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Strategic management of food security in the context of military risks: Management models and institutional mechanisms in Ukraine

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ABSTRACT

Global food security faces macroeconomic instability, food price shocks, and structural household vulnerability. Ukrainian agribusiness, amid full-scale war, operates under disrupted production and logistics chains, reduced resources, rising transaction costs, and increased risks to food accessibility. This article theoretically and empirically examines strategic management of food security in Ukraine during wartime. Secondary data from the FAO and monthly consumer and food price indices for 2019–2024 were analyzed using correlation (Pearson, Spearman, Kendall) and ANOVA methods, with CPI Gap indicators and paired t-tests applied. Results show a significant positive correlation between food prices and global food insecurity, structural asymmetry in inflation with food prices outpacing overall CPI, and a context-dependent wartime effect explaining 12% of inflation variance. The empirical findings are integrated into a hierarchical strategic management framework that links policy instruments, management models, and institutional mechanisms. The proposed strategic approach integrates state instruments, management models, and institutional mechanisms with measurable indicators, offering cross-sectoral applicability for public authorities and agri-food entities during war and post-war recovery.

Keywords: food security, agri-food sector, combat operations, crisis management, supply chains, public and corporate governance

INTRODUCTION

Over the past decade, food price volatility, macroeconomic instability, and household vulnerability have become increasingly important for global food security. According to the FAO (2025b), the ability of some countries to mitigate the impact of rising food prices has been significantly weakened by trade, monetary, and fiscal policies, as well as challenges caused by the pandemic, especially among developing and least developed countries. However, as the global economy recovered from the pandemic, a series of cascading problems came to the fore, leading to rising inflation, especially in food prices. Supply tensions were particularly exacerbated by geopolitical shocks, such as the war in Ukraine, which soon replaced post-pandemic demand growth supported by significant fiscal stimulus, as well as disruptions to trade routes, which were exacerbated by a series of meteorological and other extreme events. In other words, given the global challenges and risks associated with the war, Ukraine's food sector is currently operating amid systemic disruptions to production and logistics chains, the loss of some of its resource and infrastructure capacity, rising transaction costs, and increased risks to the physical and economic accessibility of food for the population.

The aim of this scientific article is to provide a scientific, theoretical, and empirical justification of the global state of the problem under study and the local impact of the war on food inflation and consumer prices in Ukraine. The article focuses on applied modeling of an improved approach to strategic management of food security in Ukraine in the context of military and post-crisis risks, based on the integration of crisis management tools, mechanisms of state and corporate governance, as well as adaptive management of agri-food supply chains.

LITERATURE REVIEW

The macroeconomic view of food security as a function of production volumes and resource availability was linked to early concepts of food security. Thus, the basis for analyzing

the mismatch between population growth and food production was laid in the theory of diminishing food availability (FAD) proposed in Malthus (1968). Sen (1977), on the other hand, questioned Malthus' theory and proposed another, rights-based theory that identifies political and economic inequality as the main causes of famine. His approach, based on the principle of social and economic access to food, complements the definition of food security as the physical availability of food. In another work on the 1943 famine in Bengal, Sen (1997) shifted the focus from stimulating food production to the need to ensure equitable access to resources. The variety of approaches to food theory, as noted by Cui and Zhang (2025), has made it possible to identify the main processes of past food crises and develop effective strategies to overcome them in the future. However, in times of crisis, it becomes necessary to transform traditional classical and neoclassical theories related to the development of food security, which leads to a shift in scientific discourse towards minimizing negative impacts. For example, Nekmahmud (2024), drawing on food security concepts, proposes a new conceptual framework for the paradigm of food consumption during crises. Instead, using econometric methods, Olufemi-Phillips et al. (2024) created a model of dynamic interaction between inflation rates, food prices, and socio-economic determinants.

At the same time, a priority topic in the scientific works of Ukrainian scientists is the assessment of food security risks in the context of war. Among them, Antonyuk (2024) and Krivokhyzha et al. (2023) note that infrastructure destruction, reduction of arable land, and supply disruptions are the main factors negatively affecting agriculture. Also relevant is the study conducted by Kemmerling et al. (2022) on the logic of conflicts on the African continent between 2015 and 2021 and the resulting food price crises. According to the conclusions of Ben Hassen and El Bilali (2022), the war in Ukraine was not the direct cause of the third global food price crisis in 15 years; rather, it was due to the inability to transform global food systems, which had an immediate cascading effect on global food security. As a result, the scientific debate on strategic food security management to stabilize the agri-food system proposes appropriate measures, including: Ensuring predictability and timeliness of risk response (Masyuk & Zaika, 2022); minimizing market distortions (Niu, 2025); strengthening operational management, monitoring, and forecasting capabilities (Larsson & Sjöqvist, 2022); and ensuring the quality and completeness of data for management decision-making (Stetsiv, 2023). In addition, it is associated with reducing the vulnerability of the population (Maphiri, 2022) by ensuring the continuity of food supplies (Tariq, 2025).

Despite the substantial body of research on food security in crisis conditions, several important gaps remain. First, existing wartime food security studies predominantly focus either on macroeconomic price dynamics or on institutional policy responses, while insufficient attention is given to their integrated interaction within a unified strategic management framework. Second, prior research rarely combines global food security indicators with national wartime inflation dynamics in a single analytical design. Third, the hierarchical relationships between management models, policy instruments, and institutional mechanisms remain underexplored in the literature, particularly in the context of prolonged military risks.

To address these gaps, this study develops an integrated strategic framework that combines empirical macroeconomic analysis with institutional and management dimensions of food security governance during wartime. The paper contributes by:

(1) Empirically validating the price–insecurity relationship using global and national data;

(2) Quantifying the wartime structural effect on food inflation dynamics; and

(3) Proposing a multi-level strategic management model linking state instruments, management models, and institutional mechanisms.

METHODS

Data Sources and Analytical Sample

The study was based on an analysis of secondary statistical data from the Food and Agriculture Organization (FAO, 2025a, 2025b, 2025c) on food security (data for 2015; 2019–2024), some related indicators, i.e., the food price index (data for 2015; 2019–2025), and the global level of undernourishment (data for 2015; 2019–2024). The collected food security and malnutrition indicators were supplemented with forecast data for the period up to 2025 for further use in studying correlations within the study.

A correlation analysis between the FAO Food Price Index (FFPI) and the proportion of people with food insecurity was performed using JASP software (Correlation tool) to identify the relationship between price and accessibility parameters of food security. The obtained values of Pearson's (r), Spearman's (rho), and Kendall's (tau B) coefficients confirmed the stability of the relationship between the studied variables (even with a small sample size). The results of this type of analysis demonstrated the relationship between price and accessibility parameters of food security.

Sample, Variables, and Statistical Procedures

To empirically assess the impact of the war on food inflation and consumer prices in Ukraine, monthly consumer price indices and food price indices for 2019–2024 were used, compiled in accordance with the official methodology of the State Statistics Service of Ukraine and presented in the format "December to December of the previous year."

For a more in-depth interpretation of the identified asymmetries, an integral CPI Gap indicator was constructed, defined by the formula:

$$CPIGap = FoodCPI - OverallCPI \quad (1)$$

where

Overall CPI – consumer price indices;

Food CPI – food price indices.

