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Decentralized public farmland conveyance: Rental rights auctioning in Ukraine

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ABSTRACT

This study examines whether decentralized auctioning of public agricultural land results in higher land prices in comparison to auctioning via a centralized agency. Decentralization reforms in Ukraine, first, mandated local governments to manage communal land and later transferred agricultural land in their jurisdictions. We compare the resulting land prices of centrally and locally organized auctions and evaluate whether land-use concentration affected auction outcomes. Using unique datasets on land auctions from 2014 to 2020, we find that land plots auctioned locally by rural municipalities generate more competitive land rental outcomes with higher land rental prices. In addition, land concentration is found to negatively affect land rental prices and auction markups. Based on the results, we discuss policy implications for the management of public agricultural land in weak institutional settings.

1. Introduction

While auctions are believed to be the most efficient tool of land transactions, the institutional environment necessary for them to function effectively is analyzed to a lesser extent. Scholars have consistently found that state-owned land conveyance via auctioning mechanism leads to higher prices in comparison to search markets (Bulow and Klemperer, 1996; Chow et al., 2015). Farmland auctioning has recommended itself as a non-discriminatory tool (Croonenbroeck et al., 2019) that can compensate for a low demand due to thin markets (Hüttel et al., 2014). Considering these advantages, many Eastern European countries organized the distribution of state-owned agricultural land via auctions (Hartvigsen, 2014). Although auctions provide a certain standardization of selling procedures, the institutional determinants of the auctions' success have not been studied sufficiently. Among the exceptions is Hüttel et al. (2016) who finds that German land privatization agency BVVG[1] was able to exercise its market power and sell agricultural land via auctions at higher prices in comparison to private deals. Unlike highly regulated and monitored privatization procedures implemented by BVVG, the Ukrainian weak institutional framework may challenge the success of an analogous institutional setup. Although auctioning procedures are typically highly regulated, it is unclear to which extent they can leave room for manipulation and preferential treatment in settings with weak institutions. More importantly, it remains unclear if and under which conditions decentralization of agricultural land auctioneering can minimize misuse and maximize land prices in these contexts.

We address these concerns using political economy literature and focus on the incentives of the central and local governments in Ukraine. Scholars generally agree that decentralization of governance generates productive incentives leading to economic growth (Faguet, 2014; Weingast, 2009). Decentralized public land management has been widely implemented in the developing world (Hilhorst, 2010). A central aspect of decentralization reforms is related to fiscal incentives: local governments should be more motivated to implement revenue-generating initiatives should they expect to retain at least part of these revenues (Jin et al., 2005; Weingast, 2009; Zhuravskaya, 2000). Following this logic, local governments should have stronger incentives to manage public land effectively if the resulting revenues are retained locally. Conversely, a central government that is not a recipient of land revenues may be less incentivized to convey state-owned land competitively. However, both, central and local governments, may be prone to

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[1] „Boden Verwertungs- und verwaltungs GmbH" (BVVG) is a private entity closely controlled and guided by the German state that has been responsible for privatization of East German agricultural lands via auctioning procedures.

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capture (Bardhan and Mookherjee, 2000, 2005). In particular, powerful farms interested in accessing cheap agricultural land may try to influence the decision-makers either on the central or local level to keep land prices low. Consequently, improved revenue-driven incentives of local governments may be offset by local capture. Can the standardized auctioning procedures insulate the stakeholders from these effects? If that is the case, then it should not matter whether land auctions are organized by local governments or a central agency. On the other hand, if auctions leave enough discretion to the auctioneers, we would expect auction outcomes in line with the stakeholders' incentives: local governments should achieve higher prices maximizing their budgets.

Ukraine represents an excellent case study because it implemented initial steps towards the decentralization reforms of public land management that represented roughly one-fourth of total agricultural land resources in 2019 (Kvartiuk and Herzfeld, 2019). Until 2021, Ukrainian land relations had been almost exclusively based on land rental because of the sales ban on agricultural land. In 2013, auctioning of land rental rights of state-owned land became mandatory. In addition, an important delineation of jurisdictions occurred: municipalities[2] were mandated to auction communal agricultural land within the settlement boundaries and the rest (state-owned land) was managed by a central executive agency – State Service of Ukraine for Geodesy, Cartography, and Cadaster (SGC). Irrespective of whether an auction was conducted by local governments or the SGC, rental revenues were channeled to the former. We argue that because local governments were residual claimants of the land revenues, they should have been better incentivized to maximize rental prices. Despite these expectations, there is a growing concern that competitive auctioning may be hindered by vested interests and the imperfect design of the institutions involved. Apart from capture challenges, a growing concentration of utilized land by large farms may negatively affect transferability of land and discourage new farmers from entering into agriculture (Hartvigsen, 2015; Martinelli, 2014). Large powerful farms may navigate the environment with weak institutions well and even use it to their advantage concentrating considerable areas of land (Van Der Ploeg et al., 2015; Visser and Spoor, 2011). As a result, they may be able to exert downward pressure on rental prices. Whether auctions can counteract these effects is an empirical question.

To test these two hypotheses, the decentralization and land concentration effects, we use a unique plot-level dataset for the period of 2014–2020 from the SGC. We construct a hedonic-type model accounting for spatial correlation and considering auction setup and land concentration. We show that final rental prices are higher if they were organized by local governments as opposed to the SGC. In addition, we find that land concentration has a detrimental effect on the competitiveness of public agricultural land rental.

2. Theoretical framework

The central question of this analysis is which institutional design maximizes the prices for land rental contracts and under which circumstances. Public land management with the aim of revenue generation has been one of the central goals across the world, especially in the rural communities with limited tax bases (Anderson, 2012; Palmer and Berrisford, 2015). Therefore, we assume that higher rental price represents a desirable outcome for both stakeholders at local and central levels. Although a central agency and local governments may pursue other goals (e.g., certain distribution of agricultural land between producers), budget revenue generation is the most salient aspect of public land management in underfunded Ukrainian rural communities (Shapoval and Chekh, 2021).

