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Analyzing the Direction of Trade: Indian Ginger and Lessons from Exports to Different Destinations

Namami Gohain, Surbhi Bansal, Shruti Mohapatra and Lovepreet Singh

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana

Abstract

The study analyzes the scenario of ginger exports with special emphasis on direction of ginger trade from the country by making use of the Markov chain model, the data for which have been collected from various published sources. India being the one of the major producers of ginger has witnessed significant increase in share of ginger export to total spices export from 0.98 per cent in 2000-01 to 8.03 per cent in 2020-21 due to increase in crop production. UK and the "Others" category have emerged as the most stable destinations for Indian ginger and Bangladesh being the most unstable with zero per cent transitional probability. Projected export shares of ginger to major importing countries for the next four years has shown an increasing trend in Bangladesh, Saudi Arab and rest of other countries. Hence, proper investment can aid in stabilizing the existing markets and further tapping other international markets.

Key words: Ginger, Export trend, Markov chain analysis, Transitional probabilities,

JEL classification: C22, C53, Q13,

Introduction

India is one of the largest producers and exporters of spices producing about 10.5 million tonnes of spices from an area of 4.4 million hectares in 2020-21 6 (https://dasd.gov.in). From India, spices like pepper, ginger, turmeric, chilli, bayleaves, small and large cardamom, coriander, cumin, garlic and the like are produced and exported. Ginger being a major cash crop of India, has a unique place in its production in the country. The crop has immense potentiality towards generating farm income and employment, thereby improving the farmers' standards of living (Gohain *et al*, 2020). Productivity of ginger in India is more (10.723 tonnes/ha) than the average productivity (7.5 tonnes/ha) in the world. USA is having the highest (51.9 tonnes/ha) productivity of ginger in the world. Madhya Pradesh, Karnataka, Assam, West Bengal and Maharashtra alone contribute more than 60 per cent of the total ginger produced in the country during 2020-21 (National Horticulture Board, 2020-21). Though grown all over India, the finest quality ginger comes from Kerala due to its congenial climate and a rich earthy soil. 'Cochin Ginger' (NUGC) and 'Calicut Ginger' (NUGK) varieties are famous Indian dry ginger in the world market (Singh and Dhillon,2015).

Ginger is widely grown in various countries of the world with its production distributed over India, China, Nigeria, Nepal, Indonesia, Thailand, etc. The year 2018 was accounted for an amount of 3.03 million metric tonnes of ginger trade. India's share in ginger trade was 15.08 per cent in 1997-98, which declined to 4 per cent during 2019-20, whereas during the same year, China's share in the global ginger trade was estimated to be around 53 per cent. USA, Bangladesh, Morocco, UK and Saudi Arab are the major importers of India's ginger (FAOSTAT). India, one of the major players in global ginger trade, faces steep competition for ginger export from China, Nigeria, and Thailand. The export growth depends not only on domestic production and distribution but also on other factors such as world economic scenario, domestic prices relative to world prices, exchange rate, the inflation rate in the countries competing with India for the world market and taxes and subsidies on exports.

In 2019, India exported around US$ 44.5 million worth of ginger and imported approximately US$ 19.6 million. Indian ginger is highly significant in the global market due to its characteristic lemon-like flavour (Gohain *et al*, 2020). Kerala is known for producing premium quality ginger owing to the state's favourable climate and a soil type suitable for cultivating the crop (Mathew and Subramanian, 2014). Indian states of Kerala, Assam, Meghalaya, Arunachal Pradesh and Odisha combined account for over 60 per cent of the ginger produced in the country. Export of ginger

Corresponding author email: namami@pau.edu

showed a highly fluctuating trend during the last 40 years. India has also imported significant quantities of ginger in various forms, *viz.* ginger fresh, ginger unbleached, ginger bleached, ginger powder (not elsewhere specified) includingdried ginger to the tune of 12,807 tonnes valued at INR 1,925 lakh. Several factors have contributed to the variability in exports; these included large domestic consumption, fluctuations in production due to vagaries of weather, competition from other ginger growing countries, trade competitiveness and issues related to regional trade agreements, trade barriers and food safety in the export trade of spices (Thomas and Sanil., 2019). Therefore, an attempt is made to quantify the changing structure of Indian ginger crop exports with an objective to study the pattern and direction of trade of ginger from India.

