Dhirubhai Ambani Institute of Information and Communication Technology

Masters of Science in Data Science

M.Sc. D.S. Programme

Exploratory Data Analysis

Project Report

Sem II (AY 2022-2023)

Import & Export EDA

By

Project Guided by-

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Acknowledgement

We would like to express our gratitude towards Prof. Gopinath Panda for his/her invaluable guidance and support throughout our Exploratory Data Analysis project on import & Export Data. Prof. Panda's expertise and insights in the field of data analysis have been invaluable in helping us understand the concepts and techniques used in this project. His guidance has been instrumental in ensuring the successful completion of this project. We are deeply grateful to Prof. Panda for his time, knowledge, and expertise with us. We would also like to thank our peers and colleagues who provided us with feedback and support throughout the project. Without their encouragement, this project would not have been possible.

Pande Shivani (202218044)

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DECLARATION

We hereby declare that the Exploratory Data Analysis project on import & Export Data submitted in fulfillment of the requirements for the [Course Name] is an original work carried out by us under the guidance of Prof. Gopinath Panda.

We further declare that the data and analysis presented in this report are authentic and have been collected and analyzed according to ethical principles and standards of the field of data analysis. Any references used in this report have been duly cited and credited.

We acknowledge that any form of plagiarism, including copying content from the internet or any other sources, has not been used in the preparation of this report. We understand that any such act of academic dishonesty may result in disciplinary action being taken against us.

We also declare that this project report has not been submitted to any other institution or university for any other degree or diploma.

Pande Shivani (202218044)

Sheth Swapnil (202218045)

Singh Vipul (202218052)

Bakshi Jitul (202218059)

CERTIFICATE

This is to certify that

Seat no.	Student
202218044	Pande Shivani
202218045	Sheth Swapnil
202218052	Singh Vipul
202218059	Bakshi Jitul

Students of M.Sc. Data Science, have successfully completed the Exploratory Data Analysis project on import & Export Data under my guidance.

I hereby acknowledge that the project work presented by them is an original and authentic work carried out by him/her under my supervision. The data and analysis presented in this project report are based on ethical principles and standards of the field of data analysis.

I further certify that they have complied with all the academic requirements and has proficiency in the field of data analysis.

Dr. Gopinath Panda

-Course instructor

-DAIICT

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Introduction

India is one of the world's fastest-growing economies and a significant player in the global trade market. The country's rapid industrialization and urbanization have resulted in a surge in energy demand, making it one of the largest importers of fuel in the world. India imports a significant amount of its fuel requirements, including crude oil, natural gas, and coal, to meet its energy needs. At the same time, the country also exports refined petroleum products to other nations. In this context, the import/export of fuel in India is a critical aspect of its energy security and economic growth. This topic is of significant interest to policymakers, businesses, and individuals, as it impacts India's overall energy mix and trade relations with other countries.

In this project we have collected data from the year 2012 to 2017, which shows India’s trade of fuel with different countries around the globe and India’s quantity and value of trade in different components of crude oil.

India had a total export of 275,488,744.93 in thousands of US$ and total imports of 367,980,363.48 in thousands of US$ leading to a negative trade balance of -92,491,618.55 in thousands of US$. The trade growth is -8.75% compared to a world growth of -3.91%. GDP of India is 2,622,983,732,006.45 in current US$. India services export is 203,252,809,974.88 in Bop, current US$ and services import is 116,230,057,653.75 in Bop, current US$. India exports of goods and services as percentage of GDP is 18.08% and imports of goods and services as percentage of GDP is 18.39%.

Data Description

Units

- **TMT (Thousand Metric Tons)**
  - Shows the quantity unit of the commodity fuel
  - 1 TMT = 1,000 MT = 1,000,000 kg

- **USD $ (American dollar)**
  - Shows the value of the commodity in monetary terms
  - We have used American dollar as base currency in this project

- **Per unit Value**
  - It tells us the per unit cost of fuel for import and export
  - Formula:
    - Value (million USD) / Quantity(TMT)

- **Import share %**
  - The share of total merchandise trade (import) accounted for by the product in a given year

- **Export share %**
  - The share of total merchandise trade (export) accounted for by the product in a given year

Data Files:

- **fuel_2012.csv** – shows India's trade of fuels with different countries in 2012.

- **fuel_2013.csv** – shows India's trade of fuels with different countries in 2013.
- **fuel_2014.csv** – shows India's trade of fuels with different countries in 2014.
- **fuel_2015.csv** – shows India's trade of fuels with different countries in 2015.
- **fuel_2016.csv** – shows India's trade of fuels with different countries in 2016.
- **fuel_2017.csv** – shows India's trade of fuels with different countries in 2017.
- **Crude_data** – shows India's trade of different components of crude oil from the year 2012 to 2017

Features of data

- single year data frames: (y16 – y17)
  - columns:
    - `'Partner Name'`
    - `'Export (US$ Thousand)'`
    - `'Import (US$ Thousand)',`
    - `'Export Product Share (%)',`
    - `'Import Product Share (%)']`

- Combined data frame of all years(yall)
  - Considering all the data entries we have common 85 entries of the country. We will merge them all into a single a data frame
  - Columns:

- Partner Name
- y12_export
- y12_import
- y12_exportProductShare
- y12_importProductShare
- y13_export
- y13_import
- y13_exportProductShare
- y13_importProductShare
- y14_export
- y14_import
- y14_exportProductShare
- y14_importProductShare
- y15_export
- y15_import

        - y15_exportProductShare
        - y15_importProductShare
        - y16_export
        - y16_import
        - y16_exportProductShare
        - y16_importProductShare
        - y17_export float64
        - y17_import
        - y17_exportProductShare
        - y17_importProductShare

    - shape(85,25)

- crude data frame: (crude_df)
    - Consist all the information of import and export of all the crude oils from year 2012 to 2016.
- Import dataframe: (import_df)
    - This is a filtered data frame from crude_df which filters and stores only the import data of the years
    - Shape(12,11)
    - Columns:

- 'Item',
- '2012 - Qty. - TMT',
- '2012 - Value - Million USD',
- '2013 - Qty. - TMT',
- '2013 - Value - Million USD',
- '2014 - Qty. - TMT',
- '2014 - Value - Million USD',
- '2015 - Qty. - TMT',
- '2015 - Value - Million USD',
- '2016 - Qty. - TMT',
- '2016 - Value - Million USD',
- '2017 (P) - Qty. - TMT',
- '2017 (P) - Value - Million USD'

- Export dataframe: (export_df)
  - This is a filtered data frame from crude_df which filters and stores only the export data of the years
  - Shape(12,11)
  - Columns:

- 'Item',
- '2012 - Qty. - TMT',
- '2012 - Value - Million USD',
- '2013 - Qty. - TMT',
- '2013 - Value - Million USD',
- '2014 - Qty. - TMT',
- '2014 - Value - Million USD',
- '2015 - Qty. - TMT',
- '2015 - Value - Million USD',
- '2016 - Qty. - TMT',
- '2016 - Value - Million USD',
- '2017 (P) - Qty. - TMT',
- '2017 (P) - Value - Million USD'

Libraries used

Pandas:
Pandas is a popular open-source Python library used for data analysis, data manipulation, and data visualization. It provides easy-to-use data structures and data analysis tools for efficient data handling and processing. Pandas library is an essential tool for anyone working with data in Python, as it provides a powerful and flexible way to manipulate and analyze data efficiently.

NumPy:
NumPy is a popular open-source Python library that stands for Numerical Python. It provides support for multi-dimensional arrays and matrices, along with a wide range of mathematical functions that can be applied to these arrays. NumPy is used extensively in scientific computing, data analysis, machine learning, and other fields that require numerical computations. It provides a powerful and efficient way to perform numerical calculations in Python and has become an essential tool for any data scientist or researcher working with large numerical data sets.

Matplotlib.pyplot:
Matplotlib.pyplot is a popular plotting library for Python that is used to create static, animated, and interactive visualizations in Python. It is part of the larger Matplotlib library, which provides a wide range of functionalities for creating high-quality visualizations in Python. Matplotlib.pyplot is an essential tool for any Python programmer or data scientist working with data visualization. It is a powerful and flexible library that can be used to create a wide range of visualizations, from simple plots to complex charts and graphs, with ease.

Seaborn:

Seaborn is a popular open-source data visualization library for Python that is built on top of Matplotlib. It provides a high-level interface for creating informative and attractive statistical graphics in Python. Seaborn is a

powerful and flexible data visualization library that provides a range of options for creating high-quality and informative statistical graphics in Python. It is an essential tool for anyone working with data in Python, from exploratory data analysis to production-level data visualization.

Missingno:

Missingno is a Python library for visualizing and handling missing data in data analysis. It provides a range of tools and techniques for exploring and analyzing missing data patterns, making it an essential tool for data scientists and analysts. Missingno is a powerful and flexible library that provides a range of tools and techniques for visualizing and handling missing data in data analysis. It is an essential tool for anyone working with large datasets that contain missing values, from exploratory data analysis to production-level data cleaning.

Scikit-learn:

Scikit-learn (also known as sklearn) is a popular open-source Python library for machine learning. It provides a range of tools and algorithms for data mining and data analysis tasks, including classification, regression, clustering, and dimensionality reduction. Scikit-learn is a powerful and flexible library that provides a wide range of tools and algorithms for machine learning and data analysis tasks. It is an essential tool for any data scientist or machine learning practitioner working with Python.

1) Data Pre-Processing

Data cleaning is an essential aspect of data preprocessing that involves identifying and correcting errors and inconsistencies in the data. Missing values can be filled with imputation techniques, such as mean or median imputation, or by using more advanced techniques such as regression imputation. Outliers can be detected using statistical techniques and removed or corrected. Additionally, the data can be standardized or normalized to ensure that it is on the same scale.

The steps followed for data cleaning,

- **Data reduction**: This step involves reducing the amount of data by eliminating redundant or irrelevant information, such as duplicate records or irrelevant variables.

- **Data cleaning**: This step involves identifying and correcting errors or inconsistencies in the data, such as missing values, incorrect data types, or invalid values.

- **Data transformation**: This step involves converting raw data into a format that is more suitable for analysis, such as converting categorical variables into numerical ones or scaling data to be within a specific range.

In **Data Reduction** we have reduced the data from the yearly data frames to exact the relevant information of 4 columns mentioned in the data description

Importing data

```
y12= pd.read_csv('D:\EDA Project\Fuel_2012.csv')    # Import-Export Fuel d
ataset of 2012
y13= pd.read_csv('D:\EDA Project\Fuel_2013.csv')    # Import-Export Fuel d
ataset of 2013
y14= pd.read_csv('D:\EDA Project\Fuel_2014.csv')    # Import-Export Fuel d
ataset of 2014
y15= pd.read_csv('D:\EDA Project\Fuel_2015.csv')    # Import-Export Fuel d
ataset of 2015
y16= pd.read_csv('D:\EDA Project\Fuel_2016.csv')    # Import-Export Fuel d
ataset of 2016
y17= pd.read_csv('D:\EDA Project\Fuel_2017.csv')    # Import-Export Fuel d
ataset of 2017
```

Reducing data

```
# Filtering out unnecessary columns by picking only significant columns in
 all dataframes

y12= y12[['Partner Name','Export (US$ Thousand)','Import (US$ Thousand)','
Export Product Share (%)','Import Product Share (%)']]
y13= y13[['Partner Name','Export (US$ Thousand)','Import (US$ Thousand)','
Export Product Share (%)','Import Product Share (%)']]
y14= y14[['Partner Name','Export (US$ Thousand)','Import (US$ Thousand)','
Export Product Share (%)','Import Product Share (%)']]
y15= y15[['Partner Name','Export (US$ Thousand)','Import (US$ Thousand)','
Export Product Share (%)','Import Product Share (%)']]
y16= y16[['Partner Name','Export (US$ Thousand)','Import (US$ Thousand)','
Export Product Share (%)','Import Product Share (%)']]
y17= y17[['Partner Name','Export (US$ Thousand)','Import (US$ Thousand)','
Export Product Share (%)','Import Product Share (%)']]
```

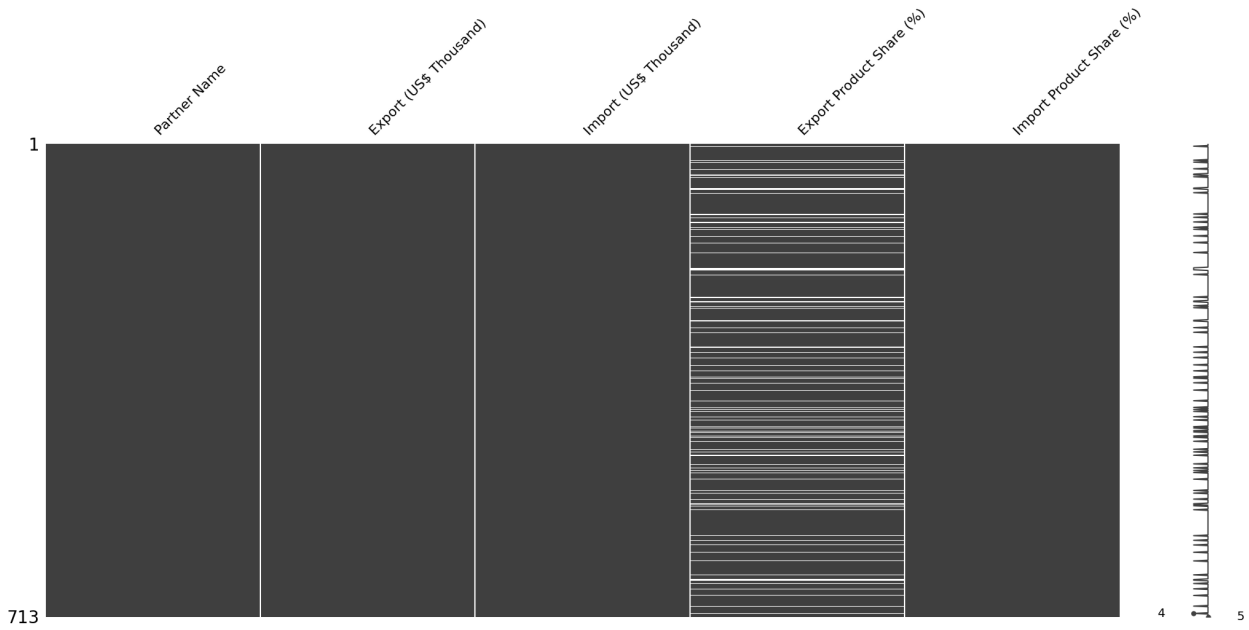
In **data Cleaning** we have checked for the missing values and irrelevant values. We found,

1) Numeric values with comma(,) giving wrong interpretation of datatype To correct that we have created a function.

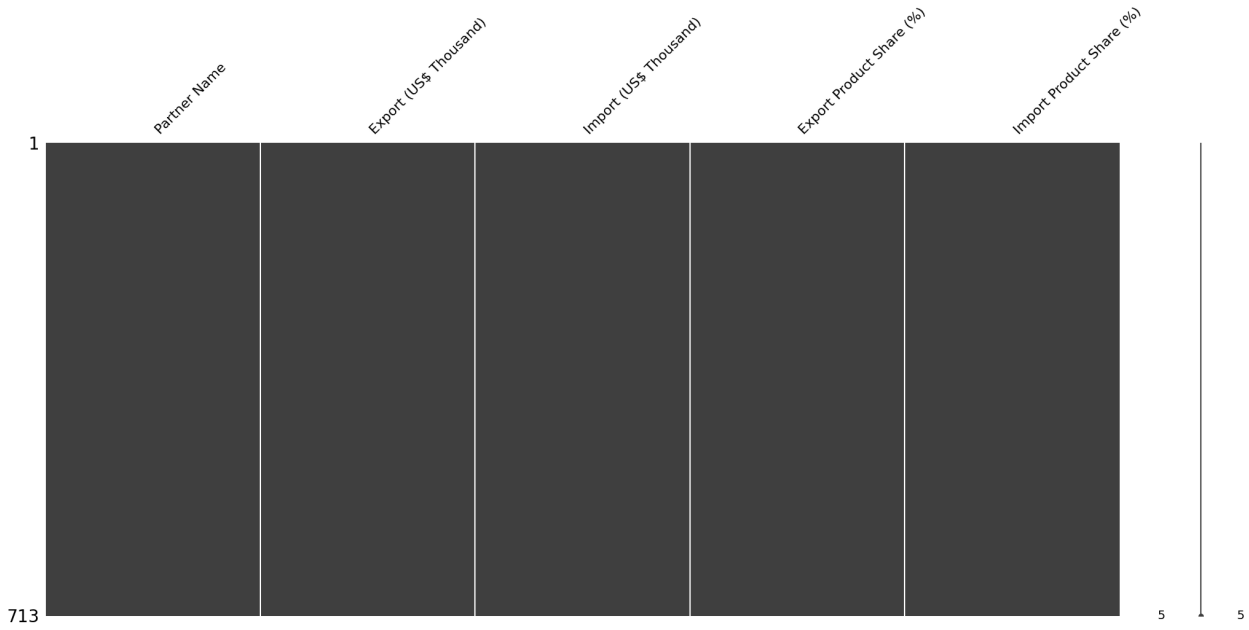
```
a. # Some of the values in the column contains comma ',' ; e.g. 1
   ,000
b. # This function remove commas from the values of each column a
   nd convert the column into numeric datatype in each dataframe
c.
d. def remove_comma(df):
e.     for i in range(len(df['Export (US$ Thousand)'])):
f.         if type(df['Export (US$ Thousand)'][i])==str:
```

```
g.              df['Export (US$ Thousand)'][i]=float(df['Export (U
   S$ Thousand)'][i].replace(',', ''))
h.
i.      df['Export (US$ Thousand)']=df['Export (US$ Thousand)'].ap
   ply(pd.to_numeric)
j.
k.      for i in range(len(df['Import (US$ Thousand)'])):
l.          if type(df['Import (US$ Thousand)'][i])==str:
m.              df['Import (US$ Thousand)'][i]=float(df['Import (U
   S$ Thousand)'][i].replace(',', ''))
n.
o.      df['Import (US$ Thousand)']=df['Import (US$ Thousand)'].ap
   ply(pd.to_numeric)
p.
q.      for i in range(len(df['Export Product Share (%)'])):
r.          if type(df['Export Product Share (%)'][i])==str:
s.              df['Export Product Share (%)'][i]=float(df['Export
    Product Share (%)'][i].replace(',', ''))
t.
u.      df['Export Product Share (%)']=df['Export Product Share (%
   )'].apply(pd.to_numeric)
v.
w.      for i in range(len(df['Import Product Share (%)'])):
x.          if type(df['Import Product Share (%)'][i])==str:
y.              df['Import Product Share (%)'][i]=float(df['Import
    Product Share (%)'][i].replace(',', ''))
z.
aa.         df['Import Product Share (%)']=df['Import Product Share
    (%)'].apply(pd.to_numeric)
```

2) Missing values in export_share for the countries having export value ’0’ . Thus they need to be imputed with zero




```
y12['Export Product Share (%)']=y12['Export Product Share (%)'].fillna(0)
y13['Export Product Share (%)']=y13['Export Product Share (%)'].fillna(0)
y14['Export Product Share (%)']=y14['Export Product Share (%)'].fillna(0)
y15['Export Product Share (%)']=y15['Export Product Share (%)'].fillna(0)
y16['Export Product Share (%)']=y16['Export Product Share (%)'].fillna(0)
y17['Export Product Share (%)']=y17['Export Product Share (%)'].fillna(0)
```



In **data transformation** we check if the data types are properly interpreted or not, the above code also corrects the data types of the wrongly interpreted columns. We also have to rename the columns in the data frame and merge it to 1 dataframe.

```
# Renaming the columns to distinguish similar columns of each datatype to
disregard any ambiguity


y12.columns=['Index','y12_export','y12_import','y12_exportProductShare','y
12_importProductShare']
y13.columns=['Index','y13_export','y13_import','y13_exportProductShare','y
13_importProductShare']
y14.columns=['Index','y14_export','y14_import','y14_exportProductShare','y
14_importProductShare']
y15.columns=['Index','y15_export','y15_import','y15_exportProductShare','y
15_importProductShare']
y16.columns=['Index','y16_export','y16_import','y16_exportProductShare','y
16_importProductShare']
y17.columns=['Index','y17_export','y17_import','y17_exportProductShare','y
17_importProductShare']


# Merging all data frame by appending the columns in one dataframe and fil
tering the data frame to have only common values

yall= pd.merge(y12,y13, how='inner', left_on='Index', right_on='Index')
yall= pd.merge(yall,y14, how='inner', left_on='Index', right_on='Index')
yall= pd.merge(yall,y15, how='inner', left_on='Index', right_on='Index')
yall= pd.merge(yall,y16, how='inner', left_on='Index', right_on='Index')
yall= pd.merge(yall,y17, how='inner', left_on='Index', right_on='Index')
```

2) IDA (Initial Data Analysis)

1) Spliting Dataset:
   We need to split dataset to set similar features to plot. We need to create multiple dataframes for different data plot and analysis
   Eg. For dataframes splitting:

```
# Divinding the merged dataframe into country wise export value dataframe
country_export_df = yall[['Index','y12_export','y13_export','y14_export','
y15_export','y16_export','y17_export']]

# Divinding the merged dataframe into country wise import value dataframe
country_import_df = yall[['Index','y12_import','y13_import','y14_import','
y15_import','y16_import','y17_import']]

# Divinding the merged dataframe into country wise export share dataframe
country_exportshare_df = yall[['Index','y12_exportProductShare','y13_expor
tProductShare','y14_exportProductShare','y15_exportProductShare','y16_expo
rtProductShare','y17_exportProductShare',]]

# Divinding the merged dataframe into country wise import share dataframe
country_importshare_df = yall[['Index','y12_importProductShare','y13_impor
tProductShare','y14_importProductShare','y15_importProductShare','y16_impo
rtProductShare','y17_importProductShare',]]
```

2) Transposing of dataset:
   To do certain analysis having values on rows, we need to transform the dataframe rows to columns and columns to rows
   For that we have created a function

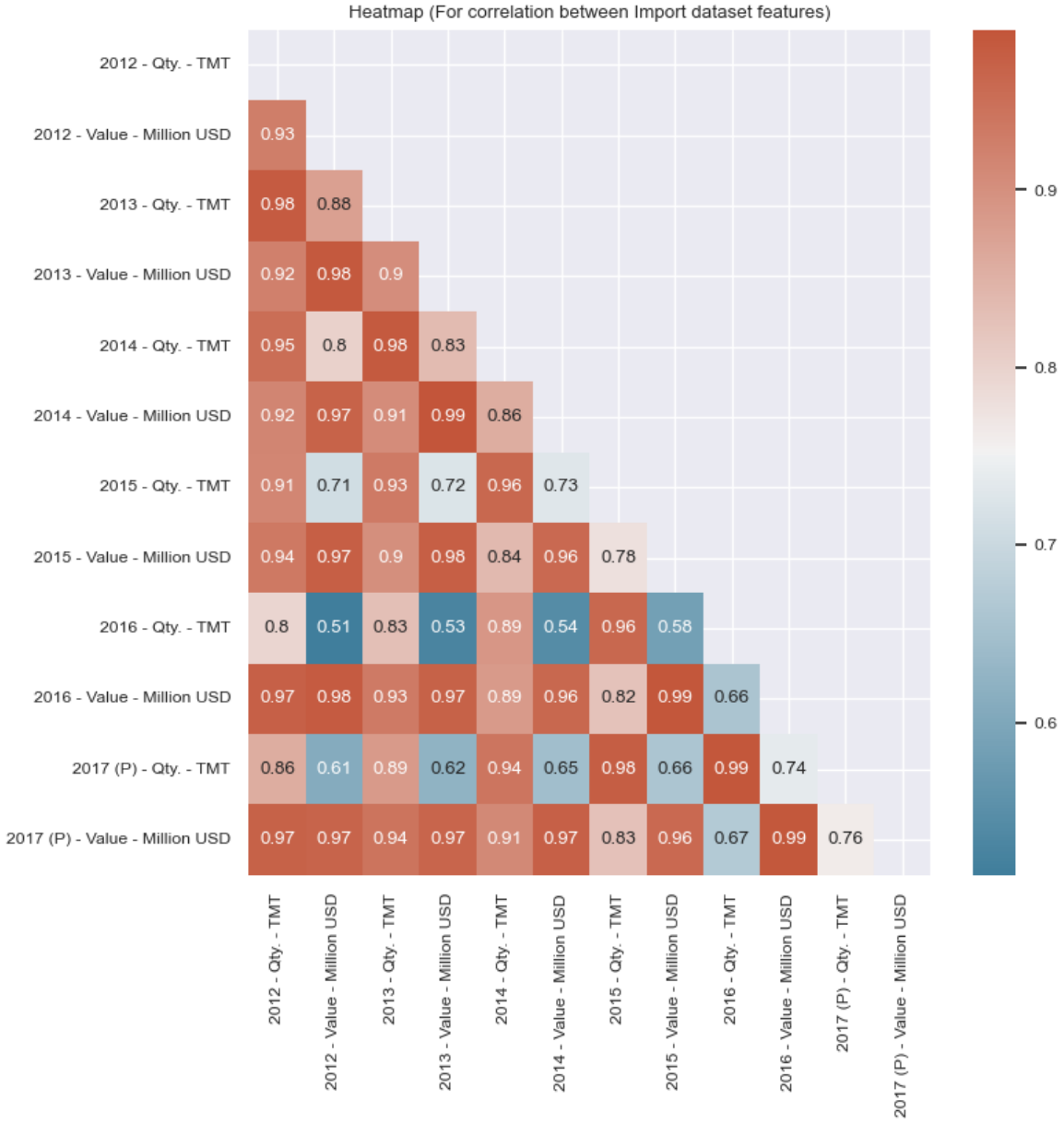
```
# This function transpose the dataframe and reindex it according to new co
lumns

def df_transpose(df):
  df = df.set_index(df.columns[0])
  column = list(df.columns)
  df = df.T
  df = df.reindex(column)
  df.reset_index(inplace = True)
  df.rename(columns = {'index':'Year'}, inplace = True)
  return df
```

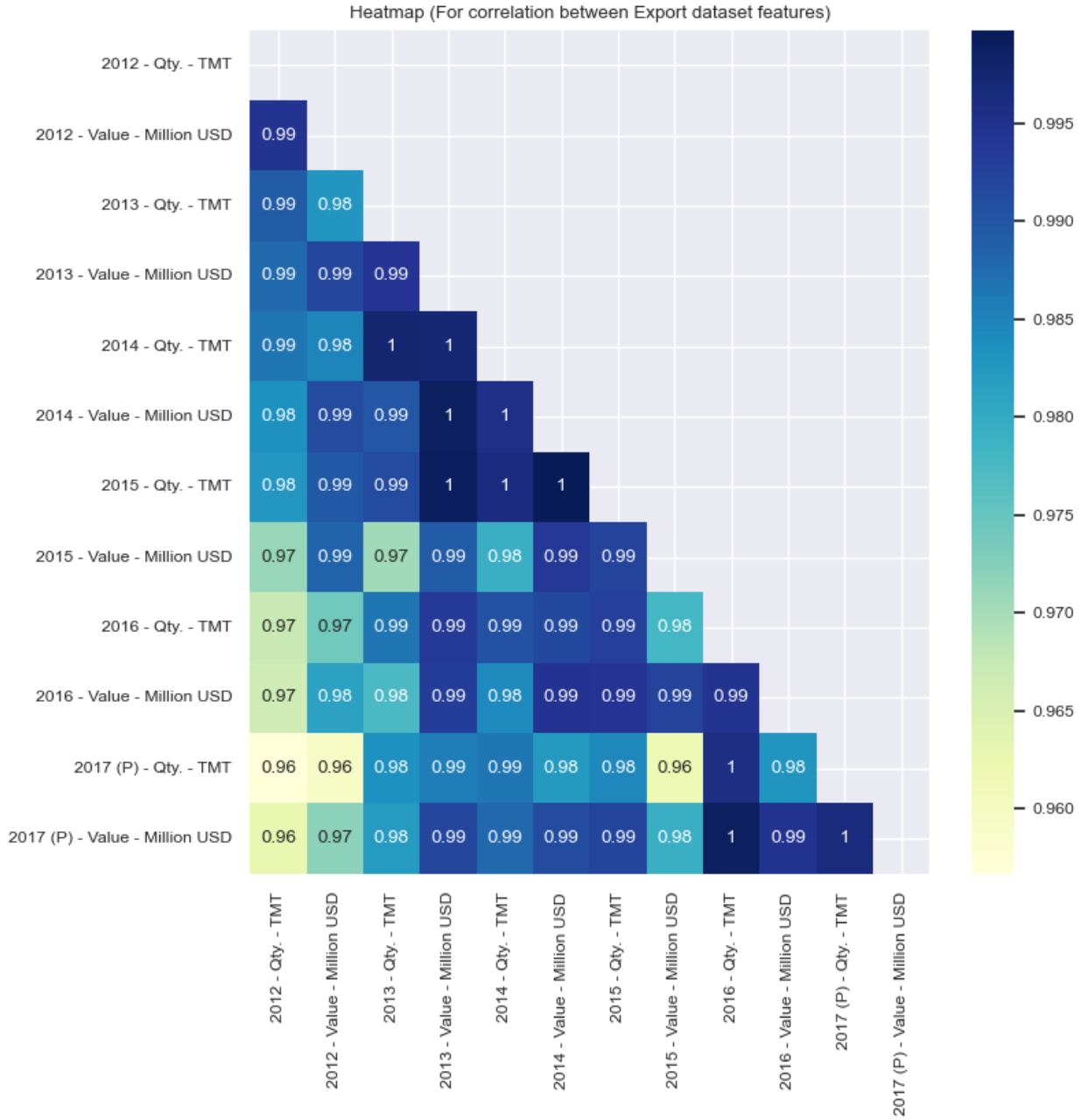
3) Data Relatability:

Here we analyze the relation between the columns. For this we check the correlation as a parameter of analysis. For better visualization we use heat map for representation.