As a starting point in modeling the price of rental rights, we use the hedonic pricing model which has become a standard in the related literature (Hüttel et al., 2016; Palmquist, 2005; Rosen, 1974). The logic of the model is that the value of a land parcel P is modeled as a function of its differentiable characteristics q_i: $P = (q_1, q_2, \ldots, q_n)$. Typical land characteristics are soil quality, climate, location, and the potential revenue when used for agricultural production. The prices emerge in a market equilibrium and, thus, a key assumption of this family of models is availability of many tenants and sellers (Nesheim, 2008). Hedonic price function implies equality of marginal willingness-to-pay (WTP) by buyers and willingness-to-accept (WTA) by sellers. In our case, we consider only two public managers (SGC and local governments) with diverging incentives which will affect their WTA. First, we highlight the theoretical origins of the difference in the sellers' incentives. Second, we relax the assumption about the availability of many potential tenants and examine how land-use concentration may affect rental prices.

2.1. The effect of decentralization

Because of the local nature of land markets and a limited number of sellers, we may observe a market power on the supply side (Balmann et al., 2021; Cotteleer et al., 2008). Both, SGC and local governments, have the tools to exert market power via discretion in the organization of auctions. In particular, the choice of land plots, auction timing as well as acting as "gatekeepers" to the auction bidding may provide significant leverage within the standard auctioning procedure. The key question is why would a given public land manager choose to exercise market power.

Following the standard industrial organization (Mookherjee, 2006; Vagstad, 2000) and decentralization literature (Faguet, 2014; Oates, 1972; World Bank, 2004), local governments may have superior information about local demand for land because of their proximity to local land markets. This information may improve their ability to select plots with economically efficient characteristics (e.g., size, shape, and location) depending on local farming modes and economic conditions. As a result, they can tailor the auction design towards the potential renters with a high WTP. The central agency would have to rely on local governments in obtaining this information and thus is generally disadvantaged.

Auctioning agricultural land via local governments may be more incentive-compatible with public revenue generation. First, within the fiscal decentralization literature, local governments' retention rate of the budgetary revenues resulting from their public management activity is typically linked to their incentives to invest effort in revenue maximization (Oates, 2005; Weingast, 2009). Thus, if a public land manager is a residual claimant of the land-rental revenue, s/he will naturally be more incentivized to maximize rental prices. In the Ukrainian context, local governments retain 100% of rental revenue irrespective of who organized the auction. Consequently, we expect local governments to have higher incentives to maximize rental prices in comparison to a central agency. Second, local governments may be subject to tighter control by constituents than the central agencies (Bardhan and Mookherjee, 2000). Generated revenue can be invested in local public goods boosting economic development which increases the probability of re-election for local mayors. On the other hand, SGC is not subject to electoral constraints and, as a result, should be less incentivized to maximize land rental revenue.

A typical criticism of the benefits of decentralized public management in an environment with weak institutions is elite capture (Bardhan and Mookherjee, 2000, 2006). Large agricultural enterprises may exert their economic power on local governments hoping for assistance with obtaining cheaper rented land. Such land accumulations by powerful farms may be easier in the countries with weak institutions as local governments are more susceptible to influence by economic interests (Van Der Ploeg et al., 2015; Visser and Spoor, 2011). On the other hand, the central agencies as well may be subject to capture when institutions are weak (Dal Bó, 2006; Harstad and Svensson, 2011). The relative vulnerability of the local or central governments to capture appears to

[2] Lowest administrative units in Ukraine with elected local governments.

be highly context-specific and theoretically ambiguous (Bardhan and Mookherjee, 2000). Which effect prevails in the Ukrainian context is to be investigated by the empirical analysis below.

2.2. Land concentration

Apart from the government capture, (potential) tenants may exercise their power on the land market. Relaxing the assumption of the hedonic pricing model about the perfect competition between the tenants, we analyze how the marginal willingness-to-pay (WTP) of the potential tenants may change depending on their type and market thickness (Cotteleer et al., 2008). Thin markets may emerge because land is limited in supply, heterogeneous in quality, and trade involves high transaction costs (Nickerson and Zhang, 2014). Local concentration of land by few farms naturally suggests decreasing possibilities of the land rental by entrants (Martinelli, 2014). As a result, for the remaining land plots the demand and respective marginal WTP by the dominant farms will be lower. Local market power is represented by downward shifts in the hedonic price function implying price markdowns (Cotteleer et al., 2008).

In the regions with fewer potential tenants, the marginal WTA by the sellers can be substantially below the WTP by the potential tenants generating a contested surplus constituting the difference between the WTP and the WTA (Cotteleer et al., 2008; Harding et al., 2003). Depending on the bargaining advantage, the surplus may be asymmetrically distributed between buyers and sellers. Should the buyers have the bargaining advantage, they will be able to acquire rental rights at a discount. Large farms renting substantial areas of land in a given region may have a dominant position in obtaining the excess surplus and thus reducing the prices (Ciaian and Swinnen, 2006).

Although bargaining and market power are typically modeled independently (Balmann et al., 2021), the reinforcing relationship may grow stronger in a context with imperfect institutions. Bargaining power may facilitate achieving a dominant land market position (Balmann et al., 2021; Gervais and Devadoss, 2006). Large farms in the East European contexts have historically maintained an advantageous bargaining position towards private landowners (Mamonova, 2015) and appear to be able to exert substantial influence on local and even central governments (Spoor, 2012). Large farms often co-fund local infrastructure where public institutions fail to deliver public goods (Gagalyuk et al., 2018) and expect the “loyalty” of local communities (Visser et al., 2019). In the Ukrainian context, exercising their weight in local bureaucracies, they may simply block potential entrants exercising their power on local bureaucracies involved in land auctioning. Such an advantageous bargaining position may reinforce large farms’ dominant position in local land rental markets.

3. Management of public agricultural land in Ukraine

Most of the state-owned agricultural land was distributed among 6.92 million landowners in the 1990s after the collapse of the Soviet Union. Land privatization had been going on with a lower pace. Accordingly, the stock of public agricultural land had been constantly falling from 10.4 million ha in 2013 to ca. 5 million ha in 2020 according to the official SGC press statement end of 2020 (Pyrozshok and Dienkov, 2020). The task of state-owned land management was assigned to the SGC which was criticized for the lack of transparency (Accounting Chamber of Ukraine, 2018).

