



# The Cointegrating Analysis of Edible Sunflower Oil Trade in India

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## Authors' contributions

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

The present study aimed at using the co-integration analysis, to find out, if or not, there exists a long run relationship amongst the consumption of sunflower oil and the tariff rates, imports, production and domestic prices in India. The co-integration analysis was also used to confirm if there exists market integration for edible sunflower oil for domestic and international markets. Annual time series secondary data was collected for tariff rates, consumption, from various sources for this study. The test was carried out using E-Views software. The results indicate strong long run relationship of consumption of edible sunflower oil with all the independent variables taken into consideration as three cointegrating equations were obtained. Only one cointegration equation was obtained when international prices and domestic prices were subjected to this test, indicating a relationship amongst the domestic and international markets and suggesting the presence of market integration.

**Keywords:** Tariff rates; co-integration; market integration; imports.

## 1. INTRODUCTION

In terms of edible oils, India has always been a net importer. India was ranked first in terms of

vegetable oil imports in the world in 2019. Annual oil-seed production in India totals 30.06 million tonnes on an area of 26.67 million hectares. The majority of oil seeds are grown in a rainfed

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setting (70 percent). Due to their relative lower profitability compared to rival crops like maize, cotton, chickpea, etc., under the current crop growing and marketing conditions, the area under oilseeds has generally undergone a deceleration. India is the world's largest importer of vegetable oils (15 percent market share), followed by China and the USA, and is heavily dependent on imports to meet its needs for edible oils. Palm oil makes up roughly 60 percent of imported edible oils, followed by soybean oil, which has a share of 25 percent, and sunflower oil (12 percent). Over the past few decades, imports of edible oils have increased by roughly 174 per cent.

Refined sunflower oil is one of the most used cooking oil in the Indian households especially by the upper middle class sector of the society. Standard plant breeding approaches have resulted in the development of several types of sunflower oil seeds, mostly to change the quantities of oleic acid and linoleic acid, which are the principal monounsaturated and polyunsaturated fats in sunflower oil. Sunflower oil is high in vitamin E [1,2].

53 percent (about 18 million tonnes) of the world's sunflower oil production in 2018 was produced by Russia and Ukraine. Due to the 2022 Russian invasion of Ukraine, there has been a global shortage of sunflower oil in 2022, resulting in a more than 50% decline in supply. In Indian scenario, sunflower oil remains to be the

third highest imported edible oil (12 per cent of all edible oil imports), following palm oil (60 per cent of all edible oils imports) and soyabean oil (25 per cent of edible oil imports). Every year, India consumes around 2 million metric tonnes of sunflower oil, 90 percent of which is imported. Domestic edible oil production has clearly not been able to keep up in pace with the demand of the consumers and their tastes and preferences. In India due to the paucity in supply, several brands are changing their recipes to include rapeseed oil in order to keep their products on the market [3-5]. The impact of the trade liberalization has led to integration between domestic and international edible oil markets in India. It is observed that India has tried to balance the interests of both producers and consumers while fixing the import tariffs [6]. Low import duties from sunflower oil exporting countries (for e.g., Ukraine) has resulted in high imports leading to stagnant and plateaued sunflower seed production (Mehta, 2013). Although Indian consumers are primarily considered to be very price-sensitive, a burgeoning middle class, higher earnings, and increased health concern have resulted in a massive increase in sunflower oil use in the country. In this article, we will see if consumption pattern and demand of sunflower oil in the country is in tandem with the tariff rates, imports, domestic production and prices [7-9]. We will also try to find out whether the international and domestic markets for sunflower oil are integrated.

