Food consumption in Ukraine: challenges and changes

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Abstract
The paper considers peculiarities of food consumption in Ukraine. Particular attention is devoted to assessing the impact of war with Russia on consumption of foodstuffs by the Ukrainian population. Data for 2004-2020 are employed in the paper, using the publications and website of State Statistics Service of Ukraine. The following indicators are chosen for this research: gross domestic product, income of the population, total money expenditure per household, money expenditure on food products per household, and consumption of food products per capita. Given the war situation in Ukraine, two periods are explored separately: the pre-war period (2004-2013) and the war period (2014-2020). The aims of our paper are as follows: 1) to examine specific features of food consumption in Ukraine, taking into account the war conflict in the country; 2) to estimate the impact of the chosen indicators (GDP and income of the population) on consumption of food products by Ukrainian inhabitants. The following statistical methods are applied in our research study: descriptive statistics and Pearson correlation coefficient. We analyze the dynamics of changes in GDP, income of the population, and money expenditure on food products. The obtained results show that the war with Russia led to a significant decline of these indicators. It is also found that there was a reduction in consumption of the majority of foodstuffs. As a result, during the war period, the actual rate of food consumption was substantially below the recommended norms, with the exception of few food products. Using the Pearson correlation coefficient, the levels of correlation between the chosen indicators (GDP and income of population) and consumption of foodstuffs are identified. Conclusions are made about changes occurred in food consumption in the pre-war and war periods in the country.

Keywords: economic challenges, food consumption, Ukraine

JEL Classification: E21, F51, O10
1. Introduction

Since 2014, unprecedented Russian aggression has seen against Ukraine. Russia has started a war in Ukraine and occupied the Crimean peninsula and territories in the east and south of Ukraine in violation of all norms of international law. This war has a significant negative effect on the Ukrainian economy and the income level of the country’s population. This situation is also exacerbated by the impact of the COVID-19 pandemic. Under these conditions it is necessary to ensure the stable functioning of the country's agri-food sector, which is important both for Ukraine and globally.

It should be noted that there are some studies, in which various aspects of food consumption and food security are considered in Ukraine and other countries, taking into account the mentioned war conflict. OECD (2022) analyses the influence of the Russia’s war in Ukraine on international agricultural market. It is revealed that, as a result of this war, the substantial increase of food prices could be observed, which will have an unfavorable impact on global food security. Employing the MAGNET model, van Meijl et al. (2022) determine that the war in Ukraine can deteriorate food security worldwide in the medium-term period. This could be particularly related to low-income countries which are highly dependent on cereal imports from Ukraine. Also, the war can have a negative impact on poor people because of the growth of food prices. Hellegers (2022) evaluates consequences of Russia’s invasion to Ukraine on the vulnerability of the global economy. Using the indicators of dependency and coping capacity, it is identified that the most significant unfavorable effects could be observed in the Middle-East and North Africa (MENA) region, as well as Sub-Saharan countries. To enhance the food security in vulnerable regions, the socio-economic aspects of the agricultural sector and open trade ought to be reconsidered. Similar results are obtained by Abay et al. (2022). They argue that the MENA region is expected to be in an especially vulnerable situation and to have trade and price shocks. This can happen due to the high food import dependence of the region.

According to the preliminary estimations by FAO (2022), as a result of the war, considerable damage was caused to the Ukrainian agricultural sector and related infrastructure. Household incomes decreased to a substantial extent, and the significant share of population can face higher levels of food insecurity and food consumption gap, especially in regions with active fighting. Mostenska et al. (2022) consider economic affordability of food for the Ukrainian population. Using the regression analysis, the close link between the indicators of food expenditures and the GDP level is determined. Based on correlation coefficients, the relationships between the consumption of foodstuffs and the level of per capita income are found. Kotykova et al. (2020) investigate peculiarities of food security in different types of Ukrainian households, paying attention to economic affordability and consumption level of food products. Using the obtained results, the most vulnerable groups of households are identified in terms of food security. Also, it is confirmed that economic affordability affects substantially the level and pattern of food consumption.