Data Sources and Methodology

The present study is carried out to unveil the production as well as international marketing status of the ginger crop in India. Fundamentally, secondary data is collected from authentic sources such as UN Comtrade, Spice Board database, Ministry of Commerce and Industry database and Hand Book of Horticulture. However other relevant information is also collected from an online portal such as Indiastat.com and the Economic and Political Weekly Research Foundation website. For calculating the direction of trade in ginger crop's exports from India in terms of market retention and market switching for the time period 2005-06 to 2019-20 are examined by using the Markov chain approach.

Markov Chain Analysis

This analysis is employed to analyze the direction of trade in any system whose progress through time can be measured in terms of a single outcome variable (Dent, 1967). It also helps to estimate the direction of trade and changing pattern of ginger crop export in India (Bansal and Singh, 2020; Sunil and Singh, 2021). In the present study, the dynamic nature of trade pattern, i.e., gain and loss in export of ginger crop in major importing countries are calculated by using the Markov chain model. It involves developing a transitional probability matrix 'P_{ij}' which indicates the probability that the export share of a country will switch from i^{th} country to j^{th} country over a period of time. The diagonal element of P_{ij} indicates the probability of a country retaining its market share or in other words, the loyalty of an importing country to a particular country's export. The off-diagonal or transfer probabilities indicate the probability that the export share of a particular country will shift to another country over time. Thus, the export share of a country during period 't' was obtained by multiplying the actual exports in the previous period (t-1) with a transition probability matrix.

In the context of the current application, there are five major importing countries viz. USA, Bangladesh, Morocco, UK, Saudi Arab and all other countries grouped under for ginger crop. The assumption that the average export of ginger crop from India amongst importing countries in any period depends on previous period export and scenario will be same for all study period. The algebraical expression is as follows

$$E_{jt} = \sum_{i=1}^{r} E_{it-1} * P_{ij} + \mu_{jt}$$

Where E_{jt} represent the export from India the to j^{th} country during the year t, E_{it-1} depict the export to the i^{th} country during the year t-1 , is the random term which is statistically independent of E_{it-1}, r is the number of importing countries and t is number of years considered for analysis. The transitional probability matric can be arranged in (c*r) matrix having the following properties.

$$\sum_{j=1}^{r} P_{ij} = 1$$

The transitional probability matrix is calculated using linear programming framework by a method referred to as minimization of Mean Absolute Deviation (Joshi *et al*.,2015).

Min OP* + Ie

Subject to,

XP* + V = Y

GP* = 1

P*e ≥ 0

Where P*e is the vector of probabilities

O is the vector of zero,

I as an appropriate dimensioned vector of area,

e is the vector of absolute error,

Y is the proportion of export to each country,

X is a block diagonal matrix of the lagged value of Y,

V is the vector of random term,

G is the grouping matrix to add row elements of P as arranged in P* to unity.

Ginger Forecast/Forecasting of Ginger Export Prediction of value of ginger crop's export share is made by using Transitional Probability Matrix (Siddeshwar *et al*.,2017)

$$Y_{jt} = \sum_{i=1}^{r} Y_{it-1} * P_{ij}$$

Where Y_{jt} is the predicted proportions of jth country's share during t year. Y_{it-1} is the observed proportion of ith country share during t-1 year and P_{ij} is the calculated value of transitional probability matrix.

