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Instability in Agricultural and Processed Food Products Exports of Punjab

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Abstract

The study devoted to the export instability of Punjab's agricultural and processed food products and its sources for the period 2007-08 to 2020-21 using Cuddy Della Valle Index for estimating export instability and step wise regression for identifying sources of export instability by considering major twenty three categories mentioned in Agricultural and Processed Food Products Export Development Authority (APEDA) . Results confirmed that all the categories of Punjab's agricultural and processed food products exports except cereal preparation are found to be highly volatile during entire study period whereas in recent five years cereal preparation and basmati rice recorded low instability. Concentration of top four categories and instability indices of other fresh vegetables comes out to be two main sources of instability. Thus, it is suggested that necessary steps should be taken to reduce export instability by adding more products to export basket of Punjab's agricultural and processed food products. The other fresh vegetables should be targeted first by providing incentives to farmers for enhancing quality and variety, which further help exporters to find out new markets to reduce variations in export values to mitigate instability in long term.

Key Words: Exports, Instability, Concentration, Agriculture, Processed food, Punjab

JEL Classification: F10, Q17, L66

Introduction

The recent agricultural policy of India aims at "Farmer Centric Approach" which means India needs to adopt such strategy which is farmers oriented to achieve its twin objective of becoming leading exporter of agricultural products and achieving food security. Although Punjab is an agrarian economy and as per the economic survey of Punjab 2020-21, Punjab has not only fought global pandemic successfully and agriculture sector being a predominant sector proved as a positive factor in the overall progress of Punjab. It is known as "food bowl" of India. As per the second edition report of export preparedness index of NITI AAYOG 2021, Punjab has been ranked fourth position in all the landlocked states of India in terms of export readiness, achievements and integrity. It is pertinent to study the various aspects of Punjab's agricultural and processed food products exports because of structural and compositional shift over the years, particularly export instability to address various issues in the long term such as agricultural distress, COVID pandemic and further to help policymakers to promote value added exports and sustainable export ecosystem in Punjab. The identification of extent and sources of export instability also helps farmers to invest in stable, high-value crops, and encourages exporters in Punjab to focus on consistent export crops, thereby promoting investment in agro-processing units. Export instability is defined as "year to year fluctuations in exports figures or mathematically instability refers to expressing the difference of actual and estimated value of exports as a percentage of average value of exports" (Devkota, 2004).

A considerable amount of literature is available on export instability and its sources which advocate strong relationship between concentration and export instability of agricultural exports at national and international exports. Tegene, 1990 examines the relationship between commodity concentration and export instability by taking sample of twenty-nine African countries from 1960 to 1982 and concluded that concentration on major exports may found to be the reason of export instability and its relationship depends on demand and supply conditions, supply chains etc for different countries. Chand and Tewari, 1991 measure the growth and instability of India's agricultural exports and imports from 1970 to 1988 and concluded that India's agricultural imports are stable as compared to agricultural exports. Sarada *et al,* 2006 measure the instability, commodity and geographic concentration of India's seafood exports from 1981-82 to 2003-04 and concluded that India's seafood exports are diversified and stable during entire study period. Malhotra

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and Meenu, 2008; Singh, 2013 examined the instability in India's agricultural exports and concluded that they are highly fluctuating particularly during post liberalization phase as well in recent years. Adhikari and Sekhon, 2014 examined the growth and instability in India's basmati rice and concluded that basmati rice exports registered high growth but with high volatility. Manohar and Udhayan, 2022 analyzed the growth and instability of India's processed vegetables exports and concluded that India's processed vegetable exports are stable in recent decade.

After considering empirical studies, it has been found out that little efforts have been made for measuring instability of agricultural exports and almost there is paucity of studies on processed food products export instability at Indian state level. There is also lack of work on sources of export instability of agricultural and processed food products. Thus, the present study makes an attempt to analyze export instability of Punjab's agricultural and processed food products and its sources for the study period 2007-08 to 2020-21.

Data Sources and Methodology

The study has gone through major 40 categories of Punjab's agricultural and processed food products exports from Agriculture and Processed Food Exports Development Authority (APEDA), Ministry of Commerce and Industry, Govt. of India out of which 23 are taken into consideration based on availability of data and India's total exports data have been extracted from Directorate General of Commercial Intelligence and Statistics (DGCI&S), Govt. of India.

