india-trade

April 15, 2024

0.1 Introduction

- Historical Growth in Exports: From 1950-51 to 2003-04, India's merchandise exports grew from USD 1.3 billion to USD 63.8 billion, with an annual growth rate of 7.6%.
- Post-Liberalization Progress: After economic reforms began in 1991, Indian exports grew faster than global demand, indicating improved competitiveness of Indian products.
- Trade Policy Changes Since 1991:

Simplified procedures. Removal of quantitative restrictions. Significant reductions in tariff rates. Growth in Export of Services: The 1990s saw remarkable growth in the export of services such as IT and telecommunications, thanks to liberalization.

- Impact of Economic Reforms:

Introduced transparency, openness, and integration with global markets. Focused on liberalization and globalization.

- Factors Influencing Trade Growth:

Dependent on global trade dynamics, especially with key trading partners. Affected by international price changes and developments in competitor countries. Influenced by exchange rate movements, especially between the Indian rupee and the US dollar.

0.2 Objective

The main objective of this notebook is to examine the trends in India s exports and import in terms of value and to examine the structural changes in composition of India s exports amd import.

0.3 Importing Packages and Collecting Data

[43]:
```
'''Ignore deprecation and future, and user warnings.'''
import warnings as wrn
wrn.filterwarnings('ignore', category = DeprecationWarning)
wrn.filterwarnings('ignore', category = FutureWarning)
wrn.filterwarnings('ignore', category = UserWarning)

'''Import basic modules.'''
import pandas as pd
import numpy as np
from scipy import stats
```

```
'''Customize visualization
Seaborn and matplotlib visualization.'''
from plotnine import *
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style("whitegrid")

'''Plotly visualization .'''
import plotly.offline as py
from plotly.offline import iplot, init_notebook_mode
import plotly.graph_objs as go
init_notebook_mode(connected = True) # Required to use plotly offline in␣
 ↪jupyter notebook

'''Display markdown formatted output like bold, italic bold etc.'''
from IPython.display import Markdown
def bold(string):
    display(Markdown(string))
```

[44]:
```
'''Read in export and import data from CSV file'''
df_export = pd.read_csv('/kaggle/input/india-trade-data/2010_2021_HS2_export.
 ↪csv')
df_import = pd.read_csv('/kaggle/input/india-trade-data/2010_2021_HS2_import.
 ↪csv')
```

[45]:
```
print(df_export.shape)
print(df_import.shape)
```

```
(184755, 5)
(101051, 5)
```

[46]:
```
'''Export and Import data at a glance.'''
bold('**Preview of Export Data:**')
display(df_export.sample(n=5))
bold('**Preview of Import Data:**')
display(df_import.sample(n=5))
```

Preview of Export Data:

	HSCode	Commodity	value	\
112309	94	FURNITURE; BEDDING, MATTRESSES, MATTRESS SUPPO…	15.56	
172684	12	OIL SEEDS AND OLEA. FRUITS; MISC. GRAINS, SEED…	3.78	
51192	99	MISCELLANEOUS GOODS.	109.70	
56764	37	PHOTOGRAPHIC OR CINEMATOGRAPHIC GOODS.	0.07	
35231	55	MAN-MADE STAPLE FIBRES.	4.55	

	country	year

```
112309         ITALY  2017
172684       DENMARK  2021
51192          JAPAN  2013
56764   SOUTH AFRICA  2013
35231      HONG KONG  2012
```

Preview of Import Data:

```
       HSCode                                          Commodity  value  \
67962      35  ALBUMINOIDAL SUBSTANCES; MODIFIED STARCHES; GL…   0.00
30688      99                                MISCELLANEOUS GOODS.   0.14
87319       7    EDIBLE VEGETABLES AND CERTAIN ROOTS AND TUBERS.   0.02
18142      59  IMPREGNATED, COATED, COVERED OR LAMINATED TEXT…   0.02
65134      49  PRINTED BOOKDS, NEWSPAPERS, PICTURES AND OTHER…   1.42

               country  year
67962         COLOMBIA  2018
30688  PANAMA REPUBLIC  2013
87319           ISRAEL  2020
18142            CHILE  2012
65134      SWITZERLAND  2017
```

In both the files we have 5 columns each are HSCode, Commodity, value, country, year.

0.3.1 What is an HS Code?

HSCode:- HS stands for Harmonized System. It was developed by the WCO (World Customs Organization) as a multipurpose international product nomenclature that describes the type of good that is shipped.

0.3.2 HS Code Structure

The HS code can be described as follows: * It is a six-digit identification code. * It has 5000 commodity groups. * Those groups have 99 chapters. * Those chapters have 21 sections. * It's arranged in a legal and logical structure. * Well-defined rules support it to realize uniform classification worldwide * HSCode List

0.3.3 What is Commodity?

In economics, a commodity is defined as a tangible good that can be bought and sold or exchanged for products of similar value. Natural resources such as oil as well as basic foods like corn are two common types of commodities. Like other classes of assets such as stocks, commodities have value and can be traded on open markets. And like other assets, commodities can fluctuate in price according to supply and demand.

- **Value**: values for export and import of commodities in million US $.
- **Export**: Exports are the goods and services produced in one country and purchased by residents of another country.

- **Import**: Imports are foreign goods and services bought by residents of a country. Residents include citizens, businesses, and the government.
- **Country**: Country Imported From/ Exported To
- **Year**: Year in which comodities where Imported/Exported which is in between 2010 to 2018.

[47]:
```
'''Variable Description'''
def description(df):
    summary = pd.DataFrame(df.dtypes,columns=['dtypes'])
    summary = summary.reset_index()
    summary['Name'] = summary['index']
    summary = summary[['Name','dtypes']]
    summary['Missing'] = df.isnull().sum().values
    summary['Uniques'] = df.nunique().values
    summary['First Value'] = df.loc[0].values
    summary['Second Value'] = df.loc[1].values
    summary['Third Value'] = df.loc[2].values
    return summary
```

[48]:
```
bold('**Variable Description of export dataset:**')
display(description(df_export))

bold('**Variable Description of import dataset:**')
display(description(df_import))
```

Variable Description of export dataset:

	Name	dtypes	Missing	Uniques	First Value	Second Value	Third Value
0	HSCode	int64	0	98	2	3	4
1	Commodity	object	0	98	MEAT AND EDIBLE MEAT OFFAL.	FISH AND CRUSTACEANS, MOLLUSCS AND OTHER AQUAT…	DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDI…
2	value	float64	19258	12944	1.4	0.08	3.89
3	country	object	0	249	AFGHANISTAN	AFGHANISTAN	AFGHANISTAN
4	year	int64	0	12	2010	2010	2010

Variable Description of import dataset:

```
        Name   dtypes  Missing  Uniques  \
0     HSCode    int64        0       98
1  Commodity   object        0       98
2      value  float64    15745    11062
3    country   object        0      243
4       year    int64        0       12

                                    First Value  \
0                                             7
1  EDIBLE VEGETABLES AND CERTAIN ROOTS AND TUBERS.
2                                          9.14
3                                     AFGHANISTAN
4                                            2010

                                     Second Value  \
0                                               8
1  EDIBLE FRUIT AND NUTS; PEEL OR CITRUS FRUIT OR…
2                                           93.82
3                                       AFGHANISTAN
4                                              2010

                    Third Value
0                             9
1  COFFEE, TEA, MATE AND SPICES.
2                          2.54
3                    AFGHANISTAN
4                           2010
```

0.4 Data preprocessing

[49]:
```
"""Let's see if export and import data contain the zero and NAN values """
bold('**Export Data with zeros:**')
display(df_export[df_export.value == 0].head(3))
bold('**Import Data with zeros:**')
display(df_import[df_import.value == 0].head(3))
bold('**Export Data with NAN:**')
display(df_export.isnull().sum())
bold('**Import Data with NAN:**')
display(df_import.isnull().sum())
```

Export Data with zeros:

```
    HSCode                                          Commodity  value  \
14      16  PREPARATIONS OF MEAT, OF FISH OR OF CRUSTACEAN…    0.0
21      23  RESIDUES AND WASTE FROM THE FOOD INDUSTRIES; P…    0.0
31      35  ALBUMINOIDAL SUBSTANCES; MODIFIED STARCHES; GL…    0.0

        country  year
```

```
14  AFGHANISTAN  2010
21  AFGHANISTAN  2010
31  AFGHANISTAN  2010
```

Import Data with zeros:

```
   HSCode                                          Commodity  value  \
5      16  PREPARATIONS OF MEAT, OF FISH OR OF CRUSTACEAN…    0.0
6      18                       COCOA AND COCOA PREPARATIONS.    0.0
9      27  MINERAL FUELS, MINERAL OILS AND PRODUCTS OF TH…    0.0

       country  year
5  AFGHANISTAN  2010
6  AFGHANISTAN  2010
9  AFGHANISTAN  2010
```

Export Data with NAN:

```
HSCode           0
Commodity        0
value        19258
country          0
year             0
dtype: int64
```

Import Data with NAN:

```
HSCode           0
Commodity        0
value        15745
country          0
year             0
dtype: int64
```

[50]:
```
df_import = df_import.dropna()
df_import['country'] = df_import['country'].replace({'U S A': 'USA'})
df_import['country'] = df_import['country'].replace({'SAUDI ARAB': 'SAUDI␣
 ↪ARABIA'})
df_import['country'] = df_import['country'].replace({'U K': 'UK'})
df_import = df_import.reset_index(drop=True)

df_export = df_export.dropna()
df_export['country'] = df_export['country'].replace({'U S A': 'USA'})
df_export['country'] = df_export['country'].replace({'SAUDI ARAB': 'SAUDI␣
 ↪ARABIA'})
df_export['country'] = df_export['country'].replace({'U K': 'UK'})
df_export = df_export.reset_index(drop=True)
```

0.5 1. Year Wise Analysis

[51]:
```
'''Coverting dataset in year wise'''
exp_year = df_export.groupby('year').agg({'value': 'sum'})
exp_year = exp_year.rename(columns={'value': 'Export'})
imp_year = df_import.groupby('year').agg({'value': 'sum'})
imp_year = imp_year.rename(columns={'value': 'Import'})

'''Calculating the growth of export and import'''
exp_year['Growth Rate(E)'] = exp_year.pct_change()
imp_year['Growth Rate(I)'] = imp_year.pct_change()

'''Calculating trade deficit'''
total_year = pd.concat([exp_year, imp_year], axis = 1)
total_year['Trade Deficit'] = exp_year.Export - imp_year.Import

bold('**Export/Import and Trade Balance of India**')
display(total_year)
bold('**Descriptive statistics**')
display(total_year.describe())
```

Export/Import and Trade Balance of India

year	Export	Growth Rate(E)	Import	Growth Rate(I)	Trade Deficit
2010	249801.18	NaN	369762.25	NaN	-119961.07
2011	305948.28	0.224767	489311.81	0.323315	-183363.53
2012	300384.32	-0.018186	490730.07	0.002898	-190345.75
2013	314388.61	0.046621	450192.99	-0.082606	-135804.38
2014	310321.02	-0.012938	448026.63	-0.004812	-137705.61
2015	262274.30	-0.154829	381000.97	-0.149602	-118726.67
2016	275835.27	0.051705	384350.29	0.008791	-108515.02
2017	303507.85	0.100323	465574.02	0.211327	-162066.17
2018	330058.64	0.087480	514071.33	0.104167	-184012.69
2019	313341.14	-0.050650	474701.75	-0.076584	-161360.61
2020	291789.46	-0.068780	394428.98	-0.169101	-102639.52
2021	421984.37	0.446195	613045.41	0.554261	-191061.04

