

The Effect of Trade Liberalization on Indian Groundnut Exports: A Markovian Analysis

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Abstract

There has been an increasingly growing demand for oilseeds for various purposes. Among oilseeds, groundnut (popularly known as peanut) is a very important crop. India is one of the largest producers of groundnut. The export of groundnut from India is continuously increasing. With time, there has been a shift in destination of groundnut exports from India owing to the stringent Sanitary and Phytosanitary Standards in the developed countries. In this paper, the author has tried to analyze the direction of change of Indian groundnut exports since liberalization and also forecasted the loyalty of major importers of Indian groundnut till the year 2016.

Keywords: Groundnut Exports, Markov Chain, aflatoxin

1. Introduction

The oilseeds markets have experienced significant changes over the past two decades, including extraordinary growth in demand for feeds, vegetable oils, food-based ingredients and bio fuels for energy. The world output of oilseeds has also risen substantially in the past 20 years from 222 million tons in 1991 to 452 million tons in 2011. The countries like USA, Brazil, China, Argentina and India are the largest producers of oilseeds. World trade in this sector comprises of trade in oilseeds, oil meal and oils. While world oilseed trade is less restricted by tariffs and other border measures, the same is less true for oilseed products.

India ranks 5th in production of oilseeds contributing around 7 percent to the global oilseed production. Groundnut, soybean and rapeseed and mustard together account for more than 80% of edible oilseed output. On production front, Indian oilseed sector is characterized by fluctuating output, low yields and depressed farm gate prices, which make oilseed production non remunerative and to some extent unattractive. Looking to the present oilseed production scenario and rising consumption of edible oil in India, shift in agricultural production in favour of oilseeds is warranted.

In India's efforts to be self-sufficient in food grains, the oilseed sector was left neglected, as a result of which country faced shortfall of edible oils. To overcome this situation, Government of India initiated TMOPP (Technical Mission on Oilseeds and Pulse Production) and made efforts to make oilseed cultivation appealing to growers. As a result, India became almost self sufficient in edible oils in early 90s. After signing WTO (World Trade Organization) agreements, India's import policy on oilseed/oil trade underwent drastic changes. On the export front, exports of oilseeds were canalized through NAFED (National Agricultural Cooperative Marketing Federation of India) during early eighties, and then came the licensing Raj when only restricted quantities of oilseeds could be traded. Later on India was forced to lift all the restrictions being maintained on balance of payment grounds after US successfully challenged India at the WTO.

Among oilseeds, groundnut (*Arachis hypogaea* L) "King of oilseed crops" is a rainfed crop grown in India mainly during *khari*/rainy season. It is also grown during *rabi*/summer either under assured irrigation or residual moisture. It is widely grown in five states namely Gujarat (33%), Andhra Pradesh (24%), Karnataka (15%), Tamil Nadu (8%) and Maharashtra (6%). Groundnut contains about 40-50 per cent oil and 20 to 30 per cent protein. In India, 80% of the total produce is used for oil extraction, 11% as seed, 8% for direct food uses and 1% is exported. India is the largest producer of groundnut and in India, groundnut is grown on 5.5 million ha with a production of 5.4 million tons, with an average productivity of 0.99 tons /ha (Ministry of Agriculture, 2011).

International Trade of Oilseeds

Both export and import trade in groundnut is highly concentrated. The seven largest net exporters of groundnut are China, Argentina, USA, India, Vietnam, South Africa and Gambia (Diop *et al.*, 2004). These countries supply about 85 per cent of the world export trade. Similarly, five largest net importers (European Union, Indonesia, Canada, Singapore, Malaysia and Philippines) purchase about three quarters of the current world imports. The positioning of the largest net exporters has shifted considerably during the last six years. China, although it has become the largest producer, lost over half of its share in the export market of handpicked selected groundnuts, mainly because of the increase of the domestic consumption. India moved up to the second place. Argentina and Vietnam doubled their shares, while exports from United States decreased slightly, facing strong competition from Argentina.

