

Performance of Growth, Instability and Comparative Advantage in Export of Fruits and Vegetables from India

Jitendra Suman^{1*}, Prem Singh Shekhawat¹, Sonu Jain¹ and Devendra Kumar Verma²

¹Department of Agricultural Economic, SKNAU, Jobner, Jaipur, Rajasthan, India

²Department of Agricultural Economic, MPUAT, Udaipur, Rajasthan, India

*Corresponding author: jitendrasuman003@gmail.com

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ABSTRACT

This paper attempts to examine the performance including the growth, instability and comparative advantage in export of fresh fruits and fresh vegetables from India. This study was based on secondary data for the period 2001-02 to 2019-20. The study revealed that the compound growth in export value of fruits and vegetable was found to be 7.09 and 9.84 per cent per annum. Both fruits as well as vegetables were showed medium degree of instability of 12.48 and 17.88 per cent during the study period. Among the major destination UAE was the largest market for Indian fruit export that registered highest growth of 13.37 per cent per annum. In case of vegetables Qatar reported highest growth in export at 21.88 per cent per annum. Both destinations for fruit and vegetables' exports revealed significant growth at 1 per cent level of significance. The results also showed that estimated values of revealed comparative advantage (RCA), in export of fruit and vegetables were found to be less than unity with negative values of revealed symmetric comparative advantage (RSCA), during whole study period. It indicated that India had comparative disadvantage among the major exporters of fruits and vegetables.

Keywords: Fruits, Vegetables, Growth rate, Instability, RCA and RSCA

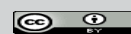
The geographical location with good logistic and suitable climate placed India in a favorable position for growing a variety of fruits and vegetables around the year. It ranks second in fruits and vegetable production in the world, after China. As per National Horticulture Database (Second Advance Estimates) published by National Horticulture Board, during 2020-21, India produced 102.48 million metric tonnes of fruits and 200.45 million metric tonnes of vegetables. The area under cultivation of fruits stood at 9.6 million hectares while vegetables were cultivated at 10.86 million hectares. According to FAO (2021), India is the largest producer of ginger

and okra among vegetables and ranks second in the production of Potatoes, Onions, Cauliflowers, Brinjal, Cabbages, etc. Amongst fruits, the country ranks first in the production of Bananas (26.45%), Mangoes (including mangosteens and guavas) (43.80%) and Papayas (39.30%).

The vast production base offers India tremendous opportunities for export. Despite this advantage,

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India's share in the global market is negligible and accounts for only 1.7 per cent of the global trade in vegetables and 0.5 per cent in fruits (Thulasiram, 2020). During 2021-22, India exported fresh fruits and vegetables worth 1679.06 USD Millions which comprised fruits worth 876.40 USD Millions and vegetables worth 802.66 USD Millions. The processed fruits and vegetables exported to be 1202.89 USD Million which comprised of processed vegetables USD 425.66 million and processed fruits and juices USD 777.23 million in 2021-22. Grapes, Pomegranates, Mangoes, Bananas, and Oranges account for the larger portion of fruits exported from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes, and Green Chilly contribute largely to the vegetable export basket. Major destinations for the Indian fresh fruits and vegetables are Bangladesh, UAE, Nepal, Netherland, Malaysia, Sri Lanka, the UK, Oman and Qatar. In case of processed fruits and vegetables major destinations are USA, UAE, China, Netherland, UK and Saudi Arab.

Over time the horticultural crops emerged as an important driver of growth and their share in overall growth of agriculture increased to 60 percent in the first decade of the 21st century. The horticulture sector has witnessed a tremendous growth as a result of investment through National Horticulture Mission (NHM) and a number of other programmes (Singh and Toppo, 2010). The horticulture sector is strongly believed to be the future for agriculture through fruits and vegetables export. The major concern during policy making is much oriented towards economic and political risks as the farmers of the country are heavily dependent on local markets and industries. All India Technology of Horticultural Crops had identified the problems in fruits and vegetables which discouraged the farmers from undertaking large scale cultivation of fruits (Navadkar, 2004). The fresh fruit export from India is very small owing to a number of constraints and any solution would lead to realization of vision to the enhancement of exports in the near future (Chandra and Kar 2006). The composition, volume, and direction of this trade have changed as incomes and insistence on quality have grown on the demand side, while technology and trade agreements have influenced the supply side (Chand *et al.* 2001).

