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Exploring India's Dairy Export Competitiveness: Insights from a Gravity Model Analysis

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ABSTRACT

The present study examines India's competitiveness in the global dairy trade using secondary data from UNCOMTRADE and World Bank databases, focusing on four major dairy products at the HS 6-digit level from 2000 to 2023. We examined four major dairy products accounting for about 90 per cent of India's dairy exports comprising milk powder (HS 040210), butter (HS 040510), other milk fats and oils (HS 040590), and certain cheeses (HS 040690). The countries like the USA, New Zealand, Germany, Netherlands, and France lead the global dairy trade with strong international export relationships. In contrast, India's dairy exports are mainly directed toward neighbouring Middle Eastern countries such as Bangladesh, UAE, and Saudi Arabia, major importers. India's unit export prices for these products are generally competitive but often lower than those of the top global exporters. The results from the gravity model indicate that distance had a consistently negative impact on trade flows across all product categories. The GDP effects varied across the products, with milk powder exports declining and butter rising with an increase in partner country GDP. Our findings suggest the need for product-specific and market-specific export strategies to fully capitalize on its position as the world's largest milk producer. India should focus on overcoming distance-related trade barriers, addressing the unique demands of various dairy product markets, and improving product quality to secure higher prices.

Keywords: Dairy trade, gravity model, export competitiveness, global dairy markets

JEL codes: Q17, F12, F13

I

INTRODUCTION

Livestock is the most crucial and rapidly growing sub-sector of Indian agriculture. The growth of India's livestock sector is imperative for sustained agricultural growth and rural poverty reduction, as most farming households in India are smallholders operating nearly one hectare of land (Arora and Kataria, 2020; Singh et al., 2022). The demand for animal food products, driven by sustained economic and income growth and a fast-growing urban population, continues accelerating (Delgado *et al*., 1999; Kumar and Birthal, 2004; Birthal and Taneja, 2006; Rao and Birthal, 2008). Global demand for animal food products is growing fast, particularly in developing countries (Delgado *et al*., 1999; Singh and Kataria, 2017). According to Central Statistical Organization estimates, the Gross Domestic Product (GDP) at current prices from the livestock sector of India increased from Rs 80 billion in 1980-81 to Rs 6726 billion in 2016-17. After that, the GDP from livestock further increased to Rs 13555 billion in 2022-23 (Government of India, 2024). The contribution of the livestock sector to GDP originating from the agriculture sector nearly doubled from

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13.9 per cent in 1980-81 to 26.7 per cent by the year 2016-17 and reached 30.2 per cent in the year 2022-23 (Government of India, 2024).

Dairying is the most important segment of India's livestock economy, contributing 28.6 per cent to the gross agricultural value-added and providing livelihood and employment to about six million people (GoI, 2023; Arora et al., 2023). Among different livestock products, the milk group contributed about 70 per cent of the total value of output, followed by the meat group (20 per cent) and eggs (4 per cent) (Government of India, 2024). India ranks 1st in global milk production (FAO 2024), and its milk production has increased from 53.9 million tonnes in 1990-91 to 230.6 million tonnes during 2022-23, growing annually at more than five per cent (Government of India, 2023). Similarly, the per capita availability of milk in the country has increased from 176 g/day to 459 g/day during 1990-91 to 2022-23.

The major exporting countries of dairy products, namely Germany, Netherlands, New Zealand, France, and the USA, contributed more than 50 per cent of the global milk products export in 2023 (UNCOMTRADE 2024). The major importing countries of dairy products are Germany (13.3 per cent), China (9.0 per cent), France (7.0 per cent), Netherlands (6.9 per cent) and Italy (6.3 per cent), respectively during the year 2023. India’s export of milk products is negligible compared to other countries, though it has increased over time. India contributed merely 0.55 per cent of the global exports and ranked in 26th position. The export of dairy products has surged from 2.5 million USD in 1990 to 560.7 million USD, whereas the import of dairy products increased from 2.1 million USD to 60.9 million USD from 1990 to 2023. About 50 per cent of the Indian export of dairy products is generally confined to neighboring countries like UAE, Oman, Bhutan, Singapore, and Sri Lanka. In the recent year (2023), India exported around 30 per cent of the global dairy products to the USA, followed by UAE (14 per cent), Oman (10 per cent), Saudi Arabia (5.2 per cent) and Qatar (4.1 per cent), respectively.