Groundnut oil is thinly traded in international markets, because the major producers like China, India and USA consume substantial amounts in their domestic markets. This consumption reduces the quantity available for export. In the 1960s and 1970s, groundnut oil was the major item traded, as edible groundnut trade was negligible. Since that period, the reverse has occurred. Edible groundnuts dominate world groundnut trade while groundnut oil is of minor importance. In the 21st century, groundnut trade has changed as a result of various WTO agreements. The main agreement affecting groundnut trade is the Agreement on Sanitary and Phytosanitary Measures. An initial survey on the implications of SPS measures for developing countries reports that SPS measures can be more significant in terms of impeding a country's ability to export agricultural and food products than tariffs (Henson and Loader, 2000).

The groundnut exports from India have been continuously on a rise. The quantity of groundnut exported from India has increased from 1.13 lakh tonnes in 2001-02 to 4.19 lakh tons in 2010-11. The value of groundnut exports has increased from Rs. 250 crore in 2001-02 to Rs 2099 crore in 2010-11. The direction of Groundnut Exports from India has seen a shift over the decades. Before liberalizing the Indian economy in 1991, India used to export most of its groundnut to European and other developed countries. However, since the initiation of liberalization, groundnut exports from India have seen a major change in its destination. Taking into account the Indian as well as global oilseed and groundnut scenario, it would be relevant to study the growth in exports of Indian groundnut as well as the direction of trade of Indian groundnut in the light of the liberalized trade regime.

2. Methodology

The study period was divided into three periods based on the policy of the government on liberalization of trade at different periods. Period I, the Pre-liberalization period is considered from 1980-81 to 1990-91, Period II, the Post-liberalization period from 1991-92 to 1994-95 and Period III, the Post WTO period from 1995-96 to 2001-2010. The data pertaining to the various aspects under study were collected from the Directorate General of Commerce, Industries and Statistics (DGCIS).

2.1 Growth Rate

Scatter diagram for different forms of groundnut exported for the three periods showed that year to year fluctuations in terms of both quantity and value of groundnut exported were higher. Of the various growth models tried, modified quadratic or log-quadratic model was found most suitable to fit the nature of the data. The log quadratic form was important because it has certain special features not possessed by others. It takes care of multiplicative error term, which is very likely to be present in most of the time series data. It also accommodates varying nature of growth patterns and smoothens a part of the short-term volatile fluctuations. Log-quadratic form is given as (Chu *et. al.*, 1970):

$\log Y = \log a + bt + ct^2 \dots \dots \dots (1)$ Where,

Y = dependent variable in exports in terms of quantity and value

a = intercept term

b and c = coefficients of independent variable t

t = time period

Equation (1) was estimated by using Ordinary Least Square (OLS) technique.

Growth rate was then given by

$g = b + 2ct \dots \dots \dots (2)$

Where,

g = growth rate in per cent per annum

2.2 Markov Chain Analyses

The trade directions of Indian groundnut exports were analyzed using the first order Markov chain approach. Central to Markov chain analysis is the estimation of the transitional probability matrix P. The elements P_{ij} of the matrix P indicates the probability that export will switch from country i to country j with the passage of time. The diagonal elements of the matrix measures the probability that the export share of a country will be retained. Hence, an examination of the diagonal elements indicates the loyalty of an importing country to a particular country’s exports.

In the context of the current application, six major importing countries of groundnut were considered. The average exports to a particular country was considered to be a random variable which depends only on the past exports to that country, which can be denoted algebraically as

$$E_{jt} = \sum_{i=1}^r E_{it-1} * P_{ij} + e_{jt} \dots\dots\dots(3)$$

Where,

- E_{jt} = Exports from India to j^{th} country during the year t.
- E_{it-1} = Exports to i^{th} country during the period t-1.
- P_{ij} = Probability that the exports will shift from i^{th} country to j^{th} country.
- e_{jt} = The error term which is statistically independent of E_{it-1} .
- t = Number of years considered for the analysis
- r = Number of importing countries

The transitional probabilities P_{ij} which can be arranged in a $(c * r)$ matrix, have the following properties:
 $0 \leq P_{ij} \leq 1 \sum_{i=1}^n P_{ij} = 1$, for all i

Thus, the expected export shares of each country during period ‘t’ were obtained by multiplying the export to these countries in the previous period (t-1) with the transitional probability matrix.