The initial data was divided into groups according to periods: Pre-war (from January 2019 to February 2022); full-scale war / wartime (from March 2022 to December 2024);

forecast (for 12 months of 2025). Also, for the calculations, the periods were coded from 1 to 3, respectively.

In order to take into account the inertial nature of inflationary processes, the values for 2025 were predicted using the Excel analysis package (the "FORECAST.ETS" tool).

As part of the analysis of the impact of the war on food inflation and consumer prices in Ukraine, the above-mentioned initial data were formed, for which a paired t-test (Paired Samples T-Test) was performed in the JASP software, which made it possible to assess the presence of a systemic difference between the Overall CPI and Food CPI indices.

In turn, repeated measures analysis of variance (Repeated Measures ANOVA tool in JASP software) was used to simultaneously assess the effect of the price index type and the impact of each macroeconomic period (codes 1-3).

Instead, to identify differences in the CPI Gap between Pre-war, Full-scale war, and Forecast (codes 1-3, respectively) periods, a one-way analysis of variance (the "One-way ANOVA" tool in JASP software) was performed, which allowed us to identify the highest amplitude and structural instability of the gap in the measured data.

Further analysis of secondary statistical data on changes in the Logistics Performance Index (LPI) for the period 2014–2023 was carried out using official data from the World Bank (2023). This analysis was conducted to confirm the previously identified fragmentation of supply chains and to further confirm the protracted hostilities as a factor contributing to the fragmentation and complexity of global logistics networks.

Model Development

The mixed-methods approach enabled the examination of critical elements of food security in Ukraine during the war. The quantitative part of the study is based on the analysis of secondary data, i.e., information obtained from official statistical and analytical reports of international organizations. The prevalence of undernourishment and moderate/severe food insecurity was visualized to further understand trends in food availability for the population in the pre-war and war periods, which which enabled the identification of structural cracks caused by the onset of full-scale aggression and quantitatively assess the extent of the deterioration in the food situation. Analysis of the content of strategic documents and scientific works enabled the classification and refinement of the current set of management models, institutional mechanisms, and public policy instruments that have been or could be used to intervene in the food situation. The complete monthly dataset used for the CPI Gap calculations is provided in **Appendix A** (**Table A1**).

RESULTS AND DISCUSSION

The Global Context of Transforming Food Security Management in Crisis Situations

Based on the results of the analysis of global time series shown in **Figure 1**, trends in food insecurity (particularly moderate and acute) after 2019 were identified. It was found that the share of the population experiencing acute food insecurity increased from 9.0% in 2019 to 10.5% during 2020–2022. Similar patterns are observed for moderate food insecurity (an increase from 15.9% in 2019 to 18% in 2022–2023). This suggests structural constraints in the global food system. Such constraints go beyond the temporary effects of the general crisis conditions associated with the pandemic and globalization, as they are systemic in nature (FAO, 2025b).

At the same time, after 2020, there is a sharp phase change in the Food Price Index value after 2020, as illustrated in **Figure 2**. Although the average value of the index was relatively stable (from 93.1 to 94.9) during 2015–2019, in 2021–2022 there was a sharp increase in prices to 125.7 and 144.5, respectively. In this regard, the FAO report (2025b) notes that the main drivers of this growth are disruptions in logistics chains, rising energy costs, trade restrictions, and military conflicts, including the war in Ukraine, given its role in supplying food to the Middle East and North Africa (MENA). Despite a partial stabilization of the index in 2023–2024, data

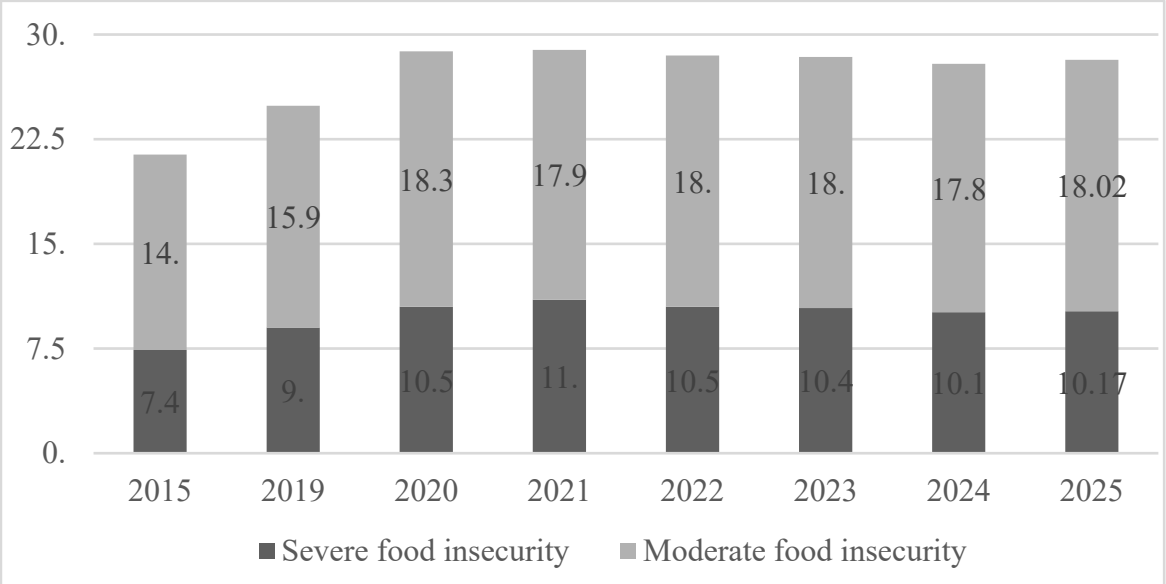


Figure 1. Global food security level (FAO, 2025b) (Note: Data for 2025 were projected by the authors)

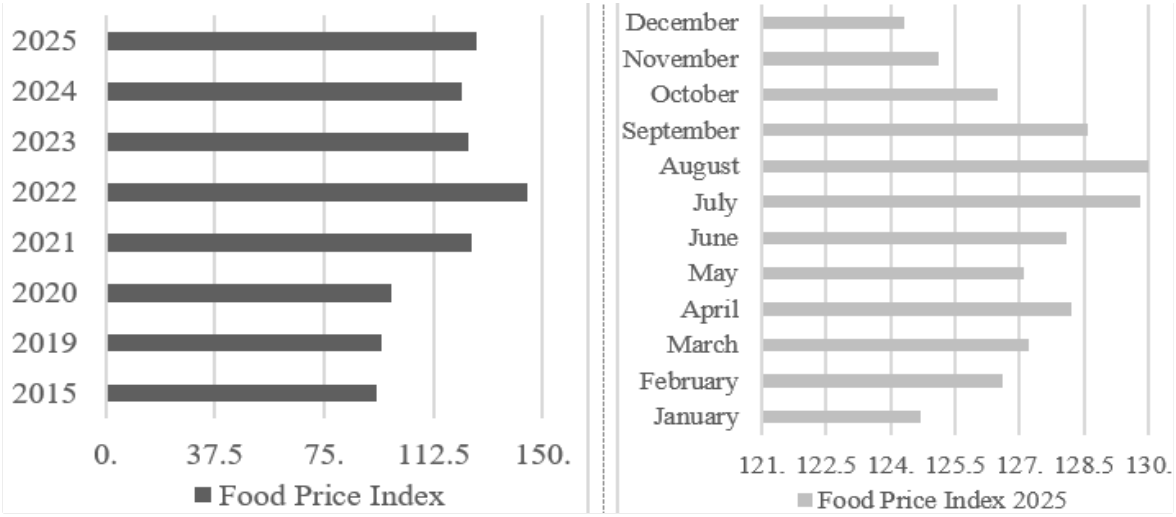


Figure 2. Average food price index (FAO, 2025b)

