**ABSTRACT**

The present study entitled “Export Performance and Trade Competitiveness of Millets from India” was undertaken with objectives to analyze the growth and instability in export, comparative advantage in export of millets, direction of trade, predict future millets export to importing destination.The secondary data was collected from ITC Trade Map data spanning from 2013 to 2023. Revealed Comparative Advantage, Revealed Symmetric Comparative Advantage, Revealed Competitiveness and Trade Specification Coefficient index were used to examine export competitiveness. The study revealed that export of millets from India was mainly focused on UAE, Nepal, Saudi Arabia, Tunisia, Libya and Egypt. Transitional probability matrix indicated that Tunisia is the most stable market among the importers of millets followed by Saudi Arabia, Nepal, Egypt and UAE. On the other hand, Libya has shown ‘zero’ probability of retention, indicating that these countries are unstable importers. The index value of revealed comparative advantage, revealed symmetric comparative advantage, revealed competitive advantage and trade specification coefficient index suggested that India has comparative advantage and competitiveness in export of millets to different parts of the world. Among the top five exporting nations, India has the highest comparative advantage during the study period followed by USA. Prediction of future millets export showed that UAE and Egypt show decreasing trend. While Nepal, Saudi Arabia, Tunisia, Libya and other countries group shows the increasing trend.

**Keywords:** Export, Millets, Comparative Advantage and Direction of Trade.

Millets are grown in 131 countries of the world and it is traditional food for 590 million people in Asia and Africa continent. Millets are drought tolerant, climate resilience, short to medium duration, survive in nutritional degraded soils, low inputs requirement, and resistance to pests and diseases. Millets are an energy-efficient and carbon-neutral crop that can withstand difficult climate conditions, including temperatures as high as 64°C and drought. While millets provide food, fodder, health, nutrition, livelihood, and ecological security, wheat and paddy provide food security (Millet Network of India, Undated). Millets have a higher water-use efficiency than major cereals (Sathish 2018), nutrient use efficiency (Nagaraj et al. 2013), climate resilience (Kumar et al. 2018), tolerance to biotic/abiotic stresses (Kumar et al. 2018, Singh et al. 2022), and are nutritionally dense (Jenkins et al. 2008, Shobana et al. 2009). Due to their richness in micronutrients and greater nutritional value over staple grains like rice and wheat, millets are currently becoming increasingly popular in India. In recent years, the Indian government has been recommending for the growth of millet due to its apparent health advantages and high nutritional content. India declared April 2018 to be the National Year of Millets and rebranded nutrient-rich millets as "Nutri cereals. India also declaring 2023 as the International Year of Millets (IYM) which the United Nations General Assembly accepted.

Presently, climate change is posing a severe threat to agriculture because of the constant rise in temperatures that causes unexpected weather patterns like heat waves, droughts, irregular rainfall, and flooding, all of which have a negative impact on crop yields. Because of their innate ability to withstand harsh environment conditions, millets are considered to be most appropriate choice in these situations. Moreover, these crops are essential for achieving nutritional security by preventing nutritional disorders due to their nutritional richness. India is unquestionably in a strong position in the millet trade, which could be advantageous to the nation's development. But as demand for millets rises around the world, policymakers are being compelled to create policies that support them.

**DATA AND METHODOLOGY**

The study is entirely based on secondary data pertaining to the millets trade, collected from trade map for the period 2013 to 2023. The statistical techniques used were Markov chain analysis to study direction of trade, Revealed Comparative Advantage, Revealed Symmetric Comparative Advantage, Vollrath Revealed Competitiveness and Trade specification coefficient index were used to examine export competitiveness.

