

Maryna NEHREY^{*,**}, Nataliia KLYMENKO^{*}, Andrii KAMINSKYI^{***} and Andrii TARANENKO^{*}

Analysis of the impact of macroeconomic turmoil (COVID-19 and RUW) on Ukrainian agroholdings

This paper examines the impact of the macroeconomic turmoil, in particular the COVID-19 pandemic and the Russian-Ukrainian war (RUW) in Ukraine, on Ukrainian agroholdings. Before the full-scale Russian invasion, Ukraine was a major global exporter of agricultural commodities, playing a crucial role in global food security and contributing significantly to the national economy. However, the outbreak of war in Ukraine brought with it unprecedented challenges such as loss of assets, damage to infrastructure, labour shortages and more. Despite these adversities, the Ukrainian agricultural sector remains resilient, attracting investment and maintaining its global presence in agriculture. This study aims to comprehensively analyse the resilience and vulnerability of Ukrainian agroholdings before and after these shocks. Our analysis shows different responses to the pandemic and war shocks, with agroholdings being resilient during the first shock but suffering significant setbacks during the second shock. These results underline the crucial role of the Ukrainian agricultural sector and provide valuable insights into its adaptability under turbulent macroeconomic conditions.

Keywords: agroholdings, COVID-19, risk, risk assessment, shock, Russian-Ukrainian war, Ukraine

JEL classifications: Q18, F36, O16

* Department of Economic Cybernetics, National University of Life and Environmental Science of Ukraine, Ukraine.

** Collegium Helveticum, ETH Zurich, Switzerland. Corresponding author: marina.nehrey@gmail.com.

*** Department of Economic Cybernetics, Taras Shevchenko National University of Kyiv, Ukraine.

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Introduction

The agricultural sector is a cornerstone of the Ukrainian economy, accounting for 10% of GDP and 40% of exports (Voronenko *et al.*, 2020; Kaminskyi *et al.*, 2021). It is the main source of livelihood for about a third of the Ukrainian population. Ukraine has approximately 25% of the world's most fertile black soil, which makes Ukrainian agriculture unique in terms of its potential (Kadiyevskyy and Klymenko, 2014).

Prior to the full-scale Russian invasion, Ukraine was one of the world's leading exporters of agricultural commodities, which are crucial to ensuring global food security. However, agriculture has also been an area of tension in Ukraine, where two different modes of production have coexisted for many years: large industrial agribusinesses and small farms. Agribusinesses control 53.9% of the arable land and account for 54.5% of Ukraine's gross domestic agricultural production, specialising mainly in the production of cereals and oilseeds for export. Some agroholdings have developed primarily based on internal capital flows, while others are part of multinational corporations. Many Ukrainian agroholdings have raised funds through public offerings on international stock exchanges and have also received funding from international organizations such as the European Bank for Reconstruction and Development and the International Finance Corporation. The full-scale war that began in 2022 did not eliminate tensions between large and small agricultural producers in Ukraine.

The war - as well as other major global shocks such as the Covid-19 pandemic - has exposed the systemic fragility of globalised neoliberal agriculture (Barrett *et al.*, 2021), characterised by narrow specialisation in agricultural production and reliance on international trade in food, fuel and fertiliser. The outbreak of war in Ukraine marked the

beginning of what economists describe as the third asymmetric shock to hit the European Union in the last two decades, following the 2008 financial and economic crisis, the subsequent Eurozone crisis and the COVID-19 pandemic (Barrett *et al.*, 2021; Hassen *et al.*, 2022; Simchi-Levi and Haren, 2022). Not only does the destruction of trade routes and infrastructure threaten the viability of Ukrainian agribusinesses, but the way they are organised makes them extremely vulnerable to major shocks and disruptions. Nearly 90% of crop farms and 60% of industrial livestock farms reported a significant or sharp decline in income in the first year of the war (FAO, 2023).

The challenges facing Ukraine's agricultural sector in the context of a full-scale war are unprecedented. These include the damage to property, the expansion of mined areas, the blockade of ports, the bombing and destruction of port infrastructure, the damage to farms and equipment, the closure of borders with western neighbours, labour shortages and fluctuations in global markets (Celi *et al.*, 2022; Glauben *et al.*, 2022). While all categories of agricultural producers face formidable hurdles, the lion's share of war-related losses have fallen on large industrial agribusinesses (agroholdings). (Klymenko *et al.*, 2023; Nasibov *et al.*, 2024; Noack *et al.*, 2024). Family farmers and individual smallholders proved more resilient during the war, as confirmed by an FAO report (FAO, 2022). Despite these adversities, Ukraine's agricultural sector continues to attract investment, create employment opportunities, and expand its agricultural presence on the global stage. It remains a significant contributor to the national budget, generating substantial revenues and playing a key role in the country's overall GDP.

This study provides a comprehensive analysis and assessment of the risks facing the Ukrainian agricultural sector in the context of various macroeconomic instabilities. The aim of the paper is to analyse the multifaceted impact of the

Russian invasion on the Ukrainian agroholdings and to compare it with the COVID-19 impact. Our particular focus is on the resilience and vulnerability of Ukrainian agroholdings before and after these shocks.

