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Growth and Instability of Exports of Vegetable Products from India

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ABSTRACT

The study examined the growth and instability of vegetable products exports from India during 1996-97 to 2019-20. The results indicated positive and significant growth rates of Indian export for all the vegetable products under study for both the periods and also for the overall period. During overall period, onion fresh and cucumber registered positive and significant growth rates both in terms of export quantity and export value. However, export price of all the products declined significantly during the period of study. In terms of export quantity and value of vegetable products, none of the product showed low instability during the entire study period. In case of export price, low to medium instability was observed in majority of the vegetable products. By analyzing the growth and instability parameters during overall period none of the countries reported to have desirable situation of high growth with low instability in case of export quantity, value and price of vegetable products. The trade liberalization after the entry of WTO led to increase in competition between the countries which resulted into higher instability in the export of products.

Highlights

◉ It was concluded that rate of growth in export of vegetable products were found significant for all study period.
◉ None of the vegetable was found to be stable in the export during the entire period of study.

Keywords: Vegetable products, export, growth rate, instability index, risk assessment

India is considered as the fruit and vegetable basket of the world. It being a residence of wide variety of fruits and vegetables, holds a unique position in production figures among all the countries. The country has witnessed incredible progress in vegetables production, especially during the post green revolution period. Potato, tomato, onion, cabbage and cauliflower account for around 60% of the total vegetable production in the country. Per capita availability of vegetables in India is 400 gm/person/day, which helps in fighting malnutrition Sahni and Kumari (2019). India is the second largest producer of vegetables next only to China with an estimated production of 187.5 million tonnes, from an area of 25.87 million hectares in the year 2018-19 NHB (2019).

The vegetables are important food crops playing greater role in food trade in India. India's diverse climatic conditions ensure availability of all varieties of fruits and vegetables for consumption throughout the year. Moreover, in India, where 20 per cent of the population is vegetarian, the need of fruits and vegetables in our diet is evident Neeraj *et al.* (2017).

Total vegetable exports from India accounted for ₹ 5419 crore during 2018-19, sharing 2.25 per cent of total agricultural exports and 0.23 per cent of total national exports CACP (2020). India accounts nearly

16 per cent of the world production of vegetables and the productivity of vegetables in India is 17.3 t/ha, which is less than the world average productivity of 18.8 t/h IIVR (2020). During 2018-19, India exported 3.33 million tonnes of vegetable products worth 5679 crore NHB (2019). This study aims to examine the growth and instability of export of vegetable products from India after the establishment of WTO.

Among various states in India, Uttar Pradesh (17%), West Bengal (16%), Madhya Pradesh (10%), Bihar (10%), Gujarat (7%), Maharashtra (7%), and Odisha (5%) are the major vegetables growing states NHB (2019). The major exporters of vegetable products (based on export value) in the world are USA, Japan, Germany, France, UK, Belgium and Netherland (FAO, 2020).

MATERIALS AND METHODS

The study is based on the time series data on export quantity, value and price which were compiled from the various public sources *viz.* Agricultural and Processed Food Products Export Development Authority (APEDA), Export–Import data of India and Director General of Foreign Trade (DGFT) for the period from 1996-97 to 2019-20. The data were categorized into three periods, *viz.* Period I (1996-97 to 2007-08), Period II (2008-09 to 2019-20) and overall period (1996-97 to 2019-20).

Based on quantity of average share of export of different vegetable products, 7 major vegetable products *viz.* (1) Onion fresh or chilled, (2) Onion dried/sliced/broken/ powder, (3) Potato other than Seed (fresh or chilled) (4) Cucumber prepared or preserved, (5) Cucumber provisionally preserved, (6) Tomato fresh or chilled, (7) Tomato Ketchup & sauces were selected for the analysis.

The compound growth rate was obtained by fitting a straight line to the logarithms of the data and estimating the slope of the line (Acharya *et al.* 2012), as given below:

Compound growth rate

The compound growth rates (CGRs) of export of vegetable products from India was calculated by using the exponential function of the following specification:

$$Y_t = ab^t \qquad \ldots(1)$$

Where,

Y_t = Dependent variable (Export quantity/ export value); t = Time variable in years taking the value of 1, 2, 3,..., n; a = Intercept; b = Regression coefficient $(1 + r)$.