Results and Discussion

The results obtained from the present investigation as well relevant discussion have been summarized as below:

Table 1. The percentage share of ginger to total spices export, 2000-01 to 2016-17

Year	Ginger Export (000 tonnes)	Spices export (000 tonnes)	% Share of ginger to total spice export
2000-01	2.31	235.92	0.98
2001-02	1.19	243.20	0.49
2002-03	1.67	264.11	0.64
2003-04	0.44	254.38	0.17
2004-05	0.74	335.49	0.22
2005-06	0.53	350.36	0.15
2006-07	2.51	393.69	0.64
2007-08	0.27	444.25	0.06
2008-09	0.48	470.52	0.10
2009-10	0.10	502.75	0.02
2010-11	0.08	525.75	0.02
2011-12	0.07	575.27	0.01
2012-13	0.78	726.61	0.11
2013-14	15.12	560.18	2.70
2014-15	26.05	578.11	4.51
2015-16	18.39	593.18	3.10
2016-17	19.90	606.67	3.28
2017-18	21.61	1028.06	2.10
2018-19	18.15	1100.25	1.64
2019-20	60.41	1208.40	4.99
2020-21	125.70	1565.00	8.03

Source: indiastat.com

Ginger Export from India

The ginger exports and quantum of spices export from India during 2000-01 to 2020-21 showed wide fluctuations in the quantum of ginger exports despite a significant increase during the period above. The fluctuation in export growth of ginger crop doesn't depend only on domestic production, distribution but also on the other factors such as economic scenario, domestic prices relative to world prices, exchange rate, the inflation rate in the countries comparing with India for the world market and taxes and subsidies on the export of crop (Karthick *et al*.,2015). However, ginger export saw a sudden increase during 2013-14 from 0.000779 MT in the previous year to 0.015116 MT, possibly due to an increase in crop production in subsequent years. We also found that the share of ginger export in total export of spices was 0.98 per cent during 2000-01, which further increased to 8.03 per cent in 2020-21.

Global Ginger Trade

The global ginger & ginger processing market was valued worth of USD 2.16 billion in 2018. In 2019, China alone accounted for more than 50 per cent of the total ginger exported globally as shown in Figure 1. A cumulative of about 30 per cent of its exports came from Netherlands, Thailand, Peru and India combined. During the same period, India stood fifth in terms of ginger global exports.

India's Ginger Trade

The trend in ginger exports, imports and trade surplus (1972-2019) in terms of value (Thousand USD) is shown in Figure 2. We saw a zig-zag pattern in ginger imports and

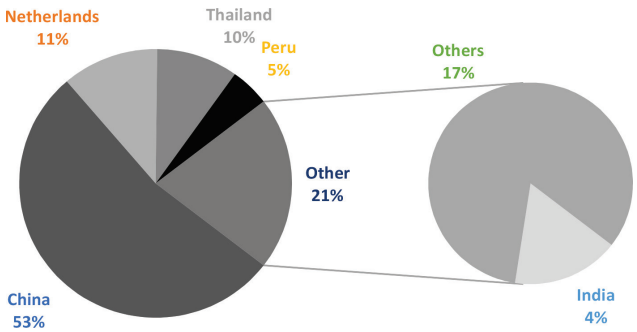

Fig. 1. Top trading economies of ginger export (2019)

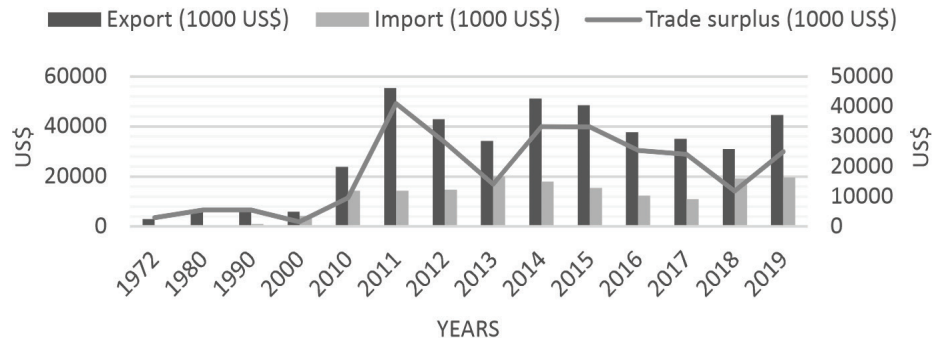

Fig. 2. India's Ginger Trade, 1972 to 2019

exports over the years, indicating wide fluctuations in the data. However, with occasional dips in trade, ginger exports witnessed a significant increase over time. Despite heavy volatility, ginger trade from the country managed to remain in surplus over the years as the value of its exports exceeded imports from the crop.

