PLANT SCIENCE TODAY
ISSN 2348-1900 (online)
Vol 11(sp3): 170-178
https://doi.org/10.14719/pst.4688

HORIZON
e-Publishing Group
HePG

RESEARCH ARTICLE

Evaluating the ASEAN-India FTA: Implications for India's Black Pepper trade

Sachu Sara Sabu[1*] & Anil Kuruvila[2]

[1]Department of Agricultural Economics, College of Agriculture, Vellanikkara, Kerala Agricultural University, Thrissur 680 656, Kerala, India

[1]Associate (Trade), Trade and Market Intelligence Unit, Agricultural and Processed Food Products Exports Development Authority (APEDA), (Ministry of Commerce and Industry, Govt. of India), New Delhi 110 016

[2]Professor and Head, Department of Agricultural Economics, College of Agriculture, Vellayani, Kerala Agricultural University 695 522, Kerala, India

*Email: sachuss15@gmail.com

OPEN ACCESS

ARTICLE HISTORY
Received: 15 August 2024
Accepted: 10 December 2024
Available online
Version 1.0 : 27 December 2024

Check for updates

Additional information
Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information is available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc
See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

CITE THIS ARTICLE
Sabu SS, Kuruvila A. Evaluating the ASEAN-India FTA: Implications for India's Black Pepper trade. Plant Science Today. 2024; 11 (sp3): 170-178. https://doi.org/10.14719/pst.4688

Abstract

The impact of the ASEAN-India Free Trade Agreement (AIFTA) on Indian black pepper was analysed using the SMART and gravity models. The reduction in tariff under AIFTA increased black pepper imports from the Association of Southeast Asian Nations (ASEAN) countries after 2000 and caused a trade creation effect of 19.36 lakh US$. This allowed Indian consumers to benefitted from low-priced black pepper imports from ASEAN countries. Indonesia and Vietnam collectively accounted for nearly 100% of the trade creation. The distance between India and ASEAN was found to have a negative effect on trade, whereas the GDP of the importing country positively influenced the likelyhood of trade between India and ASEAN countries. The main variable of interest was the AIFTA dummy, which captured the effects of trade creation and trade diversion resulting from the regional trade agreement. The estimated coefficient of the AIFTA dummy was positive and significant, indicating a trade creation effect among AIFTA member countries as a result of the agreement.

Keywords

ASEAN-India FTA; black pepper trade; trade creation; trade diversion

Introduction

Black pepper (*Piper nigrum* L.), a member of the Piperaceae family, is widely recognized as the "King of Spices" for its extensive use in global cuisines (1). Native to the tropical forests of the Western Ghats in India, black pepper thrives in humid climates with well-distributed rainfall (2). Its cultivation has expanded globally to regions including Vietnam, Indonesia, Sri Lanka and Brazil (3). Within India, the primary black pepper-producing states are Karnataka, Kerala and Tamil Nadu (4). Globally, Vietnam, Indonesia, India and Brazil are the leading producers, collectively accounting for the majority of global production (3). Globally and within the Association of Southeast Asian Nations (ASEAN) region, Vietnam remains the top producer and exporter, contributing approximately 39% of global black pepper production (5). Other significant contributors include Indonesia, Cambodia and Malaysia, with ASEAN countries collectively accounting for over 70% of the global supply (5). This highlights the strategic importance of the ASEAN region in the global spice trade.

Liberalization of trade has been a cornerstone of India's economic strategy since the 1990s, marked by significant policy shifts like the economic reforms of 1991 and the subsequent World Trade Organization (WTO) agreement in 1995 (6). These initiatives introduced the principles of Liberalization, Privatization and

Globalization (LPG) to India's economic framework, significantly transforming the country's trade landscape, especially in the agricultural sector (7). The Agreement on Agriculture under the WTO aimed to reduce trade barriers and promote fair competition. However, the complexity of multilateral negotiations often necessitated more focused regional solutions through Regional Trade Agreements (RTAs).

Regional Trade Agreements (RTAs), which eliminate tariffs and other trade barriers among participating countries, have become a widely adopted tool of enhancing trade relations and economic integration (6). India, in particular, views RTAs as building blocks toward broader trade liberalization goals (8). One of the most significant RTAs for India is the ASEAN-India Free Trade Agreement (AIFTA), implemented in January 2010 (7). This agreement involves ten ASEAN member countries: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam (7). The AIFTA was expected to be mutually beneficial, opening a vast $1.1 trillion ASEAN market to Indian exporters and reducing their dependence on Western markets (9, 10).

Although the AIFTA has spurred growth in several sectors, its impact on India's black pepper trade has been notably nuanced. Black pepper, a key agricultural product for India, has historically established the country as a significant player in the global spice market (11). However, increased market access provided to ASEAN countries under AIFTA has intensified competition, especially from Vietnam, which has experienced a substantial rise in black pepper production (11, 12).

Although previous studies (7, 11, 12) have generally explored the impact of AIFTA's on India's agricultural sector, there is a lack of focused research on how AIFTA affects India's black pepper industry regarding trade dynamics, competitiveness and market trends. This study aims to address a critical research gap by evaluating the specific implications of the AIFTA on India's black pepper trade, an area that has not been extensively explored. This article addresses this gap by providing a detailed analysis of trade data, tariff structures and market conditions in the post-AIFTA era.

Materials and Methods

This study examines the impact of AIFTA on India's black pepper trade with ASEAN nations. For this analysis, annual export and import data for black pepper from India to ASEAN countries from from 1988 to 2019, were sourced from the World Integrated Trade Solutions (WITS) database (www.wits.worldbank.org). Additionally, information on tariffs and non-tariff measures (NTMs) was gathered from WITS, Market Access Map and the World Bank database.

Partial Equilibrium Analysis – SMART Model

The SMART model, integrated within the World Integrated Trade Solution (WITS) software, simulates the effects of tariff change scenario by focusing on one importing market and its exporting partners (13). The key advantage of this model is its ability to provide detailed sector-specific analysis and relatively simple computational requirements (14). The partial equilibrium approach, applied here, assumes that the sector under study operates independently of other economic sectors. This assumption particularly applies to primary commodities like black pepper, which typically exhibit limited inter-sectoral linkages (15). The SMART model can assess several key outcomes of trade policy changes, including trade creation, trade diversion, changes in tariff revenue, consumer surplus and overall welfare.

