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# Export of wheat from India: Destinations and competitiveness

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**Abstract**
The present study aimed to examine the direction of trade and competitiveness of wheat export from India. The study depends on secondary data which was collected from APEDA website for the year 2011-12 to 2022-23. The Markov chain investigation was used for direction of trade and Nominal Protection coefficient (NPC) was employed for estimating aggressiveness of wheat export from India. The results showed that Nepal was the most stable market of Indian wheat as it could retain its share of 93.49% followed by Bangladesh, UAE and Oman with 70.07, 43.69 and 40.46% retention were found to be major destinations for Indian wheat exports. The most unsteady markets among the wheat importing countries from India were Sri Lanka, Indonesia and Malaysia with the zero% retention. The investigation of export aggressiveness revealed that the Indian wheat has a moderate degree of aggressiveness as Nominal Protection Coefficients value for all the major importing countries from India were ranged between 0.5 and 1.0.

**Keywords:** Direction of trade, export aggressiveness, market, Markov chain investigation, nominal protection coefficient, wheat crop

## 1. Introduction

Especially the population of developing countries was increasing at an alarming rate. To feed the ever-expanding population remains a difficult task to the planners of developing countries and also the world bodies. Over the years, the Indian agricultural sector has seen a limitless transformation, going from a situation of severe food shortage to self-sufficiency in the production of food grains. Cereals are a great source of protein, lipids, carbs, vitamins, and minerals. The remaining endosperm is mostly composed of carbohydrates after the bran and germ have been removed. Grain in the form of rice, wheat, millet, or maize makes up the majority of the daily diet in several developing countries. Wheat is a cereal grain that belongs to the grass genus *Triticum.* Although there are several wheat species recognized around the world, only three are commercially cultivated in India: *Triticum aestivum* (Bread wheat), *Triticum durum* (Macaroni wheat), and *Triticum dicoccum* (Emmer wheat). Wheat is globally the leading source of carbohydrate in human food, with content of about 71%, apart from this, it also contains 13% proteins which is very high as considered to cereals and hence is also a major source of proteins around the world.

The benefits of wheat for your health mostly rely on how you consume it. While white flour, which is produced by processing after just 90% of the grain has been harvested under Indian circumstances, is ingested, has less health benefits than whole wheat, which is very nutritious. Numerous studies and investigations have shown that wheat and wheat flour are playing a bigger role in managing India's food economy. With the second-largest population behind China, it consumes the second-most wheat, and its demand for wheat is enormous and growing. Uttar Pradesh is the largest producer of wheat contributing for about 32%. Madhya Pradesh accounting for about 18% followed by Punjab for about 16%, Haryana for about 11% and Rajasthan for about 10% of the total wheat output in the country. During the fiscal year 2021-22, India's cereal exports exceeded Rs. 96,011.42 crore / 12,872.64 million USD. Rice (including Basmati and Non-Basmati) accounts for 75% of India's total grains exports (in value terms) over the same time. Other grains, including wheat, account for just 25% of total cereals shipped from India during this time period. With this as a backdrop, the current article attempts to examine the trade orientation and aggressiveness of Indian wheat exports.

## 2. Objective of the study
To analyze the export aggressiveness and direction of trade of wheat from India.

## 3. Methodology
The research was based on secondary data obtained from the APEDA database. Due to a significant fall in production during 2002-03, Government restricted exports from the central pool of India from 2003. Exports from the private traders were also totally banned by 2007. The export ban was lifted only after four years in 2011. Unrestricted wheat exports were allowed by the beginning of 2011-12. So, the data gathered pertained to the study from 2011-12 to 2022-23. The Markov chain investigation was employed for direction of trade and Nominal Protection coefficient (NPC) was employed for estimating aggressiveness of wheat export from India.