Descriptive statistics

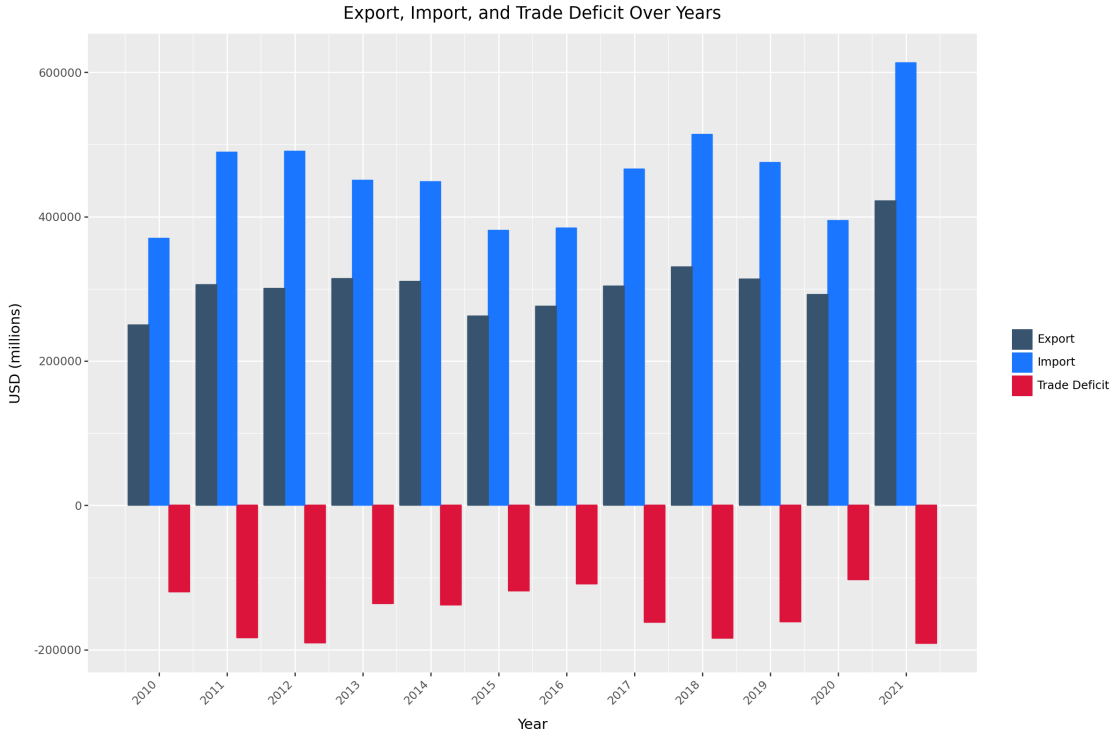
	Export	Growth Rate(E)	Import	Growth Rate(I)	\
count	12.000000	11.000000	12.000000	11.000000	
mean	306636.203333	0.059246	456266.375000	0.065641	
std	43052.939353	0.162889	69331.700692	0.219915	
min	249801.180000	-0.154829	369762.250000	-0.169101	
25%	287800.912500	-0.034418	391909.307500	-0.079595	
50%	304728.065000	0.046621	457883.505000	0.002898	
75%	313603.007500	0.093901	489666.375000	0.157747	
max	421984.370000	0.446195	613045.410000	0.554261	

```
       Trade Deficit
count      12.000000
mean   -149630.171667
std     33102.919639
min   -191061.040000
25%   -183525.820000
50%   -149533.110000
75%   -119652.470000
max   -102639.520000
```

0.5.1 Growth Rate:

Growth rates refer to the percentage change of a specific variable from its previous value. we calucate the annual growth rate. ### Trade Deficit: A trade deficit is an amount by which the cost of a country's imports exceeds the cost of its exports. It's one way of measuring international trade, and it's also called a negative balance of trade. You can calculate a trade deficit by subtracting the total value of a country's exports from the total value of its imports.

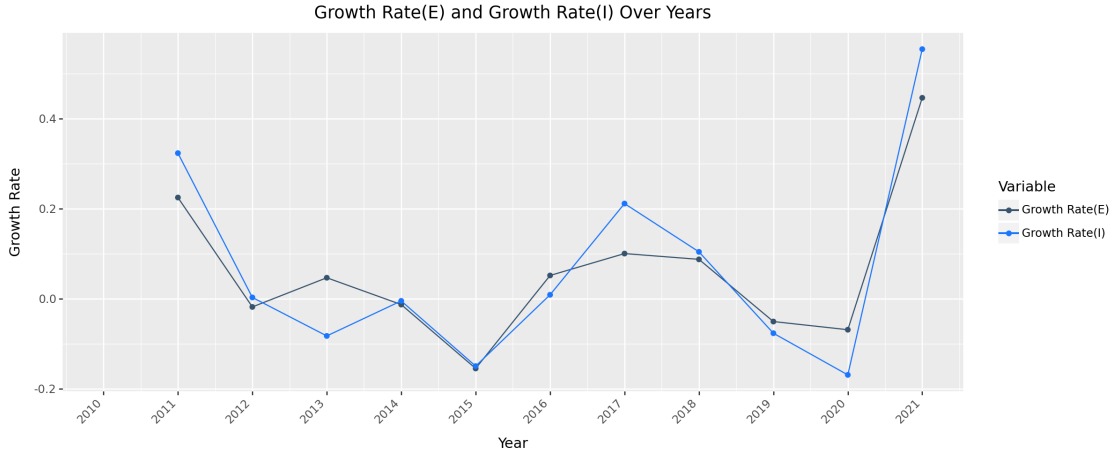
[52]:
```
total_year_filtered = total_year[['Export', 'Import', 'Trade Deficit']]

# Reshape the DataFrame for plotting
total_year_melted = total_year_filtered.reset_index().melt(id_vars=['year'],␣
 ↪var_name='Variable', value_name='Value')

custom_colors = {'Export': '#37536d', 'Import': '#1a76ff', 'Trade Deficit':␣
 ↪'crimson'}
# Create the bar plot
plot = (
    ggplot(total_year_melted, aes(x='year', y='Value', fill='Variable',␣
 ↪color='Variable')) +
    geom_bar(stat='identity', position='dodge') +
    ggtitle("Export, Import, and Trade Deficit Over Years") +
    xlab("Year") +
    ylab("USD (millions)") +
    scale_x_continuous(breaks=total_year.index.tolist()) +
    scale_color_manual(values=custom_colors) +
    scale_fill_manual(values=custom_colors) +
    theme(axis_text_x = element_text(angle=45, hjust=1),figure_size=(12,␣
 ↪8),legend_title=element_text(text=''))
)

# Print the plot
print(plot)
```



- Exports and Imports have seen a major bump in year 2021.
- The country has been experiencing trade deficits consistently for a decade indicating that the country's domestic demand for goods and services exceeds its domestic production.
- This might be due to several reasons such as domestic industries being less competitive, lack of natural resources, or consumer preference for foreign goods.

[53]:
```
growth_rates = total_year[['Growth Rate(E)', 'Growth Rate(I)']]

# Reshape the DataFrame for plotting
growth_rates_melted = growth_rates.reset_index().melt(id_vars=['year'],␣
 ↪var_name='Variable', value_name='Value')

custom_colors = {'Growth Rate(E)': '#37536d', 'Growth Rate(I)': '#1a76ff'}
# Create the scatter plot
plot = (
    ggplot(growth_rates_melted, aes(x='year', y='Value', color='Variable')) +
    geom_line() +
    geom_point() +
    ggtitle("Growth Rate(E) and Growth Rate(I) Over Years") +
    xlab("Year") +
    ylab("Growth Rate") +
    scale_x_continuous(breaks=total_year.index.tolist()) +
```

```
    scale_color_manual(values=custom_colors) +
    theme(axis_text_x=element_text(angle=45, hjust=1),figure_size=(12, 5))
)

# Print the scatter plot
print(plot)
```



- Growth rates of both imports and exports have increased for the year 2021 which were consisirently decreasing from year 2017 till 2020
- This increased export growth indicates that domestic goods and services are getting competitive on the international market.
- An increase in import growth generally indicates rising domestic demand and consumer confidence.

0.6 Commodity Wise Analysis

[54]:
```
'''Commodity export/Import count'''
print('Total number of Export commodity:', df_export['Commodity'].nunique())
print('Total number of Import commodity:', df_import['Commodity'].nunique())
```

```
Total number of Export commodity: 98
Total number of Import commodity: 98
```

[55]:
```
"""Let's count the most importing and exporting commodities"""
bold('**Most Exporting Commodities(In Numbers) from 2010 to 2021**')
display(pd.DataFrame(df_export['Commodity'].value_counts().head(20)))
bold('**Most Importing Commodities(In Numbers) from 2010 to 2021**')
display(pd.DataFrame(df_import['Commodity'].value_counts().head(20)))
```

Most Exporting Commodities(In Numbers) from 2010 to 2021

Commodity	count
NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHAN…	2537
ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS TH…	2514
PHARMACEUTICAL PRODUCTS	2513
OPTICAL, PHOTOGRAPHIC CINEMATOGRAPHIC MEASURING…	2488
PLASTIC AND ARTICLES THEREOF.	2435
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	2421
ARTICLES OF IRON OR STEEL	2401
VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING …	2400
OTHER MADE UP TEXTILE ARTICLES; SETS; WORN CLOT…	2395
PAPER AND PAPERBOARD; ARTICLES OF PAPER PULP, O…	2328
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, K…	2328
ARTICLES OF LEATHER,SADDLERY AND HARNESS;TRAVEL…	2317
RUBBER AND ARTICLES THEREOF.	2314
FURNITURE; BEDDING, MATTRESSES, MATTRESS SUPPOR…	2311
ESSENTIAL OILS AND RESINOIDS; PERFUMERY, COSMET…	2270
PRINTED BOOKDS, NEWSPAPERS, PICTURES AND OTHER …	2263
ORGANIC CHEMICALS	2238
MISCELLANEOUS MANUFACTURED ARTICLES.	2215
MISCELLANEOUS CHEMICAL PRODUCTS.	2208
ARTICLES OF STONE, PLASTER, CEMENT, ASBESTOS, M…	2206

Most Importing Commodities(In Numbers) from 2010 to 2021

Commodity	count
ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS TH…	2081
NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHAN…	1970
IRON AND STEEL	1828
ALUMINIUM AND ARTICLES THEREOF.	1716
PLASTIC AND ARTICLES THEREOF.	1712
OPTICAL, PHOTOGRAPHIC CINEMATOGRAPHIC MEASURING…	1626
COPPER AND ARTICLES THEREOF.	1498
ARTICLES OF IRON OR STEEL	1460
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	1396
RUBBER AND ARTICLES THEREOF.	1346
RAW HIDES AND SKINS (OTHER THAN FURSKINS) AND L…	1345
MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THE…	1329
NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPREC…	1321
ORGANIC CHEMICALS	1290
PAPER AND PAPERBOARD; ARTICLES OF PAPER PULP, O…	1274
MISCELLANEOUS CHEMICAL PRODUCTS.	1261
MISCELLANEOUS GOODS.	1208
INORGANIC CHEMICALS; ORGANIC OR INORGANIC COMPO…	1192
SALT; SULPHUR; EARTHS AND STONE; PLASTERING MAT…	1187
PULP OF WOOD OR OF OTHER FIBROUS CELLULOSIC MAT…	1165