The present study examines India's position at the global level and major competing countries in terms of major dairy products. The study also investigated India's bilateral trade and determinants concerning its trading partners for major dairy products using the gravity model. To understand the product composition, we have confined our exercise to HS classification at the four-digit and six-digit levels. The top commodities/products that account for 90 per cent of the country's total dairy product exports are analyzed.

II

DATABASE AND METHODOLOGY

The study is based on the secondary data. The data on global milk export and export from India were obtained from the UNCOMTRADE database (https://comtradeplus.un.org/TradeFlow) for 2000-2023. To examine the trade performance of India and its major trading partners in dairy products, information was

collected on all major milk products at the HS 4-digit level, having a competitive advantage for India. Six products were aggregated under the HS 4-digit international trade classification for dairy products. At a more disaggregated HS 6-digit level, there were 20 products. The study focused on the HS 6-digit aggregation level for empirical analysis. From the 20 products under HS 6-digit, only the major products and their major importers were selected. The gravity model was used to study the determinants of India's bilateral trade of selected dairy products with its major trading countries. The GDP data was obtained from the World Bank's World Development Indicators. The distance data was taken from the CEPII GeoDist database, which provides various measures of bilateral distances (Mayer & Zignago, 2011). The Most Favored Nation (MFN) tariff data was obtained from the World Trade Organization's Integrated (WITS) database.

Gravity Model

The gravity model, introduced by Tinbergen (1962), has become a standard method for studying bilateral trade flow between countries due to its strong theoretical foundations and empirical success (Yotov et al., 2021). The basic concept is that trade flows between two countries are directly proportional to their economic sizes and inversely proportional to their distance. The economic sizes can be measured in terms of GDP, population, GDP per capita, etc. This study measured the economic size by GDP at PPP (USD). The basic model was augmented with variables like MFN tariff for products.

The gravity model equation for the study is expressed as,

$$\ln(1 + X_{ijt}) = \beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) + \beta_3 \ln(DIST_{ij}) + \beta_4 \ln(1 + MFN_{jt}) + \pi_{it} + \chi_{jt} + \varepsilon_{ijt} - - - - - (1)$$

Where,

X_{ijt} = Export quantity from country i (India) to partner j
GDP_{it}= GDP at PPP for India (i) in time t
GDP_{jt}= GDP at PPP for partner country (j) in time t
$DIST_{ij}$=Distance between India and partner country
MFN_{jt}= Tariff for the product in time t
π_{it}= India-time fixed effect
χ_{jt}=Partner-time fixed effect

The model was estimated for the selected products to capture the determinants of trade flow between India and partner countries using the Poisson Pseudo-Maximum Likelihood (PPML) estimator, as Santos Silva and Tenreyro (2006) recommended. The PPML estimator addresses two critical issues in gravity model estimation: the presence of heteroskedasticity and the problem of zero trade flows. Unlike log-linearized OLS,

PPML performs better in heteroskedasticity and naturally includes zero trade flows (Fally, 2015). As Anderson and van Wincoop (2003) emphasized, exporter-time and importer-time fixed effects were added to the model to account for multilateral resistance terms. These fixed effects control all time-varying country-specific trade factors, such as institutional quality, factor endowments, and other unobserved characteristics (Baier & Bergstrand, 2007). The instrumental variable technique was used to address the potential endogeneity of the MFN tariff variable by employing lagged values of tariffs as instruments (Egger and Nigai, 2015). The dependent variable was lagged to capture potential dynamic effects in trade flows (Olivero and Yotov, 2012). The gravity model assumes that trade is frictionless within countries, but it may not hold for large countries with significant internal trade costs. Also, the model may not fully capture the determinants such as product quality or consumer preferences (Costinot and Rodríguez-Clare, 2014).

III

RESULTS AND DISCUSSION

This section focuses on selecting major dairy products in India with a competitive advantage at the HS-4 and HS-6 digit levels. The study also examined India's trade potential and bilateral trade of milk products with the major importing countries of India using the gravity model.