### 3.1 Markov chain model
The major wheat importing countries from India were Bangladesh, Sri Lanka, the United Arab Emirates (UAE), Oman, Malaysia, Nepal, and others. The trade directions of Indian wheat were examined using the first order Markov chain approach and the LINGO software. The calculation of the probability of transition matrix 'P', whose elements, $P_{ij}$, represent the chance of exports migrating from nation 'i' to country 'j' over time, is central to markov chain investigation. The diagonal element $P_{ij}$, where i=j, quantifies the likelihood of a country keeping its market share, or, in other words, an importing country's faithfully to a specific country's products. Annual export data from 2011-12 to 2022-23 were utilised to examine the trade direction and changing pattern of Indian wheat export. In this context, major wheat-importing countries and others were taken into account. The average exports to a specific country were thought to be a random variable that relied solely on previous exports to that country, which may be denoted algebraically as

$$E_{jt} = \sum_{i=1}^{n}[E_{i\,t-1} \times P_{ij} + e_{jt}]$$

Where,
$E_{jt}$ = India's exports to the jth country in the year "t"
$E_{i\,t-1}$ = During the year $_{t-1}$, exports or imports to ith country
$P_{ij}$ = The likelihood that exports will transfer from the ith to the jth country.
$e_{jt}$ = The error term that is statistically unrelated to $E_{jt-1}$.
n = the number of importing countries
The transitional probabilities $P_{ij}$, which can be arranged in a (c x n) matrix, have the following properties.

$$\sum_{i=1}^{n} P_{Ij} = 1 \text{ and } 0 \le P_{Ij} \le 1$$

Thus, the predicted export share of each nation during period 't' is calculated by multiplying the previous period's exports to these countries (t-1) by the probability of transition matrix. The probability matrix was calculated for the years 2011-12 through 2022-23.
Thus, the probability of transition matrix (T) is evaluated using the linear programming (LP) framework and a method known as mean absolute deviation (MAD) minimization.

Min, OP* + I e

Subject to

X P* + V = Y
GP* = 1
P* ≥ 0

Where,
P* is a vector of the probabilities $P^i_j$
P* vectors were arranged to obtain the TPM
O is the null vector
I is an appropriately dimensioned vector of export or import.
e is the vector of absolute errors (IUI)
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
G is a grouping matrix to add the row elements of P arranged in P* to Unity.

Wheat shipments to various destinations were anticipated using the calculated probability of transition by multiplying them by the respective base year shares. The export of Indian wheat to other nations was forecasted utilising 2 step, 3 step, and 4 step probability of transition for the years 2023-24 to 2025-26.

### 3.2 Export aggressiveness
The level of domestic pricing relative to foreign prices determines trade aggressiveness. Comparative advantage in the wheat prices encompasses the entire economic process of wheat production to its export. The degree of comparative advantage in both wheat production and export influences a country's international aggressiveness. In order to reveal trade aggressiveness of Indian wheat in the world market the Nominal Protection co-efficient (NPC) was used.

### 3.3 Nominal protection co-efficient
In the context of free trade, the nominal protection coefficient is a direct indicator of a country's aggressiveness towards a commodity. The nominal protection coefficient (NPC) is defined as the ratio of the commodity's local price to the world reference price.
Symbolically,

$$NPC = \frac{P_d}{P_r}$$

Where,
NPC = Nominal Protection Coefficient
Pd = Domestic price of the commodity
Pr = World reference market price of the commodity

To calculate the NPCs for the present study, Wholesale prices were obtained from Mumbai market. FOB prices were calculated by adding wholesale price, transportation charges, marketing margin of exporter, port clearance and handling charges, certification charges. Landed price was calculated by adding FOB price, freight charges and insurance premium. CIF prices were obtained by dividing landed cost with exchange rates. NPCs were calculated by dividing CIF prices with reference prices of respective importing countries major markets.

# 4. Results and Discussion
## 4.1 Direction of trade of Indian wheat export
Using a Markov chain investigation, the structural variations in the export share of Indian wheat to important destinations such as Bangladesh, United Arab Emirates, Nepal, Sri Lanka, Indonesia, Oman, Malaysia and others were investigated. The probability of transition matrix was computed for export of the real quantity of exports to importing nations in different years in series. The diagonal elements of the probability of transition matrix were used to interpret the chance of keeping the prior period I market share. The row elements of a matrix represent the trade loss due to other aggressive countries. The column elements show the trade gains from other aggressive countries. These probability of transition estimates were then used to forecast each country's future trade direction by projecting exports to destination countries up to 2025-26.

