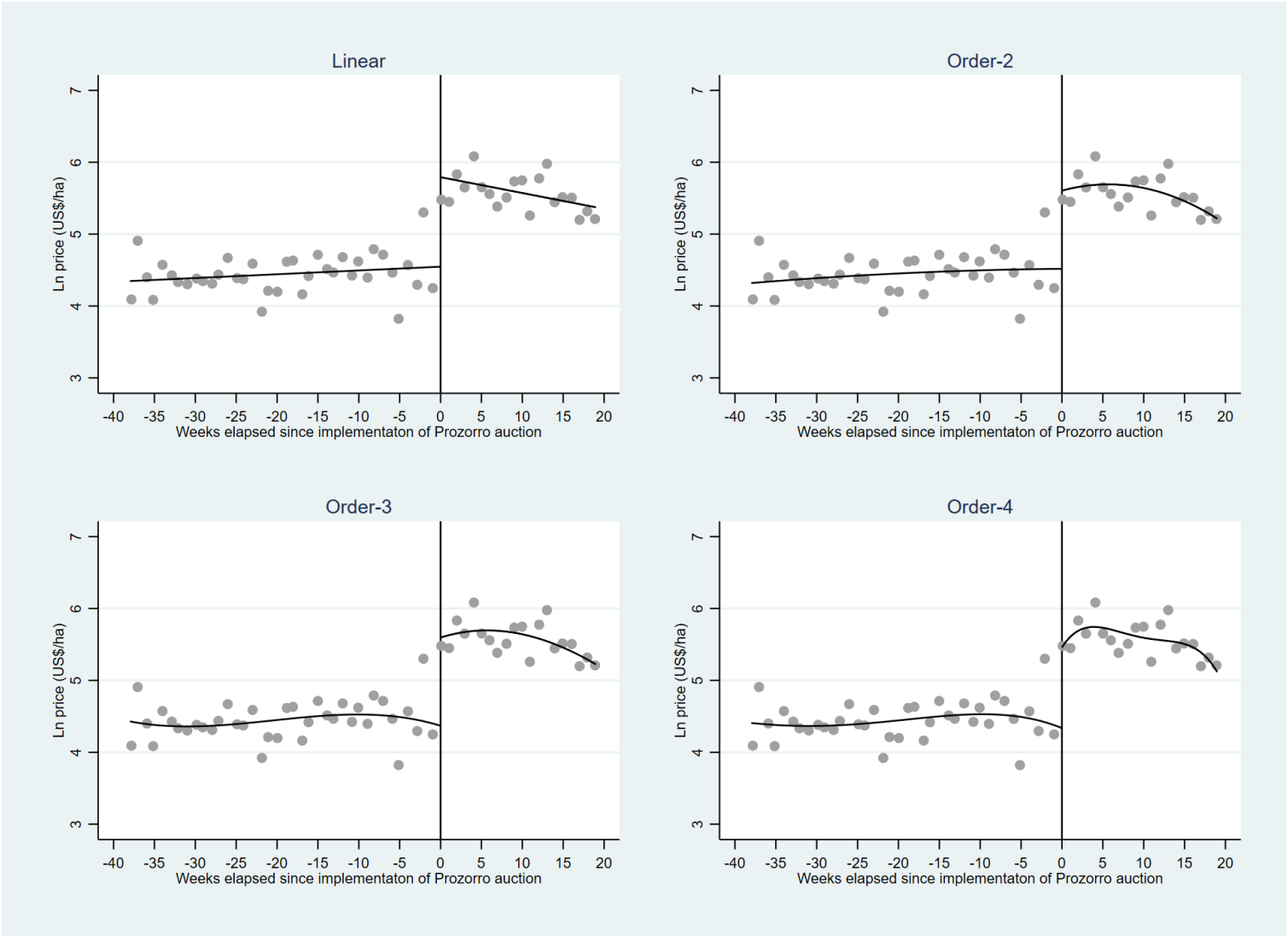
Source: 'Reform' implies mandatory use of the Prozorro Sale e-auction platform by local governments as auction organizers from November 1, 2021, based on legislation and associated implementing regulations approved earlier.

