

# Explaining Ukrainian Refugee Distribution Across Europe

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## Introduction

On the 24th of February 2022, Russian president Vladimir Putin ordered a “special military operation” in Ukraine, launching a ground invasion and air strikes on multiple fronts. Since that date, tens of thousands of Ukrainians have died and many more injured. The invasion has caused the largest refugee crisis in Europe since World War II. As of April 2023, 8.2 million refugees have been recorded across Europe, and millions more have been internally displaced. While there is sufficient data quantifying the refugee populations in Europe, less research has sought to explain why some countries host more than others. This project seeks to find the areas of greatest risk in Ukraine and explain the factors that determine the current distribution of refugees across Europe. The hypothesis is that countries’ distance from Ukraine and economic activity can together predict their refugee influx.



Image Credit: BBC News

## Methods

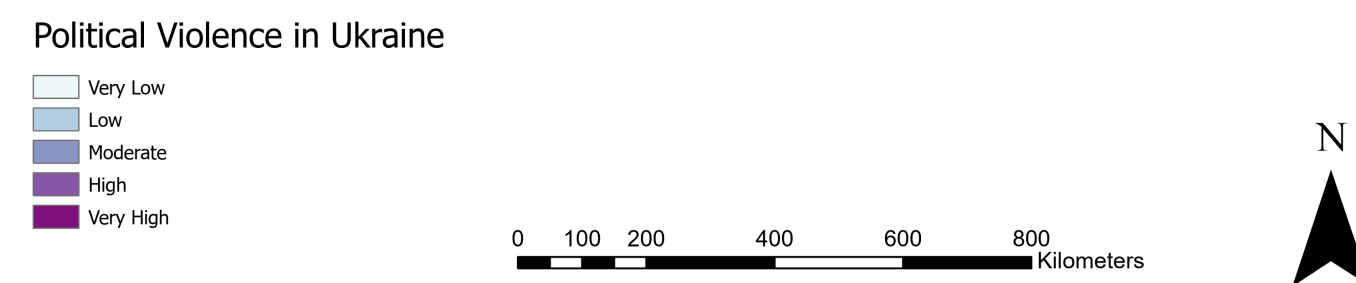
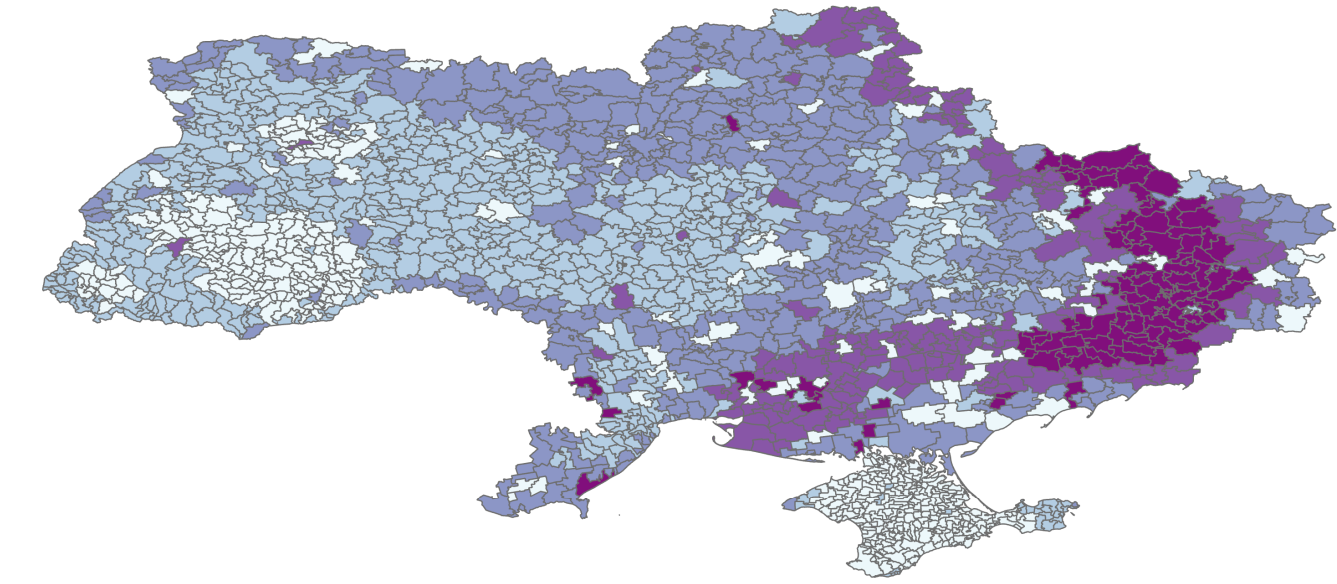
To find the geographic areas in Ukraine most at risk for Russian military attacks, political violence point data from 2022 onwards was extracted from ACLED’s Ukraine Conflict Monitor database. The data was processed in ArcGIS Pro through **Optimized Hotspot Analysis**, which created hotspots based on the geographic concentration of political violence points. To create precision, hotspots were organized by *hromada*, the smallest administrative unit in Ukraine. The hotspots for each *hromada* were classified by z-score, which measures how far each hotspot value deviates from the mean. Higher z-scores indicate a greater concentration of political violence in an area. Numbers of Internally Displaced Persons (IDPs) in Ukraine was obtained from the Humanitarian Data Exchange and compared with the political violence hotspots. This analysis sought to find the threatened areas in Ukraine that generated the largest numbers of refugees.