Import HeatMap

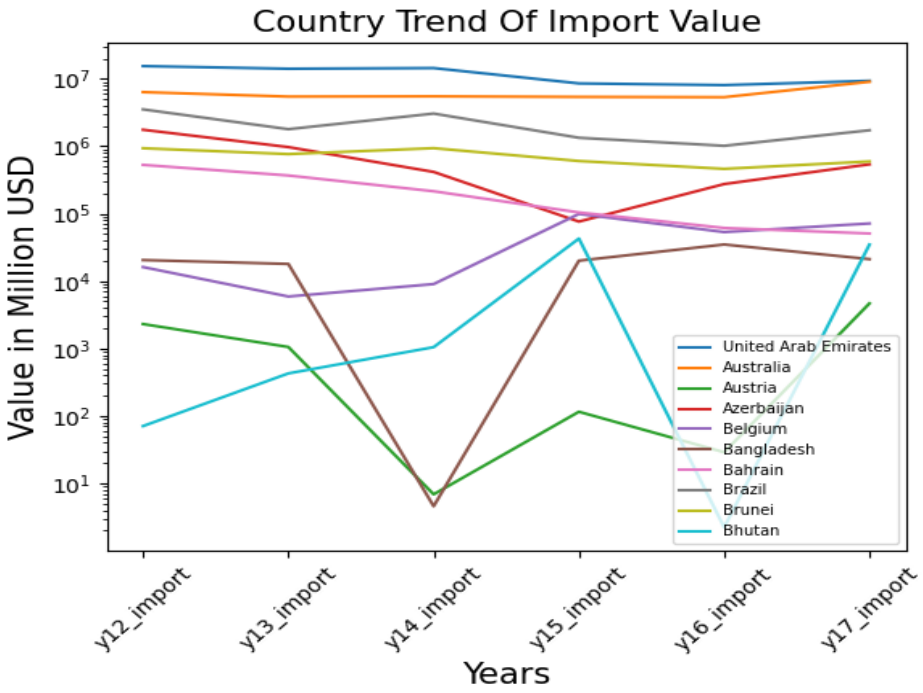


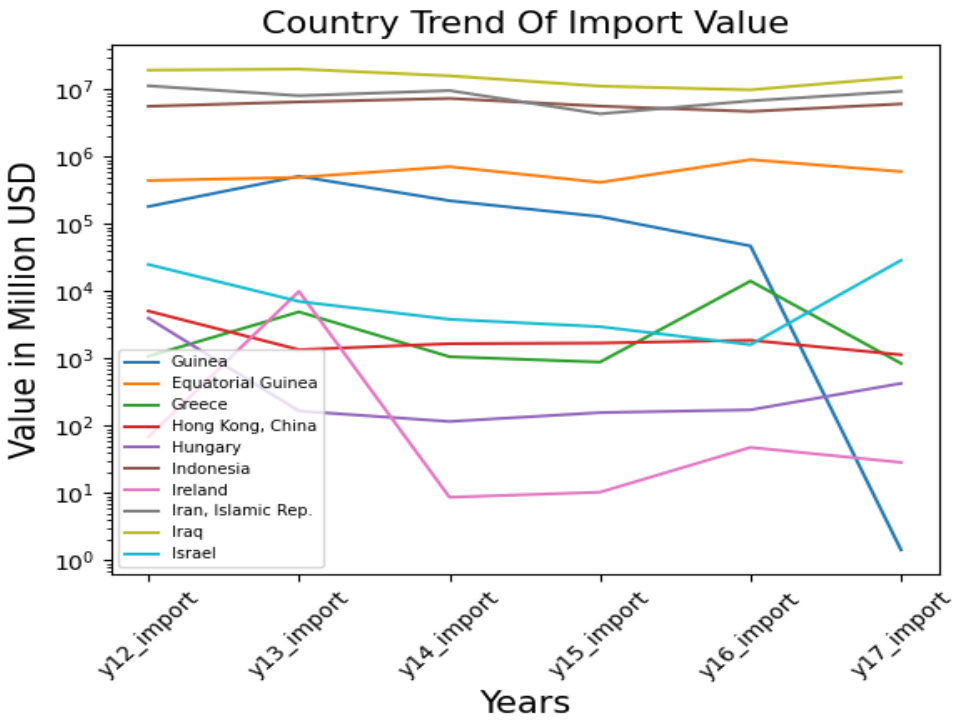
Export HeatMap

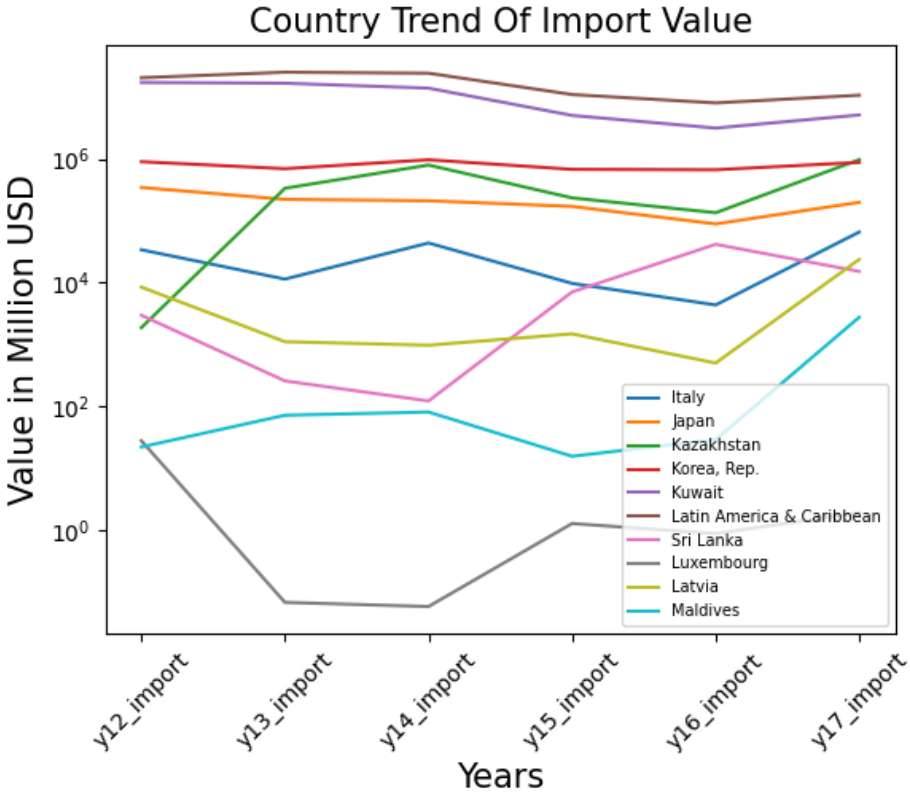


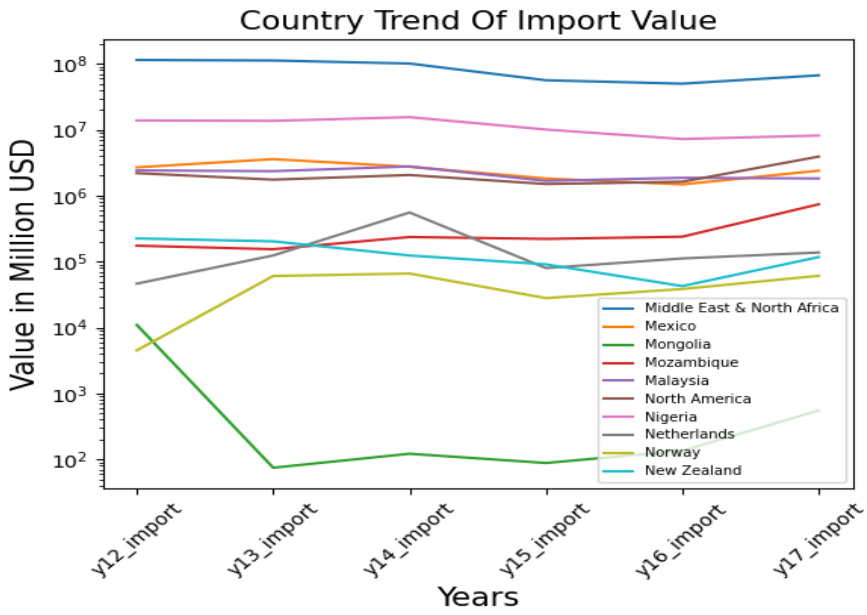
3) EDA (Exploratory Data Analysis)

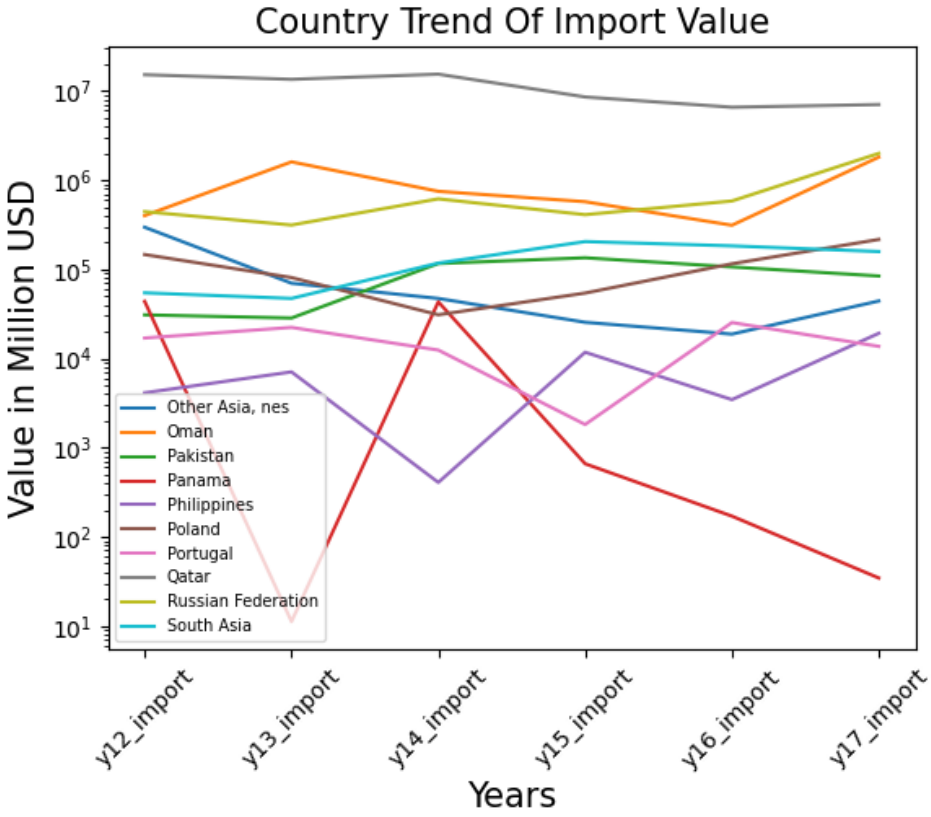
- **Line Charts to understand trend of Import and Export value of each country**
-
    - **Country Trend Of Import Value**

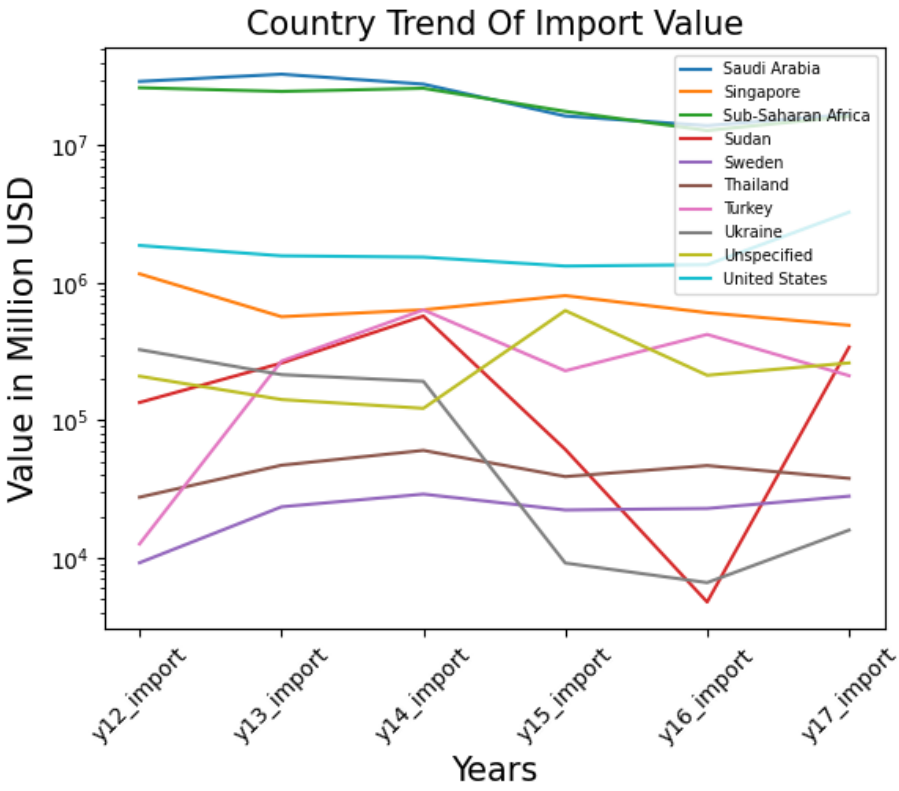


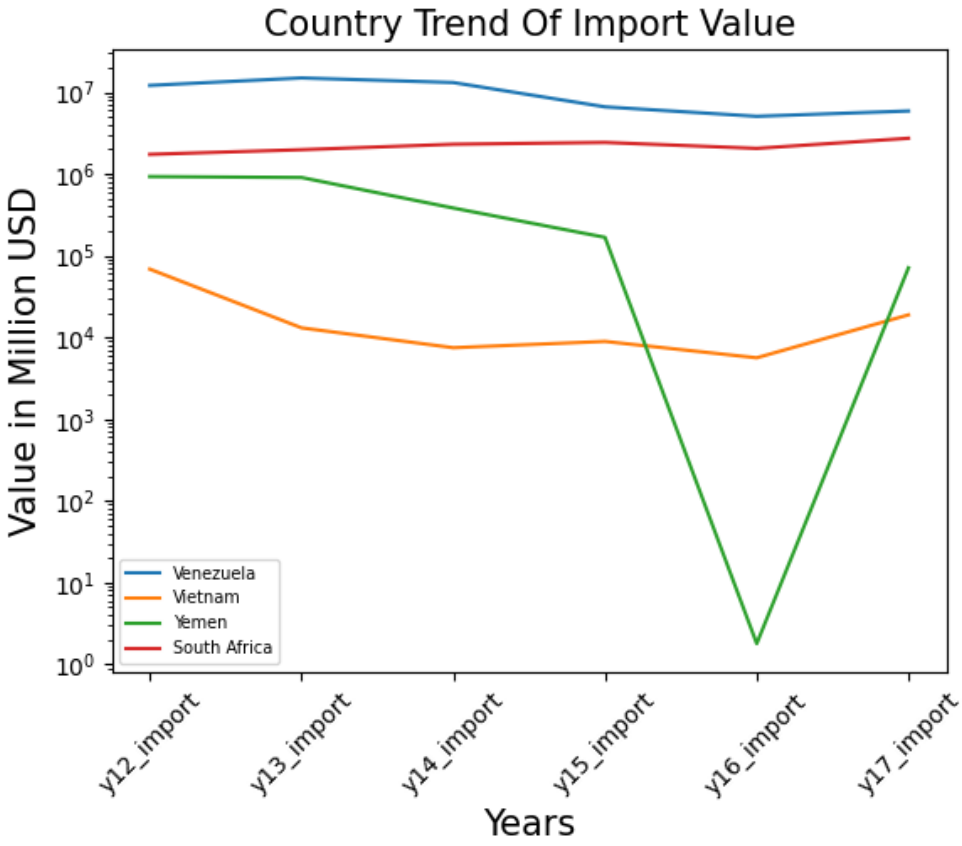

Country Trend Of Import Value
Value in Million USD
Years
y12_import
y13_import
y14_import
y15_import
y16_import
y17_import
Guinea
Equatorial Guinea
Greece
Hong Kong, China
Hungary
Indonesia
Ireland
Iran, Islamic Rep.
Iraq
Israel


Country Trend Of Import Value
Value in Million USD
Years
y12_import
y13_import
y14_import
y15_import
y16_import
y17_import
Italy
Japan
Kazakhstan
Korea, Rep.
Kuwait
Latin America & Caribbean
Sri Lanka
Luxembourg
Latvia
Maldives


Country Trend Of Import Value
Value in Million USD
Years
y12_import
y13_import
y14_import
y15_import
y16_import
y17_import
Middle East & North Africa
Mexico
Mongolia
Mozambique
Malaysia
North America
Nigeria
Netherlands
Norway
New Zealand

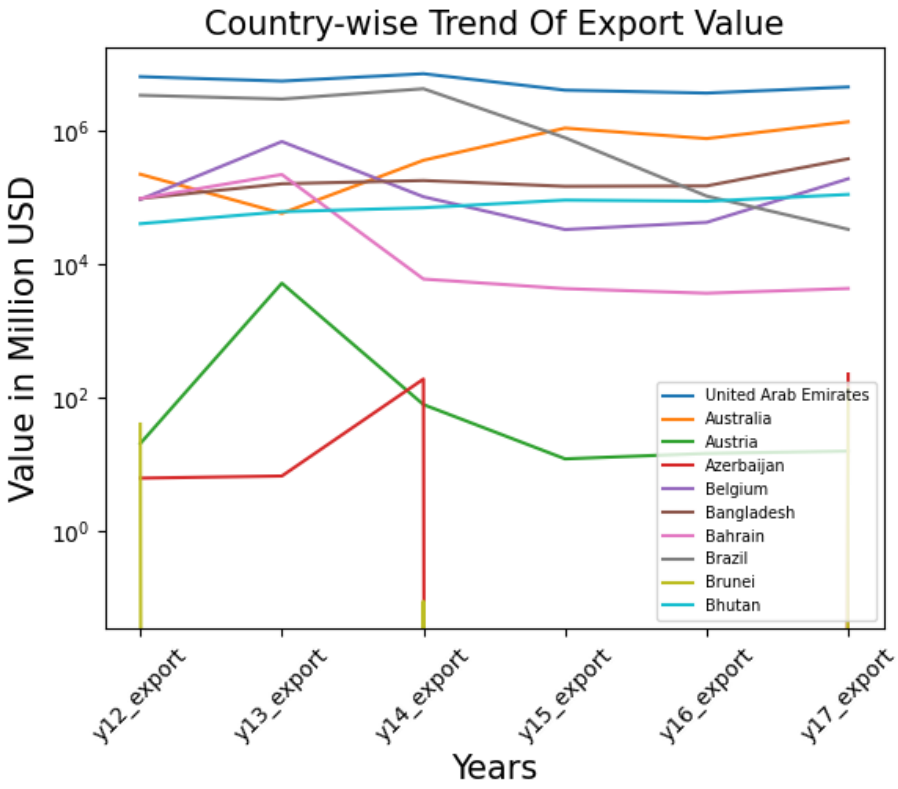

Country Trend Of Import Value
Value in Million USD
Years
y12_import
y13_import
y14_import
y15_import
y16_import
y17_import
Other Asia, nes
Oman
Pakistan
Panama
Philippines
Poland
Portugal
Qatar
Russian Federation
South Asia

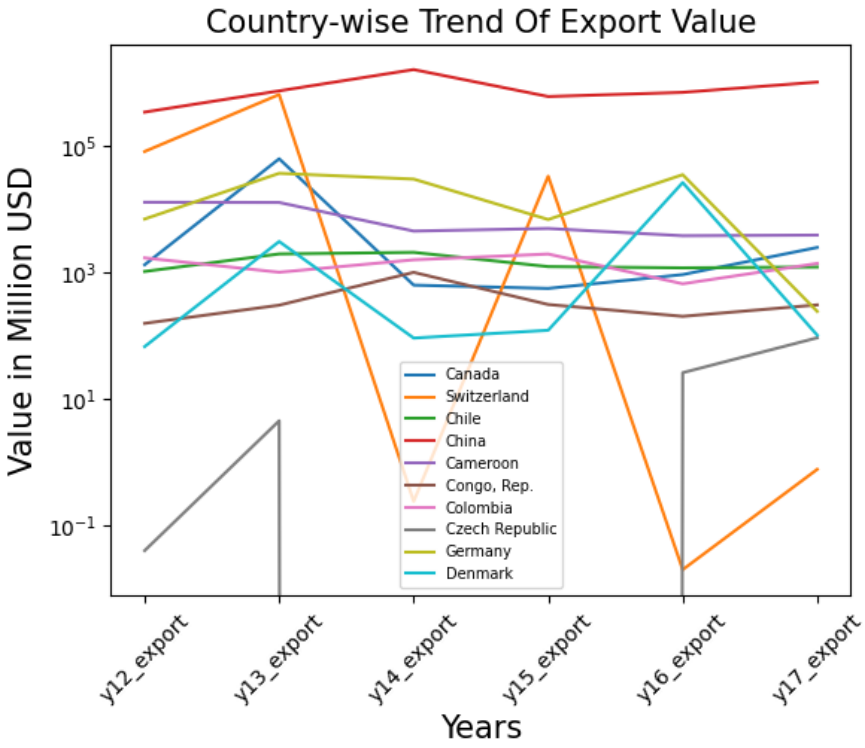

Country Trend Of Import Value
Saudi Arabia
Singapore
Sub-Saharan Africa
Sudan
Sweden
Thailand
Turkey
Ukraine
Unspecified
United States
Value in Million USD
10^7
10^6
10^5
10^4
y12_import
y13_import
y14_import
y15_import
y16_import
y17_import
Years

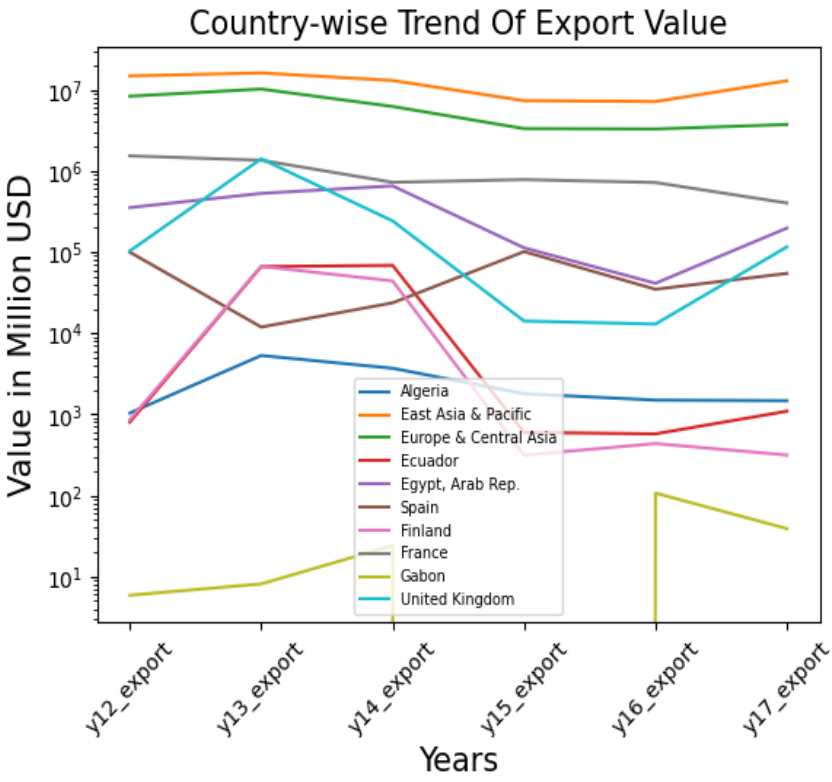

Country Trend Of Import Value
Venezuela
Vietnam
Yemen
South Africa
Value in Million USD
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0
y12_import
y13_import
y14_import
y15_import
y16_import
y17_import
Years

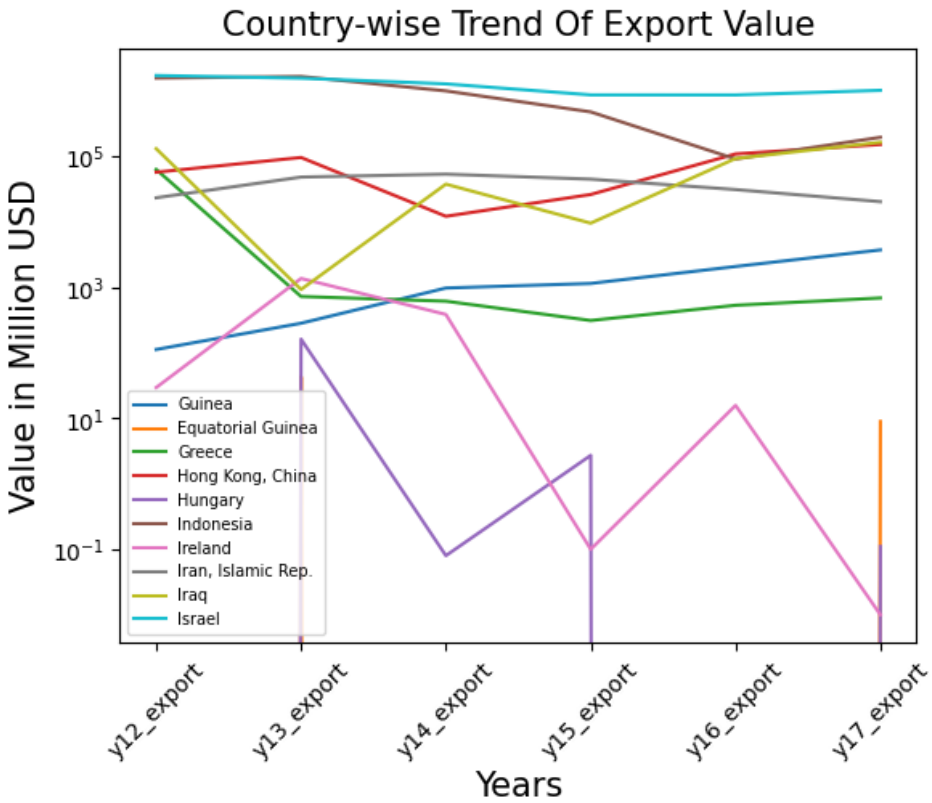
- India's trade relations with different countries have been dynamic over the years. While some countries have maintained regular imports from India, others have shown sporadic trends with occasional peaks and troughs.
- Some countries have even had zero trade and no imports from India during the six-year period. This highlights the importance of understanding the trade dynamics and preferences of each country to optimize trade relations and boost exports.
- It also emphasizes the need for India to diversify its export markets and explore new trade avenues to ensure a stable and consistent growth in its trade relations with other countries.

