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RESEARCH ARTICLE

Two decades of spice trade among SAFTA nations - Is it really aromatic for India?

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Abstract

Regional Trade Agreements (RTAs) are the foundation of the multilateral trading mechanism and act as a path to boost trade, enhance market access and strengthen relations with economies across the globe. The growing number of trade agreements between countries and within regions reflects a global momentum towards economic openness and creating more dynamic and competitive market environments. This study employs the gravity model with panel data from 2002 to 2020 to examine the trade effects, including trade creation and trade diversion of the Free Trade Agreement (FTA) on the spices trading between India and SAARC member countries under the South Asian Free Trade Agreement (SAFTA). The analysis shows a trade creation effect of SAFTA in the fixed effect (FE) model. The results also suggest that the spice trade could help in improving the Indian economy with SAFTA. India being the major spice exporter to the world nations and SAARC countries, has the relative trade advantage in spice trade with members of SAARC nations. Globally, India can use the advantage of exporting spices for higher value rather than for high volume proportional to the distance, which is a proxy for the trade costs.

Keywords

agricultural trade; free trade agreement; gravity panel analysis; SAFTA; spices

Abbreviations

RTAs - Regional Trade Agreements; FTA - Free Trade Agreement; SAFTA - South Asian Free Trade Agreement; SAARC - South Asian Association of Regional Cooperation; AEZs - Agri-Export Zones; EXIM - Export Import policy; FDI - Foreign Direct Investment; ER - Exchange Rates; UNCOMTRADE - United Nations Commodity Trade Statistics Database; CEPII - *Centre d'Etudes Prospective at d' Informations Internationales*; WTO - World Trade Organization; GDP - Gross Domestic Product; POLS - Pooled Ordinary Least Squares; FE - Fixed Effect; RE - Random Effect; CLRM - Classical Linear Regression Model

Introduction

The proliferation of bilateral and regional trade agreements globally signifies a drive towards liberalization and enhanced trade competitiveness. Regional Trade Agreements (RTAs) have broadened the scope of product and service coverage. Free trade agreements find justification in Ricardo's com-

parative advantage model and endogenous growth models (1, 2). While others (3–5) support the impact of free trade on economic growth positively, in contrast, few (6–8) suggest negative or insignificant effects. Despite concerns, trade liberalization policies persist in fostering export surpluses and eliminating trade barriers (9). Negotiating RTAs covering agricultural provisions is crucial for both developing and developed economies (10). India's significant role as the "Spice Bowl of the World", exporting to over 180 countries (11), underscores the increasing spice trade within SAARC nations post-SAFTA, indicative of trade creation .

India's spice exports have been heavily impacted by the influence of RTAs (12). RTAs include the Free Trade Agreement (FTA) with ASEAN and SAFTA for trade is given particular importance for member nations, who are the prominent global producers and competitors in the spice market (13). SAFTA's primary objective is to remove trade obstacles, enable seamless movement of goods across borders between member states and enhance trade and economic collaboration among SAARC nations.

Importance of spices in Indian agricultural trade

Indian spice area and production have increased from 3927.43 thousand hectares and 9599.90 thousand tonnes in 2017–2018 to 4485.88 thousand hectares and 11039.88 thousand tonnes in 2020–2021, respectively (Fig. 1). Also, India exports spices to more than 150 countries in the world. The major share of India is about 44 per cent in output and 36 per cent in the international spice trade. The export of spice and spice products are valued at about 1766.2 million US$ *i.e.,* 17.2 percent of the total world exports. Globally, India's main competitors are Vietnam, China, Indonesia, the Netherlands and Madagascar in recent years. Asian countries like India were found to have distinct advantages in the production as well as the export by their geographic and climatic factors, favouring spice production (14).

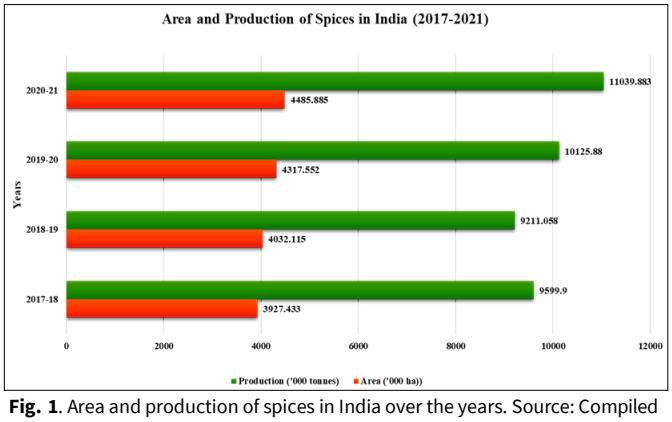

Fig. 1. Area and production of spices in India over the years. Source: Compiled data from IndiaStat (2022).