Next, the movements of refugees outside of Ukraine were studied. Firstly, current data was used from the United Nations Human Rights Commission (UNHCR) describing the total number of from Ukraine for every country in Europe. These values were reclassified on a scale of 1-5, with 5 including the countries with the highest numbers of refugees.

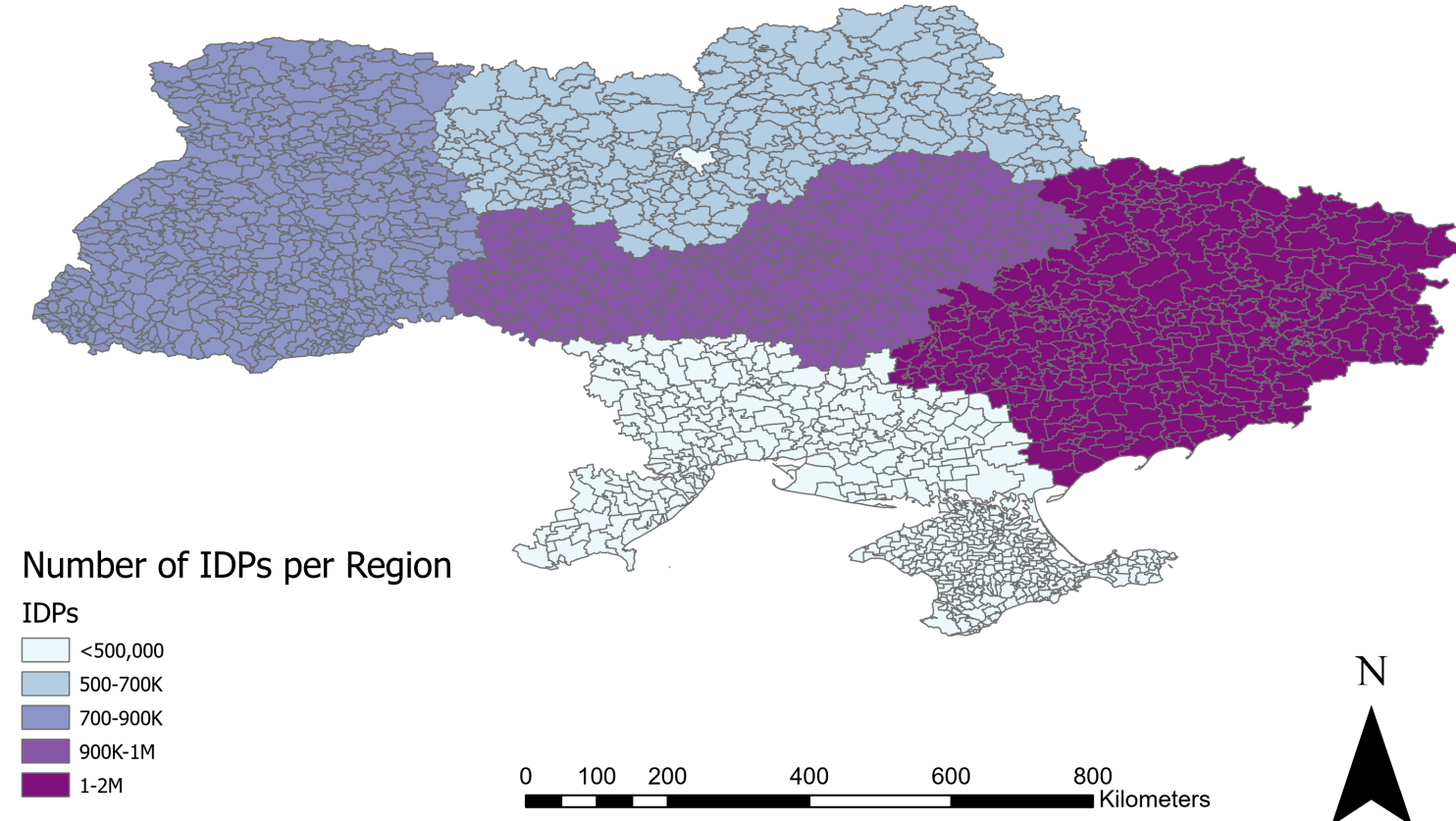
I hypothesized that the distance from Ukraine and GDP of each country were significant factors in refugee distribution. Since moving long distances is expensive, time consuming, and often unpleasant, refugees tend to prefer traveling shorter distances. Many of them travel by rail, with airfields closed and roads becoming more dangerous to use. Using data from the United Nations Economic Commission for Europe (UNECE), the distance by rail from Kyiv to each European capital city was calculated. These distances were reclassified into scores from 1 to 5, with 5 being the smallest distances. Next, I obtained the total GDP per European country as of 2021 from the Eurostat database.