Trade creation occurs when tariff reductions or eliminations in a preferential trading area displace more efficient producers, increasing imports from more efficient producers. The SMART model calculates trade creation effects by using a quantitative method that incorporates the elasticity of import demand, the current level of imports and the relative tariff change (13).

Trade diversion refers to the shift in imports from more efficient producers outside the preferential area to less efficient producers within the area, driven by preferential tariff reductions (13). This effect is calculated in SMART using the elasticity of substitution and the relative change in tariffs applied to various trading partners (16).

Gravity Model

The gravity model of trade, a well-established empirical tool for modelling bilateral trade flows, serves as an alternative analytical approach (17). Unlike the SMART model, the gravity model does not heavily depend on elasticity parameter values. The gravity model posits that trade between two countries is directly proportional to the product of their GDPs and inversely proportional to the distance between them (17, 18).

This study utilized panel data on black pepper imports to India from ASEAN countries spanning 2000 to 2019. The dataset included years with zero trade flows, which, could introduce selection bias if left unaddressed. To address this issue, the Heckman sample selection model was employed. This model comprises two stages: the first stage estimates the probability of trade occurrence (selection equation) using variables such as GDP, distance, common language, colonial ties and the presence of AIFTA. The second stage examines the intensity of trade flows (outcome equation) while accounting for selection bias through the Inverse Mills Ratio (IMS) (19, 20).

The selection model is specified as follows:

$$SM = \log \alpha + \beta_1 \log (D_{ab}) + \beta_2 \log (Y_b) + \beta_3 \log (LANG) + \beta_4 \log (COL) + \beta_5 \log (AIFTA) + u_{ab}$$

where SM = 1 given to 'country b' if it has a positive export value to India and 0 if not

Y_b is the Gross Domestic Product of the b^{th} Indian trade partner

D_{ab} denotes the distance between India 'a' and country 'b' and was calculated as the seaport distance between the two countries

LANG is a dummy, which takes '1' if India and country b share a common official language and 0 if not.

COL is a dummy, which takes '1' if India and country b have ever had a colonial link; 0 if not.

AIFTA is a dummy that takes a value of 1 for years with AIFTA; 0 otherwise,

u_{ab} is error term

The outcome equation is specified as follows:

$\log (T_{ab}) = \log \alpha + \beta_1 \log (D_{ab}) + \beta_2 \log (Y_b) + \beta_3 \log (LANG) + \beta_4 \log (COL) + \beta_5 \log (AIFTA) + \beta_6 \log (C_a) + v_{ab}$

where T_{ab} is the value of the black pepper imports to India from the b^{th} Indian trade partner (ASEAN countries) and v_{ab} is the error term

Results and Discussion

Black pepper trade between India and ASEAN

Fig. 1 shows that India primarily imported black pepper from ASEAN countries. ASEAN's share in India's black paper imports rose from 49% in 1988 to 65% in 2019 in terms of quantity and 13% to 50% in terms of value during the same period. As an exporter, India's share in exports of black pepper to ASEAN was below 6% till 2010 in terms of both quantity and value (Fig. 2). the signing of AIFTA in 2010, India's exports to ASEAN showed a slight increase for a few years but later declined to 6% in by 2019. Furthermore, as illustrated in Fig. 2, India was not a major exporter of black pepper to ASEAN countries.

Vietnam and Indonesia are the major black pepper import markets for India. Together, they accounted for 55% in quantity and 45% in value of black pepper imported to India (Fig. 3, 4). As shown in Table 1, after 2010, there was a sudden increase in the share of imports from Vietnam in the total imports to India, both in terms of quantity and value. The exports as well as imports between India and ASEAN countries have increased after 2010. Still, the imports were significantly exceeded when compared to exports, which was evident from the increasing negative balance of trade. Even from the 1990s, India had a negative trade balance with ASEAN countries in the trade of black pepper. After 2010, a noticeable growth in negative balance of trade has occurred which could be due to the free trade agreement between India and ASEAN countries (Fig. 5).

The balance of trade between India and ASEAN countries was -30,705 USD in terms of value and -430 tonnes in terms of quantity in TE 1990, which increased to -29.44 lakh USD and -1821 tonnes in TE 2000 and then immensely increased to -589.97 lakh US$ and 15932.6 tonnes in TE 2019. Balance of Trade in terms of value was found to be higher than Balance of Trade in terms of quantity, which means that the import price was lower than the export price (Table 1).

Fig. 6 illustrates the black pepper prices in India and Vietnam. The price of Vietnamese black pepper consistently remained below the Indian price, but the gap widened after 2013. Even with a 100% tariff on Vietnamese black paper imports, the tariff-adjusted price would still be lower than Indian prices. Consequently, the black pepper processing industries in India have been importing cheaper black pepper from Vietnam for re-exports, especially after processing.

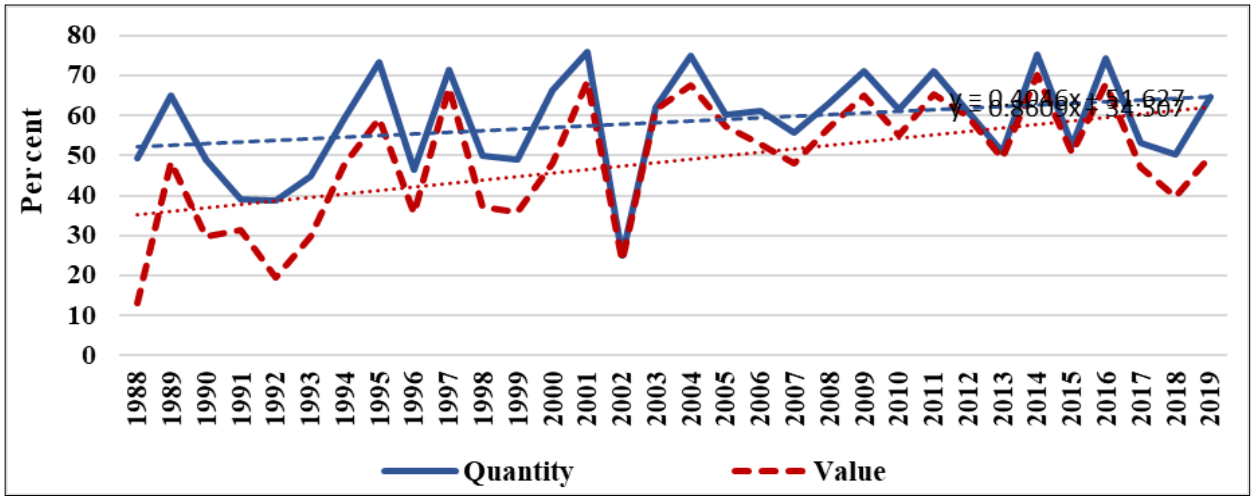

Fig. 1. Share of ASEAN countries in black pepper imports to India (%).