The Agri-Export Zones (AEZs) were initiated through the EXIM policy (1997–2001) in order to boost agricultural exports from India. Certain AEZs were deliberately identified and allocated for cultivating specific spice varieties, *i.e.,* ginger, turmeric, chillies and seed spices (15). India has been affected by the RTAs, which have enhanced its spice exports. India exported more than one million tonnes of spices, valued at 2.8 billion USD (16). Indian spices exports have seen the hike over the recent years (2018 to 2020) to SAARC nations, and in terms of imports, the dependency of India on the SAARC nations had declined, which can be reasoned with the trade diversion from SAARC nations and importing from the other exporters globally (Fig. 2). The trade has increased across the SAARC nations after the SAFTA, indicating the trade creation. The spice exports have increased from India and have made positive progress over the recent years (Fig. 3).

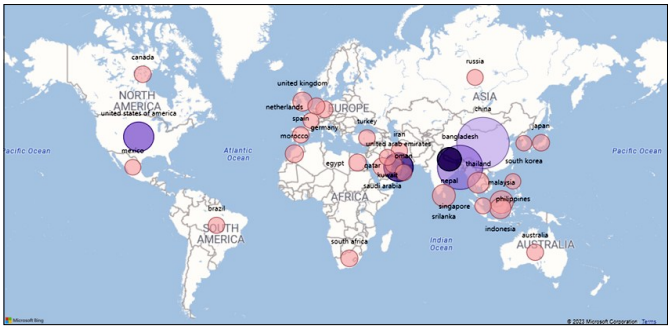

Fig. 2. Exports of spices from India to world nations in 2023 (Volume in MT). Source: Compiled from UN COMTRADE (2023). Bigger the circle, greater the export volume to that region.

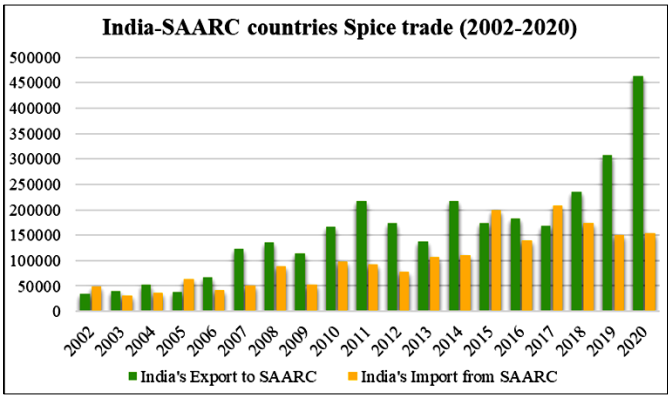

Fig. 3. Spice trade between India and SAARC nations over the years (2002–2020). Source: UN COMTRADE (2022).

Given the aforementioned context, this study was initiated to pursue the following specific research objectives: [1] To examine the trade effect of the South Asian Free Trade Agreement (SAFTA) on Indian spice trade; [2] To identify the determinants impacting the total trade and exports; and [3] To suggest policies to improve the trade performance of India through SAFTA. Economic factors like foreign direct investment (FDI), exchange rates (ER), domestic demand and trade agreements impact export performance (17). India's global export share in labour-intensive and resource-based commodities declined in the early 2000s due to liberalized trade agreements (12).

Materials and Methods

Data and description

The study compiled 19 years (2002–2020) of spice trade data of India with SAARC nations (HS 0904-0910) presented in Table 1. Data was sourced from Spice Board (18), UN-COMTRADE (11), *Centre d'Etudes Prospective at d'Informations Internationales* (CEPII) (19) and the World Bank database (20) (Table 2).

