CIS 635 03 Project Progress Report (GJKS)

Garrit Reynolds, Joseph Vanliew, Katherine Parker, Sam Kiel

Project Progress Overview

Completed tasks of our project include data acquisition and some data preprocessing and exploratory analysis. However, preprocessing and exploratory analysis have not been completed at this point. The following links has been utilized to collect our data:

- https://fpma.fao.org/giews/fpmat4/#/dashboard/tool/domestic
- https://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=37

Challenges

A significant challenge our team faced as we tried to gather data is finding enough quality data from the countries of focus for our project that went back far enough. As stated in our proposal, we are focusing on countries dependent on Ukrainian agricultural products, which limits what countries we are interested in. As well, we want data that goes back at least several years prior to the Russian invasion of Ukraine which happened in February of 2022 which has been a challenge.

We addressed these challenges by utilizing a trial-and-error approach in the FPMA data, retaining our focus on the countries of interest, and looking at their available data to gain a better scope.

Mapping major Ukrainian grain exports to the prices of the previous year (2024) may prove challenging since the BACI has not yet published data for that year.

Collaboration

Our group has had challenges in finding common times to meet. We have met three times so far with plans to meet weekly from now on. All group members have contributed meaningfully in varying ways, like brainstorming, finding sources, data acquisition, and data wrangling.

Next steps

Below we have outlined our remaining tasks in a timeline. While we believe that we have the data we need, potential challenges may arise in analysis due to the varying availability of data for different countries from our sources.

Week	Task	Goals
Week 12 3/24	Progress report due (Tuesday, 03/25) Meeting 3/28	Preprocessing & Exploratory analysis
Week 13 3/31	Meeting 4/4 @ 10am	Visualizations & Evaluation
Week 14 4/7	Meeting 4/11 @ 10am	Impact analysis of geopolitical events & Write up findings
Week 15 4/14	Final report due (Friday, 04/18) Meeting 4/18 @ 10am	Finalize project

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Your progress update report should be a concise yet comprehensive document of approximately one to two pages covering the following areas:

Please submit your report (in PDF format) to Blackboard and your team GitHub repository. One submission per group. Include in the comments section of the assignment the names of the group members.

Your project proposal should be under 3 pages, be formatted under the following headings, and address each of the following points:

CIS 635 03 Term Project Proposal (GJKS)

Overview of the Project - Goot

Team Members: Garrit Reynolds, Katherine Parker, Joseph Van Liew, Sam Kiel
https://fpma.fao.org/giews/fpmat4/#/dashboard/tool/domestic

STUDY PRICES IN NATIONS RELIANT ON UKRAINIAN AG PRODUCTS

Russia and Ukraine were the world's first and fifth largest wheat exporting countries in 2021 (World Population Review, 2025) The conflict between these two nations has exacted a toll on global food security, particularly since the beginning of the full-scale invasion. Our group will conduct a study in the economic domain to examine the effects of this conflict on the prices of agricultural products in the most affected nations. We aim to discover the impact of many events, including but not limited to the Black Sea Grain Initiative and the full-scale invasion.

Our group will calculate price changes across affected nations at the inception, conclusion (if applicable), and for the duration of relevant events. These price changes will be compared and aggregated to extract conclusions about the quantitative effect of these events on food security in the nations most affected. The knowledge gained by studying the price reaction to these events will provide actionable insight for economic policymakers to protect their constituents from similar future geopolitical crises.

Related Work - Sam

Related works have discussed food security and the impact of the Russia-Ukraine conflict on global markets. For example, Elleby et al. (2023) used a simulation scenario to look at the effect of the Russia-Ukraine conflict on the price of various products for specific countries. Fan et al. (2023) estimated the effects of the Russia-Ukraine conflict on developing countries. They state, "specifically, increases in agriculture prices are estimated to reach 3%–18% in those countries that rely on grain imports from Ukraine" (Fan et al., 2023). Hensel (2024) discussed the change of UN FAO price indices for food from 2010 to 2023 noting a "substantial increase in prices following Russia's invasion of Ukraine, and the decline in food prices with the Black Sea Initiative and with additional global efforts to locate other food sources." We aim to look at a wider range of years to assess agricultural product prices for specific countries reliant on Ukrainian exports and compare our findings to the analyses and estimates of these studies.