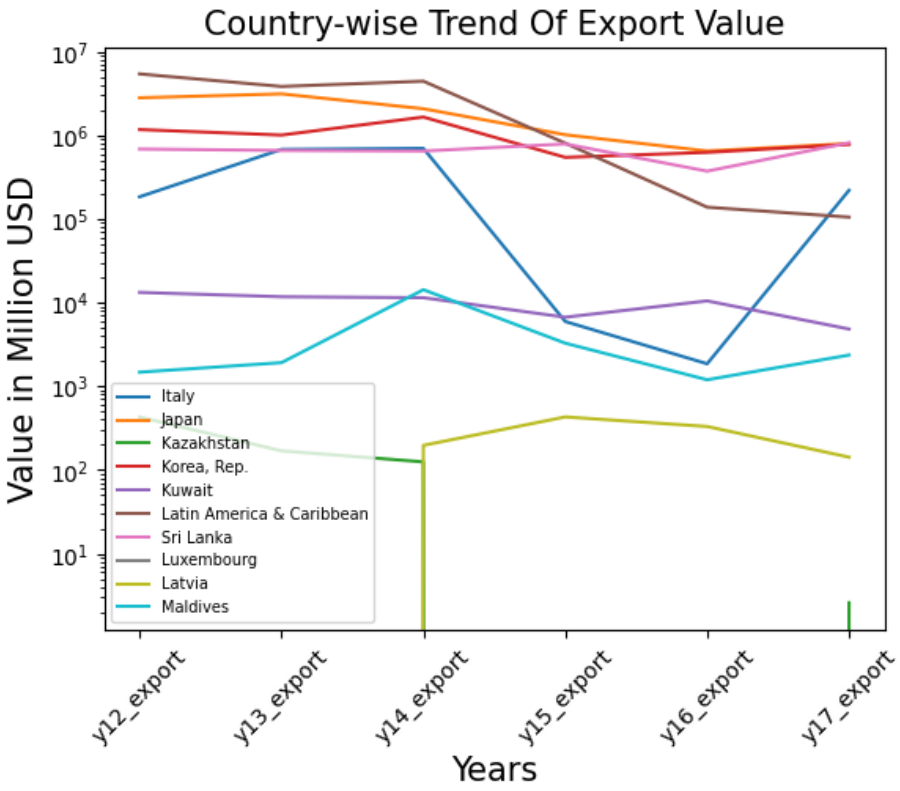
- **Country Trend Of Export Value**

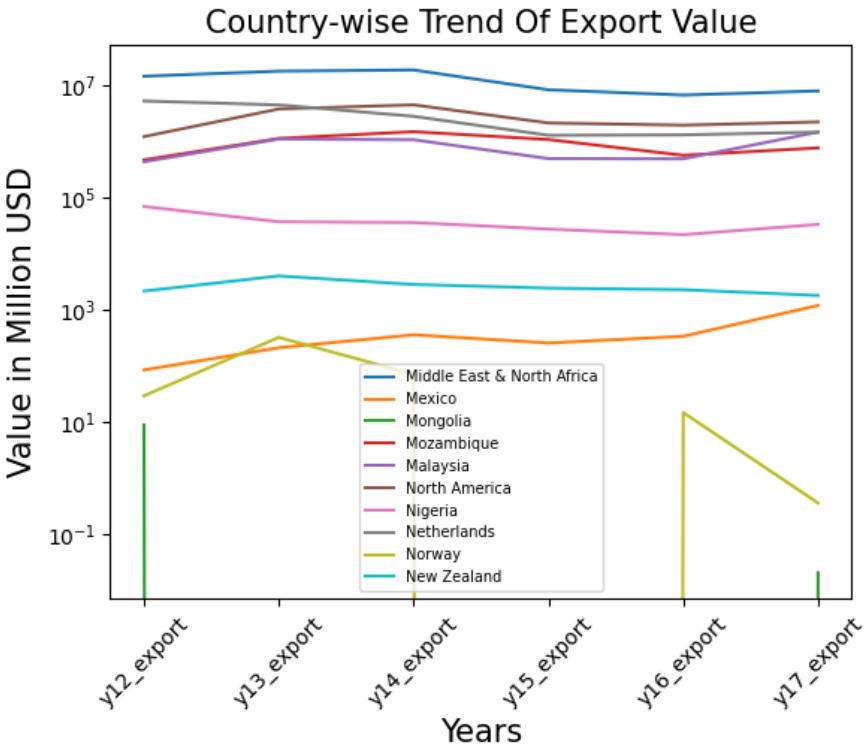

Country-wise Trend Of Export Value
Value in Million USD
10^6
10^4
10^2
10^0
United Arab Emirates
Australia
Austria
Azerbaijan
Belgium
Bangladesh
Bahrain
Brazil
Brunei
Bhutan
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Years

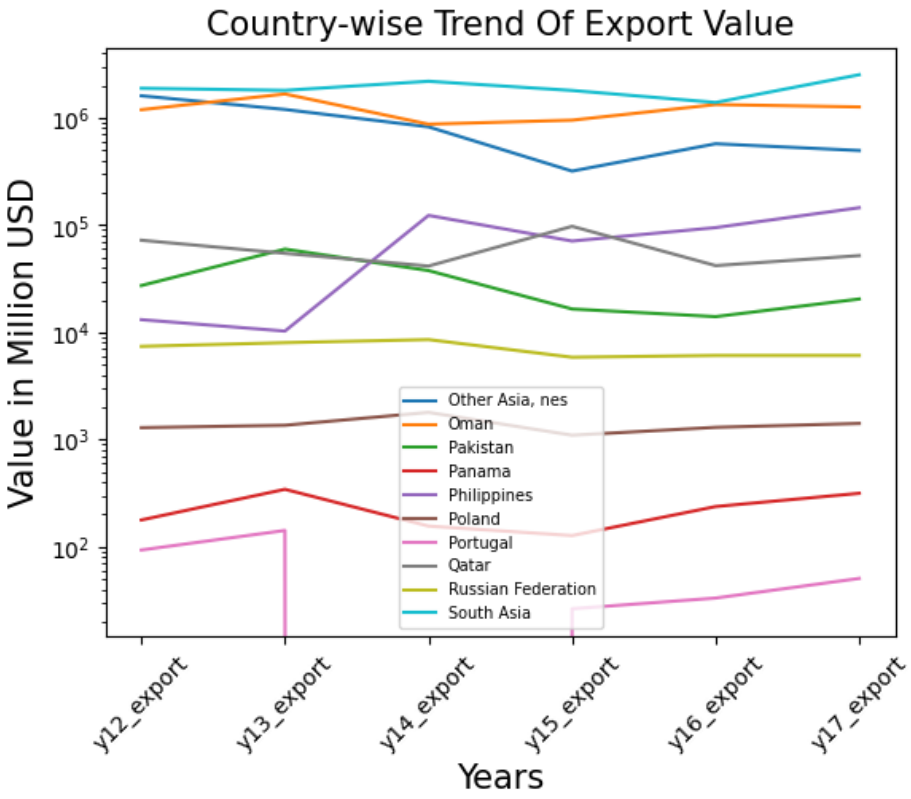

Country-wise Trend Of Export Value
Value in Million USD
10^5
10^3
10^1
10^{-1}
Canada
Switzerland
Chile
China
Cameroon
Congo, Rep.
Colombia
Czech Republic
Germany
Denmark
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Years

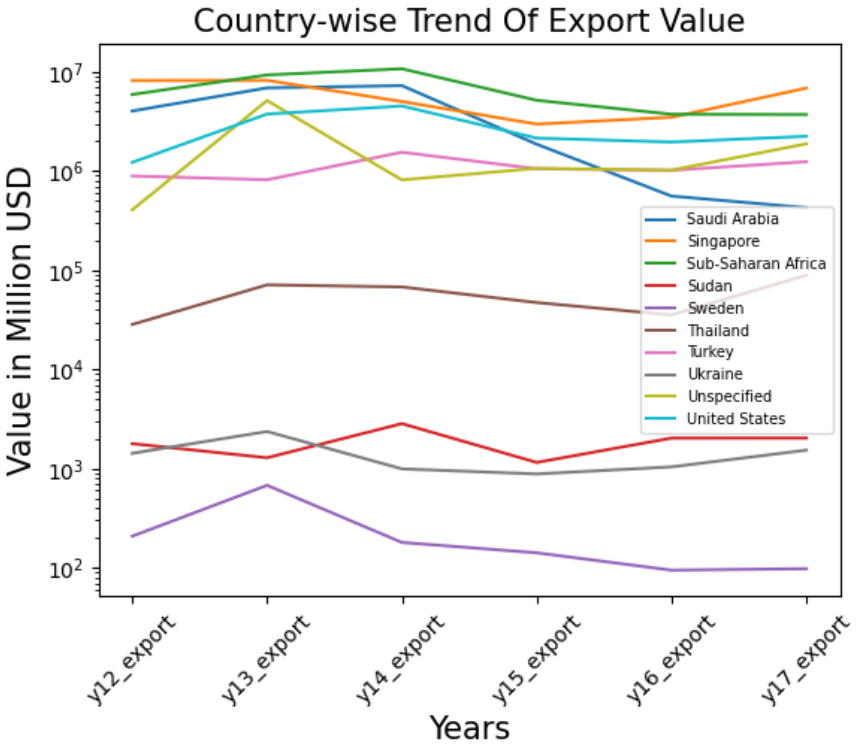

Country-wise Trend Of Export Value
Value in Million USD
Years
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Algeria
East Asia & Pacific
Europe & Central Asia
Ecuador
Egypt, Arab Rep.
Spain
Finland
France
Gabon
United Kingdom

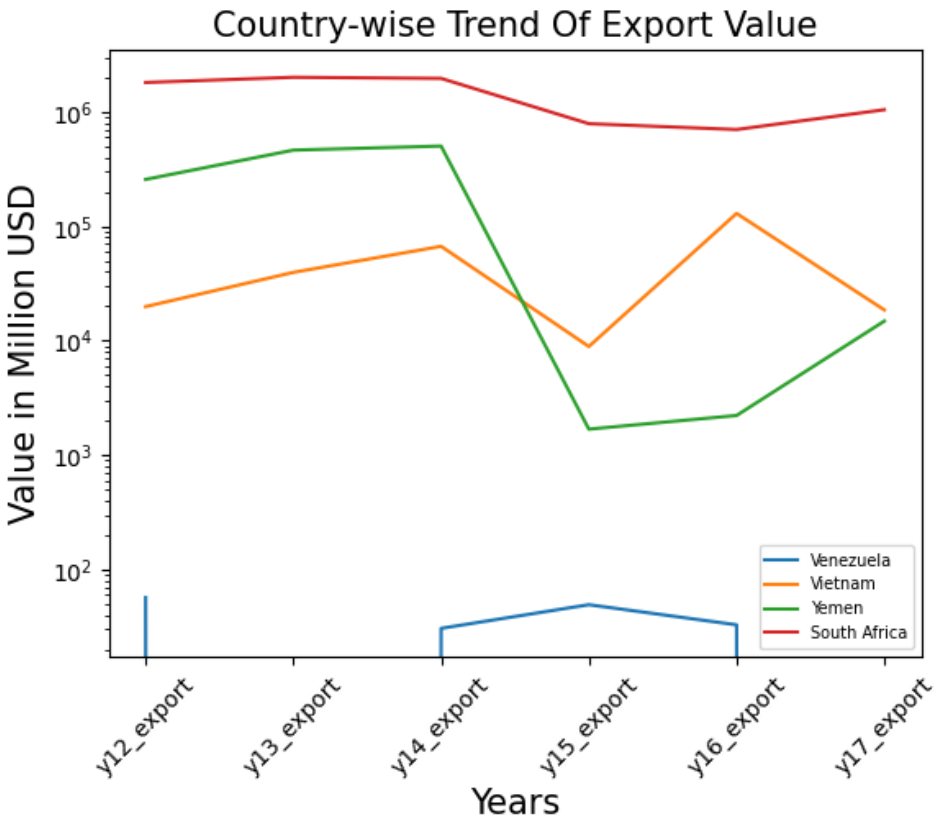

Country-wise Trend Of Export Value
Value in Million USD
Years
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Guinea
Equatorial Guinea
Greece
Hong Kong, China
Hungary
Indonesia
Ireland
Iran, Islamic Rep.
Iraq
Israel


Country-wise Trend Of Export Value
Value in Million USD
Years
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Italy
Japan
Kazakhstan
Korea, Rep.
Kuwait
Latin America & Caribbean
Sri Lanka
Luxembourg
Latvia
Maldives

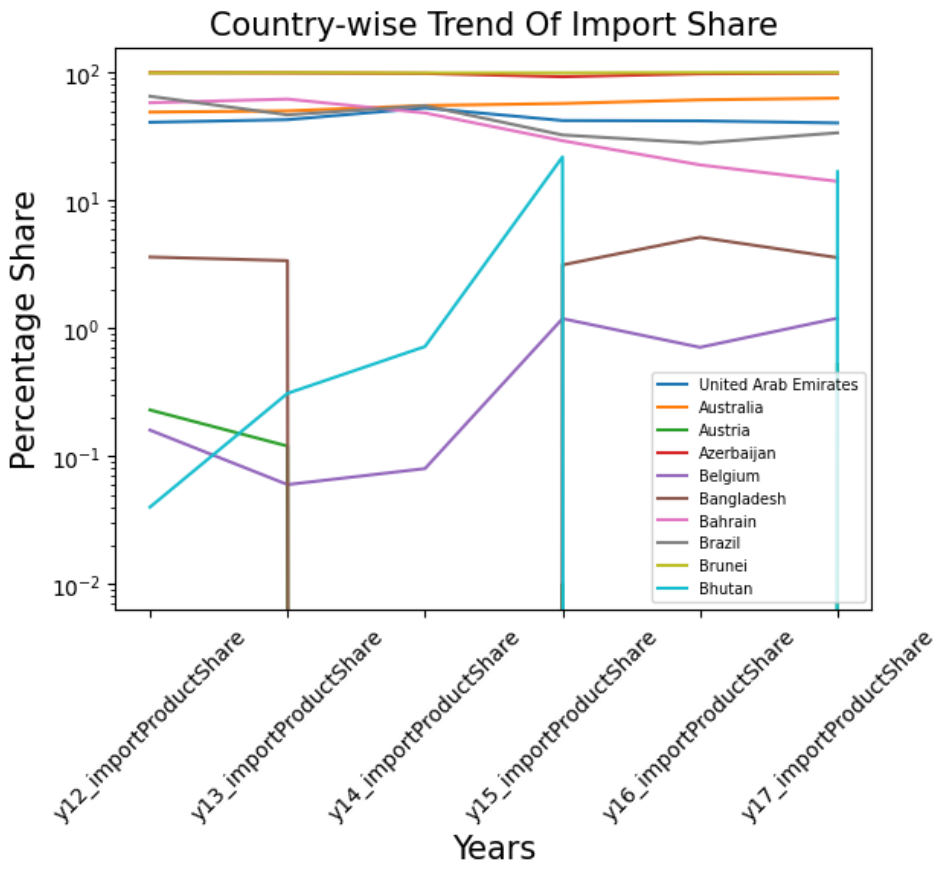

Country-wise Trend Of Export Value
Value in Million USD
Years
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Middle East & North Africa
Mexico
Mongolia
Mozambique
Malaysia
North America
Nigeria
Netherlands
Norway
New Zealand

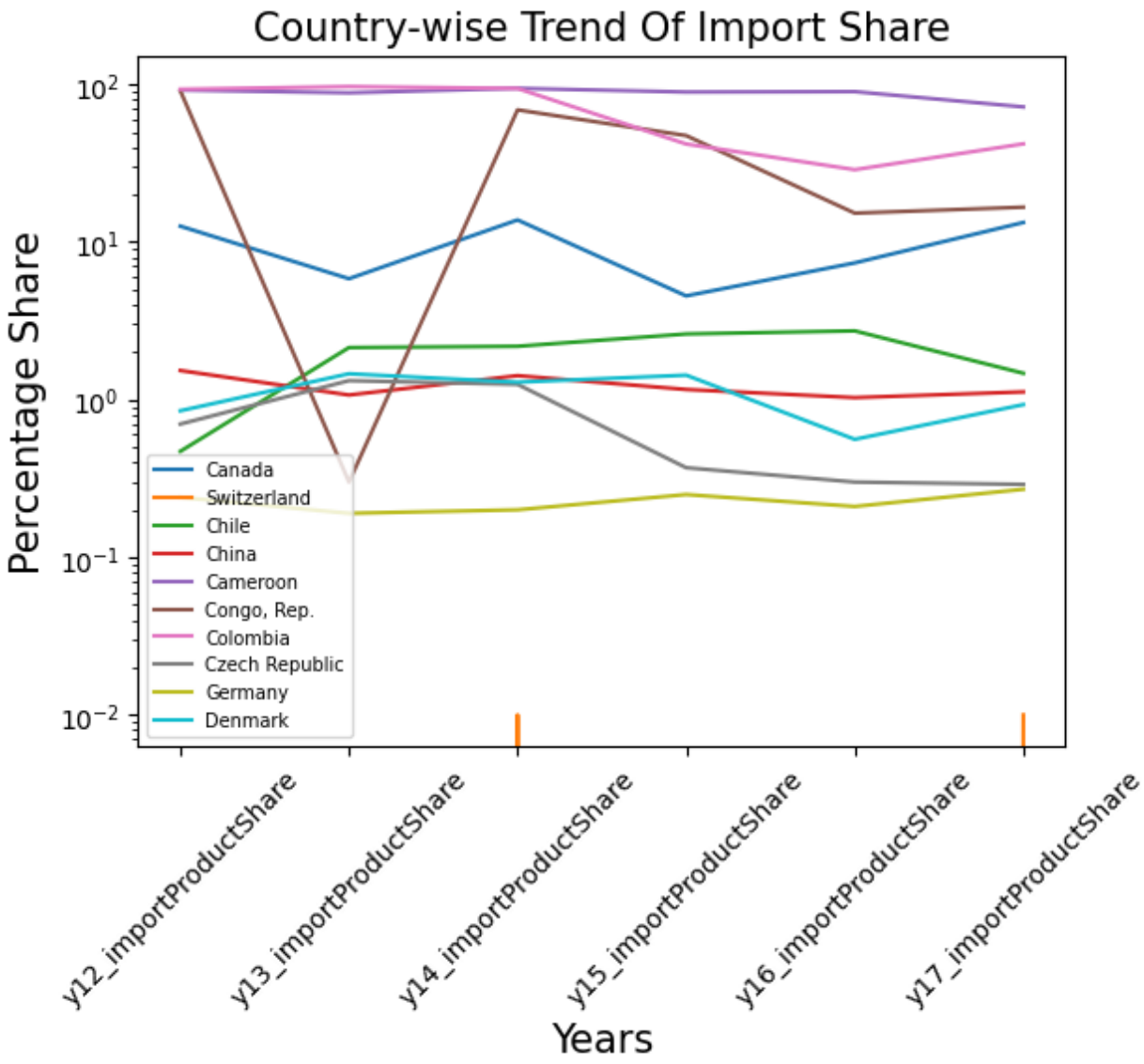

Country-wise Trend Of Export Value
Value in Million USD
Years
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Other Asia, nes
Oman
Pakistan
Panama
Philippines
Poland
Portugal
Qatar
Russian Federation
South Asia

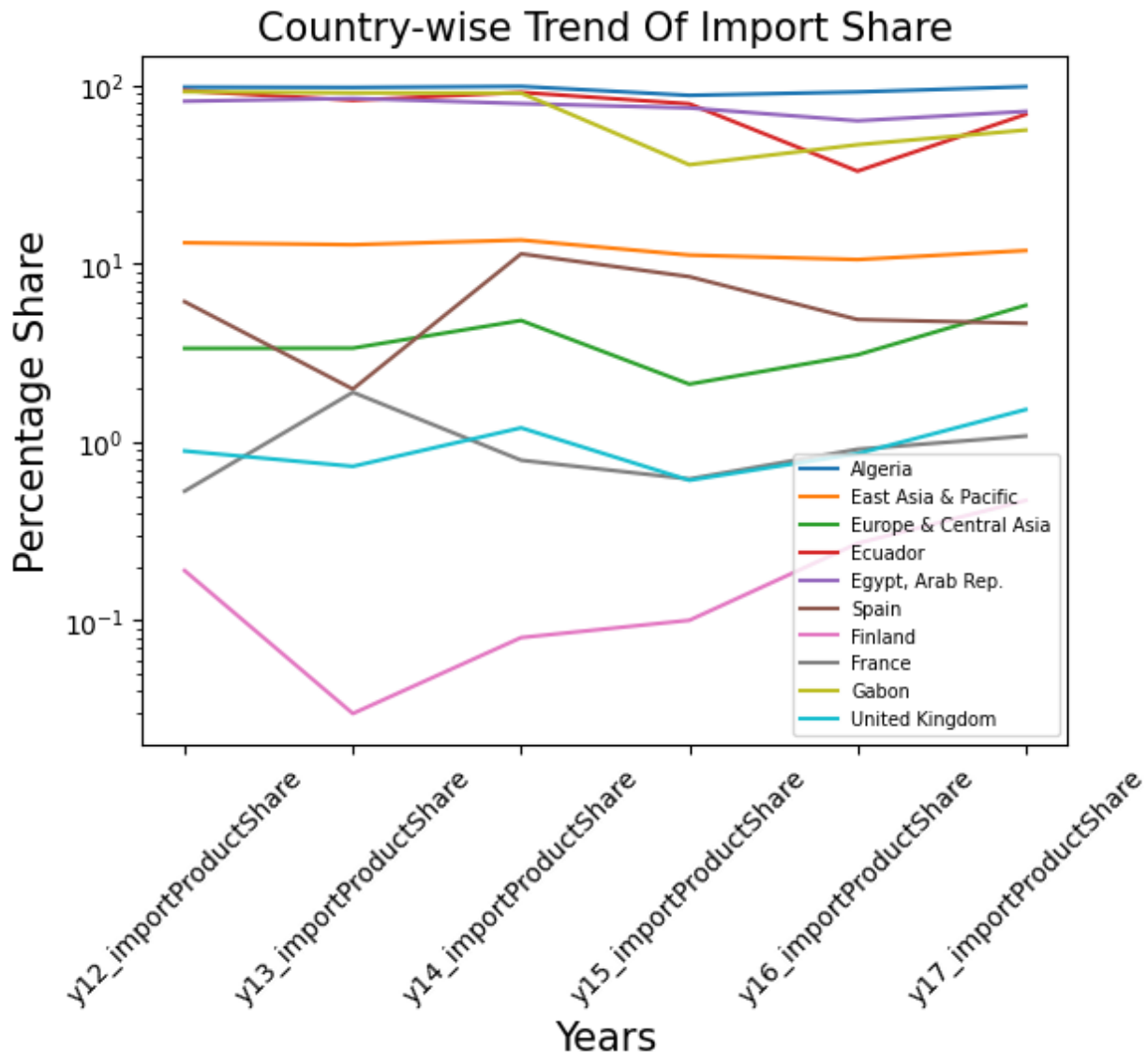

Country-wise Trend Of Export Value
Value in Million USD
Years
y12_export
y13_export
y14_export
y15_export
y16_export
y17_export
Saudi Arabia
Singapore
Sub-Saharan Africa
Sudan
Sweden
Thailand
Turkey
Ukraine
Unspecified
United States