India's Major Exporting Commodities

We have mainly focused on the exports during the most recent period, i.e., the triennium ending 2023 (TE 2023). A total of 6 products were identified, which India is exporting globally. Among six products of HS-04 at a four-digit level, the share of HS 0405 (Butter and other fats and oils derived from milk; dairy spreads) in India's milk products export is the highest (55.9 per cent) followed by HS 0402 (Milk and cream, concentrated or containing added sugar or other sweetening matter) (24.8 per cent) and HS 0406 (Cheese and curd) (14.6 per cent) during the year TE 2023. Together, these three products contributed over 90 per cent of India's milk product exports. Four commodities/products are selected at the HS-six-digit level, contributing more than 90 per cent of India's milk product export. Globally, the demand was the highest for other milk fats and oils (HS 040590), accounting for nearly 34 per cent of the global milk product export. HS 040210 accounted for almost 25 per cent of India's milk product export, followed by HS 040510 (18.3 per cent) and HS 040690 (9.6 per cent) (Table 1). The highest price was realized for HS 040630 (Cheese processed, not grated or powdered) at 7.12 USD/Kg during TE 2023. Among the major selected commodities, the highest price was realized for HS 040590 (Other milk fats and oils) with a value of 6.88 USD/kg, followed by HS 040690 (4.81 USD/Kg), HS 040510 (4.68 USD/Kg) and HS 040210 (3.06 USD/Kg) during TE 2023.

TABLE 1. INDIA'S EXPORT OF MILK PRODUCTS IN THE WORLD, TE 2023

HS codes		Product Description	Trade Value (million USD)	Share (%)	Unit Value (USD/Kg)
(1)	(2)	(3)	(4)	(5)	(6)
HS 02	Milk and milk products				
	HS 040110	Milk not concentrated nor sweetened <1% fat	0.32	0.05	0.80
	HS 040120	Milk not concentrated nor sweetened 1-6% fat	19.15	3.17	0.77
	HS 040130	Milk and cream not concentrated nor sweetened <6% fat	1.08	0.18	1.45
HS 0401					
	HS 040140	Milk and cream not concentrated nor sweetened exceeding 6% fat but not exceeding 10%	0.36	0.06	0.74
	HS 040150	Milk and cream not concentrated nor sweetened exceeding 10% fat	1.27	0.21	1.23
	HS 040210	Milk powder <1.5% fat	151.99	25.16	3.06
	HS 040221	Milk and cream powder unsweetened >1.5% fat	2.69	0.45	3.95
HS 0402	HS 040229	Milk and cream powder sweetened >1.5% fat	13.54	2.24	4.85
	HS 040291	Milk and cream unsweetened, concentrated	0.56	0.09	3.73
	HS 040299	Milk and cream nes sweetened or concentrated	1.03	0.17	2.99
HS 0403	HS 040310	Yogurt	0.02	0.00	3.11
	HS 040390	Buttermilk, curdled milk, cream, kephir, etc.	4.63	0.77	1.36
HS 0404	HS 040410	Whey	1.15	0.19	2.69
	HS 040490	Natural milk products nes	0.74	0.12	5.12
	HS 040510	Butter	110.32	18.26	4.68
HS 0405	HS 040520	Dairy spreads	0.19	0.03	6.13
	HS 040590	Other milk fats and oils	205.45	34.01	6.88
	HS 040610	Fresh cheese, unfermented whey cheese, curd	03.21	0.53	2.69
	HS 040620	Cheese, grated or powdered, of all kinds	0.75	0.12	5.27
HS 0406	HS 040630	Cheese processed, not grated or powdered	27.07	4.48	7.12
	HS 040640	Cheese, blue-veined	0.32	0.05	10.8
	HS 040690	Cheese except fresh, grated, processed or blue-veined	58.24	9.64	4.81

Source: UNCOMTRADE.