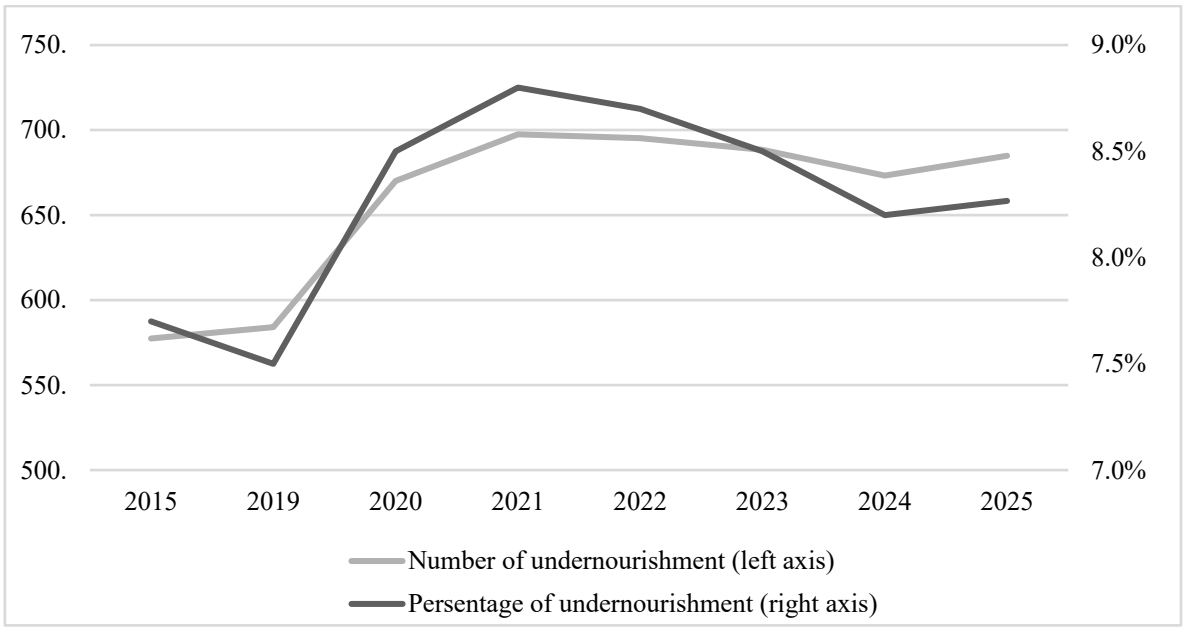


Figure 3. Prevalence of undernourishment on a global scale (FAO, 2025a)

for 2025 indicate that the current price trajectory is irreversible and that volatility will continue to increase.

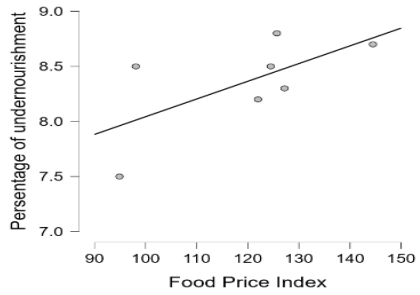
In turn, the dynamics of malnutrition prevalence on a global scale (**Figure 3**) confirms the long-term nature of these processes. After relative stability in 2015–2019, the proportion of the population suffering from chronic undernourishment increased from 7.5% to 8.8% in 2021, and the absolute number of undernourished people exceeded 697 million. Despite a slight decline in 2023–2024, projections for 2025 indicate that malnutrition will remain above 8%, which, according to FAO (2025a), reflects the new reality faced by the global food system in the context of protracted crises.

In view of the above, it is proposed to check for a correlation between the FAO Food Price Index (FFPI) and the proportion of people with food inaccessibility, which will demonstrate the relationship between price and accessibility parameters of food security. For this purpose, aggregated global time series ($n \approx 7$) were created, the results of statistical processing of which are presented in **Table 1**.

Correlation analysis between FFPI and the proportion of the population experiencing food insecurity shows a positive and moderately strong relationship (Pearson's $r = 0.649$; $p < 0.05$). The obtained Spearman and Kendall coefficients confirm the stability of this relationship even with a small sample size, which is consistent with the FAO's conclusions about the systemic nature of the impact of price shocks on food security. In other words, rising food prices are not an isolated macroeconomic phenomenon, as they are currently a structural factor in the deepening of food insecurity and malnutrition.

It should be noted that the correlation analysis is based on a relatively small number of aggregated annual observations, which limits the statistical power of the results. Therefore, the findings should be interpreted as indicative rather than conclusive evidence of the price–insecurity relationship. To mitigate this limitation, non-parametric correlation coefficients (Spearman and Kendall) were additionally

Table 1. Correlation between the FAO Food Price Index (FFPI) and the proportion of people with food insecurity

Scatter plots	Analysis						
	Pearson						
	n	r	p	Lower 95% CI	Upper 95% CI	Effect size (Fisher's z)	SE effect size	Covariance
	7	0.649	0.05*	-0.049	1.000	0.773	0.500	4.872
	Spearman						
	n	rho	p	Lower 95% CI	Upper 95% CI	Effect size (Fisher's z)	SE effect size	Covariance
	7	0.613	0.072	-0.109	1.000	0.713	0.464	4.872
	Kendall						
	n	tauB	p	Lower 95% CI	Upper 95% CI	Effect size (Fisher's z)	SE effect size	Covariance
	7	0.488	0.064	0.013	1.000	0.533	0.255	4.872

Note. All tests one-tailed, for positive correlation; *p < .05, **p < .001, one-tailed