Direction of Trade

The direction of ginger crop exports' trade to different destinations was studied by calculating the transitional probability matrix using Markov Chain analysis. The Transitional Probability Matrix is presented in Table 2. The major countries for the research are USA, Bangladesh, Morocco, UK and Saudi Arabia remaining importing countries was grouped as others (Mexico, Japan, Italy, Spain and the like).

A perusal of Table 2 reveals that in the study period of export, the UK remained the most stable market among the major importers of Indian ginger crop as reflected by the higher probability of retention at 0.6608, i.e. the probability that the UK exports share over the study period was 66.08 per cent. Other countries also showed a higher probability of 60.88 per cent over the study period. Morocco retained their export share to the tune of 49.35 per cent. The USA and Saudi Arab had retained only 10.23 and 9.88 per cent of its original share. Thus, the UK were the most reliable and loyal market for ginger crop in India.

Table 2 indicated that USA, with 10.23 probability retention gained share from Morocco and Bangladesh. In contrast, it lost 54.68 to other countries, 33.73 per cent to Morocco and nearly 1.36 per cent to the UK. Bangladesh with zero probability retention is considered the most unstable importer of ginger crop whereas it lost 55.85 per cent share from the rest of countries, followed by 20.32 to Saudi Arabia and 17.22 per cent to USA. Although Morocco was considered the second most stable market, it lost approximately 25 per cent to USA and Bangladesh. UK gained to the tune of 2.77 per cent to Saudi Arabia, 3.19 per cent to rest of other countries, whereas it lost 31.31 per cent from Saudi Arabia. Where, Saudi Arabia lost 87.35 per cent share to other country and 2.77 per cent to UK, whereas it gained from 31.31 per cent from UK and 20.32 per cent from Bangladesh.

With regard to rest of other countries, it lost 15.64 per cent to USA and 18.44 per cent to Bangladesh, whereas it gained from 87.35 per cent of Saudi Arab' s share, 55.85 per cent of Bangladesh's share and 54.68 per cent of USA. Hence, the results show that UK was the most stable importer of ginger crop followed by Morocco with the probability retention of 66.08 and 49.35 per cent respectively. Bangladesh would be considered as unstable importer as it could not retain its original share.

Table 2. Transitional probability matrix of ginger export from India, 2004-05 to 2019-20

Countries	USA	Bangladesh	Morocco	U K	Saudi Arabia	Others
USA	**0.1023**	0.0000	0.3373	0.0136	0.0000	0.5468
Bangladesh	0.1722	**0.0000**	0.0661	0.0000	0.2032	0.5585
Morocco	0.2542	0.2522	**0.4935**	0.0000	0.0000	0.0000
U K	0.0000	0.0260	0.0000	**0.6608**	0.3131	0.0000
Saudi Arab	0.0000	0.0000	0.0000	0.0277	**0.0988**	0.8735
Others	0.1564	0.1844	0.0011	0.0319	0.0175	0.6088

Source: Authors' calculations

Table 3. Actual and estimated values of ginger crop export from India for the period from 2004-05 to 2019-20 (in 000' US $)