Note: Estimated using WITS data

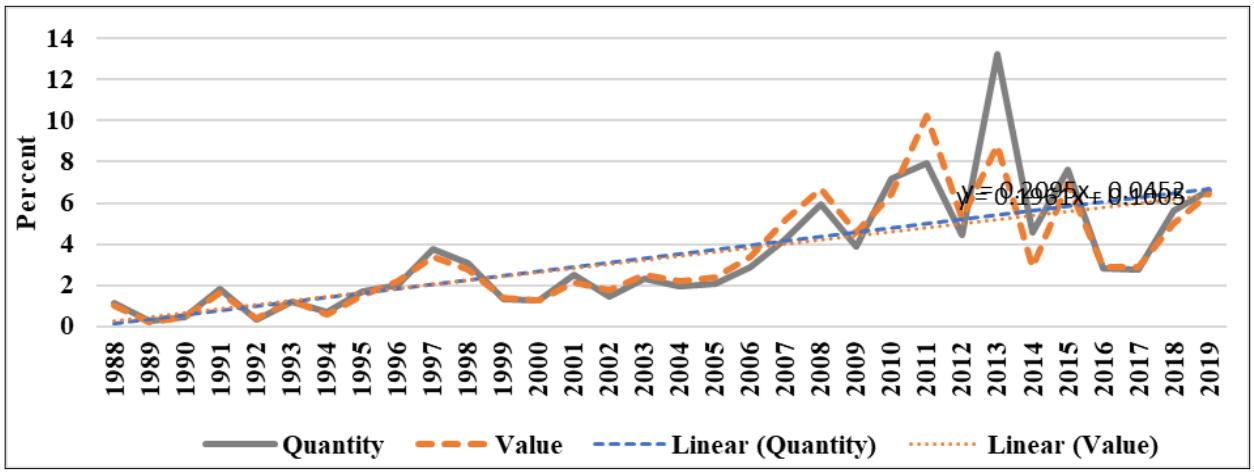

Fig. 2. Share of ASEAN countries in black pepper exports from India (%).

Note: Estimated using WITS data

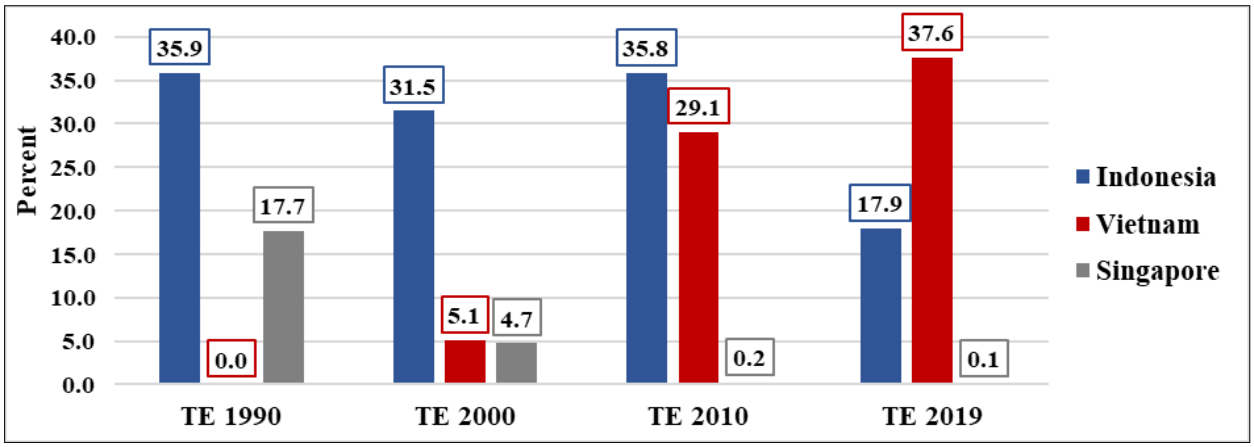

Fig. 3. Share of major ASEAN countries in quantity of black pepper imports to India (%).

Note: TE means Triennium Ending

Estimated using WITS data

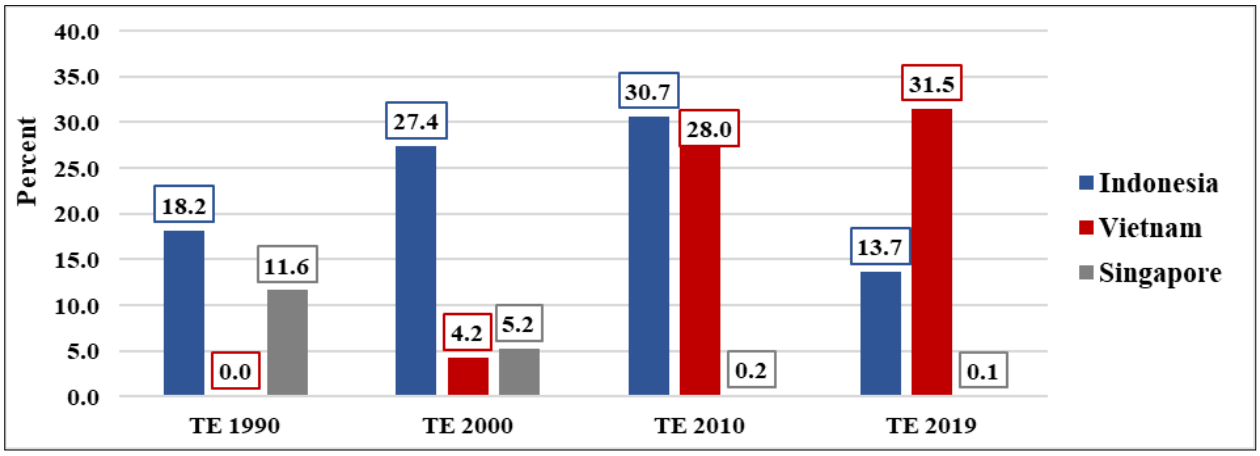

Fig. 4. Share of major ASEAN countries in value of black pepper imports to India (%).