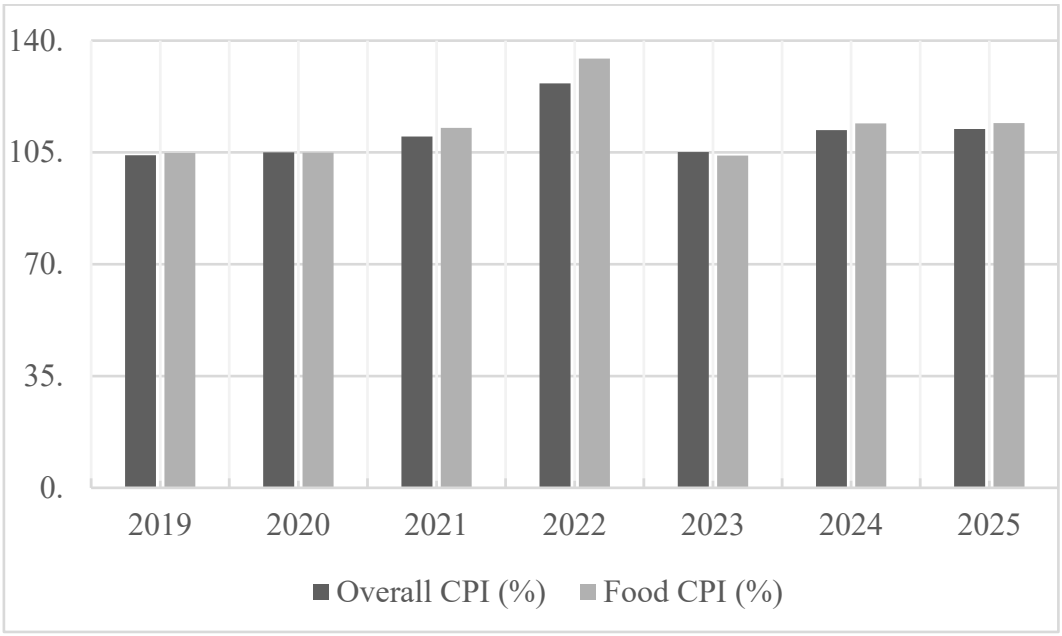


Figure 4. Dynamics of consumer price indices in Ukraine for 2019-2025 (State Statistics Service of Ukraine, 2025); Note: data are shown for December compared to December of the previous year; data for 2025 were projected by the authors

employed, which are more robust under small-sample conditions.

The Impact of War on Food Inflation and Consumer Prices in Ukraine

The war in Ukraine caused profound economic turmoil, including rapid inflation, which peaked at 26.6% in 2022. The destruction of infrastructure, disruption of logistics chains, and devaluation of the hryvnia led to a significant increase in the cost of essential goods, which particularly affected low-income groups. The dynamics of changes in consumer price indices in Ukraine, shown in **Figure 4**, indicate that food inflation structurally outpaced overall consumer inflation, especially during the period of full-scale military operations, reflecting the increased sensitivity of food markets to security and institutional shocks.

Thus, food price inflation reached 134.4% in 2022 compared to 126.6% of the overall CPI, indicating a significant inflation gap. In contrast, between 2019 and 2021, the growth of the overall consumer price index and the food price index was largely synchronous. Inflation slowed briefly in 2023, but in 2024 both the overall (112.0%) and food (114.1%) indices rose again (by 6.9% and 10.1% compared to 2023, respectively). The continuation of this trend into the future is confirmed by forecasts for 2025, which threaten to limit short-term stabilization mechanisms and maintain the inertial nature of inflationary pressure in the food sector.

The above trends highlight that the risks associated with the war, due to increased overall inflationary pressure in the Ukrainian economy, have caused a qualitative transformation of its structure, within which food inflation has become more volatile and autonomous. This highlights the need for an in-depth statistical analysis of the relationship between overall and food inflation, as well as an assessment of the role of the war factor as a determinant of price asymmetry.

The work on studying the impact of the war on food inflation and consumer prices in Ukraine includes:

Initial data

The initial research data, including the dynamics of consumer and food price indices in Ukraine and the results of the CPI Gap calculation, are presented in **Figure 5**.

A preliminary analysis of consumer and food price index dynamics (source data) showed that in the pre-war and wartime periods, fluctuations in both indicators were relatively synchronous, while since 2022, food inflation has consistently and systematically outpaced the overall consumer

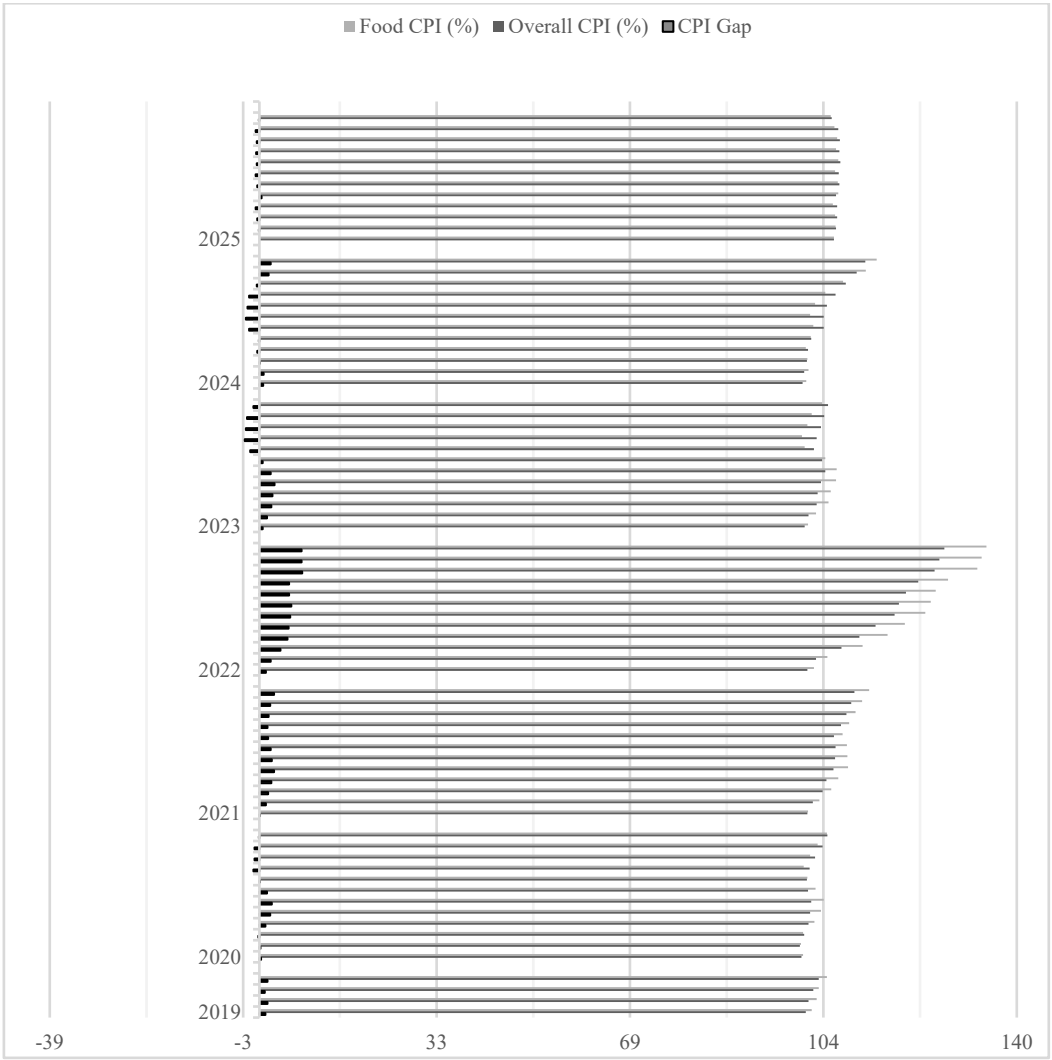


Figure 5. Initial data for statistical analysis of the impact of war on food inflation and consumer prices in Ukraine (Source: Calculated based on State Statistics Service of Ukraine, 2025); Note: Data is shown for December to December of the previous year; data for 2025 was projected by the authors

Table 2. Paired samples t-test

	N	Mean	SD	SE	Coefficient of variation
Overall CPI (%)	84	106.0	5.724	0.625	0.054
Food CPI (%)	84	107.1	7.552	0.824	0.071
Paired samples t-test					
Measure 1		Measure 2	t	df	p
Overall CPI (%)	-	Food CPI (%)	-4.574	83	< .001

Source: Calculated by the authors; Note: Student's t-test

price index. This asymmetry in inflation dynamics indicates a disruption in traditional price transmission mechanisms and highlights the need for statistical verification of the hypothesis of a structural difference in food inflation in wartime conditions. However, given that the values of the general and food indices are measured for the same time periods, a paired t-test was used to assess the existence of a systemic difference between these two indices, the results of which are presented in **Table 2**.