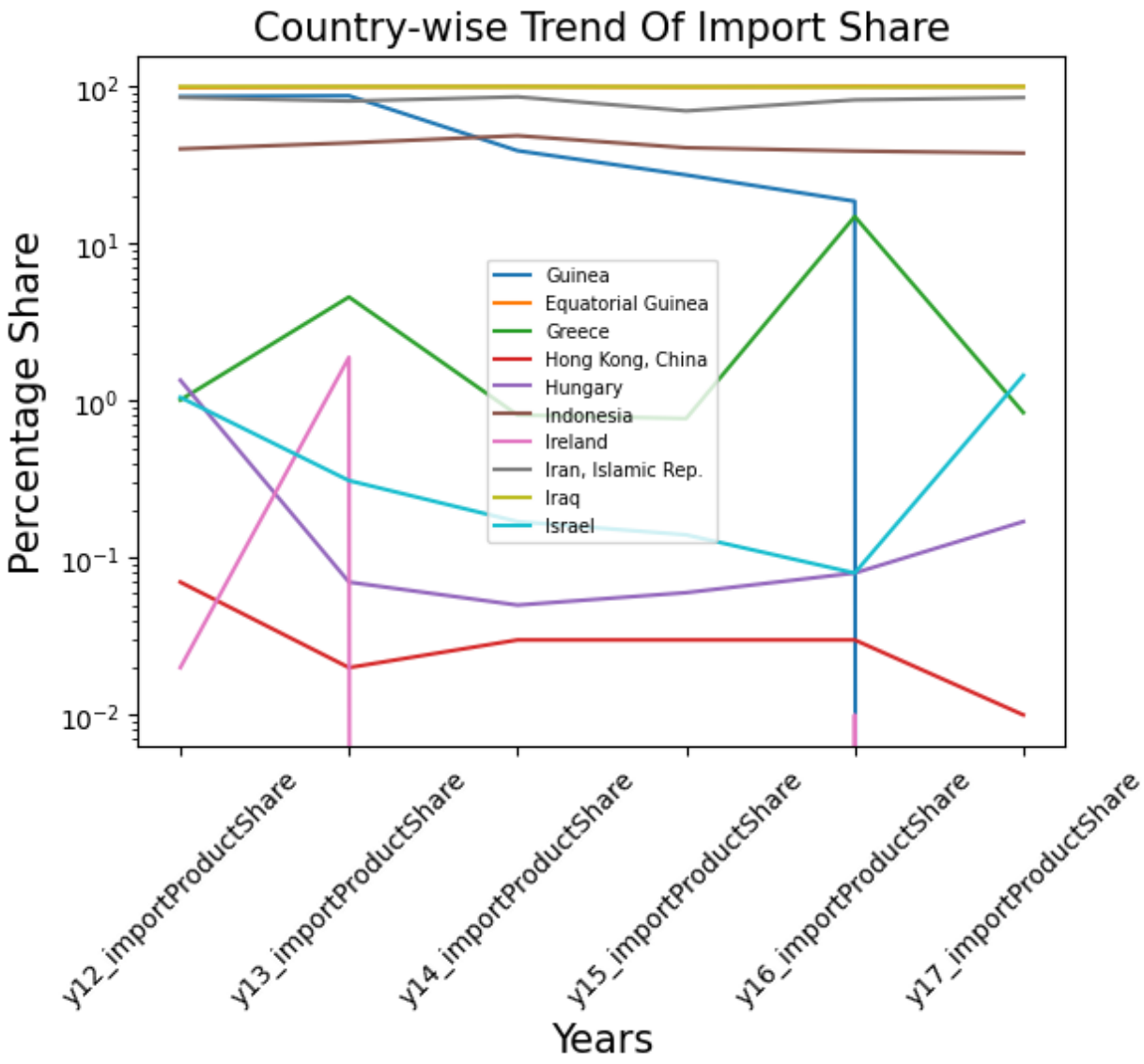


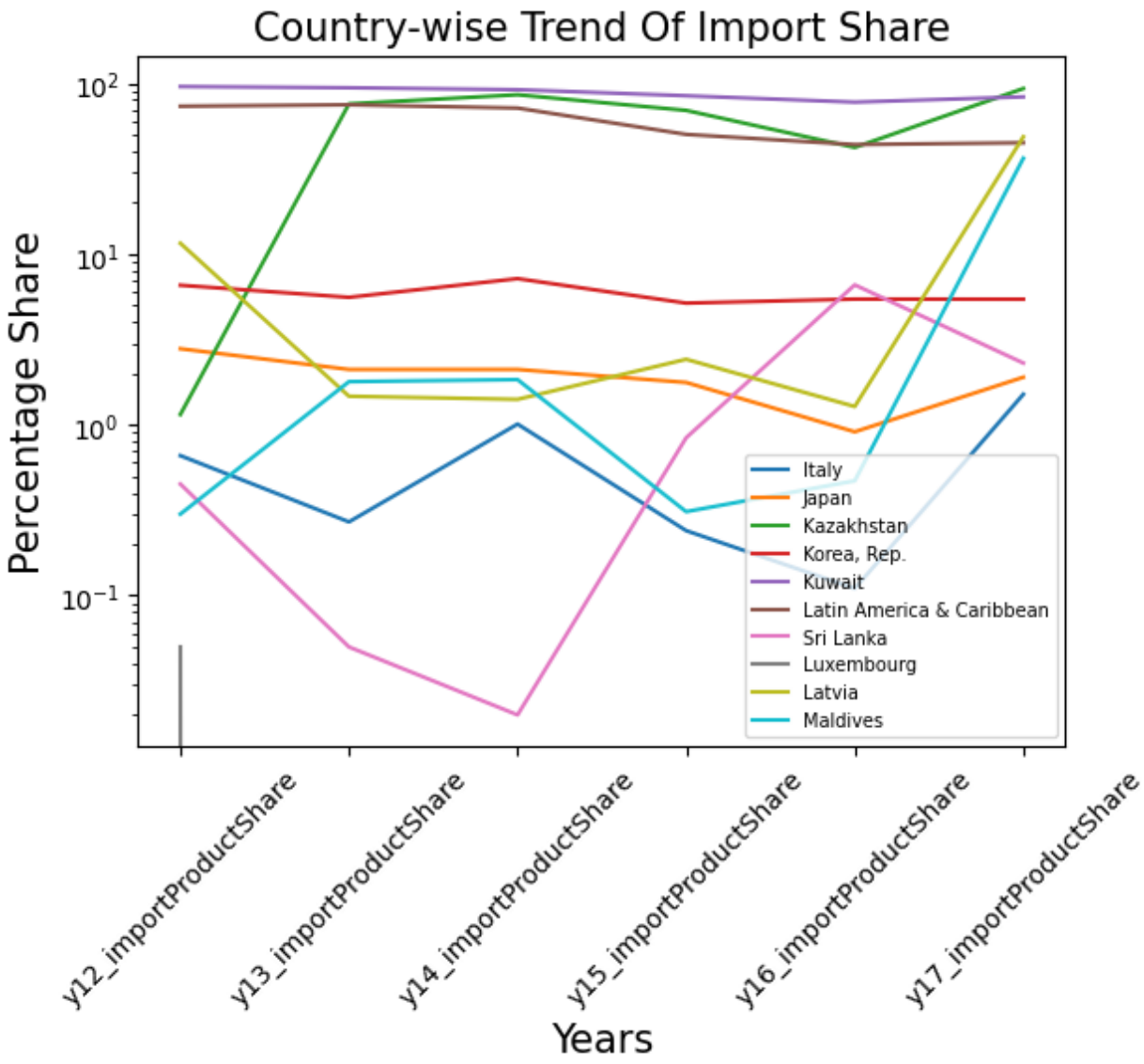
- the trends of exports over the years, highlighting that the values of exports are relatively low compared to imports. The trend of exports from many countries is stable, indicating a consistent trade relationship with India.
- In contrast, only a few countries have a dynamic trend, which means that their export values fluctuate over the years. The paragraph also mentions that there are very few zero export values, indicating that there is a consistent trade relationship between India and other countries.
- Overall, the analysis suggests that India has a relatively stable export market, with few fluctuations in export values over time.

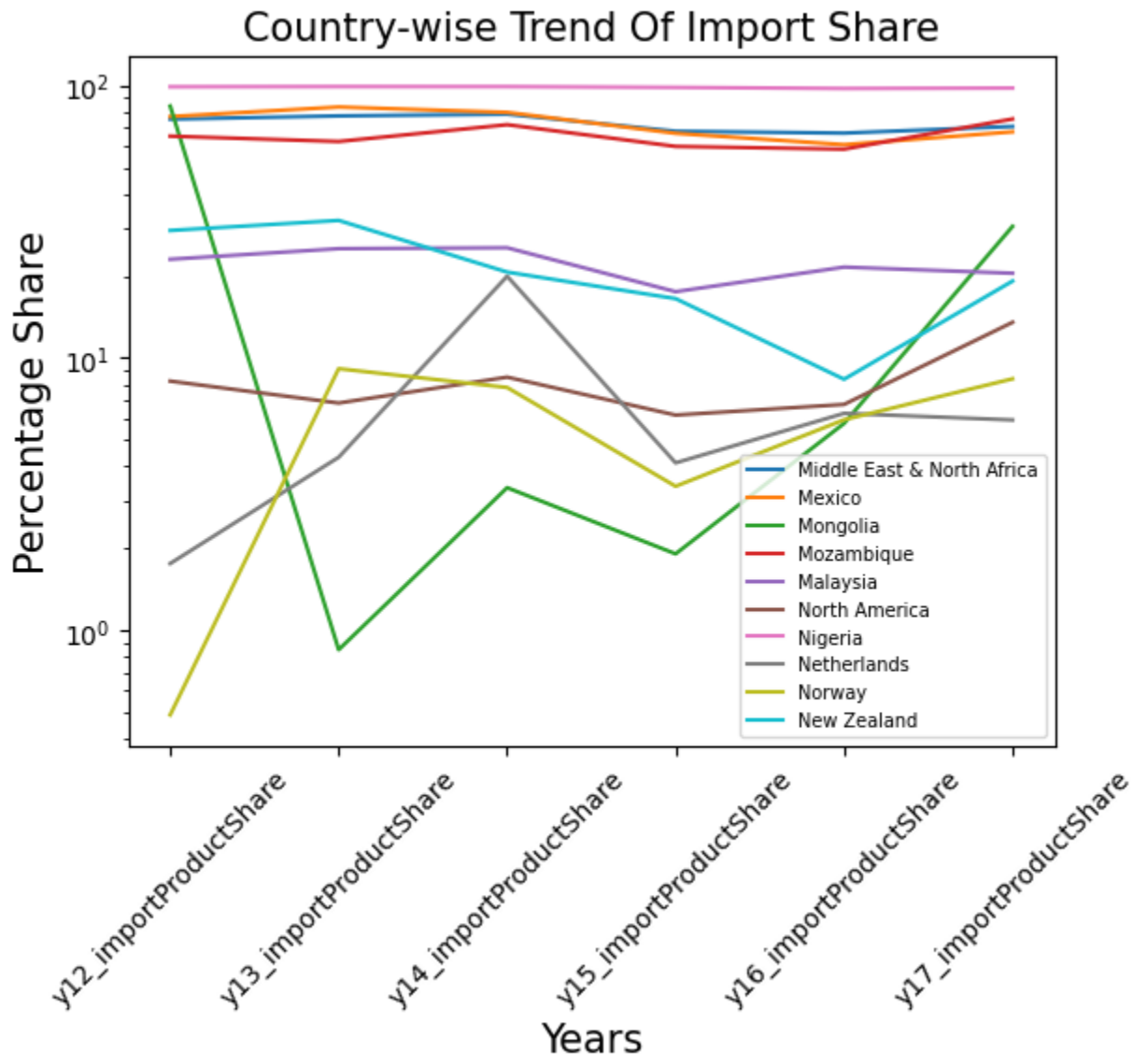

Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
10^{-1}
10^{-2}
United Arab Emirates
Australia
Austria
Azerbaijan
Belgium
Bangladesh
Bahrain
Brazil
Brunei
Bhutan
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years

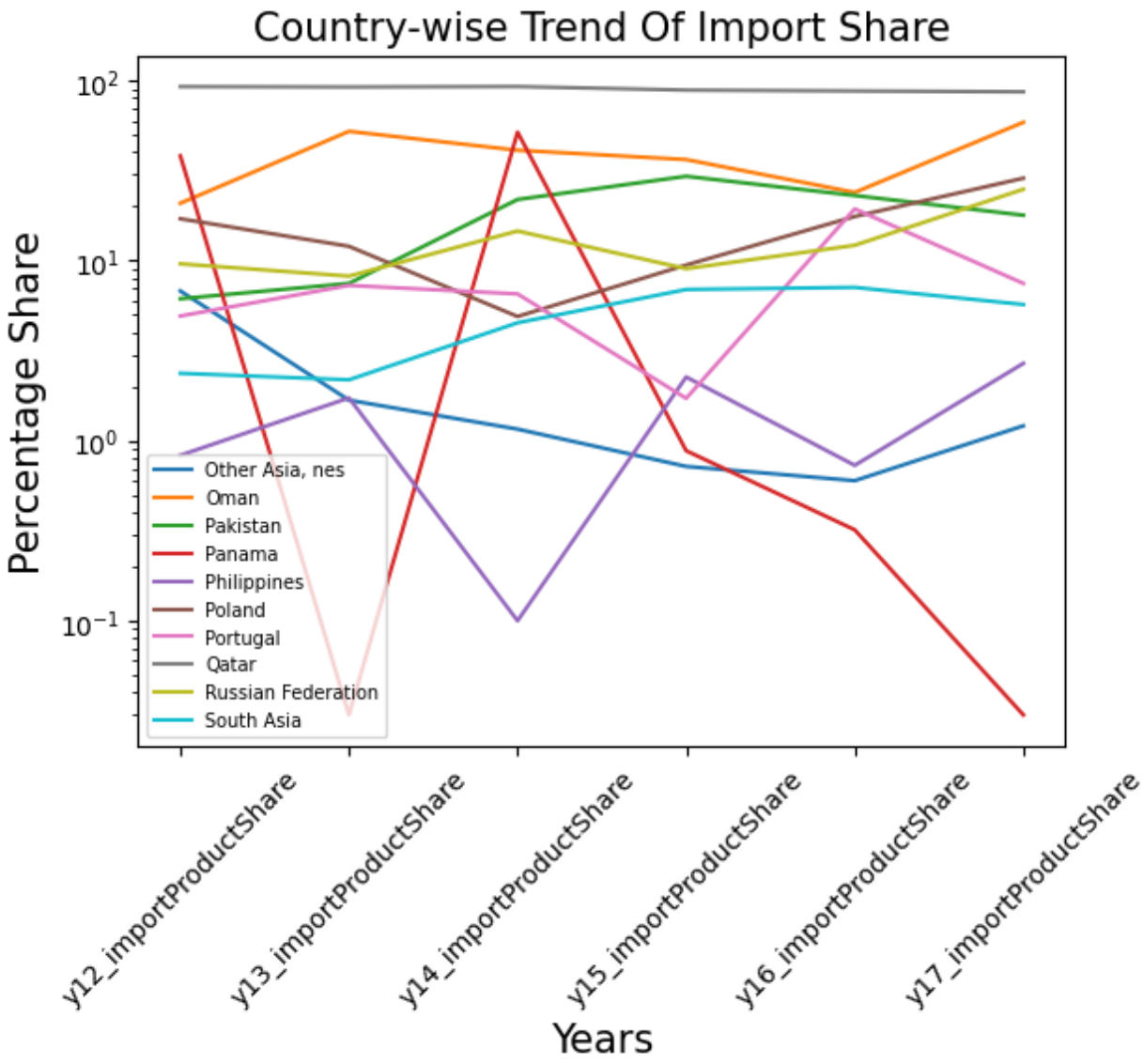

Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
10^{-1}
10^{-2}
Canada
Switzerland
Chile
China
Cameroon
Congo, Rep.
Colombia
Czech Republic
Germany
Denmark
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years

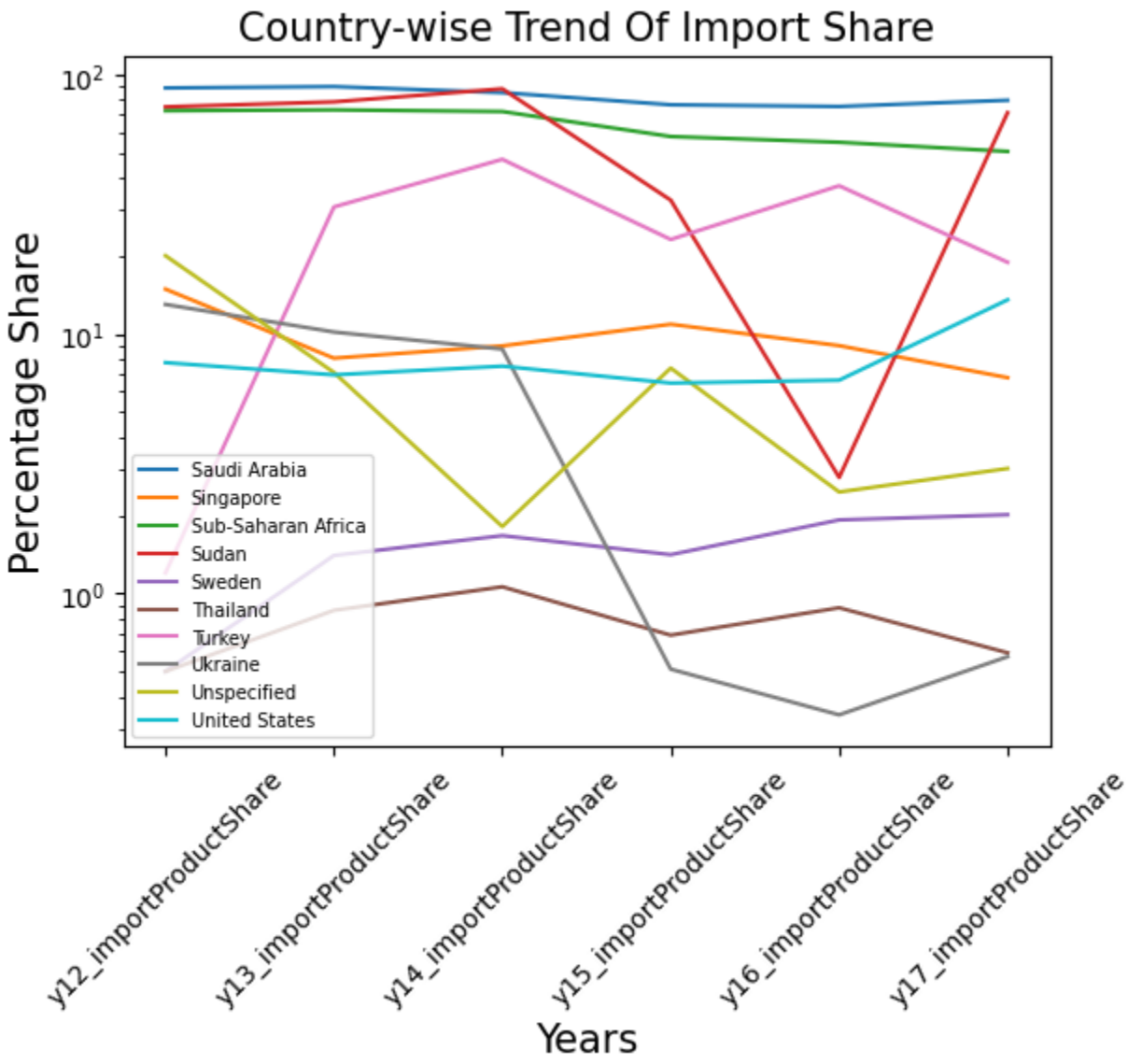

Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
10^{-1}
Algeria
East Asia & Pacific
Europe & Central Asia
Ecuador
Egypt, Arab Rep.
Spain
Finland
France
Gabon
United Kingdom
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years

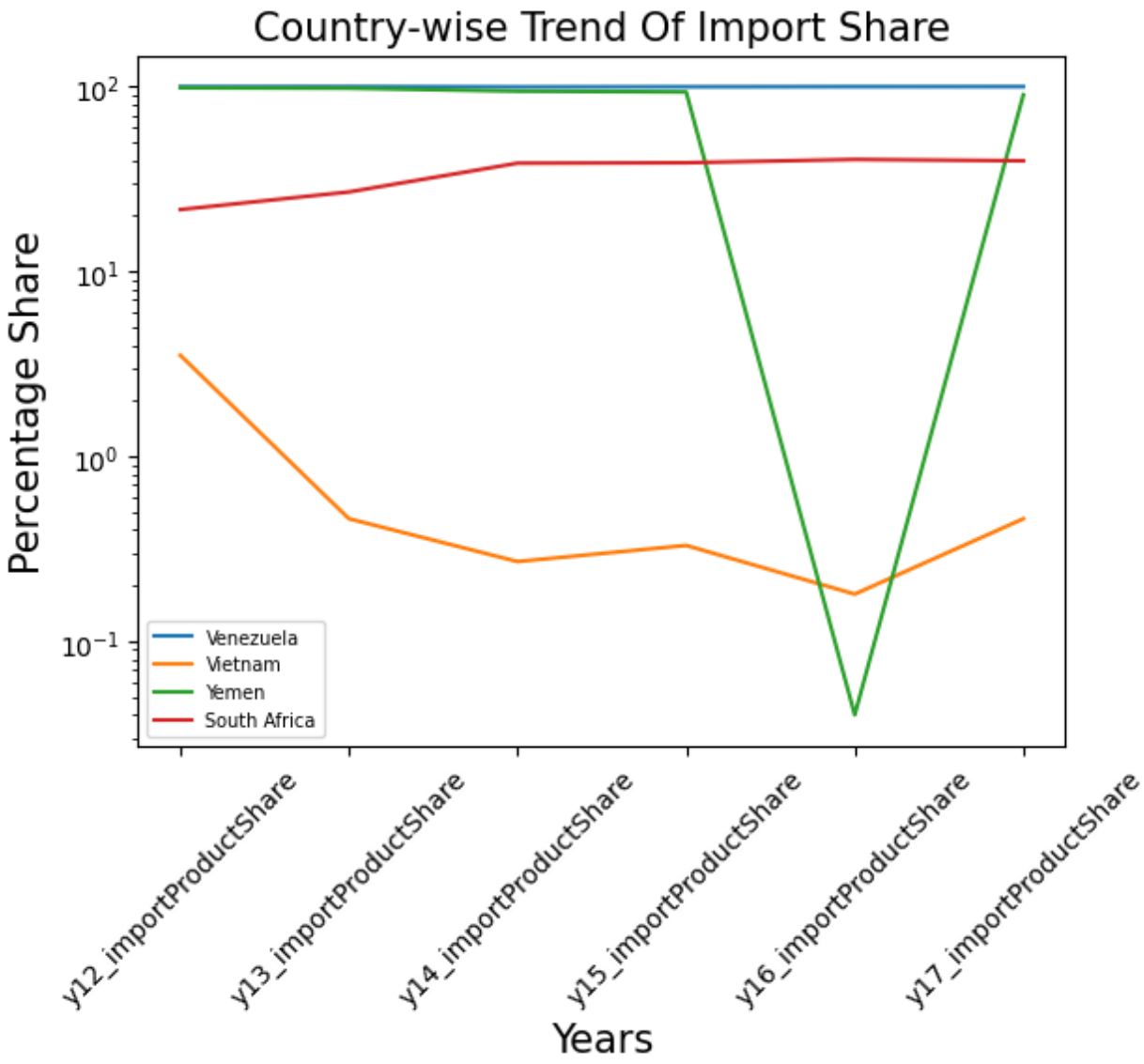

Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
10^{-1}
10^{-2}
Guinea
Equatorial Guinea
Greece
Hong Kong, China
Hungary
Indonesia
Ireland
Iran, Islamic Rep.
Iraq
Israel
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years


Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
10^{-1}
Italy
Japan
Kazakhstan
Korea, Rep.
Kuwait
Latin America & Caribbean
Sri Lanka
Luxembourg
Latvia
Maldives
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years


Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
Middle East & North Africa
Mexico
Mongolia
Mozambique
Malaysia
North America
Nigeria
Netherlands
Norway
New Zealand
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years

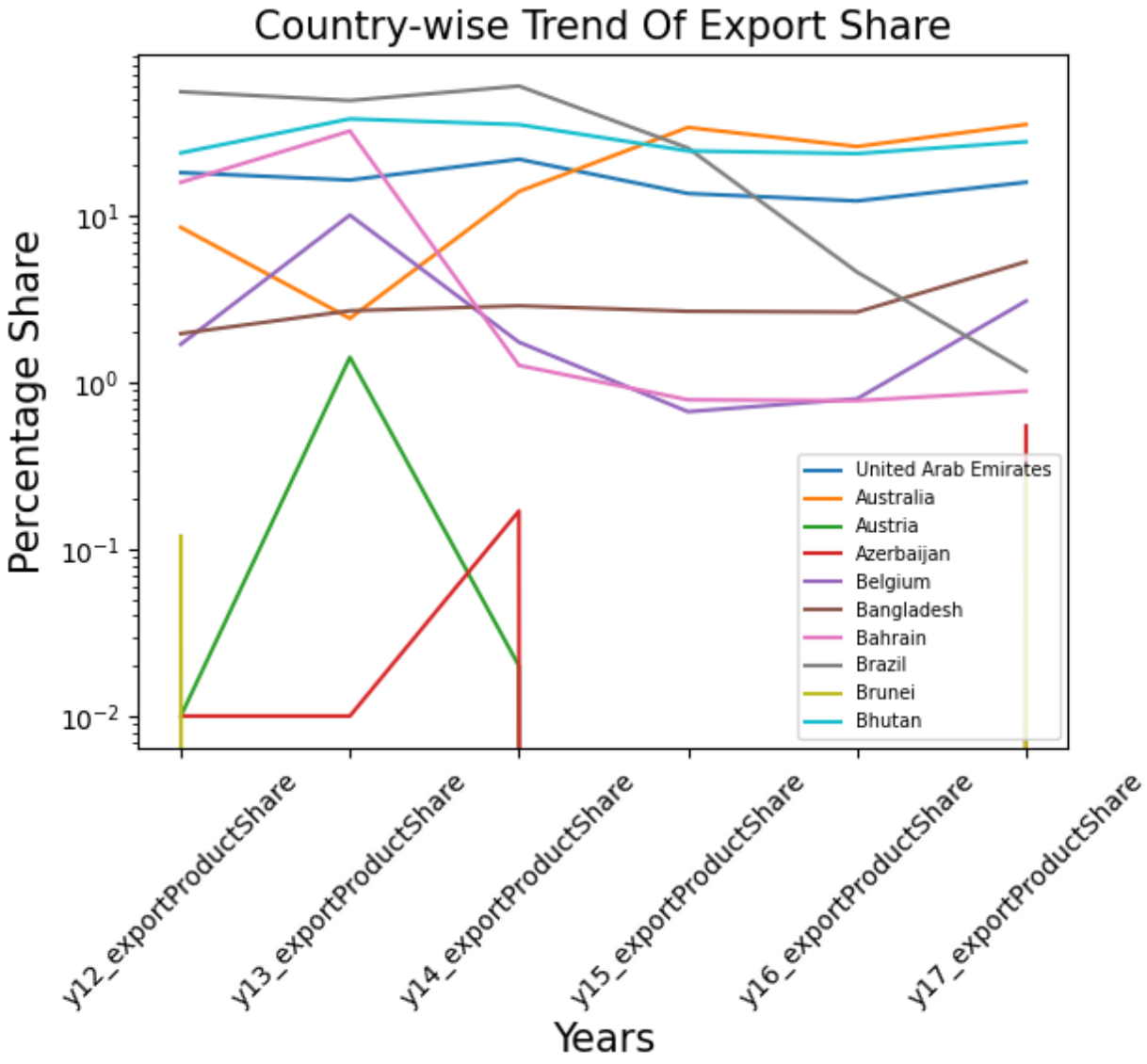

Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
10^{-1}
Other Asia, nes
Oman
Pakistan
Panama
Philippines
Poland
Portugal
Qatar
Russian Federation
South Asia
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years

