Indian millets trade potential-cum-performance: Economic perspective

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ABSTRACT

The present study examines the trade performance of millets, competitiveness and their impact on the country's growth in the agriculture sector. Empirical findings revealed that Indian millet exports contributed significantly to the global basket from the year 2000–2020 and had a huge potential in the international market. During the year 2011–2020, India's major exporting partners were neighbouring countries, i.e. Pakistan, Vietnam, Nepal and Saudi Arabia, wherein India exported more than 50% of the country's millet export. The study looked at India's comparative advantage of millets by country by using Revealed Comparative Advantage (RCA), and the results showed that Pakistan, Saudi Arabia, Vietnam, and Yemen were the major millet importing countries exhibiting RCA value greater than one, indicating that India had a significant advantage in exporting millets to these partner countries during the recent study period (2011–2020). Furthermore, gravity model is calibrated by using the variables like Gross Domestic Product (GDP), exchange rate and population of the respective countries. The results of the gravity model suggested that the country's GDP would grow with an increase in millets exports in India, but the country's exports would decrease with an increase in population.

Keywords: Economic challenge, Gravity model, Price realization, Revealed comparative advantage

India produces 41% of world's millets, generating 24.95 million USD, placing it in first place (FAO 2020, UN Comtrade 2020). Millets are better than major cereals in terms of water use efficiency (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).

However, millets lost their importance because of better inputs, high-yielding varieties, and governmental policies are available for rice, wheat, and maize (Singh *et al.* 2020). Undoubtedly, the green revolution favoured a boon for the country and gave much-needed agricultural, financial, and research attention to wheat and rice, but production of other minor crops including millets was declined (Nelson *et al.* 2019). Millets are nutritionally superior to staple cereals like rice, wheat and being rich in micronutrients are thus, presently gaining popularity in India. But the consumption of millet is declining (Kumar *et al.* 2021) in India due to the increased income levels, and government policies favouring other grains. Eventually, there is an increasing incidence of malnutrition (Narayan *et al.* 2019, UNICEF 2020). Considering the benefits of millets for people and its underutilized pattern, UN has declared 2023 as the International Year of Millets to increase awareness on millet's health benefits and its suitability of cultivation under changing climate (Kumar 2021). Undoubtedly, India has a significant position in millet trade which may be in favour of the development of the country, however, rising demand across the globe calls policymakers to design policies that favour millets which could be helpful to reduce the ballooning trade deficit of underutilized crops in near future and deficit may have been mitigated by way of promoting additional exports of any agricultural commodities. In this line, the present study is focused to understand the prospects of the trade scenario of millets and the comparative advantage of Indian millets in relation to other countries. Moreover, the paper highlights the impact of the trade of millets on the country's growth.

MATERIALS AND METHODS

The study is entirely based on secondary data pertaining to the millets trade, collected from the period 2000–2020, from various online databases like FAOSTAT and UNCOMTRADE. The HS6 classification system of millets export was selected to see the competitiveness at the national level. Data pertaining to country-wise export and import of millet were collected for 20 years, viz. 2000–2020

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and further has been divided into two sub-periods, i.e. 2000–2010 and 2011–2020 to account for the decadal difference in the trade prospects of millets. Furthermore, for a better comparison of the results, the study has also considered USA in the model as United States (USA) is the second largest exporter of millets at a global level and highly competitive country in terms of export in comparison to India. For gravity model, the data from year 2000–2020 for gross domestic product (current prices), exchange rate and population of both the countries, i.e. India and USA was compiled from the International Monetary Fund (IMF) database. Trade competitiveness of Indian millets is analysed by using Revealed Comparative Advantage (RCA) index.

Revealed Comparative Advantage (RCA) index: RCA was introduced and popularized by Balassa (1965) to identify a weak and strong competitiveness between the major exporting countries. The index measures normalized export shares, with respect to the exports of the same industry in a group of reference countries. The Revealed Comparative Advantage (RCA_{iw}) is calculated as:

$$RCA_{iw} = \ln\left[\left(\frac{x_{iA}}{X_A}\right) \Big/ \left(\frac{x_{iB}}{X_B}\right)\right]$$

Where x_{iA} and x_{iB} denote value of India's export of product 'i' and rival country's exports of product 'i' to a particular country group; X_A and X_B, denote India's total merchandise exports and rival country's comparative merchandise exports to a particular country group. A positive value of RCA is an indication of country's comparative advantage in a particular commodity against the rival country in a selected market. The study also examines the impact of trade of millets on country's economic performance by using gravity model.

