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Ukraine's agricultural land sales market: An update and the effect of Russian war against Ukraine

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The APD consists of two thematic pillars, one of them – the land component – is managed by BVVG German AgriForest Privatization Agency, a state-owned enterprise that is responsible for the administration of state-owned agricultural and forestry land in (Eastern) Germany. Under the land component, the project offers an exchange of experience and know-how between Ukrainian and German land management experts from BVVG and additional German land management institutions. The land component focusses on political, legal and technical issues related to land management and accompanies the current discussions in Ukraine concerning land market development.

Deutsch-Ukrainischer Agrarpolitischer Dialog

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ACRONYMS

Territorial community	TC
Cabinet of Ministers of Ukraine	CMU
Classification of Types of Economic Activity	CTEA
Consumer price index	CPI
Difference-in-differences	DiD
Hectare	ha
Herfindahl-Hirschman Index	HHI
State Classification of Administrative-Territorial subjects of Ukraine	KOATUU
Normative Monetary Valuation	NMV
Land for individual farming	OSG
Ministry of Justice	MoJ
State Registry of Property Rights on Real Estate	SRPRRE
State Service for Geodesy, Cartography, and Cadaster	SGC
Ukrainian hryvnia	UAH

1. Introduction

After the successful launch of the first phase of the agricultural land sales market on July 1, 2021, it (as well as the whole country) experienced an enormous shock from the Russian war against Ukraine. As all-out military aggression has severely hindered economic activity in every sector, the agricultural land market has likely experienced large demand and supply shocks. Because agricultural production has been under severe logistical pressure due to the war, the incentives to purchase and sell agricultural land may differ substantially between the periods before and after the beginning of the war on February 24, 2022. As a result, the dynamics of land sales may have changed substantially and require a separate analysis.

The aim of this study is to analyze the land sales transactions since the launch of the sales market explicitly considering the effects of the war. We utilize the study "Ukraine's agricultural land sales: First outcomes and monitoring challenges" by Kvartiuk & Martyn (2021) as a starting point and examine the developments on the sales market since then. We specifically focus on two dimensions that have been salient in the related discourse in Ukraine: land prices and land concentration dynamics. In particular, we provide a spatial and temporal analysis of the land sales prices and an exposition of the dynamics of land concentration by large landowners. Second, we assess the effects of the war on land market activity. In particular, war-related risks may have reduced the sales prices and incentivized distress sales of the individuals who intended to leave certain areas because of active fighting. Moreover, we check whether war-related legislative changes may have further constrained sales activity.

To accomplish these tasks, we use publicly available data of the system for monitoring of land relations from the State Service for Geodesy, Cartography, and Cadaster (SGC). Within our land price and concentration analysis, we evaluate the development of the data infrastructure related to Ukrainian land relations. Transparent and clear transaction information is a precondition for effective market functioning. However, proper analysis of the agricultural land sales market requires access to high-quality data and proper monitoring systems. As a result, it is important to assess the gaps and provide recommendations on how to improve the reporting system.

2. Institutional context in 2022

As Russia invaded Ukraine, all of the transactions were made impossible because of the war-related uncertainties. In the first days of the Russian war against Ukraine, the servers of the SGC

and State Registry of Property Rights on Real Estate (SRPRRE) were physically disabled to protect them from cyberattacks and save existing data. This made any land transactions impossible because related administrative services were suspended. Only from April 29, 2022, military district administrations obtained an opportunity to register rights for agricultural land plots in the "Books of registration of land ownership and land use under martial law", which were introduced as a temporary tool for land cadastral registration in the conditions of a non-functioning centralized cadastral system. This idle state won some time to adjust land-related legislation for the situation with martial law and lasted until the end of May when transaction procedures were possible again. Legislative initiatives were developed and adopted in record times because of the time pressures.

The initial legislative response of the Ukrainian legislators was to ensure the stability of agricultural production. Thus, in the first months of the war, the Ukrainian Parliament passed the Law 2145-IX "On Amendments to Certain Legislative Acts of Ukraine Regarding the Creation of Conditions for Ensuring Food Security in Martial Law**".** In particular, it stipulated an automatic renewal of rental contracts for private and state-owned agricultural land, a simplified rental procedure for state-owned land, and simplified registration procedures in a situation of martial law should the SGC be incapacitated. For instance, no auctions have been necessary to rent state-owned land plots, new contracts could not be longer than one year, the rental price could not be more than 8% of the normative monetary valuation (NMV), and prolongation of the contract was prohibited. The general goals were to ensure the preservation of agricultural land use to the extent possible under the circumstances of the all-out war and to provide an easy way to use the land for military and other strategic purposes. Importantly, these provisions prioritized strategic state interests (stable agricultural production) over the rights of landowners which could be justified during martial law.

Importantly, a previously controversial practice of granting land plots into private ownership free of charge was terminated for the period of martial law. This practice was criticized for the lack of transparency and insufficient areas available to cover the demand. This could be the first step to terminate this practice after the war is over. At the same time, the Law of Ukraine dated 19.10.2022 No. 2698-IX, which entered into force on November 19, 2022, partially restored the possibility of free privatization of land plots for citizens under their buildings, as well as land plots that were provided to citizens for use until 2002.

Because of active fighting in several oblasts, land purchases were limited to protect property rights during martial law. Thus, the Order of the Ministry of Justice (MoJ) No. 1307/5 from 05.04.2022 with the consequent changes prohibited access to the SRPRRE in certain rayons close to the frontlines. The list of these rayons changed periodically depending on the security situation.

After SRPRREE and SGC registries were relaunched in May 2022, the institutions governing the land sales market before the war were still in place. In particular, legal entities are still excluded from the sales market of agricultural land until January 1, 2024. Only Ukrainian citizens can purchase up to 100 ha of agricultural land until these restrictions are lifted in 2024. Importantly, agricultural land purchased before July 1, 2021, does not count towards the 100 ha cap. Land transactions are conducted by notaries following stipulated procedures. However, these procedures do not always have enforcement mechanisms as, for instance, in the case of land sales price recording in the SRPRREE where only a share is recorded. Second, an important provision requires all the land sales prices for commercial agriculture to be at least as high as the NMV. This rule was put in place to protect the rights of the landowners in light of possible bargaining power imbalances between them and potential buyers. Finally, despite martial law, the SGC continued to monitor the agricultural land market, including publishing relevant monitoring data on its official website.

In November 2022, some of the normal functions of the land sales market were restored. For instance, the pre-war auctioning procedures of the use rights for the state-owned agricultural land were made effective by the Law No. 2698-IX from October 19, 2022, "On Amendments to Certain Legislative Acts of Ukraine Regarding the Restoration of the System of Registration of Agricultural Land Lease Rights and Improvement of Land Protection Legislation". A particularly important amendment of this law stipulated for individuals with a permanent land use right an option of buying respective land plots via a fairly long-term installment payment scheme. Land prices for these plots are determined by the NMV.

3. Dynamics of land sales and prices

3.1 Transactions data description

We first examine the publicly available data from the SGC that we used in this study. By November 1, 2022, SGC made available the data on 395,293 transactions with the land of different use purposes. Figure 1 presents the distribution of transactions by type before and after the beginning of the Russian war against Ukraine on February 24, 2022. Although the vast majority of the land transactions during both periods were inheritances, we see that land sales activity went down after the beginning of the war substantially. In particular, the share of sales contracts went down from ca. 30% to ca. 20%. This reduction increased the share of inheritances after the beginning of the war.[1] In our analysis, we focus on the sales contracts and, thus, drop the rest of the observations.

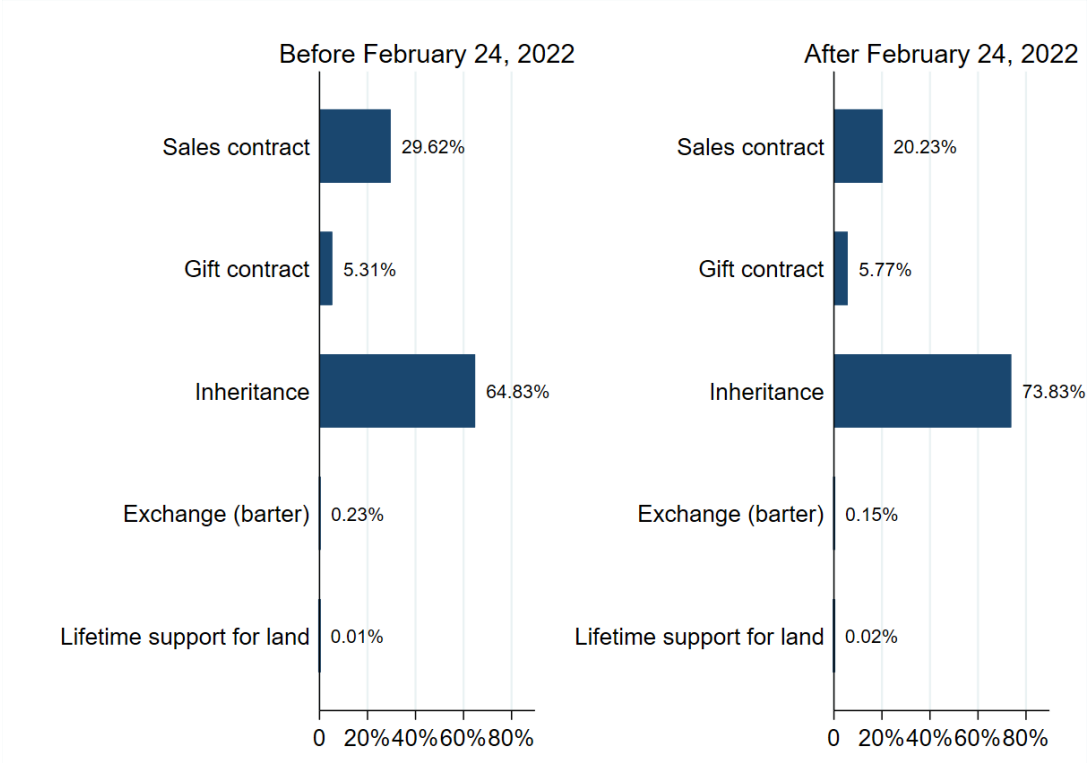

Figure 1. Distribution of transaction by type before and after February 24, 2022.