Table 1. Harmonized Coding System (HS-four digit) of spice products

HS Code	Description of spices and spice products
0904	Pepper of the genus Piper; dried or crushed or ground fruits of the genus *Capsicum* or of the genus *Pimenta*
0905	Vanilla
0906	Cinnamon & cinnamon-tree flowers, neither crushed/ground
0907	Cloves (whole fruit, cloves and stems)
0908	Nutmeg, mace and cardamoms
0909	Seeds of anise, badian, fennel, coriander, cumin or caraway; juniper barriers
0910	Ginger, saffron, turmeric (curcuma), thyme, bay leaves, curry and other spices

gravity model is used to estimate the trade effects as deployed by the models constructed in the earlier literature (24–27) with Pooled Ordinary Least Square (POLS), fixed effects (FE) and random effects (RE). Employing a multiplicative model requires natural logarithms for linear relationships (13).

$$lnT_{ijt} = \beta_0 + \beta_1(lnGDP_{it}) + \beta_2(lnPop_{it}) + \beta_3(lnDist_{it}) + \beta_4(Com\_lang\_off_{it}) + \beta_5(Com\_lang\_ethno_{it}) + \beta_6(Com\_colonizer_{it}) + u_{it} \quad \text{.....(Eqn. 2)}$$

$$lnEXP_{ijt} = \beta_0 + \beta_1(lnGDP_{it}) + \beta_2(lnPop_{it}) + \beta_3(lnDist_{it}) + \beta_4(Com\_lang\_off_{it}) + \beta_5(Com\_lang\_ethno_{it}) + \beta_6(Com\_colonizer_{it}) + u_{it} \quad \text{.....(Eqn. 3)}$$

$$lnIMP_{ijt} = \beta_0 + \beta_1(lnGDP_{it}) + \beta_2(lnPop_{it}) + \beta_3(lnDist_{it}) + \beta_4(Com\_lang\_off_{it}) + \beta_5(Com\_lang\_ethno_{it}) + \beta_6(Com\_colonizer_{it}) + u_{it} \quad \text{.....(Eqn. 4)}$$

Table 2. Variable description and data sources

Variable	Description of variable	Expected sign	Data sources
lnT_{ijt}	Natural logarithm of trade flow between the countries '*i*' and '*j*' in time '*t*'	Dependent variable	UN COMTRADE (2002 to 2020)
$lnEXP_{it}$	Natural logarithm of Exports '*i*' of exporters at time '*t*'	Dependent variable	CEPII (2002 to 2020)
$lnIMP_{it}$	Natural logarithm of Imports '*i*' of exporters at time '*t*'	Dependent variable	CEPII (2002 to 2020)
$lnGDP_i$	Natural logarithm of GDP of exporter '*i*' at time '*t*'	+	CEPII (2002 to 2020)
$lnPop_j$	Natural logarithm of Country *j* (SAARC member country's) population	+/-	CEPII (2002 to 2020)
$lnDist_{ij}$	Natural logarithm of the bilateral distance between countries '*i*' and '*j*'	-	CEPII
Com_lang_off	Binary variables that take the value 1, if countries have common official language, and 0 otherwise	+/-	Dummy variable
Com_lang_ethno	Binary variables that take the value 1, if countries have common language ethnology, and 0 otherwise	+/-	Dummy variable
Com_colonizer	Binary variables that take the value 1, if countries have common colonizer, and 0 otherwise	+/-	Dummy variable

HS Code: 0904-0910.

Methodology

Gravity model

Since the 1990s, the Gravity model has been used in international trade analyses. Economic geography, *i.e.,* geographical and other forms of distance, are the most important factors in economic activities. So, the present study employs this model in order to study the effects of International Trading Systems (WTO) and Regional Trading Arrangements (Free Trade Agreements) on international trade. Based on Newton's law of Gravitation, gravitational pulls between two objects are proportional to their body weight divided by their squared distance (13). Symbolically, it is given as:

$$GF_{ij} = \frac{m_i m_j}{d_{ij}^2} \quad \text{.....(Eqn. 1)}$$

where, *i* and *j* are the trading partners; *m* - denotes the mass and d^2_{ij} - denotes the distance between countries' capital (trade distance). The study utilizes the gravity model (20) to examine the trade impacts, such as creation and diversion of the FTA on spice trade within India and SAARC countries. Panel data analysis is employed to leverage country heterogeneity, following the economists insights (22, 23), *i.e.,* trade flow is directly proportional to Gross Domestic Product (GDP) of each country inversely related to distance between their respective economic centres (distance ($lnDist_{ij}$) between their capital cities). The panel

where u_{ij} = error term is presumed to follow a normal distribution characterized by a mean of zero and uniform variance across all observations, with no correlation between error values. Thus, it had hypothesized that volume of trade between nations is positively associated with their economic income and *vice versa* with their geographic distance, which serves as a proxy for trade-related costs.