Trends in Exports of Dairy Products from India

The information on the export of selected dairy products from India to the world is given in Table 2. India's export of HS 040210 (Milk powder <1.5 per cent fat) increased from 11.2 thousand tonnes in TE 2002 to 14.1 thousand tonnes in TE 2011; after that, it increased to 24.84 thousand tonnes in TE 2023. However, the export trend did not remain the same throughout the study period, and the highest demand for

TABLE 2. EXPORT QUANTITY AND UNIT PRICE OF SELECTED DAIRY PRODUCTS FROM INDIA, 2000 TO 2023

Year	HS 040210	HS 040510	HS 040590	HS 040690	HS 040210	HS 040510	HS 040590	HS 040690
	Export Quantity ('000 tonnes)				Unit Price (USD/Kg)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TE 2002	11.21	0.25	1.50	0.10	1.55	2.39	2.85	2.57
TE 2005	26.45	1.31	2.33	0.39	1.80	2.12	3.05	2.01
TE 2008	35.64	4.44	5.37	0.44	2.94	2.81	3.35	3.63
TE 2011	14.07	3.15	6.61	0.50	2.52	3.48	4.13	4.60
TE 2014	80.13	2.30	5.88	1.69	3.28	4.48	5.33	4.22
TE 2017	15.07	2.92	6.62	3.37	2.88	4.99	6.32	4.27
TE 2020	18.69	16.94	13.14	4.34	2.19	4.08	6.26	4.48
TE 2023	24.84	11.79	14.92	6.06	3.06	4.68	6.88	4.81

Source: UNCOMTRADE

HS 040210 was recorded for 2014, with an export quantity of 80.1 thousand tonnes. Similarly, the average price realization of HS 040210 nearly doubled during TE 2023 (3.06 USD/Kg) compared to TE 2002 (1.55 USD/Kg). The export of HS 040510 (Butter) also varied throughout the study period, from as high as 16.94 thousand tonnes in TE 2020 to as low as 0.25 thousand tonnes in TE 2002.

The unit price of HS 040510 increased from 2.39 USD/Kg in TE 2002 to 4.68 USD/kg in TE 2023. In the case of HS 040590, the export increased from 1.5 thousand tonnes in TE 2002 to 14.9 thousand tonnes in TE 2023, and the average unit price more than doubled from 2.85 USD/Kg in TE 2002 to 6.88 USD/kg in TE 2023. The export of HS 040690 increased from 0.10 thousand tonnes in TE 2002 to 0.50 thousand tonnes in TE 2011; after that, it increased to 6.06 thousand tonnes in TE 2023. The unit price jumped from 2.57 USD/Kg in TE 2002 to 4.81 USD/Kg in TE 2023.

Global Leaders in Dairy Exports

Table 3 highlights the leading exporters of various dairy products for the TE 2023. The dairy exports are categorized into four Harmonized System (HS) codes: 040210 (milk powder < 1.5 per cent fat), 040510 (butter), 040590 (other milk fats and oils), and 040690 (cheese except fresh, grated, processed, or blue-veined). The United States is the leading exporter of milk powder, with an export value of 2,634.9 USD

TABLE 3. MAJOR EXPORTING COUNTRIES OF SELECTED DAIRY PRODUCTS, TE 2023

Country (1)	Value (Million USD) (2)	Quantity ('000 tonnes) (3)	Unit Price (USD/Kg) (4)
	HS 040210		
USA	2634.9	844.75	3.12
New Zealand	1530.87	456.96	3.35
Germany	987.58	304.34	3.24
France	777.7	242.23	3.21
Australia	635.23	148.31	4.28
	HS 040510		
New Zealand	1721.57	309.81	5.56
Netherlands	1473.62	268.47	5.49
Ireland	983.39	87.00	11.3
Germany	711.14	125.20	5.68
Belgium	667.72	117.88	5.66
	HS 040590		
New Zealand	1218.47	219.70	5.55
Netherlands	474.77	69.28	6.85
Germany	165.96	23.01	7.21
Belgium	160.3	24.16	6.64
France	135.15	19.47	6.94
	HS 040690		
Netherlands	3590.46	666.47	5.39
Germany	3027.23	614.29	4.93
France	2628.8	353.96	7.43
Italy	2227.39	197.22	11.29
New Zealand	1059.45	227.69	4.65