[1] The proportions for the other types of transactions have largely stayed the same.

To examine the activity on the land sales market, it is informative to plot the transactions by month (Figure 2 and Figure 3). We see that the largest amount of land was transacted in December 2021. Interestingly, in most of the months under consideration, plots for individual farming (OSG) represented the majority of transacted land.[2] However, land for commercial farming represented the most area indicating that the plots designated for commercial farming were on average larger than the OSG-plots. No transactions were recorded after February 24th, 2022 until the end of May 2022. Afterwards, we observe a modest recovery of the market with roughly one-third of the transactions during the subsequent months. In terms of the area transacted, the drop is even more pronounced. Importantly, we observe a stable trend after the recording of the transactions resumed with an increase up until August 2022 and further stabilization in September and October. In total, 22,053 sales transactions were recorded after the beginning of the war.

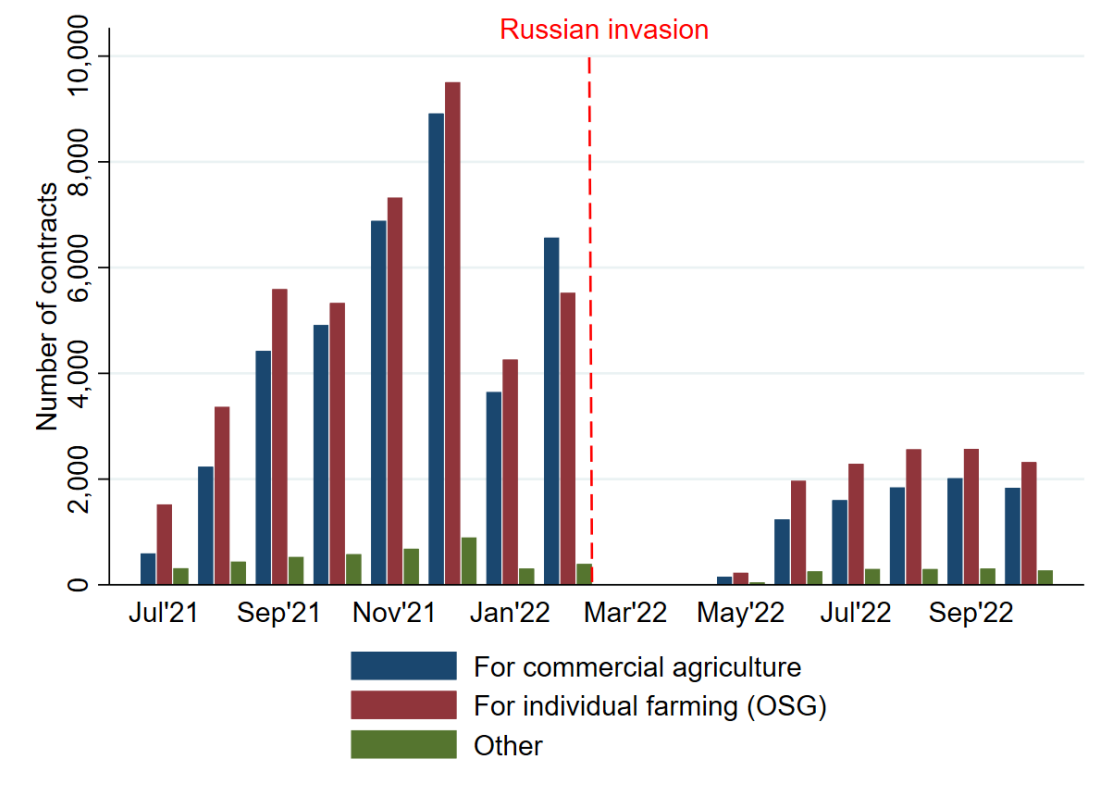

Figure 2. Distribution of sales contracts by number.

The distribution of land transactions by purpose also changed after the beginning of the Russian war against Ukraine. We see that the weight of the plots for commercial agriculture went down from 45.06% to 39.28%. On the other hand, the proportion of the transacted plots for individual

[2] Please, refer to Appendix A for further information on the types of agricultural lands.

farming (OSG) and gardening increased slightly. It is important to mention that the transaction that took place between May 2022 and November 2022 account for roughly one-quarter of all transactions recorded in the database of the SGC. What is concerned the type of land, we do not observe substantial changes over time with arable land accounting for ca. 82% of all the land transactions.

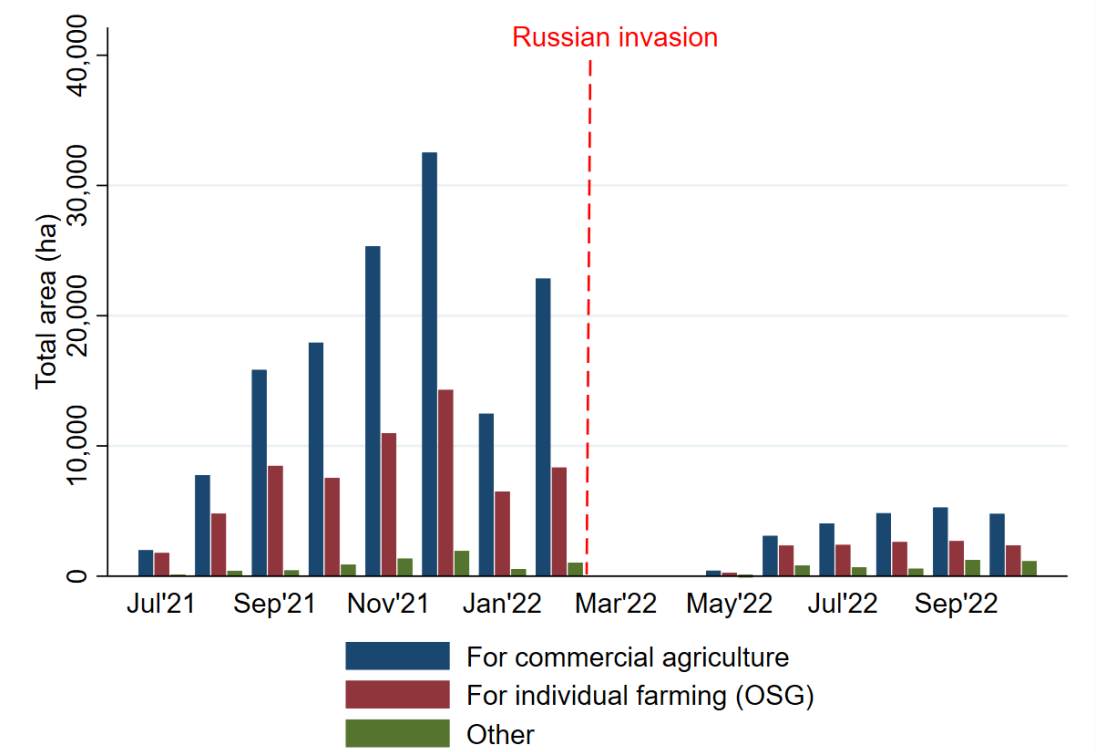

Figure 3. Distribution of sales contracts by area transacted by month.

It is important to point out that the situation with the records of prices and nominal monetary valuation (NMV) has worsened since 2021 dramatically. Thus, the number of missing price records went up from 45.16% before the war to 77.22% after the Russian invasion. Similarly, the share of missing values for NMV went up from 23.74% up to 49.05%. This is an unacceptable situation that nearly eliminates the value of the land monitoring system. Price records must be mandatory for each transaction. Otherwise incomplete datasets may contain large biases and preclude any meaningful analysis.

We find substantial differences in the rates of price recording across Ukraine after the beginning of the Russian war against Ukraine (Figure 4). We see that no transactions were recorded in Luhanska and Khersonska oblasts as well as in Crimea and Sevastopol due to the occupation by

the Russian army. Most of the transactions without records of the sales price took place in Donetska, Sumska, Vinnytska, Rivnenska, Ternopilska, and Ivano-Frankivska oblasts. Here we observe less than 10% of the transactions with price records. The best situation can be observed in Lvivska and Khmelnytska oblasts although here 40% to 60% of the records are still missing.