There are several approaches to estimate the transitional probabilities of the Markov chain model such as unweighted restricted least squares, weighted restricted least squares, Bayesia maximum likelihood, unrestricted least squares, etc. . In the present study, minimum absolute deviations (MAD) estimation procedure was employed to estimate the transitional probabilities which minimize the sum of absolute deviations. The conventional linear programming technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear programming formulation is stated as

$$\begin{aligned} & \text{Min } OP^* + Ie \\ & \text{Subject to,} \\ & XP^* + V = Y \\ & GP^* = 1 \\ & P^* \geq 0 \end{aligned}$$

Where,

- 0 is the vector of zeroes.
- P^* is the vector in which probability P_{ij} are arranged.
- I is an apparently dimensioned vector of area.
- e is a vector of absolute error (1 U 1).
- Y is the vector of export to each country.
- X is the block diagonal matrix of lagged values of Y
- V is the vector of errors
- G is the grouping matrix to add the row elements of P arranged in P^* to unity.

Using the estimated transitional probabilities, the export of groundnut to various destinations was predicted by multiplying the same with the respective shares of base year.

The export shares of Indian groundnut to different countries were predicted for the years 2012, and 2014 by using 2 step and 4 step transitional probabilities for predicting export shares 2 years and 4 years from the base year.

3. Results and Discussion

3.1 Growth Pattern in Export of Groundnut from India

In working out growth in exports of different forms of groundnut, the exponential function did not reveal a clear picture about growth rates. Different functional forms were tried but log quadratic model was found to be the best fit as judged by the coefficient of multiple determinations (R^2). The results of the analysis for the three sub periods for the exports of groundnut kernel HPS and groundnut in shell HPS are presented in table 1.

Table 1: Growth in Export of Groundnut in the Liberalization Regime

Particulars	Pre liberalization		Post liberalization		Post WTO	
	Quantity	Value	Quantity	Value	Quantity	Value
Groundnut Kernel HPS	-9.21	-6.74	42.64	43.11	9.20	11.40
Groundnut in shell HPS	-	-	42.42	42.54	3.1	7.70

In the pre liberalization period, the quantity as well as value of exports of groundnut kernel HPS decelerated as indicated by negative growth rates. This was because, by the end of December 1978, business was channeled solely through a government supported cooperative organization, which had little expertise or infrastructure. Private exporters, who had so assiduously cultivated lucrative overseas markets, were totally excluded from the export business. During this period of monopoly of exports through the National Agricultural Cooperative Marketing Federation (NAFED), as the cooperative organization is known, performance on the export front plummeted. As a result private trade was re-inducted into export business in October 1982. During the period of export channeling through NAFED from 1978 to 1982, India lost touch with most of her buyers. The switch on switch off export policy as a result of frequent embargoes on export and the change in exporting agency had a disastrous effect. The confidence of traditional Indian buyers like the United Kingdom, the Netherlands, the Federal Republic of Germany and Japan was thoroughly shaken. Naturally buyers started looking for more reliable sources of supply (Chandrashekhar, 1989).

In the post liberalization period, groundnut kernel HPS exports recorded a growth of 42.64 per cent in terms of quantity and 43.11 per cent in terms of value. Exports of groundnut kernel NES and groundnut in shell HPS also recorded a high positive growth rate. This high positive growth rate was due to sharp increase in the export of total groundnuts in 1994 (2.4 lakh tons) as compared to 4343 tons in 1993. This could again be attributed to high production during the period 1992-93 when production increased to 8.5 million tons as compared to 7.1 million tons during the preceding period. The high production and export of groundnut in early 90s could also be attributed to the Technical Mission on Oilseeds which started in 1986 and the fruits of which were realized in early 90s.