Vasylieva (2019) explores possibilities for the improvement of food security in Ukraine, with the aim to ensure the health and income levels of the country’s inhabitants. The researcher elaborates aggregate evaluation of regional food consumption, which provides a possibility to enhance Ukraine’s agricultural production and support its sustainable development. Seheda et al. (2019) assess the interaction between consumption of foodstuffs and chosen demographic indicators in Ukraine. Applying the Pearson’s correlation coefficient and linear regression, it is found that the worsening of food consumption leads to the deterioration of the country’s demographic situation. The reverse impact between the demographic indicators and consumption of food products is also revealed.
At the same time, there is a lack of publications, in which peculiarities of food consumption of the Ukrainian population are compared in the pre-war and war periods. That is why we decided to prepare this publication. The aims of our paper are as follows:

- to examine specific features of food consumption in Ukraine, taking into account the war conflict in the country
- to estimate the impact of the chosen indicators (GDP and income of the population) on consumption of food products in the pre-war and war periods.

2. Data and Methods

Data for 2004-2020 were employed in the paper, based on the publications and website of State Statistics Service of Ukraine (www.ukrstat.gov.ua). Given the war situation in Ukraine, two periods were explored separately:

- the pre-war period: 2004-2013

The following indicators were chosen for this research:

- gross domestic product (bln. US dollars)
- income of the population (bln. US dollars)
- total money expenditure per household (US dollars)
- money expenditure on food products per household (US dollars)
- consumption of food products per capita (kg, pieces).

Using the data on the resident population, gross domestic product (GDP) and income of the population were calculated per capita. For a better interpretation of the data, the respective indicators were recalculated from Ukrainian hryvnias (UAH) to US dollars (USD), employing information of the National Bank of Ukraine on the annual average official exchange rate between UAH and USD (www.bank.gov.ua).

The following statistical methods were applied in our research study:

- Descriptive statistics: it was used to characterize analyzed set of variables
- Pearson correlation coefficient: it was employed to investigate relationship between the chosen economic indicators and consumption of different food products.

The form of the Pearson’s correlation coefficient used in this paper can be calculated using the following equation:

$$
\rho_{xy} = \frac{cov(x,y)}{\sigma_x \sigma_y}
$$

where: cov(x,y) is the covariance between x and y

$\sigma_x$ is the standard deviation of the variable X

$\sigma_y$ is the standard deviation of the variable Y.

The correlation coefficient value close to 0 means weak or no relationship between variables. The value close to 1 means strong positive relationship – if the first variable increases, the second variable
grows too. The value close to -1 means strong negative relationship – if the first variable rises, the second one decreases. Correlation analysis is used to determine only the character of relationship between a pair of variables, but not to identify which the variable is the cause, and which one is the consequence.

3. Results and Discussion

The dynamics of changes of the country’s GDP in 2004-2020 is given on Figure 1. It should be mentioned that there were several periods associated with changes in this indicator. During 2004-2008, there was its steady increase: from 64,9 bln. USD to 180,0 bln. USD. In 2009, the sharp reduction of the indicator occurred to 117.2 bln. USD (65.1% of the 2008 level), driven by the global financial crisis. In 2010-2013, there was a gradual recovery of the Ukrainian economy, and, as a result, GDP increased to 190,5 bln. USD. In 2014, due to the war conflict with Russia in the east of Ukraine, as well as the annexation of the Crimean peninsula, the country’s economic situation deteriorated significantly. This also affected Ukraine’s GDP, which contracted to 133,5 bln. USD (by 29.9% less in comparison with 2013). The decline of GDP has continued until 2016, in which its level was 91,0 bln. USD (by 52.2% less than in 2013). Later, the analyzed indicator slightly increased, and it grew to 156,6 bln. USD in 2020, which was by 17.8% less compared with 2013. GDP per capita was also calculated, and its changes coincided with the above-mentioned tendencies in GDP in total. In 2020, its value was equal to 3752 USD, or by 10.4% less than in 2013.