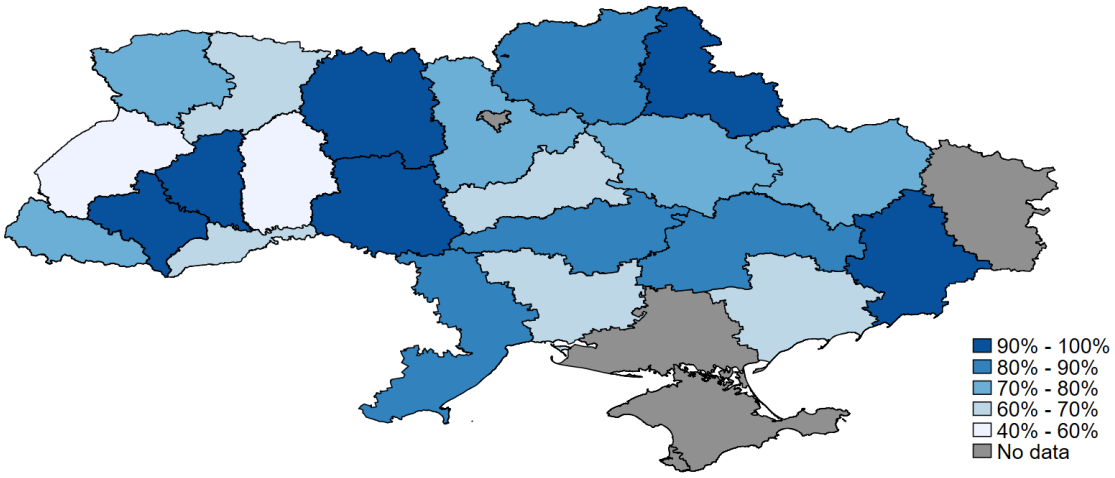

Figure 4. Distribution of the missing price records after February 24, 2022.

Moreover, no progress has been recorded with respect to the recording of the stylized categories of sellers and buyers. As was pointed out in the study "Ukraine's agricultural land sales: First outcomes and monitoring challenges" by Kvartiuk & Martyn (2021), basic data on the nature of the parties participating in the transaction is of exceptional value for the market analysis. Parties' anonymity could be ensured if the following categories were implemented: an individual, farm enterprise, agricultural enterprise, local government, cooperative, or other legal entity.

3.2 Spatial distribution of transactions

The activity on the sales market has changed substantially since the beginning of the Russian war against Ukraine. The general trend is that more plots have been purchased in the western regions, which probably reflects the risks associated with active fighting in the eastern and southern regions (Figure 5). No transactions took place in Khersonska and Luhanska oblast as well as in Crimea and Sevastopol because they were completely occupied. Only 2 and 25 land plots for commercial agriculture were sold in Donetska and Zaporizska oblasts. Moreover, we observe substantial reductions in the transaction rates in the pre-war leading oblasts: Kharkivsla, Poltavska, and Sumska. It is astonishing that these transactions were possible so close to the regions where

active fighting was happening and it would be informative to examine those transactions in more detail. On the other hand, the leading oblasts with regard to land market activity during the war-time have been Kmelnytska and Vinnytska with 1,288 and 996 land plots transacted, respectively.

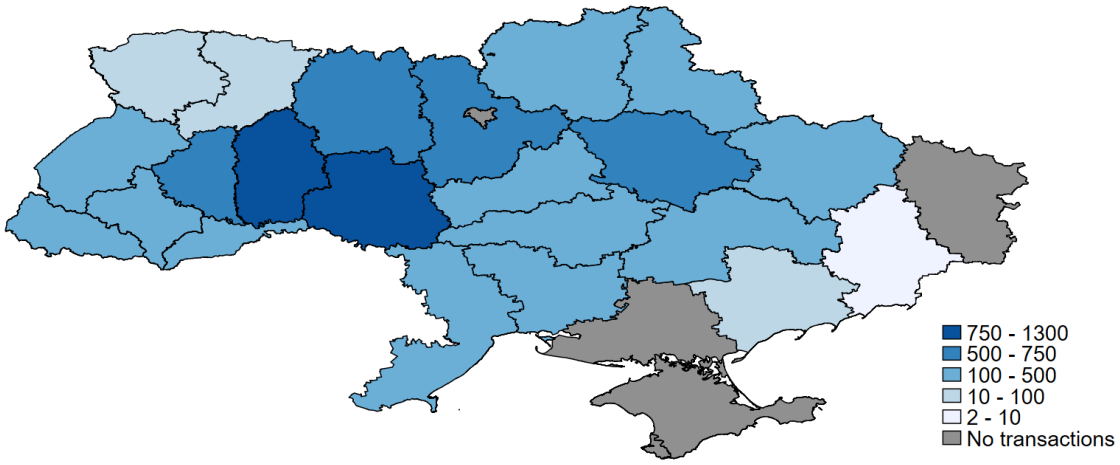

Figure 5. Number of plots transacted since Feb 24, 2022 (land for commercial agriculture only).

Because land plots are typically larger in the eastern parts of the country, transacted areas may be different (Figure 6). Thus, together with Khmelnytska and Vinnytska oblasts, which were leaders in a sheer number of plots, Kirovohradska, Poltavska, and Dnipropetrovska oblasts are leading in terms of the transacted areas. Surprisingly, we find that Cherkasska oblast neither before the war nor after the war demonstrates large transacted areas although this a region with intensive agricultural production. The rest of the regions roughly correspond to the distribution in Figure 5.

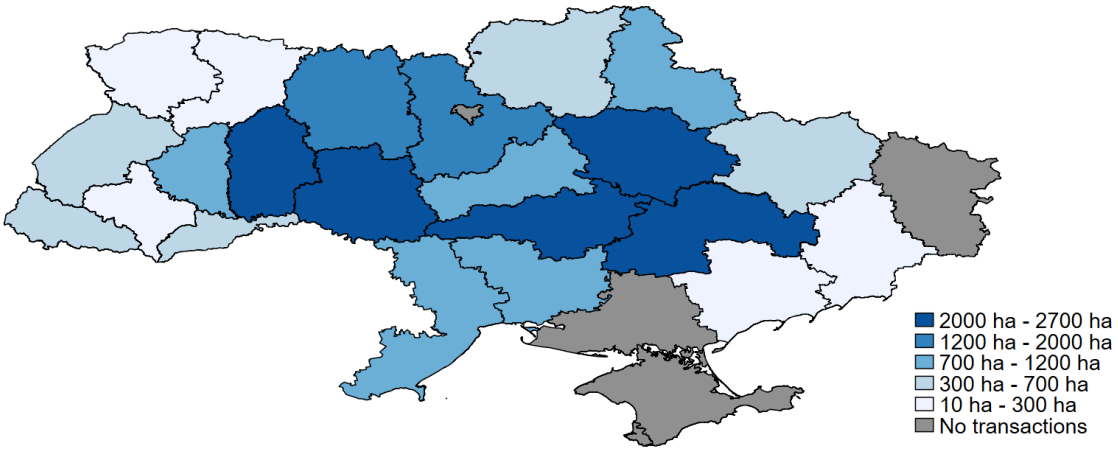

Figure 6. Total land transacted (commercial agricultural land only).

The smallest areas were transacted in Donetska and Zaporizska oblasts due to the active fighting. Furthermore, Lutska and Volynska oblasts demonstrated low market activity because of their predominant forest cover. Interestingly, small areas despite the high number of plots in Ivano-Frankivska oblast suggest that sales market activity was driven mostly by the mountainous small plots for potential conversion of the plots into non-agricultural activities as the regions has a high potential for touristic business after the end of the Russian war against Ukraine.

The distribution of transactions of the OSG-land is very similar to the land for commercial agriculture. In particular, the distributions of the number of transactions as well as land volumes parallel the ones for the land for commercial agriculture. One difference found is Lutska oblast with large areas transacted. A possible reason for this observation is that authorities allocated pais in the form of OSG-plots in this oblast before the war.

The total volume of land traded since the launch of the sales market is ca. 246,000 ha which represents ca. 0.59% of the total agricultural land. This figure is low in comparison to the countries with established land sales markets where we observe yearly turnovers in the range of 1-2% (Deininger 2003; Seifert, Kahle, and Hüttel 2021). Importantly, ca. 206,000 ha or ca. 0.5% of all agricultural land was transacted before the war which underscores the negative impact of the war on the activity on the land sales market. Moreover, the contribution of the land formerly under the sales ban is large as it accounts for ca. 159,000 ha or ca. 65% of all agricultural land area sold since the launch of the sales market.

3.3 Land prices

To make meaningful conclusions about the development of land prices over the last months, we restrict our sample in a number of ways. In doing so, we are ensuring that we are comparing land plots with comparable characteristics. First, we make a distinction between the prices for OSG-land and land for commercial agriculture. Second, we focus only on arable land excluding hayfields and pastures as well as plots for gardening and other purposes. Third, we examine the median prices because a small number of outliers with very large prices per ha distort the average values substantially. These abnormally expensive land plots are most likely to be used for non-agricultural purposes. Consequently, we recommend using median values to more accurately represent the predominant values on the land sales market.[3] Finally, we first analyze nominal

[3] For instance, using average values distorts the graphical spatial representation of the prices on the SGC's land-monitoring website.

sales prices as the period under investigation is relatively short. However, subsequently, we briefly discuss the dynamics of real prices incorporating inflation and devaluation of the Ukrainian Hryvnia (UAH).

