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ANALYSIS OF THE VEGETABLE MARKET IN UKRAINE IN CONDITIONS OF WAR

Abstract. The theses examine the specific features of the functioning of Ukraine's vegetable market under martial law, which has led to significant structural and logistical changes in the agricultural sector. Economic and mathematical modeling methods are applied to analyze demand, supply, price dynamics, and regional distribution of production. Particular attention is paid to the impact of territorial occupation, disruption of supply chains, shifts in consumer priorities, and state support for agricultural producers. The modeling results enable the development of scenarios for market stabilization, logistics optimization, and food security assurance. The findings may be useful for shaping agricultural policy in times of crisis.

Vegetable market, agricultural sector, supply and demand, state support.

Introduction. The full-scale war in Ukraine, unleashed by Russia in 2022, caused significant damage to the country's economy. Agriculture and, in particular, the vegetable growing industry were significantly negatively affected by military operations and the occupation of territories. The issues of analysis of the current situation on the market of vegetable products and prospects for its development, taking into account the consequences of the war and as a result of the economic crisis in Ukraine, remain insufficiently researched. Therefore, an urgent task is the implementation of econometric modeling of the domestic vegetable market to identify trends and forecast indicators in the future short-term period.

Problem Statement. The purpose of the study is to substantiate the theoretical and methodological aspects and practical recommendations for the development of the domestic vegetable market based on the construction of an econometric model.

The study based on data for 2003-2021 on the influence of various economic and production factors on the pricing of the vegetable market. Since the data for 2022 are quite anomalous due to the full-scale invasion of the Russian Federation into Ukraine, it was decided not to take them into account in the general model, as they may distort the overall picture of the impact.

Analysis of recent research and publications. Recent scholarship has increasingly focused on the transformation of Ukraine's vegetable market in response to wartime disruptions. The literature [1], [2], [3], [4] reveals a convergence of methodological approaches aimed at capturing the complexity of agricultural systems under stress, including econometric modeling, scenario analysis, and spatial diagnostics. Issues related to the analysis of the current situation in Ukraine's vegetable market and its future development, considering the impact of the war and the ensuing economic crisis, remain underexplored.

Purpose of the publication. The purpose of this article is to provide a comprehensive analysis of the current state and development trends of Ukraine's vegetable market, taking into account the impact of the war and the economic crisis.

RESULTS AND DISCUSSION. The presented results not only illustrate the current state of the market but also provide a foundation for forecasting possible scenarios of its development. This creates a basis for formulating practical recommendations aimed at stabilizing agricultural policy, optimizing logistical solutions, and ensuring the country's food security. In our case, the average selling price of vegetable crops by agricultural enterprises will be the dependent variable, UAH/t, and ten different socio-economic indicators were chosen as the independent variables. Let's introduce the notation of dependent and independent variables (see Table 1).

Table 1

Designation of the investigated factors

Marking	Description
Dependent variable	
Average prices, y	average sales prices of vegetable crops by agricultural enterprises, hryvnias/ton
Independent variables	
Production volume, x1	volume of production (gross harvest) of vegetables, thousand tons
Sown areas, x2	sown areas of vegetables, thousand ha
Yield, x3	yield of vegetables, ts from 1 ha of harvested area
Vegetables for 1 person, x4	volume of vegetable production per person, kg/year
Salary, x5	average monthly salary, hryvnias/month
Employed population, x6	employed population aged 15-70 in agriculture, forestry and fisheries, thousands of people
Price index, x7	price index of crop products sold by enterprises, % compared to the previous year
Export, x8	export of vegetables, thousands of US dollars
Import, x9	import of vegetables, thousands of US dollars
Inflation, x10	inflation rate, % to the previous year

Source: developed by the authors.

We will find the value of the F-criterion using the formula (1):

$$F = \frac{\sum_{i=1}^n (\hat{Y}_i - \bar{Y})^2}{n-2} \div \frac{\sum_{i=1}^n (Y_i - \hat{Y}_i)^2}{n-2}, \quad (1)$$

Where \hat{Y}_i - the estimate is obtained on the basis of a regression model;

\bar{Y} - values for all studies Y_i :

Y_i - the value of the resulting variable;

n - is the sample size.

the obtained values entered in the table 2:

Table 2

F-test for factors

Factor	The meaning of the F-criterion
Sown areas, x2	9,73
Yield, x3	40,66
Vegetables for 1 person, x4	17,09
Salary, x5	16,99

Employed population, x6	0,43
Price index, x7	32,73
Export, x8	11,32
Import, x9	0,13

Source: developed by the authors.

At the level of significance $\alpha = 0.05$ and the degrees of freedom $f_1 = 1$ and $f_2 = 17$, the table F will be equal to 4.45. Therefore, according to the conducted direct selection, it is necessary to include the values of sown areas, productivity, wages, employed population, export and import of vegetables into the model.

Having built a model of the dependence of average prices for 1 ton of vegetables on the factors listed above, it was found that the p-value of the Sown area (x2) and Export (x8) indicators significantly exceeds the norm of 0.05 (Table 3), so it was decided to exclude given factors.

As a result, we got a model with the following values: $R^2 = 0.958$, adjusted R^2 is 0.946, standard error of estimation = 294.796.

Table 3.

Meaning of p-value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Constant	5439,237	2959,009	1,838	0,091
Sown areas, x2	-5,940	8,546	-0,695	0,500
Yield, x3	16,894	7,020	2,406	0,033
Salary, x5	0,223	0,040	5,563	0,000
Employed population, x6	-0,967	0,513	-1,884	0,084
Import, x9	-0,003	0,002	-1,437	0,176
Inflation, x10	-0,004	0,002	-1,865	0,087

Source: developed by the authors.

Table 4.

Regression statistics

<i>Multiple R</i>	0,979
<i>R Square</i>	0,958
<i>Adjusted R Square</i>	0,946
<i>Standard Error</i>	294,796
<i>Observations</i>	19

Source: developed by the authors.

The value of R^2 means that the variation of average prices for 1 ton of vegetables in Ukraine for 2003-2021 is 95.8% due to the above factors, which is a good estimate for the constructed model.

In the table 2.9 presented other obtained values for our constructed model. As we can see, all p-values are within the permissible range from 0.000 to 0.05.

Table 5

Coefficients of the regression model

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Constant	3976,940	2014,011	1,975	0,031
Yield, x3	10,579	5,966	1,773	0,048
Wages, x5	0,221	0,032	6,902	0,000
Employed population, x6	-1,106	0,336	-3,294	0,005
Import, x9	-0,005	0,001	-3,474	0,004

Source: developed by the authors.

Conclusions and Directions for Future Research. The model built during the research is presented in formula (2.4). It can be used to estimate the impact of each factor on average prices for 1 ton of vegetables.

$$Y = 3976,94 + 10,58x_3 + 0,22x_5 - 1,11x_6 - 0,01x_9 \quad (2)$$

That is, with an increase in productivity by 1 hryvnia per hectare per year, the average selling price of vegetable crops by agricultural enterprises rises to UAH 10.58/t, and when the average monthly wage increases by UAH 1, it increases by UAH 0.22. With the increase in the number of employed population aged 15-70 in agriculture, forestry and fishing per 1 thousand people, the average price of selling vegetables decreases by UAH 1.11, and the cost of import of vegetable crops increases by USD 1 thousand. The USA provokes a reduction in the price by 0.01 hryvnias.

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