To achieve these objectives, we have adopted a multidimensional approach which includes (i) analysis of data from the Warsaw and London Stock Exchanges, (ii) Implementing special indicators for shock risk analysis and (iii) a comprehensive comparable risk analysis for both shocks. Finally, our research extends to the identification of key challenges for the Ukrainian agroholdings.

The following sections of this paper are structured as follows. First, a literature review on shock impact assessment is presented. This is followed by an in-depth analysis of the impact of the war on the Ukrainian agricultural sector and its consequences for global agricultural markets. Next, the paper examines agroholdings during two shocks. Finally, a comprehensive discussion of the main findings and their implications for policy and research is presented.

Literature review

The question of the impact of crises, shocks and wars on the agricultural sector has been analysed in depth by various researchers. With the outbreak of the Russian-Ukrainian war, issues and problems that had not been critically addressed for years came to the fore. First, the issue of food security arose, as Ukraine was a major supplier of agricultural products to Europe and Africa (Deininger *et al.*, 2023; Davdenko *et al.*, 2024). In particular, the main factors that have a devastating impact on food security at the European and global levels are global warming leading to climate change and its consequences for agriculture (Chen *et al.*, 2017; Passel *et al.*, 2017; Skrypnik *et al.*, 2021); the global COVID-19 pandemic (Kaminskyi *et al.*, 2021) and the war in Ukraine with consequences for both the domestic agricultural economy and global food markets (Banse, 2022; Câmpeanu, 2022). In particular, scholars stress that the food crisis will worsen as the war intensifies (Glauben *et al.*, 2022; Hassen and Bilal, 2022; Fiott, 2022), posing a challenge to many countries, especially those dependent on food imports, such as those in the Middle East and North Africa. The war has had a cascading effect on global food security over time (Hassen & Bilal, 2022; Simchi-Levi and Haren, 2022). Almost all pandemics, past and present, cause food crises, disrupt agricultural labour flows and reduce the efficiency of agricultural operations, leading to food losses (Roubík *et al.*, 2024; Karamti and Jeribi, 2023). Shocks such as wars and pandemics have a cumulative and cascading effect on food security (Paudel *et al.*, 2023) and the dynamics of global food imports and exports (AL-Rousan *et al.*, 2024).

COVID-19 not only caused problems in agricultural supply chains during the pandemic, but also led to a significant increase in risks after the pandemic ended. Supply risks, demand risks, financial risks, logistics and infrastructure risks, management and operational risks, political and regulatory risks, and biological and environmental risks

have a significant impact on agribusinesses, depending on the scope and size of the organisation (Sharma *et al.*, 2020).

The periods of the COVID-19 pandemic and the RUW Russian-Ukrainian war in 2022 brought great uncertainty to global food and financial markets. It is therefore important to study the impact of extreme risks and manage investment portfolios to increase stability during and after crises (Hu *et al.*, 2024; Kaminskyi *et al.*, 2020).

The war of 2022 is expected to have an impact similar to the financial crisis of 2009 and the COVID-19 pandemic, as there is an exponential increase in uncertainty that negatively affects consumption and investment, which has a depressive effect on GDP and employment: the longer the war lasts, the larger and more persistent its effects will be (Bentley, 2022; Celi *et al.*, 2022). The impact of two successive crises, the COVID-19 pandemic and the Russian-Ukrainian war, on stock markets and the investment attractiveness of agribusinesses is examined in (Mroua and Bouattour, 2023).

After three decades of focusing agriculture on environmental and social sustainability goals, the war in Ukraine has brought productivity and supply-side goals into focus. The views and opinions of farmers and consumers on the direction of agriculture during and after the war do not match the old and new societal demands on agriculture (Noack *et al.*, 2024). Destruction, damage and losses from the war have resulted in reduced crop areas and yields, destroyed infrastructure, and soil and water pollution (Nasibov *et al.*, 2024). Assessing these impacts on Ukrainian farms helps to understand the scale of the problem and to develop recovery and risk management strategies.

Methodology

We used a consistent methodology to assess the risks faced by Ukrainian agroholdings in the context of macroeconomic instability, particularly in times of significant shocks. We selected the largest Ukrainian agribusinesses listed on either the Warsaw or London Stock Exchange, including companies such as MHP, Astarta, Agroton, IMC, Ovostar, Agroleague, KSG Agro and Kernel. Our dataset included daily share prices of these selected agroholdings. We conducted analyses for two different shock periods: the COVID-19 pandemic and the war in Ukraine.

The sample was then divided into three periods for each of the shocks:

- 1st period (pre-shock) – the period before the shock, characterised by a certain degree of stability;
- 2nd period (shock) – the period of the shock;
- 3rd period (after shock) – the period of recovery after the shock.

By shock, we do not mean the entire period of the critical situation, COVID-19 or war, but only the time when the most dramatic changes occurred at the beginning of these, during which agricultural holdings, the agricultural sector and the world food market were unable to adapt.