Country	USA		Bangladesh		Morocco		U K		Saudi Arabia		Others		Total
Year	A	E	A	E	A	E	A	E	A	E	A	E	
2005-06	1233 (11.87)		1364 (13.13)		164 (1.58)		1300 (12.51)		1330 (12.80)		4999 (48.11)		10390 (100)
2006-07	994 (9.42)	1184 (11.40)	657 (6.23)	997 (9.59)	422 (4.0)	592 (5.70)	1363 (12.92)	1072 (10.32)	1158 (10.98)	903 (8.69)	5955 (56.45)	5641 (54.30)	10549 (100)
2007-08	1015 (12.71)	1253 (11.88)	991 (12.41)	1240 (11.75)	472 (5.91)	593 (5.62)	860 (10.77)	1136 (10.77)	448 (5.61)	779 (7.38)	4200 (52.59)	5548 (52.59)	7986 (100)
2008-09	784 (6.78)	1051 (13.16)	898 (7.77)	916 (11.47)	965 (8.35)	645 (8.08)	1239 (10.72)	728 (9.12)	1186 (10.26)	588 (7.37)	6489 (56.13)	4057 (50.80)	11561 (100)
2009-10	1485 (10.40)	1495 (12.93)	2419 (16.94)	1472 (12.73)	803 (5.62)	807 (6.98)	1321 (9.25)	1069 (9.25)	1587 (11.11)	801 (6.93)	6664 (46.67)	5917 (51.18)	14279 (100)
2010-11	2779 (11.64)	1815 (12.71)	5432 (22.76)	1466 (10.26)	1535 (6.43)	1064 (7.45)	1921 (8.05)	1150 (8.05)	1796 (7.52)	1179 (8.25)	10407 (43.60)	7607 (53.27)	23870 (100)
2011-12	8299 (14.99)	3237 (13.56)	5462 (9.87)	2356 (9.87)	4791 (8.65)	2065 (8.65)	2425 (4.38)	1689 (7.08)	5491 (9.92)	2065 (8.65)	28888 (52.19)	12458 (52.19)	55356 (100)
2012-13	6727 (15.67)	7525 (13.59)	2618 (6.10)	6598 (11.92)	2637 (6.14)	5556 (10.04)	1713 (3.99)	2789 (5.04)	2077 (4.84)	2917 (5.27)	27156 (63.26)	29973 (54.15)	42928 (100)
2013-14	4760 (13.91)	6056 (14.11)	4596 (13.43)	5716 (13.32)	1483 (4.33)	3773 (8.79)	2127 (6.21)	2147 (5.00)	1924 (5.62)	1748 (4.07)	19336 (56.50)	23488 (54.72)	34226 (100)
2014-15	3714 (7.25)	4679 (13.67)	9415 (18.39)	3994 (11.67)	300 (0.59)	2662 (7.78)	2245 (4.39)	2140 (6.25)	2930 (5.72)	2128 (6.22)	32591 (63.66)	18623 (54.41)	51195 (100)
2015-16	6999 (14.41)	7173 (14.01)	5828 (12.00)	6143 (12.00)	1952 (4.02)	2058 (4.02)	2320 (4.78)	2654 (5.18)	3298 (6.79)	3476 (6.79)	28159 (57.99)	29691 (58.0)	48556 (100)
2016-17	5142 (13.63)	6619 (13.63)	2517 (6.67)	5744 (11.83)	2977 (7.89)	3739 (7.70)	2044 (5.42)	2618 (5.39)	2121 (5.62)	2729 (5.62)	22918 (60.76)	27107 (55.83)	37719 (100)
2017-18	5734 (16.35)	5300 (14.05)	3646 (10.40)	5030 (13.33)	5552 (15.84)	3395 (9.0)	2053 (5.86)	2210 (5.86)	1637 (4.67)	1762 (4.67)	16439 (46.89)	20023 (53.09)	35061 (100)
2018-19	6157 (19.85)	5196 (14.82)	2661 (8.58)	4485 (12.79)	8838 (28.49)	4933 (14.07)	1995 (6.43)	2004 (5.72)	601 (1.94)	1833 (5.23)	10773 (34.72)	16610 (47.37)	31025 (100)
2019-20	7209 (16.18)	5019 (16.18)	12237 (7.46)	4268 (13.76)	9515 (21.36)	6626 (21.36)	1982 (4.45)	1762 (5.68)	1149 (2.58)	1413 (4.56)	12463 (27.97)	11937 (38.47)	44555 (100)

Figure in parentheses indicate the percentage to total export from India
Source: Author's calculation