Source: UNCOMTRADE

million, accounting for over 844.75 thousand tonnes at a unit price of 3.12 USD/Kg. New Zealand exports these items at a higher unit price of 3.35 USD/Kg. Germany, France, and Australia are significant exporters in this category, with Australia fetching the highest unit price of 4.28 USD/Kg. In the butter export market (HS 040510), New Zealand leads with an export value of 1,721.57 USD million, exporting over 309.81 thousand tonnes at 5.56 USD/Kg. Ireland exported at the highest unit price of 11.3 USD/Kg, reflecting its quality and reputation; Irish butter maintains high export prices due to its responsiveness and adaptability to changes in competitor prices, especially those from New Zealand (Cele et al., 2023). New Zealand again leads the milk fats (others) and oils (HS 040590), with an export value of 1,218.47 USD million, but the Netherlands and Germany also contribute significantly. The cheese, except fresh, grated, processed, or blue-veined category (HS 040690), is dominated by the Netherlands, Germany, and France, with Italy and New Zealand also major players. Italy's cheese, especially Parmigiano Reggiano, achieves the highest export prices (11.29 USD/Kg) due to its protected designation of origin (PDO) status, traditional production methods, and unique microbiological properties of the milk used (Southey, 2023 and Ciprietti, 2023). These findings coincide with global dairy trade patterns, showing that countries with established dairy industries and advanced processing capacities dominate the global market (FAO, 2022).

Export Destinations for Milk Powder (HS 040210)

Table 4 shows major milk powder exporting countries and their destination markets. The USA has emerged as a leading exporter, with a total trade value of 2.63 USD billion. Its primary destinations were Mexico, the Philippines, and Indonesia, highlighting its significant role in the global dairy trade. USA received relatively uniform unit prices across its key markets, averaging around 3.12 USD/Kg. New Zealand, another major exporter, achieved a total trade value of 1.53 USD billion. New Zealand's export prices were slightly higher, averaging 3.35 USD /Kg, with substantial shipments to China, Indonesia, and Malaysia. Germany, with a total export value of 987.58 USD million, had a more concentrated trade pattern than the USA and New

TABLE 4. MAJOR EXPORTING COUNTRIES AND THEIR DESTINATION MARKETS OF HS 040210, TE 2023

Exporting Country (1)	Destination market (2)	Trade Value (Million USD) (3)	Unit Price (USD/Kg) (4)
USA	World	2634.9	3.12
	Mexico	1154.94	3.10
	Philippines	326.19	3.13
	Indonesia	238.11	3.20
New Zealand	World	1530.87	3.35
	China	543.53	3.34
	Indonesia	212.4	3.42
	Malaysia	124.98	3.82
Germany	World	987.58	3.24
	Netherlands	235.18	3.17
	Poland	92.28	3.35
	Italy	83.41	3.31

Source: UNCOMTRADE

Zealand, with notable exports to the Netherlands, Poland, and Italy. These countries' distinct trade values and pricing indicate diverse market positioning and competitive strategies in the global dairy industry (Ohlan, 2012).

Export Destinations for Butter (HS 040510)

Table 5 presents the global exporters of butter and their primary destination markets. New Zealand is the leading exporter, with a worldwide trade value of 1721.57 USD million at 5.56 USD /Kg. Its largest market was China, accounting for 547.81 USD million in trade value, indicating a robust demand for high-quality butter. This strong demand was supported by New Zealand's reputation for high-quality dairy products, zero tariffs under the China-New Zealand Free Trade Agreement, and significant investments from both nations' dairy industries (New Zealand Ministry of Foreign Affairs and Trade, 2008 and eDairy News, 2023).