To assess the risks of the shock period, 2 indicators were used: shock depth and recovery rate:

$$\text{Shock depth} = \frac{\text{Min price in shock period}}{\text{Average price before shock}} - 1 \quad (1)$$

$$\text{Recovery rate} = \frac{\text{Average price after shock}}{\text{Average price before shock}} \quad (2)$$

Our analyses were based on relevant indicators reflecting the magnitude of the shock and the degree of subsequent recovery. Risk was assessed using the concept of volatility, alongside established methodologies such as Value at Risk (VaR) and Conditional Value at Risk (CVaR). We also included liquidity, as measured by trading volumes, as an additional parameter for assessing risk. Through this comprehensive approach, we aimed to provide a detailed understanding of the risks faced by Ukrainian agricultural producers during macroeconomic turbulence.

Results

Our study analysed the resilience and vulnerability of Ukraine's agricultural sector in the face of unprecedented macroeconomic shocks, in particular the COVID-19 pandemic and war. Despite significant challenges, including infrastructure destruction and labour shortages, Ukraine's agricultural landscape has shown considerable resilience. Our analysis of key agrohholdings during these shocks reveals different responses and variations in investment vulnerability. Agrohholdings proved resilient to the COVID-19 pandemic, but the war had a devastating impact on all. These findings underscore the critical role of Ukraine's agricultural sector within the national economy and offer valuable perspectives on its adaptability under turbulent macroeconomic conditions.

The structure of the Ukrainian agricultural sector has evolved over the last decade based on a three-pillar model

combining agricultural enterprises, small family farms and very large farms (agroholdings). Export-oriented production is increasingly in the hands of a small number of vertically integrated farms (Hervé, 2013; Cochet *et al.*, 2021). The agricultural sector in transition and developing economies is characterised by a high share of agroholdings, i.e. conglomerates of agricultural enterprises that control a large bank of farmland. Institutional turbulence in such economies leads to the emergence of agroholdings (Gagalyuk, and Valentinov, 2019).

The emergence of large, horizontally integrated agribusinesses, particularly in Eastern Europe, raises the question of whether these agroholdings can act as price leaders in local land markets (Graubner, *et al.*, 2021; Klymenko *et al.*, 2023a).

Since 2022, Ukrainian agribusinesses have been operating in a context of war and economic instability, overcoming difficulties such as the occupation and mining of part of Ukrainian territory, the blockade of seaports, shelling and the destruction of agricultural infrastructure. The result has been a shortage of resources, reduced revenues and even bankruptcies.

But even amid the losses, Ukraine's agricultural sector attracted investment, created jobs, promoted Ukrainian agriculture globally, generated significant revenues for the state budget and contributed a large share of Ukraine's GDP.

In 2023, the 10 largest tax-paying enterprises in Ukraine's agricultural sector paid almost UAH 19.4 billion to the budgets of all levels, which is 36% more than in 2022 (Figure 1). Almost all agricultural holdings increased their tax payments in 2023 compared to 2022 (Forbes, 2024).

The majority of agroholdings were able to make adjustments to their operations to maintain profitability. According to the Ukrainian Grain Association, in the 2022/2023 season domestic farmers exported 67.8 million tons of

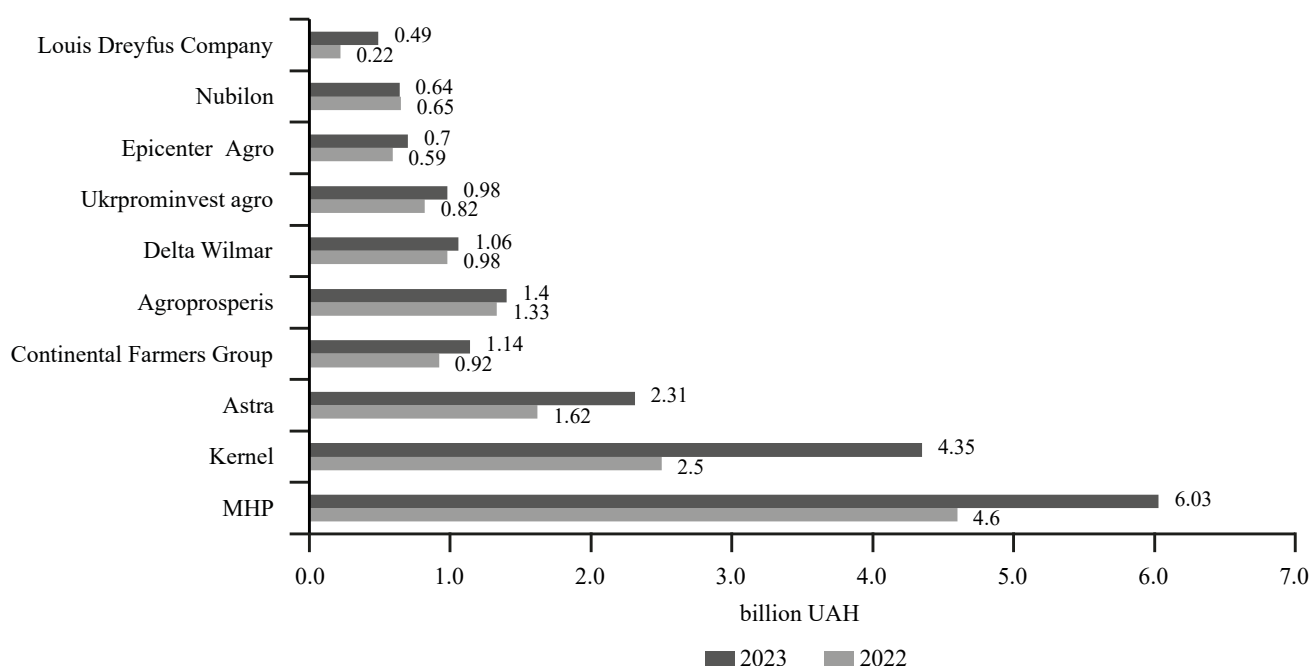


Figure 1: The largest taxpayers in the agricultural sector of Ukraine, billion UAH.