Summary statistics for successful auctions in 2021/22

	Total	Offline	Online	t-test
Panel A: Key auction parameters				
Auction starting value (%)	11.26	10.62	11.6	***
Number of bidders	3.75	NA	3.75	
Auction contract price (US$/ha) median	116.02	87.21	341.69	***
Auction contract price (US$/ha) mean	219.36	157.28	416.79	***
NMV (US$/ha) median	485.5	437.34	677.06	***
NMV (US$/ha) mean	681.47	616.34	888.47	***
Organized by SGC	0.27	0.36	0	***
Contract length (years)	8.61	8.33	9.51	***
Panel B: Parcel attributes				
Area and land use in 2020				
Area (ha)	10.9	11.4	9.31	
Crops	0.43	0.42	0.46	***
Pasture	0.41	0.42	0.38	***
Forest	0.15	0.15	0.13	**
Distance in km to				
Main road	8.65	8.48	9.22	***
Nearest city	15.64	15.66	15.58	
Grain elevator	13.39	13.55	12.84	***
Kyiv	297.22	295.17	304.04	**
Total # of auctions	6,275	4,774	1,501	

Source: Own computation from SGC and Prozorro data as described in the text and t-test is for equality of means (medians) between online and offline auctions.Stars indicate significance: * $p<0.10$, ** $p<0.05$, *** $p<0.010$.

Discontinuity plots of mean weekly winning bids



ref: Plot size RD and ref: NMV RD

Estimation strategy: Basic model using all 2021/22 obs.

Model: Rayon fixed effects regression (65-week window)

$$Y_{ait} = \beta_1 P_{ait} + \beta_2 SGC_{ait} + \delta X_{ait} + \alpha_i + \lambda_t + \epsilon_{ait}$$

Variables:
Y_{ait}: Log of highest bid (US$/ha) for auction a in rayon i in year t.
P_{ait}: Dummy for auction conducted electronically on Prozorro Sales.
SGC_{ait}: Indicator for auction organized by SGC.
X_{ait}: Parcel characteristics (e.g., normative value, area, land use, geographic features, war dummy).
α_i: Rayon fixed effects.
λ_t: Year dummies or fixed effects.
ϵ_{ait}: Random error term.

Interest:
β_1: Estimated impact of mandatory use of Prozorro electronic auction system.

Adjustments:
Standard errors adjusted for clustering at rayon level.

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Robustness checks

- Narrower time window: Utilizing a 20-week window to mitigate confounding effects from institutional changes.
- Placebo test: Employing pre-reform data with a hypothetical implementation date of May 18, 2021, the date when the law mandating e-auctions was passed.
- Piecewise linear regression: Incorporating a weekly time trend and its interaction with the post-reform indicator.
- Random effects Tobit regression: Utilizing auction starting price as a variable left-censoring point across auctions.

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Effect of Prozorro Sale online auction on lease prices

	Actual reform (Nov 1, 2021)		Placebo (May 18, 2021)	
	all obs.	20-week window	all obs.	20-week window
Online Prozorro Sales	0.938***	1.013***	-0.0465	-0.0707
	(0.0994)	(0.1540)	(0.0541)	(0.0645)
Offline organized by SGC	-0.418***	-0.559***	-0.384***	-0.284***
	(0.0721)	(0.1850)	(0.0795)	(0.0940)
Norm. value (US$/ha)	0.596***	0.551***	0.668***	0.671***
	(0.0324)	(0.0645)	(0.0347)	(0.0417)
Parcel area (ha)	0.176***	0.131***	0.167***	0.191***
	(0.0251)	(0.0473)	(0.0248)	(0.0271)
Post-invasion dummy	-0.408***			
	(0.1050)			
2022-year dummy	-0.0449	0.0373		
	(0.1080)	(0.1400)		
Land cover variables	YES	YES	YES	YES
Distance variables	YES	YES	YES	YES
Rayon fixed effects	YES	YES	YES	YES
N	6,134	2,124	4,716	2,800
R2 (within)	0.367	0.348	0.318	0.29

Note: Dependent variable is the lease price (US$/ha) in logs. May 18, 2021 is the date when the law that mandates electronic auction was passed. Robust standard errors adjusted for clustering at the rayon level in parentheses * p<0.10, ** p<0.05, *** p<0.010.