Concerned with the uncompetitive rental and illegal use of state-owned land, the Ukrainian government has undertaken several steps to improve transparency. Mandatory auctioning of public land has been introduced as an important amendment of the Land Code from July 5, 2012. It stipulates that rental rights for agricultural land can be acquired only via an English auction procedure. Auctions have to be attended by at least two bidders to be recognized as successful. All bidders have to pay so-called registration and guarantee contributions. The former is set by an auctioneer and it cannot be higher than 50% of the nationally defined minimum monthly wage. The guarantee contributions are supposed to be set at 5% of the yearly rental payment derived from the so-called "Normative monetary valuation" (NMV) and are returned to all bidders who were not recognized as auction winners. Importantly, starting price must be within the range of 3%− 12% of the NMV of land which represents a legally approved technique to calculate a land value in the absence of functional land markets. Because NMV is essentially based on the index for soil quality and expected revenue streams from a given plot, the starting price should be a good proxy for the plots’ attractiveness.

The 2001 Land Code stipulates that auction organizers can be both, municipalities and the SGC. Auction organizer is legally defined as a local government or a “designated executive body” which almost exclusively is represented by the SGC or its regional branches. Whether SGC or local governments, auction organizers conduct all the necessary work to prepare lots for the auction. This includes legal actions starting from allocating and registering a land plot to setting a starting rental price and contracting out an auction-procedure to a designated auctioneer. Importantly, the financial burden of a lot preparation lies with the auction organizers which may influence their incentives.

Despite the fact that SGC played a major role in public land management, local governments (the lowest administrative units) were the sole recipients of the rental revenues. Ukrainian local governments face vast fiscal needs for local public goods delivery (World Bank, 2008). Because of limited revenue sources in combination with insufficient public management experience within the new decentralized governance paradigm, budget maximization is by far the primary goal among the municipalities (Bogdan et al., 2017). In the context of land management, this means that mayors prefer to maximize revenues from local land resources which may generate necessary resources for public goods delivery and maximize their reelection chances. Land revenues represent an important source of budgetary income for rural municipalities accounting for roughly one-fifth of their budgets in 2017 (Accounting Chamber of Ukraine, 2018). The dependence on land rental revenue is obviously larger for more rural areas further away from the cities.

Although auctioning was introduced to standardize the procedures of rental rights sales, an auction organizer has considerable discretion in determining the characteristics of the land plots to be auctioned. The choice of a land plot’s location and size may substantially affect its attractiveness for potential tenants. If it needs to be registered first, auction organizers can influence the use purpose and legal use limitations. Moreover, the auctioneer can play the role of a “gatekeeper” by setting the level of the starting price, guarantee, and registration contributions.

Several legislation pieces delineated the mandates for public land management between local governments for communal land and SGC for the state-owned land. First, communal land is typically located close to the settlements whereas the state-owned land – further out[3] but in practice these circumstances have no implications for the attractiveness of the land. This division stems from the Soviet administrative setup. Second, major decentralization reforms granted local governments more rights in land management after 2018. In particular, on January 31, 2018, Cabinet of Ministers of Ukraine (CMU) adopted Resolution that stipulated a possibility of transfer of state-owned agricultural land from the SGC on the balance of the amalgamated territorial communities (ATCs) within broader decentralization reforms.[4] Newly created ATCs typically encompassed several municipalities and were intended as new smallest administrative units. The transfer was limited only to ATCs and

[3] It is legally defined as “within” and “outside” settlement boundaries which typically include substantial non-built-up areas.

[4] Municipality-level administrative units that have been forming since the launch of the decentralization reform in 2015. By 2020 roughly half of all municipalities amalgamated forming new larger administrative units.

was coordinated by the SGC. Because the SGC selected the plots for transfer based on a technical possibility to implement it, ATCs received only a share of state-owned agricultural land based on the exogenous selection principle. Despite the incompleteness of the transfer, the number of ATCs that newly obtained agricultural land resources grew steadily after 2018. These reforms shifted the responsibility of auctioning rental rights for the land outside municipal boundaries to the local governments.

4. Empirical strategy

4.1. Data

The study mainly utilizes the SGC's data on land rental auctions that took place in Ukraine after their legal introduction in 2013.[5] We work with the cross-sectional data that covers all land auctions from January 1, 2014, up until December 31, 2020, with the plot-level observations in all oblasts of Ukraine except for temporarily occupied territories.[6] The dataset includes information on the basic lot characteristics such as plot size, duration of the rental contract, plot location up to the lowest administrative unit, starting and final rental price as well as other features of the auctions. Out of the total 27,398 successfully auctioned land plots, we work with 20,167 plots designated for commercial agriculture based on the Classification of Land Use Purposes adopted on November 1, 2010, by the SGC. In particular, we consider the following types of land according to the Classification: "For commercial agriculture" (01.01); "For farming enterprise" (01.02); and "For hayfields and pastures" (01.08). Auctions organized by the SGC and local governments have a very similar distribution of these land types. This restriction allows us to facilitate comparability of the land plots auctioned by the SGC and local governments and to minimize selection biases.

Data availability drives our decisions on model selection. First, crucial information is not available: contract recipient, number of bidders, and the NMV are not disclosed for many lots. This substantially reduces the value of implementing the auction-theoretic approach. Second, apart from the SGC data, we use farm-level data from the State Statistics Service of Ukraine to construct land concentration indicators. Hedonic pricing model is a useful vehicle for testing the hypothesis on land concentration (Balmann et al., 2021).

We cleaned and prepared the data for analysis in a number of ways. In particular, we deflated all the variables referring to monetary values using 2018 as a base year with the help of the GDP deflator for Ukraine reported in World Bank's World Development Indicators (WDI). As a result, all monetary variables reported within the study are expressed in real 2018 Ukrainian hryvnia (UAH). We also remove outliers following Tukey's (1977) approach: as outliers we considered the values above 1.5 times the interquartile range above the third quartile and below the first one. This procedure eliminated 121 observation which we assume were due to incorrect documentation or data entering errors.

4.2. Methodology

We face a tradeoff in the choice of the methodological approaches. Considering the exogenous assignment of the land plots between the SGC and local governments, we could employ an experimental or quasi-experimental approach to test the decentralization hypothesis. However, because an explicit modeling of the plots' spatial characteristics cannot be effectively implemented in the experimental framework, we employ the hedonic pricing model as our primary approach. To test the robustness of our estimates, we estimate the price differential using propensity score matching in Section 5.3 abstracting away from the effect of land concentration.