Measures of Instability

As per the literature, there are several indices to measure export instability such as linear trend index (LTI), exponential trend index (ETI), Coefficient of Variation (CV), Cuddy Della Valle Index (CDVI) and Coppock index of instability. The CDVI is considered as most reliable index particularly in case agricultural production and exports because it de trends the time series using coefficient of determination and provides clear picture on extent of instability among agricultural crops regarding their production and exports (Sihmar, 2014; Malhotra and Meenu, 2008). To measure instability in Punjab's agricultural and processed food products exports, the present paper has used two indices- Coefficient of Variation (CV) and Cuddy Della Valle Index (CDVI).

(a) Coefficient of Variation is calculated using the formula given below:

$CV\% = (\sigma/ \bar{x}) \times 100$

Where σ=standard deviation, $\bar{x}$= Mean.

(b) Cuddy- Della Valle Index is calculated by using following formula:

$CDVI = C.V. \times (1 - R^2)^{1/2}$

Where C.V. = Coefficient of Variation

R^2 = ESS/TSS i.e., ratio of explained variation to total variation. ESS = Variation explained by explanatory variable. TSS = Total Variation.

If the values of CDVI lies within 0 to 15 indicates low instability, 15 to 30 indicates medium instability and more than 30 indicates high instability (Sihmar,2014). The CV and CDVI are calculated for Punjab's agricultural and processed food products exports as well as all the categories for all the years of study period i.e., 2007-08 to 2020-21 and for sub periods 2007-08 to 2016-17 and 2016-17 to 2020-21.

Sources of Instability

To estimate the sources of instability of Punjab's agricultural and processed food products exports, yearly export instability index has been calculated as absolute percent deviation of actual value of total commodity exports earning from the estimated values of the same commodities export earnings divided by estimated export earnings using the following formula:

$$I_{AE} = \left| \frac{Xt - \widehat{Xt}}{\widehat{Xt}} \right|$$

Where I_{AE} = instability index of Punjab's agricultural and processed food products exports in year t

Xt = actual value of Punjab's agricultural and processed food products exports

$\widehat{Xt}$ = estimated value of Punjab's agricultural and processed food products exports in year *t* using exponential trend (Love, 1985; Macbean and Nguyen, 1980)

Similarly, instability indices of top four concentrated categories of Punjab's agricultural and processed food products exports for all the years of study period have also been calculated. The concentrated categories have been found by using Concentration Ratio (CR) method by using formula:

$Pit = Qit/Qt \quad i=1, 2....m; \quad t=1, 2, ...T$

Where Pit= percent share of each commodity in exports for the year t, m=23 and T=14

Here CR(4) is calculated by adding the shares of top four concentrated categories of Punjab's agricultural and processed food products exports.

Stepwise regression has been used to fulfil the objective of finding out most significant sources of export instability of Punjab's agricultural and processed food products. As compared to other regression types/techniques stepwise regression is also supported by literature reviewed because very easily it helps in elimination of insignificant explanatory variables. Further, for model suitability and selection of appropriate variables, Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) values have also been checked. The AIC and SIC values are found to be low, which clearly justifies the use of step regression and overcome the limitation of model selection bias. Following are the steps to find out sources of export instability with

the help of stepwise regression:

Step I: Firstly, to identify the sources of export instability, Punjab's agricultural and processed food products exports is taken as dependent variable and concentration ratios of top four concentrated categories of Punjab's agricultural and processed food products exports and instability indices of basmati rice, non basmati rice, cereal preparation, other fresh vegetables, natural honey and alcoholic beverages exports are taken as explanatory variables and regression model has been applied on the following equation-

$$I_{AE} = b_0 + b_1 C_x + b_2 I_{BE} + b_3 I_{NBE} + b_4 I_{CE} + b_5 I_{FE} + b_6 I_{NE} + b_7 I_{ABE}$$

I_{AE} = Instability index of Punjab's agricultural and processed food products exports

C_x= Concentration ratio of top four concentrated categories of Punjab's agricultural and processed food products exports.

I_{BE} = Instability index of basmati rice exports

I_{NBE}= Instability index of non basmati rice exports

I_{CE}= Instability index of cereal preparation exports

I_{FE}= Instability index of other fresh vegetable exports

I_{NE}= Instability index of natural honey exports

I_{ABE}= Instability index of alcoholic beverages exports

Where I_{AE} is dependent variable, I_{CX}, I_{BE}, I_{NBE}, I_{CE}, I_{FE}, I_{NE}, I_{ABE} are independent variables, b0 is intercept and b1, b2, b3, b4, b5, b6, b7 are slope coefficients of predictors.