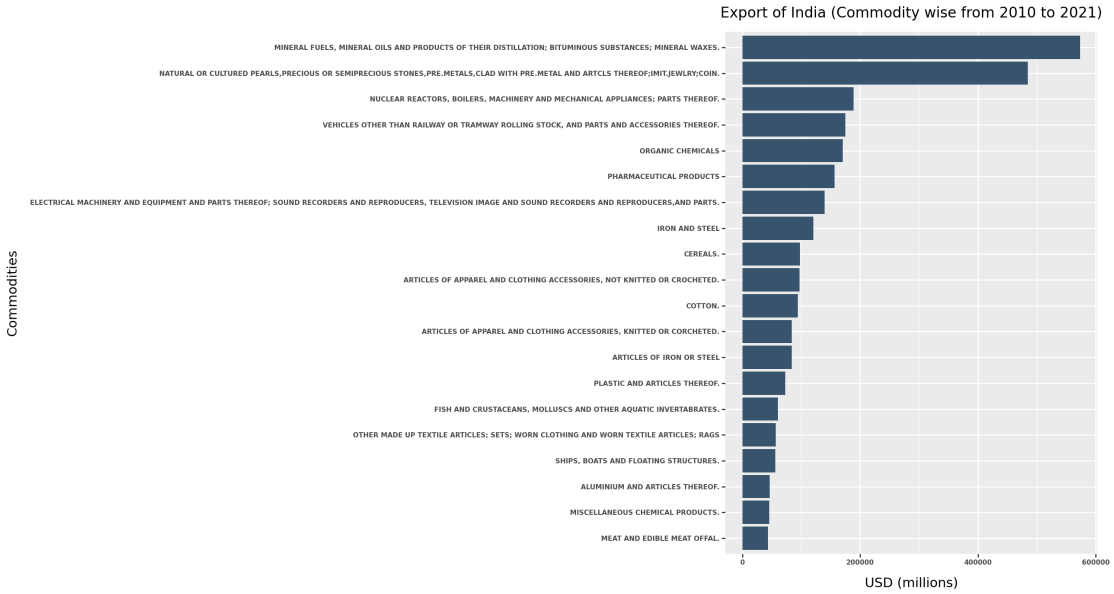
[56]:
```
'''Coverting dataset in commodity wise'''
exp_comm = df_export.groupby('Commodity').agg({'value':'sum'})
exp_comm = exp_comm.sort_values(by = 'value', ascending = False)
exp_comm = exp_comm[:20]

imp_comm = df_import.groupby('Commodity').agg({'value':'sum'})
imp_comm = imp_comm.sort_values(by = 'value', ascending = False)
imp_comm = imp_comm[:20]
```

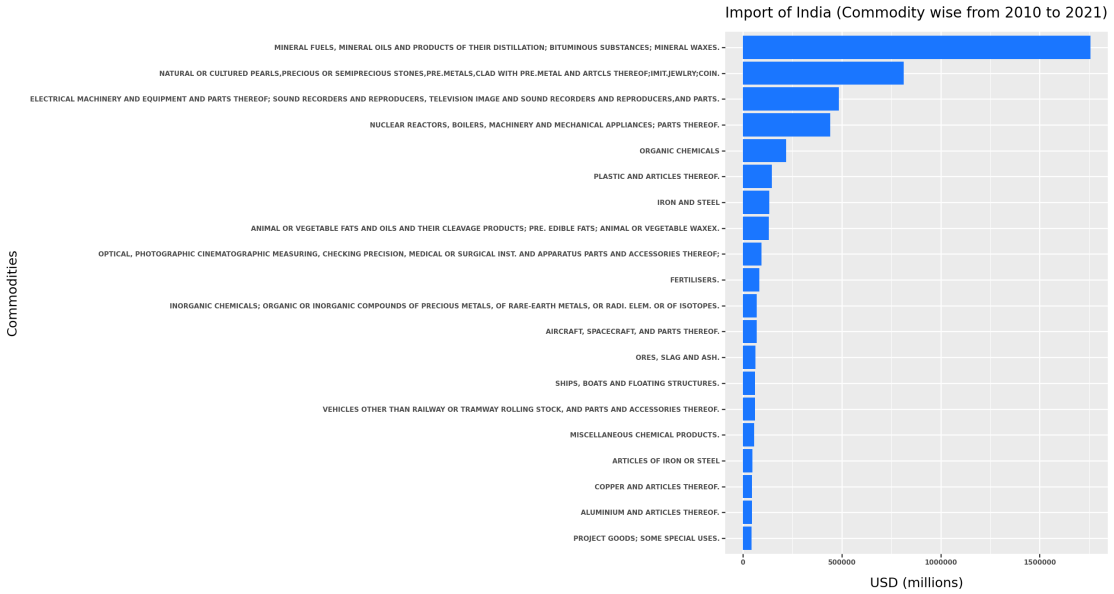
[57]:
```
print(exp_comm)
print(imp_comm)
```

```
                                                      value
Commodity
MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THE…  573781.24
NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPREC…  484859.90
NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHAN…  189003.07
VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING …  174616.34
ORGANIC CHEMICALS                                   170491.42
PHARMACEUTICAL PRODUCTS                             156859.86
ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS TH…  139396.39
IRON AND STEEL                                      120904.29
CEREALS.                                             97642.07
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…   96902.61
COTTON.                                              94126.62
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, K…   84336.04
ARTICLES OF IRON OR STEEL                            84097.54
PLASTIC AND ARTICLES THEREOF.                        72896.40
FISH AND CRUSTACEANS, MOLLUSCS AND OTHER AQUATI…   60394.39
OTHER MADE UP TEXTILE ARTICLES; SETS; WORN CLOT…   56746.00
SHIPS, BOATS AND FLOATING STRUCTURES.                55810.69
ALUMINIUM AND ARTICLES THEREOF.                      46875.96
MISCELLANEOUS CHEMICAL PRODUCTS.                     45783.89
MEAT AND EDIBLE MEAT OFFAL.                          43611.13
                                                      value
Commodity
MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THE…  1756299.54
NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPREC…   813961.33
ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS TH…   485408.24
NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHAN…   441796.29
ORGANIC CHEMICALS                                    218286.99
PLASTIC AND ARTICLES THEREOF.                        147087.63
IRON AND STEEL                                       133851.71
ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLE…   131471.56
OPTICAL, PHOTOGRAPHIC CINEMATOGRAPHIC MEASURING…    94703.59
FERTILISERS.                                          83587.98
INORGANIC CHEMICALS; ORGANIC OR INORGANIC COMPO…    71737.20
```

```
AIRCRAFT, SPACECRAFT, AND PARTS THEREOF.                70627.54
ORES, SLAG AND ASH.                                     64661.51
SHIPS, BOATS AND FLOATING STRUCTURES.                   61634.02
VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING …    61530.25
MISCELLANEOUS CHEMICAL PRODUCTS.                        58318.35
ARTICLES OF IRON OR STEEL                               49473.88
COPPER AND ARTICLES THEREOF.                            46842.21
ALUMINIUM AND ARTICLES THEREOF.                         46617.57
PROJECT GOODS; SOME SPECIAL USES.                       44231.41
```

[58]:
```
plot = (ggplot(exp_comm, aes(x='reorder(exp_comm.index, +value)', y='value')) +
        geom_bar(stat='identity', fill='#37536d') +
        theme(axis_text_x=element_text(size=5.6, weight='bold'),
              axis_text_y=element_text(size=5.6, weight='bold'),
              plot_title=element_text(size=12),
             figure_size=(13,7)) +
        labs(x='Commodities', y='USD (millions)', title='Export of India␣
 ↪(Commodity wise from 2010 to 2021)') +
        coord_flip())

print(plot)

plot = (ggplot(imp_comm, aes(x='reorder(imp_comm.index, +value)', y='value')) +
        geom_bar(stat='identity', fill='#1a76ff') +
        scale_fill_brewer(type='qual', palette='Set1') +
        theme(axis_text_x=element_text(size=5.6, weight='bold'),
              axis_text_y=element_text(size=5.6, weight='bold'),
              plot_title=element_text(size=12),
             figure_size=(13,7)) +
        labs(x='Commodities', y='USD (millions)', title='Import of India␣
 ↪(Commodity wise from 2010 to 2021)') +
        coord_flip())

print(plot)
```





[59]:
```
'''Create pivot table of export/import (commodity wise)'''
exp_comm_table = pd.pivot_table(df_export, values = 'value', index =␣
 ↪'Commodity', columns = 'year')
```

```
imp_comm_table = pd.pivot_table(df_import, values = 'value', index =␣
↪'Commodity', columns = 'year')
bold('**Commodity Composition of Exports**')
display(exp_comm_table.sample(n=5))
bold('**Commodity Composition of Imports**')
display(imp_comm_table.sample(n=5))
```

Commodity Composition of Exports

year	2010	2011
Commodity		
PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHE…	0.830870	1.250325
VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCT…	0.774536	0.535052
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	1.019357	1.363491
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	34.397371	40.405888
SUGARS AND SUGAR CONFECTIONERY.	10.444884	13.126928

year	2012	2013
Commodity		
PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHE…	1.641594	2.166667
VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCT…	0.666667	0.647473
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	1.589477	1.871695
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	37.411162	40.303285
SUGARS AND SUGAR CONFECTIONERY.	11.986781	9.279589

year	2014	2015
Commodity		
PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHE…	2.263111	2.185766
VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCT…	0.650109	0.673776
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	1.957062	2.565632
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	45.278522	45.262233
SUGARS AND SUGAR CONFECTIONERY.	7.215369	11.756667

year	2016	2017
Commodity		
PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHE…	1.663053	1.859474
VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCT…	0.664020	0.532700
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	2.368353	2.294571
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	46.517563	41.941779
SUGARS AND SUGAR CONFECTIONERY.	9.924013	6.529744

year	2018	2019
Commodity		
PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHE…	2.397164	2.460368
VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCT…	0.471043	0.438796
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	2.758652	2.499266
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	40.267681	38.996293
SUGARS AND SUGAR CONFECTIONERY.	9.697202	13.284848

year	2020	2021
Commodity		
PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHE…	3.170949	4.975833
VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCT…	0.427864	0.473363
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL.	2.704800	4.322384
ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, N…	30.158680	38.836881
SUGARS AND SUGAR CONFECTIONERY.	19.442037	30.658313