Table 1 shows the probability of transition matrix for Indian wheat exports, which provide a general idea of the shift in direction of wheat trade across the study period (2011-2012 to 2022-23). Bangladesh, the United Arab Emirates, Nepal, Sri Lanka, Indonesia, Oman, and Malaysia were the major wheat importing countries investigated for the study. Other than these countries, exports were grouped under the wide heading "Others." As shown in Table 1, the probability matrix suggests that India's early wheat shipment to Bangladesh was reserved to the tune of almost 70% over the research period.

The remaining 30% of former export share was redirected to Others, Indonesia, Malaysia, Sri Lanka, and Oman, to the tune of around 19%, 8%, 1%, 1%, and 1%, correspondingly. During the study period, however, Bangladesh gained about 100% market share from Sri Lanka, 55% from Indonesia, 24% from others, and 5% from Nepal.

According to Table 1, in terms of export reliability, Nepal and Bangladesh were the most faithful among wheat importers, as evidenced by higher probabilities of 0.93 and 0.70, correspondingly, implying that Nepal retained its export share of 93% and Bangladesh retained its share of 70%. These countries' higher odds suggest that they are more dependable and faithful in acquiring wheat from India. Others, the United Arab Emirates, and Oman were relatively unsteady, with lower probabilities of 53%, 43%, and 40%, correspondingly. With no retention, Sri Lanka, Indonesia, and Malaysia ranked as the least faithful importers of Indian wheat. The Russia-Ukraine conflict has had a substantial influence on the global supply of wheat. Wheat unit price is important in international trading. Despite the fact that the global average has climbed over the last five years, India has a somewhat higher unit export price for wheat than other countries. This is one of the factors affecting India's wheat exports. APEDA also provides financial assistance programmes for infrastructure development, quality enhancement, and market expansion.

**Table 1:** Probability of transition matrix of wheat grain from India to different destination (2011-12 to 2022-23)

| Destinations | Bangladesh | UAE | Nepal | Sri Lanka | Indonesia | Oman | Malaysia | Others |
|---|---|---|---|---|---|---|---|---|
| Bangladesh | 0.7007 | 0.0000 | 0.0000 | 0.0082 | 0.0778 | 0.0063 | 0.0134 | 0.1936 |
| UAE | 0.0000 | 0.4369 | 0.5599 | 0.0000 | 0.0000 | 0.0000 | 0.0032 | 0.0000 |
| Nepal | 0.0529 | 0.0000 | 0.9349 | 0.0102 | 0.0000 | 0.0000 | 0.0020 | 0.0000 |
| Sri Lanka | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Indonesia | 0.5506 | 0.4421 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0073 | 0.0000 |
| Oman | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1072 | 0.4046 | 0.0000 | 0.4882 |
| Malaysia | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Others | 0.2428 | 0.0901 | 0.0000 | 0.0156 | 0.0618 | 0.0322 | 0.0212 | 0.5364 |

**Table 2:** Estimations for export of wheat grain to main importing countries from India

| Market | Bangladesh | | UAE | | Nepal | | Sri Lanka | |
|---|---|---|---|---|---|---|---|---|
| Years | Real | Predicted | Real | Predicted | Real | Predicted | Real | Predicted |
| 2011-12 | 321331 | 301940 | 115653 | 93128 | 2633 | 67216 | 18261 | 6294 |
| 2012-13 | 1774040 | 2332676 | 498132 | 776972 | 6354 | 284844 | 17061 | 70220 |
| 2013-14 | 1994696 | 2171527 | 664862 | 719684 | 76736 | 443997 | 60997 | 51164 |
| 2014-15 | 1113975 | 1180931 | 391019 | 473215 | 111258 | 322947 | 22419 | 21864 |
| 2015-16 | 340552 | 260875 | 99722 | 55867 | 115118 | 163458 | 4589 | 4603 |
| 2016-17 | 37270 | 40697 | 23891 | 12528 | 186914 | 188122 | 1961 | 2385 |
| 2017-18 | 6137 | 25822 | 7087 | 7917 | 171476 | 164281 | 2242 | 2454 |
| 2018-19 | 20559 | 27083 | 7157 | 5772 | 139738 | 134648 | 2467 | 1773 |
| 2019-20 | 33310 | 36412 | 8436 | 5663 | 162093 | 156264 | 2103 | 2076 |
| 2020-21 | 1157401 | 1007329 | 187949 | 136464 | 328616 | 412456 | 94041 | 16315 |
| 2021-22 | 4083204 | 3966776 | 470598 | 557483 | 316208 | 559111 | 583123 | 56085 |
| 2022-23 | 1297882 | 3452493 | 456277 | 643549 | 51593 | 834847 | 31194 | 61660 |
| 2023-24* | | 3146405 | | 700699 | | 1140822 | | 62159 |
| 2024-25* | | 2924572 | | 705912 | | 1458876 | | 62329 |
| 2025-26* | | 2754963 | | 686553 | | 1759143 | | 62635 |