Step II: To detect multicollinearity among the predictors correlation matrix is used. "The rule of thumb states that if zero order correlation coefficient between two regressors is high or excess of 0.8 then it indicates multicollinearity as a serious problem". The variance inflating factor (VIF) is also checked for all the predictors. A rule of thumb states that if the value of VIF exceeds 10, then it indicates high collinearity among predictors. The predictors which were highly collinear with each other were eliminated (Gujarati, 2009 and Greene,2006).

Step III: Thereafter, as per the procedure of step-wise regression, the predictors that are non- significant in assessing the impact on instability of Punjab's agricultural and processed food products exports, are eliminated one by one and the final equation is obtained.

Results and Discussion

Instability in Punjab's Agricultural and Processed Food Products Exports

As per Table 1, Punjab's agricultural and processed food products exports are instable with CV and CDVI values 35.7 per cent and 35.47 per cent respectively during the whole study period i.e., 2007-08 to 2020-21. The CV and CDVI for Punjab's agricultural and processed food products exports are 42.5 per cent and 37.8 per cent, respectively for sub periods 2007-08 to 2016-17 and 6.6 per cent and 7.4 per cent, respectively during 2016-17 to 2020-21.The CV and CDVI for categories of Punjab's agricultural and processed food products exports as per Table 1are discussed as below:

1) **Floriculture**-The CV and CDVI values for floriculture exports of Punjab are 70.1 per cent and 91.13 per cent during the entire study period respectively which indicates high instability. For the sub period 2007-08 to 2016-17, the CV and CDVI are 132 per cent and 14 per cent respectively which reflects low instability.
2) **Fruit and vegetable seeds**-The CV and CDVI for fruits and vegetable seeds exports of Punjab are 39.9 per cent and 37.9 per cent respectively during the entire study period which indicates high instability. For the sub period 2007-08 to 2016-17 the CV and CDVI are 31.16 per cent and 29.29 per cent respectively, indicates medium instability. During 2016-17 to 2020-21, the CV and CDVI are 62.4 per cent and 63.6 per cent respectively, again indicating high instability.
3) **Fresh Onions**- For the study period 2007-08 to 2020-21, the CV and CDVI for fresh onions exports of Punjab are 112.9 per cent and 97.09 per cent respectively indicates high instability and during sub periods i.e., 2007-08 to 2016-17 and 2016-17 to 2020-21, both the measures are reflecting high instability.
4) **Other Fresh Vegetables**- The CV and CDVI for other fresh vegetables exports of Punjab are 106.2 per cent and 107.04 per cent respectively during the overall study period which indicates high instability. The sub periods i.e., 2007-08 to 2016-17 and 2016-17 to 2020-21 also recorded high instability.
5) **Walnuts** -The CV and CDVI for walnuts exports of Punjab are 59.9 per cent and 41.9 per cent during the entire study period respectively which gives an idea about high instability. For the sub periods 2007-08 to 2016-17 and 2016-17 to 2020-21 also the values of CV and CDVI reflect high instability.
6) **Other fresh fruits**- The CV and CDVI for fresh fruits exports of Punjab are 132.7 per cent and 137.7 per cent respectively for the overall study period which indicates high instability. During sub periods i.e., 2007-08 to 2016-17 and 2016-17 to 2020-21 also both the measures are reflecting high instability for fresh fruits exports.
7) **Other (betel leaves and nuts)–**CV and CDVI for others (betel leaves and nuts)exports of Punjab are 92.7 per cent and 95.4 per cent respectively during overall study period i.e., 2007-08 to 2020-21indicates high instability. Both the sub periods that are 2007-08 to 2016-17 and 2016-17 to 2020-21 also experienced high instability.
8) **Processed Vegetables-** In table 1, the CV and CDVI for processed vegetable exports of Punjab are 91.45

Table 1: Coefficient of Variation (CV) and Cuddy Della Valle index (CDVI) of Punjab's agricultural and processed food products exports and its categories (per cent)