The results of the t-test showed a statistically significant difference between Overall CPI and Food CPI, with the average value of the food index being higher (MeanFood CPI = 107.1); and its variation significantly exceeds the variation of the overall consumer price index (CVFood CPI = 0.071), indicating higher volatility of food prices. The results of the t-test ($t(83) = -4.574$, $p < 0.001$) indicate that food inflation in Ukraine is higher and more unstable, which is critically important in terms of food security and social vulnerability of the population.

Repeated measures ANOVA

Further analysis was deepened by applying variance analysis with repeated measurements (**Table 3**), which made it possible to simultaneously assess the effect of the price index type and the impact of the macroeconomic period, including the war period.

Table 3. Repeated measures ANOVA

RM Factor 1	Period	N	Mean	SD	SE	Coefficient of variation
Level 1	1	38	103.6	2.515	0.408	0.024
	2	34	108.3	7.932	1.360	0.073
	3	12	106.8	0.475	0.137	0.004
Level 2	1	38	104.7	3.112	0.505	0.030
	2	34	110.0	10.817	1.855	0.098
	3	12	106.5	0.422	0.122	0.004
Within subjects effects						
Cases	Sum of squares	df	Mean square	F	p	η^2
RM Factor 1	21.69	1	21.695	8.892	0.004	0.003
RM Factor 1 ✻ Period	19.12	2	9.558	3.918	0.024	0.003
Residuals	197.62	81	2.440			
Between subjects effects						
Cases	Sum of squares	df	Mean square	F	p	η^2
Period	899.7	2	449.85	5.750	0.005	0.120
Residuals	6336.8	81	78.23			

Source: Calculated by the authors; Note: Type III sum of squares

Table 4. ANOVA (descriptives – CPI Gap)

Period	N	Mean	SD	SE	Coefficient of variation
Pre-war	38	1.100	0.972	0.158	0.884
Full-scale war	34	1.715	3.298	0.566	1.923
Forecast	12	-0.358	0.342	0.099	-0.955
ANOVA-CPI gap					
Cases	Sum of squares	df	Mean square	F	p
Period	38.23	2	19.115	3.918	0.024
Residuals	395.21	81	4.879		

Calculated by the authors; Note: Type III sum of squares

The results of Repeated Measures ANOVA confirmed the presence of a statistically significant effect of index type ($F = 8.892$, $p = 0.004$), indicating a systemic difference between general and food inflation regardless of time. At the same time, a significant interaction between index type and period ($F = 3.918$, $p = 0.024$) indicates that this difference is context-dependent and significantly intensifies during wartime. A significant between-group effect of period ($F = 5.750$, $p = 0.005$, $\eta2 = 0.120$) further confirms that war is an independent factor that structurally transforms inflationary processes, explaining a significant portion of the variation in price indices. That is, the period explains 12% of the dispersion of inflation indicators, which is a medium-large effect for macroeconomic data. In practical terms, this finding indicates that wartime conditions constitute a statistically meaningful macroeconomic factor influencing inflation dynamics. Although other economic variables also contribute to price fluctuations, the war period itself accounts for a substantial portion of inflation variability, confirming its structural role rather than a temporary shock effect.

One-way ANOVA

A one-factor variance analysis was conducted to identify differences in the CPI Gap between:

1) The Pre-war,
2) Full-scale war, and
3) Forecast periods.

The results of this stage of the analysis are presented in **Table 4**.

The results of one-factor variance analysis demonstrated statistically significant differences in the CPI Gap between the pre-war (1), ongoing full-scale war (2), and forecast (3) periods. The largest amplitude and structural instability of the gap were recorded during the war ($F(2.81) = 3.918$, $p = 0.024$, $\eta2 = 0.088$), indicating the disintegration of supply chains, increased transaction costs, and limited instruments of state and corporate price regulation.

Disintegration of supply chains

Prolonged hostilities in eastern and southern Ukraine and, as a result, the deterioration of the geopolitical situation and related macroeconomic factors, such as energy shocks and rising transaction costs, are the main causes of supply chain disintegration, reflected in the fragmentation and complexity of global logistics networks. To ensure the continuity of food supplies, economic entities are forced to refocus on localizing production, diversifying suppliers, shortening value chains, and gradually transitioning from a "just-in-time" logic to models focused on increasing resilience, redundancy, and risk management (Sutar et al., 2025).

At the same time, according to the World Bank ranking (shown in **Figure 6**), Ukraine rose 14 positions in 2023 compared to the previous ranking and took 66th place among 160 countries, indicating a partial adaptation of the logistics system to wartime conditions. At the same time, the dynamics of the LPI in 2014–2023 show an overall decline from 2.98 in 2014 to 2.7 in 2023, reflecting long-term structural constraints on the development of the logistics sector in Ukraine (World Bank, 2023).

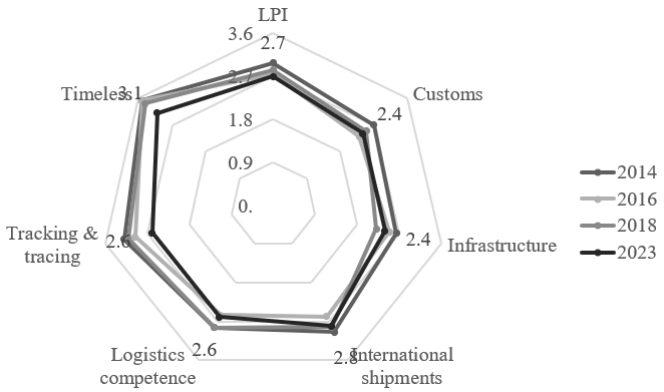


Figure 6. Logistics performance index in Ukraine in 2014–2023 (World Bank, 2023)

According to the LPI sub-index breakdown, the most vulnerable components remain customs procedures (Customs) and logistics competence (Logistics competence), which scored 2.4 and 2.6 respectively in 2023, while infrastructure indicators show a tendency toward stagnation or decline (from 2.65 in 2014 to 2.22 in 2018). Particular attention should be paid to the decline in the tracking and tracing index from 3.2 in 2014 to 2.6 in 2023, which indicates growing problems in managing product flows during the war. In addition, the uneven load on the European logistics infrastructure and the congestion of road and air transport routes are caused by the low level of transport infrastructure development and a significant outflow of labor, primarily to European Union (EU) member states. In view of this, it is particularly important to modernize Ukraine's logistics infrastructure, much of which was built in the 1990s. This modernization involves both the replacement of outdated equipment and engineering structures and a systematic rethinking of logistics processes in line with the requirements of digitalization.