TABLE 5. MAJOR EXPORTING COUNTRIES AND THEIR DESTINATION MARKETS OF HS 040510, TE 2023

Exporting Country (1)	Destination market (2)	Trade Value (Million USD) (3)	Unit Price (USD/Kg) (4)
New Zealand	World	1721.57	5.56
	China	547.81	5.71
	Australia	178.64	5.2
	Saudi Arabia	111.37	5.21
Netherlands	World	1473.62	5.49
	Germany	547.26	5.26
	France	390.79	5.46
	Belgium	177.00	5.43
Germany	World	711.14	5.68
	Netherlands	221.44	5.19
	Austria	62.24	6.29
	France	59.9	5.74

Source: *UNCOMTRADE*

Similarly, the Netherlands and Germany are prominent global butter market players. As the Netherlands is one of Germany's closest bilateral, both countries had global butter trade values of 1473.62 USD million and 711.14 USD million, respectively. Similarly, the Netherlands and Germany are key players in the worldwide butter market. The Netherlands, with a trade value of 547.26 USD million, counts Germany as its closest bilateral trade partner. Germany also exports 221.44 USD million to the Netherlands, underscoring the strong bilateral trade ties between these nations (Government of Germany, 2024; Mulatu et al., 2003).

Export Destinations for Milk Fats (Others) and Oils (HS 040590)

Table 6 illustrates the major exporting countries for milk fats (others) and oils and their primary destination markets. New Zealand dominates the global dairy spreads

market with a trade value of 1218.47 USD million. China, its largest market, imports 228.34 USD million, followed by Mexico and the Philippines. This reflects New Zealand's strategic diversification in Asia and the Americas, leveraging its high-quality dairy reputation to secure significant global market shares (Scott et al., 2023; Singh, 2022). The Netherlands and Germany also play pivotal roles in the other milk fats and oils market. The Netherlands, with a global trade value of 474.77 USD million, primarily exports to Germany, France, and Italy, reflecting strong intra-European trade relations. Germany, with a total trade value of 165.96 USD million, mainly exports to Italy, Poland, and Austria, realized more than 7 USD/Kg. This suggests German dairy milk fats and oils are perceived as premium products in these markets, justifying the higher prices. These patterns align with broader trends in the European dairy industry, where quality and regional specialties often command premium prices (Sanjuánet et al., 2023).

TABLE 6. MAJOR EXPORTING COUNTRIES AND THEIR DESTINATION MARKETS OF HS 040590, TE 2023

Exporting Country (1)	Destination market (2)	Trade Value (Million USD) (3)	Unit Price (USD/Kg) (4)
New Zealand	World	1218.47	5.55
	China	228.34	5.56
	Mexico	133.71	5.69
	Philippines	127.33	5.44
Netherlands	World	474.77	6.85
	Germany	98.29	6.9
	France	70.13	6.97
	Italy	63.55	6.50
Germany	World	165.96	7.21
	Italy	24.67	7.21
	Poland	24.54	7.00
	Austria	19.45	7.10

Source: UNCOMTRADE

Export Destinations for Cheese Except Fresh, Grated, Processed or Blue-Veined (HS 040690)

Table 7 displays the primary cheese exporters except fresh, grated, processed, or blue-veined, focusing on the Netherlands, Germany, and France. The Netherlands leads

TABLE 7. MAJOR EXPORTING COUNTRIES AND THEIR DESTINATION MARKETS OF HS 040690, TE 2023

Exporting Country (1)	Destination market (2)	Trade Value (Million USD) (3)	Unit Price (USD/Kg) (4)
Netherlands	World	3590.46	5.39
	Germany	1045.79	5.58
	Belgium	425.55	5.69
	France	410.4	5.64
Germany	World	3027.23	4.93
	Italy	441.97	4.90
	Netherlands	391.2	4.59
	Austria	234.12	5.95
France	World	2628.8	7.43
	Germany	737.11	7.23
	Belgium	322.3	8.26
	Luxembourg	201.6	6.91

Source: UNCOMTRADE.

with a global trade value of 3590.46 USD million, primarily exporting to Germany, Belgium, and France. With a global trade value of 3027.23 USD million, Germany exported significantly to Italy, the Netherlands, and Austria. With a total trade value of 2628.8 USD million, France exported predominantly to Germany, Belgium, and Luxembourg. Belgium's import prices of 8.26 USD/Kg highlight the premium status of French cheese in the European market.