Note: TE means Triennium Ending

Estimated using WITS data

Table 1. India's Balance of Trade (BoT) of black pepper with ASEAN countries.

	Quantity		Value		BoT	
Year	Export (kg)	Import (kg)	Export (USD)	Import (USD)	Quantity (kg)	Value (USD)
TE 1990	214522.7	644634.3	534538	565243	-430111.7	-30705
TE 1995	416295.0	1141058.7	687376	1421712	-724763.7	-734336
TE 2000	575960.3	2397148.0	2425493	5369024	-1821187.7	-2943531
TE 2005	364843.0	10479945.3	712298	14089343	-10115102.3	-13377046
TE 2010	1745331.0	9816304.3	5383227	27350304	-8070973.3	-21967077
TE 2015	3003915.7	12252961.0	14175402	91126137	-9249045.3	-76950735
TE 2019	913921.0	16846502.0	4497592	63494461	-15932581.0	-58996870

Note: TE means Triennium Ending

Estimated using data from WITS

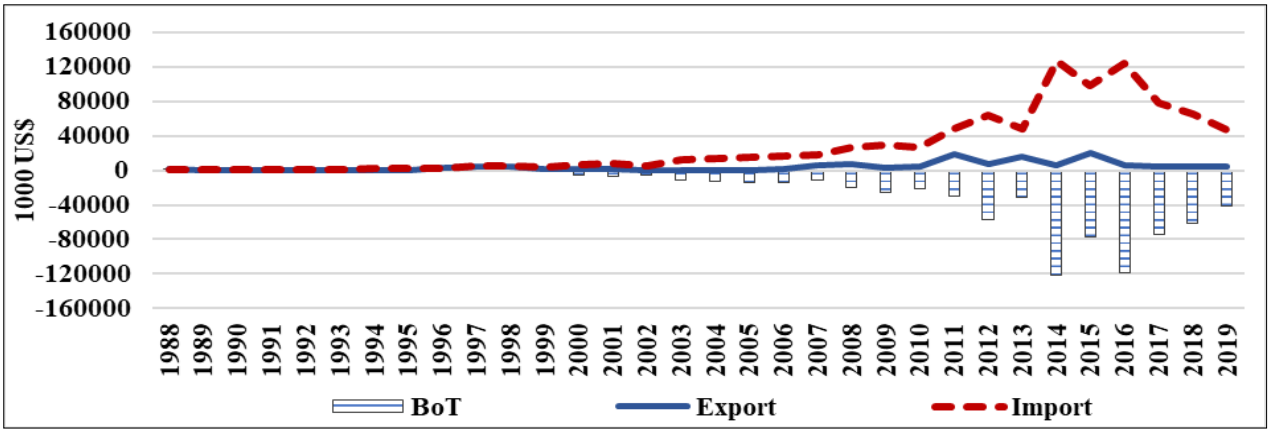

Fig. 5. India's Balance of Trade (BoT) of black pepper with ASEAN countries.

Note: Estimated using data from WITS

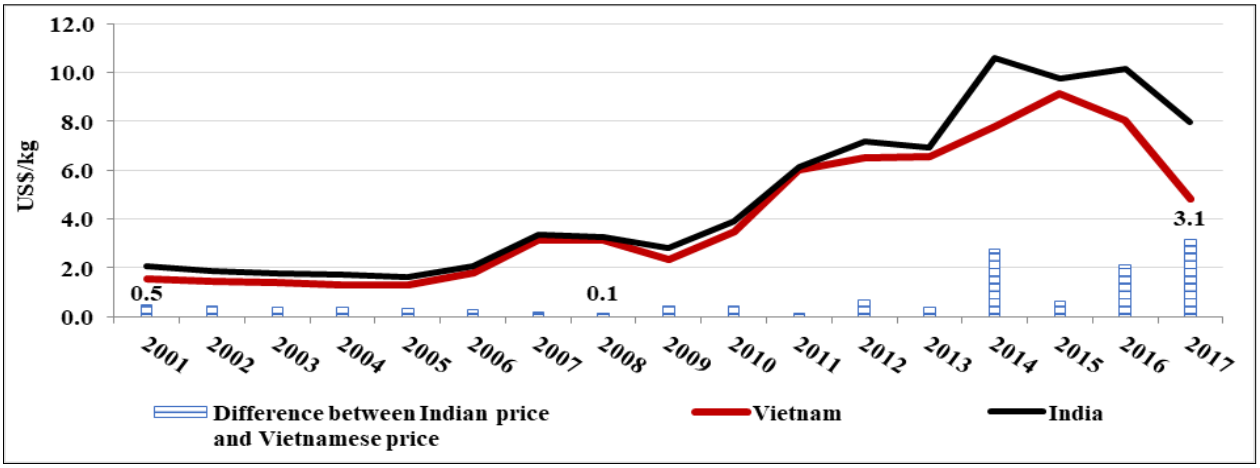

Fig. 6. Black pepper prices in India and Vietnam (2001 - 2017).

Source: Pepper statistical yearbook, IPC

The black pepper productivity ratios were calculated to understand how much times the productivities in ASEAN countries were higher than the productivity in India. The productivity ratios are termed as the ratio of yield of black pepper in each ASEAN country to the yield of black pepper in India. As evident from Table 2, the productivity of Vietnam, Indonesia, Malaysia and Thailand was higher than Indian productivity during the period from 1990 to 2017, except for Indonesia in 2017, which was below the average productivity of black pepper in India. The productivity of black pepper in Vietnam was found to be 5 times that of India. Therefore, India faces a significant disadvantage in black paper productivity compared to ASEAN countries. India's lower black pepper productivity is primarily due to aging plantations, fragmented landholdings and reliance on traditional farming practices, which constrain yields (15).

Table 2. Productivity ratios of black pepper.