Gravity model: The gravity model is the most popular method to explore the determinants of trade flows for millet in India and USA. To specify a new framework for the relationship between selected countries, the model is given below:

$$\ln(TF_{rt}) = \propto_1 + \propto_2 \ln(GDP_{rt}) + \propto_3 \ln(POP_{rt}) + \propto_4 \ln(ER_{rt}) + u_2$$

Where r, indicates the countries correctional units r = 1, 2, …, m; t, the time series t = 1, 2, …, n; TF_{rt}, denotes the trade flows; GDP_{rt}, equals country wise time series gross domestic product (current prices); POP_{rt}, equals country wise time series population; ER_{rt}, a country wise time series exchange rate and; u_{rt}, is an error term (whose variance varies by both j and r). Fixed and random effect models were employed to analyse the impact of determinants on trade flow of millets. A balanced panel data set was used with equal observations for each country. The hausman specification test was used to assess the technique's suitability for data analysis to choose the best model between fixed effect models and random effect models.

RESULTS AND DISCUSSION

Export and import scenario of millets in India: As laid out in the methodology, the present study enlists six major millets exporting countries during the two decadal

Table 1　Major exporting countries of millets (HS 100820) at global level

Particulars				Country					
Global Export	2000–10	Countries		India	USA	France	Ukraine	China	Netherland
		Export	283.0*	72.9	36.5	32.1	31.8	24.4	23.6
		Share (%)		25.8	12.9	11.3	11.2	8.6	8.3
		Rank		I	II	III	IV	V	VI
		Price realization (USD/kg)		0.25	0.31	0.12	0.21	0.13	0.28
	2011–20	Countries		India	USA	Russia	Ukraine	Turkey	France
		Export	338.1*	88.2	80.6	61.5	58.9	29.0	24.5
		Share (%)		26.1	23.8	18.2	17.4	8.6	7.2
		Rank		I	II	III	IV	V	VI
		Price realization (USD/kg)		0.31	0.40	0.20	0.23	0.24	0.46
Global Import	2000–10	Countries		Sudan	Niger	UAE	Belgium	Kenya	Yemen
		Import	314.2*	58.4	42.1	32.8	28.3	27.8	27.4
		Share (%)		18.6	13.4	10.5	9.0	8.8	8.7
		Rank		I	II	III	IV	V	VI
		Price realization (USD/kg)		0.23	0.11	0.29	0.32	0.20	0.27
	2011–20	Countries		Turkey	Indonesia	Niger	Pakistan	Germany	Belgium
		Import	344.8*	44.4	39.4	38.1	24.4	24.3	23.8
		Share (%)		12.9	11.4	11.0	7.1	7.0	6.9
		Rank		I	II	III	IV	V	VI
		Price realization (USD/kg)		0.22	0.40	0.09	0.26	0.51	0.46

*Export and import in '000 t.

study periods (2000–10 and 2011–20). During the first period, India ranked first in export of millets with a share of 25.8% of the global millets export followed by USA, France, Ukraine, China and Netherlands with export shares ranging from about 8–13% in all these countries. But, with respect to the unit value of millets in the international market, USA (USD 0.31/kg) was ahead of India, clearly indicating that the export value of Indian millets (USD 0.25/kg) in the international market is comparatively less than USA's millets but with a marginal difference (USD 0.06/kg).

During the same period, Netherland was the second highest country in terms of price realization (USD 0.28/kg) followed by India, Ukraine, China and France. India, USA and Ukraine managed to retain their respective global positions in millets export in the second period as well with Russian Federation and Turkey entering into the picture with third and fifth positions respectively. It is worth mentioning here that the price realization of USA is comparatively higher than the Indian millets price, even though the hike in price was also higher for the USA millets in the international markets, the difference in the price may be attributed to the quality differences. A fall in the rank of France in world millets export, but its price realization is highest with a value of USD 0.46/kg followed by USA, India, Turkey, Ukraine and Russian Federation. Hence, should be directing our efforts towards enhancing quality of millets produced in India, which is major driving force in gearing up the price realization in the international millets market.

Looking at the global import scenario of millets (Table 1), it can be seen that an average of 314.2 thousand tonnes of millets were imported during 2000–10 which increased by an amount of 30.6 thousand tonnes during the next decade (2011–20). During the first period, Sudan was the highest importer of millets accounting for 18.6% of the total millets imported globally followed by Niger, UAE, Belgium, Kenya and Yemen.

These six countries accounted for 69% of the global millets import in the international market. Belgium had the highest price realization of USD 0.32/kg in the first period which elevated to USD 0.46 in the second period. Sudan being the highest importer managed to import millets at an average price of USD 0.23/kg whereas the second largest importer Niger imported millets at the price of USD 0.11/kg which was three times lesser than the price paid by Belgium in the international millets market. Hence, a large range in price realized by the six major importers of millets can be seen.