Figure 7 demonstrates the development of median land prices over the months after the launch of the land sales market. Because of the war and associated uncertainties, we would expect land prices to drop. However, we do not observe this and, on the contrary, average prices across the months after the war appear to be higher than before. Prices for OSG-land were dropping until February 2022 and went up substantially after the beginning of the war. The median prices for land for commercial agriculture were relatively stable before the war but went up slightly after the war. Both increases are statistically significant in the sense of the nonparametric equality-of-medians test.

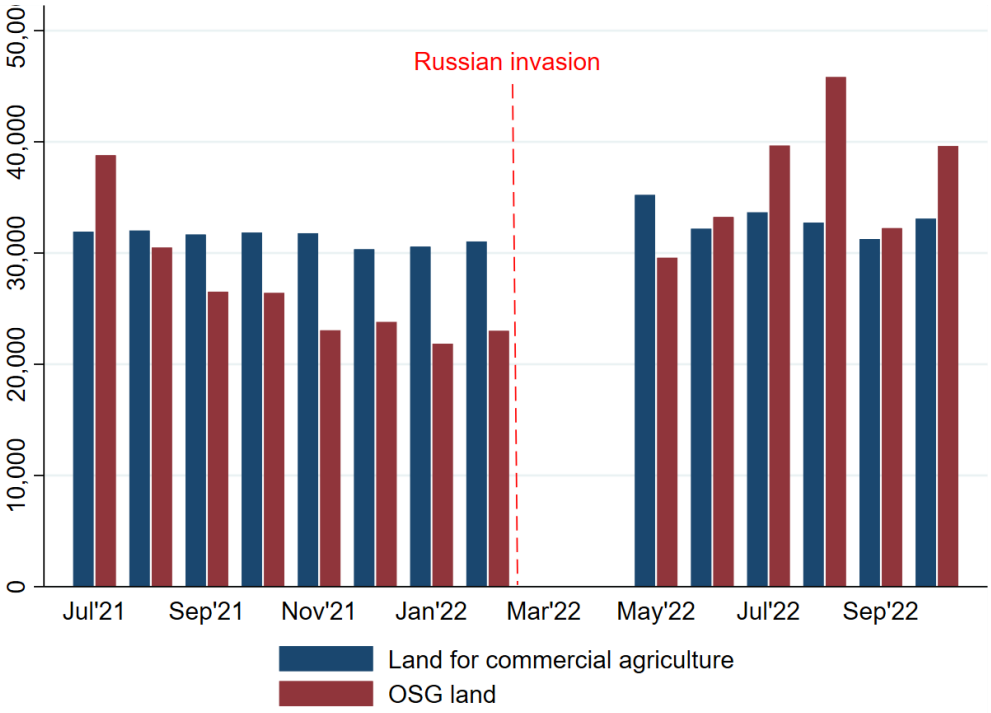

Figure 7. Median prices per ha for OSG-land and land for commercial agriculture.

We do not find mass reductions of the nominal land sales prices due to the Russian war against Ukraine. First, we run a hedonic-type of a Tobit model explaining observed sales prices with land plots' characteristics. Controlling for the standard plot characteristics, we find that average nominal land sales prices increased by 2.2%. Second, our results are backed by the Kernel densities of the prices of arable land before and after the beginning of the war (Figure 8) where we see that the after-war distribution has shifted to the right slightly. However, the increase appears to

be minimal as median prices shifted from 32,300 UAH per ha to 33,100 UAH per ha. Interestingly, a bulge around 12,000-15,000 UAH/ha suggests that a substantial number of plots were sold for this low price. Appearance of this bulge after the beginning of the Russian war against Ukraine may represent a clue about distress sales. However, to make conclusions about this, we need to examine the spatial distribution of the sales prices and run additional statistical tests.

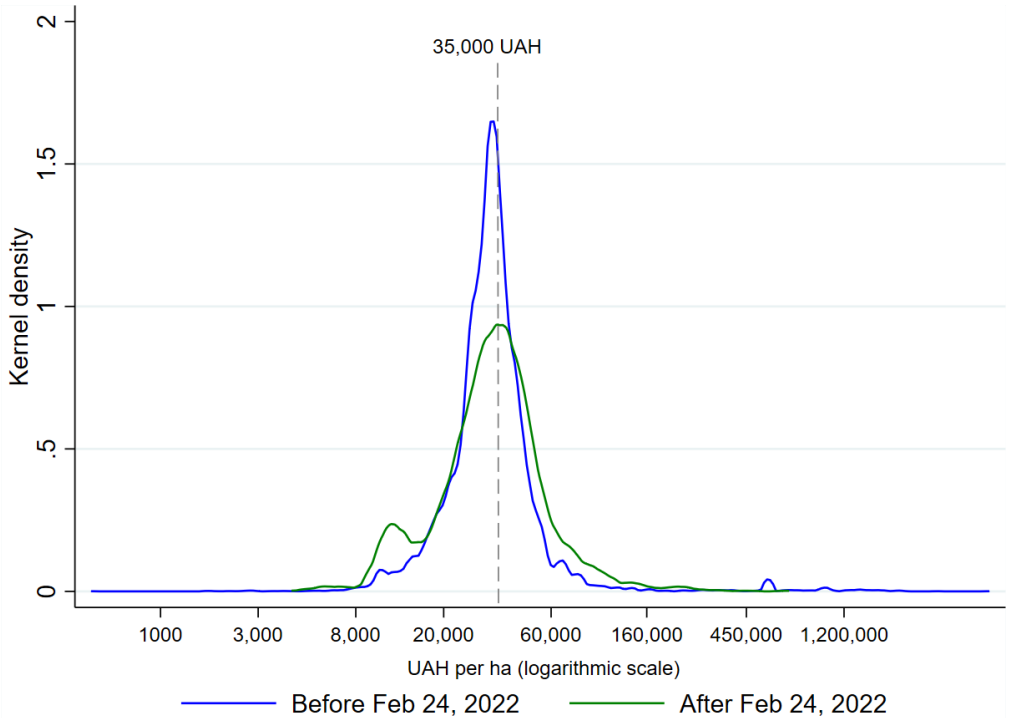

Figure 8. Distribution of prices for arable land for commercial agriculture before and after the beginning of the Russian war against Ukraine.

To test our distress sales hypothesis, we first define the oblasts that were affected by the active fighting: Luhanska (no transactions), Donetska, Zaporizska, Khersonska (no transactions), Mykolayivska, Khrakivska, Sumska, and Chernihivska oblasts. We exclude Kyivska oblast as the land prices may be affected by the proximity to the capital. We run a difference-in-differences estimation (DiD)[4] identifying an average treatment effect of the affected oblasts. In addition, we back up the results with a hedonic-type Tobit model with a war dummy. Contrary to our expectations, we do not find significant average treatment effects, which motivated us to examine the situation in more detail. In particular, we run Tobit models for each oblast with a war dummy. We find

[4] Estimation details can be consulted in Appendix B.

significant reductions in nominal prices for Chernihivska (24.7%), Kharkivska (6.6%), and Zaporizska (3%) oblasts. Interestingly, we find a 15.7% increase in nominal sales prices in Mykolayivska oblast. This could be related to a higher added value of the agricultural production in this region which may drive the prices up.

Because land prices for commercial agriculture cannot be below the NMV, it could be a safeguard against distress sales. To check whether there is any evidence for this, we examine how actual land sales prices differ from NMV. The prices for commercial agricultural land appear to cluster significantly around one. Thus, roughly one-quarter of the land plots in our sample were sold for a price that was equal the NMV. Moreover, ca. 70% of the sales transactions had a markup below 10%. These figures indicate that NMV appears to be a safeguard against distress sales. On the other hand, the competition for land may be relatively low due to restricted demand (restricting market participation to individuals and individual ownership caps of 100 ha per person) as well as the difficult economic situation caused by the Russian war against Ukraine.

Similar to the study "Ukraine's agricultural land sales market: First outcomes and monitoring challenges" (Kvartiuk and Martyn 2021), we find land plots that were sold with a price below the NMV which is prohibited by the Law on Land Circulation from 31.03.2020. However, the share of such land plots appears to be lower after the beginning of the war. In 2021, we reported 1.8% of all sales transactions to be affected. Using the updated data and narrowing the dataset to arable land for commercial agriculture, we see that before the war the price was below the NMV in 1.17% of the cases (398 transactions). However, we see that this value dropped to 0.67% (52 transactions) after the war. Analogous figures for the OSG land are higher: 7.84% (2,445 transactions) before the war and 1.31% (121 transactions) after the war. The reason is that only OSG land that was allocated within the free privatization of land was subject to the minimum price restriction during the consequent sales. Despite the reduction in such occurrences for both types of land, this is still an alarming indication that the rights of the landowners are not always enforced raising questions about the quality of institutions facilitating the land sales market.