Thus, following our theoretical framework we adjust the hedonic pricing approach capturing the auctioneer's nature and local land concentration. In particular, we specify a general reduced-form econometric model in the following log-level fashion:

$$P_i = \beta_0 + \beta_1 SGC_i + \beta_2 Concent_j + \beta_3 Controls_i + \varepsilon_i \quad (1)$$

where P_i reflects the natural logarithm of the final rental price for a lot i in 2018 UAH in a rayon j (NUTS3-level government). Our key explanatory variable is a dummy SGC_i that assumes the value of one if an auction was initiated by the SGC and zero if local governments were the organizers. Following our theoretical framework, we expect a negative sign of the coefficients. A source of identification in our models is, first, the delineation of mandates between the SGC and local governments over communal and state-owned land. Communal land is typically located closer to settlements (within municipality boundaries) and is auctioned by the municipality governments whereas the state-owned land is located beyond municipality boundaries and is under the SGC's jurisdiction. Despite these differences in location, the nature of the plots within and outside municipality boundaries is very similar. The second exogenous event that identifies our models is the transfer of the state-owned land to the ATCs. Thus, after January, 2018, ATCs were able to auction certain land plots beyond the settlement boundaries that were exogenously assigned to them by the SGC.

To test our hypothesis about land concentration, we use a proxy $Concent_j$: one year lagged Herfinhal-Hirschmann (HHI) Index of the used land calculated for each rayon j. It ranges from zero to one with larger values indicating a larger share of used land under control of a few farms or a single farm. The HHI index is considered as a more nuanced measure of concentration than simple concentration ratios (Golan et al., 1996). Following our theoretical framework, we expect this variable to be negatively associated with the dependent variables. Due to data limitations,[7] we can only construct HHI indices up to the year 2016. This means that for the observations in 2018, 2019, and 2020 double, triple, and quadruple lags were used, respectively.

Following hedonic price models, we include several control variables $Controls_i$ in our regressions. First, since the starting price is a derivative of the NMV, it should control for the soil quality (recall that NMV reflects the soil quality and the expected earnings). At the same time, it serves as a reserve price below which a lot would not be sold. Furthermore, we use plot size as larger plots rented by a given farm may reduce transaction costs (Ritter et al., 2020). Similar arguments apply to contract length because longer contracts should secure access to land for longer periods of time and spare re-negotiation and related costs (Huettel et al., 2016). We also differentiate between the arable land and hayfields/pastures by including a corresponding dummy. The latter is normally cheaper than arable land. Finally, we include year and oblast dummies to control for the respective effects of regional determinants of agricultural prices such as proximity to markets and price cycles. Unfortunately, detailed information on soil quality as another important factor of plots' valuation is not available. However, differences in soil quality might extend beyond the definition of specific plots. Thus, controlling for spatial correlation might offer a strategy to reduce this potential source of endogeneity.

Further, non-observed variables might affect the relationship between valuations of plots in close proximity (see for instance Yang et al., 2019). For instance, auction organizers may use reference prices and lot characteristics which they may find within the neighboring areas. Similar behavior may be pertinent to the bidders. In addition, unobservable lot characteristics like infrastructure or the degree of property

[5] Land auction records were web-scraped from a SGC-supported website: http://torgy.land.gov.ua/auction.

[6] Temporarily occupied territories are defined as separate rayons of Donetsk and Luhansk regions as well as Autonomous Republic of Crimea.

[7] In 2016, statistical reporting standards of agricultural data were changed and this led to disruptions and interpretability of statistical data.

rights enforcement may contribute to correlation across space. Consequently, we may observe spatial correlation which requires respective econometric techniques.

To address this challenge, we first construct a spatial inverse distance weighting matrix at the level of the lowest administrative units – municipalities (Fischer and Getis, 2009). The matrix will be our basis for the calculation of Moran's I (statistical test for spatial correlation within residuals of a regression model) and spatial regressions (Anselin, 1988). To construct the former, we assign distances of zero to the plots located within a given municipality and calculate the distances between the municipalities' centroids.[8] We normalize the weights in row-standardized form (Anselin, 1988). To specify the spatial regressions, we modify Eq. (1) by adding a spatial lag of our dependent variable and a spatially autoregressive error term. These types of models are referred to as "spatial autoregressive models with autoregressive disturbances" (SARAR) (Anselin and Florax, 1995).[9] Our aim is to estimate the following model:

$$P_i = \beta_0 + \rho\sum_k M_{ik}P_i + \beta_1 SGC_i + \beta_2 Concent_j + \beta_3 Controls_i + \lambda\sum_j M_{ik}u_k + \varepsilon_i \quad (2)$$

where we explain the auctions price outcomes P_i with the set of explanatory variables presented by Eq. (1). In addition, we weigh the prices and error term u_k by the elements of the spatial weighting matrix M_{ik} to estimate the coefficients of the prices' spatial lag and the error term, ρ and λ respectively. The coefficients of the spatial lags will give us a clue about how much prices depend on the surrounding prices. We estimate the model using a generalized spatial two-stage least-squares estimator (GS2SLS).

5. Results

5.1. Descriptive statistics

In total, rental rights for ca. 355 thousand ha of agricultural land were auctioned between 2014 and 2020. Roughly 22% were auctioned by local governments. Fig. 1 demonstrates the dynamics of auctioning activity by SGC and local governments. We see that local governments were only marginally active before 2019 when the practice of auctioning land locally got more accepted and widespread. The launch of the transfer of land to the newly formed ATCs beginning of 2018 appears to have triggered a surge in the amount of land auctioned locally in years 2019 and 2020. In 2020, SGC and local governments rented out roughly the same amount of land. Both, areas and the number of plots auctioned follow similar patterns. Transfer of public land from the SGC to the municipalities may have boosted local governments' confidence in land auctioning as a tool of budget maximization.

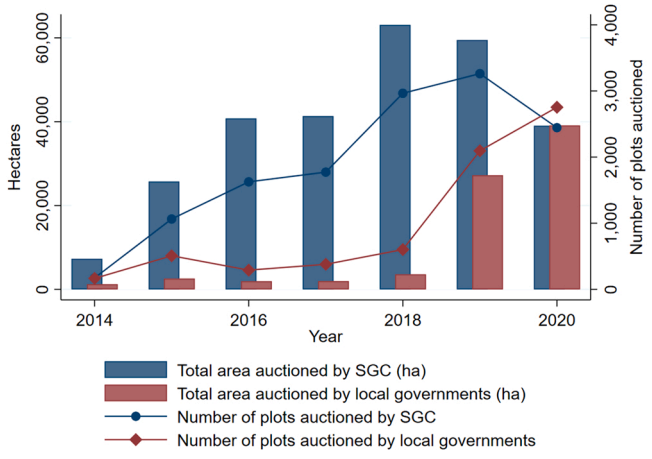

Fig. 1. Total area and the number of plots auctioned by year.