1. https://www.consilium.europa.eu/en/infographics/ukrainian-grain-exports-explained/ & https://www.consilium.europa.eu/en/infographics/how-the-russian-invasion-of-ukraine-has-further-aggravated-the-global-food-crisis/
    - Not over the same number of years and not only US
2. https://research.ebsco.com/c/6l5vh5/viewer/pdf/vazd3wcxlf?auth-callid=08eec01e-b987-48b8-b85f-1a53407c74fc
    - Doesn't discuss US and not over the same time-frame, doesn't look at sunflower oil
3. https://www.bis.doc.gov/index.php/documents/technology-evaluation/ote-data-portal/country-analysis/3413-2022-statistical-analysis-of-us-trade-with-ukraine/file
    - US, but not over the same number of years and not a ton of depth into the same products

4. https://www.ers.usda.gov/amber-waves/2024/may/ukraine-s-rise-in-grain-and-sunflower-seed-market-share-limited-by-ongoing-war
    - Most similar but global, may be interesting to compare our results of the us to theirs
5. https://www.sciencedirect.com/science/article/abs/pii/S0305750X23002140#:~:text=We%20analyze%20the%20impacts%20of,prices%20fell%20by%20about%2027%25.
    - This looks at top wheat-producing, importing, and exporting countries. Doesn't look at grains & sunflower oil and is not Ukraine/US focused. But may help offer some insight into our results.
6. https://worldpopulationreview.com/country-rankings/wheat-exports-by-country
    - List of top 10 wheat exporters

Links:

https://www.csis.org/analysis/setting-record-straight-ukraines-grain-exports

- not US focused but very interesting background makes me think of looking at change in proportion exports to US of total Ukraine production

https://doaj.org/article/16ae2396407a4dde97a0e9c030603628

- Not what we are looking at, but interesting!

Data plan - Katherine

The data we intend to use for this project is from the Food and Agriculture Organization of the United Nations's Food Price Monitoring and Analysis Tool (FPMA), and we are also considering data from the BACI, which provides data on imports and exports for over 200 countries at the product level. In this study, we will be focusing on countries that have been identified as the most dependent on agricultural products from Ukraine by the BACI which includes Egypt, Indonesia, Pakistan, Bangladesh, Lebanon, Tunisia, Yemen, and Libya, among others.

The timeline in focus is the past thirty years, dependent on data. Key events in Ukraine's geopolitical and economic history have taken place, causing ripple effects on its agricultural exports, especially the full-scale invasion of Ukraine beginning in 2022.

When preprocessing data from the BACI and the FPMA, there are several key steps to address. First, it is important to note how each dataset standardizes the way they categorize foods and agricultural products. The BACI uses The Harmonization System, and offers versions such as HS92, HS96, HS02, HS17, etc. The FPMA uses HS2017. If we wish to combine datasets or compare datasets at any point, we must be sure to download data in a comparable international classification.

After we load the data, we'll need to do some visualizations to see what the data looks like in terms of outliers, trends, and missing data. Then, we'll need to handle the missing values. If there are missing values, we may need to look at other sources to determine why that may be. We can choose to replace any missing values with the mean, median, or mode of that time period, using what we know about Ukraine's export history to create horizontal bins. If we do choose to include another data source, we will need to ensure we remove any duplicate entries and outliers that could skew our analysis. Then, we'll need to normalize the data using a z-score

normalization. Additionally, we'll need to verify the integrity of the data by cross-referencing with reliable sources to ensure validity.