Robustness check: Segmented regression with weekly trend

	Actual reform (Nov 1, 2021)		Placebo (May 18, 2021)	
	all obs.	20-week window	all obs.	20-week window
Online Prozorro Sales	1.046***	0.801***	-0.0427	0.0251
	(0.0775)	(0.1770)	(0.0641)	(0.0833)
Weekly trend	-0.00413*	0.0238	-0.00539	-0.0238**
	(0.0022)	(0.0199)	(0.0051)	(0.0109)
Prozorro # Weekly trend	-0.0107	-0.0274	0.00314	0.0164
	(0.0076)	(0.0243)	(0.0073)	(0.0153)
Norm. value (US$/ha)	0.602***	0.594***	0.695***	0.701***
	(0.0212)	(0.0380)	(0.0258)	(0.0368)
Offline organized by SGC	-0.520***	-0.556***	-0.429***	-0.383***
	(0.0504)	(0.2050)	(0.0528)	(0.0718)
Parcel area (ha)	0.165***	0.127***	0.171***	0.188***
	(0.0137)	(0.0253)	(0.0158)	(0.0228)
Post-invasion dummy	-0.340***			
	(0.0900)			
Land cover variables	YES	YES	YES	YES
Distance variables	YES	YES	YES	YES
Rayon fixed effects	YES	YES	YES	YES
N	5,905	2,038	4,567	2,731
R2 (within)	0.619	0.737	0.557	0.584

Robustness check: Random Effects Tobit

- Address diffs. in success rates (55% vs 67%) and starting price (11.6% vs 10.2% of NMV)
- Auction starting price is used as a variable censoring point across auctions.

	2021/2022 sample	20-week window
Online auction on Prozorro Sales	0.665***	1.197***
	(0.0605)	(0.0830)
Offline auction organized by SGC	-0.516***	-1.505***
	(0.0402)	(0.3210)
Normative value (US$/ha)	0.710***	0.673***
	(0.0174)	(0.0296)
Parcel area (ha)	0.202***	0.178***
	(0.0134)	(0.0241)
Post-invasion dummy	-0.924***	
	(0.0620)	
2022-year dummy	-0.102	-0.141
	(0.0672)	(0.0901)
Land cover variables	YES	YES
Distance variables	YES	YES
Rayon random effects	YES	YES
No. of obs.	9,396	3,341
Censored observations	3,262	1,217
Uncensored observations	6,134	2,124

Summary statistics for successful auctions in 2015-22

Comparing different e-auction platforms

	Total	Offline	Online		t-test
			SETAM	Prozorro	
Panel A: Key auction parameters					
Auction starting value (%)	9.66	9.72	8.44	11.6	***
Number of bidders	3.64	NA	3.57	3.75	***
Auction contract price (US$/ha) median	87.59	81.21	93.81	341.69	***
Auction contract price (US$/ha) mean	153.17	132.96	136.64	416.79	***
NMV (US$/ha) median	582.25	563.82	596.59	677.06	***
NMV (US$/ha) mean	760.05	763.78	672.76	888.47	**
Organized by SGC	0.58	0.57	0.99	0	***
Total # of auctions	21,553	17,471	2,581	1,501	

Source: Own computation from SGC and Prozorro data as described in the text and test is for equality of means (medians) between online auctions on SETAM and Prozorro. Equality of medians is tested using nonparametric chi-squared test with the null hypothesis that the online and offline samples are drawn from populations with the same median. Stars indicate significance: * $p<0.10$, ** $p<0.05$, *** $p<0.010$.

Comparing effects of different e-auction platforms

Offline local government organized auctions is the omitted category.

	Auctions conducted in	
	2018/19	**2015-22**
e-auction on Prozorro Sales		0.926***
		(0.1080)
e-auction on SETAM	-0.124**	-0.192***
	(0.0613)	(0.0413)
Offline auction organized by SGC	-0.248**	-0.372***
	(0.1070)	(0.0350)
Normative value (US$/ha)	0.649***	0.595***
	(0.0316)	(0.0212)
Parcel area (ha)	0.130***	0.119***
	(0.0156)	(0.0167)
Post-invasion dummy		-0.340***
		(0.1180)
Land cover and distance variables	YES	YES
Rayon and year fixed effects	YES	YES
No. of obs.	4,480	20,688
R2 (within)	0.292	0.297

Note: Dependent variable is the lease price (US$/ha) in logs with rayon fixed effects. The observations for the SETAM sample are restricted to months when the SETAM platform was operational (2018/19). Robust standard errors adjusted for clustering at the rayon level in parentheses: * $p<0.10$, ** $p<0.05$, *** $p<0.010$.