For the purpose of estimation, the equation is expressed in logarithmic form.

$$Log\ Y_t = Log\ a + t\ log\ b \qquad \ldots(2)$$

The value of log b in equation (2) was computed using the formula,

$$Log\ b = \frac{\left(\sum t\ Log\ Y - \left(\sum t \sum Log\ Y / N\right)\right)}{\sum t^2 - \left(\dfrac{\sum t^2}{N}\right)} \qquad \ldots(3)$$

Where,

N = Number of years.

Subsequently, the compound growth rate (%) was computed using the formula,

Compound growth rate (r) = [(Antilog of log b) $-$ 1]* 100 $\qquad \ldots(4)$

Student 't' test was used to determine the significance of the growth rates obtained for which, the following formula was employed,

$$t = Log\ b/SE(Log\ b) \qquad \ldots(5)$$

$$Log\ (B) = \sqrt{\frac{\sum\left(Y - \overline{Y^2}\right)^2 - Log\ b *\left(\sum(Y*t) - \sum(Y)*\overline{t}\right)}{(N-2)\sum\left(t - \overline{t}\right)^2}} \qquad \ldots(6)$$

The calculated 't' values, from equation (6), was compared with the table 't' values and the level of significance was tested for 1 and 5 per cent, probability levels.

Instability analysis

In order to study variability in export trade of vegetable products, an index of instability index was used as a measure of variability. The coefficient of variation (CV) was calculated by using the following formula:

$$CV(\%) = S/\ \overline{X} *100 \qquad \ldots(7)$$

The tendency factor was tested for its consequence. Whenever, the tendency factor was found to be noteworthy, the dissimilarity around the tendency rather than variation around mean was used as an index of instability. The formula suggested by Cuddy and Della (1978) was used to calculate the notch of dissimilarity around the tendency.

$$Ix = CV \sqrt{\left(1 - \overline{R}^2\right)} \qquad \ldots(8)$$

Where, Ix is Instability Index, CV = Coefficient of variation, R^2 = Adjusted coefficient of multiple determination.

According to Das *et al*. (2016) for assessment of risk factor in growth rate there are range between (0 to >10) which are likely as; Low growth rate (0 to 5), Medium growth rate (>5 to 10) and High growth rate (>10).

According to Sihmar, (2014) for assessment of risk factor in instability analysis there are range between (0 to >30) which are likely as; Low instability (0 to 15), Medium instability (15 to 30) and High instability (>30).

RESULTS AND DISCUSSION

Commodity-wise growth rates of vegetable products

It can be seen form Table 1 that the growth rates of quantity and value of vegetable products exported were positive and significant during both the periods as well as in the overall period, except in case of the export quantity of cucumber and tomato fresh or chilled during Period-II.

Further, it can be revealed that per unit export price of onion fresh or chilled, cucumber, tomato fresh as well as tomato ketchup increased significantly during Period-II. The rosy picture of these commodities should be taken into consideration by the exporters and policy makers. Similarly, probable reasons for significant decline in per unit price of onion dried/sliced/broken/powder and potato other than seeds (fresh or chilled) during the entire period of study should be explored.

It can also be observed from the results that the compound growth rates of onion fresh or chilled export from India during Period-I were found positive and highly significant in case of

quantity (15.72%) and value (17.88%), while it was negative (-1.31%) for export price. During Period-II, export quantity (0.68%), export value (4.30%) and export price (3.59%) of onion fresh or chilled were positively significant at 1 per cent level of significance. The increase in growth of price in Period-II may be due to decrease in export quantity to meet risen domestic demand. During Period-III, the pattern of the compound growth rate was similar to the pattern as observed in Period-I. The compound growth rate of quantity (8.69) and value (15.02%) observed positive and highly significant. while, negative growth rate was observed in export price (-1.55%).

The annual compound growth rates of exports of onion dried/sliced/broken/powder reported positive and significant in case of both export quantity (24.54%) and export value (21.78%), but the rate of export price (-5.26%) showed a negative growth during Period-I. The similar pattern was observed during Period-II, where the positive growth rate in both export quantity (5.45%) and export value (11.38%) noticed significant. But the export price (-2.04%) showed a negative growth rate. During overall period, growth rate in export quantity (13.28%) found positive and significant, but in case of export value (19.21%), it was non- significant, whereas for export price, the growth rate (-2.10%) was negative.