Food insecurity and risks to food access among the Ukrainian population during the war

The full-scale invasion of Ukraine by the Russian Federation has worsened the food situation for vulnerable populations and created additional risks for the production, logistics, and export capabilities of the agri-food sector (FAO, 2025b). According to FAO (2025b), moderate undernourishment (5.3%) and food insecurity (28.2%) in 2020–2022 increased to 6.9% and 32.5% in 2022–2024. respectively, the prevalence of undernourishment and moderate or severe food insecurity in Ukraine increased in 2022–2024 compared to previous periods (**Figure 7**). Due to problems with logistics, transport security, and lower family incomes, residents of frontline and frontline areas are particularly vulnerable and have limited access to food. According to estimates by the World Food Programme (2025), approximately 5 million Ukrainians suffer from serious food accessibility problems, which are particularly acute in areas close to the front line.

The military events in Ukraine in 2022–2023 posed a serious threat to food security not only in Ukraine but also in many underdeveloped countries around the world that depend on grain exports. Russia's military aggression has led to a number of negative consequences that have the most significant impact on the country's food security:

(1) Disruption of normal supply chains;

(2) Cancellation of the winter crop harvest and disruption of crop rotation in 2022 due to the spread of military operations in agricultural regions, such as Kharkiv, Mykolaiv, Kherson, and Zaporizhzhia regions; and

(3) The blockade of most of Ukraine's seaports on the Black and Azov Seas (Krivokhyzha et al., 2023).

As Ukraine is one of the world's major suppliers of grain and oilseeds, the blockade of ports and constant attacks on transport and logistics infrastructure have severely limited the country's export capabilities, affecting the availability and price of food both domestically and internationally (Polityuk, 2025).

It should be noted that, in a broader context, food insecurity in Ukraine is part of the global food crisis, as the country supplied a significant share of the world market with wheat, corn, and sunflower oil prior to the conflict. This has

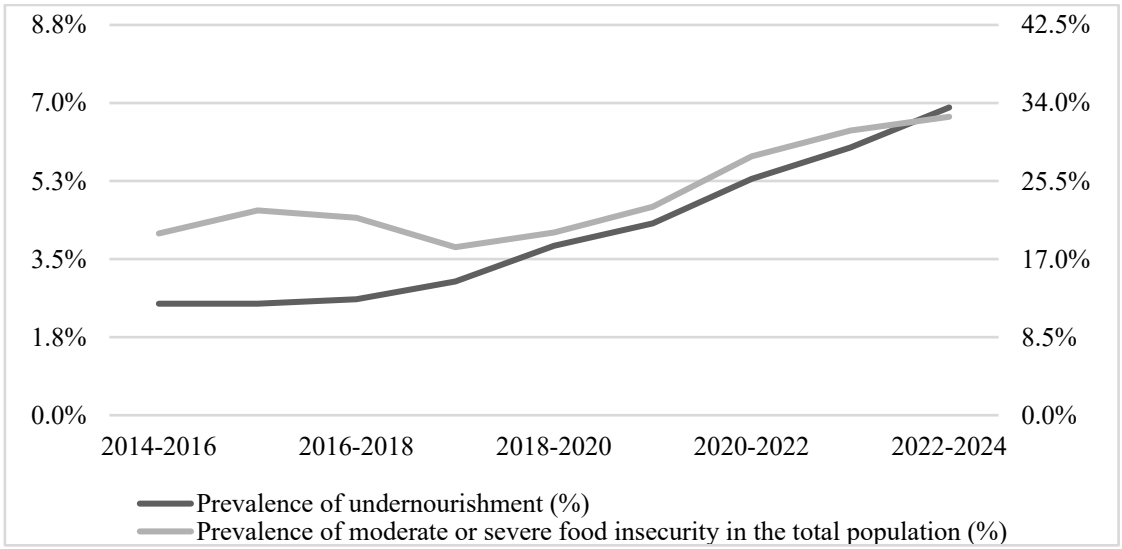


Figure 7. Prevalence of undernourishment and food insecurity (moderate or severe) among the population of Ukraine (FAO, 2025b)

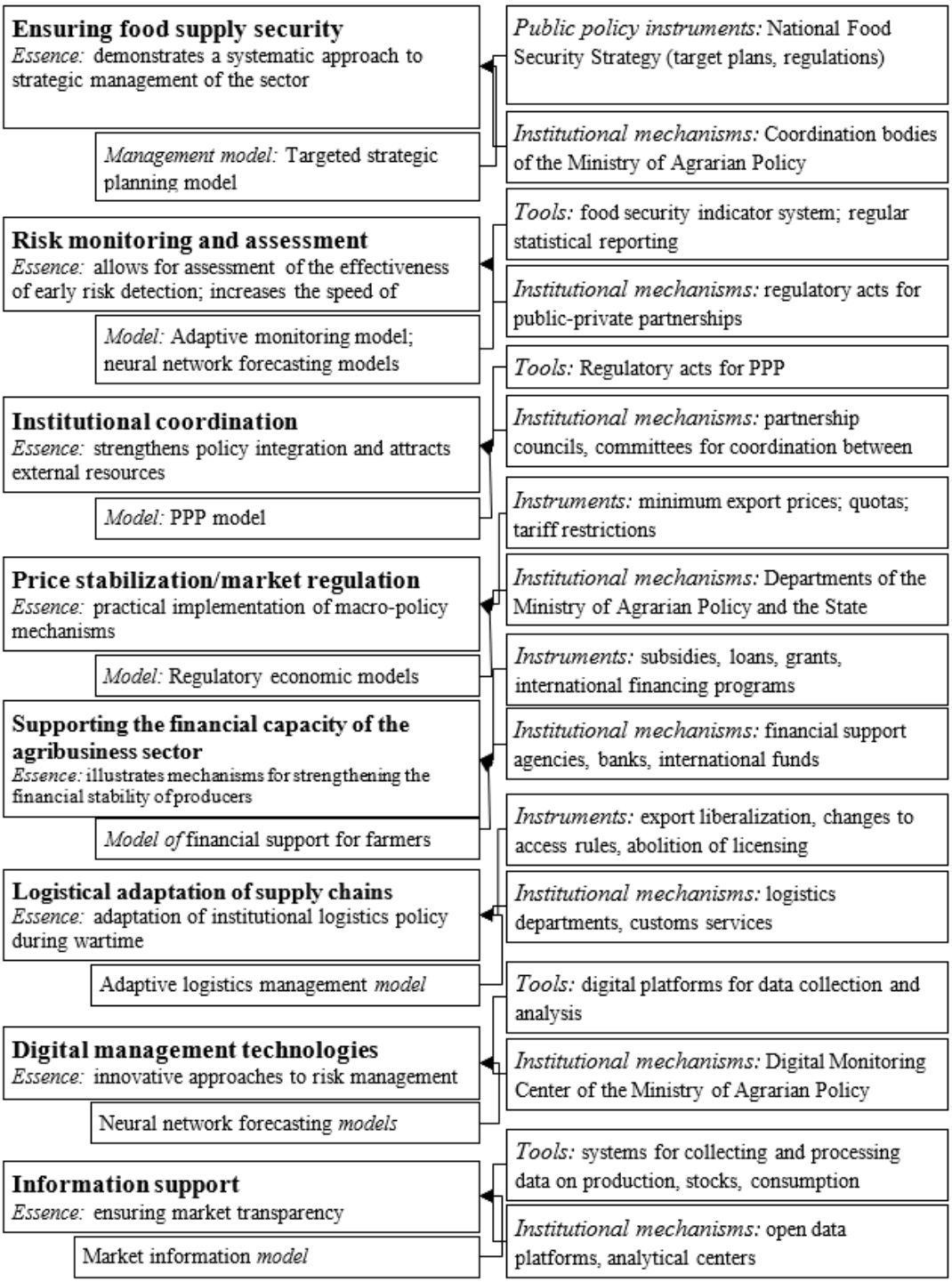


Figure 8. Recommendations for strategic food security management in conditions of military risk (Source: Authors' own elaboration)

particularly affected import-dependent countries in the MENA region, which are seeing rising prices for basic foodstuffs and an increased risk of malnutrition among the population (Ben Hassen & El Bilali, 2022; FAO, 2025c). Therefore, food insecurity during wartime is a systemic problem caused by the simultaneous interaction of production, logistical, economic, and social factors. These factors create a complex and protracted food crisis that requires appropriate strategic management decisions (**Figure 8**), taking into account the domestic and international dimensions of food security.