Country	1990	2000	2010	2019
Indonesia	2.9	2.3	1.7	0.9
Malaysia	8.4	6.0	8.4	3.2
Thailand	6.3	11.3	12.3	5.5
Vietnam	3.8	11.4	9.1	5.0
World	2.5	3.0	3.3	2.2

Source: Various issues of pepper statistical yearbook, International pepper community

Framework of tariff reductions in AIFTA

Import duties on both agricultural and non-agricultural goods were reduced in a phased manner under AIFTA for Indian and ASEAN member countries between 2010 and 2016. Products were categorized into 5 and the tariff reductions or eliminations were made based on these categories. The Most Favoured Nation (MFN) tariff rates applied in 2007 were reduced based on the category at different times. Brunei Darussalam, India, Indonesia, Malaysia, Singapore and Thailand had to eliminate tariffs for the products included under Normal Track-1 (NT-1) by 2013 and for Normal Track-2 (NT-2) products by 2016. The complete removal of bilateral duty for India and the Philippines was in 2018 and 2019 respectively. There is a list of Special Products, separately from the Sensitive Track, for which tariffs were to be decreased much slower than the Normal and Sensitive Track. Additionally, an Exclusion List of products in which no tariff elimination or reduction commitments have been made (Table 3).

Table 3. Framework of tariff reductions in AIFTA.

Category	Tariff reductions
1. Normal track i) Normal track 1 ii) Normal track 2	Tariff eliminated in phased manner
2. Sensitive track	Tariff to be brought down to 5%
3. Special products	MFN rates to be reduced in phased manner
4. Highly Sensitive products	Category 1 reduced to 50% Category 2 reduced by 50% Category 3 reduced by 25%
5. Exclusion list	No reduction of tariff

India was committed to eliminating/reducing tariffs on more than 89% of its agricultural and manufactured goods by signing AIFTA. Approximately 70% of India's products were under the Normal Track-1, for which tariffs were eliminated by 2013. Nine percent of India's products were classified in the Normal Track-2, which dropped tariffs to zero by 2016. The 496 products (9.8% of India's total tariff lines) were included in the 'Exclusion List,' which are not committed to tariff reduction, while 11.1% of its total product lines came under the 'Sensitive Track.' The 'Special Products' constituted merely 0.1% of its total product lines. Apparently, most of the products came under the category of eliminating tariff rate by 2013 or 2016 (7). Black pepper was classified under the special product group. The MFN rate for black pepper was to be reduced in a phased manner and the preferential tariff in 2010 was 68%, which was reduced to 50% by the end of 2019 (Fig. 7).

Impact of AIFTA on black pepper

The impact of AIFTA on black pepper was analysed using SMART and gravity models.

SMART simulation for impact of AIFTA on black pepper

The SMART model is a partial equilibrium simulation model used to quantify the impact of tariff reduction of black pepper under AIFTA. This model is accessible in the World Integrated Trade Solutions (WITS) software for simulation purposes. The impact of tariff change was assessed under 2 scenarios considering one importing country (India) and its exporting partners (ASEAN countries). It is clear from Fig. 7 that the tariff rate of black pepper was reduced from the base rate of 70% in 2007 to 50% in 2019. This tariff reduction scenario was used for the analysis, under 2 assumptions *i.e.*, infinite export supply elasticity and finite export supply elasticity.

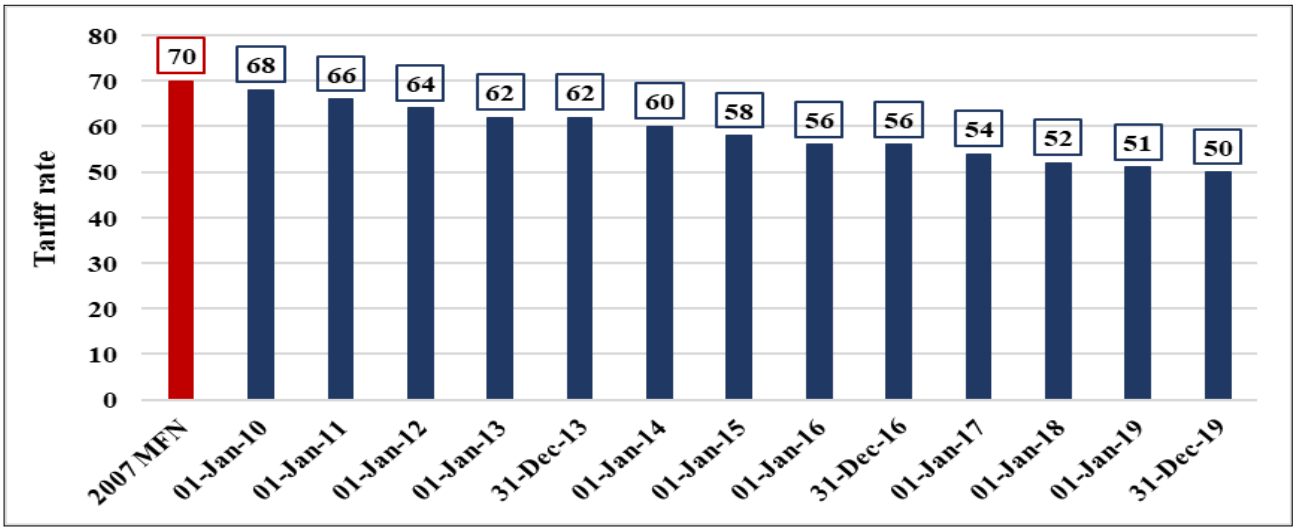

Fig. 7. AIFTA preferential tariff rates for black pepper.

Source: Ministry of Commerce and Industry, GoI

The SMART model chooses infinite export supply elasticity by default. The infinite export supply elasticity means the prices of commodities in the exporting region or countries (ASEAN) are not influenced by the higher demand in the importing country (India). Hence, the exporter would supply a higher quantity of the product at an equal price as before. Generally, in the infinite export supply elasticity, reduction of tariff results in a positive 'quantity effect' with a zero 'price effect'.

