



Statistical Analysis of India's International Export (2010-2023)

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Abstract:

International trade is very important for the economic development of India. This project studies India's International trade using statistical methods. The analysis is done from four main angles: Export-oriented analysis, country-oriented, product-oriented and tariff-oriented analysis. The study is based on secondary data (2010-2023) collected from WITS website and uses statistical tools such as Column chart, Heatmap, CAGR, CV, Heatmap, Moving Average, ARIMA Model and Fixed effect model.

The study shows that India's international trade has increased and become more diversified over the years. However, problems such as trade imbalance, tariff barriers, and global economic changes still affect trade performance. The project concluded that better trade policies, export promotion, and proper tariff planning are necessary to support India's future trade growth.

Keywords: *Country, Tariff Rate (AHS&MFN), Product, Export.*

Introduction:

International trade means buying and selling goods and services between countries. It is very important for a country's economic growth and development. India takes part in international trade by exporting goods to other countries. This project studies India's international trade using statistical methods. The study focuses on exports, major trading countries, important products which are export and tariffs. It helps to understand how India's trade has changed over time and how different factors affects on it. By analyzing trade data, this project explains the growth of India's exports, its trade relations with other countries, the role of different products, and the impact of tariffs on trade.

Literature Review:

Many studies show that international trade is important for India's economic growth.

Earlier research explains that countries export products based on their comparative advantage and competitiveness. Studies on India's exports have found that while exports have grown over time, they are still concentrated in a few major countries and products. Researchers have also used measures like HHI and diversification indices to study export concentration and stability. Recent studies suggest that tariffs affect trade, but when tariff levels are low, export performance depends more on competitiveness, productivity, and global demand rather than tariff benefits alone. However, very few studies combine export trends, product concentration, country specialization, volatility, and tariff analysis together, which this study attempts to do.

Objectives of the Study:

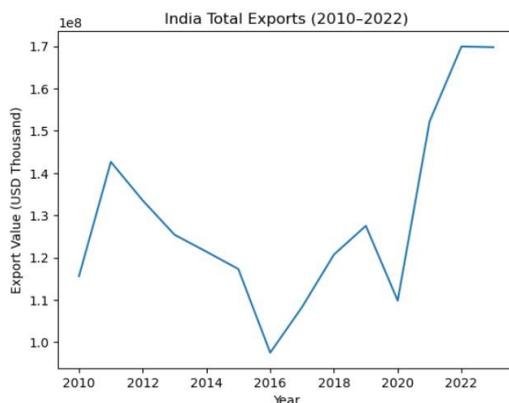
1. To analyze the overall trend of India's exports from 2010-2023.

2. To Study changes in export patterns over time.
3. To understand India's export on concentration and diversification.
4. To study what are the determinant of export performance.
5. To Study the impact of Covid-19 pandemic on India's Exports.
6. To identify Trend of India's top export partner countries and 15 products during the study period.
7. To Study India's export rely on one or few countries or is diversified across countries.
8. To study India's export rely on one or few products or diversified across products.
9. To study Which products Contribute more to India's export.
10. To Study Which are the emerging products.
11. To study the trend of tariff rates and impact of tariff on India's Export.
12. To study that is India receiving preferential access.
13. To study how tariff behaves in India's export, country-wise and product-wise.

Methodologies:

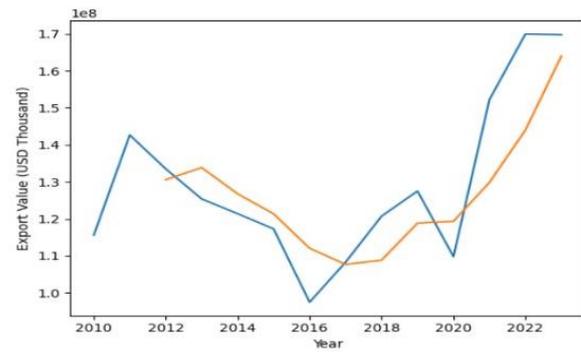
Dimension:

Export Trend analysis Plot:



Conclusion: India's Export System is growing but is also shock sensitive. There are two fluctuations of exports (USD Thousand) in the year 2016 and 2020.