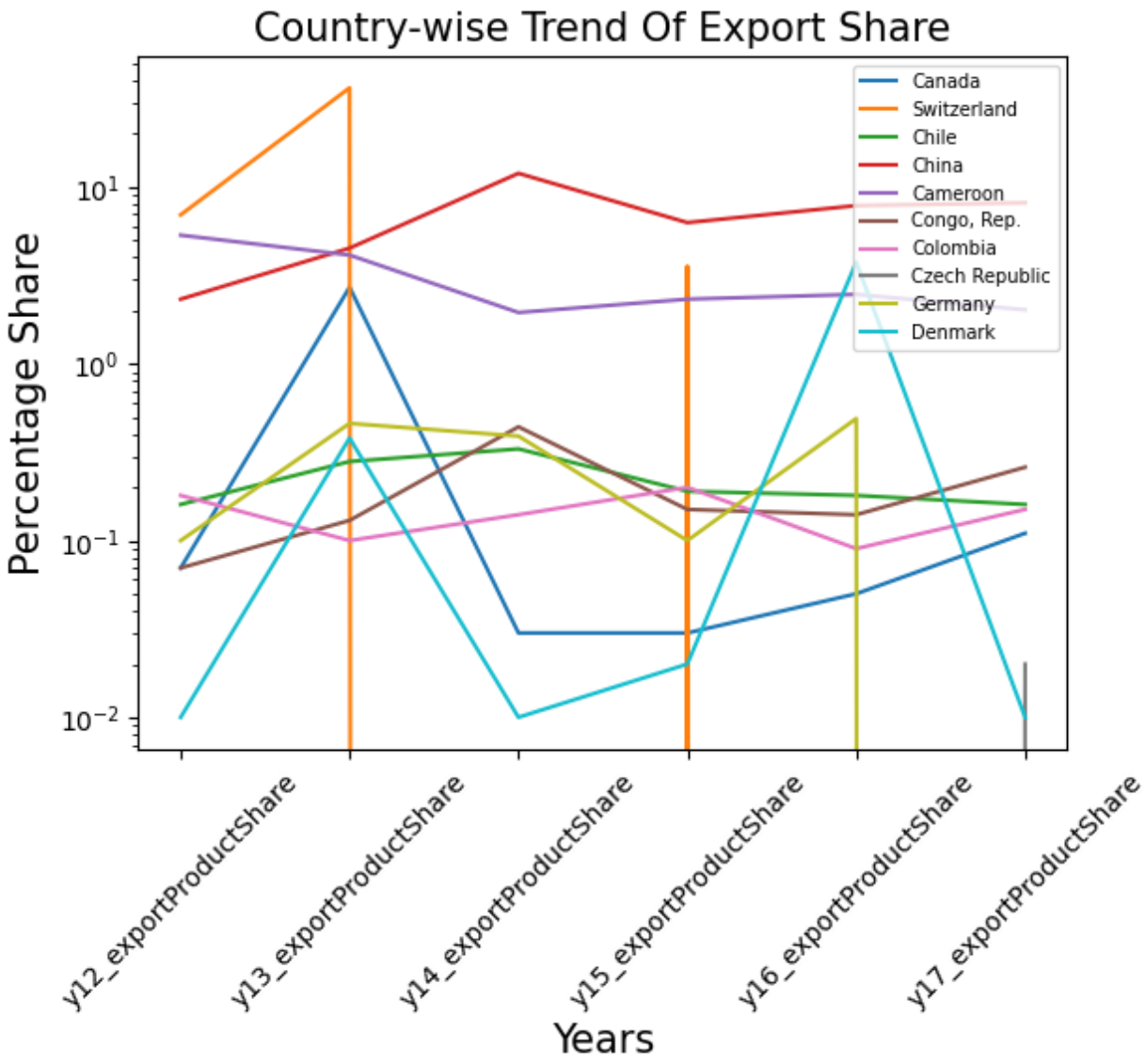

Country-wise Trend Of Import Share
Percentage Share
10^2
10^1
10^0
Saudi Arabia
Singapore
Sub-Saharan Africa
Sudan
Sweden
Thailand
Turkey
Ukraine
Unspecified
United States
y12_importProductShare
y13_importProductShare
y14_importProductShare
y15_importProductShare
y16_importProductShare
y17_importProductShare
Years

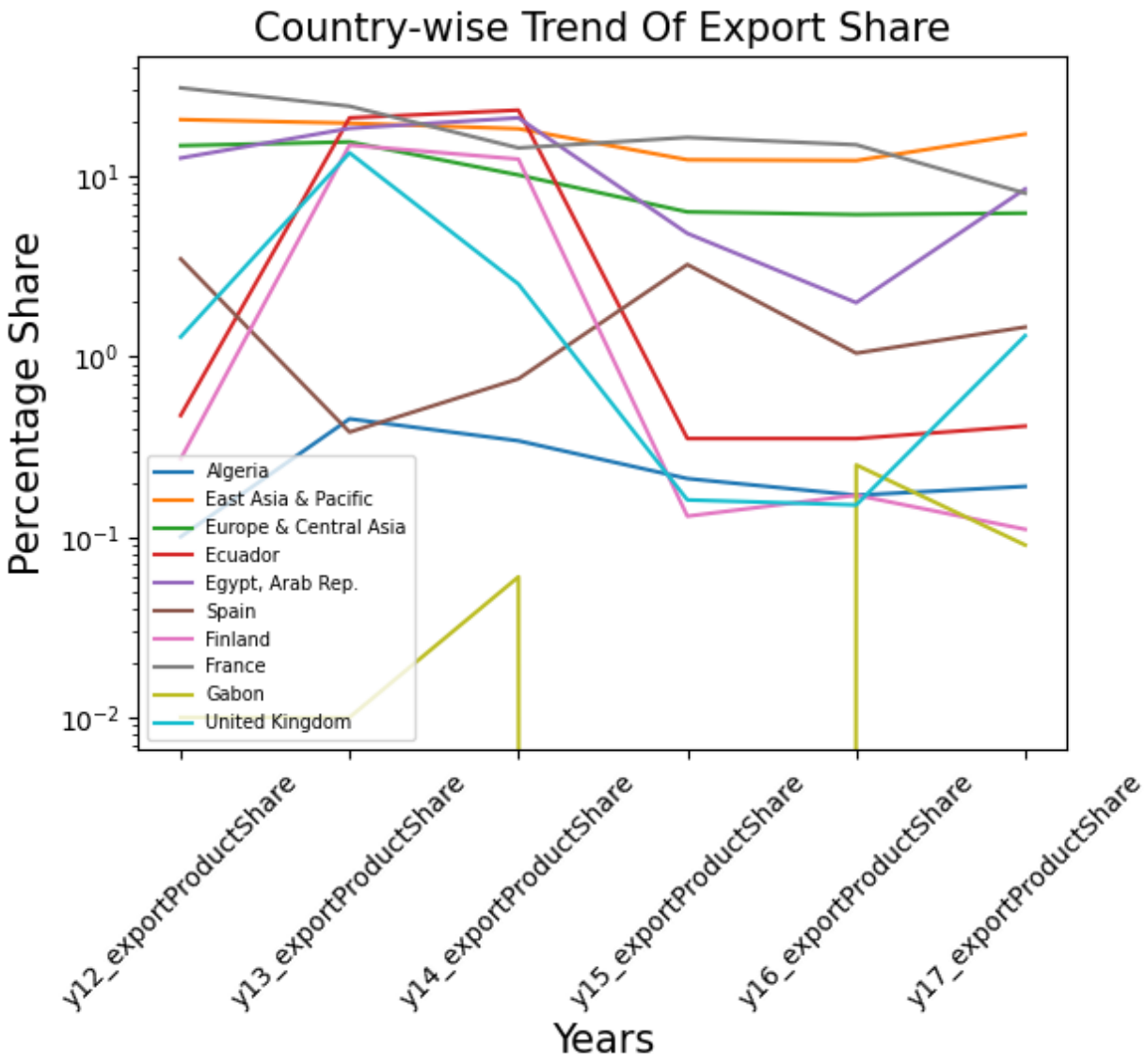


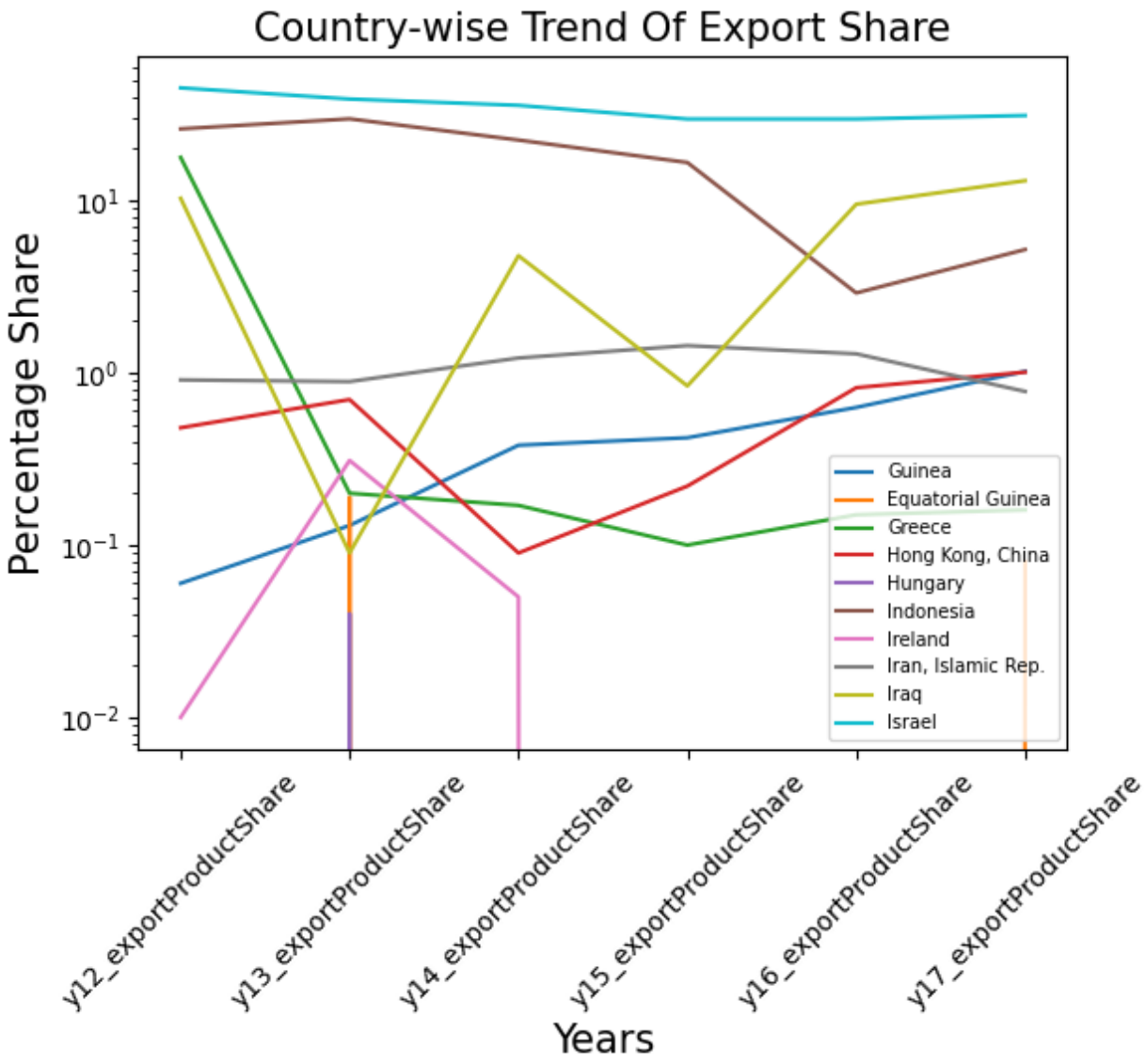
- The import share trend of various countries in India's trade market is relatively stable, indicating a consistent level of engagement in trade over the years.
- The measure of import share provides an insight into a country's activeness in India's trade market.
- Panama and Yemen are among the few countries with dynamic trends, indicating a higher level of irregular trade practices.
- However, most countries exhibit a stable trend in terms of import share, suggesting that they maintain a relatively steady level of trade with India.

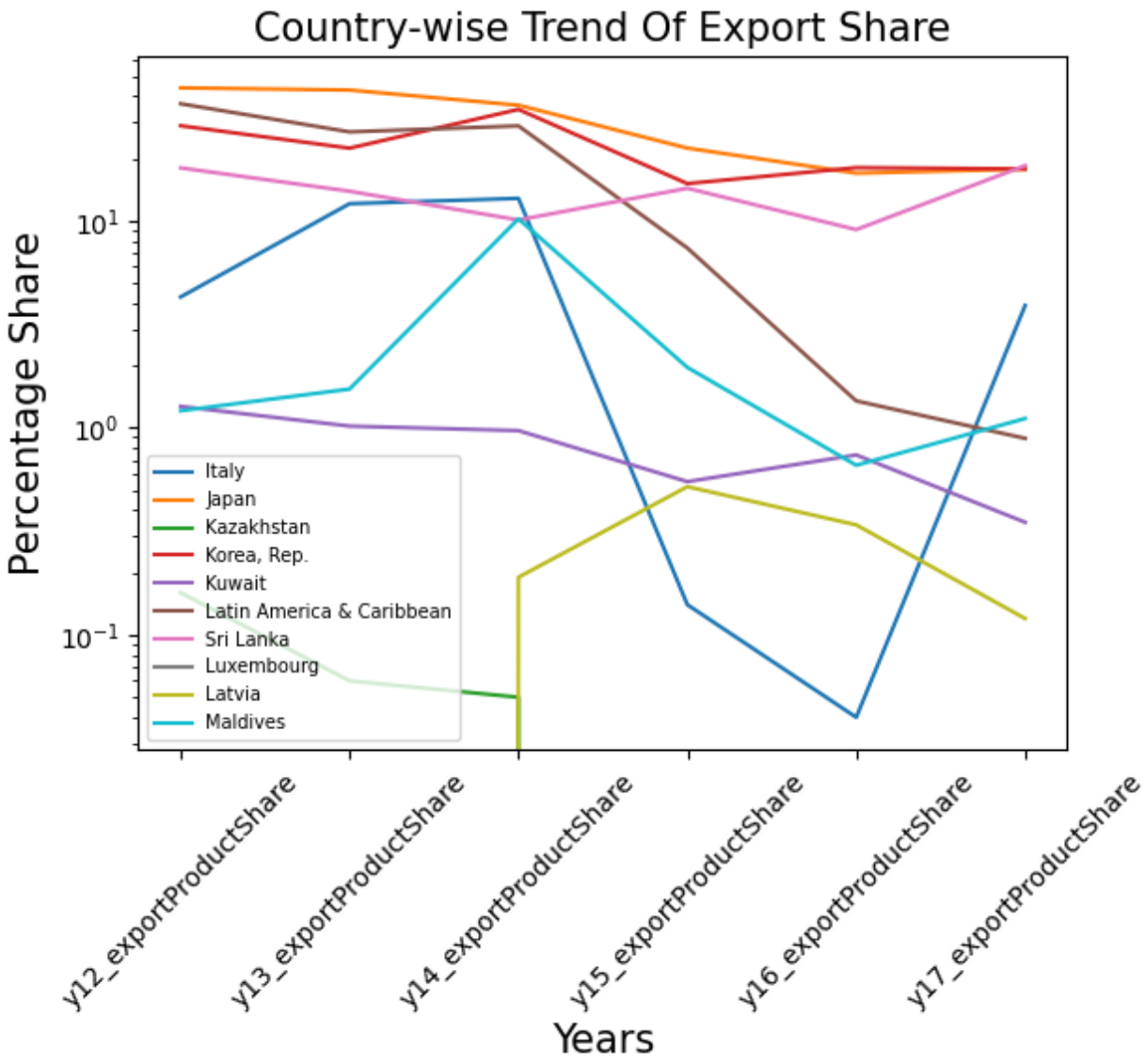
- This information can be useful for policymakers and businesses to identify countries with high trade potential and predict future market trends.

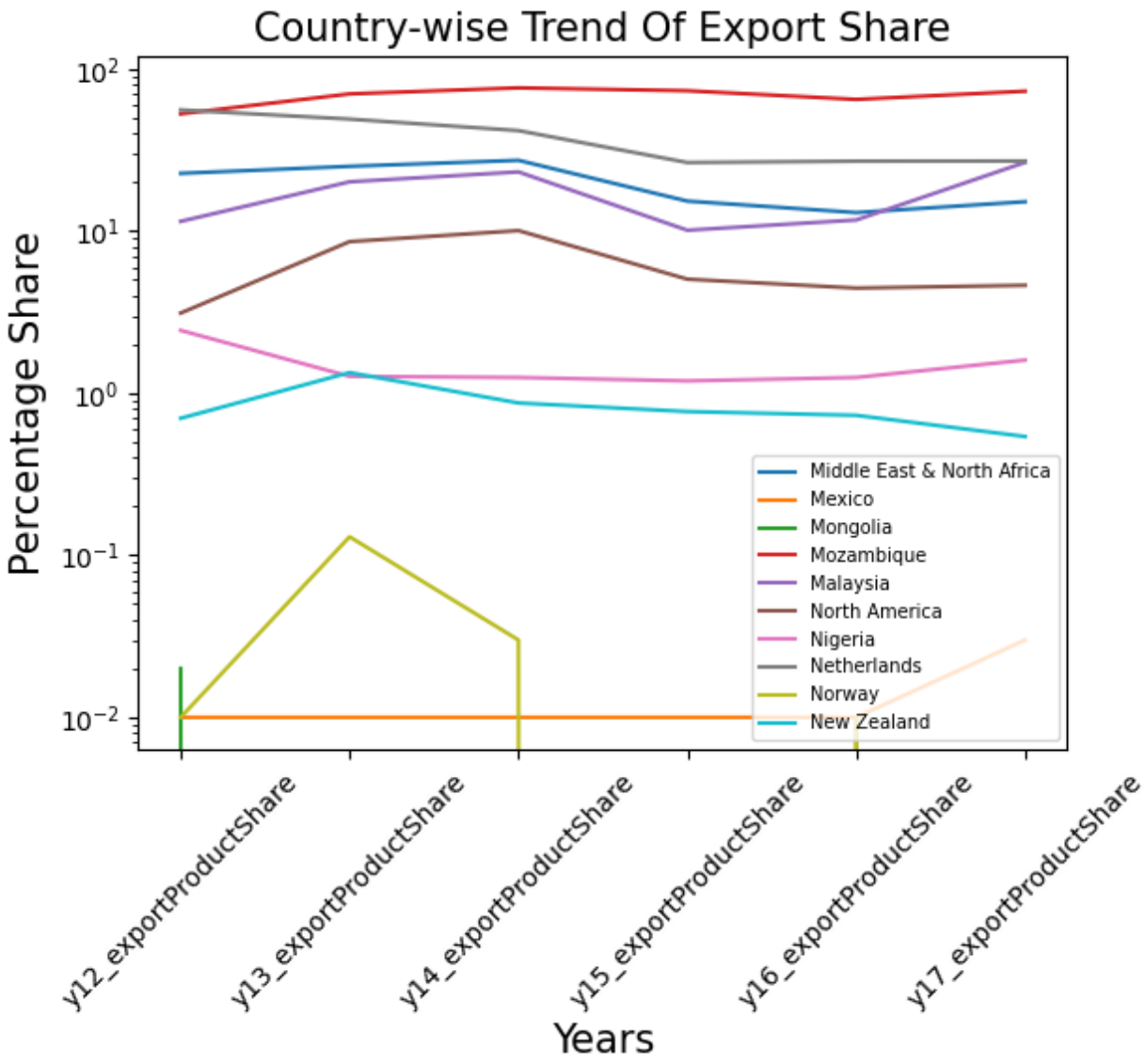


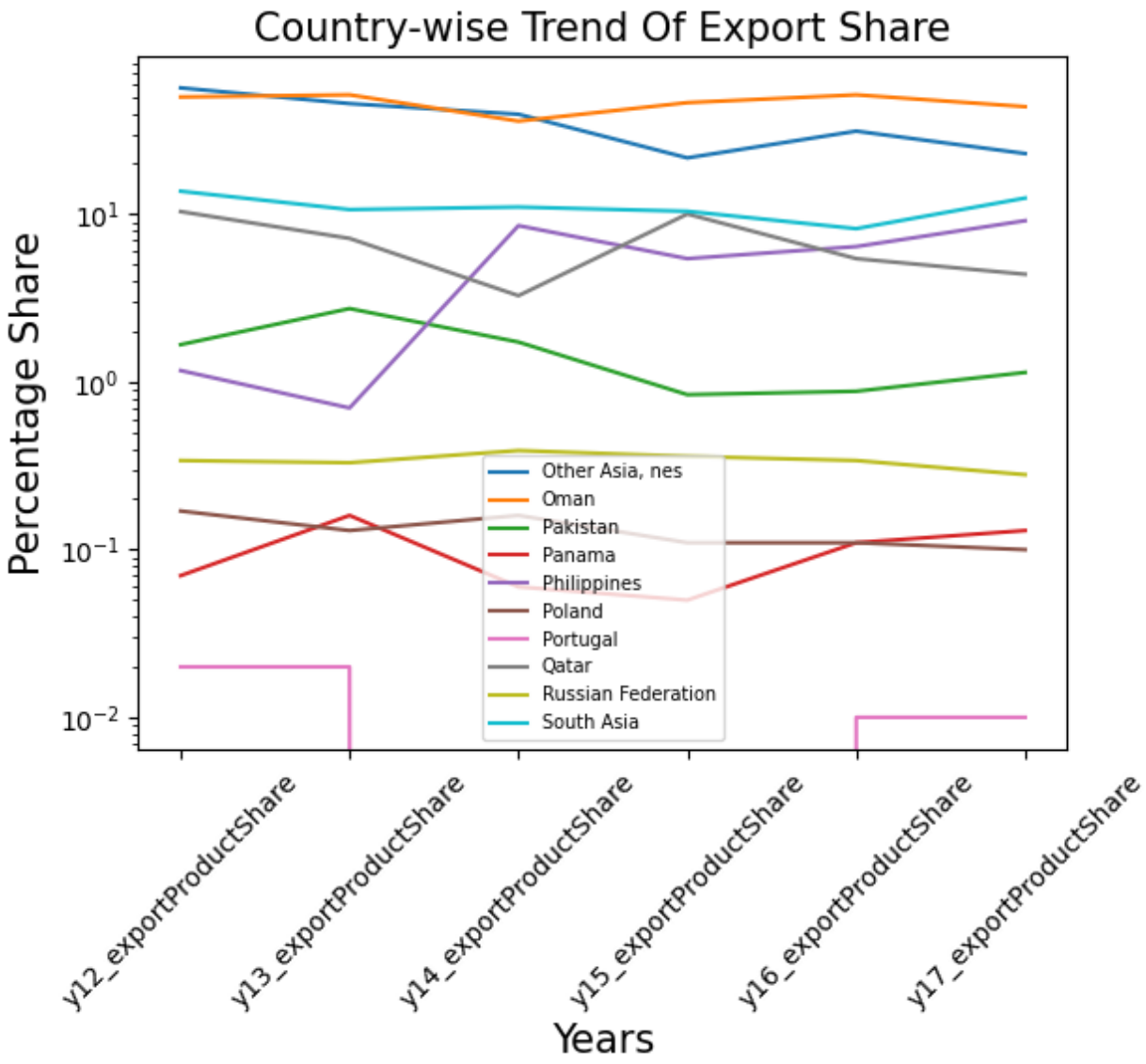

Country-wise Trend Of Export Share
Percentage Share
10^{1}
10^{0}
10^{-1}
10^{-2}
Canada
Switzerland
Chile
China
Cameroon
Congo, Rep.
Colombia
Czech Republic
Germany
Denmark
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years

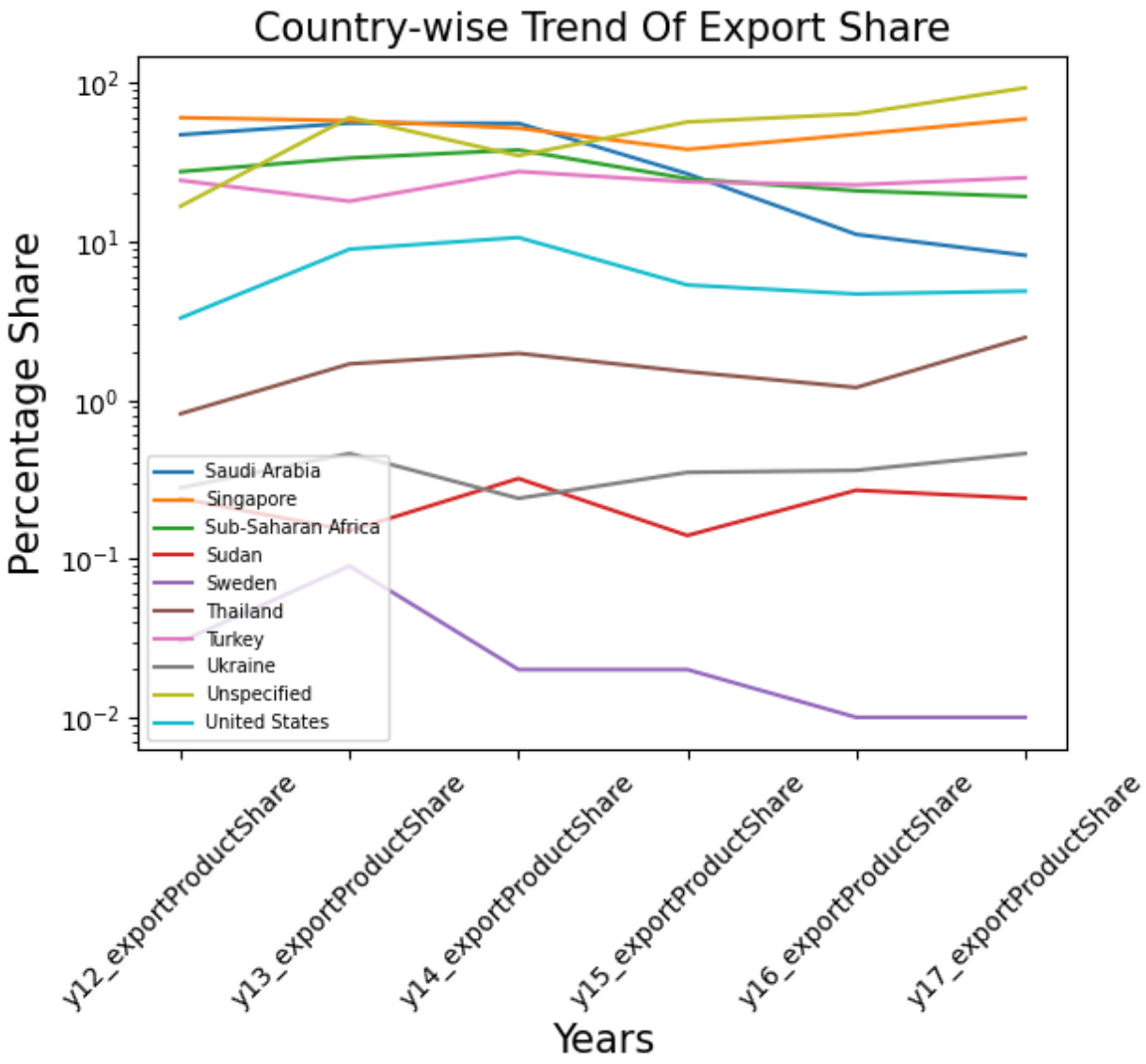

Country-wise Trend Of Export Share
Percentage Share
10^{1}
10^{0}
10^{-1}
10^{-2}
Algeria
East Asia & Pacific
Europe & Central Asia
Ecuador
Egypt, Arab Rep.
Spain
Finland
France
Gabon
United Kingdom
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years

