

# Data Analysis Plan: Ukraine Trade Shift Project

## Objective

This analysis aims to explore the shifting patterns of Ukraine's international trade, particularly in response to major political events such as the 2014 Euromaidan protests and the subsequent geopolitical realignment. The study focuses on identifying whether Ukraine's trade relationships have shifted away from Russia and post-Soviet states toward greater integration with the European Union and other democratic economies. Additionally, the analysis seeks to understand the role of institutional factors—such as political rights and civil liberties—in influencing these trade patterns. By examining economic and political determinants of trade realignment, the study will assess how these factors have shaped Ukraine's global economic position.

## Data Required and Collection Methodology

To conduct this analysis, multiple data sources are required. The primary dataset consists of bilateral trade volumes between Ukraine and its international trading partners over a period spanning from 1996 to 2022. This trade data is sourced from the World Integrated Trade Solution (WITS) database provided by the World Bank. To account for economic determinants, the study incorporates GDP data for both Ukraine and its trading partners, obtained from the World Bank's World Development Indicators (WDI). Political and institutional factors, such as Political Rights (PR) and Civil Liberties (CL) indices, are derived from the Freedom House Index. These scores allow us to assess whether countries with stronger democratic institutions engage in higher levels of trade with Ukraine compared to those with weaker institutional frameworks. Additionally, geographical data, including capital coordinates of Ukraine and its trade partners, are taken from a dataset set up by Github user ofou, which are verified by comparing them to the CIA World Factbook. Using the Haversine formula, the distance between coordinates on a global can be calculated to get the distance between Kyiv and the capital of the trading partner.

## Variables Used

The key variables in this analysis include: total bilateral trade volume (dependent variable), GDP of both Ukraine and its trading partners, geographical distance, Political Rights (PR) index, Civil Liberties (CL) index, and interaction terms capturing post-2014 effects. Additionally, categorical variables indicating whether a country belongs to the European Union or the Russosphere (post-Soviet states with strong Russian influence) are included to assess how trade realignment has occurred over time.

## Software and Analytical Approach

This analysis is conducted using **R**, with key libraries including tidyverse for data manipulation, ggplot2 and plotly for data visualization, fixest for econometric modeling, and shiny for developing an interactive dashboard. The analysis employs the Gravity Model of Trade, which posits that trade volumes between two countries are a function of their economic size and the distance between them. Additional institutional variables are incorporated to assess the extent to which political factors influence trade patterns.

## Metadata and Data Harmonization

The dataset includes multiple sources with different structures, requiring harmonization before analysis. The metadata captures essential details such as country codes, years, trade values, GDP, institutional indicators, and geospatial coordinates. Data cleaning and transformation are necessary to ensure consistency across sources. Missing data is addressed by filtering out incomplete observations or imputing values where appropriate. Variables are harmonized by ensuring common naming conventions and formats across datasets.

## Hypothesis

The hypothesis underlying this analysis is that Ukraine's trade has significantly shifted away from Russia and toward the European Union following the Euromaidan protests in 2014. Furthermore, it is expected that Ukraine increasingly trades with countries that have stronger institutional frameworks, as indicated by higher PR and CL scores. Additionally, the study hypothesizes that Ukraine's alignment with democratic economies correlates with higher trade volumes, while trade with authoritarian or politically unstable states has declined.

## Visualization Strategy

The results of this analysis will be visualized through an interactive **Shiny dashboard**, allowing users to explore Ukraine's trade evolution dynamically. Several types of visualizations will be used, including:

- **Maps:** Geospatial representations of trade shifts over time, highlighting Ukraine's trade partners and the extent of economic realignment.
- **Line Graphs:** Depicting trends in trade volume with key partners (e.g., Russia, EU countries) before and after 2014.
- **Regression Tables:** Summarizing the results of the econometric analysis in an interpretable format.

## Step-by-Step Plan

1. **Data Modification and Preparation:** Ensure datasets can be combined seamlessly by standardizing country codes, time formats, and variable names.
2. **Initial Exploration:** Conduct a preliminary analysis of trade patterns using summary statistics and exploratory visualizations to identify major trends.
3. **Data Harmonization and Cleaning:** Address missing values, remove inconsistencies, and format variables to align across datasets.
4. **Bias and Missing Data Analysis:** Assess whether any systematic bias exists in the dataset due to missing values or data collection inconsistencies.
5. **Data Preview and Visualization:** Generate preliminary static visualizations to validate data distributions before implementing interactive elements.
6. **Development of Interactive Dashboard:** Build a dynamic Shiny application incorporating trade maps, graphs, and user-driven analytics.
7. **Regression Analysis:** Estimate econometric models using the Gravity Model of Trade to quantify the impact of economic and institutional factors on trade flows.
8. **Optimization for Performance:** Improve the efficiency of the dashboard by optimizing reactive objects, reducing unnecessary computations, and speeding up rendering processes.

## Conclusion

By following this structured data analysis plan, the study will provide valuable insights into Ukraine's trade realignment and the impact of institutional factors on economic integration. The combination of econometric modeling and interactive visualization will allow for a comprehensive understanding of trade dynamics in the context of geopolitical shifts. Ultimately, this analysis contributes to broader discussions on economic diplomacy, trade policy, and international economic realignment in the post-Soviet space.