Commodity Composition of Imports

year	2010	2011
Commodity		
OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND …	4.496744	6.580000
DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIB…	4.215682	7.002778
TIN AND ARTICLES THEREOF.	5.697500	5.777188
ZINC AND ARTICLES THEREOF.	2.667419	3.225506
HEADGEAR AND PARTS THEREOF.	0.202941	0.175660

year	2012	2013
Commodity		
OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND …	6.653571	7.347568
DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIB…	0.906757	1.204194
TIN AND ARTICLES THEREOF.	6.540385	9.486538
ZINC AND ARTICLES THEREOF.	3.597444	2.955510
HEADGEAR AND PARTS THEREOF.	0.209259	0.271373

year	2014	2015
Commodity		
OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND …	7.831026	9.071707
DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIB…	1.390000	1.400541
TIN AND ARTICLES THEREOF.	8.895652	8.095000
ZINC AND ARTICLES THEREOF.	5.718776	5.116444
HEADGEAR AND PARTS THEREOF.	0.272400	0.302157

year	2016	2017
Commodity		
OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND …	7.738409	7.404468
DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIB…	0.983514	1.043556
TIN AND ARTICLES THEREOF.	6.716923	9.417308
ZINC AND ARTICLES THEREOF.	7.544409	8.356465
HEADGEAR AND PARTS THEREOF.	0.311852	0.396140

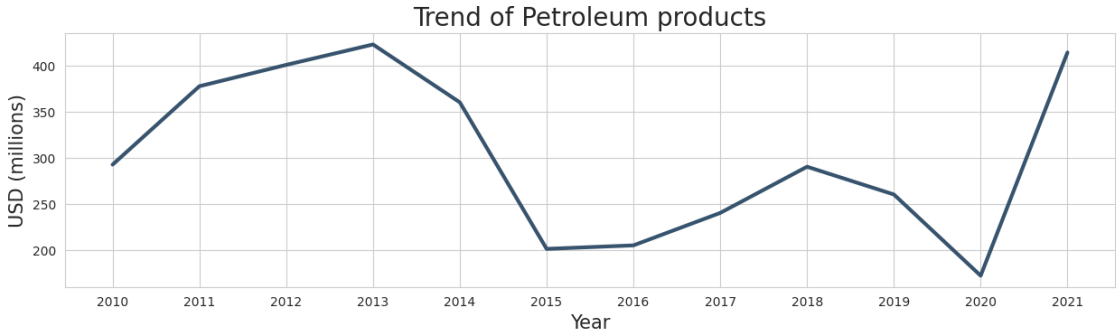
year	2018	2019
Commodity		
OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND …	6.633542	8.444000
DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIB…	0.821000	0.872093
TIN AND ARTICLES THEREOF.	8.397407	7.984815
ZINC AND ARTICLES THEREOF.	8.351340	7.173736

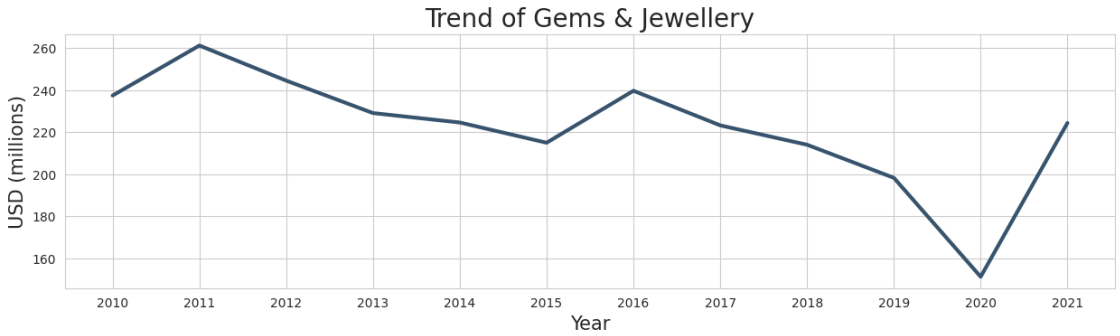
```
HEADGEAR AND PARTS THEREOF.                                0.488772  0.560000

year                                                           2020       2021
Commodity
OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND …  5.835581   8.941702
DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIB…  0.856923   0.734878
TIN AND ARTICLES THEREOF.                           7.187500  13.262414
ZINC AND ARTICLES THEREOF.                          4.995699   7.315054
HEADGEAR AND PARTS THEREOF.                         0.557308   0.548814
```

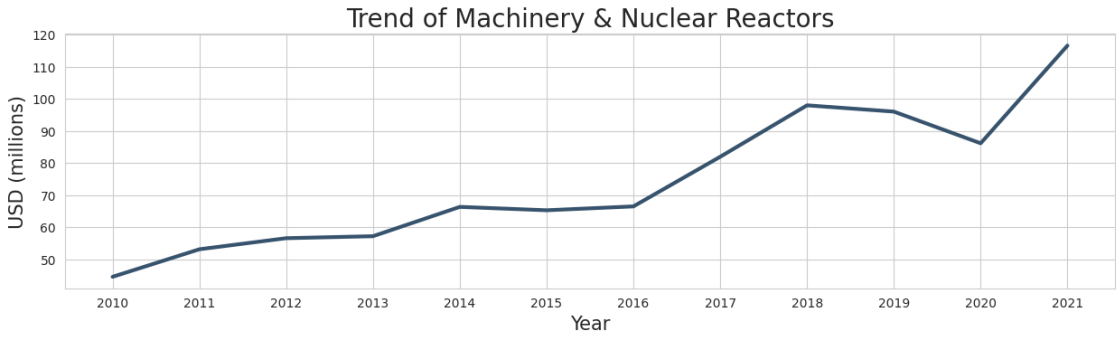
[60]:
```
bold('**Trend of the Most Exporting Goods(In Values) From 2010 to 2021**')
plt.figure(figsize=(15,19))
categorical_years = [2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018,␣
 ↪2019, 2020, 2021]

plt.subplot(411)
g = exp_comm_table.loc["MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR␣
 ↪DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES."].plot(color='#37536d',␣
 ↪linewidth=3)
g.set_ylabel('USD (millions)', fontsize = 15)
g.set_xlabel('Year', fontsize = 15)
g.set_xticks(categorical_years)
g.set_title('Trend of Petroleum products', size = 20)

plt.subplot(412)
g1 = exp_comm_table.loc["NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPRECIOUS␣
 ↪STONES,PRE.METALS,CLAD WITH PRE.METAL AND ARTCLS THEREOF;IMIT.JEWLRY;COIN."].
 ↪plot(color='#37536d', linewidth=3)
g1.set_ylabel('USD (millions)', fontsize = 15)
g1.set_xlabel('Year', fontsize = 15)
g1.set_xticks(categorical_years)
g1.set_title('Trend of Gems & Jewellery', size = 20)

plt.subplot(414)
g2 = exp_comm_table.loc["VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING STOCK,␣
 ↪AND PARTS AND ACCESSORIES THEREOF."].plot(color='#37536d', linewidth=3)
g2.set_ylabel('USD (millions)', fontsize = 15)
g2.set_xlabel('Year', fontsize = 15)
g2.set_xticks(categorical_years)
g2.set_title('Trend of Transport Equipment', size = 20)


plt.subplot(413)
g3 = exp_comm_table.loc["NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL␣
 ↪APPLIANCES; PARTS THEREOF."].plot(color='#37536d', linewidth=3)
g3.set_ylabel('USD (millions)', fontsize = 15)
g3.set_xlabel('Year', fontsize = 15)
```

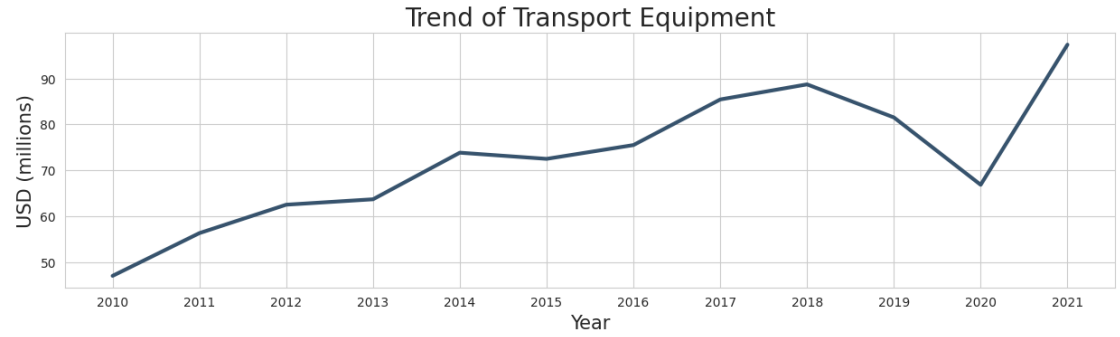
```
g3.set_xticks(categorical_years)
g3.set_title('Trend of Machinery & Nuclear Reactors', size = 20)

plt.subplots_adjust(hspace = 0.4)
plt.show()
```

Trend of the Most Exporting Goods(In Values) From 2010 to 2021







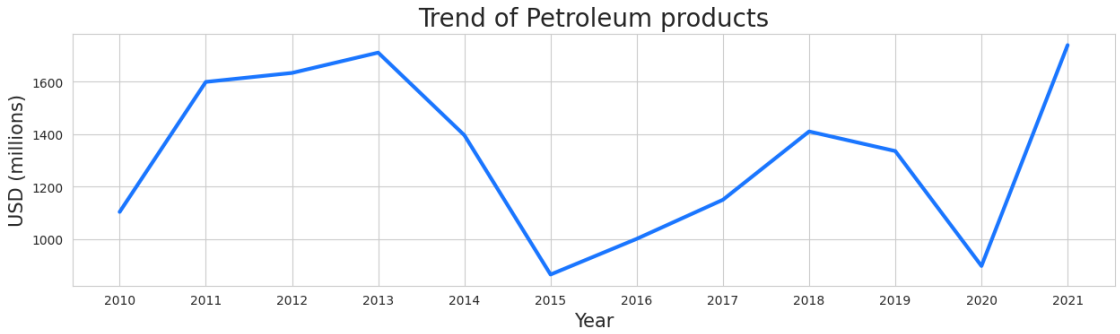


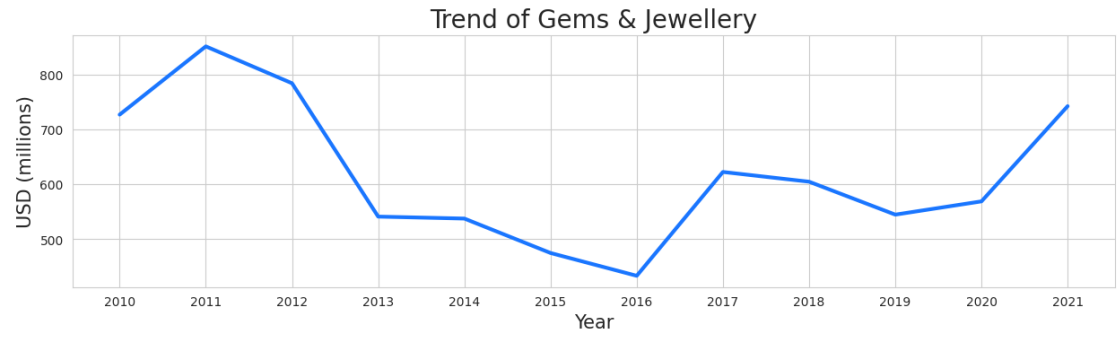
- The Petroleum products have shown a dip from 2013 till 2015 then an increase till 2018 before dipping again till 2020 and then followed by a sharp rise in the year 2021.
- The exports of Gems & Jewellery have shown a consistent major decline till 2020 before increasing in 2021.
- The exports of Transport Equipment and Machinery & Nuclear Reactors tend to show increase in trade.
- All of the four major export commodities have seen a major increase in the year 2021 as compared to the time before it.