Figure 1: Gross domestic product of Ukraine

Source: authors’ calculations based on data of State Statistics Service of Ukraine

Information about the income level of the Ukrainian population in 2004-2020 is presented on Figure 2. It can be seen that this indicator grew from 51,6 bln. USD to 160,5 bln. USD between 2004 and 2008. In 2009, its value decreased to 114,8 bln. USD (by 28,5% less compared with 2008). The population’s income went up from 138,8 bln. USD in 2010 to 193,8 bln. USD in 2013 (or by 39,6%).
Since the start of war in Ukraine, the income of the country’s inhabitants has dropped substantially. For example, its value was 127,6 bln. USD in 2014 (or by 34.2% less than in 2013). This decline has continued until 2016, in which the indicator’s value contracted to 80,3 bln. USD (or by 58.6% lower in comparison with 2013). There was a gradual increase of the income value in subsequent years. In 2020, the indicator was equal to 150,4 bln. USD (or 77.5% of its 2013 level). The same changes took place in regards to the calculated income per capita. In 2020, the value of this indicator was 3608 USD (84.6% of its level in 2013).

Similar tendencies took place for average monthly money expenditure and average monthly money expenditure spent on food products (Figure 3). These indicators had maximum values in 2008 and 2013 while their largest decrease occurred in 2009 and 2014-2016. In 2020, their values were 330 USD and 162 USD (75.3% and 70.4% of the 2013 level, correspondingly). These tendencies led to changes in the share of money expenditures on food products. The share went down from 58.1% in 2004 to 52.6% in 2013. While the indicator grew from 53.5% in 2014 to 54.8% in 2015, it reduced again from 53.1% to 49.1% between 2016 and 2020.
Figure 3: Average monthly money expenditure per household

![Graph showing average monthly money expenditure per household from 2004 to 2020.](image)

* including eating-out, alcoholic beverages and tobacco

Source: authors’ calculations based on data of State Statistics Service of Ukraine

Table 1 presents a comparison of food consumption per capita in the pre-war period (2004-2013) and the war period (2014-2020). The calculated indicators show a significant reduction in consumption of foodstuffs, with the exception of meat and meat products, as well as fruit, berries, nuts and grapes. To the most extent, the level of consumption decreased on potatoes (by 23,8%), fish and fish products (by 22,2%), and sugar (by 18,2%). By the way, this decline in food consumption was seen on products that were traditional for Ukrainian residents and played a significant role in their nutrition.

In order to have a more complete picture, we considered the consumption of animal food products by Ukrainian households, calculated as a percentage of the recommended rate (Figure 4). The general tendency for these products is that their consumption did not meet the minimum nutritional requirements, with the exception of fish and fish products in the pre-war period.
Table 1: Average monthly consumption of food products per capita, kg

<table>
<thead>
<tr>
<th></th>
<th>The pre-war period (2004-2013)</th>
<th>The war period (2014-2020)</th>
<th>The war period as % of the pre-war period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat and meat products</td>
<td>4,8</td>
<td>4,9</td>
<td>102,1</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>20,7</td>
<td>19,4</td>
<td>93,7</td>
</tr>
<tr>
<td>Eggs, pieces</td>
<td>20</td>
<td>19</td>
<td>95,0</td>
</tr>
<tr>
<td>Fish and fish products</td>
<td>1,8</td>
<td>1,4</td>
<td>77,8</td>
</tr>
<tr>
<td>Sugar</td>
<td>3,3</td>
<td>2,7</td>
<td>81,8</td>
</tr>
<tr>
<td>Sunflower-seed oil and other vegetable oils</td>
<td>1,8</td>
<td>1,5</td>
<td>83,3</td>
</tr>
<tr>
<td>Potatoes</td>
<td>8,4</td>
<td>6,4</td>
<td>76,2</td>
</tr>
<tr>
<td>Vegetables, melons and gourds</td>
<td>9,4</td>
<td>8,8</td>
<td>93,6</td>
</tr>
<tr>
<td>Fruit, berries, nuts and grapes</td>
<td>3,5</td>
<td>3,6</td>
<td>102,9</td>
</tr>
<tr>
<td>Bread and bakery products</td>
<td>9,6</td>
<td>8,4</td>
<td>87,5</td>
</tr>
</tbody>
</table>

Source: authors’ calculations based on data of State Statistics Service of Ukraine

The maximum level of consumption as the percentage of recommended norms in the pre-war period was the following: meat and meat products – 68,7%, milk and milk products – 62,5%, eggs – 79,2%, and fish and fish products – 70,6%. During the war period, there was a slight increase in the consumption of meat and meat products while the opposite situation took place on milk and milk products. Mixed changes were observed on the consumption of eggs and fish and fish products. It can be seen that in 2020, the consumption level on meat and meat products was 77,6%, milk and milk products – 59,6%, eggs – 79,2%, and fish and fish products – 82,4% of the recommended level.
Figure 4: Consumption of animal food products by Ukrainian households (% of the recommended rate)