Table 8 further explains India's dairy product exports in 2023. Total exports from India to the world are valued at 75.99 USD million, with an average unit price of 3.06 USD/kg. Bangladesh was India's biggest importer, with imports valued at 50.68 USD million. Malaysia and the United Arab Emirates (UAE) also bought significant amounts, with 9.9 and 7.1 USD million values, respectively. No significant difference was found among the importing countries regarding the country-wise unit price of imports for 04210. It varies between 2.5 to 4.0 USD /kg. Bahrain was the largest importer of India, with imports valued at 13.49 USD million. Saudi Arabia and the United Arab Emirates (UAE) also made substantial purchases, with USD 9.44 million and USD 8.72 million, respectively. Morocco followed with imports worth 5.75 USD million. Regarding the country-wise unit price for 040510, there was some variation among the importing countries. Prices ranged from 4.16 USD/kg for Morocco to 5.45 USD/kg for the UAE, with Bahrain and Saudi Arabia falling between 4.31 USD/kg and

TABLE 8. MAJOR DESTINATION MARKETS OF INDIA FOR SELECTED DAIRY PRODUCTS, TE 2023

Exporting Commodity (1)	Destination market (2)	Trade Value (Million USD) (3)	Unit Price (USD/Kg) (4)
	World	75.99	3.06
	Bangladesh	50.68	3.11
040210	Malaysia	9.9	2.68
	United Arab Emirates	7.08	3.04
	Sri Lanka	1.27	3.92
	World	55.16	4.68
	Bahrain	13.49	4.31
040510	Saudi Arabia	9.44	4.55
	United Arab Emirates	8.72	5.45
	Morocco	5.75	4.16
	World	102.72	6.88
	United Arab Emirates	27.09	7.27
040590	Saudi Arabia	14.07	6.48
	USA	10.22	7.6
	Qatar	9.01	6.65
	World	29.12	4.81
	United Arab Emirates	8.36	4.47
040690	USA	4.55	5.45
	Singapore	3.22	4.41
	Saudi Arabia	2.52	5.35

Source: UNCOMTRADE

4.55 USD/kg, respectively. For 040590, the United Arab Emirates (UAE) was the primary importer from India, with imports valued at 27.09 USD million. Saudi Arabia and the USA also made significant purchases, with values of 14.07 and 10.22 USD million, respectively. The country-wise unit price for 040590 showed some variation, ranging from 6.48 USD/kg for Saudi Arabia to 7.60 USD/kg for the USA. The United

Arab Emirates (UAE) was again the largest importer from India, with imports valued at USD 8.36 million. The USA and Singapore also made notable purchases, with values of 4.55 and 3.22 USD million, respectively. Saudi Arabia followed with imports worth 2.52 USD million. Prices ranged from 4.41 USD/kg for Singapore to 5.45 USD/kg for the USA, with the UAE and Saudi Arabia at 4.47 USD/kg and 5.35 USD/kg, respectively. The table also reveals that the UAE is a crucial market for India, appearing as a top buyer in all four product categories. The USA stands out as a high-value market, often paying premium prices for Indian dairy products.

Determinants of Indian Dairy Trade

The gravity model for trade of HS 040210 (Milk powder < 1.5 per cent fat) suggests that longer distances and higher income of trading partners reduce the trade quantity. At the same time, tariffs do not significantly influence exports (Table 9). The negative effect of distance aligns with the core principle of the gravity model, suggesting that transportation costs and logistical challenges reduce trade as distance increases. The negative impact of higher income on trading partners is somewhat counterintuitive, as higher income typically increases demand for imported goods. This could indicate that as countries become wealthier, they may invest in domestic milk powder production, reducing reliance on imports. The lack of significance for tariffs suggests that other factors are more influential in determining trade flows for this product.

In the case of HS 040510 (Butter), longer distance reduces trade. However, the increased income of trading partners increases India's export quantity. Here, an increase in tariff may increase the export quantity, as suggested by the analysis. The positive relationship between partner income and export quantity suggests that butter may be considered a premium product, with demand increasing as countries become wealthier (Table 9). The positive effect of tariffs on export quantity is unusual and contradicts traditional trade theory. This could be explained by quality differentiation or market segmentation, where higher tariffs may be associated with higher-quality butter exports that command premium prices.