Implementation plan - Joseph

- Data Mining Pipeline
    1. Data Acquisition
        a. Extract historical price data from the FPMA tool and BACI trade data. Ensure proper classification of agricultural products using HS2017 codes. Use Pandas DataFrames for Raw data.
    2. Data Preprocessing
        a. Standardize product classifications between datasets. Use sklearn and Z-score normalization techniques.
    3. Exploratory Data Analysis (EDA)
        a. Generate descriptive statistics and visualize distributions.
        b. Create time series plots to observe price trends.
    4. Impact Analysis of Geopolitical Events
        a. Perform event study analysis to quantify price fluctuations before, during, and after events. Compute percentage changes and moving averages for event-driven comparisons.
    5. Visualization and Reporting
        a. Create interactive visualizations using Matplotlib, Seaborn, and HTML-based reports. Generate summary tables with key insights.
- Implementation

1. Initial testing in Google Colab for quick prototyping and debugging.
2. Data storage and preprocessing using Pandas to structure and clean the dataset.
3. Statistical analysis using Statsmodels to evaluate dependencies and trends.
4. Machine learning techniques from Sklearn for data normalization and imputation.
5. Custom event-based analysis using Python to measure geopolitical impacts.
6. Visualization using Matplotlib & Seaborn to present key insights.
7. Final report generation in HTML/Python notebooks to document our findings.

   Leverage GitHub for version control and collaborative development.

- Components and Libraries
    - Statsmodels: numpy, mean squared, mean absolute.
    - Sklearn: Standard Scalar, Simple Imputer
    - Matplotlib, Seaborn, Python, HTML, GoogleColab

Evaluation plan - Garrit

Due to the geopolitical relevance of our study, a plethora of studies on this topic are available. To evaluate our data mining algorithm, our group will compare our derived conclusions with the most similar studies. In general, our comparisons will be made using a

percentage difference. These sources may present their conclusions in various ways, so we will need to adapt accordingly. Some general contingency plans for comparison scenarios we are likely to encounter are enumerated below:

1. Single-value comparisons can be made with a simple percent difference.
2. Time series comparisons can be made with average percent difference.
3. Time series comparisons between results of differing dates can generally be adequately represented with a linear projection of our results at the desired date for comparison. However, if faced with missing data, we may need to project over longer periods, which will require more complex methods.
4. Comparisons between differing nations or units will require normalization due to the quantitative differences. We will normalize our results to the scale of the results of our evaluation source.

Our comparisons are likely to fall in the previously articulated scenarios. Upon further progress in our study, we are likely to discover comparisons of interest that fall outside of the planned methods. We will need to determine our evaluation method accordingly.

Plan for group collaboration - Sam

Our group will typically meet weekly, on Fridays, and will communicate any changes in schedule as needed. A discord server is being utilized to communicate both asynchronously and synchronously by using text and voice channels.

We plan to collaborate to implement our data pipeline by managing our code and data via Github. Action items will be split among the group during each weekly meeting as we progress through the project. Effective deadlines will be determined for those tasks as they are likely to be dependent on each other. The timeline below establishes our goals for each week of the project.

Timeline

Week	Task	Goals
Week 8 2/24	Project proposal due (Friday, 02/28) Meeting 2/24 @ 1:00pm Meeting 2/27 @ 1:00pm	2/24: Finalize what our data plan will be & split up proposal responsibilities. 2/27: Discuss proposal progress & split up next tasks.
Week 9 3/03	No meeting (break)	
Week 10 3/10	Meeting 3/14 @ 10am	Data acquisition & preprocessing

Week 11 3/17	Meeting 3/21 @ 10am	Exploratory analysis
Week 12 3/24	Progress report due (Monday, 03/24) Meeting 3/28 @ 10am	Impact analysis of geopolitical events
Week 13 3/31	Meeting 4/4 @ 10am	Visualizations & Evaluation
Week 14 4/7	Meeting 4/11 @ 10am	Write up findings
Week 15 4/14	Final report due (Friday, 04/18) Meeting 4/18 @ 10am	Finalize project

References

- List your references.
- https://www.osw.waw.pl/en/publikacje/osw-report/2021-12-09/breadbasket-world
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Fan, F., Jia, N., & Lin, F. (2023). Quantifying the impact of Russia–Ukraine crisis on food security and trade pattern: evidence from a structural general equilibrium trade model. *China Agricultural Economic Review, 15*(2), 241-258. https://doi.org/10.1108/CAER-07-2022-0156

Hensel, N. (2024). The Russia-Ukraine crisis: How regional conflicts impact the global economy. *PRISM Security Studies Journal*, *10*(4), 102–122. Retrieved February 28, 2025, from https://research.ebsco.com/c/6l5vh5/viewer/pdf/jcz5rabj7b