Source: own composition based on Forbes (2024)

products, 12% more than in the previous year and 15% more than in 2020/2021. Studies of the investment activities of large agricultural enterprises have shown an increase in their efficiency and the adoption of corrective investment decisions to ensure Ukraine’s sustainable development (Sokolovska, *et al.*, 2021 Klymenko *et al.*, 2023b). The capitalisation of most Ukrainian agroholdings reacted to the disruptions caused by the global crisis, COVID-19 and Russia’s full-scale invasion, with falling share prices and declining trading volumes. The main factors behind the decline were the continuation of hostilities in the conflict zone, a significant decline in economic activity, the destabilisation of the financial and stock markets, the reduced activity of agribusinesses on the stock exchanges and the destabilisation of the currencies in which agribusiness shares are traded. The fall in capitalisation led to a fall in farm profits, a fall in the volume of shares traded on stock exchanges and a fall in fixed and working capital. The companies also lost a significant amount of funds that would have been used for various purposes, including the sowing campaign. In addition, the agroholdings lost some positions

on the stock exchange and the stock market. The war also led to a reduction in expenditure on the development and operation of agroholdings and to the partial or complete closure of some agroholdings. All in all, this had a negative impact on the further development of the Ukrainian agricultural sector.

We examine the dynamics of the share prices of Ukraine’s agroholdings during the shocks of the COVID-19 pandemic and the war. Our analysis includes an examination of the depth of the shock and the degree of recovery of Ukraine’s leading agroholdings (Kaminskyi *et al.*, 2020; Klymenko *et al.*, 2023).

The comparative analysis of the risk and profitability adjustment of agroholdings over three intervals is presented in Table 1.

On average, companies barely felt the impact of the pandemic and, on the contrary, grew by more than 1.5 times. The COVID-19 pandemic led to an economic downturn that reduced demand for certain types of products, including agricultural products. MHP and Ovostar suffered most, recovering only 58% and 80% respectively. KSG Agro and Agroliga, on

Table 1: Indicators of risk analysis of agricultural holdings of Ukraine.

COVID-19 period (15.07.2018 - 19.12.2021)									
Period	MHP	ASTH	AGTP	IMC	OVO	AGLP	KSG	KER	AVG
Average after shock	6.05	6.66	1.13	4.02	13.79	8.69	0.59	9.35	6.28
Min in shock	5.64	1.72	0.42	1.80	12.11	2.68	0.14	5.74	3.78
Average before shock	10.46	4.45	0.62	2.45	17.16	2.97	0.18	8.61	5.86
Shock deepness	-46%	-61%	-32%	-27%	-29%	-10%	-21%	-33%	-32%
Recovery rate	58%	150%	180%	164%	80%	293%	333%	109%	171%
RUW period (23.08.2020 - 31.12.2023)									
Period	MHP	ASTH	AGTP	IMC	OVO	AGLP	KSG	KER	AVG
Average after shock	3.54	5.70	0.70	3.18	10.82	4.16	0.43	3.28	3.98
Min in shock	3.41	2.86	0.57	2.77	7.33	3.13	0.36	3.34	2.97
Average before shock	6.06	6.98	1.17	4.31	13.66	9.13	0.62	9.57	6.44
Shock deepness	-44%	-59%	-52%	-36%	-46%	-66%	-42%	-65%	-51%
Recovery rate	59%	82%	60%	74%	79%	46%	70%	34%	63%

Source: own composition based on Forbes (2024).