Closer inspection of the distribution on the level of amalgamated territorial communities (ATCs) may reveal further details of the land prices distribution. Thus, **Ошибка! Источник ссылки не найден.** demonstrates the average prices for arable land with the use purpose "For commercial agriculture" in the ATCs where at least one transaction took place. First, we observe a clear pattern of higher prices in the western regions. Thus, the colors of the choropleth map appear to

be darker in Khmelnytska, Ternopilska, Chernivetska, and Lvivska oblasts. Similar to the finding of the study from 2021, we observe clusters of higher prices around large cities. This may indicate a consequent intention of the buyers to convert agricultural land into non-agricultural purposes that could potentially generate higher profits. Second, we observe no transactions in the areas close to the areas with active fighting in accordance with the MoJ's Order No. 1307/5 discussed in Section 2. Thus, no transactions with land for commercial agriculture were recorded after the beginning of the war in Luhanska, Khersonsa oblasts, Autonomous Republic Crimea, and Sevastopol. Only two transactions were recorded in Donetska oblast. In Zaporizska oblast, we see transactions in the northern parts of the oblast that suffered less from the active fighting. A similar situation is observed in Mykolayivska oblast where more land sales took place further away from the frontline. Third, similar to the pre-war situation, we see gaps in land sales market activity in the north-western parts of Polissia region as well as across the Carpathian Mountains.

Figure 9 also helps us better understand the spatial distribution of the missing values. We observe clear clustering of the missing values suggesting that notaries that do not record the prices in the registries are located close one to another. Oblasts that suffered from active fighting the most appear to report more missing values than other oblasts. To check this observation statistically, we run a DiD model with a dummy reflecting whether a record is missing or not with the same identification strategy as for the analogous models for the prices. Importantly, we find that after the war the prices for the land for commercial agriculture were 20.15% less likely to be recorded. Analogously, prices for the OSG-land were 16.16% less likely to be recorded in the oblasts with active fighting after the war started. As noted above, records of land prices as well as NMV should be made mandatory for each transaction.

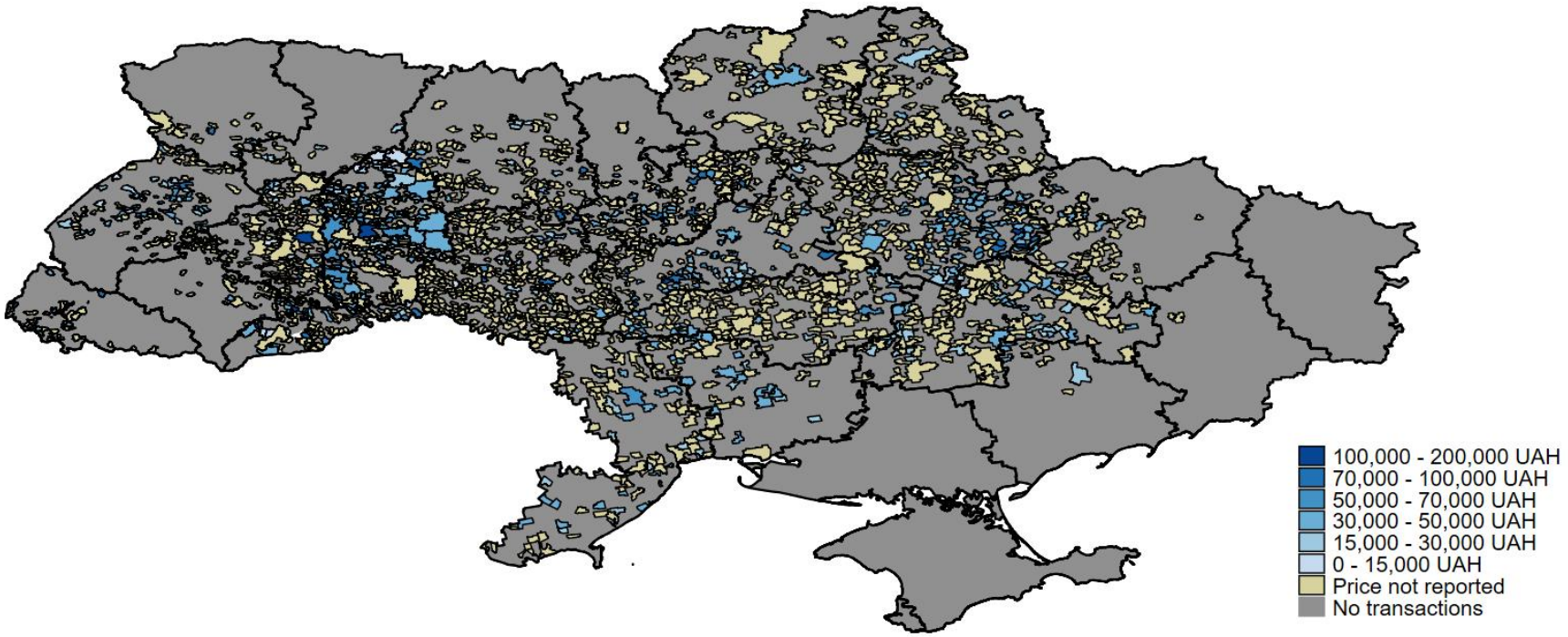

Figure 9. Average prices within municipalities after February 24, 2022 (commercial ag arable land only).

Note: The base map uses the boundaries of the municipalities as of January 1, 2018, because the SGC-data was reported with outdated municipality identification codes (KOATUU).

Although we do not find the expected war-related drop in the nominal sales prices, we do observe a uniform reduction in real prices. We re-run our models with several types of adjustments of our dependent variable. First, we correct the price by the 19% devaluation adjustment by the National Bank (NBU) of Ukraine in July 2022. The second type of adjustment accounts for the monthly inflation. With the help of the Tobit and DiD models, we find significant reductions in real land sales prices after the war. In addition, real prices appear to be substantially lower in the oblasts affected by the Russian war against Ukraine. As a result, accounting for general negative macro-economic trends in the country, we observe a substantial reduction in real sales prices. These price discounts appear to be larger closer to the frontline where active fighting takes place in line with the conjecture about the distress sales.

4. Land concentration

Because data reporting on land concentration has not changed since the publication of the study Kvartiuk and Martyn (2021) (where it is described in detail), we focus on data analysis. In particular, we utilize available data to examine the trends in land concentration by individuals and legal entities since the launch of the land sales market. It is important to mention that we mostly work with two datasets published by the SGC that contain all individual landowners with more than 20 ha of owned agricultural land and all legal entities with more than 100 ha. Moreover, using the transaction-level data, we are able to match owned plots with the ones acquired after July 1, 2021. This provides us with clues about the areas purchased by individuals with more than 20 ha and legal entities with more than 100 ha after the launch of the sales market.

4.1 Individuals

We, first, examine the general land concentration trends among individual landowners because legal entities are restricted from the land sales market until January 1, 2024. Figure 10 displays the changes in the distribution of individual land holdings for all types of agricultural land since the launch of the land sales market.[5] We see that the initial bulge around 20-25 ha (blue line) got smaller at the expense of larger land holdings. This means that relatively more individuals

[5] We had to choose September 6, 2021 as a starting point because the insufficient quality of data before this date does not allow comparison with the wave from October 31, 2022.

owned larger areas of agricultural land on October 31, 2022. This is a sign of slow land accumulation by individuals. Moreover, we observe a new bulge around the mark of 90-100 ha (green line), which represents a cap of individual land ownership stipulated by the Law on Land Circulation from 31.03.2020. If the current trends are preserved, we would expect a larger number of individual landowners at the mark of 100 ha. These people could be preparing for further market opening in 2024 by either purchasing land for allied agricultural enterprises or with an intention of re-selling it as the prices are expected to go up should the security situation improve.

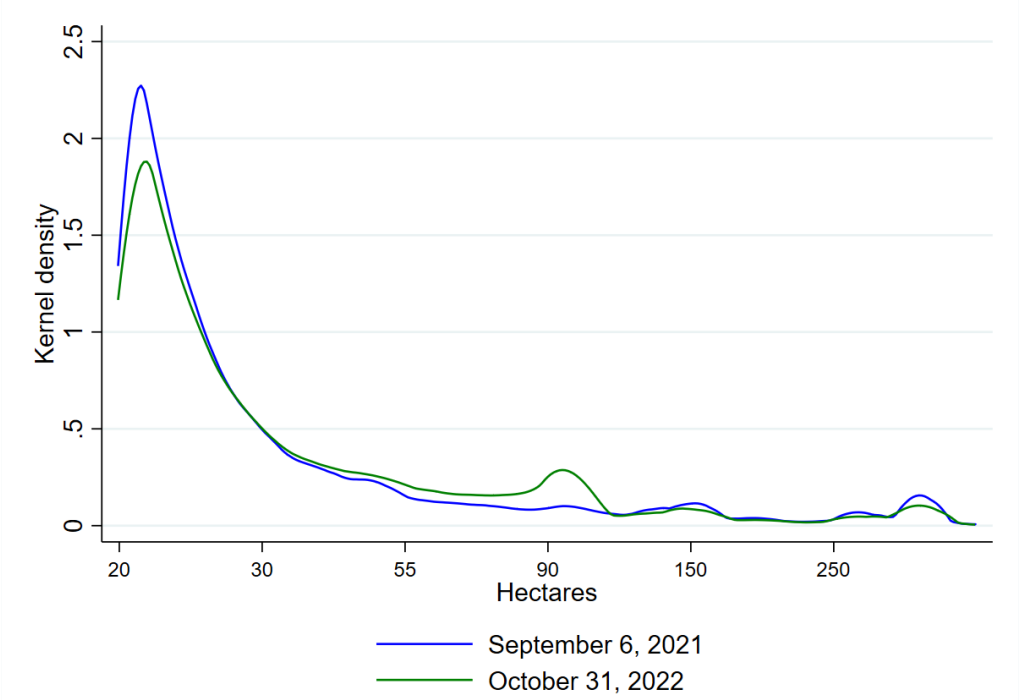

Figure 10. Trends in individual land ownership distribution for all types of land.