In the second period, four new countries namely Turkey, Indonesia, Pakistan and Germany came into the picture besides Niger and Belgium which managed to find their positions among the top six importers of millets. Turkey with rank one came out as the major importer during the aforementioned period at an average price of USD 0.22/kg in the global millets market. By computing the averages of the import data collected during the second period it was noted that Indonesia is the second largest importer with a share of 11.4% followed by Niger, Pakistan, Germany

and Belgium with a collective share of around 32% in the global import of millets. Identical to the results obtained in period, Niger has imported around 38.1 thousand tonnes of millets at USD 0.09/kg which is by far the least value of price realized among all the major importers of millets. Hence, our efforts towards formulating appropriate policy measures especially directed towards enhancing millets export from India is the need of the hour which can play a crucial role in tapping the major importers of millets in the international market.

Our collaborative effort towards determining the nature of millets trade in India relative to global millets market will pay off if we can draw some conclusions by obtaining information on major millets importer in the global market corresponding to the major export destinations of Indian millets. Based on it, we have enlisted 10 major export destinations (Table 2) of Indian millets for the two different decadal periods. During the first period, Sudan (the highest millets importer) accounted for 32% of millet exports from India followed by Benin and Iran with 12.1 and 11.9%.

In the second period, Pakistan accounted for 13.5% of Indian millets exports. During the same period in Table 1, Pakistan can be seen as the fourth largest importer of millets with global import share of 7.1%. Hence, based on the above discussion, it is observed that in both the study periods except for one country in each period, all the other five major importers have not made to the top 10 major export destinations of Indian millets. This gives us a powerful insight so as to plan and develop effective trade policy interventions to bring these countries under our trade purview.

Table 2 Country wise share of export of millets at national level

Country	Share (%)	Country	Share (%)
Avg (2000–2010)		Avg (2011–2020)	
Sudan	32.0	Pakistan	13.5
Benin	12.1	Saudi Arabia	12.3
Iran	11.9	Viet Nam	11.8
Saudi Arabia	5.0	Nepal	10.5
Japan	4.7	Yemen	10.4
Netherlands	4.4	Tunisia	6.1
Italy	3.9	Namibia	5.5
Other Asia	3.9	Morocco	4.7
Pakistan	3.8	Egypt	4.5
Nepal	3.3	Libya	4.4

Comparative advantage of India with relation to other countries: The Revealed Comparative Advantage (RCA) based on the Ricardian comparative advantage concept, is an index for calculating the relative trade performance of individual countries in particular commodity. This index assumes that the commodity trade pattern mirrors inter-country differences in relative costs as well as in non-price factors and hence we assume to reveal the comparative advantage of the trading countries. An array of factors

contributing to movements in RCA includes economic and structural change, improved world demand and trade specialization of (Supplementary Table 1) millets in two different periods. In the first period Sudan, UAE, Saudi Arabia and Benin have shown RCA of millets export with RCA indices greater than one for all these countries. However, all the other export destinations have shown comparative disadvantage as their RCA indices are less than unity which indicates lesser export strength in these countries. During the same period, Sudan witnessed the highest value of the RCA index signifying increased export strength in millets to the aforementioned country. Hence the results of the analysis also confirm the fact that India was a competitive producer and exporter of millets to Sudan. But India lost competitive advantage in Sudan during second period. This situation poses a concern of inconsistency between the RCA and share pattern in Sudan.

Although we have seen RCA indices (greater than one) of Pakistan, Saudi Arabia, Vietnam and Yemen signifying the revealed comparative advantage in the second period, the values are lower as they managed to remain just a little above unity indicative of lesser export strength in these countries. For all the other countries, we have seen RCA indices lesser than one indicating the comparative disadvantage of millets exported from India. Undoubtedly, India creates its competitive advantage in some countries like Pakistan, Vietnam and Yemen but the country has lost their competitive advantage in many countries like Sudan, UAE and Benin. Fig 1 shows the trend of RCAs for different countries over a different time-period. To see India's comparative advantage, the major destination markets of Indian millets were taken into consideration. India's RCA w.r.t different countries did not follow a similar pattern, as it is varying over the years due to difference in millets export as well as total global millets export for respective countries. The highest increase in RCA was observed for the year 2013, wherein the India's RCA for Saudi Arabia reached 6.03 followed by Yemen (4.29), Pakistan (3.35) and Nepal (2.58). Undoubtedly, the value of India's RCA w.r.t. to other countries declined thereafter, but still, it was more than unity, which clearly indicates the strength of India in terms of millets export. In 2015, the RCA of Pakistan was about 5.8, the highest among all the selected countries, the reason being for the highest value of export to the Pakistan, which was to the tune of 7.7 million USD in the same year. In the recent most study period (2020), the value of India's RCA was the highest for Nepal (1.18) followed by Tunisia (0.54), Libya (0.37) and Morocco (0.27).

Impact of determinants on trade flow: There are two models that can be used to estimate the panel data; Fixed Effect Model and Random Effect Model. Both the model has been tried in the study for better explanation of the results (Table 3). To overcome the variations in the data, it has been normalized by taking the natural logarithm of all the variables. The variables that influence the export of millets for two countries, viz. India and USA are gross domestic product (GDP), population and exchange rate.

