FACTORS INFLUENCING EXPORT OF SOYA BEAN OIL FROM INDIA : A PANEL GRAVITY MODEL ANALYSIS

ABSTRACT

Soya bean, the 'miracle bean', belongs to the family Leguminoceae, subfamily Papilionoidea. Soya bean oil is one of the most widely consumed cooking oils and is rich in linolenic acid. In the past 20 years the export of soya bean oil from India was mainly focused on Bhutan, Jordan, Canada, Singapore and Myanmar. The data was collected from 2002-03 to 2021-22. The sources of data were Food and Agriculture Organization Statistics (FAOSTAT), Directorate General of Commercial Intelligence and Statistics (DGCIS), International Monetary Fund (IMF), Statista and Trade map. The panel data was estimated by the Feasible Generalized Least Squares (FGLS) method. Factors influencing exports were partner countries' GDP, distance, openness, and exchange rates, while India's GDP and inflation had little impact emphasizing the importance of external market conditions in shaping bilateral trade.

Key words: *Soya bean oil, India, Factors influencing, Exports, Gravity model, FGLS.*

INTRODUCTION

The soya bean (*Glycine max. L.)* the 'miracle bean', is reported to be originated from China. In India, soya bean was introduced from China in the tenth century AD through the Himalayan routes. Soya bean has been traditionally grown on a small scale in Himachal Pradesh, the Kumaon Hills of Uttar Pradesh (now Uttaranchal), eastern Bengal, the Khasi Hills, Manipur, the Naga Hills, and parts of central India covering Madhya Pradesh. Soya bean has a dual character as oilseeds and pulses but basically legume and comes under oilseed crop. It belongs to the family Leguminoceae, subfamily Papilionoidea. Soya bean has emerged as the golden bean of the 21st century and it is largely used as oilseed. Soya bean is the fastest growing crop in India which replaced crops like maize, cotton, and pulses. Soya bean is the cheapest source of high-quality protein. It is valued for its high (38-45 per cent) protein content as well as its high (approximately 20 per cent) oil content. The major soya bean growing states are

Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Telangana (Parmar and Devi, 2021). This "king of beans" is mostly crushed into soy oil and meal and is found in hundreds of edible and non-edible products, ranging from cooking oil, animal grains, vegan food, and milk to biodiesel and other industrial applications. Soya bean oil is a vegetable oil extracted from the soya bean seeds (*glycine max*). It is one of the most widely consumed cooking oils and is rich in linolenic acid. Soya bean oil contains 7–10 per cent palmitic acid, 2–5 per cent stearic acid, 1–3 per cent arachidic acid, 22–30 per cent oleic acid, 50–60 per cent linoleic acid, and 5–9 per cent linolenic acid (Anon, 2024a).

In 2022, India exported $29M in Soya bean oil, making it the 42nd largest exporter of soya bean oil in the world. In the same year, soya bean oil was the 676th most exported product in India.

METHODOLOGY

Data Collection

The present study is based on secondary data collected from year 2002-03 to 2012-22. The sources of data were Food and Agriculture Organization Statistics (FAOSTAT), Directorate General of Commercial Intelligence and Statistics (DGCIS), International Monetary Fund (IMF), Statista and Trade map. From 2002-03 to 2021-22, India's major export destinations for soya bean oil were Bhutan, Jordan, Canada, Singapore and Myanmar. To obtain consistent and efficient estimators, the panel data was estimated by the Feasible Generalized Least Squares (FGLS) method. The assumption behind FGLS is that all aspects of the model are completely specified; here that includes that the disturbances have different variances for each panel and are constant within the panel. The advantage of FGLS estimation is that it can handle both heteroscedasticity and serial correlation (Akhter and Ghani, 2010; Mulenga, 2012). The FGLS is the most appropriate model if the exact form of heteroscedasticity in the data is ignored since it weighs the observations according to the square root of their variances and is robust to any form of heteroscedasticity (Zarzoso *et al.,* 2007).

Analytical Framework

Gravity Model

The factors influencing soya bean oil export were determined using the trade gravity model. The trade gravity model was the econometric model based on the idea that overall trade volumes between the two nations depend on the size of the two nations and the distance they are apart. The gravity model was first developed following the physics gravity model derived by Newton in 1687 (Newton, 1687) and was then used by economists in the 1960s to analyze international trade flows, such as, Linder (1961), Tinbergen (1962) and Linneman (1966).

Thus, it is postulated that the trade flow between the two countries is directly proportional to the two country's income and inversely proportional to the distance between them. The basic form of the gravity model is given by Equation

$$X_{ij}=K\frac{Y_i^{\beta_1}Y_j^{\beta_2}}{D_{ij}^{\beta_3}}$$

Where

X_{ij}= the value of exports between countries i and j,

Y_i = economic growth of country i,

Y_j= economic growth of countries j,

D_{ij}=denotes the geographical distance between county i and countries j,

K = constant proportionality and β's are response parameters

For sake of simplicity, equation was often transformed into linear form by using natural logarithm so that it confirmed to the usual regression analysis

$$\ln X_{ij}= \beta_0+ \beta_1 \ln Y_1 + \beta_2 \ln Y_2 + \beta_3 \ln Y_3$$

Where

β's are the coefficients estimated.