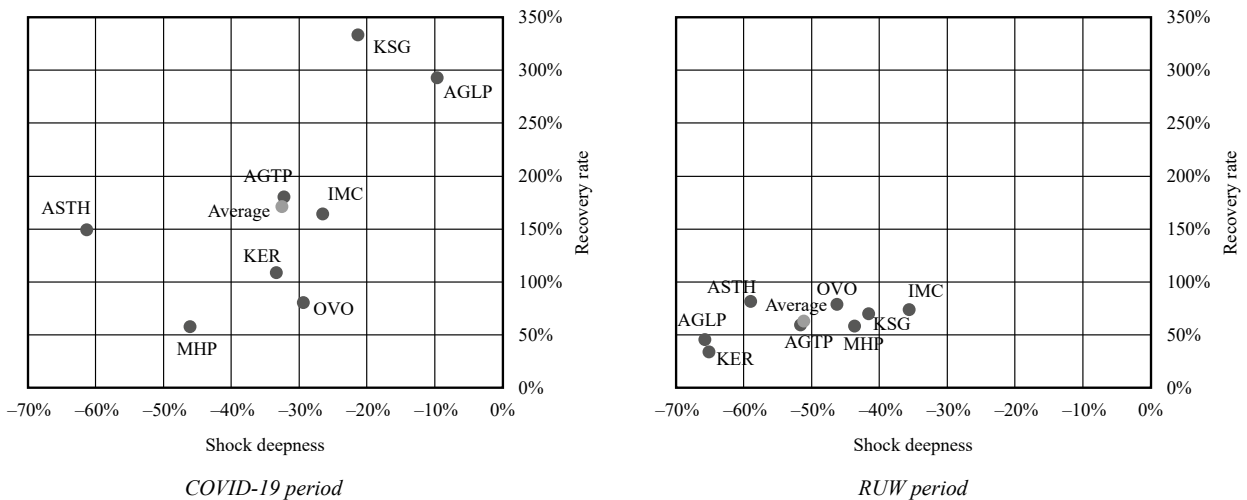


Figure 2: Comparison of SD-RR correspondence for shocks.

Source: own composition

the other hand, not only withstood the difficult conditions, but actually tripled their sales. However, the impact of the war was devastating for all the companies. On average, agroholdings fell by 51% during the shock period, with a recovery rate of only 63%. Kernel and Agroliga were the worst off, failing to recover even half of their losses. Astarta and Ovostar proved the most resilient to the difficult conditions, recovering 80% and now showing positive momentum.

The fundamental difference between the shocks is the gap between the RR for the RUW shock and the COVID-19 shock. In fact, if we compare linear trends RR from SD, the slopes of the lines are quite different; the depth of the shock and the level of recovery of assets of agricultural enterprises of Ukraine.

RR=3,8SD+2,9 (COVID-19 shock)

RR=0,9SD+1,1 (RUW shock)

The R-squares of these trends are not so high. This indicator shows that agroholdings reacted differently to the shock. Taking into account the economic essence of the slope, we can see that on average the recovery was about 4 times more intense after the COVID-19 shock.

One of the key approaches to risk assessment is based on the concept of variability. We have used this concept in our comparative analysis. The results of the statistical analysis of the stocks, which include: minimum and maximum values, mean value, standard deviation, skewness and kurtosis, are presented in Table 2.

Table 2: The results of the statistical analysis of the stock returns.

COVID-19 period (15.07.2018 - 19.12.2021)									
Company	Min			Max			Mean		
	Before shock	Shock	After shock	Before shock	Shock	After shock	Before shock	Shock	After shock
MHP	-0.081	-0.163	-0.104	0.066	0.119	0.120	-0.004	-0.013	0.002
ASTH	-0.194	-0.249	-0.145	0.227	0.174	0.265	-0.007	0.001	0.015
AGTP	-0.140	-0.204	-0.148	0.489	0.303	0.329	0.004	0.012	0.008
IMC	-0.140	-0.125	-0.077	0.193	0.155	0.149	0.000	-0.001	0.014
OVO	-0.102	-0.099	-0.113	0.115	0.099	0.117	-0.004	0.099	0.001
AGLP	-0.105	-0.074	-0.242	0.288	0.080	0.539	0.005	0.002	0.019
KSG	-0.145	-0.141	-0.220	0.197	0.340	0.806	0.003	0.009	0.024
KER	-0.111	-0.125	-0.075	0.087	0.106	0.120	-0.001	-0.003	0.005
Average	-0.127	-0.147	-0.140	0.208	0.172	0.306	-0.0004	0.013	0.011
Diff. %			110%			147%			-2,594%
Company	Standard deviation			Skewness			Kurtosis		
	Before shock	Shock	After shock	Before shock	Shock	After shock	Before shock	Shock	After shock
MHP	0.030	0.061	0.042	0.190	-0.313	0.301	0.213	1.080	0.257
ASTH	0.063	0.106	0.079	0.751	-0.665	0.823	4.061	0.133	1.051
AGTP	0.087	0.101	0.077	2.504	0.468	1.098	11.662	2.918	3.333
IMC	0.046	0.068	0.049	0.678	0.626	0.520	3.908	0.134	0.004
OVO	0.036	0.053	0.044	-0.278	-0.129	-0.174	1.592	-0.703	0.974
AGLP	0.068	0.044	0.106	1.199	0.057	1.288	2.644	-0.803	6.857
KSG	0.073	0.091	0.157	0.293	2.123	2.293	0.076	7.627	8.306
KER	0.037	0.054	0.037	-0.173	0.086	0.689	0.173	0.152	1.155
Average	0.055	0.072	0.074	0.645	0.282	0.855	3.041	1.317	2.742
Diff. %			134%			132%			90%
RUW period (23.08.2020 - 31.12.2023)									
Company	Min			Max			Mean		
	Before shock	Shock	After shock	Before shock	Shock	After shock	Before shock	Shock	After shock
MHP	-0.302	-0.205	-0.147	0.120	0.320	0.136	-0.002	-0.001	-0.001
ASTH	-0.402	-0.222	-0.145	0.265	0.291	0.258	0.007	0.005	0.011
AGTP	-0.352	-0.146	-0.201	0.329	0.151	0.472	0.005	-0.018	0.004
IMC	-0.259	-0.141	-0.133	0.149	0.128	0.281	0.008	-0.007	-0.001
OVO	-0.116	-0.166	-0.145	0.113	0.111	0.254	-0.002	-0.017	0.013
AGLP	-0.242	-0.464	-0.114	0.539	0.241	0.314	0.012	-0.036	0.004
KSG	-0.367	-0.103	-0.143	0.806	0.150	0.204	0.013	0.009	0.003
KER	-0.425	-0.230	-0.319	0.120	0.710	0.213	-0.001	-0.014	-0.001
Average	-0.308	-0.210	-0.168	0.305	0.263	0.266	0.005	-0.010	0.004
Diff. %			55%			87%			81%
Company	Standard deviation			Skewness			Kurtosis		
	Before shock	Shock	After shock	Before shock	Shock	After shock	Before shock	Shock	After shock
MHP	0.055	0.112	0.050	-1.895	1.300	0.022	10.775	3.998	1.028
ASTH	0.092	0.142	0.065	-0.497	0.873	0.883	4.770	0.243	2.761
AGTP	0.089	0.081	0.086	-0.023	0.125	2.852	4.258	-0.039	14.095
IMC	0.060	0.074	0.063	-0.879	0.114	1.353	4.410	-0.541	4.508
OVO	0.044	0.059	0.065	-0.463	-0.368	0.790	0.859	2.419	2.279
AGLP	0.105	0.143	0.063	1.415	-1.299	1.735	7.464	5.026	6.823
KSG	0.153	0.077	0.056	2.161	0.681	1.091	0.076	-0.614	3.382
KER	0.060	0.210	0.077	-4.313	2.747	-0.395	31.366	9.477	3.966
Average	0.082	0.112	0.066	-0.562	0.522	1.041	7.997	2.496	4.855
Diff. %			80%			-185%			61%