Before the panel data analysis, the data should be made stationary, usually at the first differencing, followed by the cross-sectional dependency tests (Breusch-Pagan Lagrange Multiplier and cross-sectional Pesaran) for confirming the cross-sectional dependency among the variables in the model. In order to verify the heteroscedasticity and autocorrelation as the data contains both cross-sectional and time series terms, Chi-Square and Durbin-Watson tests could be conducted. Since panel data, the testing of main violations of CLRM *i.e.* multicollinearity (correlations among independent variables) should be tested using variance inflation factor (VIF) and Tolerance limit techniques.

Results and Discussion

The descriptive statistics (Table 3) summarizes the characteristics of the variables taken for the present study with basic statistical values. To understand, the relationship between the variables in-prior to the model building, they were subjected to correlation analysis and the bivariate correlation among the variables is presented in Table 4.

Table 3. Descriptive statistics of the variables

Variables	Mean	Std. Error	Std. Dev.	Kurtosis	Skewness	Minimum	Maximum	Observation
T_{ijt}	37733.07	4432.20	51114.66	4.89	2.08	0.00	278603.95	133
EXP_{ijt}	22938.97	3013.16	34749.50	21.74	3.64	0.00	278603.95	133
IMP_{ijt}	14794.10	2180.26	25143.96	5.00	2.19	0.00	121803.34	133
GDP_{it}	1701068.57	50315.19	580263.07	-1.24	0.27	871072.90	2695611.32	133
Pop_{jt}	60.83	6.41	73.93	-0.65	1.02	0.29	227.20	133
$Dist_{ij}$	1566.55	26.95	310.78	-0.68	0.37	1141.18	2134.14	133
Com_lang_off	0.16	0.03	0.35	2.62	2.11	0.00	1.10	133
Com_lang_ethno	0.29	0.04	0.45	-0.91	1.03	0.00	1.10	133
Com_colonizer	0.59	0.04	0.50	-1.92	-0.29	0.00	1.10	133

Table 4. Bivariate correlation among the variables

	T_{ijt}	EXP_{ijt}	IMP_{ijt}	GDP_{it}	Pop_{jt}	$Dist_{ij}$	*Com_lang_off*	*Com_lang_ethno*
T_{ijt}	**1.000**							
EXP_{ijt}	0.885	**1.000**						
IMP_{ijt}	0.312	0.322	**1.000**					
GDP_{it}	0.712	0.612	0.042	**1.000**				
Pop_{jt}	-0.351	-0.326	0.000	-0.593	**1.000**			
$Dist_{ij}$	0.119	0.203	0.034	0.457	-0.435	**1.000**		
Com_lang_off	0.286	0.406	-0.050	0.660	-0.369	0.544	**1.000**	
Com_lang_ethno	0.274	0.500	0.000	0.212	0.271	0.336	0.532	**1.000**

A strong positive correlation was found between the export and GDP. Since the gravity model would be estimated in logarithmic function, which includes '*ln*' subscript, log-linear functional form was used. Given that the dataset combines cross-sectional and time-series elements, it is essential to assess potential violations of Classical Linear Regression Model (CLRM) assumptions before conducting panel data regression. Initially, stationarity tests revealed the presence of unit roots, which were resolved by differencing the data to achieve stationarity. Subsequently, the data underwent comprehensive diagnostics to evaluate potential statistical violations, specifically multicollinearity, heteroscedasticity and autocorrelation. The diagnostic results (Table 5) confirmed that all statistical issues were within acceptable statistical thresholds, thereby validating the dataset's suitability for panel data analysis.