Source: authors’ calculations based on data of State Statistics Service of Ukraine

The calculated results on consumption of plant food products (in the percentage of the recommended level) is given on Figure 5. In the pre-war period, their level on several products exceeded recommended rates, while it had a downward tendency. For instance, the consumption level of sunflower-seed oil and other vegetables oils, bread and bakery products, and sugar fell from 172,7%, 123,8%, and 112,5% in 2004 to 154,5%, 107,1%, and 93,8% in 2013, correspondingly. Besides, its significant decrease was observed on potatoes: from 98,1% to 68,9%. The mixed tendencies occurred on other products, and their consumption was at a low level, namely: fruit, berries, nuts and grapes – 36,0% in 2004 and 54,7% in 2013 and vegetables, melons and gourds – 64,9% in 2004 and 70,1% in 2013.

Figure 5: Consumption of plant food products by Ukrainian households (% of the recommended rate)

Source: authors’ calculations based on data of State Statistics Service of Ukraine
The reduction in the consumption rate continued for the majority of plant foodstuffs during the war period. In 2020, while the consumption rate of sunflower-seed oil and other vegetables oils (127,3%) was still above the recommended level, its values for bread and bakery products and sugar were already below this level: 95,2% and 75,0%, respectively. In the same year, the lowest level of consumption was found on fruit, berries, nuts and grapes (49,3%), potatoes (58,3%), and vegetables, melons and gourds (64,9%).

In the pre-war period, the highest consumption increase was determined for foodstuffs that provide healthy and balanced nutrition (fruit, berries, nuts and grapes, meat and meat products, and fish and fish products). Ukrainian households had such an opportunity owing to the growth of their income level. The smallest rise was identified for food products, which can harm people’s health in case of excessive consumption (potatoes, sugar, and bread and bakery products).

The different situation on food consumption was observed during the war period. Due to the decrease of households’ income, mixed changes were determined in its pattern. On the one hand, the largest decline was revealed in consumption of fish and fish products, as well as products consumed significantly by the Ukrainian population in the past (sunflower-seed oil and other vegetable oils and sugar). On the other hand, we found that households reduced their consumption of meat and meat products, vegetables, melons and gourds, and fruit, berries, nuts and grapes to the least extent. We consider the above-mentioned changes as the efforts of households to maintain balanced nutrition in limited income conditions.

In order to determine the impact of GDP on the food consumption pattern in the pre-war and war periods, the Pearson correlation coefficient (PCC) was calculated (Table 2).

**Table 2: Pearson correlation coefficient: GDP and consumption of food products**

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<tr>
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<tbody>
<tr>
<td></td>
<td>PCC, value Interpretation</td>
<td>PCC, value Interpretation</td>
</tr>
<tr>
<td>Meat and meat products</td>
<td>0,888 strong positive correlation</td>
<td>0,972 very strong positive correlation</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>-0,178 negligible negative correlation</td>
<td>-0,529 moderate negative correlation</td>
</tr>
<tr>
<td>Eggs</td>
<td>0,405 weak positive correlation</td>
<td>0,282 negligible positive correlation</td>
</tr>
<tr>
<td>Fish and fish products</td>
<td>0,301 weak positive correlation</td>
<td>0,766 strong positive correlation</td>
</tr>
<tr>
<td>Sugar</td>
<td>-0,684 moderate negative correlation</td>
<td>-0,518 moderate negative correlation</td>
</tr>
<tr>
<td>Sunflower-seed oil and other vegetable oils</td>
<td>-0,536 moderate negative correlation</td>
<td>-0,482 weak negative correlation</td>
</tr>
</tbody>
</table>
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Potatoes
-0.858 strong negative correlation -0.651 moderate negative correlation

Vegetables, melons and gourds
0.475 weak positive correlation -0.278 negligible negative correlation

Fruit, berries, nuts and grapes
0.909 very strong positive correlation 0.847 strong positive correlation

Bread and bakery products
-0.866 strong negative correlation -0.365 weak negative correlation

Source: authors' calculations based on data of State Statistics Service of Ukraine

The research results show that in the pre-war period, the very strong positive correlation was determined between GDP and consumption of fruit, berries, nuts and grapes (0.909), and the strong positive correlation was found between this economic indicator and meat and meat products (0.888). At the same time, strong negative correlation was identified in the case of bread and bakery products (-0.866) and potatoes (-0.858). In the war period, the very strong positive correlation was observed regarding meat and meat products (0.972) while strong positive correlation was revealed in the case of fruit, berries, nuts and grapes (0.847) and fish and fish products (0.766). The very strong and strong negative correlations were not found during this period.