MATERIALS AND METHODOLOGY

The study was based on the secondary time series data on export value, which was compiled from the various public sources *viz.* official websites of Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce and Industry- Director General of Foreign Trade (DGFT), Directorate General of Commercial Intelligence and Statistics (DGCIS), Ministry of Agriculture & Farmer Welfare, Food and Agriculture Organization (FAO) Rome, Italy, UN Comtrade Database of India and other for the period from 2001-02 to 2019-20.

In this study to analyze the growth rate and instability, major destinations were identified, for exports of fruits and vegetables which altogether accounted more than 70 per cent share in India's total exports for each commodity. Further comparative advantage in exports of fruits and vegetables from India and other top exporting countries were worked out and compared India's comparative advantage with those of major exporting countries for the years 2001-02, 2007-08, 2013-14 and 2019-20. These countries were selected based on their value of exports of the respective commodities to the global market. The exercise is immensely valuable as it help in identifying the commodities for which India has a comparative advantage and also leaves room for introspection for India, as the world adjusts itself to changing scenario of international trade.

1. Growth rates analysis

The compound growth rates (CGRs) of export of fruits and vegetable products from India was calculated by using the exponential function of the following specification (Dhakre and Bhattacharya, 2013):

$$Y_t = ab^t U_t$$

By taking logarithms on both sides, the equation takes the form.

$$\text{Log } Y = \text{Log } a + t \text{ Log } b + \text{Log } U$$

Where,

Y_t = Dependent variable (exports value)

t = Time (Independent variable $t = 1, 2, \dots, n$)

a = Intercept and

b = Regression coefficient

U_t = Error terms with usual assumptions

Compound growth rate was worked out as follows:

$$C.G.R. (r) = [(antilog of \log b) - 1] \times 100$$

Students 't' test was used for testing the significance of growth rates.

Instability analysis

Cuddy Della Valle Instability Index Cuddy and Valle (1978) created the Cuddy- Della Valle index to measure the instability in time series data that was characterised by trend. The co-efficient of variation was calculated using the expression to investigate the stability in exports of fruits and vegetables. The Cuddy Della Valle Index was used to measure the instability in this study. The Cuddy Della Valle index de-trends the given series first, indicating the direction of instability. The use of the coefficient of variation as a measure of instability in time series data has significant drawbacks. If the time series data show any trend, the variation assessed by coefficient of variation can be overstated, i.e., if coefficient of variation is used to quantify instability, the exports which increases with at a constant rate will score high in instability. In contrast, the Cuddy-Della Valle index uses coefficient of determination to de-trend the coefficient of variation.

The coefficient of variation (CV) is a statistical measure of data points' dispersion around the mean in a data series. The coefficient of variation is a useful statistic for assessing the degree of variation between two data series, even if the means are radically different. It indicates the ratio of the standard deviation to the mean.

The magnitude of instability in export of fruits and vegetables was worked out by using the following methods:

The Instability Index (I_x) was measured as follows:

$$Instability\ Index\ (I_x) = CV \sqrt{1 - AdjR^2}$$

Coefficient of variation (C. V) was calculated as follows:

Coefficient of Variation (C.V) =

$$\frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (\bar{X})} \times 100$$

$$CV = \frac{\sqrt{\frac{\sum (X - \bar{X})^2}{N}}}{\bar{X}} \times 100$$

Where,

Adjusted = Coefficient of determination

N = No. of observations

The magnitude of the instability index was explained under the following range accordingly Cuddy Della Valle Instability Index:

Low Instability = between 0 to 15 Per cent

Medium Instability = greater than 15 and lower than 30 Per Cent

High Instability = greater than 30 Per Cent

Comparative advantages in fruits and vegetables export

The concept of comparative advantage was first developed by the classical economist David Ricardo (1817) building on Adam Smith's (1776) principle of absolute advantage. According to this theory, if a country has comparative advantage in production of a good over another country it means that its opportunity cost of production are relatively lower than in the other country.

Neo-classical economists Eli Heckscher (1919) and Bertil Ohlin developed the idea of comparative advantage in a model based on differences in resource endowments. However, it is well known that measuring comparative advantage and testing the Hecksher-Ohlin theory have some difficulties since relative prices under autarky are not observable. Given this fact, Balassa (1965) proposed that it may not be necessary to include all constituents effecting country's comparative advantage. Instead, Balassa suggests that comparative advantage is "revealed" by observed trade patterns. Comparative advantage

from observed data is named “revealed” comparative advantage (RCA). In practice, this is a commonly accepting method for analyzing trade data. The Balassa index tries to identify whether a country has a “revealed” comparative advantage rather than to determine the underlying sources of comparative advantage. Since then, methodology proposed by Balassa is most often used in empirical studies of specialization and comparative of countries, including India.