The results of annual compound growth rates of export of potato other than seeds depicted a positive trend in both export quantity (19.11%) and export value (18.46%) and found significant at 10 per cent level of significance, whereas growth rate of export price (-3.65%) was negative during Period-I. During Period-II, it also registered positive growth rate in both export quantity (10.36%) and export value (18.09%) but the growth rate was negative in case of export price (-0.75%). During overall period also, it registered positive growth rate in both export quantity (17.41%) and export value (23.86%) whereas, negative growth rate was realized for export price (-1.87%). In all the periods, export quantity and export value had positive growth, but export price witnessed negative growth. Kavita *et al*. (2015) also observed similar trend in their study on mango export from India. The results of cucumber prepared or preserved reflects a positive and significant growth in both export quantity (26.12%)

Table 1: Commodity-wise growth rates of major vegetable products export from India

Sl. No.	Export Commodities	Period-I (1996-97 to 2007-08)		Period-II (2008-09 to 2019-20)		Overall (1996-97 to 2019-20)	
		Study period					
		CGR (%)	SE	CGR (%)	SE	CGR (%)	SE
1	**Onion fresh or chilled**						
	Export quantity	15.72***	0.3013	0.68***	0.2865	8.69***	0.3773
	Export value	17.88***	0.2645	4.30***	0.2405	15.02***	0.3606
	Export price	-1.31***	0.2083	3.59***	0.2269	-1.55***	0.1966
2	**Onion dried/sliced/broken/powder**						
	Export quantity	24.54***	0.2483	5.45***	0.2560	13.28**	0.5392
	Export value	21.78***	0.2936	11.37***	0.3223	19.21	0.7392
	Export price	-5.26***	0.2262	-2.04***	0.1519	-2.10***	0.2155
3	**Potato other than seeds (fresh/chilled)**						
	Export quantity	19.11*	0.5987	10.36***	0.2852	17.41	0.9683
	Export value	18.46*	0.6523	18.09**	0.4790	23.86	1.2626
	Export price	-3.65***	0.1372	-0.75***	0.2497	-1.87***	0.2326
4	**Cucumber prepared or preserved**						
	Export quantity	26.12***	0.1734	-4.79***	0.1676	9.87***	0.3846
	Export value	26.43***	0.2095	4.92***	0.2343	16.36*	0.6134
	Export price	-2.88***	0.1330	2.22***	0.1402	-1.48***	0.1694
5	**Cucumber provisionally preserved**						
	Export quantity	15.67***	0.2302	-2.32***	0.2708	6.12**	0.3962
	Export value	17.36***	0.2639	6.59**	0.3547	12.14**	0.4701
	Export price	-1.71***	0.1230	1.22***	0.1330	-1.70***	0.1515
6	**Tomato fresh or chilled**						
	Export quantity	57.22**	0.6623	-5.69	0.7527	30.68	1.0452
	Export value	64.39**	0.6404	1.90	0.8232	39.60	1.3399
	Export price	1.29***	0.2330	0.22***	0.1576	-0.61***	0.1972
7	**Tomato Ketchup or sauce**						
	Export quantity	8.22	0.7696	2.47*	0.5099	14.40	0.9403
	Export value	13.18*	0.5964	10.81**	0.4127	20.32	1.0511
	Export price	1.31***	0.3166	0.30***	0.2582	-2.16***	0.3147

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

2. CGR - Compound Growth Rate and SE- Standard Error

3. Nominal export values (₹ lakh) were deflated using WPI of the base year 2011-12.

4. (Export quantity in tonnes, Export value in ₹ Lakh, Export price in ₹ Lakh/MT

and export value (26.43%) whereas, negative growth rate for export price (-2.88%) were observed during Period-I. During Period-II, it registered negative growth rate in export quantity (-4.79%) whereas, the growth rate was positive and highly significant in both export value (4.92%) and export price (2.22%). The higher growth rate in both export volume and export value were noticed during Period-I and Overall period, but in Period-II, it declined significantly due to tough competition faced by Indian exporters in international market and also due to significant increase in domestic production of cucumber prepared or preserved. During the overall period, it also registered positive and significant growth rate in both export quantity (9.87%) and export value (16.36%). Whereas, export price(-1.48%) registered a negativelysignificant growth rate.