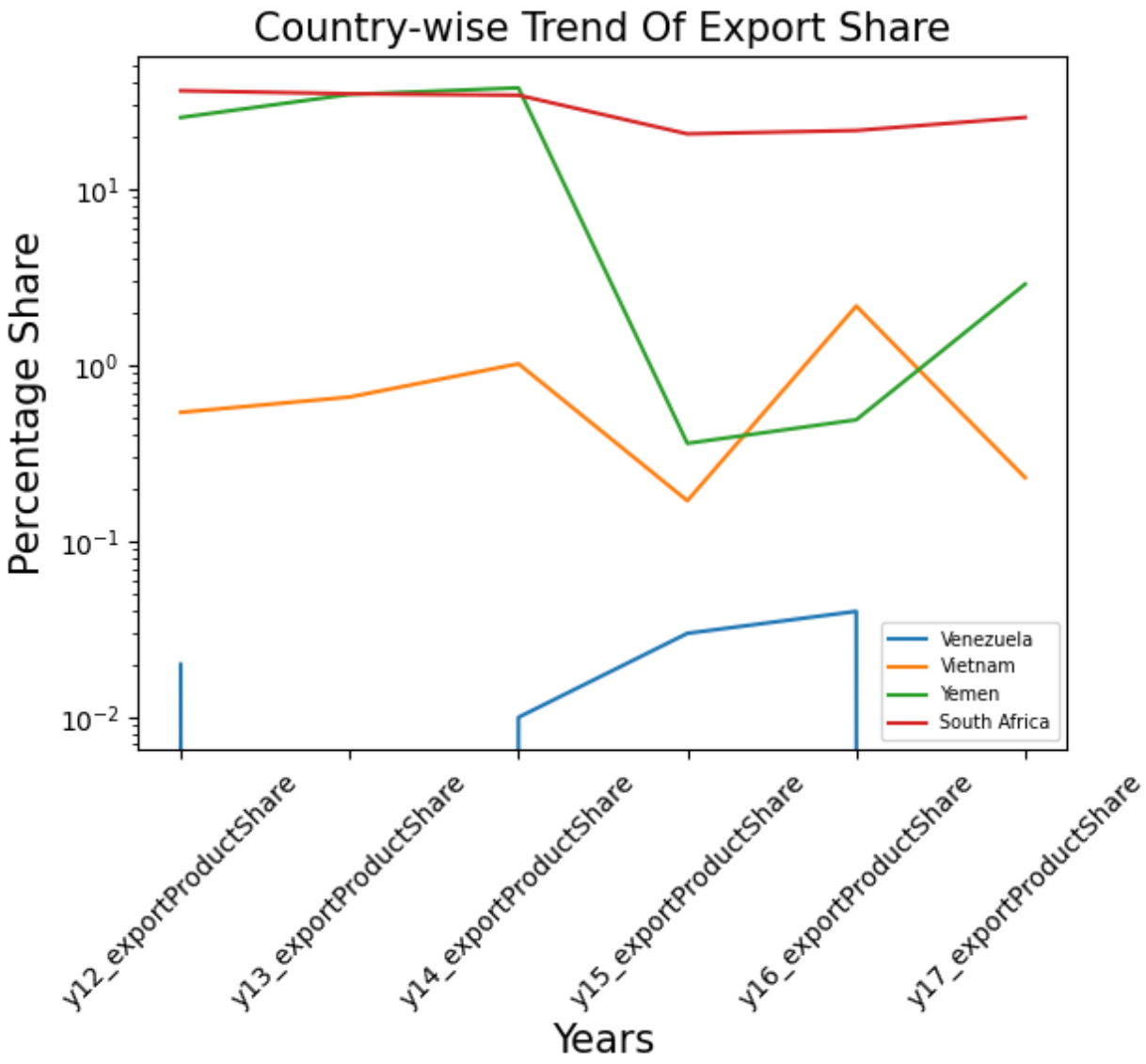

Country-wise Trend Of Export Share
Percentage Share
10^{1}
10^{0}
10^{-1}
10^{-2}
Guinea
Equatorial Guinea
Greece
Hong Kong, China
Hungary
Indonesia
Ireland
Iran, Islamic Rep.
Iraq
Israel
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years


Country-wise Trend Of Export Share
Percentage Share
10^1
10^0
10^{-1}
Italy
Japan
Kazakhstan
Korea, Rep.
Kuwait
Latin America & Caribbean
Sri Lanka
Luxembourg
Latvia
Maldives
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years


Country-wise Trend Of Export Share
Percentage Share
10^2
10^1
10^0
10^{-1}
10^{-2}
Middle East & North Africa
Mexico
Mongolia
Mozambique
Malaysia
North America
Nigeria
Netherlands
Norway
New Zealand
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years

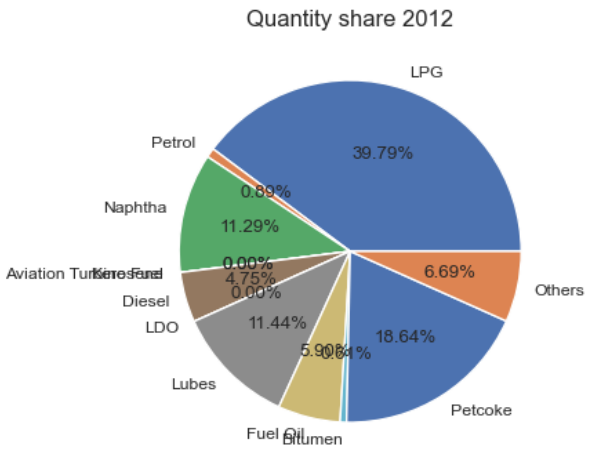

Country-wise Trend Of Export Share
Percentage Share
10^{1}
10^{0}
10^{-1}
10^{-2}
Other Asia, nes
Oman
Pakistan
Panama
Philippines
Poland
Portugal
Qatar
Russian Federation
South Asia
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years

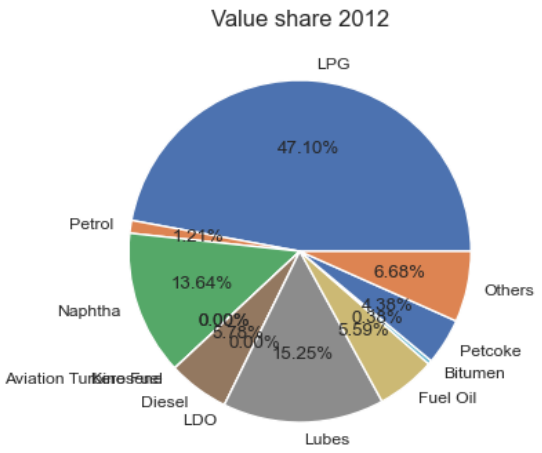

Country-wise Trend Of Export Share
Percentage Share
10^2
10^1
10^0
10^{-1}
10^{-2}
Saudi Arabia
Singapore
Sub-Saharan Africa
Sudan
Sweden
Thailand
Turkey
Ukraine
Unspecified
United States
y12_exportProductShare
y13_exportProductShare
y14_exportProductShare
y15_exportProductShare
y16_exportProductShare
y17_exportProductShare
Years

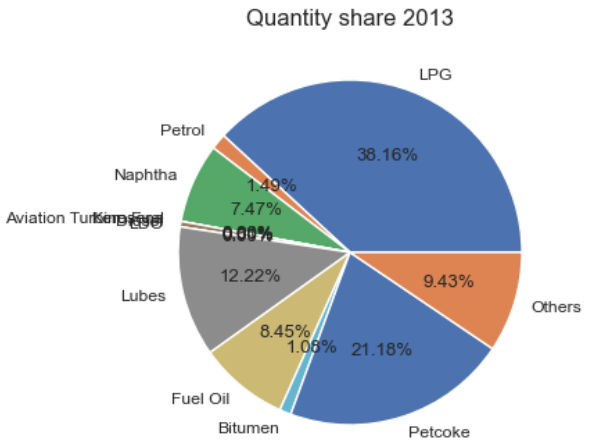


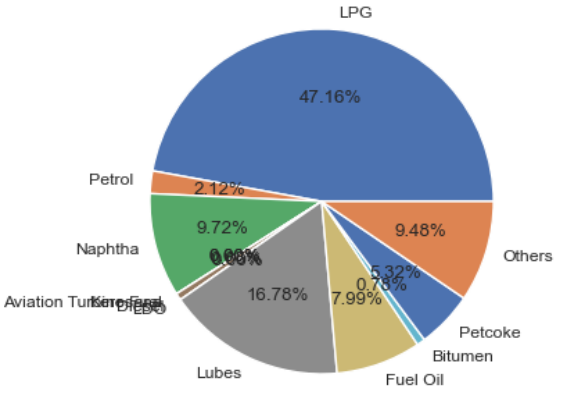
- This paragraph is referring to the trends of import in India's trade with other countries.
- It states that, similar to the export trends, there are very few countries with zero trade with India.
- The dynamism, or variability, of the import trends is comparatively higher than that of the actual export trend.
- However, despite this variability, there are still a few small countries that have a stable trend in their imports from India.

- Import _df
  - Quantity Share vs Value share
- Pie Chart of Quantity Share And Value Share of import

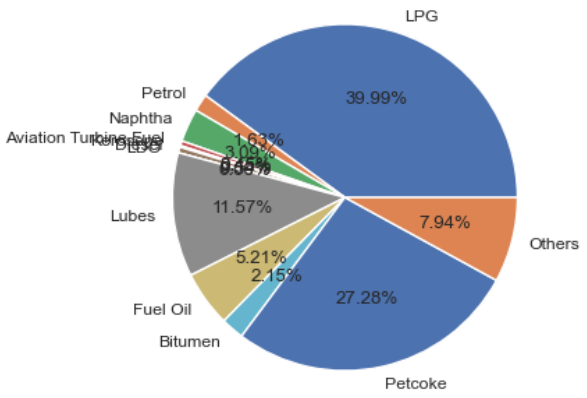




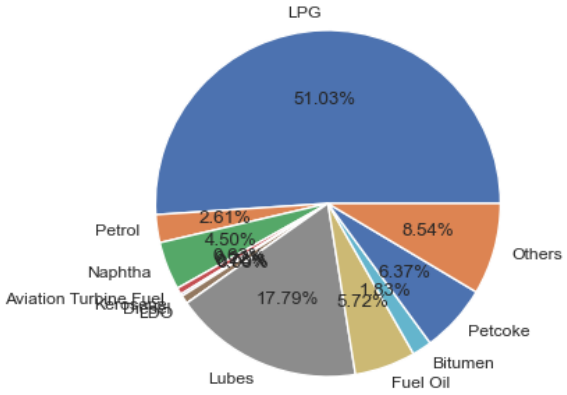




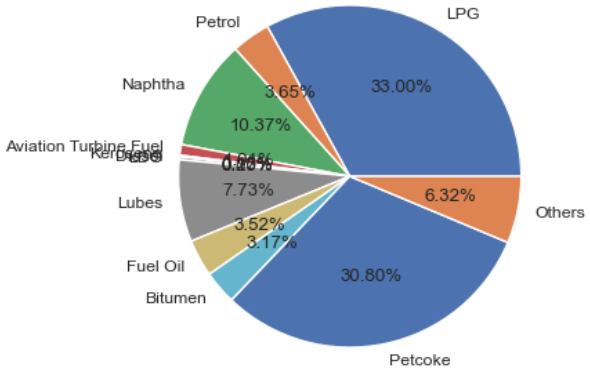
Quantity share 2014



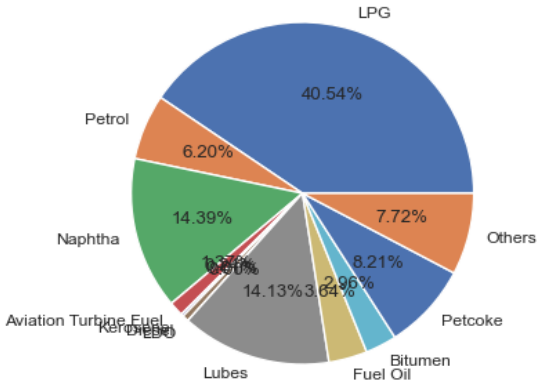
Value share 2014



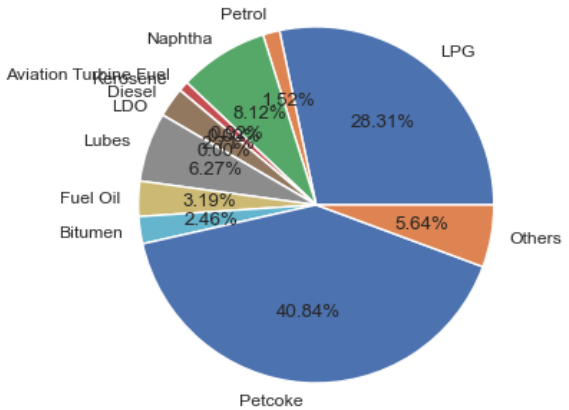
Quantity share 2015



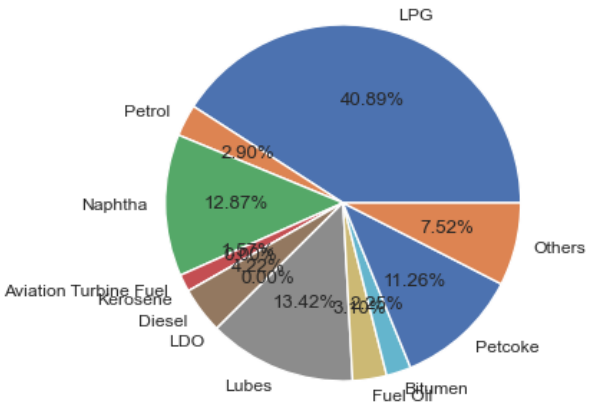
Value share 2015

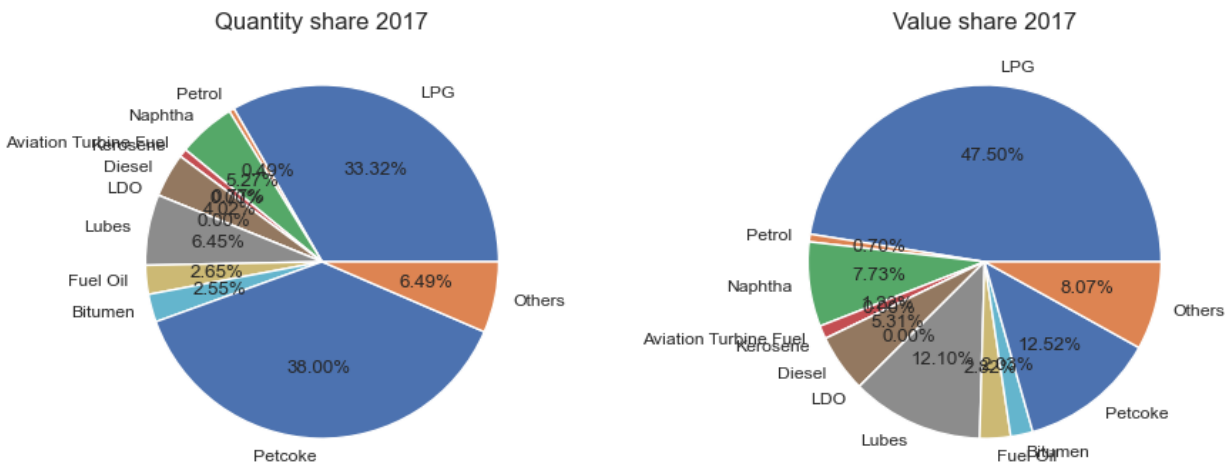


Quantity share 2016



Value share 2016



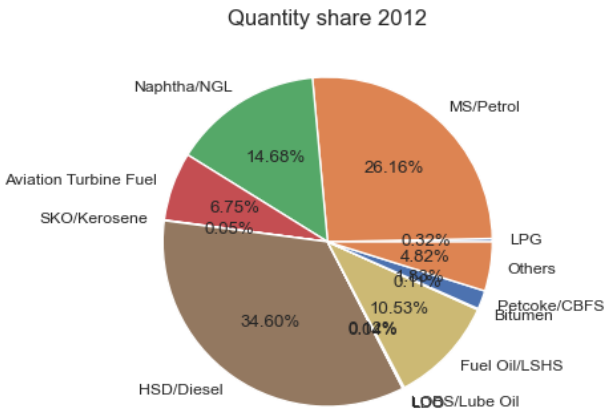


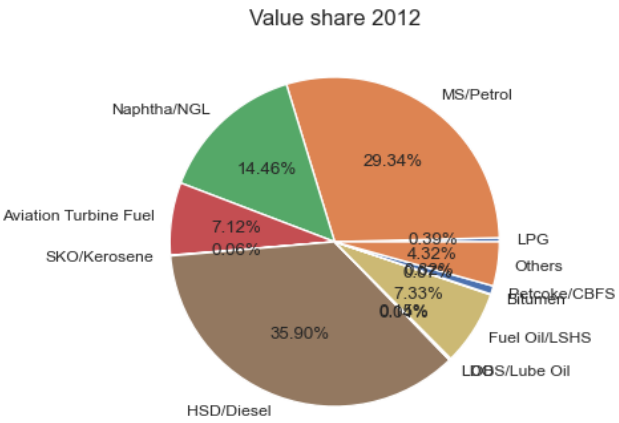
- The data analysis shows that LPG is the most imported product over the six-year period, with a share of approximately 35% of all imports in terms of quantity and around 47% in terms of value. In contrast, petcoke has a higher quantity share (approximately 27%) than its value share (approximately 9%).

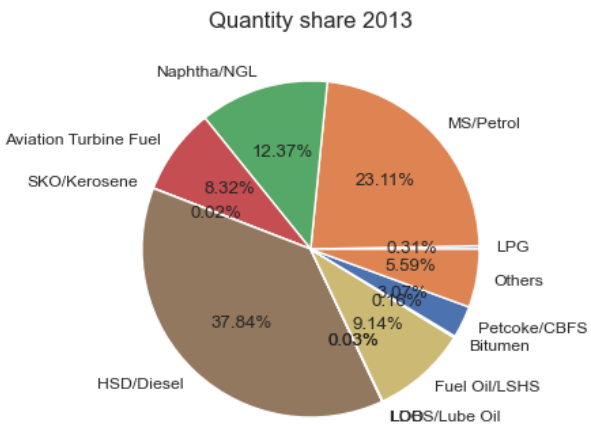
- Furthermore, the quantity share of petcoke is increasing over the years, and its value share has increased from 5.32% to 11.26% over six years. However, the increase in the quantity share is more significant, from 18.64% to 39% over the same period.

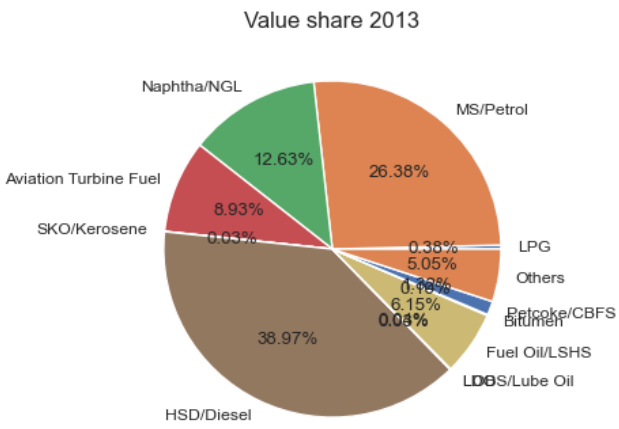
- The other products have less significance and follow a similar ratio of quantity import to cost of import. These observations suggest that LPG and petcoke are the most important products in terms of import quantity and value, and petcoke has been gaining in importance over the years. These insights could help in making strategic decisions related to import policies and trade agreements.

- Export _df
    - Quantity Share vs Value share
- Pie Chart of Quantity Share And Value Share of Export

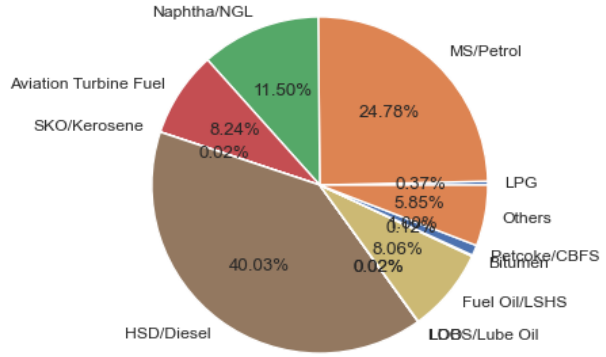




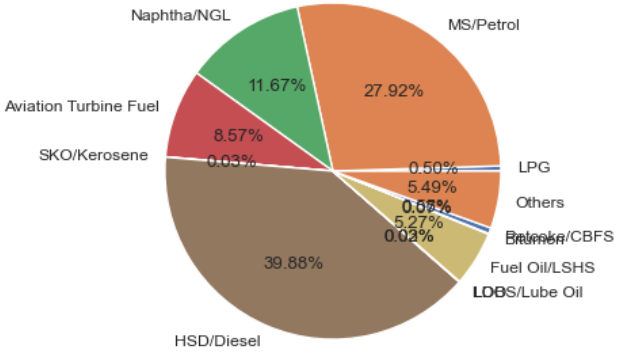




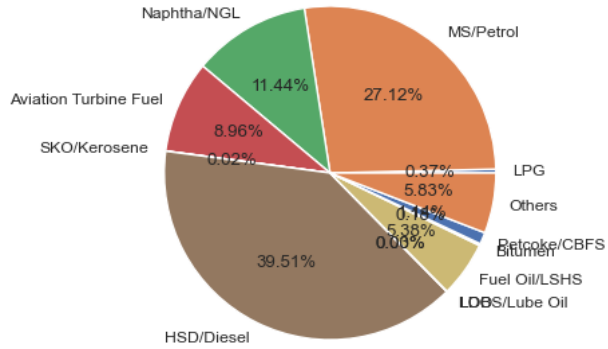
Quantity share 2014



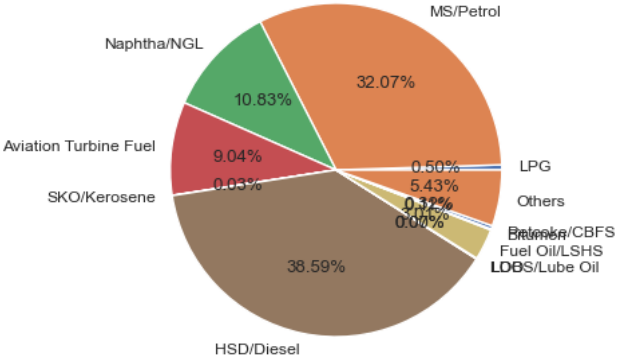
Value share 2014



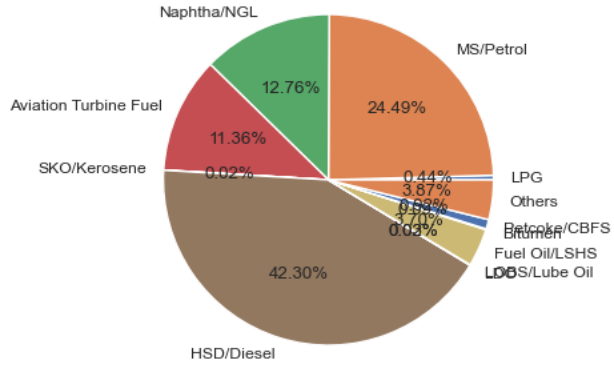
Quantity share 2015



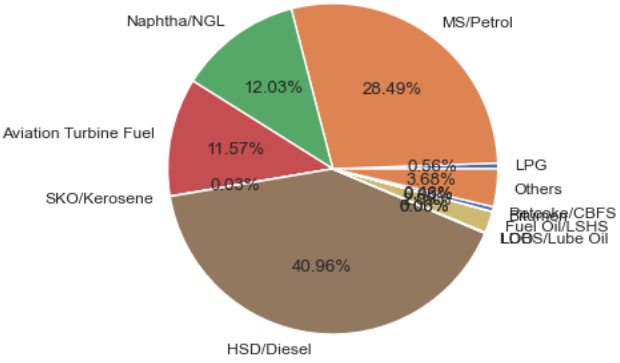
Value share 2015

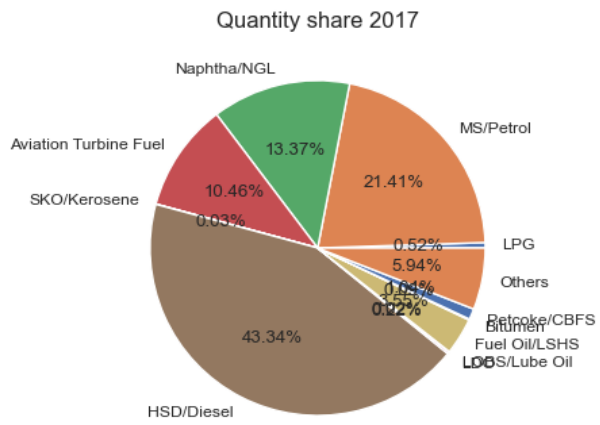


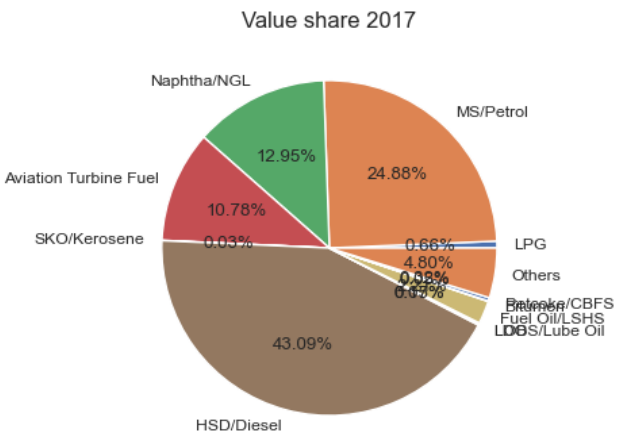
Quantity share 2016



Value share 2016





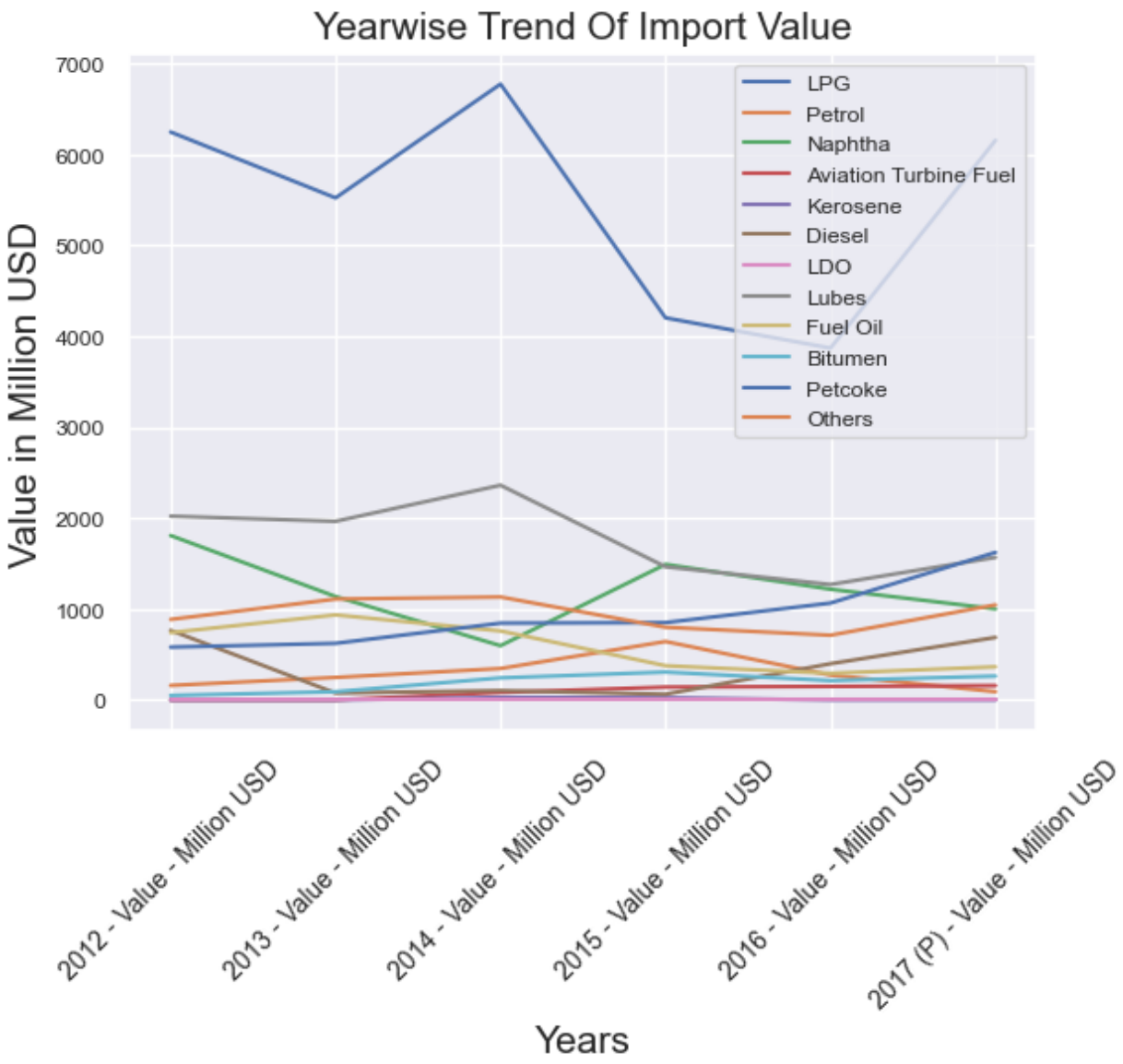


- The data analysis indicates that over the six-year period, the value share of petrol is greater than its quantity share, with a value share of approximately 27% and a quantity share of approximately 23.5%.