Categories/Years	2007-08 to 2020-21		2007-08 to 2016-17		2016-17 to 2020-21	
	CV	CDVI	CV	CDVI	CV	CDVI
Floriculture	70.1	91.13	132.09	141.6	-	-
Fruits and vegetable seeds	39.99	37.99	31.16	29.29	62.47	63.66
Fresh onions	112.9	97.09	104.6	91	170.9	79.81
Other fresh vegetables	106.2	107.04	72.53	66.72	212.6	175.82
Walnuts	59.97	41.9	43.57	40.08	68.56	68.42
Other fresh fruits	132.7	137.7	107.8	76.53	192.1	146.38
Others (betel leaves& nuts)	92.73	95.41	88.2	82.73	98.18	89.83
Processed vegetables	91.45	75.07	78.76	70.41	40.65	42.52
Processed fruits, juices & nuts	60.68	61.95	73.36	74.97	19.91	17.58
Pulses	151.3	152.6	195.7	199.8	75.28	67.30
Buffalo meat	147.8	154.3	200.29	172.1	103.1	125.78
Dairy products	44.23	45.77	47.18	65.1	17.15	18.83
Natural honey	29.84	30.07	304.15	313.27	25.95	25.95
Groundnuts	155.07	156.15	140.52	77.28	155.2	88.62
Guar-gum	153.2	125.16	114.52	46.26	98.16	98.16
Jiggery & Confectionary	51.57	43.93	57.72	30.30	35.24	36.72
Cereal preparation	31.21	21.22	34.55	25.56	11.55	13.25
Milled Products	69.31	67.92	74.05	27.84	38.01	41.77
Alcoholic beverages	80.97	56.67	100.23	37.68	43.06	36.26
Basmati rice	42.74	37.39	53.2	45.2	11.86	9.33
Non basmati rice	107.17	108.56	96.7	102.9	28.86	28.48
Maize	229.86	212.16	21.27	19.2	126.08	138.31
Other cereals	61.8	69.27	55.27	53.05	79.17	88.99
Punjab's agricultural and processed food products exports	35.73	35.47	42.56	37.87	6.62	7.48

Source: Authors' Calculations

per cent and 75.07 per cent respectively for the whole study period which confirms high instability. For sub period, 2007-08 to 2016-17 the values of CV and CDVI reflects high volatility and for recent years i.e., 2016-17 to 2020-21 medium volatility is recorded.

9) **Processed fruits, juices and nuts-**The CV and CDVI for processed fruits, juices and nuts exports of Punjab are 60.68 per cent and 61.95 per cent respectively which indicate high volatility for overall study period i.e., 2007-08 to 2020-21. For the sub period 2007-08 to 2020-21, both the instability measures reflect high instability whereas for sub period 2016-17 to 2020-21, the CDVI reflects medium instability.

10) **Pulses**- TheCV and CDVI for pulses exports of Punjab are 151.3 per cent and 152.6 per cent respectively during the study period i.e., 2007-08 to 2020-21. Both the sub periods 2007-08 to 2016-17 and 2016-17 to 2020-21 also confirmed about high instability.

11) **Buffalo meat-** The CV and CDVI for buffalo meat are 147.8 per cent and 154.3 per cent respectively which reflect high volatility buffalo meat exports in overall study period i.e., 2007-08 to 2020-21. Both the sub periods that are 2007-08 to 2016-17 and 2016-17 to 2020-21 also experienced high instability.

12) **Dairy Products-** The CV and CDVI for dairy products exports of Punjab are 44.23 per cent and 44.7 per cent respectively for the whole study period which confirms medium instability. For sub period, 2007-08 to 2016-17 the values of CV reflect medium volatility and CDVI reflects high instability whereas for recent years i.e.,

2016-17 to 2020-21 CDVI shows medium volatility.

13) **Natural Honey**–The CV and CDVI for natural honey exports of Punjab are 29.84 per cent and 30.07 per cent respectively for the overall study period i.e., 2007-08 to 2020-21 which indicate medium instability. For the sub period 2007-08 to 2016-17, the CV and CDVI measures indicate high instability. For the sub period 2016-17 to 2020-21, both the instability measures indicate medium volatility in natural honey exports.

14) **Groundnuts**-The CV and CDVI for groundnuts exports of Punjab are 155.07 per cent and 156.16 per cent respectively which reflect high volatility for the overall study period. Both the sub periods also recorded high instability.

15) **Guar-gum**- The CV and CDVI for guar-gum exports of Punjab are 153.2 per cent and 125.1 per cent respectively which indicate high instability. As per CDVI index guar gum exports show medium instability but CV reflects high instability for sub period 2007-08 to 2016-17. For recent years 2016-17 to 2020-21, both instability measures indicate high volatility in guar gum exports.

16) **Jaggery and Confectionary**-The CV and CDVI for jiggery and confectionary exports of Punjab are 51.57 per cent and 43.93 per cent respectively for the overall study period i.e., 2007-08 to 2020-21 which indicates high instability. As per the CDVI measure, for both the sub periods, jaggery and confectionary exports show medium but near to high instability.