**Markov chain analysis**

Markov chain analysis is primarily based on the estimation of the transitional probability matrix P. The element Pij of this matrix indicates the probability that exports will switch from the country i to the country j with time. The diagonal element Pii measures the probability that the export share of a country will be retained. Hence, examination of diagonal element indicates the loyalty of an importing country to a particular country’s exports. In the context of the current application, the average exports to a particular country were considered to be a random variable which depended only on its past exports to that country and which can be denoted as

$$Ejt=\sum\_{i=1}^{r}Eit-1Pij+ejt$$

Where,

Ejt = Exports from India to the jth country during the year t,

Eit-1= Exports to the ith country during the year t-1,

ejt = The error-term which is statistically independent of Eit-1, and

r = Number of importing countries.

The transitional probabilities Pij, which can be arranged in a (c×r) matrix, have the following

properties

O < Pij < 1

$$\sum\_{i=1}^{r}Pij=1 for all i$$

Thus, the expected export shares of each country during period t were obtained by multiplying the

exports to these countries in the previous period (t-1) with the transition probability matrix. The transition probability matrix was estimated in the linear programming (LP) framework by the method

referred to as Minimization of Mean Absolute Deviation (MAD), the LP formulation is stated as:

Min O’P\* + Ie

Subject to, XP\* + V = Y

GP\* = 1

P\* > 0

where, P\* is a vector of the probabilities Pij, O is a vector of zeros, I is an appropriately dimensional vector of areas, e is the vector of absolute errors (|U|), Y is the vector of exports to each country, X is a block diagonal matrix of lagged values of Y, V is the vector of errors, and G is a grouping matrix to add the row elements of P arranged in P\*, to unity. Analysis was done by using LINGO software.

**Revealed Comparative Advantage Index**

Revealed Comparative Advantage (RCA) was first introduced by Bela Balassa (1965). RCA Index is defined as a country’s share of world exports of a commodity divided by its share of total world exports. It uses a relative share of the individual country to examine whether the country has a comparative advantage or disadvantage over the rival countries.

RCAij = (Xij/Xik)/ (Xnj/Xnk)

Where,

Xij = Exports of country ‘I’ of commodity ‘j’

 Xik = Exports of country ‘I’ of a total agricultural commodity’s ‘k’

Xnj = Exports of a world ‘n’ of commodity ‘j’, and

Xnk = Exports of a world “n’ of a total agricultural commodity’s ‘k’

The calculated value of the index lies between zero to infinity. If the value of the index is greater than one, then it shows that country has revealed comparative advantage in millets and the value less than one indicates the country’s comparative disadvantage.

However, RCA suffers from the problem of asymmetry as pure RCA is basically not comparable on both sides of unity. The index is made symmetric, following the methodology suggested by Dalum, Laursen and Villumsen (1998), Widodo (2009), and Laursen (2015) called Revealed Symmetric Comparative Advantage (RSCA). A modified formula is

RSCA= RCA-1/RCA+1

The value of RSCA ranges between -1 to +1 and is free from the problem of skewness. A commodity is said to have comparative advantage in its exports if the corresponding RSCA value is positive and disadvantage if the corresponding RSCA value is negative (Shinoj and Mathur, 2008).

**Trade specification coefficient index (TSC)**

 The Trade specification coefficient index (TSC) is also known as the Lafay index (Lafay, 1992) was estimated to analyze the export competitiveness of Indian millets exports during the study periods.This index represents the trade balance ratio (changes between exports and imports ) of a particular commodity in a country to the trade value (cumulative value of exports and imports) for the particular commodity.

The mathematical model of the TSC is represented as:

TSC=(Xij-Mij)/Xij+Mij)

Where,

Xij = Total exports of the commodity

Mij= Total imports of the commodity

The value of the index ranges between -1 and +1. The value of this index equal zero when a commodity’s exports equal to its imports. A positive index indicated that the country’s exports of a particular commodity were higher than the imports of the commodity. Hence, this measure indicated the degree of equilibrium between exports and imports of a particular commodity and was a suitable method for comparing the trends over more extended period.