Source: own calculations.

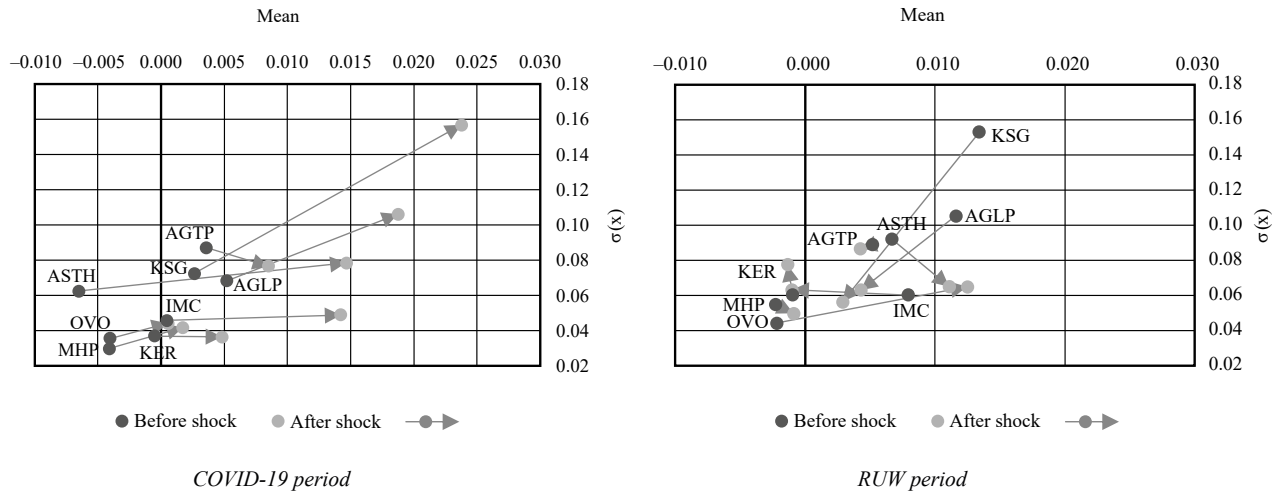


Figure 3: Changes in the risk-expected return correspondence through passing shocks: comparative analysis. Source: own composition