17) **Cereal Preparation**–For the entire study period, the CV and CDVI for cereal preparation exports of Punjab are 31.21 per cent and 21.22 per cent respectively which indicates medium instability. For the sub period 2007-08 to 2016-17, all measures are reflecting medium instability in cereal preparation exports. In recent years i.e., 2016-17 to 2020-21, the CV and CDVI are 11.55 per cent and 13.25 per cent which shows low instability.

18) **Milled Products**-The CV and CDVI for milled products exports of Punjab are 69.3 per cent and 67.92 per cent for the whole study period respectively which reflects high instability. For the sub period 2007-08 to 2016-17, as per CDVI measure milled products exports show high instability. For recent years i.e., 2016-17 to 2020-21, the exports of milled products have shown medium instability.

19) **Alcoholic Beverages-**For the entire study period, the CV and CDVI for alcoholic beverages exports of Punjab are 80.97 per cent and 56.67 per cent respectively which indicates high instability. For the sub period 2007-08 to 2016-17, the CV indicates high instability whereas CDVI show medium instability. In recent years i.e., 2016-17 to 2020-21, the CV and CDVI are 43.06 per cent and 36.26 per cent respectively which indicates medium instability.

20) **Basmati Rice-** In table 1, the CV and CDVI for basmati rice exports of Punjab are 42.74 per cent and 37.79 per cent respectively during study period 2007-08 to 2020-21 which indicate high instability. For the sub period 2007-08 to 2016-17, the values of CV and CDVI reflect high instability whereas during the sub period 2016-17 to 2020-21, basmati rice exports experienced low instability.

21) **Non Basmati rice-**The CV and CDVI for non- basmati rice exports of Punjab are 107.17 per cent and 108.5 per cent respectively which indicates high instability. For the sub period 2007-08 to 2016-17, both measures are reflecting high instability in non basmati exports. In recent years i.e., 2016-17 to 2020-21, the values of CV and CDVI are 28.86 per cent and 28.48 per cent respectively which reflect medium instability.

22) **Maize-**For the entire study period i.e., 2007-08 to 2020-21, the values of CV and CDVI for maize exports of Punjab are 229.86 per cent and 212.16 per cent respectively which indicates high instability. For the sub period 2007-08 to 2016-17, the values of CV and CDVI reflect high instability. In recent years i.e., 2016-17 to 2020-21, both the instability measures show high volatility.

23) **Other cereals**– During the entire study period, the CV and CDVI for other cereals exports are 61.8 per cent and 69.2 per cent respectively which indicates high instability. For the sub period 2007-08 to 2016-17, the CV and CDVI for other cereals exports are 55.2 per cent and 53.05 per cent respectively which indicates high instability. Also during recent five years i.e., 2016-17 to 2020-21, both the instability measures indicate high instability.

Sources of Instability in Punjab's Agricultural and Processed Food Products Exports

The perusal of Table 2 shows the year wise instability indices of all the explanatory variables which include concentration index of top four concentrated categories during all the years of study period and their instability indices i.e., basmati rice, cereal preparation, other fresh vegetable, natural honey, alcoholic beverages and non-basmati rice. The dependent variable is instability index of Punjab's agricultural and processed food products exports. After checking the values of VIF, the instability indices of basmati rice and cereal preparation exports of Punjab were eliminated because they were highly collinear.

The stepwise regression results to measure the impact of remaining explanatory variables on instability of agricultural and processed food products exports of Punjab have been explained in table 3.

The two explanatory variables i.e. concentration ratio of

Table 2: Year wise concentration and instability of Punjab's agricultural and processed food products exports

Years/ Commodity	Concentration index of top four concentrated categories	Agricultural and Processed food exports instability index	Basmati instability index	Cereal Preparation instability index	Other fresh vegetable instability index	Natural honey instability index	Alcoholic beverages instability index	Non Basmati instability index
2007-08	66.68	17.55	3.20	3.37	10.95	41.41	0.89	27.56
2008-09	72.87	38.41	15.73	13.92	12.31	59.89	0.10	1.74
2009-10	73.82	17.67	6.20	8.48	5.86	47.32	0.54	1.00
2010-11	76.61	20.67	6.22	14.22	0.41	97.61	0.44	1.00
2011-12	75.04	42.50	15.66	22.27	28.71	80.29	1.98	14.60
2012-13	83.31	53.88	24.62	14.96	29.36	64.08	6.49	45.59
2013-14	86.04	66.75	29.84	17.88	50.00	51.91	4.01	54.59
2014-15	86.48	55.95	26.20	19.20	43.20	48.07	8.20	21.82
2015-16	82.46	36.72	16.53	18.35	14.11	46.14	11.66	5.28
2016-17	83.34	35.84	14.73	17.31	19.84	45.70	15.75	5.34
2017-18	85.51	40.03	19.84	22.39	0.96	43.94	13.95	4.11
2018-19	83.23	40.42	19.95	23.58	0.76	51.65	9.50	6.93
2019-20	90.99	34.65	20.30	20.01	0.86	35.62	2.88	4.01
2020-21	91.64	36.91	19.99	19.38	0.58	70.59	10.55	8.60