- Furthermore, the pie chart shows that diesel has the highest contribution in terms of both quantity and value shares among all export products. In fact, petrol and diesel have the most significant export shares compared to other products.

- These observations suggest that petrol and diesel are the most important export products and could be considered as key drivers of the economy. Policymakers and business leaders could use this information to make informed decisions related to export strategies, trade agreements, and investment opportunities.

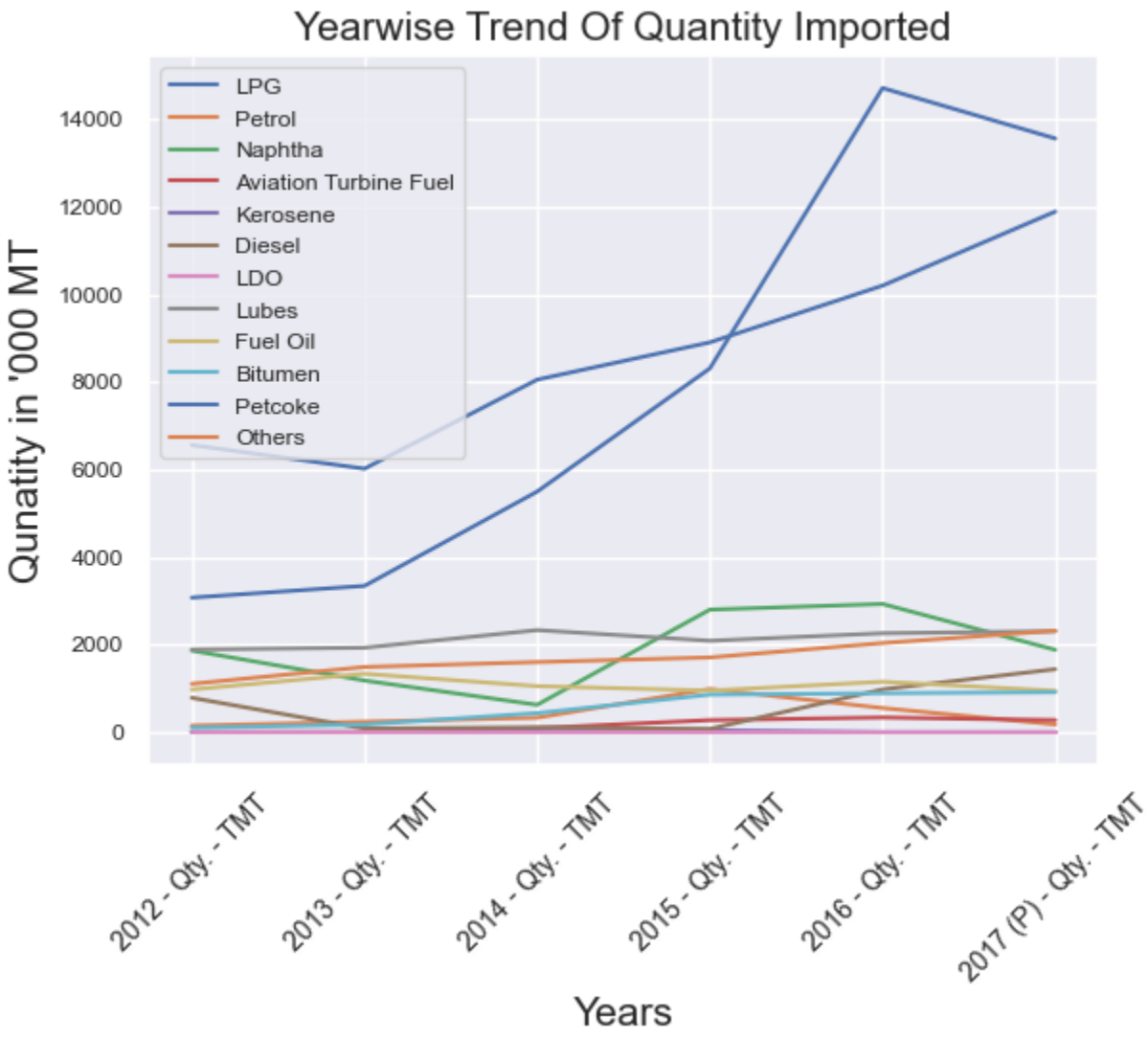
- Year Wise Trend of Import Values



- The data analysis shows that there was a significant decrease in the import of LPG from 2014 to 2016, but after 2016, there was a significant growth in the import of LPG. This suggests that there might have been some changes in the policies, market conditions or availability of alternative resources that could have impacted the LPG imports during that time period.

- In addition, the share of pet coke in the import value has been constantly increasing over the years. This trend is mainly attributed to the fact that petcoke is a direct replacement for coal and is a cheaper alternative with a higher calorific value of more than 7800 kcal/kg. The increased usage of petcoke as an alternative fuel is a reflection of the growing need for cost-effective and efficient fuel options. This observation highlights the significance of petcoke as an alternative fuel in the energy sector, which could lead to a shift in the energy mix of the country in the coming years.

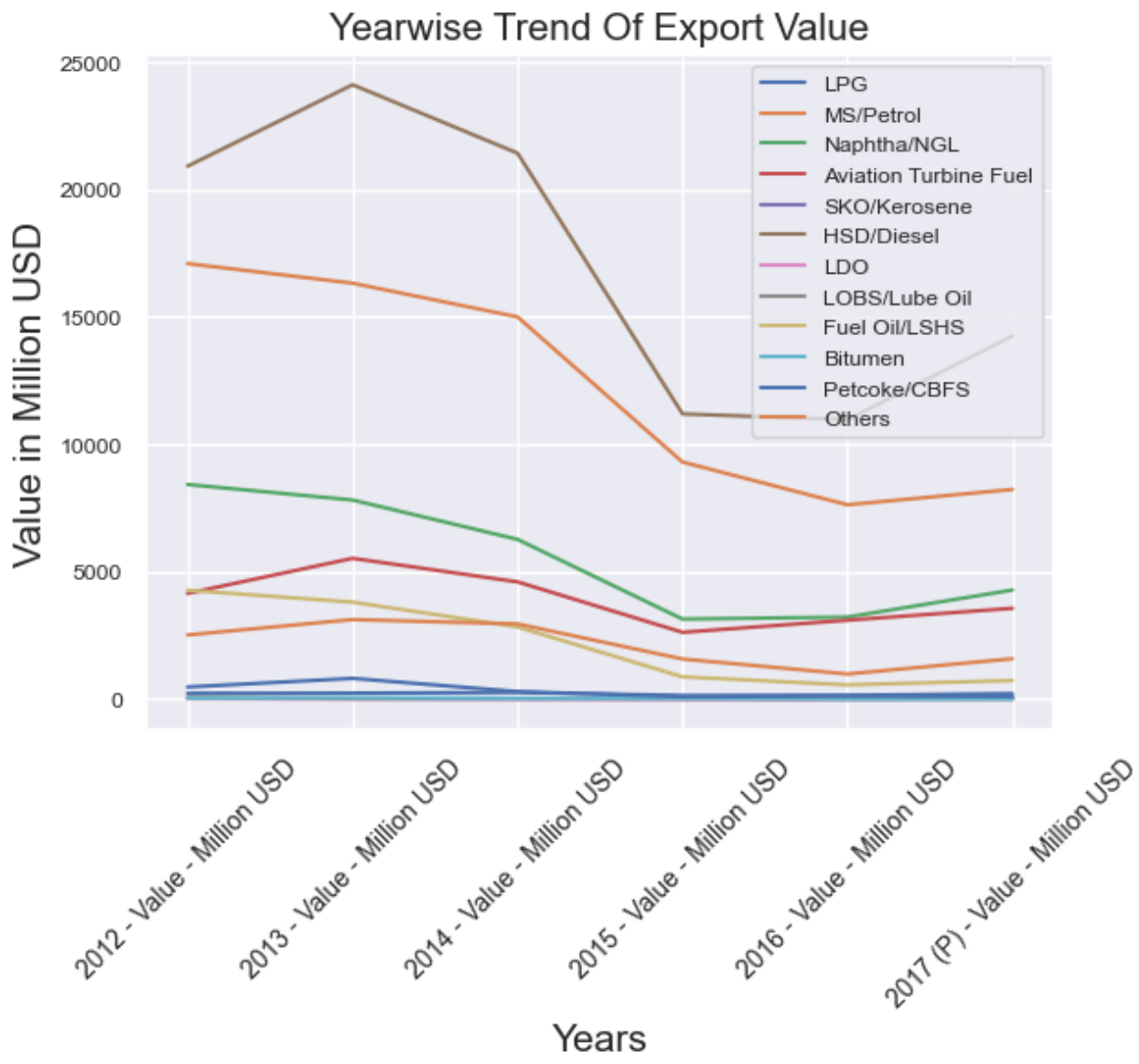
- Year Wise Trend of Quantity Imported



- The data analysis reveals that there has been a significant increase in the quantity of LPG imports over the years, with the quantity increasing from approximately 3000 to 13000 TMT. This is due to the fact that LPG has been made more widely available to the public as a domestic fuel, which is now accessible through cylinders and embedded pipelines. This has resulted in an increase in the demand for LPG as a domestic fuel, hence the significant rise in its imports.

- In addition, there has been a constant increase in the import values of petcoke over the years, with the import value increasing from approximately 6500 to 12000. Furthermore, there has been a consistent increase in its share of imports as well. This trend is mainly attributed to the fact that petcoke is a cheaper alternative to coal and has a higher calorific value, making it an attractive option for the energy sector. The rise in petcoke imports highlights the growing importance of alternative fuels in the energy mix of the country.

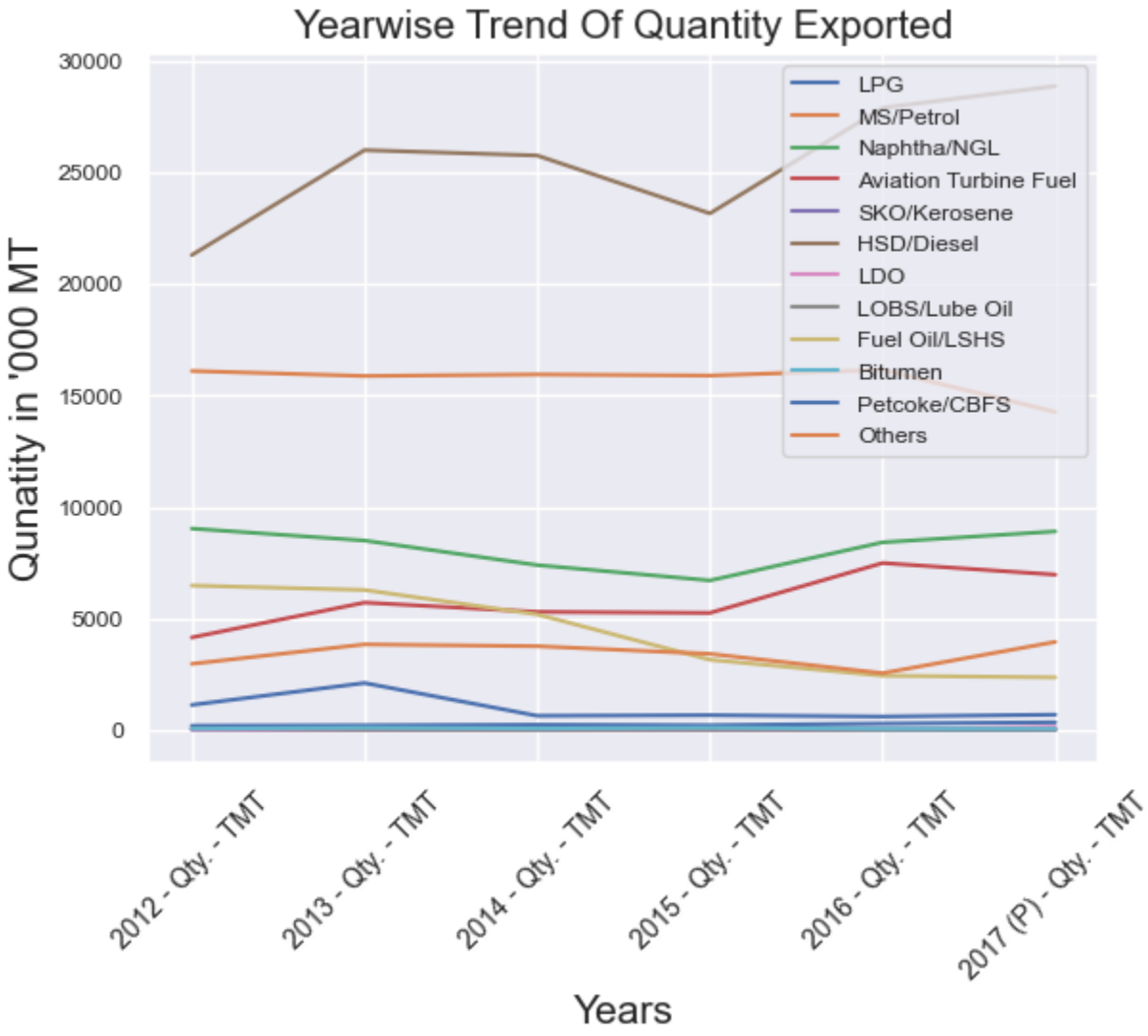
- Year wise Trend of Export Values



- The analysis of the data reveals that the export values of Diesel, Petrol, and Napht have experienced a significant fall over the years. This trend can be attributed to the increased supply of these fuels in the global market, leading to a drop in their prices. The fall in the export values of these fuels highlights the challenges faced by exporting countries in a highly competitive market.

- As the global supplies of fuels increase, the cost of the fuels is expected to fall further, resulting in a more challenging export environment for fuel-exporting countries. The decline in the export values of Diesel, Petrol, and Napht underscores the need for fuel-exporting countries to explore other export options and diversify their export portfolio.

- Year Wise Trend of Quantity Exported

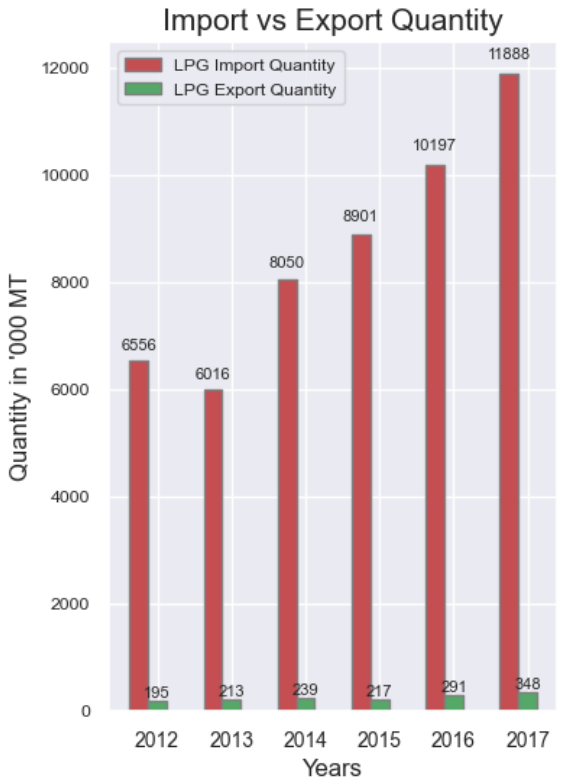


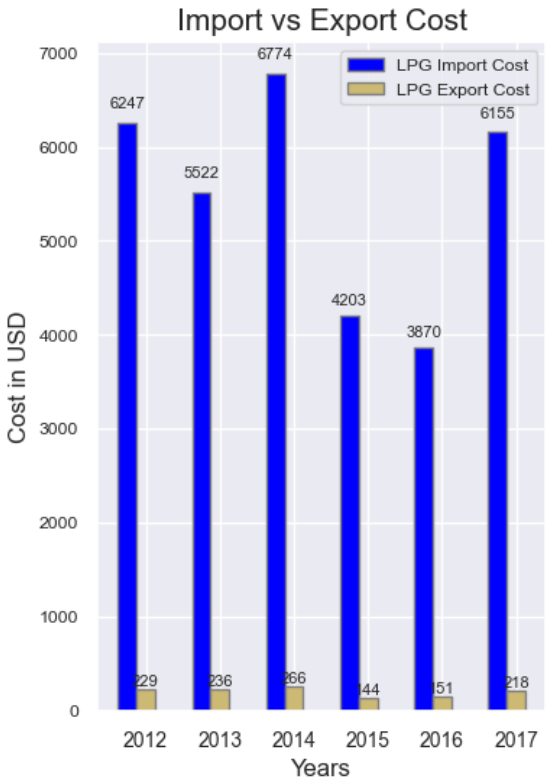
- There has been a stable trend in the quantity of exports over the years, but the values of exports have been fluctuating. This means that the quantity of goods being exported from India has not seen a significant change, but the price of those goods in the international market has been changing.

- However, there has been a considerable increase in the export quantity of Diesel. This could be attributed to the fallen price of Diesel in the global market, which has made it a more profitable commodity for India to export. It is also mentioned that India refines the fuel and exports it for profit, which could be a contributing factor to the increase in Diesel exports.

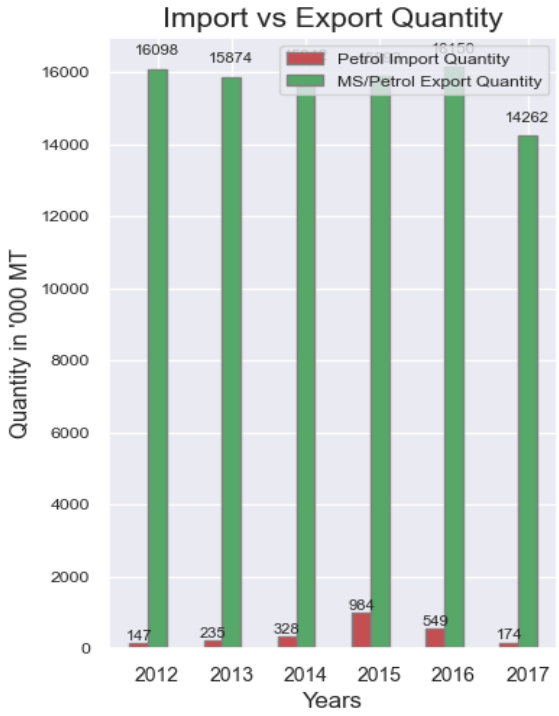
Import Vs Export

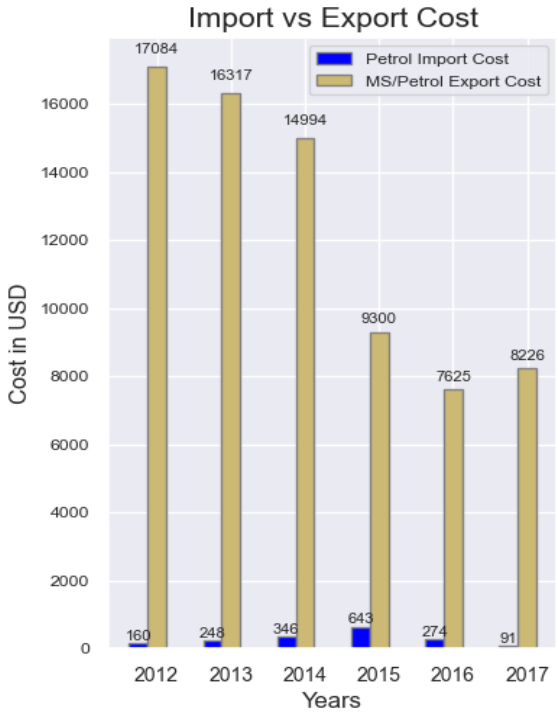
- Import Vs Export of LPG Quantity & Cost



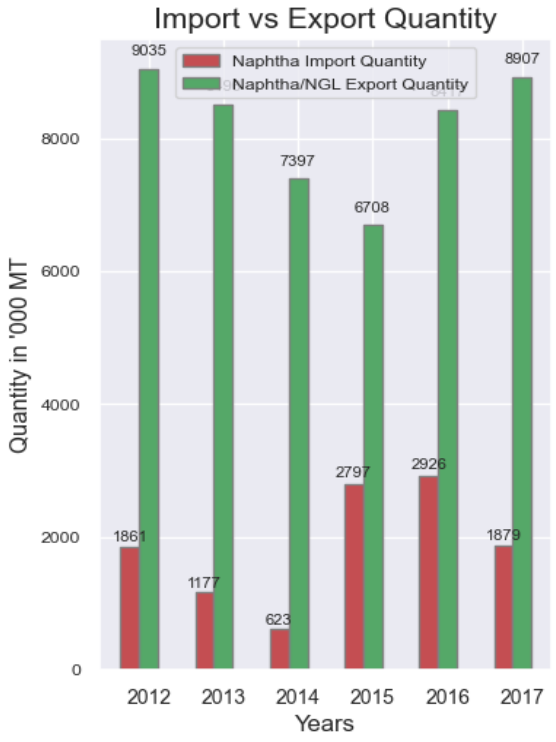


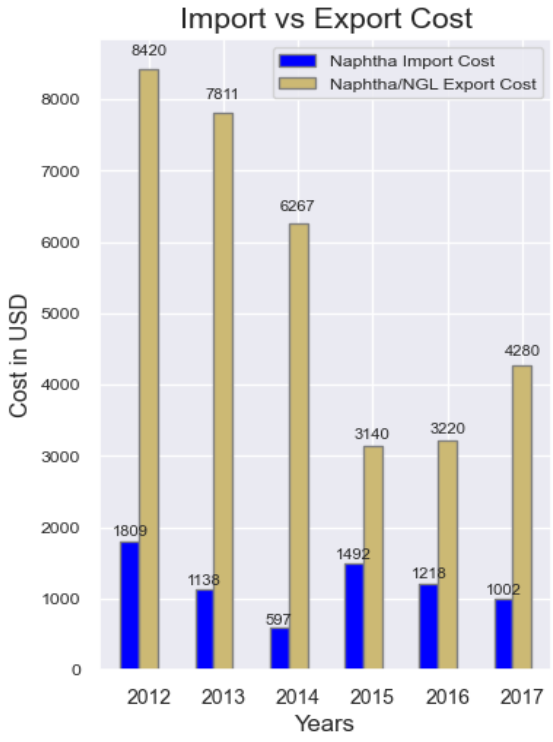
- Import Vs Export of MS/Petrol Quantity & Cost



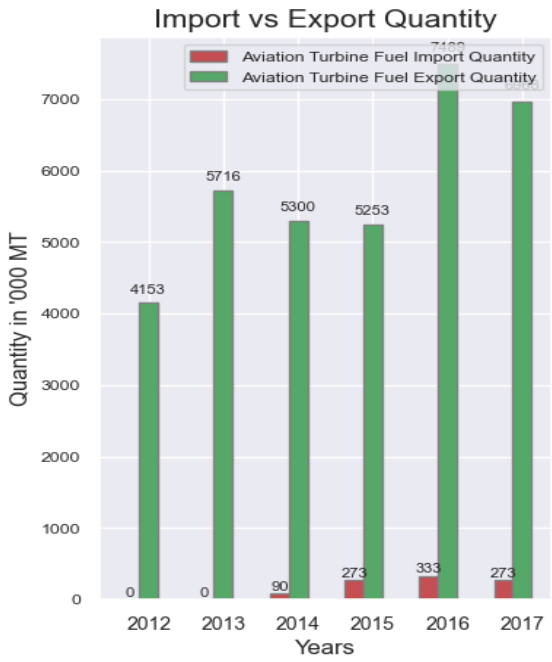


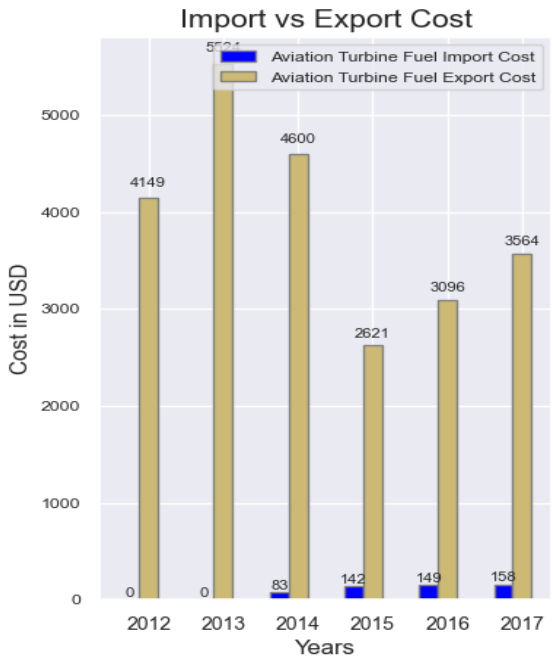
- <u>Import Vs Export of Naphtha/NGL Quantity & Cost</u>