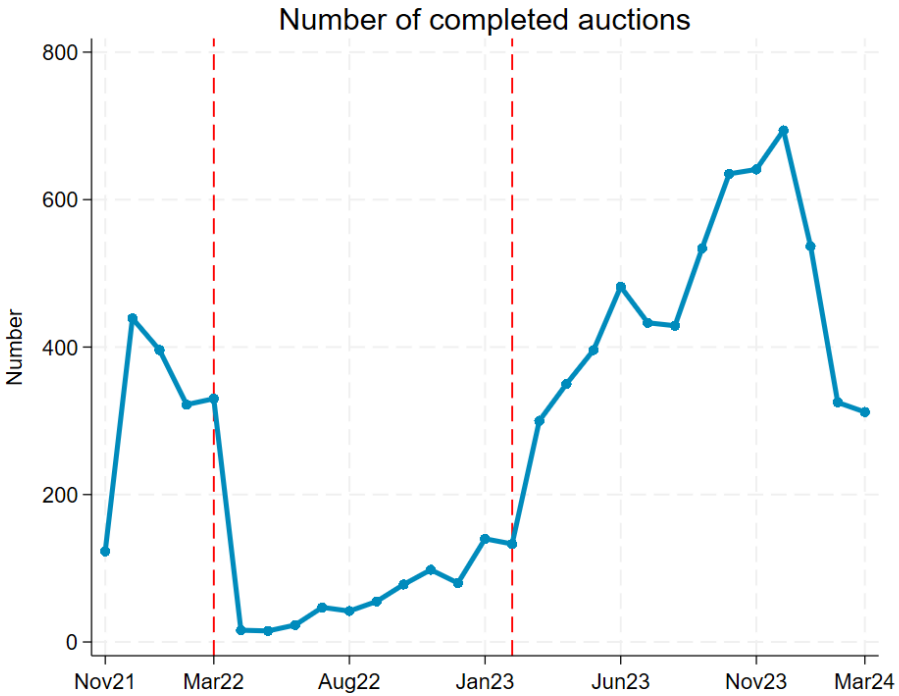
Predicted revenue gain

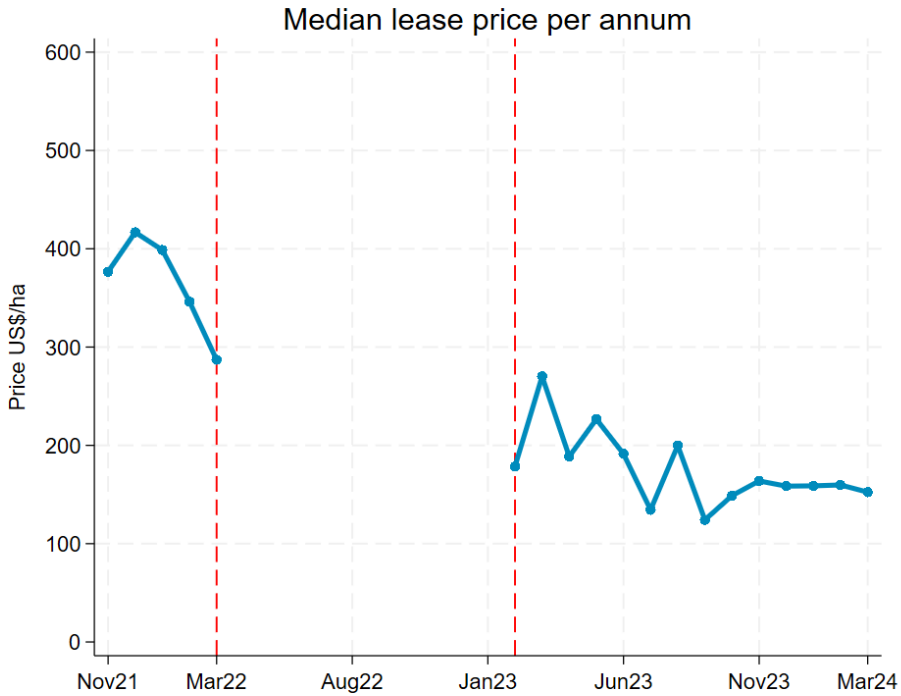
- Revenue gain from transferring parcels transacted pre-reform under reform modality: 64 million US$ per annum.

	All parcels	Auction modality	
		Offline	SETAM
Predicted lease price ($/ha per year) without reform	98.27	98.07	99.66
Predicted lease price ($/ha per year) with reform	298.29	297.39	304.55
Total area auctioned Jan 2015-Nov. 2021 (ha)	312,813	271,727	41,086
No of parcels auctioned Jan 2015-Nov 2021	19,267	16,852	2,415
Potential lease price increment w. reform (US$ mn/a)	64.48	55.66	8.81

- The annual lease revenue from incremental land would exceed US$500 million if the 1.5 million hectares of public land transferred through 'free privatization' prior to the 2021 reform were included.