| Market | Indonesia | | Oman | | Malaysia | | Others | |
|---|---|---|---|---|---|---|---|---|
| Years | Real | Predicted | Real | Predicted | Real | Predicted | Real | Predicted |
| 2011-12 | 3352 | 43185 | 35400 | 23845 | 20137 | 9642 | 232858 | 204397 |
| 2012-13 | 375433 | 380502 | 206965 | 209696 | 72185 | 103690 | 3564645 | 2356570 |
| 2013-14 | 325508 | 309205 | 179366 | 155368 | 88785 | 77625 | 2181065 | 1643663 |
| 2014-15 | 348006 | 143671 | 103293 | 72742 | 81562 | 34698 | 743211 | 664752 |
| 2015-16 | 3038 | 29339 | 3026 | 4683 | 7282 | 5999 | 40769 | 89277 |

| 2016-17 | 72 | 3607 | 200 | 673 | 1059 | 1185 | 11095 | 13264 |
|---------|------|--------|-------|--------|-------|-------|---------|---------|
| 2017-18 | 34 | 3073 | 19 | 1398 | 1024 | 1338 | 41970 | 23710 |
| 2018-19 | 58 | 2322 | 122 | 548 | 1586 | 822 | 11474 | 10194 |
| 2019-20 | 120 | 3216 | 299 | 640 | 1060 | 1002 | 9589 | 11738 |
| 2020-21 | 56051 | 107039 | 30180 | 26671 | 9511 | 21897 | 222620 | 358220 |
| 2021-22 | 370920 | 404353 | 92485 | 103141 | 75976 | 85895 | 1242159 | 1501954 |
| 2022-23 | 862478 | 412492 | 137293 | 115084 | 55957 | 90850 | 1709901 | 1623969 |
| 2023-24* | | 381302 | | 120605 | | 87431 | | 1595684 |
| 2024-25* | | 356332 | | 120000 | | 83297 | | 1523949 |
| 2025-26* | | 334575 | | 116048 | | 79274 | | 1442227 |

Note: * Forecasted quantity of wheat

**Table 3:** Export aggressiveness of Indian wheat grain to major destinations during 2022-23

| Sl. No | Particulars | Unit | Bangladesh | UAE | Nepal | Sri Lanka | Indonesia | Oman | Malaysia |
|--------|-------------|------|------------|-----|-------|-----------|-----------|------|----------|
| 1 | Wholesale price (Mumbai) | Rs./qtl | 2650.00 | 2650.00 | 2650.00 | 2650.00 | 2650.00 | 2650.00 | 2650.00 |
| 2 | Marketing margin (5%) | Rs./qtl | 132.50 | 132.50 | 132.50 | 132.50 | 132.50 | 132.50 | 132.50 |
| 3 | Port clearing & handling charges | Rs./qtl | 575.00 | 575.00 | 575.00 | 575.00 | 575.00 | 575.00 | 575.00 |
| 4 | FOB Price (1+2+3) | Rs./qtl | 3357.50 | 3357.50 | 3357.50 | 3357.50 | 3357.50 | 3357.50 | 3357.50 |
| 5 | Freight charge | Rs./qtl | 470 | 550 | 480 | 520 | 630 | 550 | 600 |
| 6 | Insurance at 2% of price | Rs./qtl | 67.15 | 67.15 | 67.15 | 67.15 | 67.15 | 67.15 | 67.15 |
| 7 | Landed cost (4+5+6) | Rs./qtl | 3894.65 | 3974.65 | 3904.65 | 3944.65 | 4054.65 | 3974.65 | 4024.65 |
| 8 | Exchange rate | $ = Rs. | 78.60 | 78.60 | 78.60 | 78.60 | 78.60 | 78.60 | 78.60 |
| 9 | CIF price (row 7 / row 8) | US $ / qtl | 49.55 | 50.57 | 49.68 | 50.19 | 51.59 | 50.57 | 51.20 |
| 10 | Reference price | US $ / qtl | 66.79 | 57.63 | 70.64 | 51.08 | 54.67 | 58.14 | 53.66 |
| 11 | NPC of (row 9/row 10) | | 0.74 | 0.88 | 0.70 | 0.98 | 0.92 | 0.86 | 0.95 |