The pattern of the compound growth rate of

cucumber provisionally preserved was similar to the pattern of cucumber prepared or preserved as observed in all the periods. Similar growth pattern was observed during Period-I and Overall period, whereas negative growth rate was realized for export quantity during Period-II.

The results of annual compound growth rates of export of tomato fresh or chilled observed a positive and significant trend in export quantity (57.22%), export value (64.39%) and export price (1.29%) during Period-I. During Period-II, it registered a negative growth rate in export quantity (-5.69%), whereas, the growth rate was positive in both export value (1.90%) and export price (0.22%) and the export price was significant at 1 per cent level of significance. During Overall Period, it registered positive growth rate in both export quantity (30.68%) and export value (39.60%), whereas, export price (-0.61%) registered significantly declining rate.

Tomato Ketchup or sauce registered a positive growth rate in export quantity (8.22%), export value (13.18%) and export price (1.31%). Which were significant respectively at 10 and 1 per cent, level of significance during Period-I. During Period-II, positive and significant growth rate was observed in

export quantity (2.47%), export value (10.81%) and export price (0.30%). But in Period-II, the growth rate was found decreased in export quantity (2.47%). This may be due to increase in demand in domestic area. During overall period, the positive growth rate was observed for export quantity (14.40%) and export value (20.32%) and export price was declined significantly at the rate of -2.16 per cent per annum. These results are in conformity with the findings obtained by Karthick *et al.* (2015) in their study on export of Ginger from India.

Instability analysis in export of major vegetable products

The results showed that all vegetable products exports, registered high instability except onion fresh or chilled (export quantity) during Period-I. The instability in vegetable products export quantity was higher in Period-II as compared to Period-I. In case of export price, the instability ranged from 13.06 to 30.15 during Period-I (Table 2).

During Period-II, the instability in export quantity, value and price, respectively ranged from the 13.78 to 66.09, 23.10 to 70.94 and 13.18 to 39.54. During overall period, the instability in vegetable products'

Table 2: Instability analysis of vegetable products export from India

Sl. No.	Commodities	Study period					
		Period-I (1996-97 to 2007-08)		Period-II (2008-09 to 2019-20)		Overall (1996-97 to 2019-20)	
		C.V(%)	CDV(%)	C.V(%)	CDV(%)	C.V(%)	CDV(%)
1	**Onion fresh or chilled**						
	Export quantity	57.22	27.84	28.56	28.56^	56.43	32.67
	Export value	70.84	36.20^	27.36	23.66	77.97	32.10
	Export price	19.60	19.60	49.28	39.54	68.58	43.08
2	**Onion dried/sliced/broken/powder**						
	Export quantity	99.27	60.78	28.48	23.66	69.27	31.85
	Export value	91.87	55.22	37.66	24.21	91.51	35.83
	Export price	26.55	20.65	16.21	15.13	25.16	19.94
3	**Potato other than seeds (fresh/chilled)**						
	Export quantity	69.70	38.46	40.26	25.83	88.90	72.47
	Export value	75.43	46.60	71.31	58.12	128.56	100.98
	Export price	20.09	14.79	26.10	26.10	24.55	24.24
4	**Cucumber prepared or preserved**						
	Export quantity	81.31	35.49	20.82	13.78	56.65	40.34
	Export value	82.79	66.30	28.10	23.10	76.79	29.19
	Export price	17.48	14.69	15.84	14.17	20.19	17.30

5	Cucumber provisionally preserved					
	Export quantity	59.47	32.73	25.09	25.08^	47.07	35.49^
	Export value	65.09	35.76	40.49	34.49	75.04	38.52
	Export price	13.98	13.06	13.26	13.18	19.06	14.71^
6	Tomato fresh or chilled					
	Export quantity	209.14	168.92	66.09	66.09	120.62	98.32
	Export value	228.23	189.05	70.94	70.94	131.42	103.23
	Export price	22.94	22.94	15.68	15.68	21.04	20.78^
7	Tomato Ketchup or sauce					
	Export quantity	68.34	67.16	62.94	62.94	105.79	86.34^
	Export value	73.76	57.33^	42.96	34.30	101.20	50.97
	Export price	30.15	30.15	21.71	21.71	34.19	30.86^

Note: *CV- Coefficient of Variation (%), CDV- Cuddy Della Vella Index (%), ^ - Non significant; Export quantity in tonnes, Export value in ₹ Lakh, Export price in ₹ Lakh/MT.*