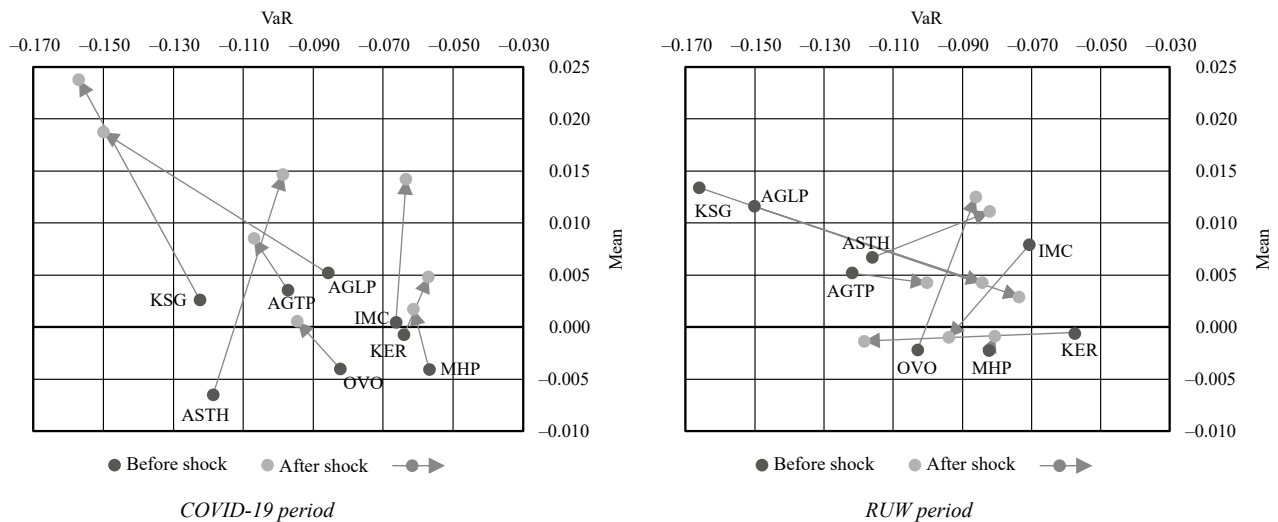


Figure 4: Changes in the VaR-expected return correspondence through passing shocks: comparative analysis. Source: own composition

After the pandemic, the average share value increased for all companies, and while half of the companies had negative average profitability before the pandemic, all agroholdings had positive profitability after the pandemic. However, investment risk increased for most companies, on average by 134%. The impact of the war was more pronounced. Most companies experienced a decline in average profitability, but MHP, Ovostar and Astarta managed to improve their position slightly. It's interesting to note the decline in investment risk, which was 8.2% before the war, peaked at 11.2% during the shock period and then fell sharply to 6.6%. This again underlines the importance of agriculture as one of the most, if not the most, important sectors in Ukraine. The figure shows the risk-return relationship based on the classical Markowitz risk-return frameworks.

Risk assessment has also been realised within the Value at Risk (VaR) and Conditional Value at Risk (CVaR) frameworks. Value at Risk (VaR) assesses the amount of potential loss, taking into account the confidence level and time hori-

zon. CVaR is a forward-looking measure that focuses on the tail of the probability distribution function of losses. CVaR is calculated by taking the weighted average of the “extreme” losses in the tail of the distribution above the VaR cut-off point.

It should be noted that while the choice of VaR or CVaR is not always clear-cut, the majority of respondents believe that using the latter method generally leads to a more conservative risk approach. Figure 4 illustrates the results.

Based on Figure 4, we draw some conclusions. The pandemic did not have a significant impact on agricultural holdings. For most agroholdings we observe an increase in return, but the high level of uncertainty also led to an increase in risk. Conversely, the results after the RUW shock are quite the opposite. The decrease in average return was quite predictable, but the decrease in investment risk was not. This method also confirms our earlier findings using the variability assessment method.

The final step of our comparable analysis concerns liquidity. Liquidity is assessed using a measure such as the

average daily trading volume of stocks. Examining changes in risk and profitability confirms assumptions about fluctuations in daily trading activity over periods.

For most companies, there is a slight decrease in average trading volume during the COVID-19 shock period and a significant increase in the post-shock period. Only MHP and Ovostar show a negative trend. During the RUW, however, share trading decreased significantly: no company returned to pre-shock levels, but half of the companies showed a positive trend. A comparison is shown in Figure 5.

Overall, we can conclude that agrohholdings were resilient to the pandemic and continued to grow, but the war had a devastating effect on all of them. The explanation, in our view, is that there are different degrees of uncertainty about the shocks. For the first shock, the uncertainty was global and all investors reduced their activity. However, the recovery from the COVID-19 shock was quite rapid. There was a strong rebound in business activity. Investment in the food industry and commodities revived. Investors began to reformat their portfolios. Ukrainian agrohholdings were part of this process. As a result, liquidity increased.

The liquidity situation of shares of Ukrainian agricultural holdings during the RUW is different. The high uncertainty about the business development of these companies limits the interest of investors and their low liquidity. It has decreased.

From the results, it can be said that Astarta and Ovostar have the best dynamics, as evidenced by their recovery almost to pre-shock levels, while the worst situation is seen in Kernel and MHP. At the beginning of the war, Verevsky bought 134,000 hectares of land on the Warsaw Stock Exchange to reduce business risks and improve liquidity. The company was forced to take this step because of the high level of uncertainty. As a result of the sale of almost 30% of its land, Kernel will receive about \$210 million, which will be used to service its debts. In addition, Kernel has lost over \$100 million due to spoiled meals and the devaluation of its business reputation in the oilseed processing industry. MHP suffered colossal losses in poultry farming, leading the agribusiness to reduce production capacity to 85%.

In particular, the impact of the pandemic on agrohholdings was relatively muted, with a remarkable post-pandemic growth boost of more than 1.5 times. However, the COVID-19 pandemic led to an economic downturn that reduced demand for some products, including agricultural products. MHP and Ovostar were hardest hit, recovering only 58% and 80% respectively. At the same time, KSG Agro and Agroleague managed not only to withstand the shock but also to grow three times. Conversely, the outbreak of the war had a devastating effect on the entire spectrum of agricultural holdings. On average, agricultural stocks fell by 51% during the shock period, with a subsequent recovery rate of 63%.