During the post WTO period, the quantity of groundnut kernel HPS exported from India accelerated at the rate of 9.20 per cent per annum. The growth in groundnut export during the post WTO regime was much lower than that witnessed during the pre WTO period. The decline in growth rate of quantity exported could also be due to the fact that until 1999, the European Union was permitting a maximum of 15 parts per billion (ppb) of aflatoxin in groundnut with the content of aflatoxin B₁, limited to 8 ppb maximum and B₂, G₁ and G₂ aflatoxin to 7 ppb maximum. Under a new regulation in European Union, from February, 1, 1999, the maximum amount of B₁ aflatoxin admissible in groundnuts, nuts and dried fruits would be 2 ppb and other aflatoxin 4 ppb. Public discourse and concern about the health risks of food and appropriate sanitary standards have been emerging in industrialized countries (Pinstrup-Andersen, 2000), and they have been especially prominent in Europe (Nielsen and Anderson, 2000). Coupled with this, there was a reduction in the world production of groundnut oil in the year 1997-98. This resulted in steep increase in the international prices of groundnut oil from \$897/ton in 1996 to \$1010/ton in 1997. As a result, the imports of edible oil declined from 14.2 lakh tons in 1996 to 12.7 lakh tons in 1997.

To meet domestic demand of edible oils, the quantity of groundnut available for exports was probably cut down. The groundnut in shell production has shown wide fluctuations over the last few years because of weather related stresses and touched a low of 53 lakh tonnes in 1999-2000. Shrinking output base, poor domestic quality norms and high prices have led to a sharp decline in groundnut kernel exports (Chandrashekhar, 2001). The international market prices of groundnut declined sharply from \$962/ton in 1996 to \$690/ton in 2002. This has reduced the rate of growth of value of exports in the post WTO period.

Though India is the second largest groundnut producing country in the world, there is a high year to year fluctuation due to high dependence on rainfall. Besides, due to high domestic demand, the surplus left for export is less. Since there is little scope to increase the area under groundnut, the yield of groundnut needs to be improved which in case of India is very low. Another factor which hampers Indian groundnut exports is high level of aflatoxin in Indian groundnut which has caused a major setback to groundnut exports to the European Union which is the major importer of groundnuts. There is a need to put a check on the aflatoxin content in groundnut by adopting proper growing and drying methods.

3.2 Direction of Trade, Changing Pattern and Projected Share of Exports

The export promotion policy of a country must be in tune with the fast changing and dynamic international markets for commodities. Hence it would be of interest to document the changes that perhaps aid in export promotion policies. Though it would be difficult to pinpoint the nature of these changes and its directions, Markov chain analysis provides a probability approach in broadly unraveling the changes. Estimation of transitional probability matrix is central to Markov chain analysis. It indicates the direction of the changes which help to decide whether the changes are in the desirable directions or if changes are needed to boost sales to a particular market.

The transitional probabilities presented in Tables 2 to 5 give a broad indication of the change in the direction of trade of groundnut kernel HPS and groundnut in shell HPS during pre and post liberalization and post WTO periods.

It is evident from Tables 2 to 4 that the then USSR was a highly loyal market for the export of Indian groundnut kernel HPS during pre liberalization period as indicated by the high retention probability of 82.93 per cent. India could not retain its previous export shares to Netherlands, Yugoslavia and others. Germany, Singapore and Czechoslovak were found to be not so loyal markets for Indian groundnut kernel HPS during the pre liberalization period. During this period India lost confidence of traditional Indian groundnut buyers like Netherlands, Germany *etc.*, because of changing export policy as a result of frequent embargoes on export and the change in exporting agency. Hence the buyers started looking for more reliable sources of supply. Moreover, the production of groundnut had itself become unstable owing to persistent drought in principal growing areas. During the period 1981-82 to 1986-87, production had oscillated between 5.0 and 7.3 million tons. In the post liberalization period, Russia and Indonesia exhibited high degree of loyalty towards Indian groundnut kernel HPS exports. Russia retained 100 per cent of its previous export shares and Indonesia retained 68.75 per cent of its previous export shares. While the per cent retention of previous export shares to Singapore, UK, Germany and others was very low, India could not retain its previous share to Netherlands. In the post WTO period, Indonesia and Malaysia were the most loyal markets for groundnut kernel HPS and showed retention probabilities of 59.25 per cent and 43.02 per cents respectively. However, India could not retain its previous export shares to Singapore, Ukraine, America, UK and Philippines. The main reason for increased export of groundnut kernels from India to Indonesia is due to low freight rate to Indonesia which has made groundnut kernel export an attractive proposition for exporters from India.