**Revealed competitiveness Advantage (RC)**

Vollrath (1992) developed a comprehensive index called Revealed competitiveness Advantage (RC). This index includes imports(M) as well as exports(X) related to the commodity.This way, RC avoids the problem of double counting.It is expressed as :

RC= (Xij/Xik)/ (Xnj/Xnk) – (Mij/Mik)/Mnj/Mnk

Where,

 Mij = imports of country ‘I’ of commodity ‘j’

 Mik = imports of country ‘I’ of a total agricultural commodity’s ‘k’

Mnj = imports of a world ‘n’ of commodity ‘j’, and

Mnk = imports of a world “n’ of a total agricultural commodity’s ‘k’

This Revealed competitiveness Advantage (RC) index as measure of competitiveness shows how well a country’s particular sector competes abroad and at home (Mirzaei et al., 2012). A positive RC measure that country’s ‘I’ has a competitive edge in producing and trading commodity ’j’

**Results and discussion**

The annual compound growth rate in export quantity and export value of cumin with standard error are presented in table 1, the results revealed that during the study period, the export of cumin was mainly focused on UAE, Nepal, Saudi Arabia, Tunisia, Libya and Egypt. The results revealed that most the importing countries have shown a negative growth and non-significant in both terms of quantity and value except Saudi Arabia has a negative growth but significant whereas Nepal shows positive and significant. The highest growth in terms of quantity (24.62) % was found in Nepal whereas in terms of value (37.94) % was observed in Egypt. The instability for both in terms of quantity (178.96) % and value (160.29) % was found in Saudi Arabia. All countries showed instability in millets export during study period.

Table 1: Growth and Instability analysis of millets Export from India

|  |  |  |
| --- | --- | --- |
|  | **CAGR (%)** | **Instability (%)** |
| **Export market** | **Export quantity** | **Export value** | **Export quantity** | **Export value** |
| UAE | -1.99 (0.04) | 3.45(0.04) | 34.46 | 37.02 |
| Nepal | 24.62\*(0.07) | 29.85\*\*(0.07) | 113.20 | 131.41 |
| Saudi Arabia | -31.53\*\*(0.08) | -26.46\*\*(0.07) | 178.96 | 160.29 |
| Tunisia | -10.41(0.11) | -8.92(0.10) | 83.22 | 81.13 |
| Libya | -9.56(0.10) | -6.66(0.09) | 53.29 | 52.21 |
| Egypt | 12.58(0.25) | 37.94(0.22) | 60.09 | 80.17 |

\*\* Significant at 1 per cent level, \* Significant at 5 per cent probability level. Figures in the parentheses indicate respective SE = Standard error.

**Trade direction of millets export from India**

Table 1 presents transitional probabilities depicting broad changes in the direction of trade. The period considered for analysis was 2013 to 2023. The major countries considered for the analysis were UAE, Nepal, Saudi Arabia, Tunisia, Libya and Egypt importing countries were grouped as ‘others.

The transitional probability matrix in Table 1 indicated that UAE lost its share to Saudi Arabia, Tunisia, Egypt and others to the extent of 10.7 per cent, 1.6 per cent, 2.4 per cent and 66.4 per cent respectively. It gained same amount of 27 per cent from Nepal and Saudi Arabia, 47.2 per cent from Egypt and 5.7 per cent from others.Nepal retained its original share to the extent of 68.5 per cent and it gained only from others (11.7 %).It lost its share to UAE (27 %) and Egypt (4.6%).Saudi Arabia retained its original share to the extent of 70.9 per cent and only gained from UAE (10.7 %) and lost its share to UAE (27%) and Libya (2.1%).Egypt retained its original share to the extent of 52.8 per cent and gained from UAE (2.4%), Nepal (4.6%). Tunisia is the most stable importer of rice, as it retained its original share of 72.7 per cent and gained from UAE and others i.e 1.6 per cent and 1.7 per cent respectively and it had lost its share to Libya (14%), Egypt (1.3%) and others (11.6%). Rice exports to Libya are the most unstable importer of rice from India since it could not retain even its original share. It gained its share from Saudi Arabia (2.1%), Tunisia (14.5%) and others (11.6%). Lost its share to only others (100%).