Using the Pearson correlation coefficient, the influence of the population’s income on consumption of food products was estimated as well (Table 3). In the pre-war period, the very strong positive correlation was seen between the income of population and consumption of fruit, berries, nuts and grapes (0.928), and the strong positive correlation was found between this indicator and consumption of meat and meat products (0.862). At the same time, the very strong negative correlation was identified regarding bread and bakery products (-0.908), while the strong negative correlation was revealed in the case of potatoes (-0.898) and sugar (-0.737).

Table 3: Pearson correlation coefficient: population’s income and consumption of food products

<table>
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<td>PCC, value Interpretation</td>
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<tr>
<td>Meat and meat products</td>
<td>0.862 strong positive correlation</td>
<td>0.972 very strong positive correlation</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>-0.287 negligible negative correlation</td>
<td>-0.478 moderate negative correlation</td>
</tr>
<tr>
<td>Eggs</td>
<td>0.410 weak positive correlation</td>
<td>0.285 negligible positive correlation</td>
</tr>
</tbody>
</table>
### Table 1: Correlation of the population’s income with consumption of foodstuffs (2010-2018)

<table>
<thead>
<tr>
<th>Food and bakery products</th>
<th>0.205  negligible positive correlation</th>
<th>0.785  strong positive correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>-0.737  strong negative correlation</td>
<td>-0.491  moderate negative correlation</td>
</tr>
<tr>
<td>Sunflower-seed oil and other vegetable oils</td>
<td>-0.492  moderate negative correlation</td>
<td>-0.433  weak negative correlation</td>
</tr>
<tr>
<td>Potatoes</td>
<td>-0.898  strong negative correlation</td>
<td>-0.618  moderate negative correlation</td>
</tr>
<tr>
<td>Vegetables, melons and gourds</td>
<td>0.545  moderate positive correlation</td>
<td>-0.268  negligible negative correlation</td>
</tr>
<tr>
<td>Fruit, berries, nuts and grapes</td>
<td>0.928  very strong positive correlation</td>
<td>0.821  strong positive correlation</td>
</tr>
<tr>
<td>Bread and bakery products</td>
<td>-0.908  very strong negative correlation</td>
<td>-0.321  weak negative correlation</td>
</tr>
</tbody>
</table>

Source: authors’ calculations based on data of State Statistics Service of Ukraine

In the war period, the situation changed to a certain extent. The very strong positive correlation was found between the population’s income and consumption of meat and meat products (0.972), and the strong positive correlation was determined between the mentioned indicator and consumption of fruit, berries, nuts and grapes (0.821) and fish and fish products (0.785). Similar to the case of GDP, the very strong and strong negative correlations of the population’s income with consumption of foodstuffs were not revealed during the war period.

### 4. Conclusion

Based on received research results, the shift of the Ukrainian population towards a more balanced consumption of food products was revealed in the pre-war period. The decrease in consumption of foods in high in carbohydrates was also found in this period. These positive changes occurred because of the growth of the population’s income.

The situation on food consumption was different during the war period. Mixed changes in consumption of foodstuffs were identified (for instance, the highest reduction in consumption of fish and fish products and sugar). At the same time, it was determined that the Ukrainian population made efforts to maintain a balanced consumption of food products in conditions of the limited income level.

The obtained results are essential not only for Ukraine, but also for Slovakia due to their close geographic location and economic ties. In the field of food strategy, it is related to food imports and exports between Slovakia and Ukraine, which are significantly influenced by the situation in both countries. Findings of this paper should be also taken into consideration during the implementation of the new EU food strategy in Slovakia. It should be done the way, which will help to improve the situation in both neighboring countries.
Acknowledgements

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References