Groundnut in shell HPS was exported from India mainly during the post WTO period. It is evident from the Table 5 that Indonesia was the major market for Indian groundnut in shell HPS as indicated by the high retention probability of 97.20 per cent. This was because the freight cost for a 20 feet container to Indonesia is as low as \$175-200 which translates to a \$10/ton. A full container load can take up to 20 tons (Anon., 2000a). Besides Indonesia, Singapore and Malaysia also showed high retention probabilities of 67.77 percent and 65.94 per cent respectively. India could retain only a marginal share of its previous export shares to Nepal and UK. However, India could not retain any of its previous export shares to Malaysia, Philippines, Singapore and UK.

Table 2: Transition Probability Matrix of Groundnut Kernel HPS Exports during Pre-Liberalization Period (1985-1991)

	USSR	Singapore	Czechoslovak	Netherlands	German F Rp	Yugoslavia	Others
USSR	0.8293	0.0000	0.0000	0.0000	0.0000	0.0000	0.1707
Singapore	0.6774	0.1396	0.0000	0.0000	0.0000	0.1831	0.0000
Czechoslovak	0.7039	0.0000	0.0556	0.0000	0.2406	0.0000	0.0000
Netherlands	0.5146	0.0000	0.0000	0.0000	0.0000	0.0000	0.4854
German F Rp	0.0000	0.0000	0.0000	0.0000	0.2341	0.0000	0.7659
Yugoslavia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Others	0.0000	0.3241	0.3423	0.1452	0.0891	0.0993	0.0000

Table 3: Transition Probability Matrix of Groundnut Kernel HPS Exports during Post Liberalization Period (1992-1995)

	Singapore	Indonesia	UK	Russia	Netherlands	German F Rp	Others
Singapore	0.2984	0.1940	0.3210	0.0000	0.1866	0.0000	0.0000
Indonesia	0.0000	0.6875	0.0000	0.3125	0.0000	0.0000	0.0000
UK	0.0000	0.4619	0.2516	0.0000	0.0000	0.0000	0.2865
Russia	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
Netherlands	0.0000	0.0000	0.0000	0.0000	0.0000	0.5165	0.4835
German F Rp	0.0000	0.0000	0.1472	0.0000	0.0000	0.1141	0.7387
Others	0.7588	0.1089	0.0000	0.0000	0.0000	0.0018	0.1305

Table 4: Transition Probability Matrix of Groundnut Kernel HPS Exports during Post WTO Period (2001-2008)

	Singapore	Ukraine	America	UK	Philippines	Malaysia	Indonesia	Others
Singapore	0.0000	0.0000	0.4681	0.0000	0.0000	0.0000	0.0000	0.5319
Ukraine	0.4044	0.0000	0.0000	0.0000	0.0000	0.3692	0.2265	0.0000
America	0.0000	0.1174	0.0000	0.4579	0.0000	0.0000	0.0000	0.4246
UK	0.0000	0.0000	0.0000	0.0000	0.1212	0.8788	0.0000	0.0000
Philippines	0.0000	0.0300	0.0000	0.0000	0.0000	0.0000	0.9700	0.0000
Malaysia	0.0166	0.0000	0.0000	0.0000	0.2943	0.4302	0.0000	0.2589
Indonesia	0.0229	0.0553	0.0000	0.1076	0.0000	0.0419	0.5925	0.1798
Others	0.0000	0.0000	0.0000	0.0705	0.1369	0.0035	0.6769	0.1121