3 Yearly Moving Average



Conclusion: Moving average smooths the short term fluctuations and shows underlying long term trend. We observe from the plot that export shock are sharp in the year 2016 and 2020. The moving average shows smooth decline followed by gradual recovery.

Therefore, there is no permanent structural collapse in the India's Export. The 2016 shock was occurred due to Global trade Slowdown and the 2020 shock was occurred due to the Covid 19 pandemic. So, we confirm from the above plot that India's Export has the shock absorption capacity. Even we see there is Recovery after the year 2020 in 2021-2022 period.

CAGR: It measures the average annual growth rate for the study period.

$$\log(\text{Export}) - \log(\text{Export}-1) = \beta_1 D_{2016} + \beta_2 D_{2020} + \epsilon_t$$

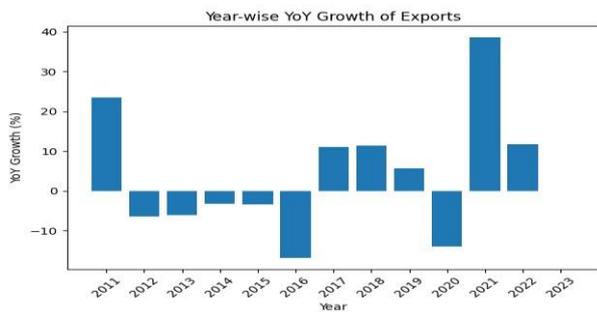
$$\text{Formula Used: } CAGR = \frac{(\text{Ending Value})^{n-1}}{\text{Starting Value}}$$

$$CAGR = 3\%$$

Conclusion: The Compound Annual Growth Rate of India's exports is 3%. Although India's export decline in the 2016 and 2020, the overall export growth is positive.

Year on Year Growth Model:

The year-on-year (YoY) growth rate measures the percentage change in export value from one year to the next.



Conclusion: From above Column chart, it shows in some years India’s export growth is positive and in some years India’s export growth is negative In 2011 it shows the strong positive Growth.

In 2016 it shows the negative Growth.

In 2021 it shows exceptional rebound .

ARIMAX Model:

Hypothesis 1:

(H₀₁): The 2016 shock has no significant impact on export growth. ($\beta_1 = 0$) v/s

(H₁₁): The 2016 shock has a significant impact on export growth. ($\beta_1 \neq 0$)

Hypothesis 2:

(H₀₂): The 2020 shock has no significant impact on export growth. ($\beta_2 = 0$) v/s

(H₁₂): The 2020 shock has a significant impact on export growth. ($\beta_2 \neq 0$)

$\Delta \log(\text{Export}) = -0.145D2016 - 0.238D2020 + \epsilon_t$ **For 2016:** p-value = 0.290 (> 0.05), so Fail to reject H₀₁ therefore 2016 shock has no significant impact on export growth.

For 2020: p-value = 0.000 (< 0.05), so we Reject H₀₂ Therefore 2020 shock has **affected exports**

Dimension 2. Country

HHI (Herfindahl-Hirschman Index): HHI explains Export Concentration across the study variable (Countries)