Table 3: Growth v/s instability of major vegetable products exports from India

	Export quantity	Export value	Export price
LGWHI	—	—	Onion fresh or chilled, Tomato Ketchup or sauce
LGWMI	—	—	Onion dried/sliced/broken/powder, Potato other than seeds (fresh or chilled), Cucumber prepared or preserved, Tomato fresh or chilled
LGWLI	—	—	Cucumber provisionally preserved
MGWHI	Onion fresh or chilled, Cucumber prepared or preserved, Cucumber provisionally preserved	—	—
MGWMI	—	—	—
MGWLI	—	—	—
HGWHI	Onion dried/sliced/broken/powder, Potato other than seeds fresh or chilled, Tomato fresh or chilled, Tomato Ketchup or sauce	Onion fresh or chilled, Onion dried/sliced/broken/powder, Potato other than seeds(fresh or chilled), Cucumber provisionally preserved, Tomato fresh or chilled, Tomato Ketchup or sauce	—
HGWMI	—	Cucumber prepared or preserved	—
HGWLI	—	—	—

Note: *LGWHI = Low growth with high instability, LGWMI = Low growth with medium instability, LGWLI = Low growth with low instability, MGWHI = Medium growth with high instability, MGWMI = Medium growth with medium instability, MGWLI = Medium growth with low instability, HGWHI = High growth with high instability, HGWMI = High growth with medium instability, HGWLI = High growth with low instability.*

export ranged from 31.85 to 98.32, 29.19 to 103.23 and 14.71 to 43.08, respectively in case of quantity, value and price. Tomato fresh or chilled and tomato ketchup or sauce in both export quantity and export value showed high instability. Whereas tomato fresh or chilled and tomato ketchup or sauce are the most unstable commodity in terms of export quantity and export value. During Period I, the lowest instability in terms of export quantity was observed in onion fresh or chilled *i.e.* 27.84 per cent, whereas, 35.76 and 13.06 per cent in cucumber provisionally preserved in terms of export value and export price, respectively.

During Period-II, the lowest instability in terms of export quantity and export value were observed in cucumber prepared or preserved *i.e.* 13.78 and 23.10 per cent, respectively, whereas in case of export price the lowest instability was observed in cucumber provisionally preserved (13.18%). The result are in the line of Das *et al.* (2016) in their study on export of Marine products.

In case of overall period, the lowest instability in terms of export quantity was observed in onion fresh or chilled *i.e.* 32.67 per cent, whereas, the lowest instability in export value and export price were observed in cucumber prepared or preserved and cucumber provisionally preserved about 29.19 and 14.71 per cent, respectively (Table 2).

As furnished in Table 3, it can be observed that in case of export quantity onion fresh or chilled, cucumber prepared or preserved and cucumber provisionally preserved were found in medium growth and high instability. This implies that, none of the product were found in desirable situation of low instability and high growth. In case of export price the majority of the vegetable products were placed into high growth with high instability, which indicates that, none of the vegetable products in any countries were found to be placed in desirable situation during the study period. In case of vegetable products export price Onion fresh or chilled and tomato ketchup or sauce were placed in low growth with high instability, onion dried/sliced/broken/powder, potato other than seeds (fresh or chilled), cucumber prepared or preserved and tomato fresh or chilled were placed in low growth with medium instability, while cucumber provisionally preserved was placed in low growth with low instability, the result indicates that none of the countries reported to have desirable situation of high growth with low instability in case of export price of vegetable products.

CONCLUSION

The analysis of the rate of growth in export of vegetable products revealed that annual compound growth rates of Indian export for all the vegetable products under study were found significant for both the periods and also for the overall period. None of the vegetable were found to be stable in the export during the entire period of study. The main reason for higher instability in vegetable products

price is due to drastic fluctuation in domestic price of vegetable products and hence, export is fluctuated over the time as higher domestic price leads to reduce the competitiveness in international trade. The other reason for high instability in vegetable products exports is due to the establishment of WTO which encouraged the entry of more numbers of countries in international trade. The trade liberalization took place after the entry of WTO led to increase in competition between the countries and because of that, availability of quality products increased at lower price. The policy makers and vegetable products traders should make intensive effort to overcome the bottlenecks in export of vegetable products so as to assume the consistency in world trade of vegetable products.

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