Table 5: Transition Probability Matrix of Groundnut in Shell HPS Exports during Post WTO Period (2001-2008)

	Nepal	Sri Lanka	UK	Singapore	Philippines	Malaysia	Indonesia	Others
Nepal	0.0730	0.0000	0.0000	0.3035	0.0000	0.0000	0.6235	0.0000
Sri Lanka	0.0000	0.4305	0.0115	0.0000	0.0000	0.5580	0.0000	0.0000
UK	0.0000	0.0000	0.0867	0.0000	0.0000	0.9133	0.0000	0.0000
Singapore	0.0000	0.0000	0.0000	0.6777	0.3223	0.0000	0.0000	0.0000
Philippines	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
Malaysia	0.0351	0.0000	0.0179	0.0094	0.0043	0.6594	0.0000	0.2741
Indonesia	0.0000	0.0067	0.0000	0.0132	0.0000	0.0081	0.9720	0.0000
Others	0.0000	0.0000	0.0000	0.0397	0.3851	0.0000	0.5752	0.0000

3.3 Forecasting of Exports of Groundnut

The export shares of Indian groundnut kernels HPS and Groundnut in shell HPS were predicted for different years namely 2014 and 2016 by using two step and four step transitional probabilities respectively. The one step transitional probabilities are used with n step transitional probabilities to predict the export shares for 'n' years from the present. These 'n' step transitional probabilities indicate the possibility that exports will switch over from one country to another country and also helps to understand the probability of import loyalty of a country after 'n' years from the present.

The export share of Indian groundnut kernel HPS is predicted to be highest (46.65%) to Malaysia. The export shares to Malaysia, Indonesia and Ukraine are expected to rise but India's share to UK and America is expected to fall by 2016 as can be seen from table 6. In case of groundnut in shell HPS, India's export shares to Sri Lanka and Indonesia is expected to rise by 2016. Indonesia will be the major importer of groundnut in shell HPS by the mid of this decade. However, the share of Nepal, Singapore, Philippines, Malaysia and others is expected to fall by 2016.

Table 6: Projected Export Shares of Indian Groundnut to Major Importing Countries (Percentages)

Groundnut Kernel HPS								
Year	Singapore	Ukraine	America	UK	Philippines	Malaysia	Indonesia	Others
2014	2.53	2.95	1.21	6.73	7.77	15.94	46.65	16.24
2016	2.53	2.96	1.18	6.72	7.70	15.84	46.88	16.19
Groundnut in Shell HPS								
Year	Nepal	Sri Lanka	UK	Singapore	Philippines	Malaysia	Indonesia	Others
2014	0.51	0.86	0.27	4.47	2.95	13.35	73.89	3.70
2016	0.50	0.87	0.27	4.40	2.89	12.88	74.61	3.58

4. Conclusion and Policy Implication

There has been a shift in importers of Indian groundnut over period of time. While UK and Netherlands used to be one of the major importers of Indian groundnut in pre-liberalization period, their share has been declining in the post WTO period. The high standards of level of aflatoxin fixed by European Union and Netherlands and inability of Indian exports to meet their standard have resulted in India losing these major markets. Now India exports most its groundnut to East-Asian countries like Malaysia and Indonesia as these countries are not so particular about aflatoxin content. While in short run our policies should aim to broaden our markets and capture markets where India's export shares are likely to increase, in long run India should aim towards quality production so as to meet the requirements of international market.

European Union, Indonesia, Canada, Singapore, Malaysia and Philippines are the five largest net importers of groundnut. India's export share to UK for both types of groundnut exported is expected to decline by the end of the decade. Though India's export shares to Indonesia are considerably high, they are also likely to decline by the end of the decade. India should strive to improve its export shares to these two major importers by improving upon the quality of groundnut exported, especially by having a check on the aflatoxin content and also by improving the productivity which is much below the world average. Besides, in order to avoid dependency on a single market, there is a need to identify the consumer preferences of the new markets where India's export shares are likely to increase with time like Malaysia, Philippines, Sri Lanka, Egypt, Poland and Singapore.

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