 Table 2: Transitional probability matrix of Indian millets export, from 2013 to 2023

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **UAE** | **Nepal** | **Saudi Arabia** | **Tunisia** | **Libya** | **Egypt** | **others** |
| UAE | 0.189 | 0.000 | 0.107 | 0.016 | 0.000 | 0.024 | 0.664 |
| Nepal | 0.270 | 0.685 | 0.000 | 0.000 | 0.000 | 0.046 | 0.000 |
| Saudi Arabia | 0.270 | 0.000 | 0.709 | 0.000 | 0.021 | 0.000 | 0.000 |
| Tunisia | 0.000 | 0.000 | 0.000 | 0.727 | 0.145 | 0.013 | 0.116 |
| Libya | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| Egypt | 0.472 | 0.000 | 0.000 | 0.000 | 0.000 | 0.528 | 0.000 |
| others | 0.057 | 0.117 | 0.000 | 0.017 | 0.116 | 0.000 | 0.693 |

**Projection of Indian Millets Exports to Major Importing Countries**

The export share of Indian rice in export to different countries were computed using transitional probability matrix. The future market shares of Indian rice to the major importing countries were projected for the period of 2024 to 2028. The projections share of Tunisia suggested increasing trend from 2.58 to 3.57 per cent. Similar pattern was found in Saudi Arabia and Nepal where the share has shown an increasing trend from 4.81 to 4.91 per cent and 18.53 to 18.70 per cent respectively. UAE showed contradictory trend where the share has decrease from 14.17 to 13.04 per cent.

Table 3: Projected exports of Indian maize to major importing countries: 2024 to 2028

(‘000 US$)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | UAE | Nepal | Saudi Arabia | Tunisia | Libya | Egypt | others |
| 2024 | 1032.16(14.17) | 1349.79(18.53) | 350.77(4.81) | 188.04(2.58) | 437.67(6.01) | 269.63(3.70) | 3656.94(50.20) |
| 2025 | 990.46(13.60) | 1351.67(18.55) | 359.48(4.93) | 215.78(2.96) | 457.33(6.28) | 231.46(3.18) | 3678.83(50.50) |
| 2026 | 968.70(13.30) | 1355.52(18.61) | 361.19(4.96) | 235.65(3.23) | 464.05(6.37) | 210.72(2.89) | 3689.18(50.64) |
| 2027 | 956.90(13.14) | 1359.36(18.66) | 360.07(4.94) | 249.92(3.43) | 468.16(6.43) | 199.66(2.74) | 3690.92(50.66) |
| 2028 | 950.29(13.04) | 1362.20(18.70) | 358.01(4.91) | 260.14(3.57) | 470.40(6.46) | 193.90(2.66) | 3690.05(50.65) |

Figures in parentheses indicate percentage to total export from India

**Comparative advantage and competitiveness of India’s millet export**

To study the comparative advantage and competitiveness of Indian millets trade, Revealed Comparative Advantage (RCA),Revealed Symmetric Comparative Advantage (RSCA), Revealed Competitive Advantage (RC) and Trade Specification Coefficient (TSC) index was analyzed for the period of 2013 to 2023 and index values are presented in Figure 1, 2, 3 and 4. The RCA index value for millets export was ranged between 11.86 to 19.59 during study period, which was more than one suggests that India has comparative advantage in the millets export (Figure 1). The index value of Revealed competitive advantage (RC) was lying between 6.41 to 21.51 with positive sign for all the years of study, thus it can be suggested that India’s millets export was competitive as shown in figure 2. The revealed symmetric comparative advantage (RSCA) index was found to be between 0.84 and 0.90 with positive sign for all years which suggest that India has comparative in the export of millets to different parts of the world (Figure 3). In figure 4 displayed the index value of trade specification coefficient was ranging between 0.98 to 1.00 with positive sign throughout the study period. Singh and Singh (2024) also observed similar results. The TSC value or millets which suggests that export of millets from India was higher than the import value and Indian millets export were export competitiveness.