To analyze the Comparative advantages, Balassa’s index of Revealed Comparative Advantage was used. The Revealed Comparative Advantage technique is a measure for identify the international trade specialization in extent to which a country has a comparative advantage in a commodity with respect to another country or group of countries. A country’s comparative advantage is “revealed” by the value of RCA, if RCA is more than unity, then the country has a comparative advantage and there is scope of agricultural trade between India and other countries of the world.

The original index of RCA was first formulated by Balassa, 1965 and it was computed as:

$$B = \frac{(X_{ij} / X_{ik})}{(X_{nj} / X_{nk})}$$

Where,

$B = RCA$

X_{ij} = Exports of country ‘i’ of commodity ‘j’

X_{ik} = Exports of country ‘i’ of a set of commodities ‘k’

X_{nj} = Exports of a set of countries ‘n’ of commodity ‘j’

X_{nk} = Exports of a set of countries ‘n’ of a set of commodities ‘k’

Hence, country ‘i’ refers to India, commodity ‘j’ refers to any of the selected commodities, set of commodities ‘k’ refers to total exported commodities and set of countries ‘n’ refers to world.

Further, revealed symmetric comparative advantage suggested by Dalum *et al.* (1998) was also calculated, because of RCA suffers from the problem of asymmetry as ‘pure’ RCA is basically not comparable on both sides of unity, as the index ranges from zero to one, if a country is said not to be specialized in a

given sector, while the value of the index ranges from one to infinity, if a country is said to be specialized.

Revealed symmetric comparative advantage (RSCA) was used in following formula:

$$RSCA = (RCA - 1) / (RCA + 1)$$

Since, this method measures the ranges between -1 and +1 and indicates the free from the skewness problem.

RESULTS AND DISCUSSION

Growth rate and Instability Export of Fruits

The establishment of World Trade Organization international trade in fruits and vegetables has increased rapidly than other agricultural commodities. Relatively low quantity was exported before 1994-95. So far, trade in fruits and vegetables has well globalized and large volume are traded around the world. Pomegranates, grapes, bananas, mangos and citrus fruits were most exported fruits from country. It is revealed from the table 1; Exports of fruits from India to the world grew at 7.09 per cent per annum during the study period 2001-02 to 2019-20. UAE was the largest market for Indian fruit which registered highest and significant growth of 13.37 per cent per annum. Only exports to USA Exhibited negative and insignificant rate of -3.60 per cent per annum, due to USA was shifted its import from India to other competitors like Mexico, Chile, and Peru etc. however pesticide residual content is major issue for export of fruits from India.

Table 1: Growth rate and instability in exports of fruits from India (2001-02 to 2019-20) (Value terms)

Sl. No.	Destination	CAGR (In per cent)	Instability (In per cent)
1	UAE	13.37**	22.16
2	Netherland	6.74**	15.05
3	Saudi Arab	10.69**	16.84
4	USA	-3.60	26.46
5	Japan	8.66**	12.24
6	UK	3.51**	13.40
7	Bangladesh	7.22**	29.87
8	World	7.09**	12.48

** Significant at 1 per cent level of significance.

Other destinations viz-Netherland, Saudi Arab, Japan, UK and Bangladesh exhibited positive and highly significant growth at 1 per cent level. Exports to the world were found to be stable (7.9 per cent). India has a geographically advantage of its diverse and conducive climatic conditions for cultivation of fruits (Larson *et al.* 2004; Gheetha, 2007; Kashish and Dhawan, 2017).

Growth Rate and Instability Export of Vegetables

Around 80 per cent of India's vegetables were exported to various Asian markets like UAE, Bangladesh, Nepal, Malaysia, Sri Lanka, Saudi Arab and Qatar during the study period 2001-02 to 2019-20. The major exported vegetables from India were fresh potatoes, tomatoes, onion, garlic, cabbage, cauliflower and certain roots & tubers.