Average rental prices for state-owned agricultural land have been growing in real terms until 2017 and then stagnated (Fig. 2). Interestingly, the growing and subsequently declining trends are more pronounced for the plots auctioned by local governments whereas analogous trends are constant for the prices achieved by the SGC. It is informative to observe the distribution of rental prices within each year. Boxplots (right graph of Fig. 2) suggest that interquartile ranges are substantially larger for the prices achieved by local governments. This may reflect the effect of the differences in the way auctions were organized by local governments whereas the SGC-organized auctions may have been more uniform in their procedures and key characteristics. An important observation from both charts is that average and median rental prices achieved during the auctions organized by local governments were significantly higher in comparison to the prices that resulted from the auctions organized by the SGC. Of course, this could be caused by a number of factors (e.g., due to an inherently better quality of land auctioned by local governments). For this reason, multivariate analysis is necessary to single out the effect of systematic differences in plot characteristics together with possible local governments' advantage in maximizing the rental prices.

We observe indications about the differences in strategies between the SGC and local governments in line with our hypotheses. First, the SGC on average was auctioning larger land plots (13.13 ha) in comparison to local governments (5.19 ha) favoring large agricultural enterprises. On the other hand, local governments were choosing the maximum starting price (12% of the NMV) substantially more often (in 55% of the cases) than the SGC (in only 11% of the cases). This implies that local governments may have been driven by revenue generation to a larger extent than the SGC.

Fig. 3 presents the spatial distribution of the rental prices averaged out on the municipality level for the period of 2014–2020.[10] First, we observe auctioning of land rental rights all over the country with the exception of temporarily occupied territories[11] and the mountainous areas in the Carpathians (Western part of Ukraine). Apart from that, we see that auctioning activity is lagging behind in Kyiv and Zhytomyr oblasts – areas with relatively good climatic and infrastructural conditions. Second, there appears to be a concentration of more expensive land plots (more than 5,000 UAH per ha) in the central regions whereas in the extreme north and south we see clusters of the municipalities with cheaper land plots (below 1,000 UAH per ha). The latter may be the effect of the proximity to the borders.

Before proceeding with the regression analysis, we examine the descriptive statistics (Table 1). Roughly 65% of all auctions were organized by the SGC within our sample. Interestingly, local governments were the most active in the central part of the country and organized 49% of all the land auctions. Expectedly, the central part of Ukraine

[8] Note that due to the decentralization reforms which resulted in amalgamation of municipalities into ATCs, the boundaries of the lowest administrative units were changing during the period of our sample. We use the boundaries effective as of Jan 1, 2018 as the basis for our calculations.

[9] Spatial matrices and SARAR models were implemented in Stata 16 using *spmatrix* and *spregress* commands, respectively.

[10] Note that Ukraine has been undergoing large decentralization reforms stipulating constant amalgamation of municipalities since 2015. Fig. 3 presents the smallest administrative units (village councils and ATCs) as they were in 2018.

[11] These territories include Autonomous Republic of Crimea illegally annexed by Russia in 2014 and Donbass region de facto occupied by Russian military forces.

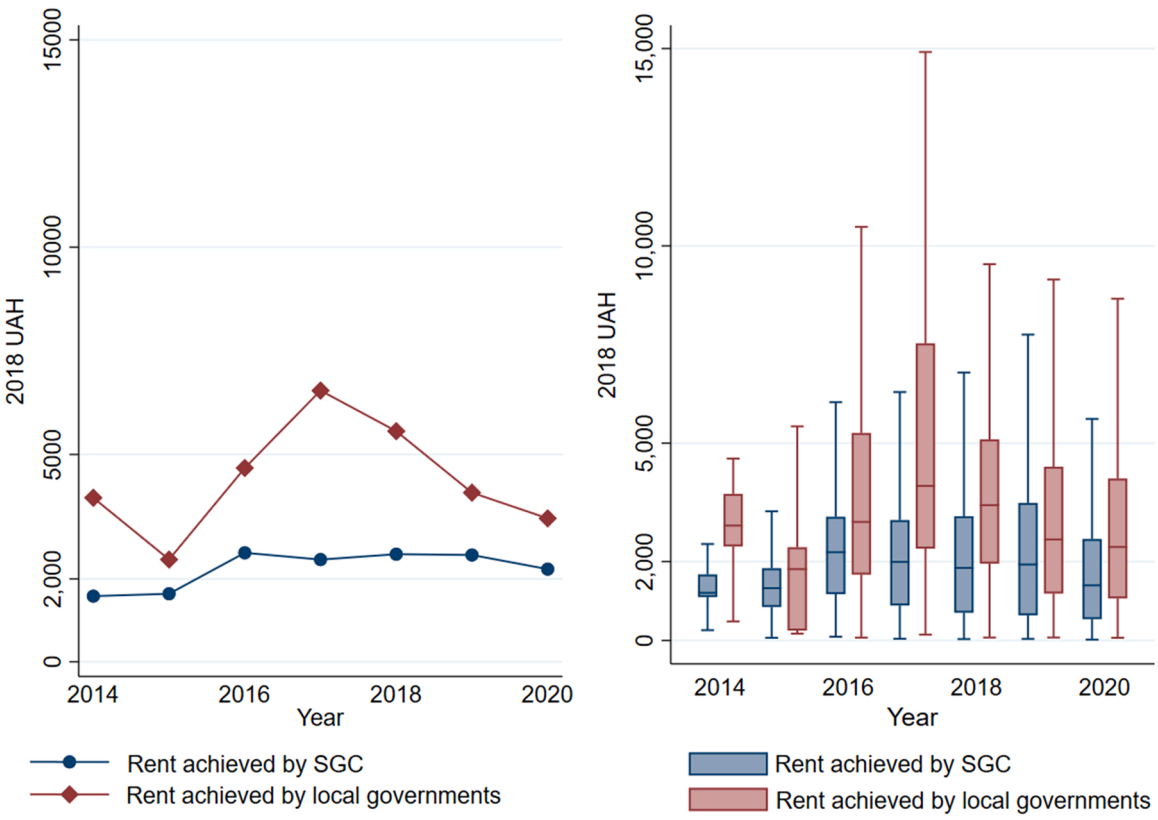

Fig. 2. Rental price dynamics achieved by SGC and local governments with means (left) and distributions (right).