The assumption of infinite export supply elasticity appears unrealistic, as India is a much bigger country compared to the individual ASEAN countries; the higher import demand by India will have an effect on prices. So, the SMART model also fits finite export supply elasticity values other than the default infinite export supply elasticity assumption. The estimates of export supply elasticity values at the 6-digit level of Harmonized System of Nomenclature (HSN) classification are provided by the World Bank Research Department. The results of the simulations are reported based on the hypothesis of finite as well as infinite values of export supply elasticities. The finite export supply elasticity infers that the higher import demand causes a price surge in the exporting countries. In other words, tariff reduction usually results in a positive 'quantity' and 'price' effect', which means a country exports a higher quantity of the produce only at a higher price in the importing country. Table 4 shows the aggregate simulation results under the above tariff reduction scenario, based on the assumption of finite export supply elasticity and infinite export supply elasticity. The increase in black pepper imports from ASEAN countries and its decomposition into trade creation and trade diversion effects. Also reported are the assessed tariff revenue loss and the total welfare effects as a result of imports (Table 4).

According to a report, free trade agreement between countries generates dynamic and static benefits (21). The static benefits accumulate in member countries as trade creation and in non-member countries as trade diversion. Trade creation is the direct increase in imports because of the reduction of tariffs imposed on goods from the exporting country by the home country (22). Trade diversion is defined as the extent of exports from non-member countries that are being replaced by exporting partner countries as a result of the free trade agreement. Conventionally, trade diversion is regarded as negative for the global welfare, as the less efficient ones are replacing more efficient producers as a result of the new trade pact (23). When the elasticity of the export supply is finite, along with trade creation and diversion effects, there will be a price effect. Therefore, a price decrease tends to a surge in demand, which simultaneously increases the world price of the commodity. Altogether, the impact of trade comprises of both trade creation and trade diversion effects, which are linked with quantities, whereas price effect adds to the import value (24).

In the case of black pepper imports to India, tariff reduction under AIFTA resulted in trade creation for both infinite and finite export supply elasticity assumptions. As explained earlier, trade creation has a positive effect on welfare as the imports after the formation of FTA replace the high-cost domestic production. In this case, the magnitude of trade creation had only slight domination over trade diversion. The results showed that the tariff reduction has led to a substantial loss in the government's tariff revenue (Table 4). However, the increase in consumer surplus resulting from a decline in domestic prices surpasses the reduction in tariff revenue, leading to an overall welfare improvement. While consumers in FTA member countries may benefit from enhanced welfare by accessing cheaper imports, the member country as a whole could experience a reduction in government tariff revenue.

The assumption of an infinitely elastic export supply suggests that India's tariff reduction will not impact prices in ASEAN countries, meaning there are no 'price effects' (thus, these are excluded from Table 4). However, if export supply elasticity is finite, tariff changes will result in price adjustments alongside changes in quantity. As a result, the price effect reflects the portion of India's increased import value (in USD) due to rising prices in ASEAN countries. It is clear that the quantity effect (i.e., trade creation) outweighs the price effect, indicating that most of India's import growth is driven by increased volumes rather than higher prices. Table 5 presents the distribution of trade creation in black pepper among ASEAN trading partners, with Indonesia and

Table 4. Aggregate impact on black pepper trade under tariff reduction in ASEAN-India FTA (Values in '000 USD).

Aggregate simulation results		Infinite export supply elasticity	Finite export supply elasticity
Base Year Import (2007)	Value	28226.02	28226.02
Total increase in imports	Value	3845.43	133.86
	%	13.62	0.47
Trade creation	%	6.04	0.23
Trade diversion	%	5.95	0.21
Price effect	Value	0.00	4.96
Tariff Revenue Loss	Value	-5078.17	-149.45
Total welfare	Value	1201.12	46.92

Source: Simulations using the SMART model (WITS)

Table 5. India's trade creation and trade diversion with ASEAN countries.

ASEAN partners	Trade Creation ('000USD)	Trade diversion ('000USD)
Infinite export supply elasticity		
Indonesia	1058.133	1050.195
Singapore	1.189	1.111
Thailand	1.672	1.563
Vietnam	875.701	855.87
Aggregate	1936.695	1908.739
Finite export supply elasticity		
Indonesia	35.575	32.612
Singapore	0.038	0.035
Thailand	0.053	0.049
Vietnam	28.992	26.591
Aggregate	64.658	59.287

Source: Simulations using the SMART model (WITS)

Vietnam contributing nearly 100% of the trade creation.

Although trade creation typically outweighs trade diversion, it is important to identify the non-ASEAN nations whose trade with India has been diverted to ASEAN countries due to India's preferential tariff reductions. Table 6 presents the top eight non-ASEAN countries most impacted by trade diversion. These countries represent the major exporters to India whose trade has declined due to India increasing its imports from ASEAN nations. Sri Lanka was the most affected country among non-ASEAN countries.

Gravity model for assessing the impact of AIFTA on black pepper

The SMART model is sensitive to import demand and export supply elasticities, which are pre-determined. The gravity model is an alternative method to assess the impact of AIFTA on black pepper trade without relying on elasticity parameters. This model is inspired by Newton's law of gravitation, which states that the force between 2 objects is directly proportional to the product of their masses and inversely proportional to the square of the distance separating them (25). Similarly, the basic gravity model predicts that trade between two nations will be proportional to the product of their GDPs and inversely related to their geographic distance (26). Additional variables can also be incorporated into the model to capture factors that either promote or impede bilateral trade.

The panel data on imports of black pepper to India from ASEAN countries during the period from 2000 to 2019 were used for gravity analysis. This data showed zero trade

Table 6. Top non-ASEAN countries that account for the largest extent of trade diversion (Values in '000 USD).

Countries	Infinite export supply elasticity	Finite export supply elasticity
Sri Lanka	-1888.65	-57.651
United States	-25.991	-0.884
China	-10.923	-0.372
Madagascar	-5.311	-0.181
Brazil	-3.579	-0.122
Canada	-1.352	-0.046
Germany	-0.494	-0.017
Korea, Rep.	-0.384	-0.013

Source: Simulations using the SMART model (WITS)

Note: Negative sign represents the decline in value of imports

flow between India and ASEAN countries in some of the years. Overlooking zero trade flows can lead to selection bias, especially when these flows are not random, which is often the case (10). It was introduced a theoretical framework to account for zero trade flows and recommended estimating the gravity equation with an adjustment for the likelihood of trade between countries (19). The Heckman sample selection model can be employed to determine if selection bias exists, pinpoint the factors driving it and mitigate its effects.