To better understand the dynamics of agricultural land purchases since the launch of the sales market, we plot the total land purchased by individuals (**Ошибка! Источник ссылки не найден.**).[6] In doing so, we distinguish between the land for commercial agriculture, OSG-land, and other lands. We find that areas of OSG-land gained were predominantly small, clustering around 2-5 ha. The gains in terms of land for commercial agriculture (blue line) appear to be larger and cluster around 10-20 ha. Moreover, we see a small growth in the number of individuals who acquired 10-20 ha of this type of land as the dashed blue line represents the distribution of transactions as of September 6, 2021, and the solid blue line – as of October 3, 2022. Otherwise,

[6] By combining the datasets on individual land ownership containing the lists of all land plots owned by a given individual with more than 20 ha and the data on all transactions with agricultural land after the launch of the sales market, we can deduct all the purchased agricultural land after the launch of the sales market.

we do not see substantial changes in the amount of acquired land. What is noteworthy, is that we observe several individuals who purchased more land than 100 ha allowed by the Law on Land Circulation from 31.03.2020. In particular, we find eight individuals who purchased in total more than 100 ha with the largest gains in terms of land for commercial agriculture totaling 192.4 ha. We also find five persons who purchased more than 100 ha of OSG-land with the largest gain of 195.2 ha. These purchases indicate that enforcement of the ownership caps should be im-

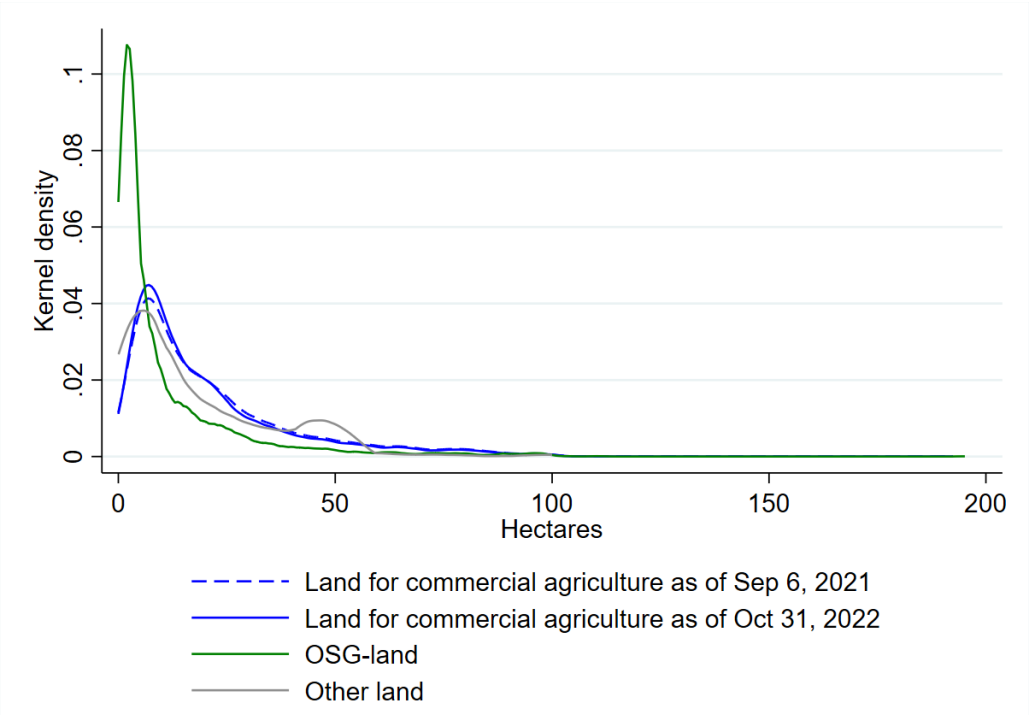

Figure 11. Distribution of the total area purchased by individuals with holdings over 20 ha between July 1, 2021 and November 1, 2022.

proved.

Land ownership concentration by individuals has increased only marginally since the launch of the agricultural land sales market. Figure 12 demonstrates the choropleth map with the shares of the total agricultural land[7] owned by individual landowners with land holdings of at least 100 ha. Cherkaska and Odeska oblasts are absolute champions in terms of land concentration with 12% and 9.14%, respectively. All the western regions demonstrate low levels of land concentration with large landowners controlling below 1% of total agricultural land. This is remarkable because

[7] We consider here land for commercial agriculture, OSG, and other types of agricultural land.

we observe high land market activity in Khmelnytska and Vinnytska oblasts in particular suggesting market involvement of a broad range of participants.

Although the choropleth map with land concentration looks very similar to the one published in Kvartiuk and Martyn (2021), we observe several oblasts with substantial changes in land concentration by individuals. Thus, Poltavska oblast stands out with a 9.33% increase in the share of land owned by individuals with at least 100 ha. Other oblasts with analogous substantial increases are Odeska (5.70%), Ternopilska (4.62%), and Zaporizska (4.09%). On the other hand, we observe a substantial decrease in land concentration in Zakarpatska oblast (-8,18%). Minor decreases are observed in Khmelnytska (-2.80%) and Chernihivska (-2.36%). Nevertheless, the general trend appears to be an increase in land concentration as the average increase in land concentration across all oblasts is 1.25%.

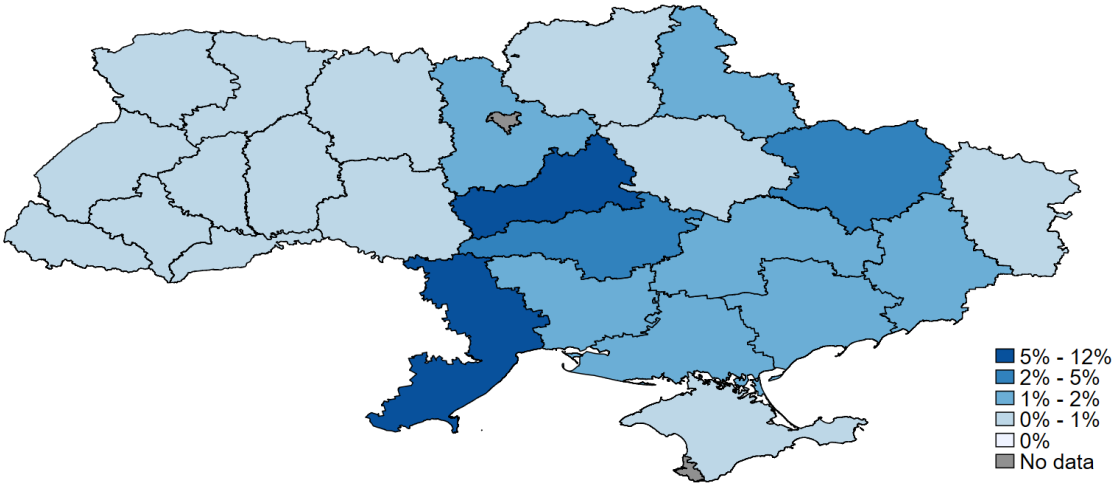

Figure 12. Share of agricultural land of all types owned by individuals with at least 100 ha of owned land.

4.2 Legal entities

Private enterprises have been the major landowners during the last year (Figure 13). The dataset provided by the SGC contains 338 legal entities that owned more than 100 ha in 2022 as opposed to 331 in 2021. The largest share among the landowners with over 100 ha of land holdings is represented by private enterprises went up from 73.27% on September 6, 2021, up to 75.15% on October 31, 2022. With farms and cooperatives, the share of agricultural producers goes up

to 88.76%. Interestingly, local governments and the SGC lost their weight in the dataset. We do not find educational institutions among the land owners with more than 100 ha in 2022 anymore.

Importantly, the share of banks has been stable at around 1.5% of all entities found in the dataset suggesting that owned land may be perceived as viable collateral by the banks. In particular, we found five banks that owned more than 100 ha. All of them except for one increased their land holdings between 2021 and 2022. The largest landholding was 293.1 ha consisting of 143 land plots by Oshchadbank. Although these increases indicate farms' credit defaults, in general, these observations suggest improvements in the collateralization of land indicating increasing liquidity of the land sales market. Considering these trends, we expect further increases in ownership of agricultural land by other banks if the security situation improves.