HHI = 0.229

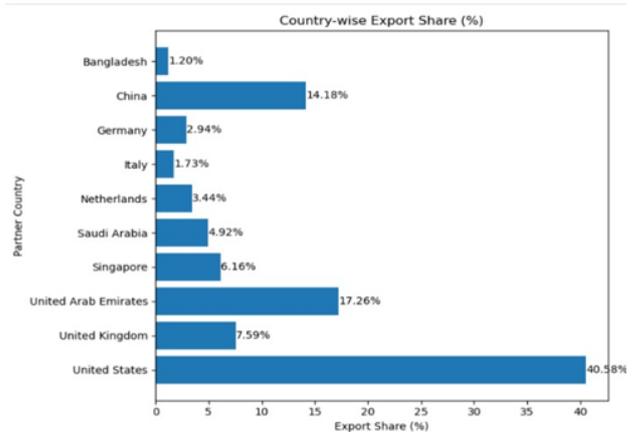
HHI Value	Interpretation
< 0.15	Low concentration (Highly diversified)
0.15 – 0.25	Moderate concentration
> 0.25	High concentration

Conclusion:

HHI =0.229 is between 0.15 to 0.25

The India’s Exports are Moderately concentrated across the Countries.

Export Share by Country:



Conclusion:

Highly Concentrated Exports: The United States has the highest export share at 40.58 %This indicates high Dependence on U.S Market. **Second Major Partners:** United Arab Emirates and China

Top 3 Country Share:

Top 3 Country Export Share =7

Conclusion: More than 72 % India earn from exporting to top 3 countries and remaining from the other partner countries.

Dimension 3: Product

HHI

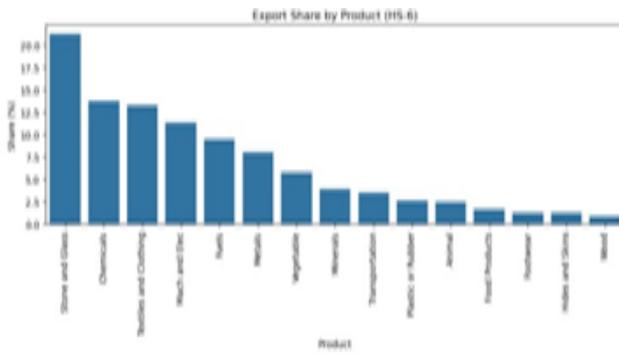
HHI =0.117

Conclusion:

0.117 < 0.15 It tells low concentration.

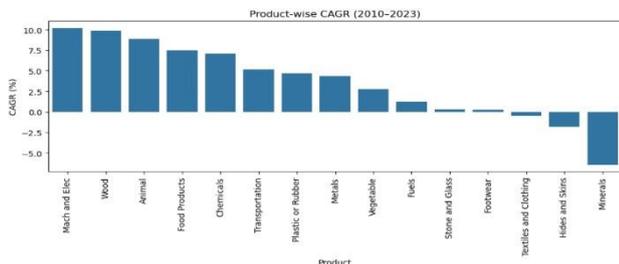
India’s Export is well diversified across products. It does not depend on the a single or a few Products (HS 6 level).

Export Share of each product (%)



Conclusion: Highly Dominant Export Products: Stone and Glass, Chemicals, Textiles and Clothing and Machinery and Electrical. Mid-level contributing export Products: Fuels, Metals, Vegetable Products. Low share export products are Plastic or Rubber, Animal, Food, Footwear, Hides and skins, Wood. India’s Export is mostly depend on the top 4 products and moderately depend on the Mid-level products The presence of many low share sectors suggests a scope for the further diversification.

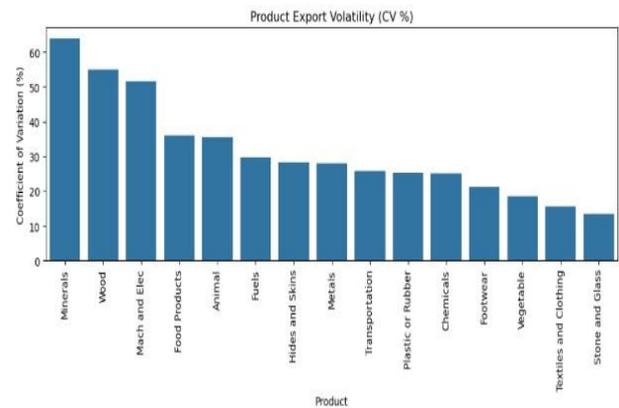
CAGR



Conclusion:

Strong growth drivers: Machinery and Electrical, Wood, Animal, Food Products and Chemicals. Moderate-Growth Products: Transportation, Plastic or Rubber, Metals and Vegetable. Low Growth Products: Fuels, Stone and Glass and Footwear. Negative Growth Products: Textiles and Clothing, Hides and Skins, Minerals The Export Growth is Shifting from the traditional sectors to machinery, Chemical, Wood, Animal.