The estimation of Heckman sample selection model has 2 stages. In the first stage, the equation for the selection of the trade partners is estimated and then an outcome equation for trade flow is estimated for adjusting the selection bias (27). The selection equation estimates the probability of India and individual ASEAN countries engaging in trade (dependent variable) on a number of independent variables (GDP, distance, language, colony and AIFTA dummy). The Inverse Mills Ratio (IMS) is derived from a probit model (selection equation) to account for the portion of the error term that reflects differences in the outcome variables due to selection bias rather than the program itself (26). In the second stage, the model assesses bilateral trade intensity by regressing the outcome variable on a treatment dummy and a set of control variables, incorporating IMS as an explanatory variable to reduce endogeneity concerns.

The estimated results of the gravity model by using the Heckman sample selection model are presented in Table 7. The Wald test shows the statistical significance of the Heckman sample selection model at a one percent level of significance. A Likelihood Ratio test assesses whether the selection and outcome equations are independent. In particular, it evaluates the null hypothesis that the correlation coefficient (rho) is zero, representing the relationship between the error terms in both equations. If the null hypothesis is not rejected, it suggests that sample selection bias is not significant. Conversely, rejecting the null hypothesis implies that the Ordinary Least Squares (OLS) model yields biased estimates. Here, the null hypothesis was rejected and hence, it is concluded that the use of the Heckman model was appropriate.

The former part of the output is the selection equation, *i.e.,* the probit model. From the results, it could be observed that the distance had a negative effect on the probability that India and ASEAN countries would engage in trade and it was

Table 7. Estimates of the Gravity model: Heckman sample selection model.

Variables	Selection Model	Outcome Model
	Probit	Regression
GDP	0.0932 (0.5212)	0.112 (0.596)
Common language	0.049 (0.421)	4.256 (1.616)
Common colony	-5.474** (2.324)	-11.099*** (3.632)
Distance	-0.0037*** (0.0009)	-0.0056*** (0.0020)
AIFTA dummy	0.165** (0.0704)	0.196** (0.077)
Inverse Mills Ratio		-0.431 (0.824)
Constant	22.914 (14.12)	33.641** (15.04)
Observations	180	159
Pseudo- R^2	0.364	0.387

Notes: Robust Standard error in parenthesis, *** p<0.01, ** p<0.05, * p<0.1, Log likelihood = -55.327, Wald chi^2 = 173.13***, LR test of rho=0 is 43.86***

significant at a 1% level. The trade volume between geographically nearer countries tends to be superior because of the lower transportation costs and other benefits arising from greater geographical proximity (15, 28). A shared cultural and political foundation can enhance bilateral trade (29, 30). From the cultural variables like common colony and language, only the dummy for common colony was significant and had a negative effect on trade. Singapore, Malaysia and Brunei had common colonial links (British colonies) among the ASEAN countries and these countries were importing fewer quantities of black pepper to India. So, the dummy for the common colony showed an adverse effect on trade. The GDP had a positive effect on the probability that India and ASEAN countries would engage in trade, but it was not statistically significant. Similar results were reported (15) while studying the impact of AIFTA on plantation crops using gravity model.

The latter part of the result is the outcome equation, *i.e.,* the typical gravity model. The variables that were significant in the selection equation turned out to be significant in the outcome equation as well, with the signs of the coefficients being the same in the 2 equations. The Inverse Mill's ratio, which takes into account the selection bias, was insignificant, which in turn means that the null hypothesis of uncorrelated errors could be accepted. The main variable of interest was the AIFTA dummy that captures the effects of trade creation and trade diversion. The estimated coefficient of AIFTA dummy was positive and significant which indicated a positive trade creation effect among AIFTA member countries. Trade creation improves welfare as the increased black pepper imports to India from FTA member countries as a result of AIFTA replaces the high-cost domestic production (31). It can be inferred from the coefficient of AIFTA dummy (0.196) that black pepper imports to India from ASEAN countries would be higher by 19.6% of the black pepper imports with the rest of the world after the formation of AIFTA. It was reported similar findings that trade creation effect outweighed the trade diversion effect, suggesting that the former contributes more to enhancing the welfare of AIFTA member countries (32). The results clearly show that AIFTA promotes trade creation over trade diversion in the context of India's black pepper trade.

Conclusion

The analysis of the ASEAN-India Free Trade Agreement (AIFTA) reveals significant implications for India's black pepper trade. The application of SMART and gravity models provided a comprehensive assessment, highlighting the impact of tariff reductions under AIFTA, which notably increased the import of black pepper from ASEAN countries. The trade creation effect, valued at 19.36 lakh USD underscores the benefits to Indian consumers, who gained access to lower-priced black pepper primarily from Indonesia and Vietnam. These two countries accounted for nearly the entirety of the trade creation observed. The study also found that geographical distance posed a challenge, exerting a negative influence on trade between India and ASEAN nations. In contrast, the GDP of the importing country positively influenced trade engagement. The AIFTA dummy variable, representing the agreement's effect, was positive and significant, affirming that AIFTA has facilitated a positive trade creation effect among member countries.

AIFTA has played a crucial role in shaping the dynamics of India's black pepper trade, particularly by enhancing import flows from ASEAN nations. While consumers have benefited from the resultant lower prices, the agreement has also encouraged stronger trade relationships within the region. India's participation in AIFTA and similar trade agreements presents both opportunities and challenges for the black pepper sector. While these agreements enhance market access for competitive products, they intensify competition and price pressures, threatening the livelihoods of small farmers engaged in black pepper cultivation. To safeguard the sector, it is crucial to adopt targeted interventions that improve productivity, quality and market access, while leveraging government initiatives like the Spices Board's export promotion schemes and subsidized quality certification. By focusing on premium market segments and strengthening exports to ASEAN countries, India can ensure sustainable growth for its black pepper industry and secure better livelihoods for its farmers.

Acknowledgements

The authors extend their sincere appreciation to Kerala Agricultural University for the financial and technical support that made this study possible. This research is part of the first author's PhD work carried out at the university.

Authors' contributions

SSS carried out the data collection, statistical analysis and drafted the manuscript. AK participated in the design, coordination and drafting of the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: The authors declare no conflict of interest regarding the publication of this research article.