Source: Authors Calculations

Table 3: Stepwise Regression Results

Categories	Coefficients	t value	p value
Constant	-50.939	-1.951	0.092
Concentration ratio of top four categories	0.918*	2.771	0.028
Other fresh vegetables instability index	0.585*	3.160	0.016
Natural honey instability index	0.055	0.467	0.655
Alcoholic beverages instability index	0.058	0.122	0.906
Non basmati rice instability index	0.102	0.575	0.583
R square= 0.873, Adjusted R square= 0.783, F value= 9.638			

Source: Authors' Calculations,
**Significant at 5% level,*

top four categories and other fresh vegetables instability index (both significant at 5% level) are main sources of overall instability of Punjab's agricultural and vegetables processed food products exports. With a unit increase in concentration of top four categories and instability index of other fresh vegetables exports, instability of Punjab's agricultural and vegetables processed food products exportsrises by 91.8 per cent and 58.5 per cent respectively. The reason might be that concentration of top four categories is increasing throughout the study period i.e. 2007-08 to 2020-21. On the other hand, the instability indices of natural honey, alcoholic beverages and non basmati rice exports have also positive but less and insignificant impact on instability in Punjab's agricultural and processed food products exports. The value of R square is 0.873 which indicates 87.3 per cent variation in instability of Punjab's agricultural and processed food products exports is explained by change in all the explanatory variables. The value of adjusted R square is 0.783. The F value is 9.63 which is significant at 5 % level indicates that the model is fit.

Conclusions and Policy Implications

In most of prominent studies CDVI is considered as best and widely accepted measure to estimate export instability. Thus, as per CDVI measure results during the entire study period, all the categories of Punjab's agricultural and processed food products exports recorded high instability except cereal preparation exports which registered medium

instability. The categories of fresh onions, other fresh vegetables, pulses, buffalo meat, groundnuts, guar gum, maize, and non-basmati rice experienced very high instability with more than 100 values for the overall period 2007-08 to 2020-21. During last five-year period 2016-17 to 2020-21, the number of categories whose exports show medium instability increased to four which are processed fruits, juices and nuts, dairy products, natural honey and non-basmati rice. The categories whose exports reflect low instability also appeared which are cereal preparation and basmati rice.

Results confirmed that index of top four concentrated categories exports during all the years of study period and instability index of other fresh vegetables exports are the main sources which have strong impact on Punjab's agricultural and processed food products exports instability for the considered study period.

The results confirm high to medium instability in all categories except cereal preparation and basmati rice exports (recorded low instability) during last five years of study period. Thus, necessary steps should be taken to promote basmati rice production and exports at micro level such as promotion and awareness campaigns about the use of direct seeding of rice among farmers, investment in R&D by establishing Centre of Excellence along with Produce and Food Services (PFS) which is an autonomous body for promoting storage facilities, marketing and value addition for basmati rice. To mitigate instability and promoting cereal preparation exports, food processing units should be promoted and intensified and food parks should be established in districts of Punjab which are witnessing high and significant cereal production. Further regression results confirmed that index of top four concentrated categories exports and instability index of other fresh vegetables exports as main sources of instability in Punjab's agricultural and processed food products exports. Thus, it is suggested that necessary steps should be taken to reduce export instability by adding more products to export basket of Punjab's agricultural and processed food products. Among all concentrated categories, exports of other fresh vegetables are found to be highly unstable because of abrupt decline in its exports after 2016-17 (This result is also supported by year on year instability indices as per Table 2). Thus, other fresh vegetables should be targeted first by providing incentives to farmers for enhancing quality and variety, which further help exporters to diversify by finding out new markets to reduce variations in export values to mitigate instability in long term. To find out the countries to which Punjab is exporting agricultural and processed food products and India is having Free Trade Agreement (FTA), is a future scope of research which add more value to the present work.

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