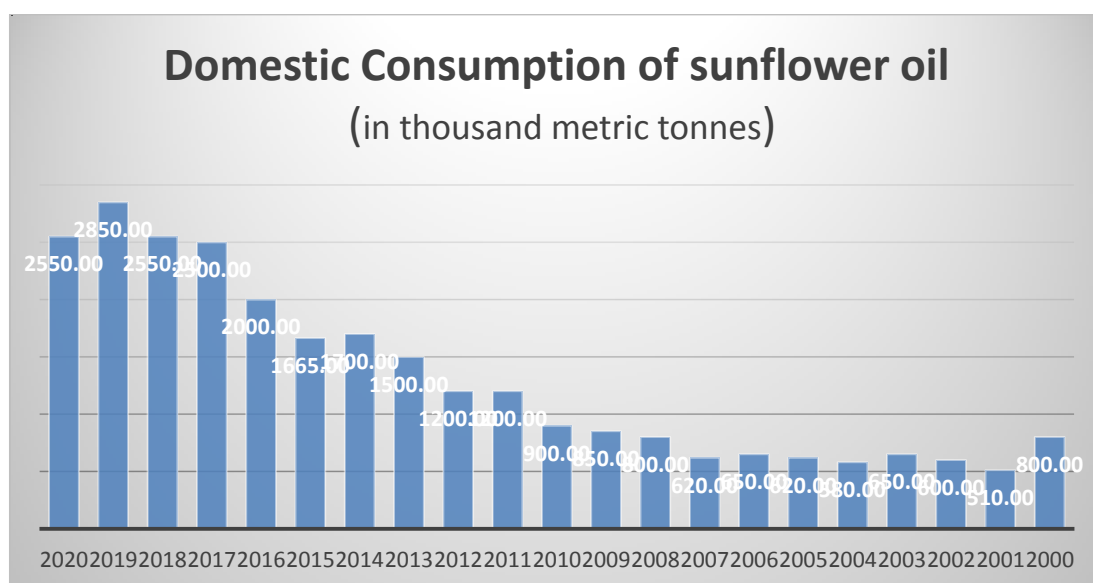
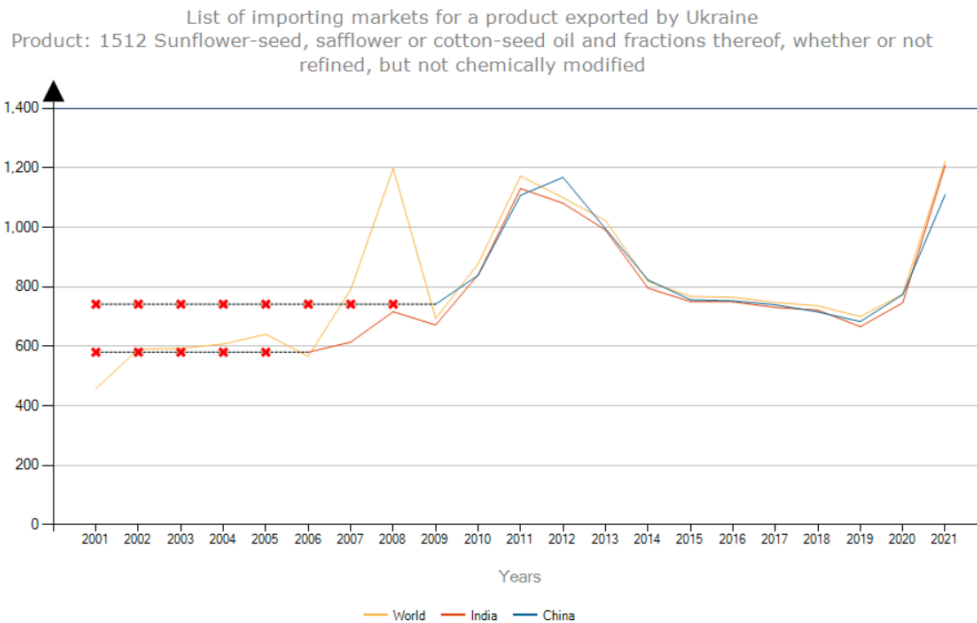


Fig. 1. Domestic consumption of sunflower oil



**Fig. 2. List of importing markets for a products exported by Ukraine**  
Source:- Comtrade, ITC (2021)

## 2. MATERIALS AND METHODS

This study was carried out using secondary data. Annual data for applied tariff rates, consumption, production, imports, international prices and domestic prices for sunflower oil of edible grade from the period of 2001-2021 was collected. The data for applied tariff rates in India was collected from notifications issued by the Directorate General of Foreign Trade (DGFT), Ministry of Commerce and Industry. The annual data for production of sunflower oil was collected from the annual issues of Agricultural Situation at a Glance. The data for consumption for sunflower oil in India was obtained from <https://www.nationmaster.com> compiled from USDA. The data for international prices and imports for sunflower oil was obtained from International Trade Centre website. The data for domestic prices were obtained from [www.indexmundi.com](http://www.indexmundi.com).