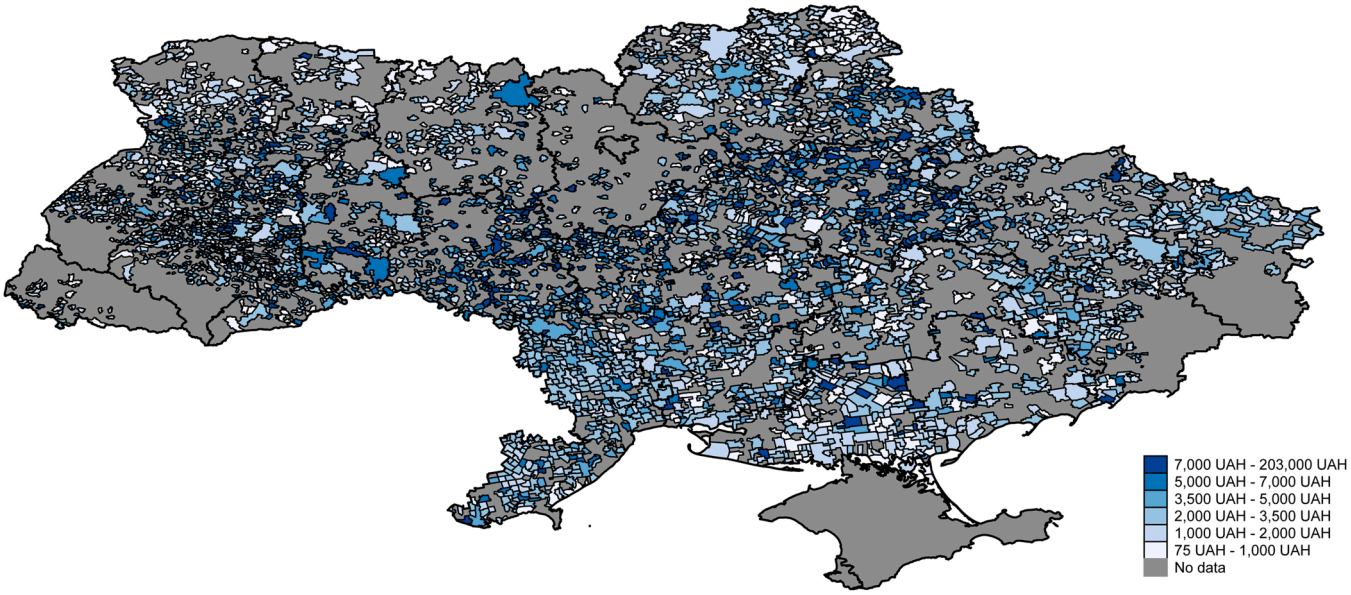

Fig. 3. Spatial distribution of rental prices across municipalities (administrative units are depicted as of January 1, 2018).

demonstrates the highest rental prices as the natural conditions favor intensive agricultural production. However, we do not observe similar patterns in the NMV and the starting price which suggests an auction-related competition in these areas. However, these areas demonstrate average HHIs whereas land use was substantially concentrated in the western parts of the country with HHI index averaging 0.34. Interestingly, in each part of the country, we find rayons with highly concentrated land distribution (HHI index equals one). The average plot size was rather large compared to other countries and totaled 17.75 ha with an average rental period of ca. 10 years in our sample. The rental period was 19.4 years before 2016 and went down dramatically to 8.5 years thereafter. This is an indication that public land conveyance had gotten more competitive over time. A small number of land transactions appear to have resulted in particularly favorable conditions: plot sizes over 500 ha for periods over 20 years and with particularly low prices. Since the bidding data is not available, we cannot say if manipulations were prevalent during these auctions.

Table 1
Descriptive statistics.

	Whole Ukraine			West			Center			South			East		
	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max
Rental price per ha (2018 UAH)	2,979.41	22.60	202,383	2,641.64	22.60	202,383	3,457.49	36.06	118,272	2,668.26	33.93	179,663	2497.27	97.11	94,580
Starting rental price per ha (2018 UAH)[a]	1,691.63	22.16	111,009	1,328.41	22.16	93,298	1,882.40	32.05	111,009	1,715.16	33.60	99,241	1,822.36	96.63	94,110
NMV (thousands of 2018 UAH)[b]	21.16	.19	1,433.66	16.21	.19	1107.70	22.39	.34	1,433.66	22.27	.42	1,344.20	27.37	2.07	866.99
Lagged HHI index	.20	.04	1.00	.34	.06	1.00	.16	.04	1.00	.09	.04	1.00	.14	.05	1.00
Length of the contract (years)	9.53	1.00	50.00	8.91	1.00	50.00	10.06	1.00	49.00	9.19	1.00	49	9.64	7.00	49.00
Plot size (ha)	17.75	.01	1,318.4	15.35	.02	270.53	15.23	.01	254.93	25.70	.0187	1,318.4	15.54	.09	284
Dummy for an SGC-organized auction	.65	0	1.00	.76	0	1.00	.51	0	1.00	.78	0	1.00	.64	0	1.00
Dummy for a pasture or a hayfield	.01	0	1.00	.0004	0	1.00	.002	0	1.00	.02	0	1.00	.0006	0	1.00
Observations	19,271			4,964			8,130			4,528			1,649		

[a] Note that this variable contains 3,221 missing observations uniformly distributed across the years.
[b] NMV is only available for the years 2019 and 2020.

5.2. Econometric estimations

We start with the OLS estimations as a reference point and proceed with the SARAR models. The estimations utilize Generalized spatial two-stage least squares cross-section regression (Drukker et al., 2013). Constructing the spatial matrix, we consider that 77.27% of observations have at least one direct neighbor (with distances in the spatial matrix equal to zero) within their respective municipalities. The Moran's I statistics point in the direction of spatial autocorrelation in the residuals of the OLS models. Consequently, SARAR model results should be preferred. All the specifications include year and oblast fixed effects to account for exogenous factors.