Volatility (CV: Coefficient of Variation):

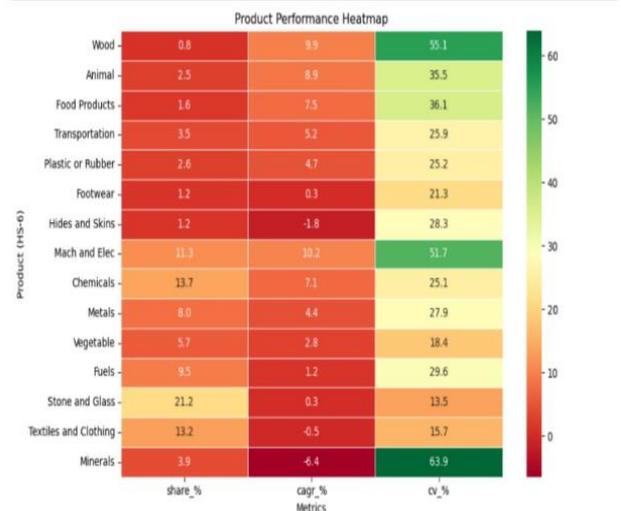


Conclusion:

High risk Products: Minerals, Wood, Machinery and Electrical and Machinery. Moderate risk Products: Food, Animal, Fuel, Metals, Transportation, Plastics, Chemicals, Footwear. Low risk Products: Vegetable, Textile and Clothing, Stone and Glass.

India’s Export Basket displays a mix of some stable sectors and more volatile emerging products.

Product-country (Heatmap):



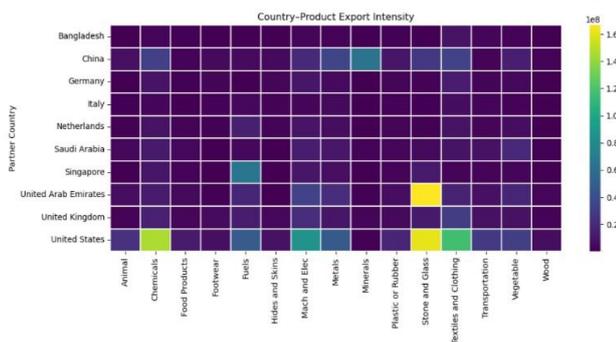
Conclusion:

Core Strength Product: Stone and Glass (High share%, very growth, low volatility) Emerging Products: Machinery and Electrical (High share, High Growth, High volatility) Strong but Moderately Growing

products: Chemical, Metals, Fuels, Vegetable (Medium share, Moderate growth, Moderate volatility)Declining Traditional products: Textiles and Clothing, Hides and skins, Minerals (Negative growth).Most concerning products: Minerals (Low share, Negative growth, highest volatility).Small but fastgrowing products: Wood (High growth but high volatility), Animal, Food products (Moderategrowth). India’s exports are stable for core products but evolving towards the Industrial products having higher growth and higher risk.