Region	Average Z-Score	IDPs
Kyiv	-0.581	497000
East	<b>3.182</b>	<b>1964000</b>
Center	-0.983	928000
North	-0.398	604000
South	0.33	496000
West	-1.228	863000

Table 1: Average Z-Score and Number of Internally Displaced Persons by Region



Since GDP measures economic output, I predicted that countries with greater GDP would have more resources to provide for refugees. As a result, I expected GDP to be correlated with higher numbers of refugees. GDP values were reclassified into scores from 1 to 5, with 5 assigned to the countries with the highest GDP. Then, the average of the GDP and distance scores was calculated to create a refugee prediction score for each European country. Finally, the refugee scores were compared with the prediction scores. I extracted the highest refugee scores and examined the corresponding prediction scores. Then I looked at the distribution of refugee scores for the countries with the highest prediction scores. From this analysis, I could make a conclusion if GDP and distance from Ukraine were important factors in refugee distribution across Europe.

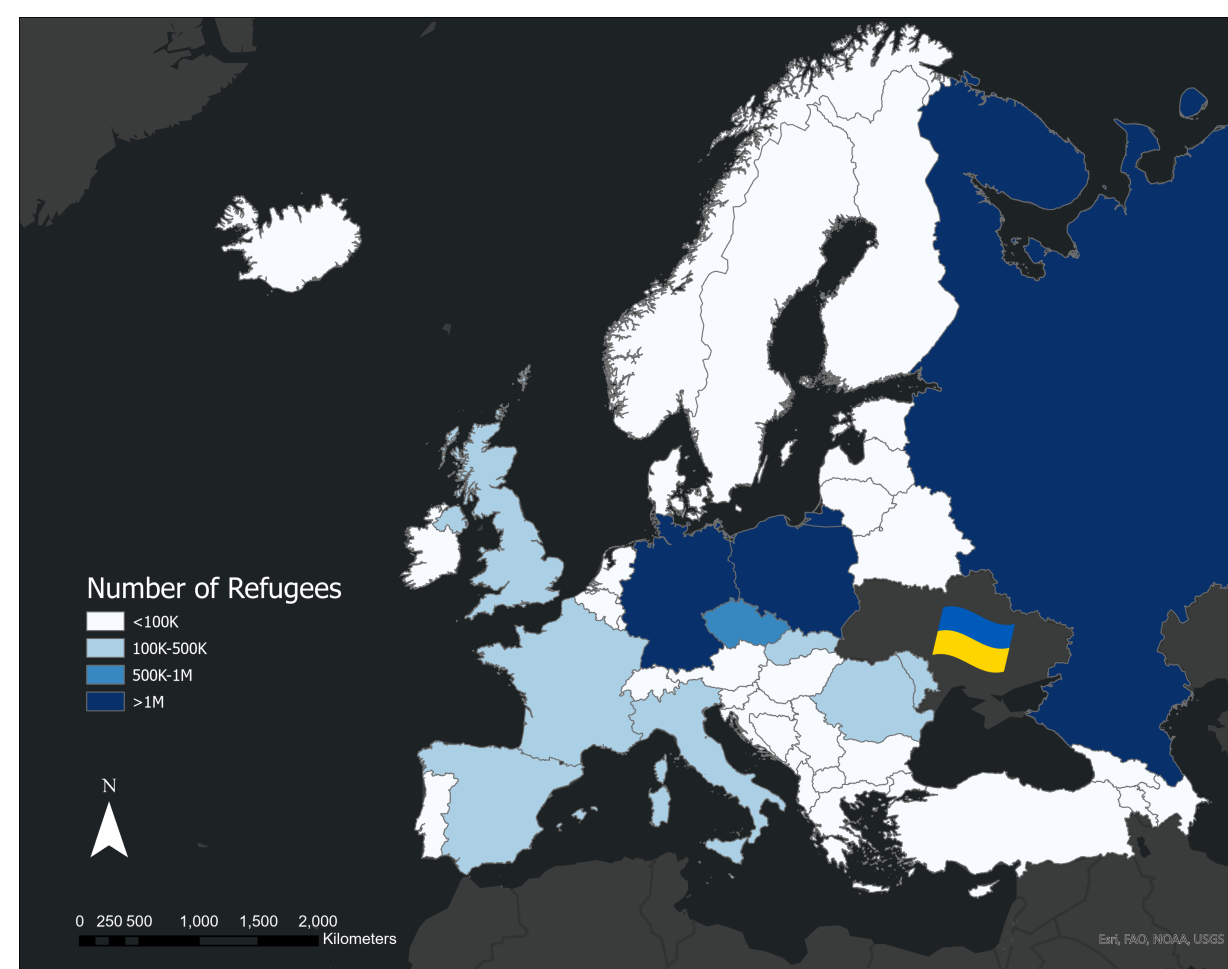
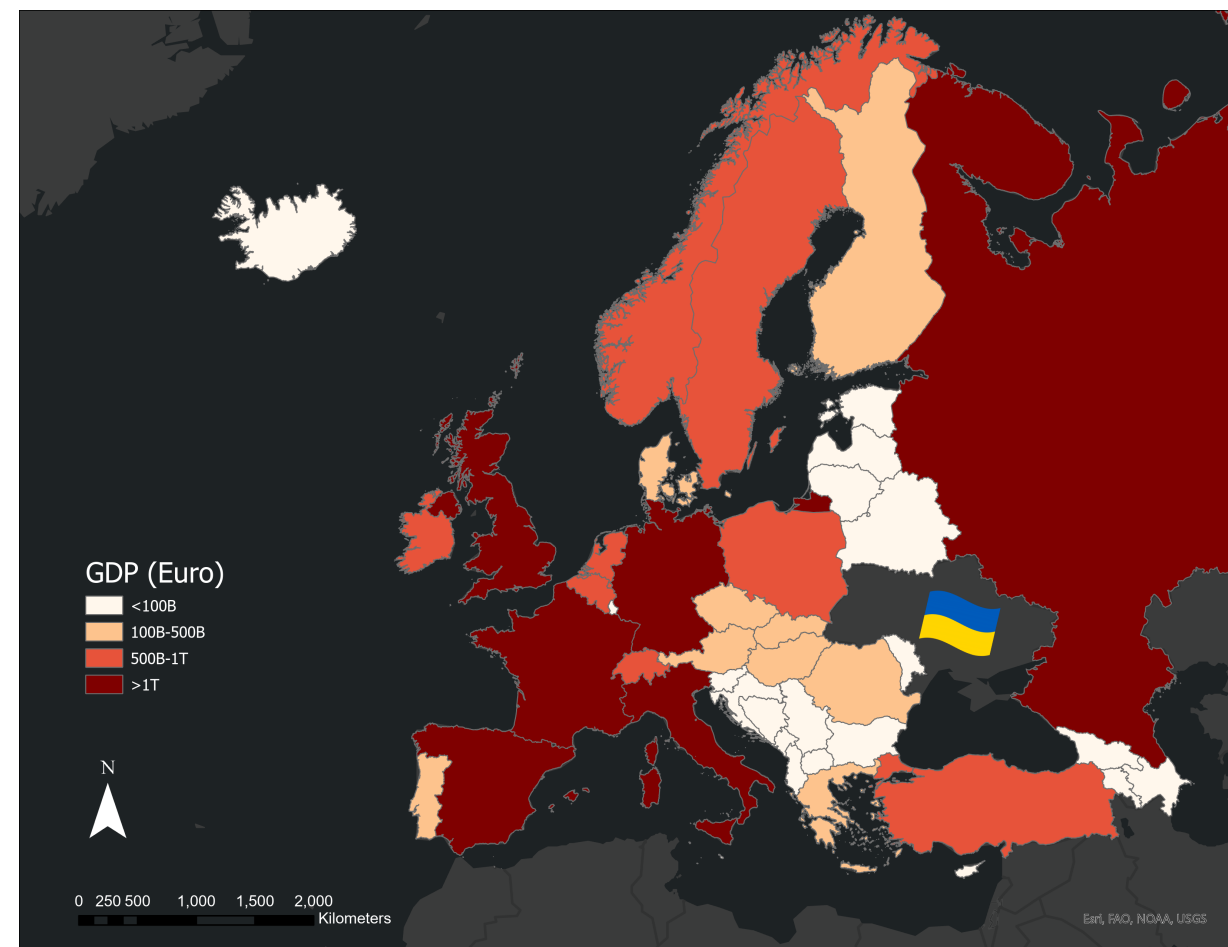