To clarify the internal logic of the proposed framework, the relationships between management models, policy instruments, tools, and institutional mechanisms are structured hierarchically and causally. At the strategic level, public policy instruments define priorities, regulatory conditions, and strategic goals of food security governance. At the managerial level, management models operationalize these priorities by determining planning, monitoring, and adaptive decision-making approaches. At the operational level, tools represent specific regulatory, financial, and analytical instruments used to implement management decisions. Finally, institutional mechanisms constitute the

organizational and coordination structures that ensure practical execution of these instruments.

The comprehensive approach of the Ministry of Agrarian Policy and Food of Ukraine (MAPA) to strengthening food security in the context of military risks is based on the developed Food Security Strategy of Ukraine until 2027 (VRU, 2024), which in the first stage (2023–2027) involves infrastructure restoration, food aid provision, investment attraction and credit support for the food sector, specialist training, security provision, and local production promotion; while the second stage (post-war period) involves ensuring resilience to crises and market stability, encouraging innovation and new technologies in the agricultural sector to ensure productivity, strengthening cooperation with international partners, and protecting the environment (Krivokhyzha et al., 2023). As a result, it is recommended to establish a more effective method of ensuring food security at the intersection of state instruments, government regimes, and institutional mechanisms. Each of the above-mentioned aspects of management is characterized by certain criteria of effectiveness that allow for the assessment of resource integration, risk adaptation, and policy effectiveness.

In addition, there is a need for crisis management in wartime, given the rapid functioning of high risks in society and military risks, as well as overcoming symmetric shocks by combining strategic planning with operational flexibility (Larsson & Sjöqvist, 2022). Chains are a key element of crisis management in Ukraine's export position, and disruptions have an immediate impact on both the availability and accessibility of products within the country and on global food markets (Polityuk, 2025; Reuters, 2024). It is important to emphasize the need for the government, the agribusiness sector, and international organizations to establish the necessary cooperation mechanisms to ensure an adequate level of food security, reduce the vulnerability of the population, and guarantee continuity of supply even in a crisis situation (Maphiri, 2022; Tariq, 2025). Food insecurity in Ukraine is mainly a consequence of the war, testing the national system of public and corporate governance for its ability to apply effective crisis management methods and restore supply chains that have suffered from prolonged war, political and socio-economic instability.

CONCLUSIONS

Based on research into aspects of food insecurity and related risks to food access in Ukraine in the context of full-scale war, a new approach to strategic food security management in wartime was proposed, with the possibility of revising certain mechanisms and instruments for the post-war recovery period. It takes into account effective state instruments, relevant management models, and available institutional mechanisms with a clear definition of specific performance indicators. In view of this, the proposed improved approach has cross-sectoral applied value and can be used by state and public administration bodies (central and regional) in formulating food security strategies in conditions of high uncertainty for future periods; by local self-government bodies when adapting the provisions of the general food security strategy to the specific needs of the territories; and by entities in the agri-food sector to align corporate strategies with state priorities in the field of food security. Therefore, a promising direction for further research in this field is to assess the effectiveness of integrating corporate strategies of agri-food enterprises with public food security policy instruments based on a system of performance indicators.

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REFERENCES

Antonyuk, P. (2024). Food security risks in wartime and the possibilities of import substitution in pork and beef production. *Economy and Society*, (67). https://doi.org/10.32782/2524-0072/2024-67-109

Ben Hassen, T., & El Bilali, H. (2022). Impacts of the Russia-Ukraine war on global food security: Towards more sustainable and resilient food systems? *Foods*, *11*(15), Article 2301. https://doi.org/10.3390/foods11152301

Cui, S., & Zhang, Y. (2025). A comparison between Thomas Malthus's and Amartya Sen's views on famine: Natural constraints or political pathologies? *Journal of US-China Public Administration*, *22*(1), 37-43. https://doi.org/10.17265/1548-6591/2025.01.003

FAO. (2025a). *FAOSTAT: Food security data* [Statistical database]. Food and Agriculture Organization of the United Nations (FAO). https://www.fao.org/faostat/en/#data/FS/visualize

FAO. (2025b). *Hunger map* [Interactive map]. Food and Agriculture Organization of the United Nations. https://www.fao.org/interactive/hunger-map/en/

FAO. (2025c). *The state of food security and nutrition in the world 2025: Addressing high food price inflation for food security and nutrition* (Report No. cd6008en). Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cd6008en

Kemmerling, B., Schetter, C., & Wirkus, L. (2022). The logics of war and food (in) security. *Global Food Security*, *33*, Article 100634. https://doi.org/10.1016/j.gfs.2022.100634

Krivokhyzha, Y., Bashlai, S., & Kurylo, Y. (2023). Strategy for ensuring food security in Ukraine in times of war. *Economy and Society*, (55). https://doi.org/10.32782/2524-0072/2023-55-59

Larsson, O. L., & Sjöqvist, S. (2022). Managing National Food Security in the Global North: Is collaborative governance a possible route forward? *Risk, Hazards & Crisis in Public Policy, 13*(2), 118-143. https://doi.org/10.1002/rhc3.12231

Malthus, T. R. (1968). *An essay on the principle of population 1798*. University of Michigan Press.

Maphiri, M. (2022). Food security in South Africa: Lessons from the COVID-19 pandemic on creating sustainable value chains through corporate social responsibility (CSR). In S. O. Idowu, & R. Schmidpeter (Eds.), *Case studies on sustainability in the food industry* (pp. 135-158). Springer. https://doi.org/10.1007/978-3-031-07742-5_6

Masyuk, O. P., & Zaika, O. V. (2022). Public management of food security in Ukraine during the war. *Bulletin of the Kherson National Technical University, 4*(83), 165-171. https://doi.org/10.35546/kntu2078-4481.2022.4.24

Nekmahmud, M. (2024). Food consumption behavior, food supply chain disruption, and food security crisis during the COVID-19: The mediating effect of food price and food stress. *Journal of Foodservice Business Research*, *27*(3), 227-253. https://doi.org/10.1080/15378020.2022.2090802

Niu, Y. (2025). Rethinking the role of international food trade in ensuring global food security. *Food and Energy Security*, *14*(3), Article e70087. https://doi.org/10.1002/fes3.70087