Note: FOB: Freight on Board: CIF: Cost, Insurance and Freight

## 4.2 Estimations for export of wheat grain to main importing countries from India

The probability of transition matrix was used to estimate Indian wheat exports to major importing countries through 2025-26. Wheat export projections to the key importing nations were calculated up to 2025-26, and the real and anticipated export quantities are shown in Table 2.

The forecasts were only indicative and provide an estimate of the market shares rather than the real quantity. From the Table 2, it can be seen that Bangladesh was the major importer of Indian wheat. It's total exports varied in between 3,21,331 tonnes in 2011-12 and 12,97,882 tonnes in 2022-23. The reason attributed to this wide fluctuation is purely based on the demand of the importers. The estimated market share varied between 301940 tonnes in 2011-12 and about 34,52,493 tonnes in 2022-23. However, predicted share at 2025-26 indicated 27,54,963 tonnes decreased from the present 34,52,493 tonnes (Table 2). Among all the countries, the export of Indian wheat to all the destinations showing decreasing trend in the future except Nepal and Sri Lanka.

It is evident from the Table 2 that the real quantity of wheat exported to Bangladesh had decreased during this period. Similarly, the countries like United Arab Emirates, Indonesia, Oman, Malaysia and other countries the real quantity of wheat exported had also decreased during certain period and recently towards increasing trend. Among all the countries, the export of Indian wheat to all the destinations showing decreasing trend in the future except Nepal and Sri Lanka. It was mainly due to these two countries has been importing wheat mainly from India as it is cheaper compared to other countries.

## 4.3 Export aggressiveness of Indian wheat

The results revealed that all nations were determined to be aggressive for wheat exports from India, as evidenced by NPCs less than unity. Table 3 shows the results of calculating the notional protection coefficient for wheat export to various destinations under the exportable hypothesis for the year 2022-23. With NPC values of 0.98, 0.95, and 0.92, correspondingly, the estimated NPCs for Sri Lanka, Malaysia, and Indonesia indicated that they were less aggressive marketplaces. With NPC values of 0.88 and 0.86, the United Arab Emirates and Oman were deemed to be moderately aggressive markets. Nepal and Bangladesh were discovered to be more aggresive markets, with NPC values of 0.70 and 0.74, correspondingly. As a result, Nepal and Bangladesh were the most profitable markets to which wheat was sold during the study period. It is stated that it is an efficient to exportable and profitable for Indian exporters to these countries. The findings of this study demonstrated that the notion that there is strong aggressiveness in wheat export has been confirmed and hence accepted.

## 5. Conclusion

Nepal and Bangladesh were the faithful importers of Indian wheat as reflected by retention of 93.49% and 70.07% of its original share over the study period. Destinations like Others, United Arab Emirates and Oman were relatively unsteady with lower probability of 53.64%, 43.69% and 40.46% correspondingly. Sri Lanka, Indonesia and Malaysia were came up as least faithful importer of Indian wheat with no retention. Nominal Protection Coefficients were less than one ranging from 0.70 to 0.98 for major importing countries, which suggested that Indian wheat was moderately aggressive globally under the exportable hypothesis.

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