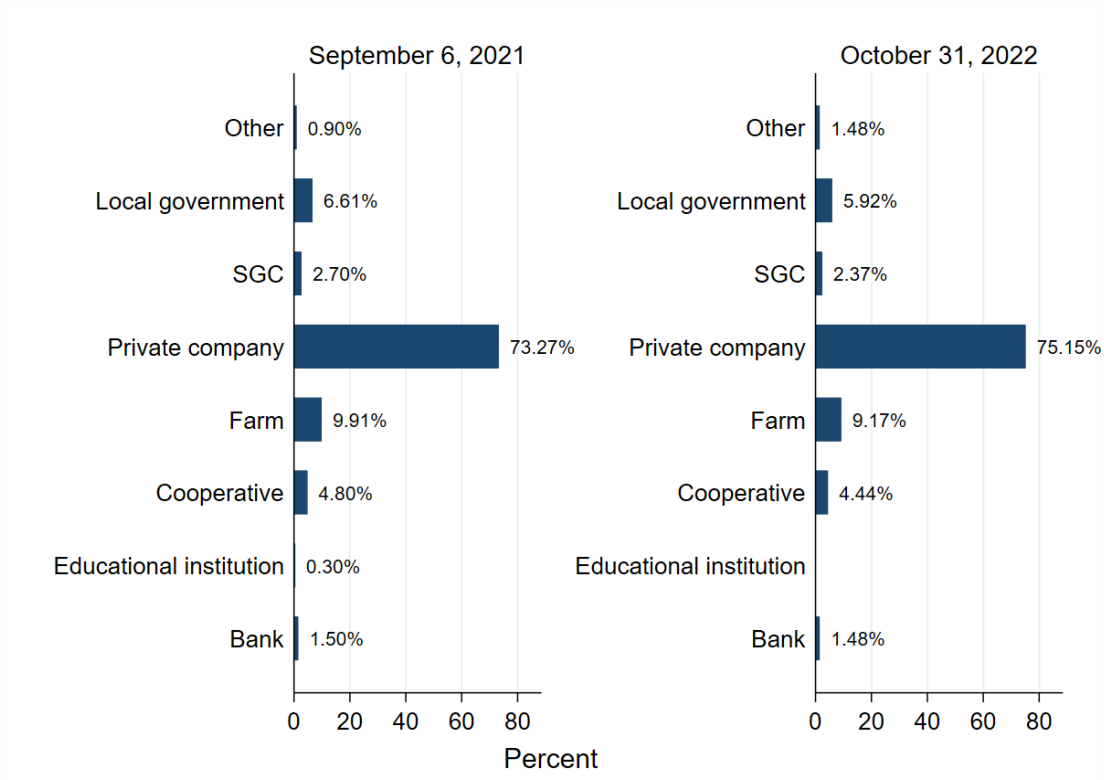

Figure 13. Entities owning more than 100 ha by type.

The distribution of land ownership by agricultural producers has largely remained the same since the launch of the agricultural land sales market. Figure 14 demonstrates Kernel densities of land ownership by private companies, farms, and cooperatives with land holdings over 100 ha as of September 6, 2021 (blue line) and October 31, 2022 (green line). Although the lines appear to be very close to each other, we observe a slight shift to the right. This indicates that the land holdings of some companies have increased slightly. Because the Law on Land Circulation from

31.03.2020 precludes land purchases by legal entities until January 1, 2022, land accumulation took place almost exclusively via OSG-land. Thus, we find seven companies, three farms, and one cooperative that purchased OSG-land since the lifting of the moratorium on land sales. In most of the cases, these were insignificant land purchases with land gains below 30 ha. However, we observe one exception where a company purchased 267 land plots with a total area of 522.8 ha. Remarkably, we find one land plot for commercial agriculture with an area of ca. 6 ha that was purchased by a private company. Whether it is an input mistake or a real sale that took place is probably worthy of a closer investigation. Furthermore, similar to our 2021 study, we find 11 companies and one farm that inherited land. The largest inheritance since the launch of the agricultural sales market was 112.5 ha. Although these transactions appear to be legal, they should be examined closely to exclude the possibility of the rights violation of the land owners.

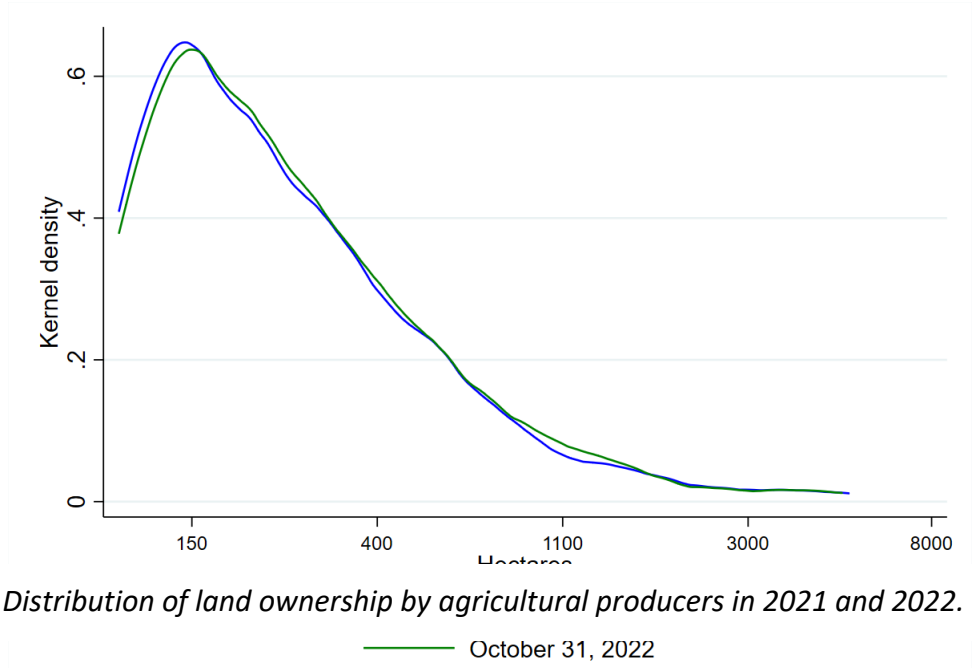

Figure 14. Distribution of land ownership by agricultural producers in 2021 and 2022.

Land concentration by agricultural producers appears to be generally less pronounced than by individuals. Following Figure 15, we find Kyivska, Zhytomyrska, and Vinnytska oblasts with the highest share of agricultural land owned by enterprises with at least 100 ha of owned land, with 1.67%, 1.2%, and 0.59%, respectively. However, these rates are substantially lower than for individuals. Interestingly, we find an enterprise that owns a substantial area in Sevastopol.

On average, land concentration by agricultural producers grew by 0.02% only. The absolute champion in terms of the acquisition of agricultural land by large legal entities is Zhytomyrska oblast where the share of land owned by agricultural producers with at least 100 ha grew by 0.23%. The next fast-growing oblast is Poltavska with 0.11%. It may be noteworthy that this is where we found the only sales transaction with the land for commercial agriculture by a legal entity. These oblasts should be closely considered in the land monitoring to avoid rapid substantial concentration after January 1, 2024, when legal entities will have access to the land sales market.

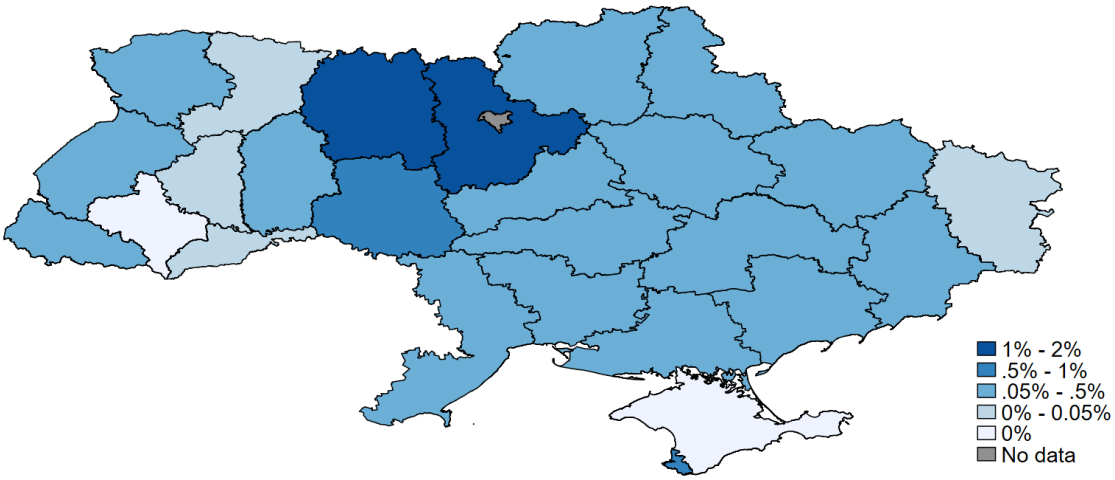

Figure 15. Share of agricultural land owned by enterprises with at least 100 ha of owned land.

5. Conclusion and discussion

This study represents a follow-up from our 2021 analysis of the first months of the functioning of the land sales market (Kvartiuk and Martyn 2021). Apart from monitoring the land prices and concentration as in the 2021 study, we examine the effects of the Russian war against Ukraine. In particular, we scrutinize the quality of the data reported by the SGC and provide recommendations about ways to improve it. Furthermore, we analyze how the Russian invasion affected nominal and real prices of agricultural land in general and in selected regions checking whether war-induced distress sales occurred. Finally, we examine the general trends in land accumulation.

Generally, we find that the volume of transactions fell after the beginning of the war substantially. Thus, the number of transactions after the war was only one-third of the level during the pre-war period and only one-fifth in terms of area. To put it in perspective, we find that ca. 0.5% of the

total agricultural land was transacted between July 1, 2021, and the beginning of the Russian war against Ukraine whereas, after the beginning of the war until October 31, 2022, only 0.09%. These figures are far from 1-2% per year reported in the countries with established land markets.