TABLE 9. ESTIMATES OF THE PPML-GRAVITY MODEL FOR SELECTED DAIRY PRODUCTS EXPORTED FROM INDIA TO MAJOR TRADING PARTNERS FROM 2000 TO 2023

Particulars	HS 040210	HS 040510	HS 040590	HS 040690
(1)	(2)	(3)	(4)	(5)
Intercept	18.108**	7.119***	1.588***	3.136*
	(6.375)	(1.796)	(0.410)	(1.395)
Log of distance	-7.570*	-3.318**	0.375NS	-1.139NS
	(2.918)	(0.990)	(0.253)	(0.730)
Log of GDP at PPP (India)	0.074NS	0.325***	0.016NS	0.583***
	(0.119)	(0.043)	(0.039)	(0.073)
Log of GDP at PPP of partner	-0.119*	0.043***	0.293***	-0.057NS
	(0.050)	(0.011)	(0.049)	(0.139)
Log MFN tariff	-0.060NS	0.738*	0.031NS	0.061NS
	(0.151)	(0.331)	(0.066)	(0.062)

Note: "***", "**" and "*" represents significance at 1%, 5%, and 10% levels of significance. NS represents non-significant coefficients. Figures in the parenthesis denote robust standard errors.

For the product HS 040590 (Other milk fats and oils), the increase in GDP of the partner country shows increased exports (Table 9). The positive relationship between partner country GDP and export quantity is consistent with the gravity model's prediction that larger economies engage in more trade. As countries grow economically, their demand for specialized dairy products like milk fats and oils increases, possibly due to expanding food processing industries. In the case of product HS 040690 (cheese except fresh, grated, processed, or blue-veined), with an increase in India's GDP, its export quantity has increased. The positive relationship between India's GDP and export quantity indicates that as India's economy grows, its capacity to produce and export cheese increases (Table 9). This could be due to improvements in dairy technology, increased production efficiency, or growing domestic expertise in cheese-making. The distance effect is consistently negative across products, aligning with findings from studies like Disdier and Head (2008), who found a persistent negative impact of distance on trade. The varying effects of income and GDP across products are consistent with Balogh et al. (2017), who found that GDP influences dairy trade, but the effects can differ by product category. The lack of significance or positive impact of tariffs contrasts with Beckman et al. (2018), who found that tariffs generally hinder dairy trade. This discrepancy could be due to product-specific factors or India's unique position in the global dairy market. As noted in numerous studies, the positive relationship between GDP and exports for some products aligns with the general gravity model principle that larger economies trade more.

IV

CONCLUSION AND POLICY IMPLICATIONS

The livestock sector plays a vital role in Indian agriculture. It is also one of the fastest-growing subsectors in the industry. The study identified four major dairy products that account for over 90 per cent of India's dairy exports, comprising milk powder (HS 040210), butter (HS 040510), other milk fats and oils (HS 040590), and certain cheeses (HS 040690). For these products, the global dairy trade is led by countries like the USA and New Zealand and European nations such as Germany, the Netherlands, and France. These countries have established strong export relationships internationally.

In contrast, India's dairy exports are primarily concentrated in neighboring and Middle Eastern countries, with Bangladesh, UAE, and Saudi Arabia significant importers. India's export unit prices for these products are generally competitive but often lower than those of leading global exporters. This indicates potential for value addition and quality improvement in India's dairy exports. The United Arab Emirates emerged as a crucial market for India across all four product categories, often paying premium prices. This highlights the importance of Middle Eastern markets for Indian dairy exports and suggests potential for further market development in this region. The gravity model analysis revealed that distance consistently hurts trade flows across all

the selected products. However, the effects of GDP and tariffs varied by product category. Higher incomes in partner countries unexpectedly reduced trade for milk powder, possibly due to increased domestic production. Butter exports showed a positive relationship with partner country income, suggesting it may be viewed as a premium product. Partner country GDP positively influenced exports for other milk fats and oils, indicating growing demand as economies expand. These findings highlight the complex dynamics of India's dairy trade and suggest opportunities for targeted export strategies. To fully capitalize on its position as the world's largest milk producer, India may need to overcome distance-related trade barriers, tailoring its export strategies to the specific demands of different dairy product markets and improving product quality to command higher prices.

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