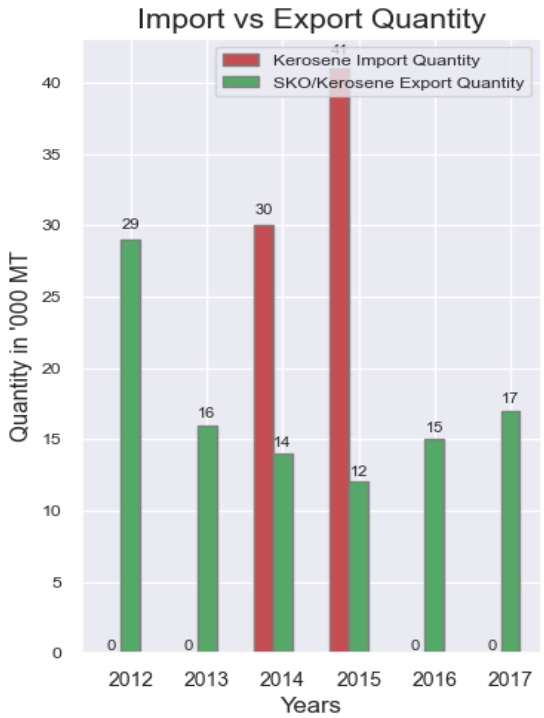


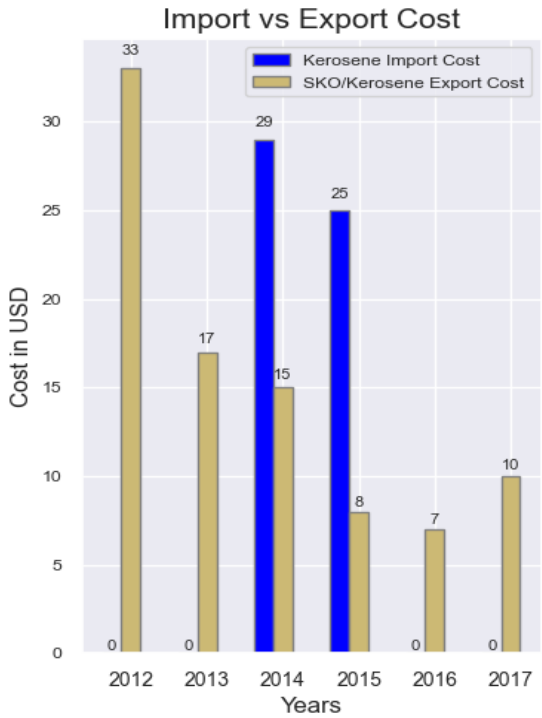
- Import Vs Export of Aviation Turbine Fuel Quantity & Cost



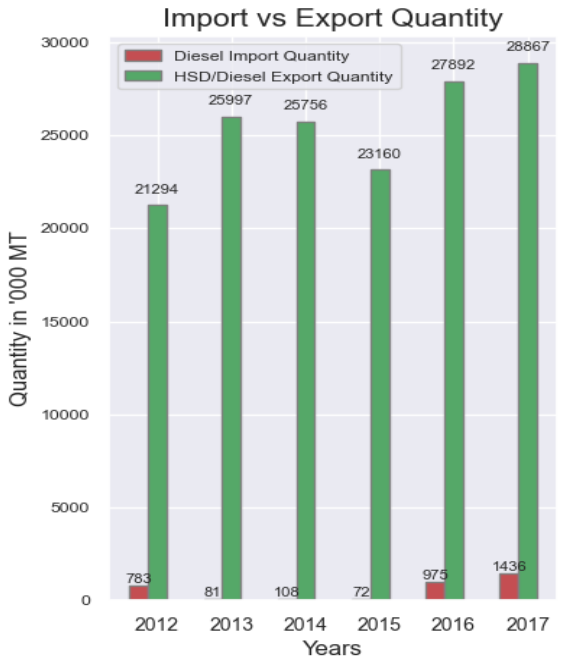


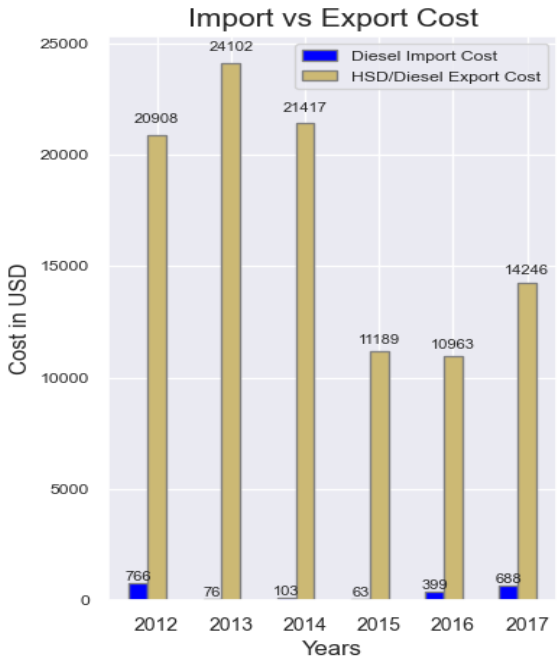
- Import Vs Export of SKO/Kerosene Quantity & Cost



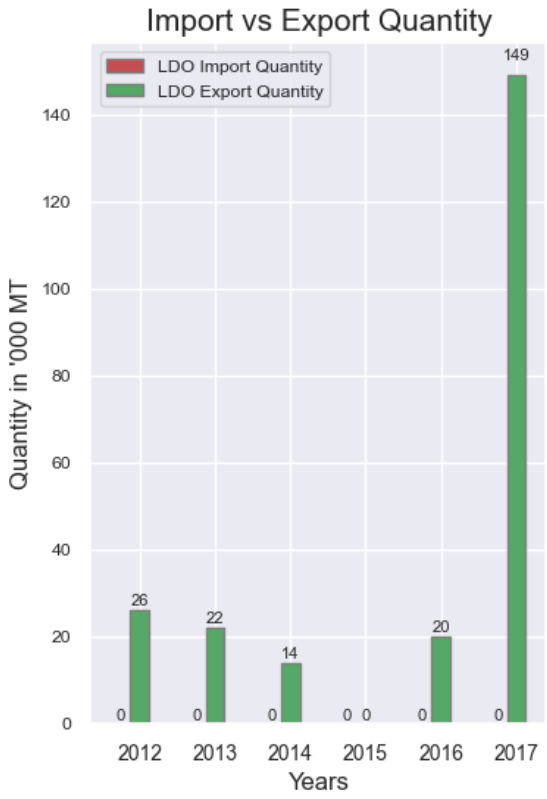


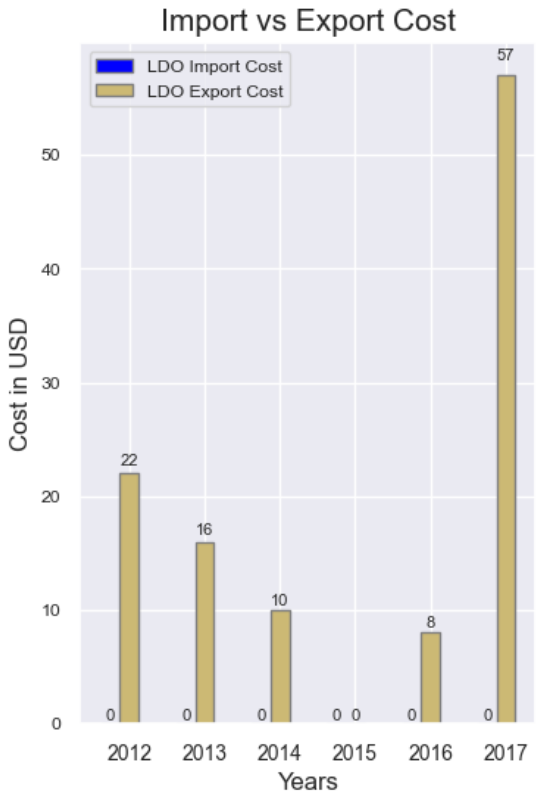
- Import Vs Export of HSD/Diesel Quantity & Cost



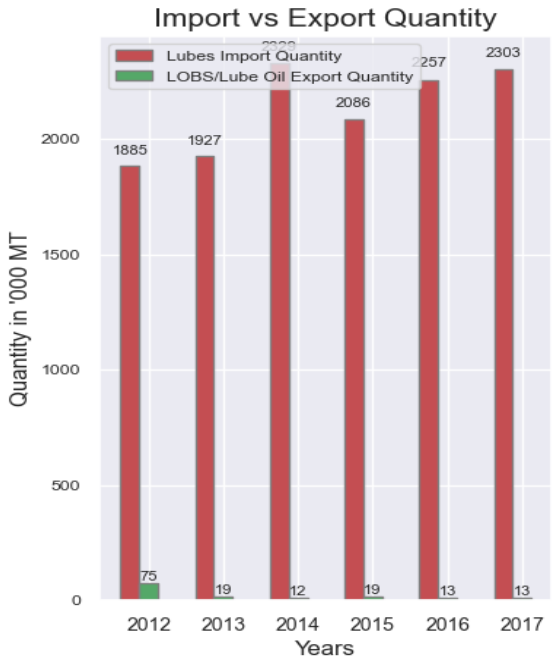


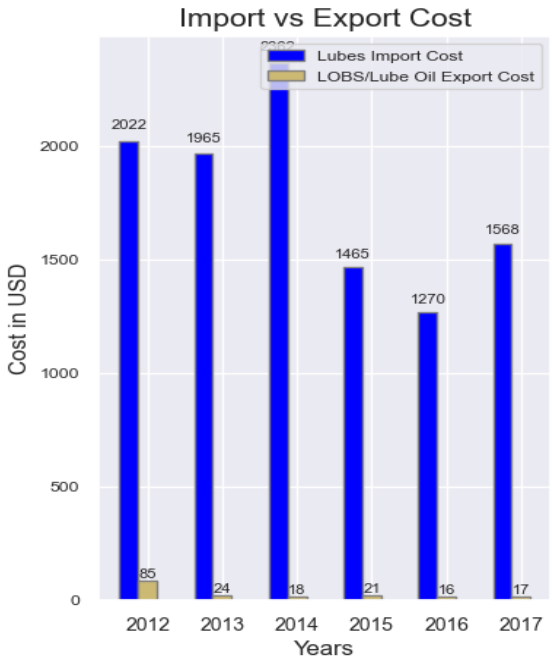
- Import Vs Export of LDO Quantity & Cost



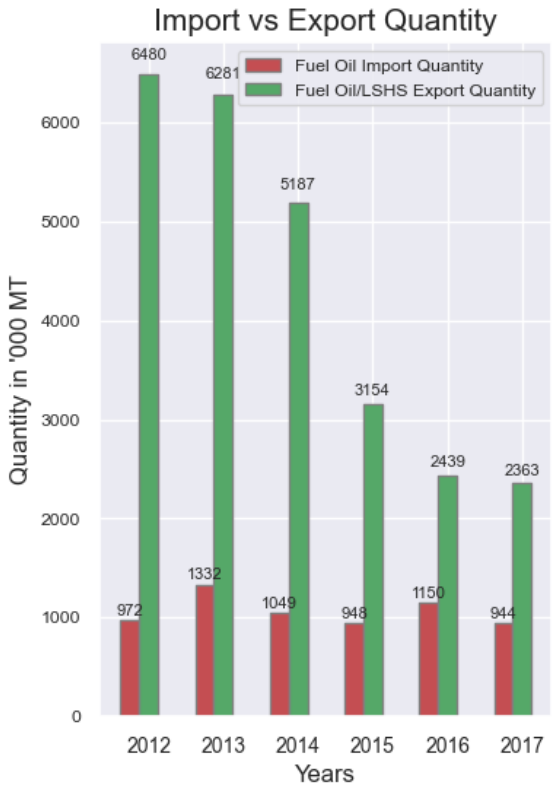


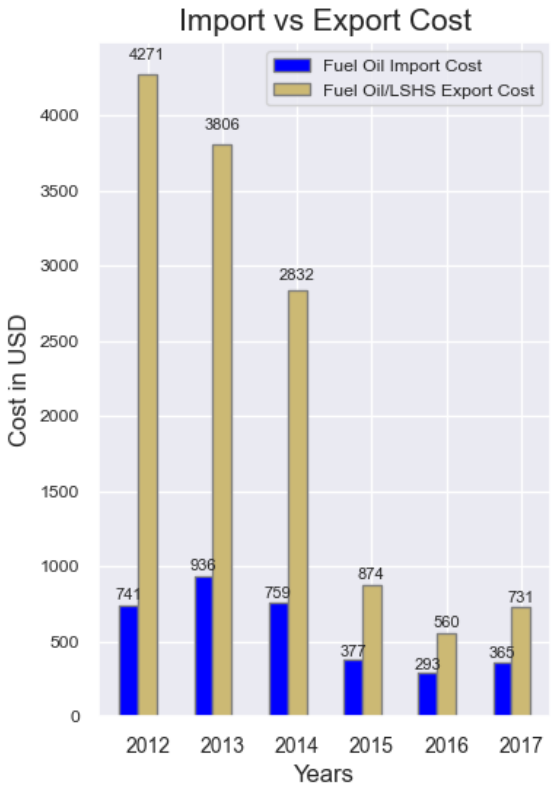
- Import Vs Export of LOBS/Lubes Quantity & Cost



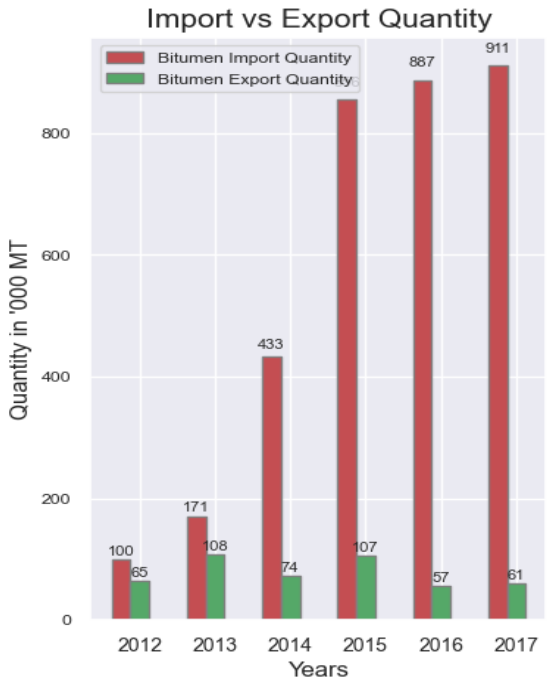


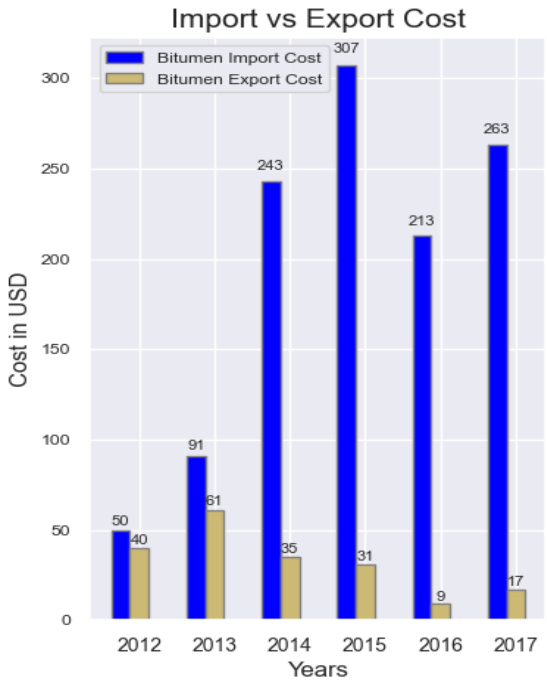
- Import Vs Export of Fuel Oil/SHS Quantity & Cost



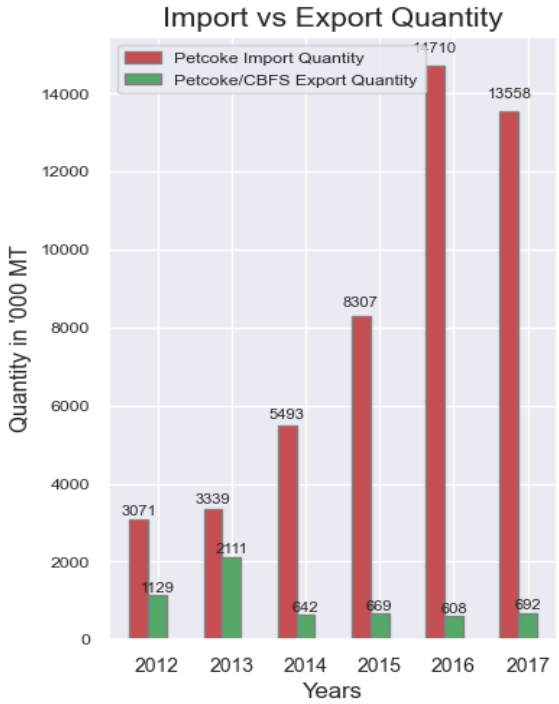


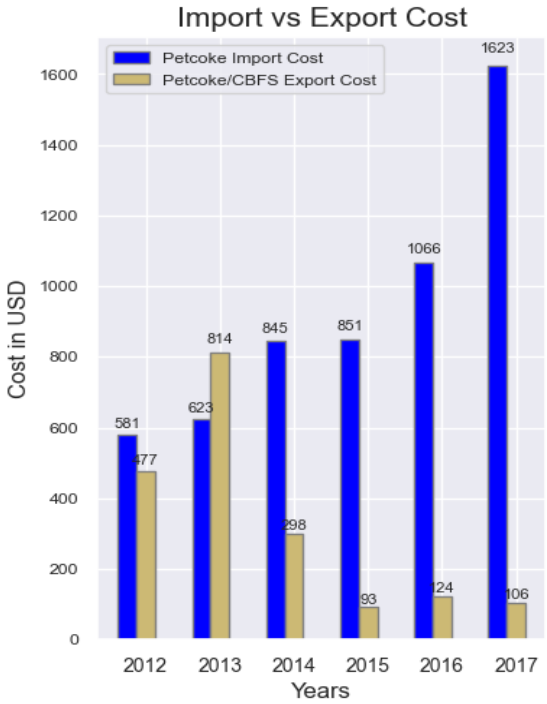
- Import Vs Export of Bitumen Quantity & Cost



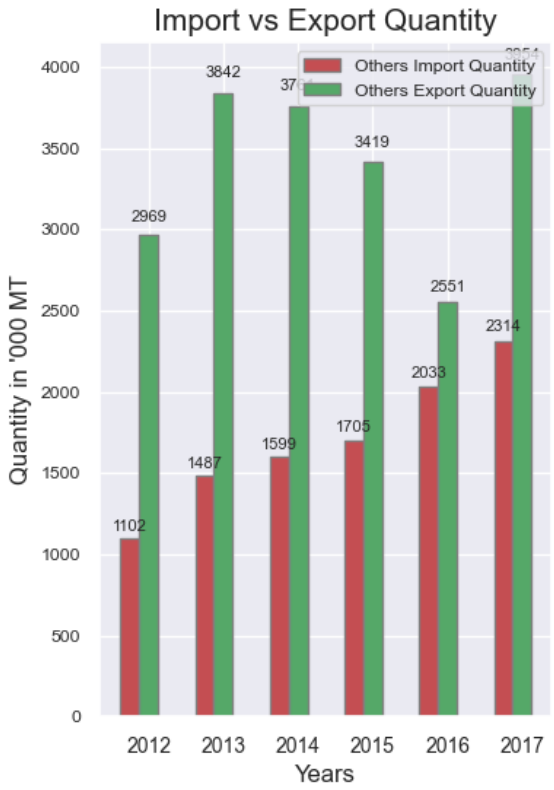


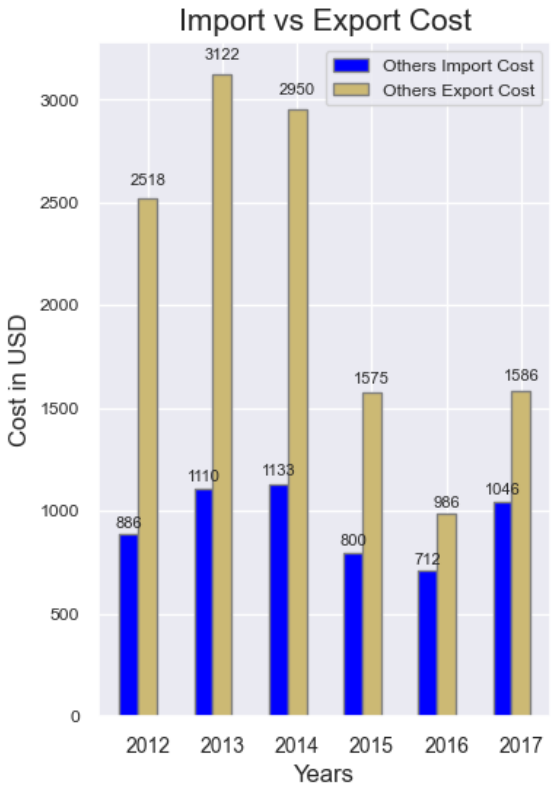
- <u>Import Vs Export of Petcoke/CBFS Quantity & Cost</u>





- Import Vs Export of Others Quantity & Cost





- India is one of the largest importers of crude oil in the world due to limited domestic reserves. As a result, it has to import crude oil for its consumption and refine it in the refineries for domestic use and exports. The cost of crude oil products in India is highly influenced by international market trends, and hence the prices fluctuate based on global demand and supply dynamics. As observed from the trends, the price of crude products in India has been quite volatile, with significant falls in 2014 and 2015.

- Despite being a net importer of crude oil, India has managed to export some refined products for profit. The exports of naphtha and petrol are higher than their imports, indicating that India has been able to refine crude oil and export the refined products for a profit. However, the overall quantity of exports is still relatively small compared to the volume of imports.

- The reason behind the increase in diesel exports can be attributed to the falling prices of diesel in the global market. India refines crude oil to produce diesel and exports it to gain a profit when the prices of diesel are low. The decreasing trend in the price of crude oil products in 2014 and 2015 might have provided an opportunity for India to refine more diesel and export it for profit.

- In conclusion, India's import of crude oil and its refining and export of crude products are highly influenced by global market dynamics. The fluctuation in the price of crude products, coupled with India's limited domestic reserves, has resulted in India's import of crude oil and refining it for domestic consumption and exports. While India has been successful in exporting some refined products like naphtha and petrol, the volume of exports is still relatively small compared to imports. The falling prices of diesel in the global market have provided an opportunity for India to refine more diesel and export it for profit, leading to an increase in diesel exports.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4) Prediction

1. **Model Used**
   Here we have used linear regression model for prediction of values. We use years as independent variable(x) and the per unit value as dependent variable(y)

   We use RMSE as the loss function to analyze the reliability of the model.
   The output of the model gives us a value ‘y’ (per unit value) for a given year x

   This could be used to predict the near years future of import export trends.
   We have used liner regression model as the data points available are only 6 and polynomial regression will overfit the data.

2. **Data for model**
   To implement the model we need to split data into training and testing dataset. For the same purpose we have given
   - 5 data points as train data
   - 1 data point as test data

3. **Result & error**
   To test the result we are using the loss function of RMSE this helps us to know the precession and reliability of the model.
   RMSE calculation

Refrences:

- https://wits.worldbank.org/CountryProfile/en/Country/IND/Year/2017/Summary
- https://numpy.org/doc/
- https://pandas.pydata.org/docs/
- https://matplotlib.org/stable/index.html
- https://economictimes.indiatimes.com/defaultinterstitial.cms

Data source:

1) https://wits.worldbank.org/CountryProfile/en/Country/IND/Year/2017/TradeFlow/EXPIMP/Partner/all/Product/27-27_Fuels#
2) https://data.gov.in/search?title=import%20export%20crude%20in%20dollars%20for%20fuel

Students Introduction

1) Shivani Pande(202218044)

Age - 23

State of Belonging - Maharashtra

Hobbies - Painting, Reading Novels

Education :

MSc Data Science (Enrolled) at DA-IICT College, Gandhinagar

BSc Programme (Physics, Mathematics, Computer Science) from Pragati Mahavidhyala Degree College, Osmania University, Hyderabad

Studying all the three application based subjects in my bachelor's degree, I developed skills about studying and analyzing trends and peculiar results, which I think is very much needed in the career which I aim to pursue. I have expertise in several languages which include C++, Python, SQL . These skills along with decision making power and analytical mindset, I will be well-suited in this career.

2) Swapnil Sheth (202218045)

Age - 21

State of Belonging - Gujarat

Hobbies - Playing Cricket, Music

Education :

MSc Data Science (Currently Doing) from DA-IICT College, Gandhinagar

BCA from JG College of Computer Application, Gujarat University, Ahmedabad

I have knowledge of programming languages such as - C++, Python, Java PHP.

I am interested in this field of Data Analysis because I love the application part of computer science and love to understand different trends happening around the world like - trends of stocks, world growth of India etc.

I am self employed having a business of online trade of mobile and accessories for the last 3 years.

3) Vipul Singh (202218052)

Age - 22

State of Belonging - New Delhi

Hobbies - Puzzle Solving, Football

Education :

MSc Data Science (Enrolled) at DA-IICT College, Gandhinagar

BSc Mathematics (Honors) from Dyal Singh College, University of Delhi

With a strong background and keen interest in their applied side of mathematics, I developed interest into this field of tech - Data Analysis.

With passion for puzzle solving, I honed my skills in C/C++ , Python and SQL to understand better about the field. Other than these, I am good with R and LaTex software as well.

Now learning the topic like EDA, Machine Learning, Deep Learning etc., are helping me to become the best asset into this career.

4) Jitul Bakshi (202218059)

Age - 22

State of Belonging - Gujarat

Hobbies - Dancing, Animations

Education :

MSc Data Science (Pursuing) from DA-IICT College, Gandhinagar

BCA from SDJ College, Veer Narmad South Gujarat University, Surat

I am very interested in animation and UX-UI and hold a degree in it. I am comfortable with several languages like C++, Python, JAVA, PHP. I am also well-versed with softwares like Microsoft PowerPoint, Excel, Word. I have worked as an animation artist with Creative Cursor and worked as a Chief Developer for Rentio Dal.