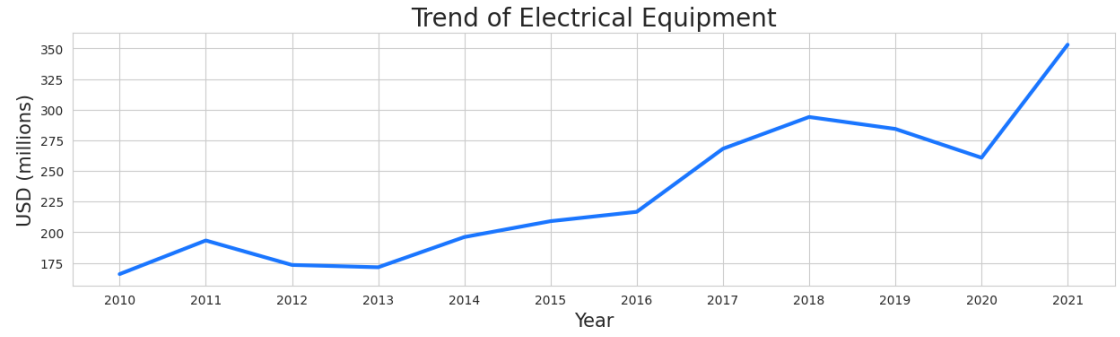
[61]:
```
bold('**Trend of the Most Importing Goods(In Values) From 2010 to 2021**')
plt.figure(figsize=(15,19))

plt.subplot(411)
g = imp_comm_table.loc["MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR␣
 ↪DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES."].plot(color='#1a76ff',␣
 ↪linewidth=3)
g.set_ylabel('USD (millions)', fontsize = 15)
g.set_xlabel('Year', fontsize = 15)
g.set_xticks(categorical_years)
g.set_title('Trend of Petroleum products', size = 20)

plt.subplot(412)
g1 = imp_comm_table.loc["NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPRECIOUS␣
 ↪STONES,PRE.METALS,CLAD WITH PRE.METAL AND ARTCLS THEREOF;IMIT.JEWLRY;COIN."].
 ↪plot(color='#1a76ff', linewidth=3)
g1.set_ylabel('USD (millions)', fontsize = 15)
g1.set_xlabel('Year', fontsize = 15)
g1.set_xticks(categorical_years)
g1.set_title('Trend of Gems & Jewellery', size = 20)

plt.subplot(413)
g2 = imp_comm_table.loc["ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF;␣
 ↪SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND␣
 ↪REPRODUCERS,AND PARTS."].plot(color='#1a76ff', linewidth=3)
g2.set_ylabel('USD (millions)', fontsize = 15)
g2.set_xlabel('Year', fontsize = 15)
g2.set_xticks(categorical_years)
g2.set_title('Trend of Electrical Equipment', size = 20)


plt.subplot(414)
g3 = imp_comm_table.loc["NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL␣
 ↪APPLIANCES; PARTS THEREOF."].plot(color='#1a76ff', linewidth=3)
g3.set_ylabel('USD (millions)', fontsize = 15)
g3.set_xlabel('Year', fontsize = 15)
```

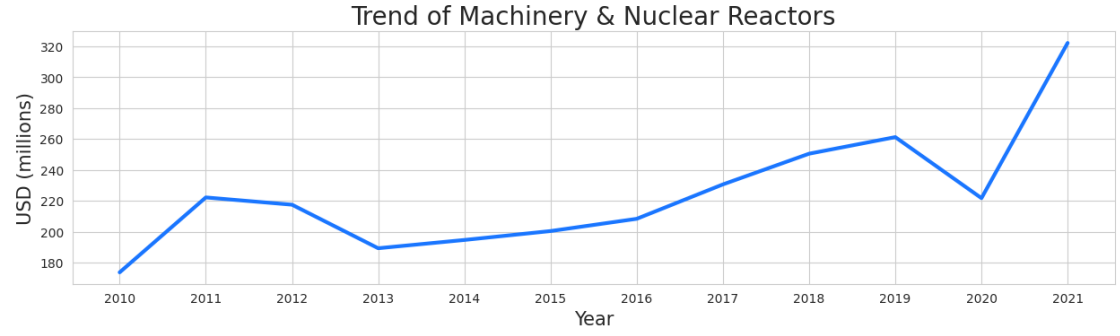
```
g3.set_xticks(categorical_years)
g3.set_title('Trend of Machinery & Nuclear Reactors', size = 20)

plt.subplots_adjust(hspace = 0.4)
plt.show()
```

Trend of the Most Importing Goods(In Values) From 2010 to 2021









- The imports of petroleums products have shown significant decline from 2013 to 2015 just like the exports indicating volatality of oil prices during that period.
- The imports of Gems and Jewellaries have shown a decreasing trend till 2020.
- From 2010 to 2015, imports of Electrical Equipment and Machinery & Nuclear Reactors were low but after 2015 it started to increase.
- All four commodities have shown sharp increase of imports in 2021.

- Petroleum products, Gewelry, Machinery, Electrical Equipments have shown higher exports and imports indicating that they might be relying on complex global supply chains. Different components or stages of production may occur in different countries, leading to both imports and exports of the final product or its components.
- It might also be the case that the competitiveness of those products is very high.
- Both the insights highlights the interdependence of economies in the globalized world.

0.7 Country Wise Analysis

[62]:
```
'''Country export/Import count'''
print('Total number of country Export to:', df_export['country'].nunique())
print('Total number of country Import from:', df_import['country'].nunique())
```

```
Total number of country Export to: 249
Total number of country Import from: 242
```

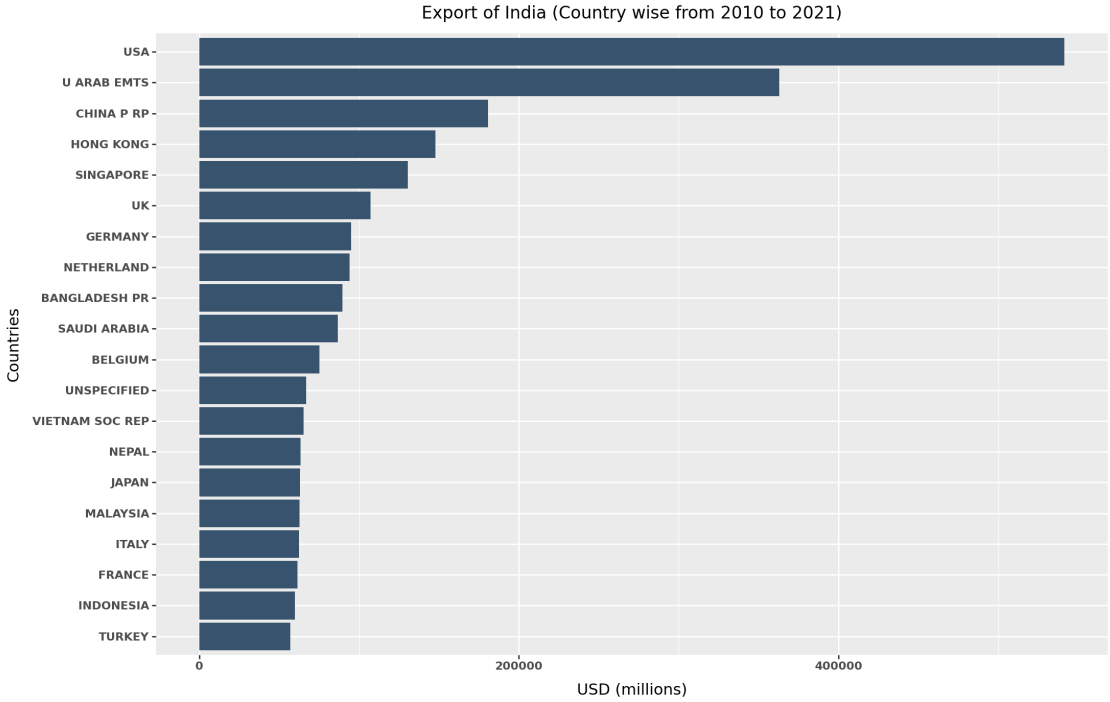
[63]:
```
'''Coverting dataset in Country wise'''
exp_country = df_export.groupby('country').agg({'value':'sum'})
exp_country = exp_country.rename(columns={'value': 'Export'})
exp_country = exp_country.sort_values(by = 'Export', ascending = False)
exp_country = exp_country[:20]

imp_country = df_import.groupby('country').agg({'value':'sum'})
imp_country = imp_country.rename(columns={'value': 'Import'})
imp_country = imp_country.sort_values(by = 'Import', ascending = False)
imp_country = imp_country[:20]
```

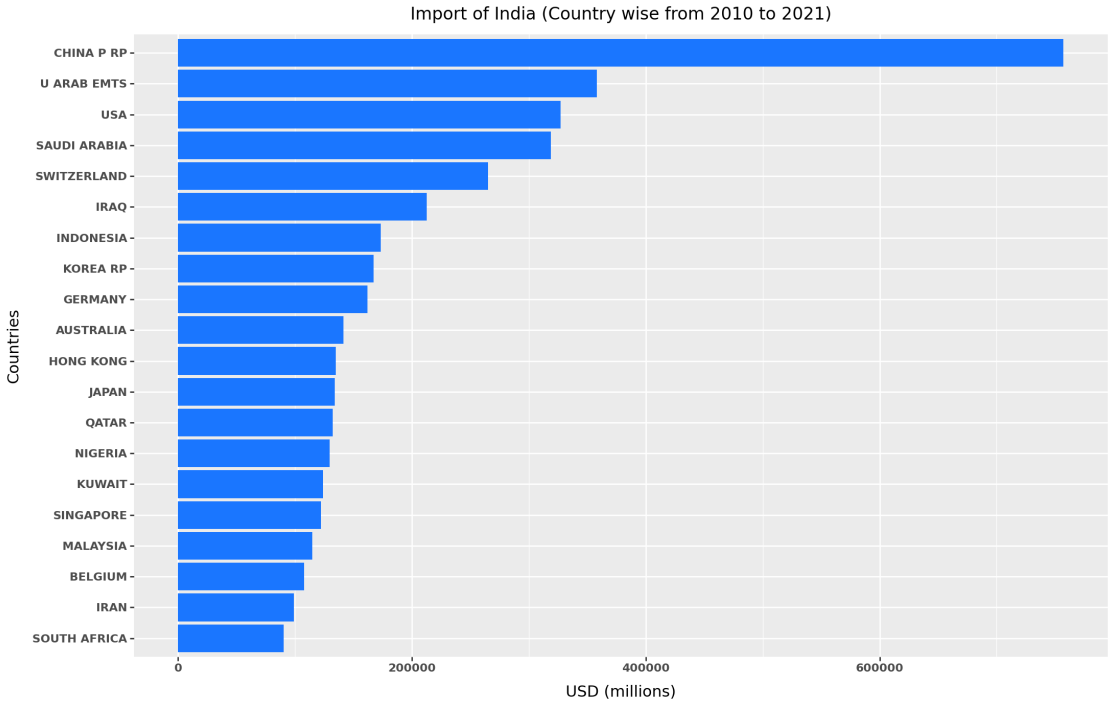
[64]:
```
print(exp_country)
```

```
                Export
country
USA           541487.45
U ARAB EMTS   362951.83
CHINA P RP    180865.06
HONG KONG     147807.24
SINGAPORE     130427.76
UK            107298.44
GERMANY        95153.81
NETHERLAND     93963.12
```

```
BANGLADESH PR     89520.36
SAUDI ARABIA      86847.66
BELGIUM           75098.44
UNSPECIFIED       66839.80
VIETNAM SOC REP   65171.06
NEPAL             63505.18
JAPAN             62953.11
MALAYSIA          62794.30
ITALY             62480.10
FRANCE            61353.39
INDONESIA         59775.33
TURKEY            56998.92
```