In the aftermath of the pandemic, there was a marked increase in the average share prices of all companies, a marked departure from the negative average returns observed before the pandemic. In stark contrast, the post-pandemic period saw a more pronounced effect, with the majority of companies experiencing significant declines in average profitability.

In addition, the results of the Value at Risk (VaR) and Conditional Value at Risk (CVaR) assessments underlined the differences in risk escalation during periods of instability. In particular, COVID-19 did not have a significant impact on agrohholdings. Most of them experienced an increase in profitability, but the high level of uncertainty also led to an increase in risk. The opposite results were observed after the war shock. The decline in average returns was fairly predictable, but the decline in share price volatility was not.

We use the average daily trading volume of shares to measure liquidity. For most companies, there was a slight decrease in average trading volume during the shock period and a significant increase in the post-shock period. MHP and Ovostar showed negative dynamics. During the war, however, share trading decreased significantly: none of the companies reached the level of the pre-shock period, but most companies showed positive dynamics.

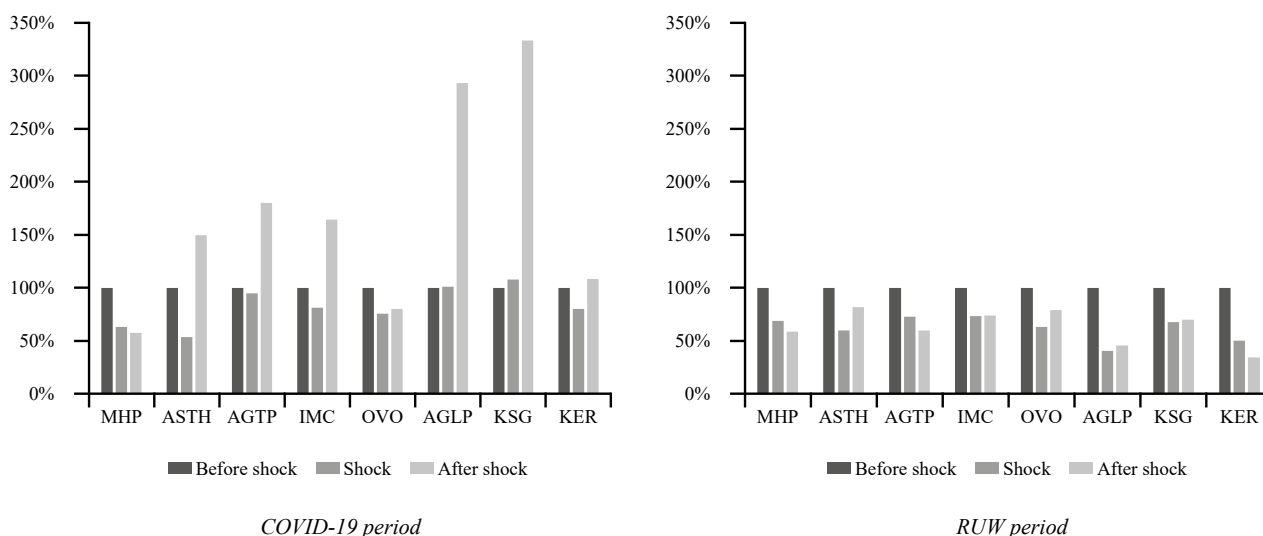


Figure 5: Comparison of the liquidity of agrohholdings' stocks in passing shocks.

Source: own composition

Discussion and Conclusions

Our study analyses the impact of two macroeconomic shocks (COVID-19 pandemic and RUW) on the agricultural sector in Ukraine, focusing on agrohholdings. Our results show significant differences in the resilience and vulnerability of these subjects to the shocks under consideration. During the COVID-19 pandemic, agrohholdings showed considerable resilience. Despite the initial drop in demand for agricultural products, most farms managed to recover and even exceed their pre-pandemic performance. This period highlighted the adaptive potential of Ukrainian farms, as they used their operational flexibility and market positioning to mitigate the negative impact of the pandemic. By contrast, the full-scale war that began in 2022 had a devastating impact on the agricultural sector. The destruction of infrastructure, the loss of farmland and the disruption of transport routes have had a severe impact on all major agrohholdings. Our analysis shows that the war led to a sharp decline in share values and trading volumes, significantly affecting the financial stability and operational capacity of these companies. Recovery from the crisis has been much slower than during the pandemic, indicating the deep and long-term impact of this shock. This brings to the fore the risk of competition from global players. The difficulty of attracting investors under wartime conditions.

The policy implications of our study are twofold. The first is the need to develop an adaptation strategy for Ukrainian agrohholdings. The second is the need for robust risk management strategies and investment in resilient infrastructure to protect the agricultural sector from future shocks. Increased support for smallholders and family farms, which have shown greater resilience, could also be a strategic focus for policymakers. In addition, promoting diversification within the agricultural sector can mitigate the risks associated with overdependence on specific commodities and markets.

In conclusion, while Ukraine's agricultural sector faces unprecedented challenges, it also shows remarkable resilience and adaptability. It can be further explored through continued investment, strategic policy interventions and a focus on sustainable practices. This will manage future uncertainties and ensure the long-term viability of Ukraine's agricultural economy.

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