Table 2 presents the results of our estimations. Before testing our hypothesis, it should be highlighted that the control variables confirm theoretical expectations. Naturally, more attractive land plots (higher starting rental price) are positively and significantly associated with the final prices. Interestingly, we observe a discount for larger land plots but the effect is diminishing as the squared term of the plot size is positive and significant. Thus, a 1 ha increase in a land plot size translates into a 1.2% decrease in the final rental price. This is in line with the internationally widespread phenomenon called "small parcel size premium" (see for instance Brorsen et al., 2015). Similarly, we find a negative relationship between the length of the contract and the rental prices. Finally, pastures and hayfields were cheaper than other types of agricultural land.

All of our specifications (models (3) and (4)) suggest that rental prices are affected by regional average prices. In particular, the spatial lags are positive and highly significant suggesting that a 100-UAH increase in local prices would translate into 29 UAH higher rental price for a particular lot. We observe these effects because bidders are likely to be guided by local reference prices. This effect highlights the importance of

Table 2
Estimations of the final rental price.

	Log of final rental price (2018 UAH)		Log of final rental price (2018 UAH)	
	(1) OLS	(2) OLS	(3) SARAR	(4) SARAR
Spatial lag			0.289*** (0.000)	0.295*** (0.000)
Spatial error term			0.081*** (0.001)	0.064*** (0.007)
Dummy for an auction initiated by the SGC (1-yes; 0 – no)	-0.321*** (0.000)	-0.218*** (0.000)	-0.258*** (0.000)	-0.183*** (0.000)
One year lagged HHI index of used land	-0.389*** (0.000)	-0.023 (0.786)	-0.261*** (0.000)	0.005 (0.947)
Starting rental price (thousands of 2018 UAH per ha)	0.099*** (0.000)	0.099*** (0.000)	0.091*** (0.000)	0.091*** (0.000)
Land plot size (ha)	-0.013*** (0.000)	-0.014*** (0.000)	-0.012*** (0.000)	-0.012*** (0.000)
Land plot size squared	-0.000 (0.485)	-0.000 (0.568)	-0.000 (0.671)	-0.000 (0.757)
Length of the contract (years)	-0.030*** (0.000)	-0.031*** (0.000)	-0.020*** (0.001)	-0.020*** (0.001)
Length of the contract squared	0.000*** (0.000)	0.000*** (0.001)	0.000*** (0.006)	0.000*** (0.004)
Dummy for a pasture or a hayfield	-0.458*** (0.000)	-0.464*** (0.000)	-0.414*** (0.000)	-0.417*** (<0.001)
1. SGC dummy # Lagged HHI index		-0.534 (0.000)		-0.384*** (0.000)
Constant	7.769*** (0.000)	7.706*** (0.000)	5.494*** (0.000)	5.404*** (0.000)
Observations	14,875	14,875	14,875	14,875
R2	0.2813	0.2832	0.3541	0.3555

Note: *Significant at 10%-level; **Significant at 5%-level; ***Significant at 1%-level. Please, note that p-values are reported in brackets. Year and oblast dummies are included in each specification but are not reported due to space limitations.

transparency in auctioning process. With a free flow of information, potential bidders can better inform themselves about local prices which would drive the lagged average price up thus increasing the rental price for a particular lot.

We now turn to the central variables within our study. First, across all the specifications we see that the dummy for the SGC conducting an auction demonstrates a strong negative effect across the specifications. This is in line with our hypothesis that land auctions result in higher rental prices when they are organized by local governments. Models (3)-(4) suggest that the effect appears to be large as local governments obtained 25.8% higher rental prices than the SGC. Second, we find a significant negative effect of the land concentration on rental prices. In particular, a 0.1 increase in the rayon-level HHI-index translates into 2.6% lower rental prices. Interestingly, we also find negative and significant coefficients for the interaction terms between the SGC dummy and the land concentration. This suggests that the price-dampening effect of the SGC organizing an auction is reinforced if a land plot is located in a rayon with a higher HHI-index and points in a direction of a political economy channel of the effect. In particular, regional branches of the SGC may be more prone to capture by large farms because they are not residual claimants of the generated public revenue and are not subject to electoral accountability.

5.3. Robustness check

We ensure the robustness of our results in a number of ways. First, we restrict the spatial spillover effects to the ones from neighboring municipalities only. To achieve that, we construct a different weighting matrix that considers one observation per municipality only. We follow Kim et al. (2019) and utilize a bootstrapping procedure with an inverse-distance matrix constructed on a subsample of one observation per municipality. Naturally, this matrix is the same for every random sample with replacement drawn from the universe of our observations. We generated 500 Monte Carlo draws for each specification to calculate the coefficients and the significance statistics.[12] Results are presented in Table 3. Due to the bootstrapping procedure, the sample size goes down to 3,240 observations for the final price and 3,212 for the markup specifications (the number of municipalities from which observations are randomly drawn). Similar to the full-sample estimations, the negative persistent effects of the SGC dummy and rayon-level HHI index are preserved with the exception of land concentration which fails in gaining significance in the models (3) and (4). The magnitudes of the effect are similar to our main estimations. However, the coefficients of the interaction terms, although in the expected direction, fail in gaining significance. This may be due to the fact that the land concentration proxy is constructed on a rayon level. As a result, we may observe less significant coefficients because we essentially limit the variation of the SGC dummy within a given rayon by focusing on a subsample. Apart from that, the coefficients of our control variables closely follow the specifications in Table 2.

Second, we use the reported NMV as a more direct proxy for the plots' attractiveness variable substituting the starting rental price. Doing so comes at the cost of losing all observations before 2019 with the resulting sample size reduction of 8,017 observations. The reason is that the SGC started publishing NMV only in 2019. Because the starting rental price is set within the range of 3%−12% of the NMV (combination of soil quality and expected agricultural profits), it may not reflect the attractiveness of a land plot perfectly. Thus, we use NMV as a more direct measure. Examining the estimation results in Table 3 (models (3)-(4)), NMV, as a new key explanatory variable, behaves very similarly to the starting rental price. In fact, the correlation coefficient between starting rental price and NMV for the period when both data are available is 0.84. Importantly, the coefficients of the SGC dummies and HHI indices are very similar to the ones in the main specifications.

Table 3
Robustness checks.