5.1. Data quality

We find that the quality of data of the Land Monitoring System by the SGC deteriorated substantially in 2022. In particular, the number of missing land price records has increased substantially up to 77.22% making land market analysis nearly impossible. Although the Law on Land Circulation from 31.03.2020 stipulates an obligatory recording of the sales prices in the SRPRREE, there is no enforcement mechanism. This leaves price recording up to the discretion of the notaries. A similar situation (although slightly better) is observed with the NMV. The absence of such large shares of vital information is unacceptable for effective monitoring of the land market. This defeats the very purpose of the Land Monitoring System put in place by the SGC in the first place. To address this situation, an effective enforcement mechanism should be developed to make each transaction impossible without recording all the necessary information in the respective registries.

Another important deficiency of the data is the absence of stylized categories of buyers and sellers. An important part of the land market analysis is understanding the demand for land and, as a result, accumulation dynamics. Stylized categories (e.g., farms, enterprises, etc.) with consideration of buyers' anonymity are of substantial value for an effective monitoring system and scientific analysis. This deficiency can be addressed by the SGC data managers who can implement a simple data generation algorithm based on the Classification of the Types of Economic Activity (CTEA).

5.2. Land prices

Contrary to our expectations, nominal land prices did not drop en masse. We find that average nominal prices for land for commercial agriculture actually increased by 2.2% after the Russian invasion. Median nominal prices although increased slightly from 32,300 UAH/ha to 33,100 UAH/ha, did not significantly differ before and after the beginning of the war.

We do observe some nominal price reductions in the oblasts that were most affected by active fighting which grants suggestive evidence of distress sales. Interestingly, using Tobit and DiD

hedonic-type models, we do not find significant nominal price reductions in all the affected oblasts. The reason is that the nature of agricultural production and consequently the demand for land is different among the affected oblasts. To examine possible differences, we run hedonic-type Tobit models for each specific oblast. We find that nominal land sales prices dropped in Chernihivska, Kharkivska, and Zaporizska oblasts. We find a 15.8% price increase in Mykolayivska oblast which could probably be explained by a higher added-value type of agricultural production in this oblast.

NMV appears to be a safeguard against distress sales in most of the transactions after the beginning of the war. We find that in a quarter of the cases NMV equals the sales price and in 70% of the transactions the markup is less or equal to 10%. Thus, sales prices for land for commercial agriculture heavily cluster around the NVM suggesting that further price reductions would most probably take place without this safeguard. Interestingly, we find that in 1.17% (398 transactions) of all sales transactions with the land for commercial agriculture before the war sales prices were below the NMV. The corresponding figure for the analogous transactions after the war is 0.67% (52 transactions). These cases clearly contradict the provisions of the minimal price by the Law on Land Circulation from 31.03.2020 and should be investigated in more detail to prevent further violations of the landowners' rights.

If we adjust the sales prices by the inflation and the devaluation of UAH in July 2022 by the NBU, we find significant reductions in land sales prices. Real sales prices dropped all across the country and naturally more so in the oblasts affected by the Russian war against Ukraine.

5.3. Land concentration

Individuals have been active on the land sales market contributing to some land accumulation. In particular, we observe an accumulation of land up to the allowed ownership cap of 100 ha. The number of individuals with just under 100 ha is likely to increase in the following year before the cap is increased up to 10,000 ha. On the other hand, legal entities were inactive on the sales market of the land for commercial production but some were actively purchasing OSG-land.

Importantly, we find that banks were among the landowners with more than 100 ha. Four out of five increased their land holdings since the launch of the sales market substantially. These increases in land ownership may indicate either an intensification of using land for commercial

agriculture as collateral or an increase in the default rates due to unfavorable economic conditions inflicted by the Russian war against Ukraine.

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Seifert, Stefan, Christoph Kahle, and Silke Hüttel. 2021. "Price Dispersion in Farmland Markets: What Is the Role of Asymmetric Information?" *American Journal of Agricultural Economics* 103 (4): 1545–68. https://doi.org/10.1111/ajae.12153.

Appendix A. Classification of the use purposes of agricultural lands.

Code	Name	Subject to moratorium (yes/no)
01.01	For commercial agriculture	Yes
01.02	For farming enterprise	Yes[8]
01.03	For individual farming (OSG)	No[9]
01.04	For subsistence farming	No
01.05	For individual gardening	No
01.06	For collective gardening	No
01.07	For amateur gardening	No
01.08	For hayfields and pastures	Yes
01.09	For scientific and educational purposes	Yes
01.10	For propagating modern agriculture	Yes
01.11	For providing services in agriculture	No
01.12	For hosting bulk markets of agricultural produce	No
01.13	For other agricultural purposes	No
01.14	For preservation and use of lands of the nature reserve fund	No

[8] There was no direct ban on the alienation of land for farming enterprise, but notaries have historically interpreted the norm of Article 1 of the Law of Ukraine "On Farming", according to which "farming is a form of entrepreneurial activity of citizens who want to produce commercial agricultural products, process and sell them." Therefore, it was widely considered that these land plots are subject to a ban on alienation as land for commercial agricultural production.

[9] As a general rule, these land plots were not restricted in economic circulation, but if a land plot with such purpose was obtained by allocating a land share in the distribution of lands of a collective agricultural enterprise, then it was prohibited from alienation. Land plots up to 2 hectares of size provided through privatization free of charge (but not land shares) were in free circulation.

Appendix B. Tobit and DiD estimations

For all of our price estimations with difference-in-differences (DiD) and Tobit models, we use we use the following specification based on hedonic approach where characteristics of a land plot determine the price:

$$Price_i = \beta_1 War_i + \beta_2 NMV_i + \beta_3 Controls_i + u_i,$$

where $Price_i$ is a logarithm of the price per ha for a given land plot i. Among the explanatory variables we include the dummy War_i for whether a transaction was before or after February 24, 2022; NMV_i reflects the attractiveness of a given land plot as it includes the soil quality and the expected return per ha. Among the control variables, we include area, area squared as well as oblast and months dummies depending on the model.

All the Tobit models with price estimations can be found in the Table 1. We first present the models with the transactions from the whole country (model (1)). Then, we limit our sample to affected oblasts only (model (2)) and estimate the same specifications on the sub-samples of the concrete affected oblasts (models (3)-(7)). Please, note that we exclude Luhanska, Donetska, and Khersonska oblasts as there were no or little transactions. These estimations give us the idea about the exogenous effect of the war on the land prices controlling for the factors that may affect land prices.

To back up our results, we estimate our models using the DiD estimations (Table 2). First, we estimate the sales prices for the land for commercial agriculture (model (1)) and the OSG land (model (2)). Then, we use the dummy for non-missingness of the prices for both types of land to calculate the average treatment effect in the affected oblasts.

Table 1. Tobit estimations of nominal sales prices of the land for commercial agriculture.

	(1) Whole country	(2) Affected oblasts	(3) Chernihivska	(4) Kharkivska	(5) Sumska	(6) Zaporizska	(7) Mykolayivska
War dummy	0.022*	-0.036	-0.247***	-0.066***	-0.048	-0.030***	0.158***
	(0.075)	(0.204)	(0.000)	(0.000)	(0.252)	(0.006)	(0.004)
Area (ha)	-0.027***	-0.015***	0.017	-0.016***	-0.035*	-0.003	-0.002
	(0.000)	(0.000)	(0.465)	(0.000)	(0.092)	(0.495)	(0.807)
Area squared	0.001***	0.001***	-0.002	0.001***	0.005*	-0.000	0.000
	(0.000)	(0.000)	(0.190)	(0.000)	(0.091)	(0.519)	(0.699)
NMV per ha	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Oblast dummies	Yes	Yes	No	No	No	No	No
Constant	9.646***	9.445***	9.429***	9.604***	9.330***	9.126***	9.484***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	19381	6308	686	3278	1665	675	679

*Significant at 0.1; **Significant at 0.05; ***Significant at 0.01. P-values are reported in brackets.

Table 2. DiD estimations for the price and non-missingness.

	(1) Price per ha (land for commercial ag)	(2) Price per ha (OSG-land)	(3) Dummy for a non-missing price (1-non-missing; 0 - missing)	(4) Dummy for a non-missing price (1-non-missing; 0 - missing)
ATET (1 – affected oblasts: 0 – otherwise)	1133.233	13573.570	-0.107***	-0.156***
	(0.837)	(0.570)	(0.000)	(0.000)
Area (ha)	-5441.476	-20653.024***	0.002	-0.009***
	(0.207)	(0.001)	(0.273)	(0.001)
Area squared	171.744	159.497***	-0.000	0.000***
	(0.226)	(0.001)	(0.858)	(0.000)
NMV per ha	0.095	0.486	0.000	0.000
	(0.893)	(0.380)	(0.519)	(0.791)
Constant	52683.730	164697.801**	0.529***	0.507***
	(0.110)	(0.042)	(0.000)	(0.000)
Observations	19381	11011	39145	20933

*Significant at 0.1; **Significant at 0.05; ***Significant at 0.01. P-values are reported in brackets.