[65]:
```
plot = (ggplot(exp_country, aes(x='reorder(exp_country.index, +Export)',␣
 ↪y='Export')) +
       geom_bar(stat='identity', fill='#37536d') +
       theme(axis_text_x=element_text(size=8, weight='bold'),
             axis_text_y=element_text(size=8, weight='bold'),
             plot_title=element_text(size=12),
            figure_size=(11,7)) +
       labs(x='Countries', y='USD (millions)', title='Export of India (Country␣
 ↪wise from 2010 to 2021)') +
       coord_flip())

print(plot)

plot = (ggplot(imp_country, aes(x='reorder(imp_country.index, +Import)',␣
 ↪y='Import')) +
       geom_bar(stat='identity', fill='#1a76ff') +
       scale_fill_brewer(type='qual', palette='Set1') +
       theme(axis_text_x=element_text(size=8, weight='bold'),
             axis_text_y=element_text(size=8, weight='bold'),
             plot_title=element_text(size=12),
            figure_size=(11,7)) +
       labs(x='Countries', y='USD (millions)', title='Import of India (Country␣
 ↪wise from 2010 to 2021)') +
       coord_flip())

print(plot)
```


Export of India (Country wise from 2010 to 2021)
USA
U ARAB EMTS
CHINA P RP
HONG KONG
SINGAPORE
UK
GERMANY
NETHERLAND
BANGLADESH PR
SAUDI ARABIA
BELGIUM
UNSPECIFIED
VIETNAM SOC REP
NEPAL
JAPAN
MALAYSIA
ITALY
FRANCE
INDONESIA
TURKEY
Countries
0
200000
400000
USD (millions)


Import of India (Country wise from 2010 to 2021)
CHINA P RP
U ARAB EMTS
USA
SAUDI ARABIA
SWITZERLAND
IRAQ
INDONESIA
KOREA RP
GERMANY
AUSTRALIA
HONG KONG
JAPAN
QATAR
NIGERIA
KUWAIT
SINGAPORE
MALAYSIA
BELGIUM
IRAN
SOUTH AFRICA
Countries
0
200000
400000
600000
USD (millions)

- China has the biggest market in India followed by UAE, USA and Saudi Arabia
- For India, USA is thge biggest importer followed by UAE and China.

[66]:
```
'''Create pivot table of export/import (country wise)'''
exp_country_table = pd.pivot_table(df_export, values = 'value', index =␣
 ↪'country', columns = 'year')
imp_country_table = pd.pivot_table(df_import, values = 'value', index =␣
 ↪'country', columns = 'year')
bold('**Direction of Foreign Trade Export in India**')
display(exp_country_table.sample(n=5))
bold('**Direction of Foreign Trade Import in India**')
display(imp_country_table.sample(n=5))
```

Direction of Foreign Trade Export in India

year	2010	2011	2012	2013	2014	2015
country						
MALTA	11.853333	13.917377	6.527049	2.708065	5.038923	4.924545
CHILE	6.342875	6.365976	8.733165	8.095244	6.734762	7.897674
N. MARIANA IS.	0.013000	0.006667	0.000000	0.020000	0.018000	0.070000
GUINEA	1.376857	1.939412	2.901127	2.991029	3.782800	4.033333
CHAD	0.363030	0.948293	0.702424	0.824500	0.967619	1.010698

year	2016	2017	2018	2019	2020	2021
country						
MALTA	2.213226	3.210492	3.700968	3.153636	4.731343	7.122537
CHILE	7.839884	8.877209	11.119438	9.332941	9.469294	13.583908
N. MARIANA IS.	0.002500	0.006000	0.032500	0.023333	0.031111	0.038000
GUINEA	5.218971	4.844487	5.325395	4.489873	6.688933	7.485200
CHAD	0.855556	0.664390	0.813261	1.248723	1.138654	1.126383

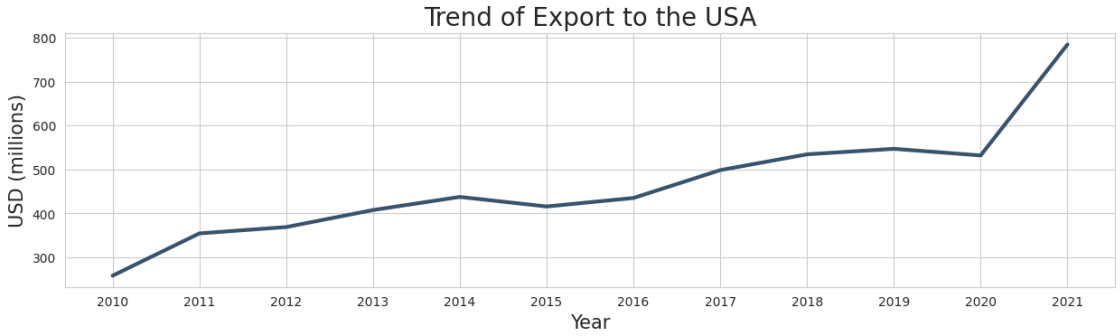
Direction of Foreign Trade Import in India

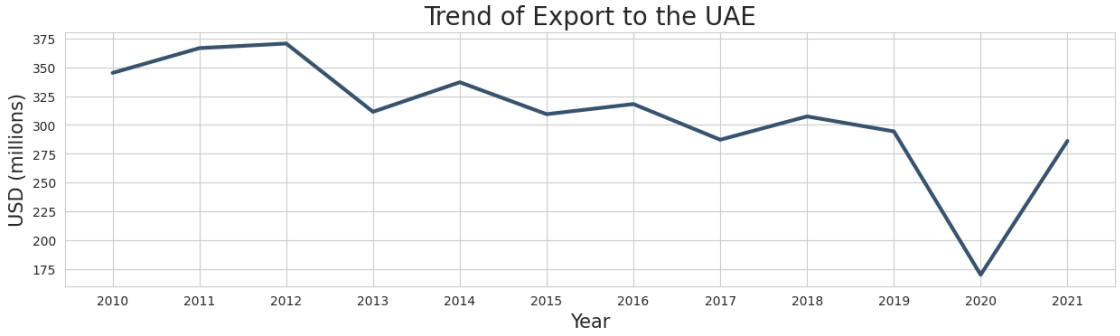
year	2010	2011	2012	2013	2014	2015
country						
LESOTHO	0.380000	0.608000	1.453333	0.833333	0.230000	1.235000
PANAMA REPUBLIC	6.730357	5.541379	6.847500	2.450000	1.904375	4.264118
ICELAND	0.184800	0.204348	0.122222	0.413125	0.275882	0.303571
LAO PD RP	0.030000	8.924000	8.155882	3.580000	8.527000	12.859286
MALI	0.144783	0.610000	3.283333	6.447273	8.732222	24.278000

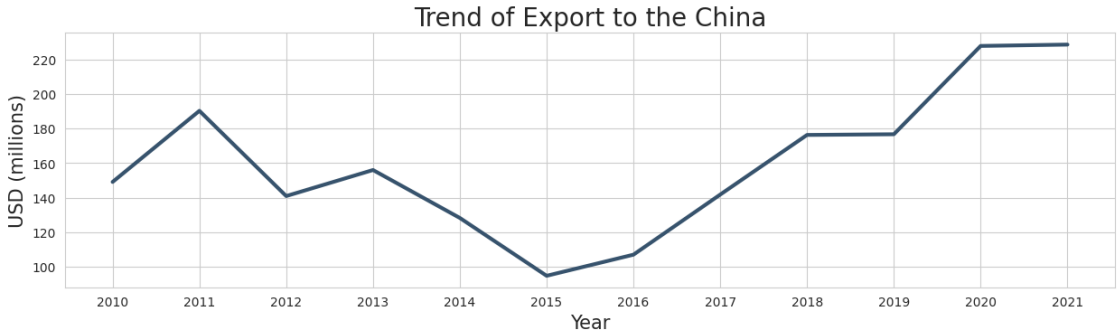
year	2016	2017	2018	2019	2020	2021
country						
LESOTHO	12.455000	29.856667	0.000000	0.040000	0.085000	NaN
PANAMA REPUBLIC	11.872941	1.883043	1.689565	2.808519	1.647500	13.923810
ICELAND	0.245263	0.435882	0.319630	0.520500	0.414667	0.357500
LAO PD RP	9.015652	9.919412	0.094545	0.257500	0.242857	0.080000
MALI	12.405000	10.378182	1.662727	3.808000	1.397000	1.757692

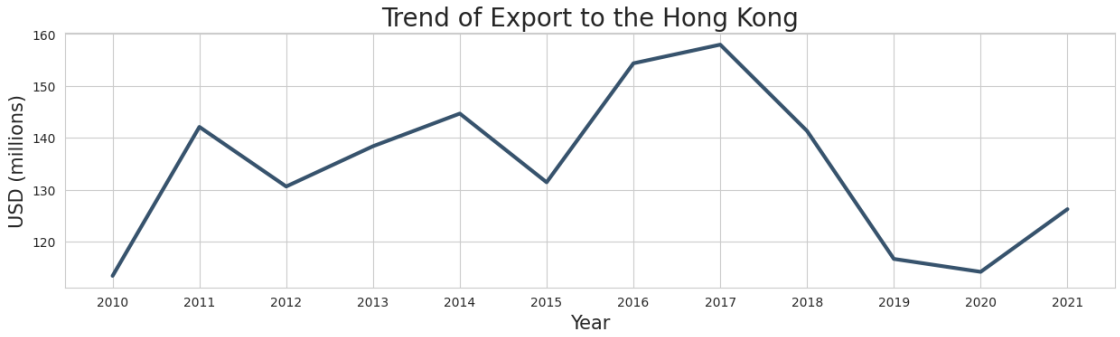
[67]:
```
bold('**Trend of the Direction of Foreign Trade Export in India From 2010 to␣
 ↪2021**')
plt.figure(figsize=(15,19))

plt.subplot(411)
g = exp_country_table.loc["USA"].plot(color='#37536d', linewidth=3)
g.set_ylabel('USD (millions)', fontsize = 15)
g.set_xlabel('Year', fontsize = 15)
g.set_xticks(categorical_years)
g.set_title('Trend of Export to the USA', size = 20)

plt.subplot(412)
g1 = exp_country_table.loc["U ARAB EMTS"].plot(color='#37536d', linewidth=3)
g1.set_ylabel('USD (millions)', fontsize = 15)
g1.set_xlabel('Year', fontsize = 15)
g1.set_xticks(categorical_years)
g1.set_title('Trend of Export to the UAE', size = 20)

plt.subplot(413)
g2 = exp_country_table.loc["CHINA P RP"].plot(color='#37536d', linewidth=3)
g2.set_ylabel('USD (millions)', fontsize = 15)
g2.set_xlabel('Year', fontsize = 15)
g2.set_xticks(categorical_years)
g2.set_title('Trend of Export to the China', size = 20)


plt.subplot(414)
g3 = exp_country_table.loc["HONG KONG"].plot(color='#37536d', linewidth=3)
g3.set_ylabel('USD (millions)', fontsize = 15)
g3.set_xlabel('Year', fontsize = 15)
g3.set_xticks(categorical_years)
g3.set_title('Trend of Export to the Hong Kong', size = 20)

plt.subplots_adjust(hspace = 0.4)
plt.show()
```