## Results

Most of Ukraine’s political violence continues to happen in a relatively small area in the eastern region of Ukraine. There were 62 *hromada* in Ukraine with z scores greater than 2.5 standard deviations away from the mean in the positive direction. 55 of these *hromada* were in the East, 1 was in the North, and 6 were in the South. Nearly 2 million of Ukraine’s IDPs were located in the East, more than twice the number of any other region.

Country	Number of Refugees	Refugee Prediction Score
Russia	2852395	5
Poland	1583563	4.5
Germany	1056628	4.5
Czech Republic	504352	3.5
United Kingdom	199900	3.5
Italy	173213	3.5
Spain	173169	3
France	118994	3.5
Slovakia	113024	3.5

Table 2: Refugee Prediction Scores for Top 10 Highest Populations



The only three countries with more than one million refugees and with a refugee prediction score of 5 when reclassified were **Russia, Germany, and Poland**. Russia had the largest number of refugees, with over 2 million. **All three countries also had the highest refugee prediction score** in terms of GDP and distance.

9 of the 11 countries that had scores of 3 or more for refugees had scores of 3.5 or more for the refugee prediction score.

In general, countries that had many refugees also had lower distances and higher GDP on average.

Russia had the largest number of reported refugees and the highest refugee prediction score. However, this may be misleading. Most Ukrainian refugees in Russia are brought there against their will. They are subject to human rights abuses and are often housed in remote places where they have little hope of leaving.

Apart from Russia, Poland and Germany have taken in the most refugees, likely due to their accessibility and resources to help Ukrainians. Many Ukrainian refugees travel to Lviv, a city in western Ukraine. They are transported across the border into Poland by train, and either stay or travel to other countries such as Germany and the Czech Republic. In short, one of the reasons Poland and Germany receive so many refugees is simply because **they are accessible by rail**. However, distance alone does not fully account for this pattern. Many countries that are very close to Ukraine by rail, especially in southern Europe, host far fewer refugees. Most of these countries have low economic output. Countries with a larger GDP, such as Poland and Germany, are more likely to have the resources to provide aid, such as food, shelter, and financial assistance. In addition, these countries generally have a higher standard of living and employment opportunities. In sum, **including both distance and GDP as factors can accurately predict refugee distribution across Europe**.

This analysis is by no means an exhaustive list of the factors contributing to refugee distribution. For example, government policies, language barriers, family connections, and xenophobia all likely influence where refugees stay.

This map shows the predicted number of refugees for every European country, based on the average of distance from Ukraine and nominal GDP in 202.

## Conclusion

Russia’s invasion of Ukraine has forced millions of people to flee their homes in search of safety. This project sought to show the origin and destinations of refugees and explain their distribution across Europe. The hypothesis was that distance from Ukraine and economic status were two important contributing factors in where refugees settled. Ultimately, the refugee prediction model showed striking similarities to the actual distribution of refugees. While each refugee has a unique situation and set of priorities, we can conclude that a country’s economic activity and distance from Ukraine are relevant factors in the choices refugees make and their final destinations. The findings of this project can help countries predict refugee flows in the future and provide aid to geographic areas more efficiently. Future projects could include volunteered geographic information and civilian reports to achieve a more holistic study.



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## References

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GIS analyses and maps were created in Esri ArcGIS Pro and displayed in ArcGIS StoryMaps.

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