Country and its demand for Product:

Serial No.	Parnter_Country	Prodcut	share %
1	Bangladesh	Textiles and Clothing	38%
2	China	Minerals	24%
3	Germany	Textiles and Clothing	23%
4	Italy	Textiles and Clothing	17%
5	Netherlands	Fuels	23%
6	Saudi Arabia	Vegetable	20%
7	Singapore	Fuels	58%
8	United Arab Emirates	Stone and Glass	53%
9	United Kingdom	Textiles and Clothing	21%
10	United States	Stone and Glass	21%



Conclusion:

Textile dominance: Bangladesh, Germany, Italy, United Kingdom.
 Fuel dominance: Singapore and Netherlands
 Stone and Glass dominance: UAE and USA.
 Vegetable dominance: Saudi Arabia.
 Mineral dominance: China.

The Table and Heatmap Shows India’s Export Basket is highly destination specific.

Textiles and Clothing dominate several traditional and European markets, while Fuels exports are heavily concentrated in trade hub economies such as Singapore and the Netherlands. Highvalue Stone and Glass exports are particularly prominent in the United Arab Emirates and the United States, confirming their role as India’s flagship export products. In contrast, exports to China are concentrated in Minerals, a sector characterized by declining growth and high volatility, indicating potential vulnerability. Overall, the findings suggest that India’s export structure varies significantly across partner countries, reflecting differentiated demand patterns and trade relationships.

Dimension 4 : Tariff

Fix Effect Model

$$\ln(Export_{it}) = \alpha_i + \beta AHS_Tariff_{it}$$

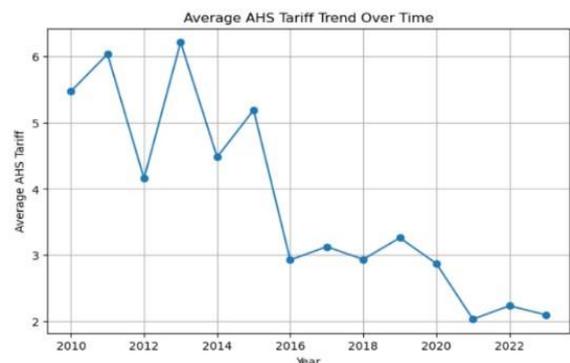
H₀: There is no significant relationship between AHS tariff rates and India’s export. v/s

H₁: There is a significant relationship between AHS tariff rates and India’s export performance.

Main Result: Tariff Impact Coefficient of AHS Tariff = -0.0304 p-value = 0.000 Conclusion:

If a partner country increases its AHS tariff by 1% the India’s export decrease by approximately 3.04% from that country. The fixed effects regression results indicate that AHS tariff rates imposed by partner country have a statistically significant negative impact on India’s export

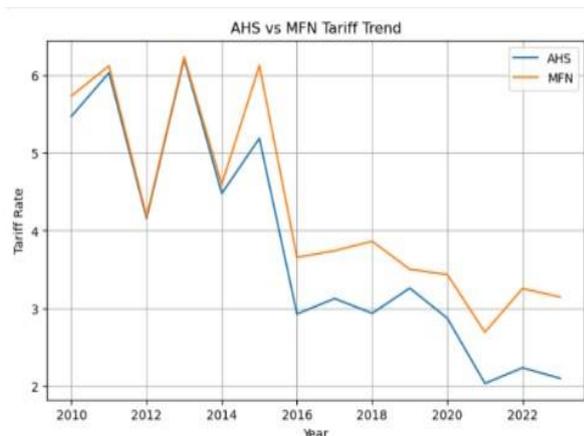
Tariff Trend Over Time



conclusion: AHS Tariff rates are Declining. AHS tariffs on India have declined structurally, indicating improved market access over time.

AHS and MFN Comparison

Tariff Gap Plot



Conclusion: AHS Tariff Rates < MFN tariff rates. Across the entire period (2010–2023), the AHS tariff is consistently lower than the MFN tariff. This clearly indicates that India enjoys preferential tariff access in the selected partner countries.

Country-wise Tariff gap.