The results of the fixed effect panel model indicated that, the growth in GDP of both countries has a positive and significant impact on the millets trade flow clearly indicating that one-unit increase in trade flow, the gross domestic product of the country will increase by 3% while the population has a negative and non-significant effect on the trade flow of the millets. The estimates of the population showed that the trade flow will decrease with an increase in population with an eventual increase in consumption of millets, signifying negative impact on the trade flow of the country. Thereafter, the study has also considered the effect of exchange rates on the trade flow for both the major millets exporting countries. The results showcased that the trade of millets to the other countries will decrease by 4% with increase in exchange rate which signify a negative relationship with one another. It might be due to the fact that with devaluation, the exports will become cheaper and imports will become expensive which will motivate the exporters to invest in the international markets that leads to increase in the trade flows.

Hausman test was used to decide that which model (fixed effect and random effect) gives a better result in a more accurate manner. From both the models, fixed effect panel data model was selected whose test statistic value was observed to be 10.89 and found to be statistically significant ($P<0.05$).

The finding of the study showed that the export of Indian millets contributed to nearly one fourth of the global export during the study period, however, the country had imported a negligible amount of millets during a few years clearly indicating that the country is self-sufficient in terms of millets production. The study analysed that few countries like Pakistan, Saudi Arabia, Vietnam and Yemen are having comparative advantage with value of more than one, which signifies that India had a significant advantage to export millets to these partner countries, while India has a lower comparative advantage in the export of millets to Nepal, Tunisia, Libya, and Morocco. Furthermore, the study apprehended the gravity model to see the impact of trade on country's growth by considering selected economic

Table 3 Impact of determinants on trade flow of millets in India *vis-à-vis* USA

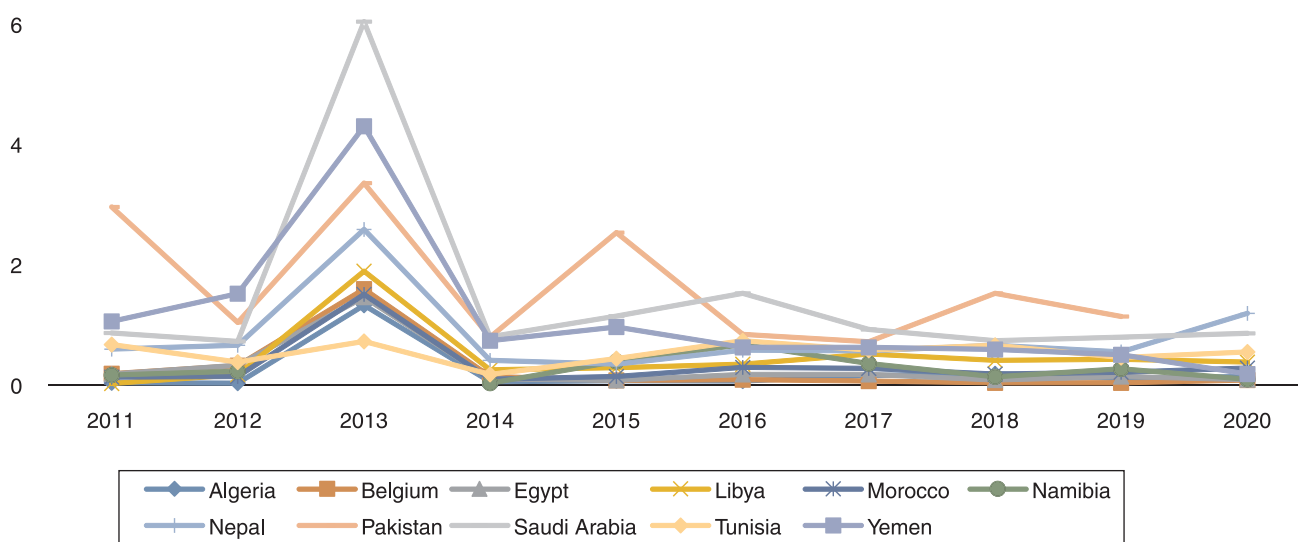| Parameter	Fixed effect		Random effect	
	Coefficient	p-value	Coefficient	p-value
Constant	16.251	0.404	-42.519	0.000
lnGDP	3.487	0.000	1.291	0.000
lnPopulation	-3.588	0.346	8.161	0.000
lnExchnage rate	-4.369	0.000	-3.028	0.000
σ_u	17.79		0.00	
σ_e	0.3433		0.3433	
Rho	0.9996		0.00	

Fig 1 India's Revealed Comparative Advantage (RCA) of millets crop over the years.

indicators. The findings of the model elucidated that GDP of the country would increase with the increase in export of millets.

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