Figure 1: Revealed Comparative Advantage

 Figure 2: Revealed Competitive Advantage

Figure 3: Revealed Symmetric Comparative

Advantage

 Figure 4: Trade Specific Coefficient

 Index

**CONCLUSION**

Tunisia was one of the most loyal importers of Indian millets as reflected by retention of 72.7 percent of its original share followed by Saudi Arabia, Nepal, Egypt, UAE and others. Libya was found to be the unstable importers as they could not retain their original share. India has comparative advantage and competitiveness in the export of millets during the study period. Any country's economic progress can be accelerated in large part through exports. Thus, in addition to helping to expand India's potential in the futures trading market and increasing the amounts of millets traded through futures in tandem with continuous production development, it is imperative to enhance millets exportation from the country.

**REFERENCES**

Balassa, B. 1965. Trade liberalization and revealed comparative advantage. *The Manch Sch*, **33**(1): 99-123.

Dalum, B. Laursen, K. and Villumsen, G. 1998. Structural Change in OECD Export Specialisation Patterns: Despecialisation and Stickiness. *Int. Rev. Appl. Econ*, **12**(3): 423-443.

Jenkins, A. L. Jenkins, D.J. Wolever, T.M. Rogovik, A.L. Jovanovski, E. Bozikov, V. Rahelić, D. and Vuksan, V. 2008. Comparable postprandial glucose reductions with viscous fiber blend enriched biscuits in healthy subjects and patients with diabetes mellitus: acute randomized controlled clinical trial. *Croatian Medical Journal* **49**(6): 772–82.

Lafay, G. 1992. The measurement of revealed comparative advantages. *In International trade modelling* (pp. 209-234). Springer US.

Laursen, K. 2015. Revealed Comparative Advantage and the Alternatives as Measures of International Specialisation. *Eurasian Econ. Rev*, **5**(1): 99-115.

Millet Network of India.2023. Undated. Millets: Future of food and farming. Deccan Development Society-FIAN India. Retrieved from the website (https:// milletindia.org/wp-content/uploads/2015/ 07/Milletsfutureoffoodandfarming.pdf).

Mirzaei, F. Syed, M.M. and Saeed, Y. 2012."Export comparative advantage analysis of Iranian hen egg by RCA & RSCA and RC criteria." *Modern Economy* 3, no. 05: 553-556.

Narayan, J. John, D.and Ramdas, N. 2019. Malnutrition in India: status and government initiatives. *Journal of Public Health Policy* **40**(1): 126–41.

Sathish, G. 2018. The Story of Millets. Karnataka State Department of Agriculture, Bangalore, India in collaboration with ICAR Indian Institute of Millets Research, Hyderabad, India.

Shinoj, P. and Mathur, V.C. 2008. Comparative Advantage of India in Agricultural Exports vis-á-vis Asia: A Postreforms Analysis. *Agric. Econ. Res. Rev*, **21**: 60-66.

Singh, P. Adhale, P. Guleria, A. Bhoi, P.B. Bhoi, A.K. Bacco, M. and Barsocchi, P. 2022. Crop diversification in South Asia: A panel regression approach. *Sustainability* **14**(15): 9363.

Singh, O. P. and Singh, P. Trends in millets production, consumption and export from India. *The journal of research angrau*, **52**(1), 121-133.

UN Comtrade. 2023. UN Comtrade Database, United Nations, New York, USA.

Vollrath, T. L.1991. A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. *Weltwirtschaftliches Archiv*, **127**(2), 265-280.

Widodo, T. 2009. Comparative Advantage: Theory, Empirical Measures and Case Studies. *Rev. Econ. Stud*, **4**: 57-82.