Actual and Estimated Share of Ginger Crop Export from India

The export share of ginger crop to different countries was computed using transitional probability matrix. The future market shares of ginger crop to the major importing countries were projected upto 2023-24. A close look at the actual and predicted share of ginger crop exported from India to different countries during the study period reveals that the observed proportions of exports shares were inconsistent with the predicted share of exports derived from the Markov Chain process. As evident from Table 3 that the actual export to USA has increased from INR. 1233 crores to INR.7209 crores between 2005-06 to 2019-20. However, during the same period, the expected export share of USA had shown increased from 11.40 per cent to 16.18 per cent. The projected exports of ginger crop to importing countries up to 2023-24 had suggested decreasing trend. But in the case of Bangladesh, actual export and expected value export of ginger crop had shown fluctuation over the period (2005-06 to 2019-20). But the projected share of ginger crop was more or less than 12 per cent upto 2023-24. Moreover, the results of the transitional probability matrix revealed that Morocco was the second most loyal importer of ginger crop. Its actual and predicted share of export of ginger crop had shown increasing trend till 2019-20. After that, the predicted future market share had suggested decreasing trend upto 2023-24. The actual share of the UK and Saudi Arabia had shown a decreasing trend from 12.51 per cent to 4.45 per cent and 12.80 per cent to 2.58 per cent during the study period. While the estimation for 2023-24 suggested negligible change from 5.33 per cent to 5.61 per cent in UK and 5.70 per cent to 5.69 in Saudi Arabia. Considering the other countries, both the

Table 4. Projected exports of ginger crop to major importing countries (in 000' US $)

Year/ Countries	USA	Bangladesh	Morocco	U K	Saudi Arabia	Others
2020-21	4799 (15.47)	3918 (12.63)	5258 (16.95)	1653 (5.33)	1767 (5.70)	13630 (43.93)
2021-22	4634 (14.93)	3882 (12.51)	4487 (14.46)	1641 (5.29)	1727 (5.57)	14654 (47.23)
2022-23	4575 (14.75)	3876 (12.49)	4050 (13.05)	1663 (5.36)	1730 (5.57)	15132 (48.77)
2023-24	4531 (14.60)	3855 (12.42)	3814 (12.29)	1691 (5.45)	1744 (5.62)	15390 (49.61)

Figure in parentheses indicate the percentage to total export from India
Source: Authors' calculations

actual and predicted exports declined during the study period. While the estimation of the future export market of ginger crop from 2020-21 to 2023-24 has suggested an increase from 43.93 per cent to 50.26 per cent shown in Table 4.

Conclusion and Policy Implications

An analysis of the data and compilation of results in the study has led us to various observations notable among which are the share of ginger to the total spice trade of the country, pattern of ginger exports and direction of trade of ginger from India. Fresh ginger occupies a share of 8.03 per cent in the total spices export in 2020-21 relative to a much lower share during 2000-01 which is less than 1 per cent which projects an increase in the production of the crop over the years. Another important arena of the study is that ginger exports from the country (value terms) has increased over time however with occasional dips in various years. Despite this high volatility in the data, we have seen that the trade surplus of ginger has managed to stay positive with exports being greater than imports for all the years. UK has emerged to the most stable destination for Indian ginger followed by "others" category and Morocco with probability retention values of 66.08 per cent, 60.88 per cent and 49.35 per cent respectively. On the other hand, Bangladesh has been the most unstable importer of Indian ginger. Hence, there is a need to focus on countries such as the UK, Morocco and the rest of other countries for higher quality products thereby exploring more trade options. By using the Markov chain analysis, we have also seen that the observed proportions of exports shares are inconsistent with the predicted share of exports but we have seen consistency in the trend of export between actual and estimated values for all the countries except Bangladesh. The projected shares of export of ginger to the various countries has exhibited a decreasing trend for USA and Morocco whereas for Bangladesh, Saudi Arabia and UK the projected shares of export upto 2023-24 has remained fairly constant. For all the other countries, grouped together, the projected value of export shares has shown an increasing trend which is a sign that India ginger can improve exponentially in the segment of its entire spices export. Hence investment in the right direction can lead to an increase in area as well as production of the crop which can help in exploring and tapping other international markets for the crop. As agricultural balance of trade has always been as savior in tackling the forex deficit, promoting ginger crop growth can further its reputation.

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