The main focus of this article is to analyze the trends and patterns in consumption and if it is on par with the tariff rates regime and factors like production, imports and prices.

To find out whether there exists a long run relationship between the demand (consumption) for sunflower oil with the tariff rates, imports and domestic prices, Johansen cointegration test was

carried out. For finding out whether there exists market integration amongst the international and domestic markets for sunflower edible oil, cointegration test was also conducted for international and domestic prices.

### 2.1 Johansen Cointegration Test

To assess the long run relationship between price series, Johansen and Juselius (1990) created the Co-integration test, and Likelihood Ratio test statistics are proposed to test the number of co-integrating vectors. The trace-statistic and maximum Eigen values are used to test the null hypothesis of at most 'r' co-integrating vectors versus 'more than r' co-integrating vectors (the alternative hypothesis co-integrating vectors).

$$\text{Trace statistic } (\lambda - \text{trace}) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i)$$

$$\text{Maximum Eigen value statistic } (\lambda - \text{max}) = -T \ln(1 - \hat{\lambda}_i)$$

$\lambda_i$ s are the estimated Eigen values (characteristic roots) obtained from the markets, T is the number of usable observations. The number of co-integrating vectors indicated by the tests is an important indicator of the existence of co-movement of the prices. As the number of cointegrating vectors increases, it implies the strength and stability of price linkages.

### 3. RESULTS AND DISCUSSION

The integration among the variables taking consumption of sunflower oil as the dependent variable and tariff rates, production, imports and domestic prices as the causal or independent variables was carried out. The data was analysed and interpreted using the time series data of all the variables by utilizing Johansen multiple co-integration procedure. The analysis was done using E-Views software. The results of both unrestricted co-integration rank tests i.e. Maximum Eigen statistic and Trace statistic are indicated in Table 1. The table indicated the presence of at least one co-integrating equation at 5 per cent level of significance (Maximum Eigen statistic) and three co-integrating equations at 5 per cent level of significance (Trace statistic).

**Table 1. Results of Johansen Co-integration Analysis of Consumption of Sunflower oil with Tariff rates, Imports, Production and Retail Prices**

Co-integrating equations	Max-Eigen Statistic	0.05 Critical Value	Trace statistic	0.05 Critical value
None	40.2369*	27.58434	83.8481*	47.8561
At most 1	22.1079*	21.1316	43.5841*	29.797
At most 2	18.7130*	14.2646	21.4762*	15.4947
At most 3	2.76319	3.8414	2.7631	3.8414

\*denotes rejection of hypothesis at 0.05 level of significance

**Table 2. Results of Johansen Co-integration Analysis for International and Domestic prices for sunflower oil**

Co-integrating equations	Max-Eigen Statistic	0.05 Critical Value	Trace statistic	0.05 Critical value
None	14.3959*	13.2646	17.042*	15.4947
At most 1	2.6462	3.8414	2.6462	3.8414

\*denotes rejection of hypothesis at 0.05 level of significance

The table indicated the presence of three co-integrating equation at 5 per cent level of significance (Maximum Eigen statistic) and three co-integrating equations at 5 per cent level of significance (Trace statistic). The strength of co-integration depends upon the number of co-integrating equations. Thus consumption of sunflower oil has a strong long-run equilibrium relationship with each all the above endogenous variables- tariff rates, imports, production and retail prices.

The integration of world international prices of sunflower oil with the domestic prices was also carried out to see if there exists market integration and a long run relationship amongst the markets. The results of both the co-integration rank tests – Maximum Eigen statistic and Trace statistic are indicated in Table 2.

The table indicated the presence of at least one co-integrating equation at 5 per cent level of significance (Maximum Eigen statistic) and at least one co-integrating equation at 5 per cent level of significance (Trace statistic). Thus there exists integration in the long-run among the

domestic and international markets for sunflower oil. This finding is in line with Thomas et al. [6].

### 4. CONCLUSION

The study clearly depicts a long run relationship amongst the demand for sunflower oil with its domestic production, imports, domestic prices and the tariff rates. Also we can confirm the presence of market integration of domestic and international markets for sunflower oil. The government policies should be so aimed that the consumption patterns and trends move in tandem with the supply of edible oil that is constituted by its supply i.e., production and imports.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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