Table 2: Growth and instability in exports of vegetables from India (2001-02 to 2019-20) (Value terms)

Sl. No.	Destination	CAGR (In per cent)	Instability (In per cent)
1	UAE	9.75**	20.43
2	Bangladesh	5.05**	32.28
3	Nepal	20.26**	41.46
4	Malaysia	7.18**	25.19
5	Sri Lanka	7.76**	24.57
6	USA	5.72**	33.03
7	Saudi Arab	10.13**	15.90
8	Qatar	21.88**	15.54
9	World	9.84**	17.88

** Significant at 1 per cent level of significance.

Table 2 indicated that all the destinations registered positive and highly significant growth at 1 per cent level of significance during the study period. The highest growth of 21.88 per cent was observed in exports to Qatar followed by Nepal 20.26 per cent. Remaining selected countries' annual compound growth was found to ranged from 5 to 10 per cent for the exports of vegetables. Nepal, USA and Bangladesh were showed high degree of instability of 41.46, 33.03 and 32.28 respectively. Other destinations registered moderate degree of instability of 15 to 25 per cent. The estimated growth rate of vegetables exports to overall world was registered at 9.84 per cent with medium degree of instability

of 17.87 per cent. It was indicated that Asia was the stable markets for Indian vegetables exports. India has a huge potential for export of fresh vegetables in other countries. The similar trend was observed by Hazari and De (2015) and Mohandas *et al.* (2018).

Comparative advantage in exports of fruits

RCA and RSCA estimates of fruits for the India and various competing countries are given in Table 3. This table indicated that, in all the study periods, the RCA values were found to be less than unity and also suggest a comparative disadvantage for Indian and USA fruits exports. The estimated values of RCA for India ranged from 0.34 to 0.37, during the various years under consideration and it was never showed any signs of notable improvement. Further the very low export performance ratio or RCA, (<1) and negative value of revealed symmetric comparative advantage (RSCA) indicated that fruits was not export competitive in case of India and USA. The above findings were in line with Chhabi *et al.* (2012). The exports from Netherland were not very competitive but indicate marginally recoveries in later years. In comparison to other countries, Spain was better off with comfortable level of comparative advantage. However, there was a downward movement over the period. Mexico and China were found to be little advantage during the whole study periods (Bhattacharyya 2014).

Table 3: Value of RCA and RSCA for exported fruits from India and other major countries

Country	Year			
	2001-02	2007-08	2013-14	2019-20
Balassa RCA				
India	0.34	0.31	0.25	0.37
USA	0.95	0.87	0.94	0.82
Spain	2.77	2.53	2.49	2.10
Mexico	1.35	1.45	1.39	1.53
Netherland	0.68	0.89	0.93	1.00
China	0.87	1.59	1.77	1.75
RSCA				
India	-0.49	-0.53	-0.60	-0.46
USA	-0.03	-0.07	-0.03	-0.10
Spain	0.47	0.43	0.43	0.36
Mexico	0.15	0.18	0.16	0.21
Netherland	-0.19	-0.06	-0.04	0.00
China	-0.07	0.23	0.28	0.27

Comparative advantage in exports of vegetables

Table 4 shows that India had experienced a comparative disadvantage in the fresh vegetables exports sector during the entire study periods. It was also reported that USA was also passed through a similar condition with its all RCA values which were less than unity throughout the study period under consideration. The values of revealed symmetric comparative advantage (RSCA) were also reported negative viz., -0.21, -0.22, -0.31 and -0.19 for the years 2001-02, 2007-08, 2013-14 and 2019-20 respectively of Indian vegetables exports. The vegetable exports from China, Netherland, Mexico and Spain were found competitive during the study period. These similar findings of study were reported by Vanitha et al. (2014). If a commodity had a comparative advantage then it means that the share of this country exports is increasing in the world total share, but this commodity might not be export competitive in price terms. Thus it means that the high delivery cost impacts the competitive of our fresh fruits and vegetables, due to this commodities in which we might have comparative advantage lose in the world market due to high costs of delivery. The best examples for this were onion and mango. Quality problems and policy barriers Indian exporters have to face an important impediment which significantly erodes the production cost advantage enjoyed by Indian farmers (Aneja, 2017).

Table 4: Value of RCA and RSCA for exported vegetables from India and other major countries

Country	Year			
	2001-02	2007-08	2013-14	2019-20
Balassa RCA				
India	0.65	0.64	0.53	0.53
China	2.39	3.136	3.26	3.12
Netherland	1.48	1.50	1.46	1.49
Mexico	5.47	5.30	5.32	4.74
Spain	3.64	3.23	2.78	2.68
USA	0.68	0.58	0.57	0.53
RSCA				
India	-0.21	-0.22	-0.31	-0.19
China	0.41	0.52	0.53	0.52
Netherland	0.19	0.20	0.19	0.20
Mexico	0.69	0.68	0.68	0.65
Spain	0.57	0.53	0.47	0.46
USA	-0.19	-0.27	-0.27	-0.31

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