	Monte Carlo simulations		Sample with NMV (2019 – 2020)	
	Log of final rental price (2018 UAH)		Lot of final rental price (2018 UAH)	
	(1) SARAR	(2) SARAR	(3) SARAR	(4) SARAR
Spatial lag	3.475***	3.467***	0.195***	0.214***
	(0.000)	(0.000)	(0.000)	(0.000)
Spatial error term	-1.069	-1.064	0.252***	0.215***
	(0.219)	(0.223)	(0.000)	(0.000)
Dummy for an auction initiated by the SGC (1-yes; 0 – no)	-0.379***	-0.364***	-0.335***	-0.300***
	(0.000)	0.000)	(0.000)	(0.000)
One year lagged HHI index of used land	-0.296***	-0.249	-0.291***	-0.196 *
	(0.006)	(0.187)	(0.000)	(0.052)
Starting rental price (thousands of 2018 UAH per ha)	0.083***	0.083***		
	(0.000)	0.000)		
NMV per ha (2018 UAH per ha)			0.004***	0.004***
			(0.000)	(0.000)
Land plot size (ha)	-0.015***	-0.015***	-0.009***	-0.009***
	(0.000)	0.000)	(0.000)	(0.000)
Land plot size squared	-0.000	-0.000	0.000**	0.000**
	(0.511)	(0.478)	(0.017)	(0.013)
Length of the contract (years)	-0.010	-0.010	-0.016*	-0.017**
	(0.425)	(0.430)	(0.065)	(0.048)
Length of the contract squared	0.000	0.000	0.000	0.000
	(0.613)	(0.601)	(0.325)	(0.268)
Dummy for a pasture or a hayfield	-0.582**	-0.570**	-0.592***	-0.589***
	(0.041)	(0.037)	(0.000)	(0.000)
1. SGC dummy # Lagged HHI index		-0.064		-0.148
		(0.596)		(0.198)
Constant	-18.341***	-18.293***	6.358***	6.203***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3,240	3,240	8,817	8,817
R2			0.227	0.227

Note: *Significant at 10%-level; **Significant at 5%-level; ***Significant at 1%-level.. Please, note that p-values are reported in brackets. Year and oblast dummies are included in each specification but are not reported due to space limitations. [a] We used 500 simulations for each of the specifications.

Third, we use propensity score matching (Imbens and Rubin, 2016) to estimate an average treatment effect of the auctions organized by local governments. Land plots auctioned by the SGC serve as control group. We follow von Hobe and Musshoff (2021) in constructing the matching equation and include plot size, a dummy for hayfields and pastures as well as the full set of location and year dummies. Because only plot-specific characteristics can be included in the matching model to satisfy unconfoundedness assumption, we cannot control for land concentration. Estimating a logit model for propensity scores estimation and using different matching techniques, we find very similar results as portrayed in Table 2.[13] In particular, we find that local governments were generating on average 30.6% higher rental prices whereas the analogous estimation with the SARAR model produced 25.8% price markup.

Finally, we re-estimate the OLS models with a full set of rayon-level dummies to rule out the unobserved fixed effects. This comes at a cost however because we cannot check the robustness of the land concentration which is constructed on a rayon level. We are thus restricted by the unavailability of the more disaggregated data on land concentration. Nevertheless, the rest of the variables in these estimations performs very similarly to the main estimations in Table 2 raising the confidence in our results.

[12] Following Kim et al. (2019), we used the following STATA 16 commands to conduct Monte Carlo simulations: *bsample* and *simulate*.

[13] Estimations are not presented due to space limitations and are available upon request.

In sum, our robustness checks generally suggest the reliability of the results. We find that the main hypothesis that local governments are more effective managers of the public agricultural land is supported by all of our checks. We also find evidence for the second hypothesis on the negative relationship between land concentration and land rental prices.

6. Conclusion

This paper has analyzed how decentralization of public agricultural land management and local land use concentration may affect the competitiveness of land auction outcomes in the Ukrainian context. We focus on how institutional framework and stakeholders' incentives can affect auctioning procedures skewing auction results. Local governments, representing the beneficiaries of land rental revenues, may have better incentives in maximizing rental prices of the state-owned agricultural plots as opposed to the central agency without beneficiary claims – the SGC. Better incentivized local governments may also have more tools at their disposal to improve the revenues as they can adjust land plot's size, location, and contract length in accordance with the superior information on local land market dynamics. However, both levels of government may be vulnerable to the influence of vested interests of some influential farmers. In addition, influential farmers may be able to exercise their market power and repel potential entrants in areas where they control substantial areas. Consequently, land concentration may have dampened land rental prices. Based on a theoretical framework of the hedonic pricing models, we test these hypotheses using unique data from the SGC and the Ukrainian Statistics Service covering the whole of Ukraine and all the agricultural land rental transactions that took place between 2014 and 2020.

Using spatial econometric techniques, we find evidence supporting our hypotheses. The first major finding is that auctions organized by the SGC systematically result in lower rental prices. Thus, on average, local governments achieved 25.8% higher prices than the branches of the SGC. We also find clues that incentive-compatible auctioning may be the driving force behind this price differential. Although impossible to check with the available data, there may be other mechanisms at work as well. For instance, by having more direct access to potential bidders, local governments may spread information about the auctions more effectively thus increasing the number of participants. Moreover, they can choose land plots in a way that would cater to the local land market more. For instance, manipulating allocation of a land plot may allow participation of a diversity of agricultural producers avoiding discrimination and maximizing rental prices.

Our second major finding is that the level of land concentration matters for the outcomes of agricultural land auctions in Ukraine. In particular, we find that an increase in HHI index of 0.1 leads to a 2.6% drop in the final price. Interestingly, we find that effect to be stronger if a given plot was auctioned by the SGC suggesting that SGC may had been more susceptible to the influence of powerful farms. This is in line with the arguments of Van Der Ploeg et al. (2015) and Visser and Spoor (2011) that weak institutions facilitate large land concentration. Consequently, influential farms may be more willing to target SGC for the conveyance of cheap agricultural land as it is less incentivized to maximize public revenue. Conversely, local governments may be better equipped to counteract the negative effect of land concentration.

Results call for decentralization reforms in public land auctioning in weak institutional settings. Despite some successful experiences of public land management via a centralized agency in rich countries (e.g., BVVG in Germany), developing context may introduce additional challenges for such an institution. Limited information about the demand for land on the ground, low incentives to maximize public revenue, and vulnerability to capture can make national-level agencies inappropriate for competitive land distribution in developing countries. Local governments may simply work harder to maximize their own budgets. Furthermore, local governments may also be in a better position to counteract land concentration.

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