Serial No.	Partner_country	Tariff_gap
1	United Kingdom	1.35
2	Netherlands	1.16
3	China	0.76
4	United Arab Emirates	0.55
5	United States	0.5
6	Bangladesh	0.47
7	Singapore	0.36
8	Italy	0
9	Germany	0
10	Saudi Arabia	0

Conclusion:

Top Preference Providers: United Kingdom, Netherlands and China. Moderate Preference Providers: UAE, United States, Bangladesh, Singapore. No Preference Providers: Italy,

Germany, Saudi Arabia. Tariff gap is not extremely large. Therefore tariffs are not the dominant driver of India's Export Performance.

Product-wise Tariff gap.

Serial No.	Product	Tariff gap
1	Food Products	1.45
2	Footwear	0.88
3	Plastic or Rubber	0.63
4	Animal	0.61
5	Hides and Skins	0.56
6	Textiles and Clothing	0.52
7	Chemicals	0.51
8	Vegetable	0.49
9	Transportation	0.45
10	Stone and Glass	0.43
11	Metals	0.33
12	Machinery and Electricals	0.29
13	Fuels	0.2
14	Wood	0.18
15	Minerals	0.18

Conclusion:

Top Beneficiaries: Food products, Footwear, Plastic or Rubber, Animal Products, Hides and Skins.

Medium Beneficiaries: Textiles and Clothing, Chemicals, Vegetable, Transportation, Stone and Glass. Minimal Beneficiaries: Metals, Machinery and Electrical, Fuels, Wood, Minerals Food products and Footwear exhibit larger tariff advantages, While, industrial sectors such as Machinery and Electrical, Metals, and Minerals receive relatively limited preferential margin. Importantly, the overall tariff gaps remain Modest across all products suggesting tariff preference are not primary driver of India's Export Performance.

Overall conclusion:

Export growth will therefore depend on market diversification, technological upgrading. This study provides a comprehensive statistical analysis of India's International export trade, by examining it Country-wise, Product wise and Tariff wise using Top 10 Countries and HS6 level products. The results indicates that India's exports have experienced long-term positive growth despite two temporary shocks in 2016 and 2020. The COVID-19 Shock had a significantly negative impact, while the 2016 slowdown was not significant. Country-level analysis shows moderate concentration of export across countries, with substantial dependence on the United States and top three trading partners, highlighting the exposure to external market risks. At the product level, exports are well diversified, though a few core sectors such as stone and Glass, Chemicals, Textiles and Clothing and Machinery dominate overall performance. Growth analysis shows structural transition towards industrial sectors such as machinery and chemical. Volatility analysis reveals stable core products and High growth but High-risk products where the Stable core products are Stone and Glass, Vegetable, Textiles and Clothing and High growth but high-risk products are Machinery and electrical. Country-product analysis confirms that India's export basket is destination specific. Tariff Analysis indicates declining of AHS tariffs and consistent preferential access. However, product level sensitivity results indicate that most exports are not strongly tariff driven, implying that competitiveness, productivity and global demand conditions play a more decisive role than tariff advantages. Overall India's export system appears moderately diversified, structurally evolving towards industrialization, resilient to shocks, and increasingly driven by supply side competitiveness rather than trade policy

concessions. Sustained risk management and strengthening global value chain integration rather than relying solely on tariff reductions.

Limitations:

Tariffs and exports may influence each other. Although lagged tariffs and fixed effects reduce bias, strict causality cannot be fully established. Restricted Country Coverage The study focuses on the top 10 export partner countries, which may not represent the entire global export structure. Non-Tariff Barriers not included. Although HS-6 level is detailed, intra-product quality differences are not examined.

Future Scope:

Future research may extend this study by incorporating macroeconomic variables such as GDP, exchange rates, and distance within a gravity modelling framework to strengthen causal interpretation. Further studies may also include non-tariff barriers, sector-specific analysis, and state-level export performance. In addition, exploring post-COVID structural transformation, digital trade expansion, and the impact of emerging trade agreements would provide deeper policy insights. Advanced econometric techniques such as dynamic panel models or instrumental variable approaches could further enhance robustness and analytical precision.

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