Table 5. Pre-estimation tests of the variables

S. No.	Testing for	Test	Results
1	Stationarity test	Unit root test (Augmented Dickey Fuller test)	Stationary at first difference
2	Cross-sectional dependency	BP- LM test C-S Pesaran test	Present, $Chi^2(1) = 56.28$; $Prob > Chi^2 = 0.0000$
3	Group-wise heteroskedasticity	Chi-Square test	
4	Serial autocorrelation	Durbin Watson test	DW Statistic: -1.273 (Negative correlation)
5	Multicollinearity test	Variance Inflation Factor / Tolerance limit	Mean VIF = 2.80 (Permissible level)
6	Hausman test	RE *vs* FE	FE is selected

Panel data analysis

Panel data analysis offers a significant advantage in addressing omitted variable bias (28). The multicollinearity test reveals that correlated variables do not imply direct causation, instead, their correlation might stem from an unobserved shared factor. Panel data methodology encompasses two primary modelling approaches: FE and RE models. The error structure in panel data is characterized by two distinct components: the cross-sectional unit-specific error (a_i), which remains consistent across time for a particular unit and idiosyncratic error (u_{it}), which varies across both units and time periods. This nuanced error structure allows for more sophisticated and precise statistical modelling (28–33).

The results of panel data estimates for spice trade are presented in Table 6, which shows that distance influences negatively and was found significant in pooled OLS and estimation of time-effect analyses. The fixed effect model would be a better choice over the random effect (RE) model when we are interested in analysing trade between pre-determined countries (34). As our data contain spice trade between India and SAARC nations only, the FE model may be the most appropriate specification, as confirmed through the Hausman specification test. As expected, the GDP of India has a significant positive relation with total trade and exports of spices with SAARC

Table 6. Panel data estimates of Spice Trade (2002–2020)

Variable	**Total trade** (T_{ijt})			**Exports** (EXP_{ijt})			**Imports** (IMP_{ijt})		
	HS 0904-0910								
	OLS	**FE**	**RE**	**OLS**	**FE**	**RE**	**OLS**	**FE**	**RE**
$lnGDP_{it}$	1.705*** (0.668)	1.881*** (0.673)	1.733*** (0.668)	2.406*** (0.332)	2.461*** (0.491)	2.586*** (0.298)	0.129 (0.583)	0.914 (0 .781)	0.961* (0. .456)
$lnPOP_{jt}$	0.914*** (0.120)	1.069 (2.633)	0.888*** (0.120)	0.625*** (0.079)	1.126 (1.523)	0.472* (0223)	1.617*** (0.139)	1.286 (2.423)	0.883 (0.534)
$lnDIST_{ijt}$	-3.669*** (1.517)	128.358 (45.376)	-3.327*** (1.517)	-8.426*** (0.971)	115.909 (96.197)	-3.054 (2.678)	-4.524** (1.703)	72.107 (153.017)	0.252 (6.346)
com_lang_ off	-2.276*** (0.417)	0.635 (0.157)	-2.189*** (0.417)	-3.094*** (0.442)	0.536 (0.967)	-0.964 (0.829)	0.679 (0.776)	0.343 (1.539)	-0.177 (1.395)
com_lang_ ethno	-2.702*** (1.246)	2.432*** (0.293)	-2.341*** (1.246)	-2.474*** (0.439)	2.579** (0.781)	-0.783 (0.742)	-8.198*** (0.771)	2.526* (1.243)	1.149 (1.204)
com_coloni zer	2.612*** (0.737)	-2.219 (1.031)	2.396*** (0.737)	5.106*** (0.364)	-3.675 (2.382)	2.152* (0.905)	0.475 (0 .639)	-2.221 (3.789)	-3.296 (1.944)
Intercept	-27.382** (18.171)	-1020.543 (328.921)	-30.238** (18.171)	-9.762 (11.867)	-928.716 (706.822)	-51.255* (22.162)	11.267 (20.809)	-569.129 (1124.315)	-35.480 (50.612)
Observa-	133	133	133	133	133	133	133	133	133
R-square	0.79	0.52	0.25	0.79	0.50	0.43	0.68	0.09	0.19
RESET values	F(6,126) =80.84	F(6,120) =21.60	Wald $Chi^2(6)$ =357.61	F(6,126) =81.55	F(6,120) =20.08	Wald $Chi^2(6)$ =120.81	F(6,126) =44.04	F(6,120)=2.06	Wald $Chi^2(6)$ =15.87
	Prob>F=0.0	Prob>F=0.0	Prob>Chi^2=0.0	Prob>F=0.0	Prob>F=0.0	Prob>Chi^2=0.0	Prob>F=0.0	Prob>F=0.063	Prob>Chi^2=0.014

Values in parentheses indicate the standard error.

nations, and the distance between the trade partners has been found statistically positive and significant in all the estimated models, which would sustain the spice trade even in the future.