War effect: next steps





Conclusion and policy implications

- Impact: Shifting to transparent electronic auctions by local councils instantly increased revenue from public land leases by 175%, highlighting the immediate economic benefits of legal reforms.

- Lessons learned:
  - The Ukrainian experience underscores the importance of effective governance in utilizing technology for transparent land transfers
  - But IT solutions alone are insufficient without robust legal frameworks and local institutional capacity.
  - Avoid delayed reforms in governance to maximize public benefits.

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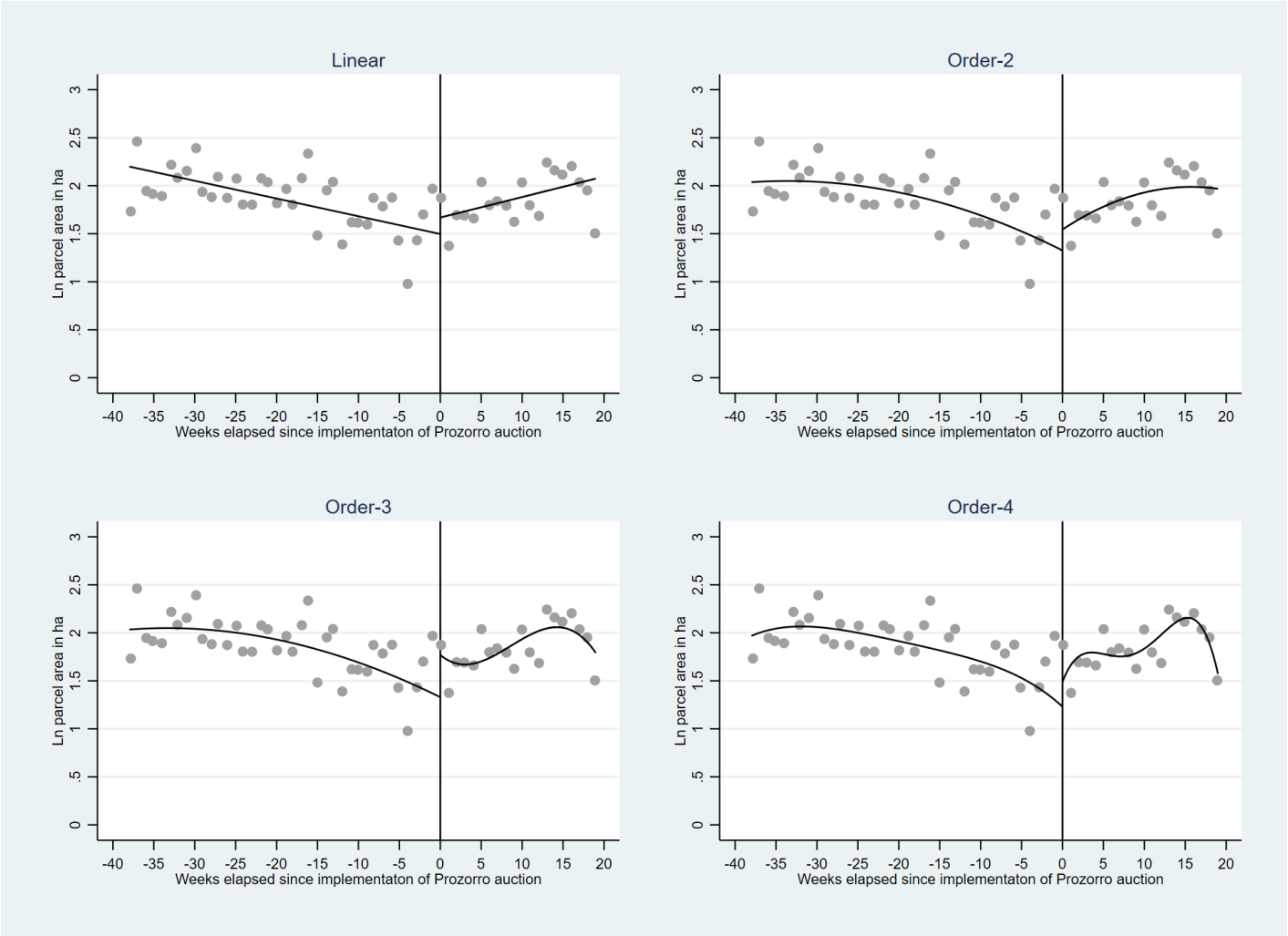
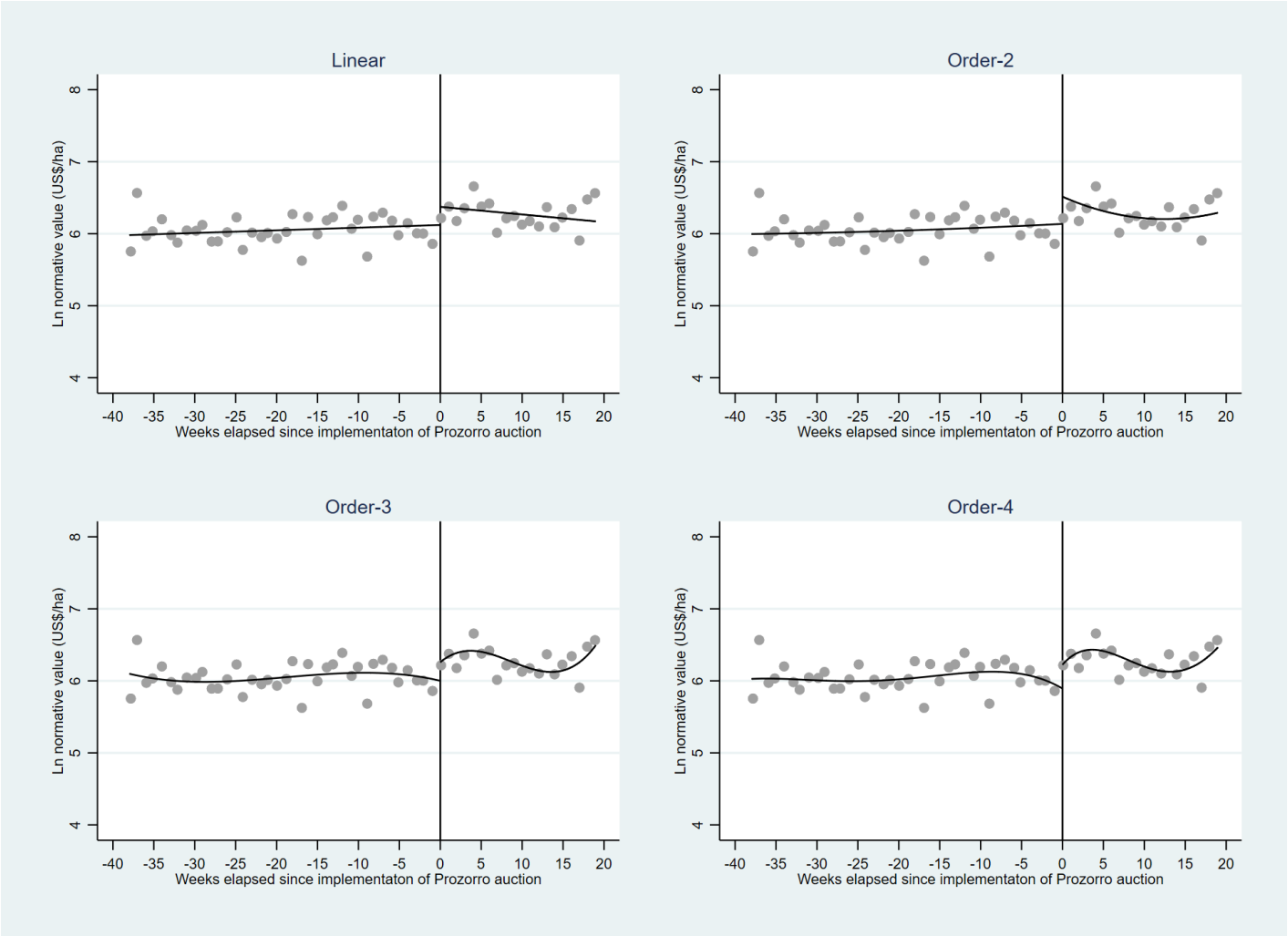
Discontinuity of mean weekly parcel size with polynomials of degree 1-4



ref: Winning price RD

Discontinuity of mean weekly parcel size with polynomials of degree 1-4



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