Finally, with regard to the gravity model of India's export of soya bean oil, the following model was used:

$$\begin{aligned} \ln X_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} & \\ + \beta_2 \ln GDP_{jt} & \\ + \beta_3 \ln POP_{it} & \\ + \beta_4 \ln POP_{jt} + \beta_5 \ln RER_{ijt} + \beta_6 \ln INF_{it} + \beta_7 \ln DIS_{ijt} + \alpha_i + \varepsilon_{ijt} & \end{aligned}$$

Where ,

X_{ijt}= India's soya bean oil export at time t,

GDP_{it}= real GDP of the exporting country (India) at time t,

GDP_{jt}= real GDP of the importing country at time t,

POP_{it}= population of exporting country at time t,

POP_{jt}= population of importing country at time t,

RER_{ijt}= real exchange rate between countries i and j at time t,

INF_{it}= domestic inflation of exporting country at time t and

DIS_{ijt}= time-invariant physical distance between the economic center of exporting and importing country.

The GDP represents the market size and purchasing power of the trading partners which postulates that the countries are expected to trade more with the increase in their economic size. The distance variable indicates not only higher transportation costs, but also is correlated with larger cultural differences, which can retard the transfer of information and establishment of trust. Therefore, the distance variable is negatively correlated with the bilateral trade.

RESULTS

The results of the Feasible Generalised Least Square method (FGLS) examined the relationship between various predictors and an unspecified dependent variable. The trade between the countries during the past 20 years might be influenced by many factors that can be assessed by the gravity model (Table 1).

Table 1 Estimates of the gravity model of Indian soya bean oil

VARIABLES	COEFFICIENT	SE	Z	P>Z
Constant	10.113	6.110	1.660	0.098
India GDP	-0.401	2.441	-0.160	0.870
Per capita GDP of India	6.299	33.546	0.190	0.851
Per capita GDP of partners	1.166*	0.664	1.760	0.079
Distance between India and partners	-1.048*	0.555	-1.890	0.059
Trade openness of partners	0.238*	0.132	1.810	0.071
Domestic Inflation	0.308	0.343	0.900	0.369
Exchange rate between India and partners	-1.109***	0.282	-3.930	0.000

Note: 1. *, ** *and* ****indicate significance at 10%, 5% and 1% respectively.*

2. Wald $chi^2(6) = 61.86$; Prob > $chi^2 = 0.000$; Log likelihood = -224.7728

The variable India's GDP showed a negative but non-significant effect (-0.401, p = 0.870), indicating that changes in India's GDP may not substantially impact trade flows. Similarly, the per capita GDP of India was positive but insignificant (6.299, p = 0.851), while the per capita GDP of trading partners had a positive and marginally significant effect (1.166, p = 0.079), suggesting that higher economic prosperity in partner countries encourages more trade.

The variable distance was observed to be negative and significant, which shows that trade will decrease by 1.048 per cent with increase in bilateral distance which is in accordance with Renjini *et al* (2017). Trade openness of partners positively influenced trade (0.238, p = 0.071), suggesting that more liberal trade policies in partner countries foster increased bilateral trade. Domestic inflation had a positive but non-significant effect (0.308, p = 0.369), while the exchange rate showed a highly significant negative effect on trade (-1.109, p = 0.000), indicating that unfavorable exchange rates reduced trade flows between India and its partners.

Overall, the analysis revealed that partner country prosperity, distance, trade openness, and exchange rates played critical roles in India's bilateral trade, while factors like India's GDP and inflation had less influence.

However, in the results, the Wooldridge test for autocorrelation was observed. As observed Table 2, showed that the estimation failed to reject the null hypothesis and concluded that the data did not have first-order autocorrelation.

Table 2 Autocorrelation Lagrangian Multiplier (LM) Test

Wooldridge test for autocorrelation	
H_0: No first-order correlation	
Test statistic: F(1,4)	6.383
Prob > F	0.1649

CONCLUSION

The study concluded that partner countries' economic prosperity and trade openness positively impact exports, while greater bilateral distance and unfavorable exchange rates significantly reduce trade flows. In contrast, India's GDP and inflation have limited impact on export performance, emphasizing the importance of external market conditions in shaping bilateral trade.

SUGGESTIONS

India should invest in trade infrastructure to reduce transportation costs and address the challenges posed by distance, especially in markets like Canada. Hedging against unfavorable exchange rates, along with negotiating free trade agreements (FTAs) or preferential trade agreements (PTAs), will further enhance market access. Finally, focusing on branding Indian soya bean oil as a premium, health-focused product across all markets, supported by strong marketing campaigns, can significantly boost export performance.

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