

GLOBAL SHIPPING AND TRADE ANALYSIS

1. Project Overview

The goal of this project is to analyse global shipping patterns and trade flows using UN Comtrade Seaborne Trade dataset as the main data source. By integrating import/export data, the aim is to uncover trends in maritime trade, assess shipping efficiency and explore external factors such as weather and economic disruptions.

This analysis will help answer key questions about trade dynamics, vessel activity and cargo movement on a global scale. Additionally, forecasting techniques will be applied to predict future shipping volumes and trade patterns.

2. Key objectives

- Identify global trade trends by sea from 2015 to 2023
- Analyse key trading countries, commodities and trade volumes.
- Examine how trade flows vary over time and identify seasonal trends.
- Investigate potential factors affecting shipping efficiency (e.g. port congestion, vessel type, weather conditions)
- Develop predictive models to forecast future shipping and trade flows.

3. Hypotheses to test

1. Trade volumes fluctuate seasonally, with peak activity during certain months.
2. The largest trade imbalances occur between specific regions due to supply chain dependencies.
3. Vessel types and sizes have a measurable impact on shipping efficiency and trade volume.
4. Weather conditions (storms, wind speed, etc) significantly impact port congestion and trade delays.
5. The global economic climate, including fuel prices and political events correlates with fluctuations in trade volume.

4. Data Source

Primary Dataset: UN Comtrade Seaborne Trade (Import & Exports)

This dataset provides historical seaborne trade statistics across various countries. The import and export datasets contains identical columns and will be merged for analysis.

Why this dataset?

- It is open source and comes from an authoritative institution (UN Comtrade)

- The dataset includes both imports and exports, allowing for a complete view of trade flows.
- It covers multiple years (2015-2023), providing enough historical data for trend analysis.
- It contains both continuous variables (trade volume, vessel tonnage) and categorical variables (trade flow, vessel type, country)
- The dataset has a strong geographical component (countries and port activity)

Weather dataset (ERA5 Data)

To assess the impact of weather on shipping, ERA5 reanalysis data will be used, which includes wind speed, temperature and precipitation levels.

Additional Complementary Data

- Port congestion and performance data (if accessible UN trade dataset)
- Global economic indicators (fuel prices, GDP trends maybe)

5. Data dictionary (UN Comrade seaborne trade dataset)

This dataset includes the following columns

Column Name	Description
typeCode	Categorical code for trade type.
freqCode	Frequency of the data (e.g., daily, monthly).
countryareaCode	Numeric country code of the reporting country.
countryareaDesc	Name of the reporting country.
vesselTypeCode	Numeric code representing the vessel type.
vesselTypeDesc	Description of the vessel type (e.g., LPG/LNG, oil tankers).
flowCode	Categorical trade flow code: M for Imports, X for Exports.
flowDesc	Trade flow description (Imports/Exports).
date	Date of trade activity (YYYY-MM-DD format).
num_pc	Number of port calls related to the trade flow.
mtc	Metric tons carried by the vessel.
dwt	Deadweight tonnage (vessel carrying capacity).
num_pc_ma	Moving average of the number of port calls.
mtc_ma	Moving average of metric tons carried.
dwt_ma	Moving average of deadweight tonnage.

6. Methodology and analysis stages

Data cleaning and preprocessing:

- Merge import and export datasets.
- Convert date columns into appropriate formats.
- Handle missing values and outliers.

Exploratory Data Analysis (EDA):

- Visualise trade flows by country and vessel type.
- Identify seasonal patterns and anomalies.
- Compare import vs. export trends.

Geospatial & Network Analysis:

- Map key shipping routes.
- Identify the busiest ports and trade hubs.

Predictive Analytics & Modeling:

- Time series forecasting of trade volumes.
- Regression models to assess factors influencing trade efficiency.

Integration with Weather Data:

- Correlate trade disruptions with extreme weather events.
- Assess how wind speeds and precipitation affect trade flows.

Final Insights & Dashboard Creation:

- Summarise findings in an interactive Tableau Public dashboard.
- Provide recommendations for stakeholders in global trade.

7. Expected Outcomes

- A clear understanding of how global shipping trade has evolved from 2018 to 2023.
- Insights into the role of vessel types, port congestion, and trade imbalances.
- Predictive models to forecast trade fluctuations.
- Interactive dashboards to visualise findings.
- Recommendations for policymakers and logistics companies to improve trade efficiency.

9. Ethical Considerations & Limitations

- **Data Accuracy:** The dataset is based on reported trade statistics and may have inconsistencies.
- **Sampling Bias:** Some smaller ports or less-tracked shipments might be underrepresented.
- **Temporal Gaps:** Missing records for specific dates or regions could impact analysis.
- **Privacy Considerations:** The dataset does not contain personally identifiable information.

Key questions for the global shipping and trade analysis project

1. Trade flow and volume trends

- How have global maritime trade volumes (imports vs. exports) evolved over time (2018–2023)?
- What are the busiest months for maritime trade? Are there any seasonal trends?
- Which countries contribute the most to global maritime trade (both imports and exports)?
- What are the most common vessel types used in seaborne trade, and how has their usage changed over time?
- What percentage of port calls results in actual trade activity, and how does this vary by country?

2. Country-specific trade analysis

- Which countries have the largest trade surpluses/deficits in seaborne trade?
- How does the volume of imports and exports vary by country and region?
- Are there countries that rely more on certain vessel types (e.g., LNG carriers vs. oil tankers)?
- How do emerging economies compare to developed economies in terms of seaborne trade activity?
- What is the share of intra-continental trade (e.g., Europe-to-Europe) versus intercontinental trade?

3. Port & shipping efficiency

- What are the most frequent shipping routes globally?
- Are certain ports more efficient than others in handling trade volume?
- How does port congestion affect trade flow and vessel turnaround times?
- Do certain vessel types experience longer port stays than others?
- How does deadweight tonnage (DWT) relate to trade efficiency? Are larger vessels more efficient?

4. Weather economic factors

- How do extreme weather events (storms, strong winds) impact trade volumes and vessel movement?
- Is there a correlation between global fuel prices and trade volume fluctuations?
- Do geopolitical events (e.g., trade sanctions, conflicts) correlate with significant drops in trade volume?
- How did COVID-19 impact global maritime trade flows?
- Can we predict future trade volumes using past trends and external factors (weather, economic indicators)?