Olufemi-Phillips, A. Q., Igwe, A. N., Ofodile, O. C., Eyo-Udo, N. L., & Toromade, A. S. (2024). Analyzing economic inflation's impact on food security and accessibility through econometric modeling. *GSC Advanced Research and Reviews*, 21(02), 102-128. https://doi.org/10.30574/gscarr.2024.21.2.0411

Polityuk, P. (2025, December 24). *Russian attacks on Ukrainian ports cause drop in food exports.* Reuters. https://www.reuters.com/business/russian-attacks-ukrainian-ports-cause-drop-food-exports-2025-12-24/

Reuters. (2024, December 2). *Ukraine introduces minimum export prices for major agricultural goods.* https://www.reuters.com/markets/commodities/ukraine-introduces-minimum-export-prices-major-agricultural-goods-2024-12-02/

Sen, A. K. (1977). Starvation and exchange entitlements: A general approach and its application to the great Bengal famine. *Cambridge Journal of Economics, 1*(1), 33-59. https://doi.org/10.1093/oxfordjournals.cje.a035349

Sen, A. K. (1997). From income inequality to economic inequality. *Southern Economic Journal*, *64*(2), 383-401. https://doi.org/10.1002/j.2325-8012.1997.tb00063.x

State Statistics Service of Ukraine. (2025). *Consumer price indices, 2024*. https://stat.gov.ua/en/publications/consumer-price-indices-2024

Stetsiv, I. (2023). On the issues of monitoring the economic mechanism of state management of food security. In *Scientific Bulletin of the Vinnytsia Academy of Continuing Education. Series "Ecology. Public Management and Administration"*, (3), 151-156. https://doi.org/10.32782/2786-5681-2023-3.20

Sutar, P. S., Kolte, G. C., & Yamini, S. (2025). Food supply chain disruptions and its resilience: A framework and review for resilience strategies in the digital era. *Opsearch,63,* 164-198. https://doi.org/10.1007/s12597-025-00915-z

Tariq, M. U. (2025). Public-private partnerships in crisis management: Collaboration to stabilize supply chains. In *Mass Media and Impact of Fake News on Supply Chains* (pp. 211-238). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3373-2175-2.ch008

VRU. (2024). *On approval of the food security strategy of Ukraine for the period until 2027 and approval of the operational plan of measures for its implementation* [Order of the Cabinet of Ministers of Ukraine, July 23, 2024, No. 684-p]. Verkhovna Rada of Ukraine. https://zakon.rada.gov.ua/laws/show/684-2024-p?lang=en#Text

World Bank. (2023). *Logistics Performance Index scorecard: Ukraine* [Data set]. World Bank Group. https://lpi.worldbank.org/international/scorecard/line/C/UKR/2023

World Food Programme. (2025). *Ukraine emergency* [Web page]. World Food Programme. https://www.wfp.org/emergencies/ukraine-emergency

APPENDIX

Table A1. Monthly consumer price indices, food price indices, and CPI Gap values used in the statistical analysis

Period	Year	Month	Overall CPI (%)	Food CPI (%)	CPI Gap	Period	Year	Month	Overall CPI (%)	Food CPI (%)	CPI Gap
Pre-war	2019	January	101.0	102.1	1.1	Pre-war	2022	February	102.9	105.0	2.1
Pre-war	2019	February	101.5	103.0	1.5	Pre-war	2022	January	101.3	102.5	1.2
Pre-war	2019	March	102.4	103.4	1.0	Full-scale war	2022	March	107.6	111.5	3.9
Pre-war	2019	April	103.4	104.9	1.5	Full-scale war	2022	April	110.9	116.1	5.2
Pre-war	2019	May	104.2	105.9	1.7	Full-scale war	2022	May	113.9	119.3	5.4
Pre-war	2019	June	103.6	104.8	1.2	Full-scale war	2022	June	117.4	123.1	5.7
Pre-war	2019	July	103.0	104.0	1.0	Full-scale war	2022	July	118.2	124.1	5.9
Pre-war	2019	August	102.7	103.7	1.0	Full-scale war	2022	August	119.5	125.0	5.5
Pre-war	2019	September	103.4	104.0	0.6	Full-scale war	2022	September	121.8	127.3	5.5
Pre-war	2019	October	104.2	105.0	0.8	Full-scale war	2022	October	124.8	132.7	7.9
Pre-war	2019	November	104.3	104.8	0.5	Full-scale war	2022	November	125.7	133.5	7.8
Pre-war	2019	December	104.1	104.8	0.7	Full-scale war	2022	December	126.6	134.4	7.8
Pre-war	2020	January	100.2	100.5	0.3	Full-scale war	2023	January	100.8	101.4	0.6
Pre-war	2020	February	99.9	100.1	0.2	Full-scale war	2023	February	101.5	102.9	1.4
Pre-war	2020	March	100.7	100.5	-0.2	Full-scale war	2023	March	103.0	105.2	2.2
Pre-war	2020	April	101.5	102.6	1.1	Full-scale war	2023	April	103.2	105.6	2.4
Pre-war	2020	May	101.8	103.8	2.0	Full-scale war	2023	May	103.8	106.6	2.8
Pre-war	2020	June	102.0	104.3	2.3	Full-scale war	2023	June	104.6	106.7	2.1
Pre-war	2020	July	101.4	102.8	1.4	Full-scale war	2023	July	104.0	104.6	0.6
Pre-war	2020	August	101.2	101.3	0.1	Full-scale war	2023	August	102.5	100.8	-1.7
Pre-war	2020	September	101.7	100.6	-1.1	Full-scale war	2023	September	103.0	100.3	-2.7
Pre-war	2020	October	102.7	101.8	-0.9	Full-scale war	2023	October	103.8	101.3	-2.5
Pre-war	2020	November	104.1	103.2	-0.9	Full-scale war	2023	November	104.4	102.1	-2.3
Pre-war	2020	December	105.0	104.9	-0.1	Full-scale war	2023	December	105.1	104.0	-1.1
Pre-war	2021	January	101.3	101.4	0.1	Full-scale war	2024	January	100.4	101.1	0.7
Pre-war	2021	February	102.3	103.5	1.2	Full-scale war	2024	February	100.7	101.5	0.8
Pre-war	2021	March	104.1	105.7	1.6	Full-scale war	2024	March	101.2	101.3	0.1
Pre-war	2021	April	104.8	107.0	2.2	Full-scale war	2024	April	101.4	101.0	-0.4
Pre-war	2021	May	106.1	108.8	2.7	Full-scale war	2024	May	102.0	101.9	-0.1
Pre-war	2021	June	106.4	108.7	2.3	Full-scale war	2024	June	104.3	102.4	-1.9
Pre-war	2021	July	106.5	108.6	2.1	Full-scale war	2024	July	104.3	101.8	-2.5
Pre-war	2021	August	106.2	107.8	1.6	Full-scale war	2024	August	104.9	102.7	-2.2
Pre-war	2021	September	107.5	109.0	1.5	Full-scale war	2024	September	106.5	104.6	-1.9
Pre-war	2021	October	108.5	110.2	1.7	Full-scale war	2024	October	108.4	107.9	-0.5
Pre-war	2021	November	109.4	111.4	2.0	Full-scale war	2024	November	110.4	112.1	1.7
Pre-war	2021	December	110.0	112.7	2.7	Full-scale war	2024	December	112.0	114.1	2.1

Source: State Statistics Service of Ukraine (2025)