Gravity equation analysis

The population of SAARC member countries also has a positive impact on total trade and imports only over time effects. The Free Trade Agreement between SAARC and India had a positive and significant relationship with total spice trade in panel estimation with both time and country effects (Table 7). The country effect model of panel gravity analysis supported that the GDP of India, with respect to spice trade between India and SAFTA member nations, increased which offered India trade creation and not diversion.

As it can be noticed, the trade volume of India with SAARC nations was significantly affected positively by the economic size of the partner countries and significantly negatively by distance, which are in line with the expecta-

Table 7. Estimation of gravity equation for Indian spice trade with SAFTA (2002–2020)

Variable	**Total trade** (T_{ijt})			**Exports** (EXP_{ijt})			**Imports** (IMP_{ijt})		
	HS 0904-0910								
	Time effect	**Country effect**	**Both effects**	**Time effect**	**Country effect**	**Both effects**	**Time effect**	**Country effect**	**Both effects**
$lnGDP_{it}$	1.508* (0.668)	1.881** (0.673)	2.134** (0.728)	3.073** (0.952)	2.461 (1.277)	3.040* (1.404)	0.098 (1.272)	0.914 (1.703)	0.295 (2.074)
$lnPOP_{jt}$	0.897*** (0.120)	1.069 (2.633)	0.740 (3.020)	0.4226 (0.349)	1.126 (3.879)	0.636 (4.193)	0.923** (0.350)	1.286 (4.174)	1.370 (4.823)
$lnDIST_{ijt}$	-3.385* (1.517)	128.358** (45.376)	118.111** (37.418)	-3.068 (5.186)	115.91 (60.914)	78.879 (60.461)	0.608 (4.513)	72.107* (36.091)	74.717 (83.354)
com_lang _off	-2.206*** (0.417)	0.635*** (0.157)	0.753 (0.450)	-1.011 (0.586)	0.536 (0.355)	0.568 (0.444)	-0.003 (1.303)	0.343 (0.511)	0.664 (0.482)
com_lang _ethno	-2.435 (1.246)	2.432*** (0.293)	2.856*** (0.533)	1.184 (1.759)	2.579*** (0.452)	3.185*** (0.758)	0.973 (2.303)	2.526*** (0.573)	2.698* (1.272)
com_colo nizer	2.435*** (0.737)	-2.219* (1.031)	-3.774* (1.532)	2.099 (1.626)	-3.675** (1.351)	-5.27** (1.993)	3.443 (2.236)	-2.221 (1.922)	-1.664 (1.935)
Intercept	-23.903 (18.171)	-1020.543** (328.921)	-945.113*** (264.369)	-64.020 (49.751)	-947.983* (430.586)	-678.99 (420.924)	-14.441 (54.486)	-577.393* (270.669)	-580.916 (639.631)
Observa- tions	133	133	133	133	133	133	133	133	133
R-square	0.28	0.52	0.58	0.81	0.50	0.58	0.18	0.09	0.19
RESET values	F(23,109) =19.45	F(6,120) =21.60	F(23,103) =6.12	F(23,109) =20.39	F(6,120) =20.08	F(23,103) =6.23	F(23,109) =11.50	F(6,120)=2.06	F(23,103)=1.08
	Prob>F=0.0	Prob>F=0.0	Prob>F=0.0	Prob>F=0.0	Prob>F=0.0	Prob>F=0.0	Prob>F=0.0	Prob>F=0.063	Prob>F=0.3763

Values in parentheses indicate the standard error.

tions of the gravity trade model. Irrespective of all the variables, the total spice trade, exports and imports experienced a negative effect but were found statistically insignificant. The common ethnology (*com_lang_ethno*) would act as a limiting force to strengthen the spice trade under SAFTA.

Conclusion

The panel analysis revealed that spice trade had a trade creation effect on SAFTA in the panel fixed effect model. In recent times, Indian trade relations with the SAARC countries witnessed an overall increase in the spice trade, implying to sustain the FTA with SAARC nations. India being the major spice exporter under SAFTA, as it has the relative trade advantage in terms of proximity and volume of trade, it can use the advantage of exporting spices for higher value rather than for higher volume, which may reveal different options for sustaining trade relations.

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Authors' contributions

ENK carried out the study and analysed the data. KMS guided the research by formulating the research concept, helped in securing research funds and approved the final manuscript. KMS, AV, KM, RJ and MK helped in editing, summarizing and revising the manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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