Trend of the Direction of Foreign Trade Export in India From 2010 to 2021







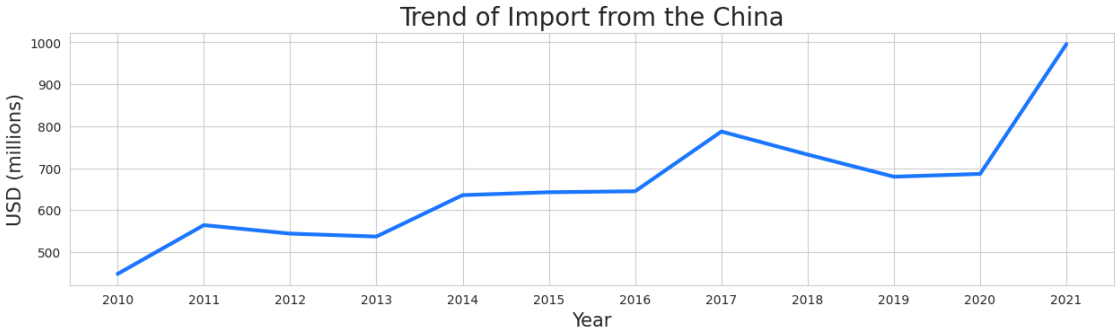


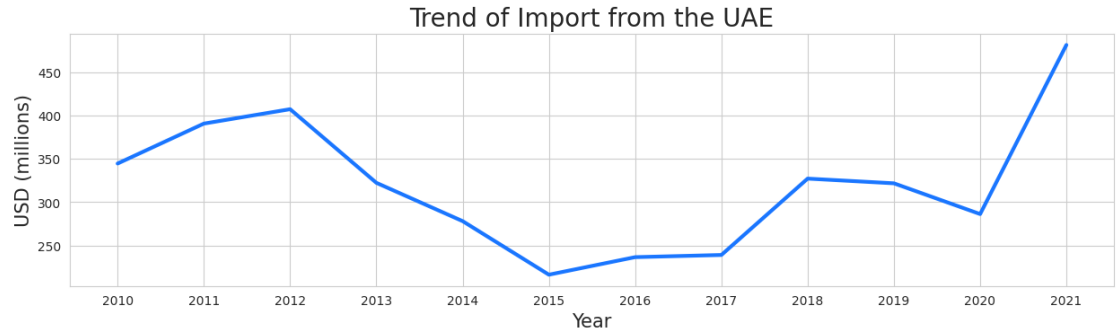
- Every year India has increased its export to USA and therefore USA is growing as one of the major trading partners of India.
- Exports to UAE show decreasing trend from 2012 to 2020, with rise in 2021
- Exports to China have also shown a decreasing trend from 2011 to 2015, afterwards it started to increase.

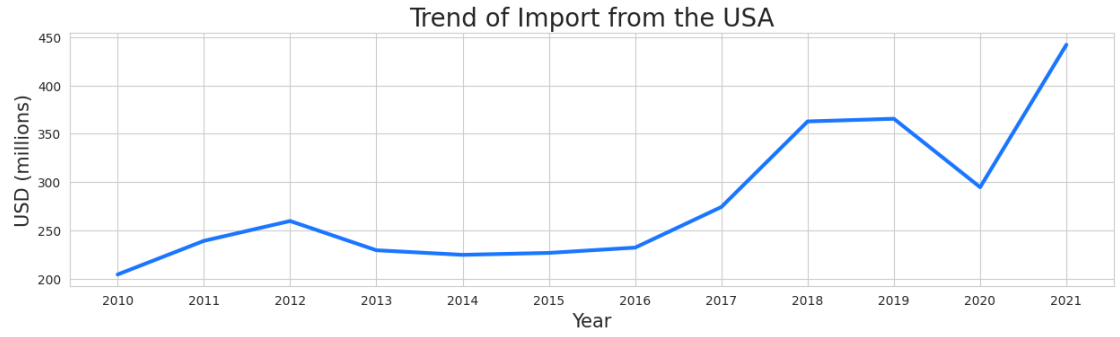
- Exports to Hong Kong have shown a decrease fronm the year 2017 till 2020.

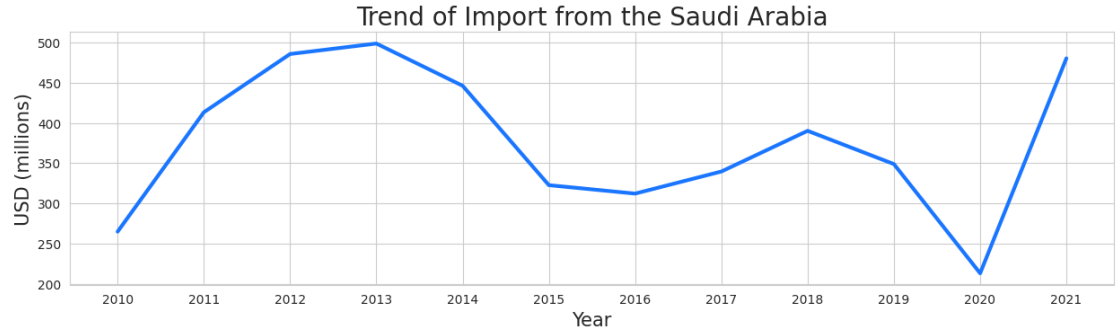
[68]:
```
bold('**Trend of the Direction of Foreign Trade Export in India From 2010 to␣
 ↪2021**')
plt.figure(figsize=(15,19))

plt.subplot(411)
g = imp_country_table.loc["CHINA P RP"].plot(color='#1a76ff', linewidth=3)
g.set_ylabel('USD (millions)', fontsize = 15)
g.set_xlabel('Year', fontsize = 15)
g.set_xticks(categorical_years)
g.set_title('Trend of Import from the China', size = 20)

plt.subplot(412)
g1 = imp_country_table.loc["U ARAB EMTS"].plot(color='#1a76ff', linewidth=3)
g1.set_ylabel('USD (millions)', fontsize = 15)
g1.set_xlabel('Year', fontsize = 15)
g1.set_xticks(categorical_years)
g1.set_title('Trend of Import from the UAE', size = 20)

plt.subplot(413)
g2 = imp_country_table.loc["USA"].plot(color='#1a76ff', linewidth=3)
g2.set_ylabel('USD (millions)', fontsize = 15)
g2.set_xlabel('Year', fontsize = 15)
g2.set_xticks(categorical_years)
g2.set_title('Trend of Import from the USA', size = 20)


plt.subplot(414)
g3 = imp_country_table.loc["SAUDI ARABIA"].plot(color='#1a76ff', linewidth=3)
g3.set_ylabel('USD (millions)', fontsize = 15)
g3.set_xlabel('Year', fontsize = 15)
g3.set_xticks(categorical_years)
g3.set_title('Trend of Import from the Saudi Arabia', size = 20)

plt.subplots_adjust(hspace = 0.4)
plt.show()
```

Trend of the Direction of Foreign Trade Export in India From 2010 to 2021









- From 2010 to 2016, imports from USA were low, after 2016 it started to increase .
- Imports from UAE and Suadi Arab show a similar trend. Imports fall during 2012 to 2015, after 2015 it started to increase.
- Imports from China has been continuously rising.

0.8 HS Code Wise Analysis

For HScode Wise Analysis, we are creating dataframe according to Hs Codes list and Section

List Of Indian HS Classification is based on HS Code used in actual Shipment Data: http://www.cybex.in/HS-Codes/Default.aspx

[69]:
```
''' creating a new dataframe on Sections of HSCode'''
HSCode = pd.DataFrame()
HSCode['Start']=[1,6,15,16,25,28,39,41,44,47,50,64,68,71,72,84,86,90,93,94,97]
HSCode['End']=[5,14,15,24,27,38,40,43,46,49,63,67,70,71,83,85,89,92,93,96,99]
HSCode['Sections Name']=['Animals & Animal Products',
'Vegetable Products',
'Animal Or Vegetable Fats',
'Prepared Foodstuffs',
'Mineral Products',
'Chemical Products',
'Plastics & Rubber',
'Hides & Skins',
'Wood & Wood Products',
'Wood Pulp Products',
'Textiles & Textile Articles',
'Footwear, Headgear',
'Articles Of Stone, Plaster, Cement, Asbestos',
'Pearls, Precious Or Semi-Precious Stones, Metals',
'Base Metals & Articles Thereof',
'Machinery & Mechanical Appliances',
'Transportation Equipment',
'Instruments - Measuring, Musical',
'Arms & Ammunition',
'Miscellaneous',
'Works Of Art',]
HSCode.index += 1
HSCode.index.name = 'Section'
```

[70]:
```
bold('**List Of indian HS Classification is based on the HS Code:**')
display(HSCode)
```

List Of indian HS Classification is based on the HS Code:

Section	Start	End	Sections Name
1	1	5	Animals & Animal Products
2	6	14	Vegetable Products
3	15	15	Animal Or Vegetable Fats
4	16	24	Prepared Foodstuffs
5	25	27	Mineral Products
6	28	38	Chemical Products
7	39	40	Plastics & Rubber

```
8           41   43                                    Hides & Skins
9           44   46                               Wood & Wood Products
10          47   49                                 Wood Pulp Products
11          50   63                       Textiles & Textile Articles
12          64   67                                 Footwear, Headgear
13          68   70     Articles Of Stone, Plaster, Cement, Asbestos
14          71   71  Pearls, Precious Or Semi-Precious Stones, Metals
15          72   83                    Base Metals & Articles Thereof
16          84   85                 Machinery & Mechanical Appliances
17          86   89                          Transportation Equipment
18          90   92                  Instruments - Measuring, Musical
19          93   93                                 Arms & Ammunition
20          94   96                                     Miscellaneous
21          97   99                                      Works Of Art
```

[71]:
```
df_export['Sections Name'] = df_export['HSCode']
df_import['Sections Name'] = df_import['HSCode']
for i in range(1,22):
    df_export.loc[(df_export['Sections Name'] >= HSCode['Start'][i]) &␣
 ↪(df_export['Sections Name'] <= HSCode['End'][i]),'Sections Name']=i
    df_import.loc[(df_import['Sections Name'] >= HSCode['Start'][i]) &␣
 ↪(df_import['Sections Name'] <= HSCode['End'][i]),'Sections Name']=i
```

