Repercussions of the Russian invasion in 2022 on Ukraine's Economy

Jan Burakowski
Student Number: 2764440
Vrije Universiteit

Mateusz Kielan
Student Number: 2774206
Vrije Universiteit

Liang Man Loeng
Student Number: 2611672
Vrije Universiteit

1 Introduction and Motivation

The Russo-Ukrainian war began in early 2014 and reached a peak in February 2022 when Russia launched a full-scale invasion of Ukraine. This military action significantly disrupted the lives of Ukrainians, affecting everything from social structures to the economic stability of the country. We have decided to analyze the economic impact of this invasion to better understand the monetary consequences of such a drastic event.

In this report, we will analyze this matter by attempting to answer the following question: "What are the economic repercussions of the Russian invasion in 2022 on Ukraine's economic indicators such as GDP and state budget revenue, which economic sectors agriculture or industry were affected the most and how did the prices of food changed?" by dividing it into subquesions and analyzing related datasets.

2 Methods

2.1 Data Cleaning

We initialized dataframes by reading XLS or CSV files and removed rows with only NaN values. Since some of the datasets were in Ukrainian, we have constructed a Google Translate API-based function to translate the dataframes. Column names were either translated or hard-coded after understanding each dataset.

For industrial indices, only the most prosperous industries were retained, and monthly values were averaged per year. In the other datasets, all columns were kept, but lower-value rows were removed.

For the World Bank data the dataset was transformed from wide to long format and all the entries converted to the numeric form.

For analyzing food prices, we filtered the dataset to retain only monthly food prices for Kherson and Zaporizhzhya (war zone cities).

2.2 Data Merging or Division

Manufacturing data (2015–2024) had 10 datasets with the same structure. After cleaning the 2015 dataset, we created a function that combines all of the operations and applied it iteratively to other datasets. Dataframes were merged based on the first column (industry category), with a new column added for the respective year.

For the statistical tests for macro economic indicators the dataset was split into two separate frames. Before and after 2014. This will allow to understand if major conflicts in 2014 and 2022 influenced significantly the indicators.

2.3 Data Visualization

We created simple plots using Matplotlib library to illustrate the progression of values over the years. For clarity, we have used the "o" marker to indicate the changes in period and added legends in upper-left corner of each plot.

3 Discussion

3.1 Macroeconomic Indicators: GDP, Debt, and Investments

Sub-Question 1: How have key macroeconomic indicators such as GDP, Central Debt, and Investments evolved and changed during the period of war?

To analyze macroeconomic trends, we examined four key indicators: GDP, GDP per capita, central government debt, and foreign investments. Figure 1 demonstrates GDP and GDP per capita plotted in the US dollars.

In 2022, following the beginning of the invasion, both GDP and GDP per capacity dropped significantly, reflecting the disruptions caused by the war.

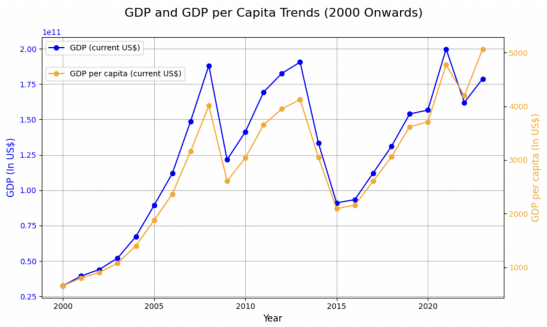

Figure 1: GDP and GDP Per Capita Trends

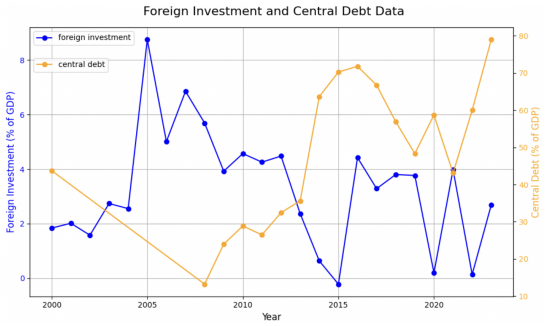

Figure 2: Foreign Investment and Central Debt

However, by the succeeding year, both indicators partially recovered in value. This could be related to the financial aid provided by international institutions. For instance, in 2023, the EU provided around 19 billion Eur in economic aid to stabilize Ukraine's economy.[1] This could be directly related to the GDP increase in 2023. A similar pattern occurred during the 2014-2015 Crimea crisis when Russia annexed Crimea.

A homogeneous pattern can be observed when analyzing foreign investment data. The investments dropped during the beginning of a crisis as more funds were directed towards military funding. Later, the indicator recovered, as companies like Philip Morris and SCM Holding with the Ukrainian government help made significant investments (over 1 billion) into infrastructure and manufacturing.[2] A central government debt kept growing through the conflict as the Ukrainian government accepted more aid and military packages from allies. The initial drop in 2022 can be explained by the currency devaluation that occurred in that year, significantly lowering the value of hryvnia.

Statistical Analyses were conducted on the Foreign Investment and Central Debt Data. The correlation test revealed a r =-0.25 for foreign investment and r=0.62 for central debt. The weak negative correlation for foreign investment indicates a slight decline over the years and a strong positive correlation for the central debt stipulates a significant increase over the years and suggests that the war might not be the only factor that affected the debt as it was already on the rise before the period of turmoil.

To further evaluate the impact of geopolitical crises, two independent t-tests were conducted on both indicators. The dataset was divided into two periods: before 2014 (The year of Crimea Annexation) and after 2014. This will help to understand whether the values were significantly affected by the events in Crimea 2014 and the Russian invasion in 2022. A standard significance level of 0.05 was set.

Indicator	P-Value	T-Stat
Central Debt	0.0000129	-6.534
Foreign Investment	0.0559	2.072

The P- value for Central Government Debt indicates that the debt significantly changed after 2014. The T-statistics indicate that the debt levels were lower pre-2014 and higher post-2014 The Foreign Investments P-value indicates that there is no significant difference between pre-2014 and post-2014.

3.2 Impact on Economic Sectors: Agriculture vs. Industry

Sub-Question 2: Which economic sectors agriculture or industrial sector were most affected by the conflict?

We analyzed data from the Ukrainian State Statistics Service on agricultural and industrial production indices. This data allows us to understand how the volume of output for each industry has changed over the years.

Both sectors saw steep declines in 2022, but agriculture suffered a sharper drop and remains below pre-invasion levels.

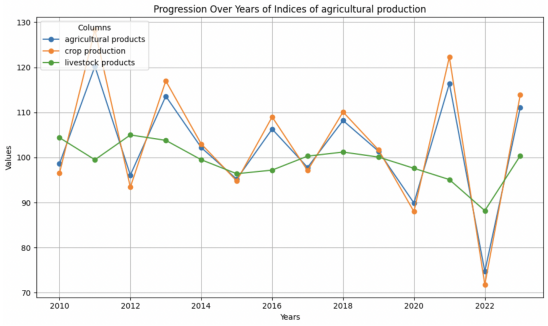

Figure 3: Agriculture Production Index

While the Black Sea Grain Initiative, signed in July 2022, briefly enabled Ukraine to export nearly 33 million tonnes of grain and foodstuffs by mid-2023, Russia's withdrawal from the agreement in July 2023 threatens long-term agricultural recovery [3].

On the other hand, industrial production demonstrated resilience, with two of the three largest sectors exceeding their pre-invasion output levels by 2023.

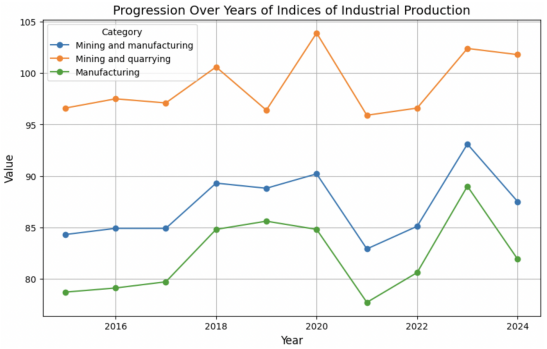

Figure 4: Industrial Production Index

Because of the difficulties related to the export, pre-invasion levels of output for the Agricultural sector might be more difficult to obtain than the case of Industrial sectoras reflected in the data. Therefore it can be concluded that Agricultural sector was more impacted by the conflict.

3.3 Impact on Basic Goods: Barley and Beef Prices

Sub-Question 3: How did the war impact the prices of essential commodities, such as barley and beef, in regions experiencing the most intense conflict?

Ukraine is a major producer of wheat, corn, barley, and dairy products. However, war-related destruction of farmland, labor shortages, and the occupation of key agricultural regions have significantly reduced food production.

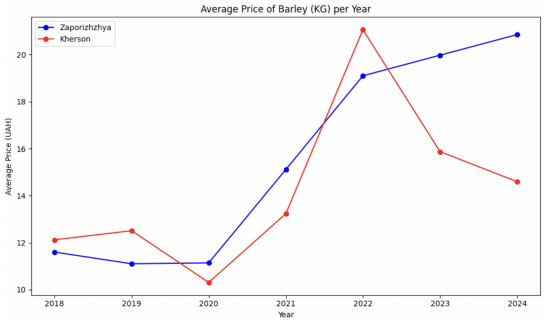

Figure 5: Barley Prices in Kherson and Zaporizhzhya

Energy price hikes have also contributed to rising food costs. Russia's halt in gas exports to Ukraine increased production, refrigeration, and transportation expenses, affecting both producers and consumers.

The figure above compares barley prices in Kherson and Zaporizhzhya. In Kherson, prices peaked in 2022 but declined significantly in 2023, as the city's battlefront stabilized. Conversely, Zaporizhzhya has experienced steady price increases due to prolonged conflict.

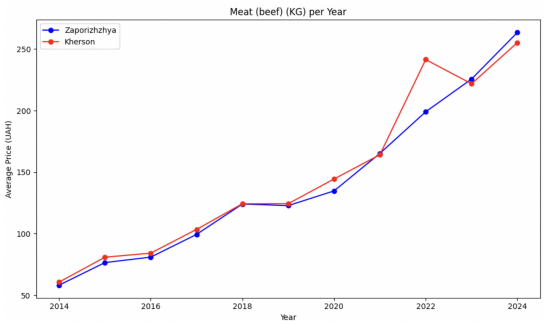

Figure 6: Beef Prices in Ukraine

Beef prices follow a similar trend, though with less volatility. Since Kherson and Zaporizhzhya were not major beef producers, their conflict-related production disruptions were less severe than for grain crops. However, overall beef prices in Ukraine remain affected by the war's impact on livestock farming.

4 Conclusion

The war in Ukraine has caused severe economic disruptions, particularly in **GDP, foreign investments, and government debt**. While **industrial sectors have shown resilience**, the **agriculture sector** faces persistent challenges due to export restrictions and infrastructure damage. Additionally, **food prices have been heavily impacted**, with prolonged conflicts driving price volatility. These economic repercussions highlight the need for continued international aid and investment in Ukraine's post-war recovery.

References

[1] European Commission. (2023, November 22). *Commission pays a further €1.5 billion in assistance to Ukraine*. Enlargement and Eastern Neighbourhood. Retrieved from `http://neighbourhood-enlargement.ec.europa.eu/news/commission-pays-further-eu15-billion\-assistance-ukraine-2023-11-22_en`

[2] Newsroom. (n.d.). *Akhmetov's SCM holding boosted investment 50% to $835 million in 2023*. Interfax Newsroom. Retrieved from `https://interfax.com/newsroom/top-stories/99835/`

[3] ScienceDirect. (2024). *Article from ScienceDirect*. Retrieved from `https://www.sciencedirect.com/science/article/pii/S0967070X24003858?casa_token=PvcRbQ2vEqMAAAAA:cRpo5BWXyqyUs7QQ0unZzTPBONfLrvgJcxrXqXa0nHDcIRXCdX7rp`