Ethical issues: None

References

1. Ravindran PN, editor. Black Pepper: *Piper nigrum*. USA: CRC Press; 2000. https://doi.org/10.1201/9780203303870
2. Nair KP. The agronomy and economy of black pepper (*Piper nigrum* L.) - The "King of Spices". In: Sparks DL, editors. Advances in Agronomy. California: Elsevier academic press; 2004;273-392.
3. FAO [Food and Agriculture Organization]. World Food and Agriculture - Statistical Yearbook 2021. Rome: Food and Agriculture Organization of the United Nations; 2021. https://doi.org/10.4060/cb4477en
4. Spices Board India. State-wise Black Pepper Production Report [Internet]. 2023 [cited 2024 March 4]. Available from: www.indianspices.com
5. Nedspice. Pepper Crop Report 2023 [Internet]; 2023 [cited 2024 March 4]. Available from: https://www.nedspice.com/app/uploads/2023/02/Nedspice-Pepper-Crop-Report-2023.pdf.
6. Kotwal A, Ramaswami B, Wadhwa W. Economic liberalization and Indian economic growth: What's the evidence ?. J Econ Lit. 2011;49 (4):1152-99. https://doi.org/ 10.1257/jel.49.4.1152
7. Francis S. A sectoral impact analysis of the ASEAN-India free trade agreement. Econ Polit Wkly. 2011;46(2):46-55.
8. Frankel JA, Rose AK. Economic structure and the decision to adopt a common currency. Seminar Papers 611, Stockholm University: Institute for International Economic Studies. 1996.
9. Mansfield ED, Reinhardt E. Multilateral determinants of regionalism: The effects of GATT/WTO on the formation of preferential trading arrangements. International Organization. 2003;57(4):829-62. https://doi.org/10.1017/S0020818303574069
10. Batra A. India's global trade potential: The gravity model approach. Global Econ Rev. 2006;35(3):327-61. https://doi.org/10.1080/12265080600888090
11. Joseph KJ. ASEAN-India pact and plantations: Realities of the myths. Econ Polit Wkly. 2009;31:14-18.
12. Harilal KN. Regional cooperation for whom?. A study of ASEAN-India FTA in the context of plantation/tropical products. Millennial Asia. 2014;5(2):137-55. https:// doi.org/10.1177/0976399614541189
13. Laird S, Yeats A. The UNCTAD trade policy simulation model. [Internet]; 1986 [cited 2024 April 14]. Available from: https://wits.worldbank.org/data/public/SMARTMethodology.pdf
14. Jammes O, Olarreaga M. Explaining smart and GSIM. [Internet]; 2005 [cited 2024 April 3]. Available from: https://wits.worldbank.org/witsweb/download/docs/explaining _smart_and_gsim.pdf
15. Veeramani C, Saini GK. Impact of ASEAN-India Preferential trade agreement on plantation commodities: a simulation analysis. Econ Polit Wkly. [Internet]. 2011[cited 2024 January 3];5:83-92. Available from: https://www.jstor.org/stable/41151946
16. United Nations Conference on Trade and Development (UNCTAD). A Practical Guide to Trade Policy Analysis [Internet]; 2012 [cited 2024 April 2]. Available from: https://www.wto.org/englishrese/publications_e/wto_unctad12_e.pdf
17. Tinbergen J, editor. Shaping the world economy: Suggestions for and international economic policy. New York: The Twentieth Century Fund; 1962
18. Pöyhönen P. A tentative model for the volume of trade between countries. Weltwirtschaftliches Archiv; [Internet]. 1963 [cited 2024 January 3];1:93-100. Available from: https://www.jstor.org/stable/40436776
19. Helpman E, Melitz M, Rubinstein Y. Estimating trade flows: Trading partners and trading volumes. The Quart J Econ. 2008;123(2):441-87. https://doi.org/10.1162/qjec.2008.123.2.441
20. Sabu SS, Kuruvila A, Subash SP. Price volatility of black pepper in Kerala: could institutional mechanism such as contract agreement be a solution ?. Indian J Agrl Econ. 2020;75(2): 166-85. https://doi.org/10.22004/ag.econ.345132
21. Balassa B. The theory of economic integration. London: Routledge; 1961
22. WITS [World Integrated Trade Solutions]. WITS user manual [Internet]; 2011 [cited 2024 January 3]. Available from: https://wits.worldbank.org/data/public/ WITS_User_Manual.pdf
23. Chandran BS, Sudarsan PK. India-ASEAN free trade agreement: Implications for fisheries. Econ Polit Wkly. 2012;47(16):65-70.
24. Pereira Villa C, Gómez Abella D, Herrera LO. The colombia-canada free trade area: a partial equilibrium simulation. Semestre Económico. [Internet]. 2012 [cited 2024 January 3];15(31):15-42. Available from: https://www.redalyc.org/pdf/1650/16502 4299001.pdf
25. Harrigan J. Specialization and the volume of trade: do the data obey the laws ?. HandBook of International Trade. 2003;85-118. https://dx.doi.org/10.2139/ssrn.921392
26. Anderson JE, Van Wincoop E. Trade costs. J Econ Liter. 2004;42 (3):691-751. https://doi.org/10.1257/0022051042177649
27. Greene WH. Econometric analysis. New Jersey: Prentice Hall; 2008
28. Leamer EE, Levinsohn J. International trade theory: the evidence. Handbook of International Economics [Internet]. 1995 [cited 2024 January 3];3:1339-94. Available from: https://ssrn.com/abstract=226540
29. Eichengreen BJ, Irwin DA. The role of history in bilateral trade flows. Cambridge: National Bureau of Economic Research; 1996. https://doi.org/10.3386/w5565
30. Fidrmuc J, Fidrmuc J. Disintegration and trade. Rev Inter Econ. 2003;11(5):811-29. https://doi.org/10.1046/j.1467-9396.2003.00419.x
31. Nag B, Sikdar C. Welfare implication of India-ASEAN FTA: An analysis using GTAP model. Indian Institute of Foreign Trade Working Paper No. EC-11-06; 2011. https://dx.doi.org/10.2139/ssrn.2031637
32. Jagdambe S, Kannan E. Effects of ASEAN-India free trade agreement on agricultural trade: The gravity model approach. World Dev Perspet. 2020;19:100212. https://doi.org/10.1016/j.wdp.2020.100212