[72]:
```
exp_hscode = df_export.groupby(['Sections Name']).agg({'value':'sum'})
exp_hscode['Sections_Name'] = HSCode['Sections Name']
imp_hscode = df_import.groupby(['Sections Name']).agg({'value':'sum'})
imp_hscode['Sections_Name'] = HSCode['Sections Name']
```

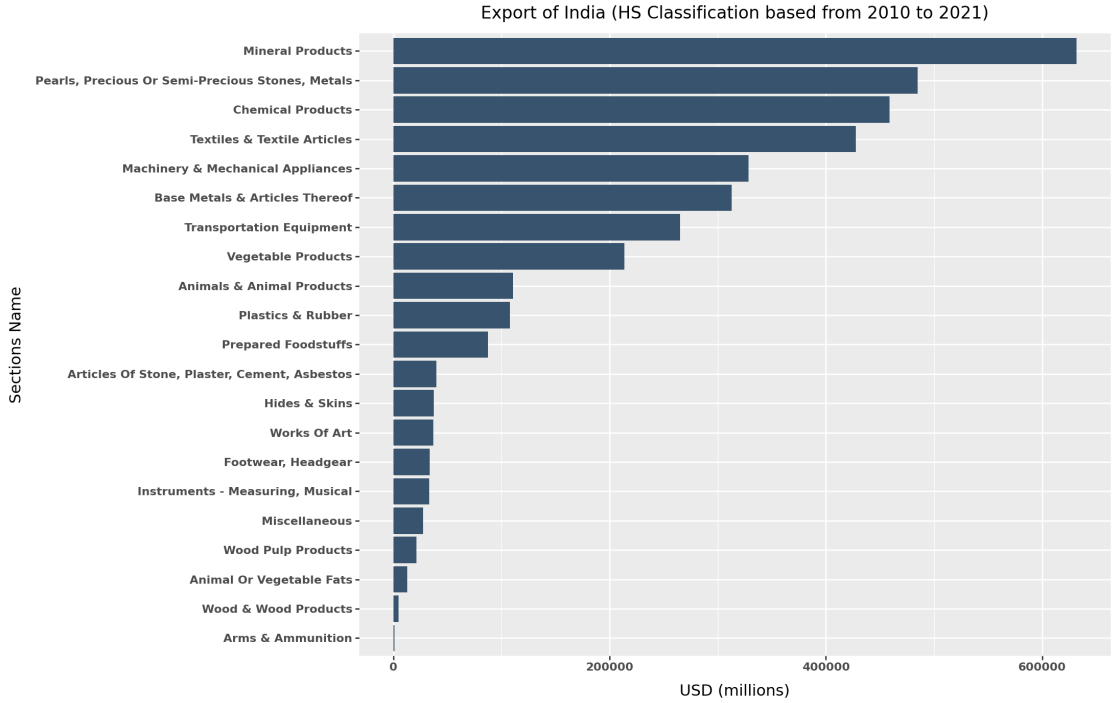
[73]:
```
print(exp_hscode)
print(imp_hscode)
```

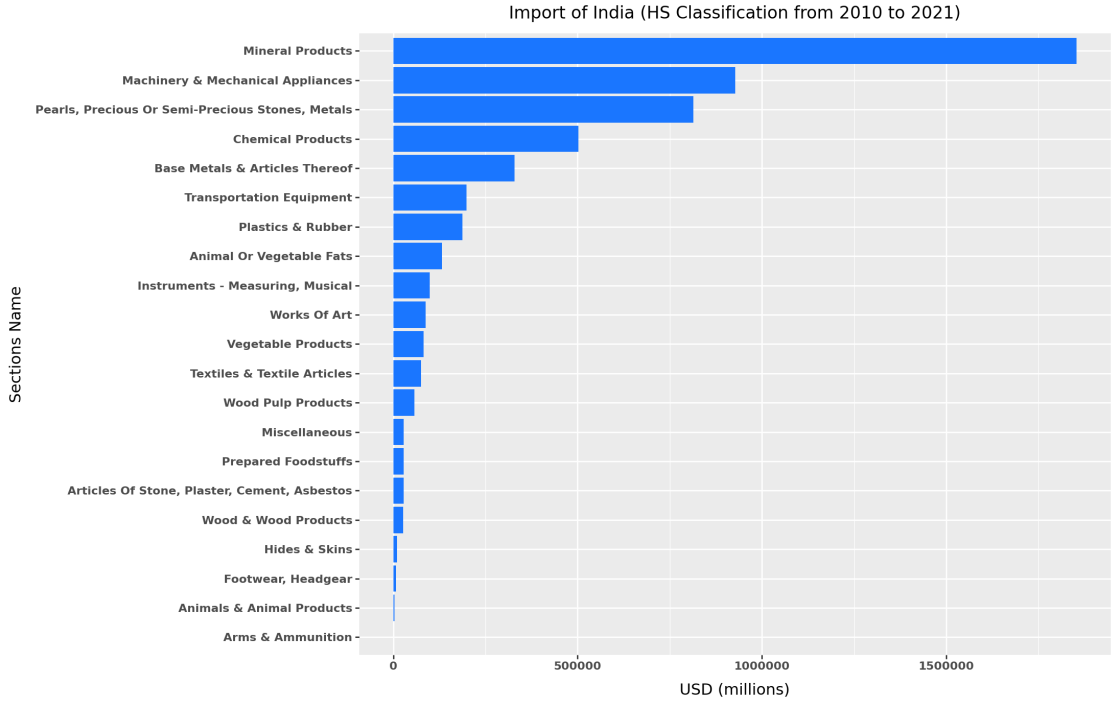
```
                  value                                Sections_Name
Sections Name
1              110692.18                 Animals & Animal Products
2              213836.65                        Vegetable Products
3               13119.69                  Animal Or Vegetable Fats
4               87690.55                       Prepared Foodstuffs
5              631776.46                          Mineral Products
6              458731.77                         Chemical Products
7              107686.51                         Plastics & Rubber
8               37685.75                             Hides & Skins
9                5054.63                      Wood & Wood Products
10              21476.48                        Wood Pulp Products
11             427602.33                 Textiles & Textile Articles
12              33843.44                           Footwear, Headgear
13              39841.17     Articles Of Stone, Plaster, Cement, Asbestos
14             484859.90  Pearls, Precious Or Semi-Precious Stones, Metals
15             313046.96              Base Metals & Articles Thereof
```

```
16              328399.46                 Machinery & Mechanical Appliances
17              265088.75                         Transportation Equipment
18               33149.95                  Instruments - Measuring, Musical
19                1244.95                                 Arms & Ammunition
20               27595.36                                     Miscellaneous
21               37211.50                                      Works Of Art
                     value                                      Sections_Name
Sections Name
1                 2586.15                       Animals & Animal Products
2                82782.85                              Vegetable Products
3               131471.56                       Animal Or Vegetable Fats
4                27772.22                            Prepared Foodstuffs
5              1853431.17                               Mineral Products
6               502470.29                              Chemical Products
7               187356.37                              Plastics & Rubber
8                10467.71                                  Hides & Skins
9                26973.87                           Wood & Wood Products
10               57442.39                              Wood Pulp Products
11               74608.71                     Textiles & Textile Articles
12                6850.53                              Footwear, Headgear
13               27755.00     Articles Of Stone, Plaster, Cement, Asbestos
14              813961.33  Pearls, Precious Or Semi-Precious Stones, Metals
15              328663.17                Base Metals & Articles Thereof
16              927204.53             Machinery & Mechanical Appliances
17              198944.78                      Transportation Equipment
18               98858.13               Instruments - Measuring, Musical
19                 571.54                              Arms & Ammunition
20               27830.19                                  Miscellaneous
21               87194.01                                   Works Of Art
```

[74]:
```
plot = (ggplot(exp_hscode, aes(x='reorder(Sections_Name, +value)', y='value')) +
        geom_bar(stat='identity', fill='#37536d') +
        theme(axis_text_x=element_text(size=8, weight='bold'),
              axis_text_y=element_text(size=8, weight='bold'),
              plot_title=element_text(size=12),
             figure_size=(11,7)) +
        labs(x='Sections Name', y='USD (millions)', title='Export of India (HS␣
 ↪Classification based from 2010 to 2021)') +
        coord_flip())

print(plot)

plot = (ggplot(imp_hscode, aes(x='reorder(Sections_Name, +value)', y='value')) +
        geom_bar(stat='identity', fill='#1a76ff') +
        scale_fill_brewer(type='qual', palette='Set1') +
        theme(axis_text_x=element_text(size=8, weight='bold'),
              axis_text_y=element_text(size=8, weight='bold'),
```

```
            plot_title=element_text(size=12),
            figure_size=(11,7)) +
       labs(x='Sections Name', y='USD (millions)', title='Import of India (HS␣
 ↪Classification from 2010 to 2021)') +
       coord_flip())

print(plot)
```





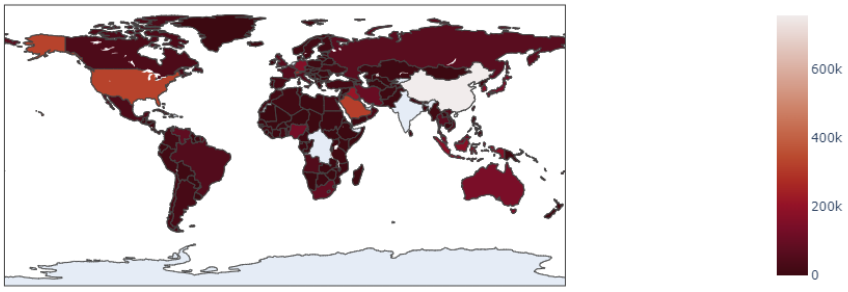
- Above two plots give more clear picture about the export/import of goods.
- Its seems that most exporting goods are Mineral Products followed by Pearls, Precious Or Semi-Precious Stones, Metals and Chemical products etc.
- The most importing goods are Mineral Products followed by Machinery & Mechanical Appliances and Pearls, Precious Or Semi-Precious Stones, Metals, etc.

[75]:
```
export_map = pd.DataFrame(df_export.groupby(['country'])['value'].sum().
 ↪reset_index())
count = pd.DataFrame(export_map.groupby('country')['value'].sum().reset_index())

trace = [go.Choropleth(
            colorscale = 'algae',
            locationmode = 'country names',
            locations = count['country'],
            text = count['country'],
            z = count['value'],
            reversescale=True)]

layout = go.Layout(title = 'India Export to Other Country')

fig = go.Figure(data = trace, layout = layout)
py.iplot(fig)
```

India Export to Other Country

[76]:
```
import_map = pd.DataFrame(df_import.groupby(['country'])['value'].sum().
 ↪reset_index())
count = pd.DataFrame(import_map.groupby('country')['value'].sum().reset_index())

trace = [go.Choropleth(
            colorscale = 'amp',
            locationmode = 'country names',
            locations = count['country'],
            text = count['country'],
            z = count['value'],
            reversescale=True)]

layout = go.Layout(title = 'India Import from Other Country')

fig = go.Figure(data = trace, layout = layout)
py.iplot(fig)
```

India Import from Other Country



[ ]: