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Assessing the Impact of Tariff Reductions under the ASEAN-India Free Trade Agreement on India's Black Pepper Imports from Vietnam (2010–2023)

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Abstract

This study examines the impact of tariff reductions from the ASEAN-India Free Trade Agreement (AIFTA) on India's imports of black pepper obtained from Vietnam from 2010 to 2023. AIFTA aimed to enhance regional trade and economic integration, yet growing dependence on low-cost Vietnamese pepper has raised concerns regarding India's domestic competitiveness. This study employs time-series econometric techniques, such as Augmented Dickey–Fuller tests, Vector Autoregression (VAR), and Vector Error Correction Model (VECM), to assess the extent to which tariff liberalization has impacted trade patterns. The findings suggest that factors in the Indian pepper market show notable short-term interactions affected by production shocks, price fluctuations, and changes in exports, whereas tariff rates exert little influence in the short run. However, the VECM indicates a significant long-term equilibrium relationship influenced by variations in domestic consumption. Forecasts indicate continuous variations in India's pepper prices and consumption, with a short-term rise expected until 2030 before entering a stabilization period. The results show that tariff reductions from AIFTA improved Vietnam's competitiveness in the Indian market, boosting India's dependence on imports but offering limited long-term benefits to domestic producers. These results highlight the need for specific policy actions to protect India's pepper sector while maintaining the advantages of local trade liberalization.

Keywords: *AIFTA; Tariff Liberalisation; Black Pepper Trade; Vietnam Exports; India Agricultural Sector; Import Dependency; Time-Series Econometrics; VAR; VECM; Forecast Modelling*

Introduction

The regional agreements have been influential in liberalization of trade and enhancing global integration of economies. The ASEAN-India Free Trade Area (AIFTA) refers to the ASEAN-India structure understanding on overall financial collaboration between the Republic of India and the Association of Southeast Asian Nations (ASEAN). Conversely, ASEAN denotes Malaysia, the Republic of Singapore, the Kingdom of Cambodia, the Lao People's Democratic Republic, the Kingdom of

Thailand, Brunei Darussalam, the Union of Myanmar, the Republic of Indonesia, the Socialist Republic of Vietnam, the Republic of the Philippines; that is, collectively, these states are called the ASEAN Member States and, separately, as an ASEAN Member State (Association of Southeast Asian Nations & Republic of India, 2009). The tariff reductions are the intended reduction of import duties on agricultural products as a part of AIFTA (Sabu & Anil, 2024). Researchers argue that AIFTA has enabled increased growth of trade and at the same time subjected some domestic industries to increased competition of imports. India as well as the ASEAN had witnessed significant growth in agricultural imports and exports in the 1990s and early 2000s, but these were rather vulnerable to external shocks since they were disadvantaged in terms of costs (Jagdambe and Kannan 2020). Vietnam is becoming a major producer of black pepper which is the best commodity influenced by tariff opening. In the past, pepper industry prevailed in the Indian market, but is currently facing many threats in the form of high import prices, low harvest and deteriorating export market. Whereas the establishment of AIFTA was to balance both trade and investment, the trade between India and ASEAN expanded significantly and this raises the question of whether the liberalization of tariffs gives rise to other unintended effects in the domestic spice industry in India (Singh, 2021; Jagdambe & Mouzam, 2019b). Given the situation at hand, it is relevant to ask whether the dependence of the Indians on Vietnam as imports of black pepper under the tariff cut of the AIFTA has generally affected the competitiveness of Indians. The research question is whether the tariff reduction by AIFTA will impact on the imports of black pepper in India among the Vietnam countries. As the importation of agricultural products on AIFTA has progressively been made cheaper in terms of importation duties, Vietnamese pepper has become a common and less expensive food commodity in India (Yogesh & Dr.S. Mokshapathy, 2013). The structural factors have hampered the production of pepper in India because of the old varieties of crops and a high rate of disease which lead to poor production and high production costs. This has seen the Vietnamese pepper being cheaper hence strengthening the dependency of imports by India and resulting in high levels of importations (Jagdambe & Kannan, 2020). Lack of non-tariff barriers and internal logistical hurdles have undermined the competitiveness of India exporting products in world markets with less trade benefits to the members of ASEAN (Khati & Kim, 2022). However, despite the fact that tariff policy and structural weakness are associated, symmetric liberalization has led to an improvement in the growth of imports. The cut in tariffs has increased the pace of market growth in India as compared to the domestic industries. Much of the literature that is currently available is focused on the evaluation of the overall welfare or aggregate agriculture impact of AIFTA with the view of explaining the commodity-specific trade patterns. This paper fits into this gap by considering the impact of AIFTA tariff cuts on the black pepper trade, one of the key exports. It explores the possibility of diversion or creation of trade during AIFTA implementation of lower tariffs on black pepper imports of Vietnam in the period between 2010 and 2023. The study separates the product-level impacts and a general indicator of the trade, giving a subtle insight into the effects of agreements on free trade on certain agricultural commodities. This case only analyzes the pepper trade between India and Vietnam after AIFTA; a weakness of the study is that there was no other country in ASEAN that was studied.

Literature Review

The AIFTA effect on India is examined, and it is observed that the agricultural imports and exports with the member countries of the ASEAN have increased significantly. Using a gravity model, the research shows a strong trade creation, and not trade diversion and focuses on benefits of welfare. Reduction in tariffs has created apprehension among the industries that are vulnerable like spices and rubber. The AIFTA agreement has not reduced the force of Vietnam in the importation of Indian black pepper because of high pressure (Jagdambe & Kannan, 2020). With the help of the SMART and the gravity models, the paper discusses the level of effectiveness of the ASEAN-India Preferential Trade Agreement on the agricultural commodities. These tariff cuts have increased imports by the ASEAN

members like Vietnam and Indonesia. The rising consumer surplus has been compensated by the falling tariff revenue although India has received welfare benefits. Pepper is the second-largest plantation product that is expected to be a significant import. The authors mention that the surge can exceed the potential of Indian farmers and plantation workers, requiring the systematic changes (Veeramani et.al). The effects that AIFTA had on India, Indonesia and Vietnam were analyzed through the SMART model. The research established that trade diversion did not succeed in stimulating trade creation as compared to boosting exports of specialty products in India like coffee, tea or pepper. The analysis shows that AIFTA has a profound impact on trade relations of India with ASEAN which are achieved due to increase in imports in comparison to exports. Major markets that have been found to be most important by ASEAN such as India have been in efforts to gain access to them, as is seen in the trade deficit of the two countries that increased to US$23.00 billion in 2019, and this has raised concerns with regard to tariff liberalization (Singh, 2021). The literature existing on India as a black pepper exporter and its transformation into a leading importer is the focus of the studies as well as the use of Compounded Annual Growth Rate (CAGR) data and that of Confederation of Indian Industries (CII). The global export share reduced to 5 per cent and the exports were reduced to 18,210,000 tonnes between 1990 and 2019, a drop of 25 per cent. Although there was relative consistency in import stability, there was an upsurge in relying on imports. The black pepper industry in India has undergone major structural policy changes and production changes (Sabu et al., 2024b). Compound Annual Growth Rate or CAGR is a statistic used to estimate the average annual growth rate of an investment/production over given time assuming constant annual growth rate (Kumar & Shobana, 2025). Although the relations of agricultural trade between India and ASEAN were characterized by discernible improvement over the 20132022 period, empirical Indian data proves that the country trade deficit reached the peak only in 2021. At the same time, the increase in imports was 2.2 per cent, whereas the growth rate of exports per annum was negative, which is -2.11 per cent, which indicates sluggish growth. The Trade Intensity Index also confirms that the relationship in imports turned out to be rather stable. The TII is a set of measurements of the volume, relative level, and the amount of economic development in a country (Wardani et al., 2024). Unfairness persists despite the policy attempts at curbing the same, which can be explained by the lack of sufficient competitive processes. India, therefore, needs to come up with strategic market-diversification programs to ensure that they attain a competitive positioning in the ASEAN framework (Saikia & Gogoi, 2024). According to previous research, it has been suggested that the production of black pepper in India has been experiencing a shift making the country a strategic player in the presence of such determinants as the disease prevalence, crop senescence, the decline of productivity and heavy competition with Vietnam. Despite India having 40 percent of the land used to harvest black pepper worldwide, India exports a small portion of the entire sweet black pepper to other countries worldwide at only 10 12 percent. In 2001 through to 2010, there was a sharp rise of pepper imports by India in Vietnam, and it rose up to US 12,572,000 which was later on to US 7,405,000 per capita (Yogesh & Dr. S. Mokshapathy, 2013). Modern sources show that the black pepper industry in India experiences restricted production and shrinking cultivation between 2000 and 2018 that subsequently affects the consumption trends. The volumes of imports increased to 16,000 tonnes in 2016 after the pre-1990 levels. The declining prices of commodities and decreased competition at the global scale have been weakening the international position of the country. Although the Free Trade Agreement provides a liberal tariff regime, the high cost of production supports the income of farmers, and domestic markets are also affected by the changes in the trade routes and the existence of illegal imports (Cariappa & Chandel, 2020). Based on studies done since the inception of World Trade Organization, there has been a booming growth of Regional Trade Agreements (RTAs) that have been seen to be both beneficial in creating trade and also diversions. The end of 2010 required a significant reduction in tariffs and the Tariff agreement between ASEAN and India (AIFTA) is a model that allow trade agreements between member states. The results are, however, inconsistent, some studies argue that trade was created in some goods before net, but others indicate that most of the trade becomes concentrated to an objective function (Rachman & Hartono, 2023). These investigations have shown that the imports of black pepper by India according to its ASEAN member countries and especially Vietnam

and Indonesia grew significantly under the AIFTA with almost all the imports being sourced by India and amounting to 1.9366 USD. The Indian pepper market had a high demand, which encouraged high increases in Indian export production. The tariff cuts made Vietnamese pepper cheaper to import than Indian pepper in spite of increased domestic cost of production. There was a need to have re-exports after processing. Since 2010, the trade balance in India had been gradually worsening as the imports outweighed the export (Sabu & Anil, 2024). The influence of AIFTA on India–ASEAN trade was strong and the fact that studies used gravity models to identify the application of unconventional trade barriers indicated this. An increase in trade with the members of the ASEAN, including Vietnam was associated with an increase in GDP growth, but the influence of the geographical distance was relatively weak. The non-tariff barriers put on agricultural products such as black pepper to offset the tariff reductions that followed AIFTA put a restriction on the export capacity of India. This point implies that tariff policy changes are not always enough to ensure fair trade outcomes (Khati & Kim, 2022). Vietnam has undergone a significant improvement in trade due to signing of free trade agreements with other countries, which have seen bilateral FTAs with Chile and Japan generate export gains of over 300 and 60 percent, respectively. The effectiveness of FTAs relies on the complementary nature of the industrial structures; the complementary ones are advantageous to the developed economies and have little impact and favor the developing side of the partnership. In order to keep up with the compliance of the AIFTA analysis, the pepper trade in India and Vietnam should be distinguished, considering the product differentiation and competition of prices. In addition to this, tariff cuts may either ease or impede trade (Oanh, 2017). A paper which uses the PPML gravity model discovered that the introduction of AIFTA in 2010 saw the shift of trade to efficient non-members and the decrease of export-imports among the members. The estimations indicate that the historical linkages are very volatile, but GDP and distance are still significant variables in trade. No short-term solution was to be found, though, since the global recession and gradual introduction of changes damaged exports. The reliance of India on black pepper imports especially Vietnamese might have been a direct result of tariff liberalisation as it is one of the major ASEAN-Indian commodities (Khurana & Nauriyal, 2017). Regardless of this country experiencing a fall in terms of trade, the previous studies have suggested that AIFTA provided both ASEAN and India with terms of trade benefits amounting to the US 4,201, million. Even though the effects of tariff liberalisation were divergent in the areas of processed food, grain crops, and textiles (especially heavy manufacturing), the agricultural export boom (mainly spices) in ASEAN posed a threat to Indian jobs and wages (Ahmed, 2010). According to recent researches, in 2009, India signed the ASEAN-India Free Trade Agreement and has since been moving towards the region blocs more than multilateralism. The more sophisticated gravity models show a high level of variation with the ASEAN dummy coefficient having a positive value which is very influential. Despite the benefit of increased Indian tariffs to ASEAN, the benefit of competitive advantage by India is only achievable through investment and development of Indian services but not commodities (Chandran, 2018).

Methodology

1. Research Design

The study is a quantitative, longitudinal time-series study to determine the effects of reduction in tariffs under the ASEAN-India Free Trade Agreement (AIFTA) on the dynamics of black pepper imports in India especially with regard to Vietnam within 2010-2023. Since the tariff adjustments, domestic production shocks, consumption, and international trade variables vary over time, it is necessary to use a multivariate time-series econometric model to determine the short-run relationships, as well as the long-run equilibrium relationships. The research hence uses unit-root and stationarity tests (Augmented Dickey Fuller (ADF)) to evaluate the relationship between two or more variables, Vector autoregression (VAR) to model short run fluctuations, Johansen cointegration tests in order to determine long run equilibrium

vectors, a Vector error correction model (VECM) to model both the short-run and long-run dynamics, and forecasts as a way of projecting the trends until the year 2030. All data cleaning, transformation, modelling and diagnostic testing were conducted using Stata MP17, ensuring replicability and adherence to standard economic practices. Such a methodological pathway is consistent with the procedures that are well established in the trade-econometrics literature on tariff liberalisation and commodity-specific trade flows.

2. Data Sources and Variables

Six core variables that were close to the black pepper market in India and AIFTA tariff schedule were gathered in monthly and annual time series observations. These variables are the pepper tariff rate under AIFTA (PT, measured as percent), export quantity of pepper produced in Vietnam to India (VEPTI_Q, measured as metric tonnes), the export price of pepper in Vietnam (VEPTI_P, measured in USD per tonne), local pepper production in India (IPRO_Q, measured in metric tonnes), local pepper consumption in India (ICON_Q, measured in metric tonnes) and the India Monthly Local Pepper Price (IMALPP, measured in per kilogram). The information was obtained from the International Pepper Community Database. The series were combined into a standardized annual time-series structure covering 2010-2023.

3. Pre-Estimation Tests: Trend Analysis and Stationarity

3.1. Visual Trend Assessment

Trend behaviour and stochastic properties were visually inspected by plotting each variable with the help of the tsline command. As can be described in the Results section, most of the variables had very strong upward or downward trends, or increased volatility, which signals non-stationarity. It was only PT which showed relative stability after 2019.

3.2. ADF Unit Root Testing

To test formally the stationarity, Augmented Dickey Fuller (ADF)tests were run on each of the series in both its level and differenced forms. The result indicated that PT was stationary at level which corresponded to I(0) process, but ICONQ, IMALPP and VEPTIQ needed second differencing to be stationary, they were I(2). IPROQ and VEPTIP became stationary upon a first difference and hence were considered as I(1). Since the variable set contained two processes I(1) and I(2), levels estimation of a VAR would not have been suitable, thus the following cointegration test.

4. Lag Selection for VAR/VECM

In determining the best lag structure, the three criteria of information that were used in the investigation include Akaike (AIC), Hannan-Quinn (HQIC) and Schwarz Bayesian (SBIC) criteria. The three criteria collapsed to a specification of two lags as the best specification with AIC = -297.11, HQIC = -300.325, and SBIC = -296.634. Both the VAR and the VECM estimates always used this lag length.

5. Johansen Cointegration Test

With the mixed integration orders and theoretical anticipations of the long-run trade bonds, the Johansen procedure with trace statistics was used to establish the quantity of cointegrating vectors. The findings reveal the existence of at least one major long-run equilibrium relationship between the tariff rate, domestic consumption, domestic production, the amount of exports made by Vietnam, the price of

its export, and the domestic price of India. The null hypothesis of the absence of cointegration was rejected, which justified the use of a Vector Error Correction Model (VECM) in the further analysis.

6. Vector Autoregression (VAR) Modeling

Preliminary estimation of a VAR(2) model was done using the variables that should be stationary and differentiated accordingly based on their significance, i.e., D2ICONQ, D2IMALPP, D2VEPTIQ, DIPROQ, DVEPTIP, and PT. The model showed very strong short-run interdependence especially among the domestic production, domestic consumption and the quantity of exports of Vietnam; the model however did not pass the stability tests necessary, as the eigenvalues of many of them are greater than one. This volatility made the VAR inappropriate in long-run forecasting and supported the necessity of using the VECM framework.

7. Vector Error Correction Model (VECM)

VECM model used short-term dynamics to capture short-term variations in form of differenced variables, long-term adjustments in the error-correction term and the cointegration structure. The long-run cointegrating equation was normalised on ICONQ, and it was easy to interpret how domestic consumption would approach the equilibrium with other variables of the market. The IPROQ coefficient was significant in the negative ($p = 0.003$) and thus there was evidence of an important long-run adjustment process between consumption and domestic production but there was little evidence of a long-run process through export related variables. The error-correcting factor was substantial in the DICONQ equation ($p = 0.029$) which validates the fact that consumption is the adjusting variable of the system, thus indicating the long-run effect of AIFTA tariff effects on the domestic market behaviour. The remaining diagnostic tests with the LjungBox procedure revealed the white-noise errors in majority of equations, which were an indication of the sufficiency of the overall model specification.

8. Forecasting Procedure

Dynamic predictions were made using the VECM estimates and the confidence interval on the dynamic forecasts of the pepper consumption, domestic prices, export quantity in Vietnam, production in India and export prices in Vietnam. These forecasts were projected until 2030 to determine the projected trend of India-Vietnam pepper trade under the current AIFTA tariff. The fact that the confidence intervals were gradually increasing past 2030 was viewed as model-consistent long-term uncertainty which encapsulated reduction in predictive accuracy as the forecast horizon increases.

Results

Plots of time-series of each variable were created to perform a visual analysis of stochastic trends before the actual stationarity testing. The variables were plotted against time each with the tsline command. The unit root was evident in the graphs of the variables India Monthly Average Pepper Price (IMALPP), Vietnam Exports Pepper to India_Quantity (VEPTI_Q), and India Production_Quantity (IPRO_Q) because of strong upward and downward trends in the graphs. Gradually, Pepper Tariffs (PT) were the only tariffs that were comparatively stable. The non-stationarity was plotted down in form of a graph and then established statistically using Augmented Dickey-Fuller (ADF) tests. Variable PT declined steadily between the years 2010 and 2019, and then it stagnated. The trend is indicative of policy-related liberalisation, which may require Dickey-Fuller tests of non-stationarity.

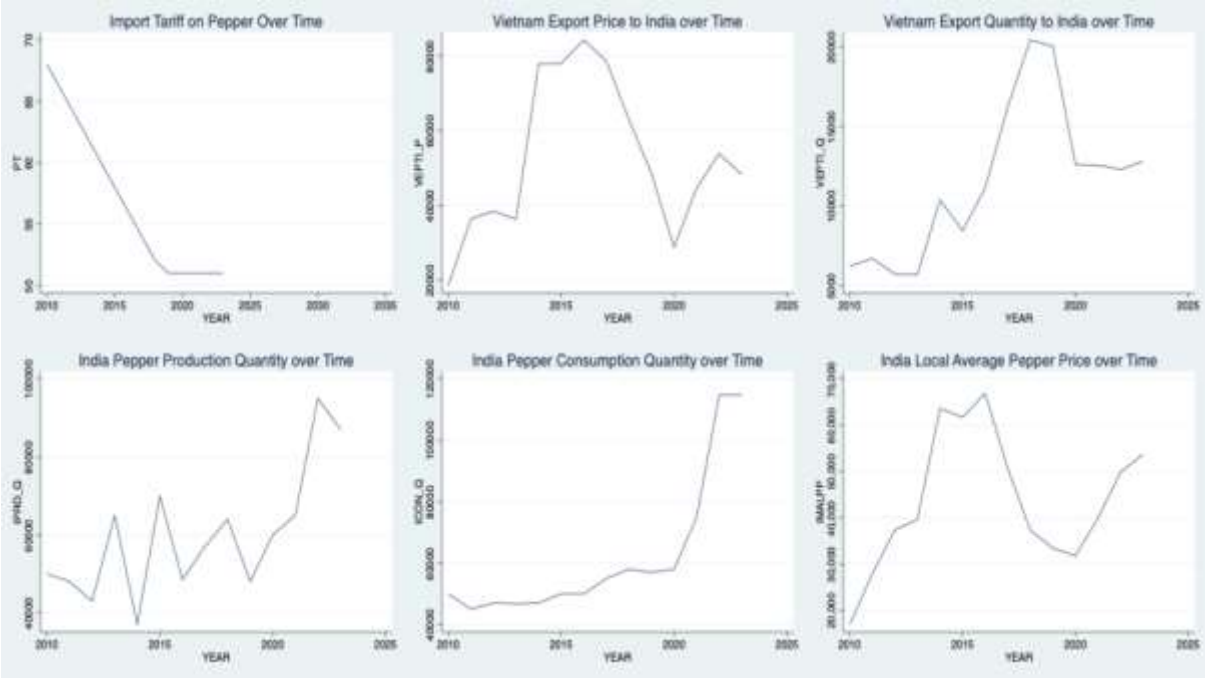

Figure 1 Original Variables Plotted Against Time

Variable Vietnam Export Pepper to India_Price (VEPTI_P) hit its maximum point in 2016-2017 and dropped significantly as a result of non-stationarity and uneven prices, so that differentiation is necessary before further examination can provide stationarity. The pepper exports of Vietnam to India (VEPTI_Q) increased significantly between 2013 and 2018 and dropped after 2019, which indicates a structural change and non-stationarity that should be followed by the use of Dickey-Fuller test to establish a stable position. Because of the climatic and agricultural shocks, the production of pepper in India (IPRO_Q) varied significantly during the period of 2014-21. Non-stationarity can be implied by such volatility and a stationarity test and possible differencing are required. The consumption of black pepper in India (ICON_Q) had been growing gradually, but in 2018, the rise was steep, and this is an indicator of demand shock and volatility. The trend indicates that the series of ICON_Q is not stationary and requires differentiation to obtain a stationary state. The domestic pepper prices in India (IMALPP) showed significant volatility between 2010 and 2023 which reached its peak in 2016 following supply shocks and policy responses. The ensuing non-stationarity makes the Dickey Fuller test binding to measure. Augmented Dickey-Fuller tests were conducted in order to test the stationarity of six variables. PT was the only variable that was stable at I(0) ($p < 0.05$); the other variables had unit roots, and as such, they needed to be differenced before subjecting them to any other econometric analysis. ΔICON_Q gives a less notable trend and variance, as the ADF (–2.655, p = 0.0822) statistic exhibits weak stationarity at the 10 per cent level. First differencing works well in eliminating unit-root behavior and is stable at the I(1) integration. The second difference (ADF = -3.167, p = 0.0220) of ICON_Q is at rest at the 5% level; the transformed series is randomly fluctuating around a constant value, which ascertained the integration of order I(2) prior to the estimation of the model. ΔIMALPP is approximately centered around the mean but not quite non-stationary (ADF = -2.498, p= 0.1160). Second differentiation is necessary to remove non-stationary residual and be fully stable to form part of the VAR model. IMALPP, second-differentiated (ADF = -5.429, p = 0.0000) shows a stable oscillation near zero, which indicates complete stationarity. The variable is I(2) and could be included in VAR or in VECM. ΔIPRO_Q swings at random, without a deterministic tendency. The value of the ADF is -7.579, and p = 0.0000, which supports the high-value stationarity, and the first-differentiated variable can be directly included in the multivariate analysis. ΔVEPTI_Q has trend removal following differencing and the ADF test (-2.743, p =.0669) validates weak

stationarity at the 10% level. So, the series satisfies the low stability conditions of VAR estimation. The second difference (ADF = -4.116, p =0.0009) of VEPTI_Q supports 1% level stationarity. The variable has a lower variance and shorter-term mean-reversion, which means that I(2) integration can be used in VAR or VECM. ΔVEPTI_P shows mean reversion and stabilized variance, and ADF (-3.016, p = 0.0334) exceeds the 5% level. Therefore, I(1) integration is sufficient to estimate a model.

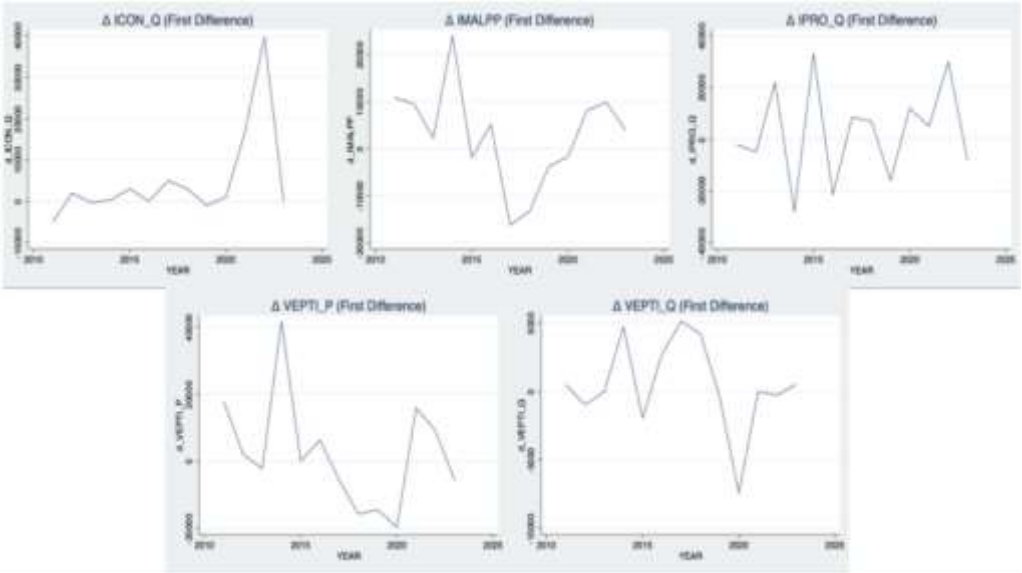

Figure 2 First Differenced Variables

The lag-order selection test was used in order to identify the best lag in the Vector Autoregression (VAR) model. Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC) were used in the test. Based on the findings, the two lag (Lag = 2) specification had the lowest three criteria (AIC = -297.11, HQIC =-300.325, SBIC = -296.634). As a result, two-lag model was selected as the most appropriate specification that balances between model fit and parsimony.

Table 1 Lag-order selection criteria

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-428.962				6.8e+39	108.741	108.339	108.8
1		.	36	.	0*	.	.	.
2	1236.44	.	36	.	.	-297.11*	-300.325*	-296.634*
3		.	36	.	.	.	.	.
4	1228.53	.	36	.	.	-295.132	-298.346	-294.655

*optimal lag Sample: 2016 thru 2023 Number of obs = 8
Endogenous: d2_ICON_Q d2_IMALPP d2_VEPTI_Q d_IPRO_Q d_VEPTI_P PT
Exogenous: _cons

The variables that are tested by the Johansen cointegration test on the existence of a long-run equilibrium relationship include pepper consumption in India (ICON_Q), local price (IMALPP),

production (IPRO_Q), export quantity in Vietnam (VEPTI_Q), export price (VEPTI_P), and the tariff rate (PT). In the null, it is assumed that there is no cointegration (rank = 0), whereas the alternative hypothesis is that there is one or more cointegrating vectors. The eigenvalues in the output were similar to one, and trace statistics were not explicitly shown, which may indicate the possibility of multicollinearity, which is a frequent problem in a small sample (N = 12). Although the sample size is limited, the Johansen test showed that the relationship had at least one cointegrating relationship. The test of no cointegration was rejected and thus a VECM was used. This way the model was able to measure the long-run equilibrium between the variables as well as their short-run dynamics.

Table 2 Johansen tests for cointegration

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistic	5% critical value
0	30	.	.	.	68.52
1	39	.	1.00000	.	47.21
2	46	.	1.00000	.	29.68
3	51	.	1.00000	.	15.41
4	54	.	1.00000	.	3.76
5	55	.	0.78733		

Trend: Constant Number of obs = 12
Sample: 2012 thru 2023 Number of lags = 2

The stationary and second-differentiated variables of Δ^2ICON_Q, Δ^2IMALPP, Δ^2VEPTI_Q, ΔIPRO_Q, ΔVEPTI_P, and PT were estimated with an optimal lag length of two on Vector Autoregression model based on VARSOC criteria. The general fit of the model was excellent as indicated by highly negative Akaike Information Criterion (AIC = -290.23) and close-to-one values of R^2 in all the equations, which proves that the lag structure was effective in capturing dynamic interdependencies between the variables. The majority of the coefficients were significant at the 1% level ($p < 0.01$), which highlights the strong short-run relations between pepper production, domestic prices, consumption, and the export variables in Vietnam. Namely, lagged domestic production (ΔIPRO_Q) and lagged export quantity (Δ^2VEPTI_Q) had considerable effect of positive impact on the following prices and output volume meaning that simultaneity shocks in production and trade volumes propagate quickly in the system. The tariff rate (PT) on the other hand had little short-run explanatory power and was omitted because it had little variability, which emphasized on its long-run, policy-driven effect. In general, the estimation of the VAR(2) was effective in revealing a coherent structure of short-run connections between the variables within the pepper market of India confirming the specification of the model and providing the justification of further diagnostic tests, such as the residual autocorrelation test and the test of stability, to warrant robustness. The test of autocorrelation Breusch Godfrey LM-test (varlmar, mlag(2)) did not fail because the autocorrelation was multicollinear between the lagged model residuals and the dependent variables. Stata produced an error message, which indicated that residual values might not be collinear with lags of dependent variables. In practical terms, it means that the internal lag structure of the model is overly interdependent to be able to test serial-correlations, thus may over-parameterize the existing VAR model. The model does not pass the test of stability of the VAR, as several of the eigenvalues have a bigger modulus than one, e.g. 1.568 and 1.476.

Table 3 Eigenvalue stability condition

eigenvalue	modulus
-1.568142	1.56814
.2440692 + 1.45584i	1.47616
.2440692 - 1.45584i	1.47616
.8382087 + .6811142i	1.08005
.8382087 - .6811142i	1.08005
-.05234924 + 1.012143i	1.0135
-.05234924 - 1.012143i	1.0135
-.8160203 + .4731792i	.943286
-.8160203 - .4731792i	.943286
-.07820394	.078204
0	0
0	0

At least one eigenvalue is at least 1.0.
VAR does not satisfy stability condition.

In addition, the instability condition cannot be met with the single-digit lag length. The implication of the result is that the system would not stabilize in the long term, to reach equilibrium after shocks. As a result, the present variational model is dynamically unstable as well as being unforecastable. The stability test failure along with the previous evidence of cointegration gives solid reasons to apply a Vector Error Correction Model (VECM) to assist in a stronger long-run analysis. Nevertheless, the findings are still tentative. The Vector Error Correction Model (VECM) is an algorithm that should correct integration errors, which means that the presence of one significant long-run equilibrium relationship between the variables of the level was demonstrated ($\chi^2 = 23.20$, $p = 0.0001$). The long-run coefficient of the domestic production (IPRO_Q) is negative and statistically significant when normalized on the consumption (ICON_Q) (-0.752, $p = 0.003$). The local price (IMALPP), export quantity (VEPTI_Q) and export price (VEPTI_P) coefficients are statistically insignificant implying that there is a low transmission of data through the local price, export quantity and export price in the long-run. The error-correcting term contributes unimportantly in the short run in the equation of D_ICON_Q (-2.50, $p = 0.029$), which means that the consumption is the variable that responds to bring about the equilibrium with other variables showing negligible feedbacks. A number of lagged variables have a strong impact on the short-run dynamics, which has affirmed selective but economically coherent short-run interplay and a leading long-run adjustment mediated by the consumption behaviour of India. The tests of serial independence were the Ljung-Box Portmanteau applied to the residuals of each differenced equation. Most equations, namely — D_ICON_Q ($p = 0.4383$), D_IMALPP ($p = 0.5619$), D_VEPTI_Q ($p = 0.1798$), and D_IPRO_Q ($p = 0.2290$) — have p-values greater than 0.05, which proves that their residues are white-noise processes without significant autocorrelation. Nevertheless, D_VEPTI_P ($p = 0.0329$) was less than 0.05, which means that the amount of autocorrelation remaining in the equation of exports-price is minor. In general,

these findings suggest that the VECM residuals meet white noise assumption in most equations and the model is mostly well-specified. The one exception (D_VEPTI_P) does not nullify the system as a whole, but does give reason to approach forecast errors on export prices with some caution.

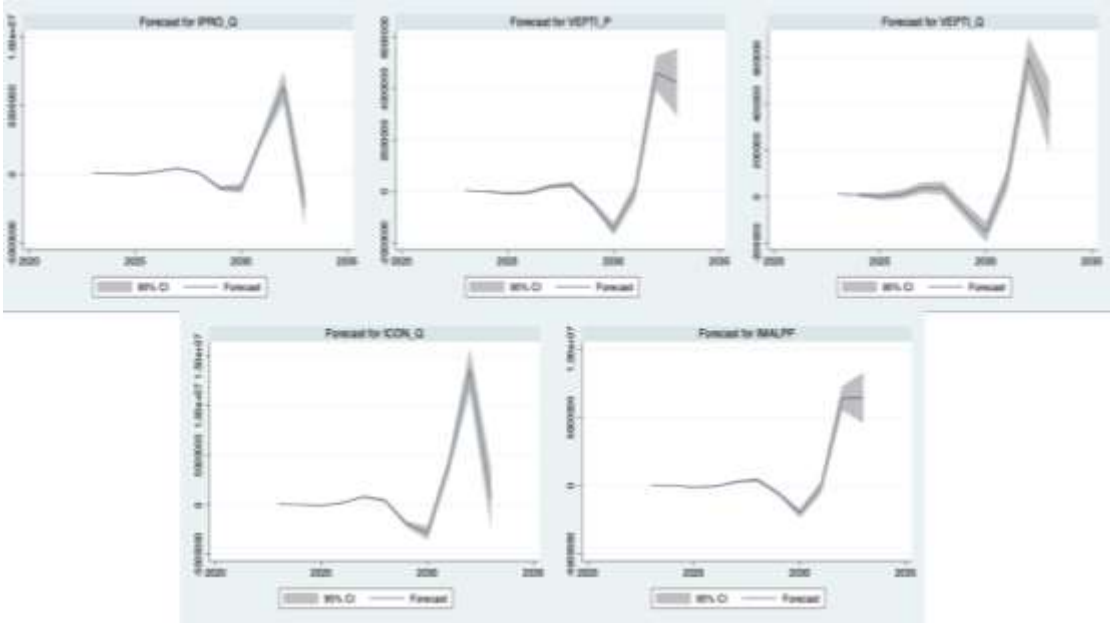

Figure 2 Forecast of all Variables

The projection of India pepper consumption (ICON_Q) has a sharp projected growth in the year 2030 and then steep decline. The trend implies that the domestic demand may experience a temporary boost that may be in the short-run because of some economic or policy related factors but should then get to the base at a later stage. The 95% confidence interval widens beyond 2030 indicating increased uncertainty in the forecast in the long-run.

The forecasted local price of pepper (IMALPP) follows a similar pattern and its consumption follows a similar pattern with a sharp increase reaching around 2030. This co-movement shows that there is a high demand price correlation in the Indian pepper market. The broadening band of confidence after 2030 depicts that the domestic prices are becoming even more ambiguous as the model forecasts the future to a greater extent. The projected export volume in Vietnam (VEPTI_Q) shows that it will increase moderately until 2030 and then decrease. This action suggests that the levels of exports are positively sensitive to the short-run demand growth in India, and they shrink when changes occur in the domestic level. The confidence interval is also narrow, and this means that the export trends are quite stable as compared to the other variables. Its production projection (IPRO_Q) displays a sharp increase around 2030, which corresponds to the growth of consumption and imports requirements. Nonetheless, the next trough implies a possible production adjustment, which may be caused by the market saturation or weather limitations. The forecast precision is going to be high within a short-term, but the forecast uncertainty has risen after 2030. According to the export price forecast (VEPTI_P), there will be a significant increment to 2030, aligned with the rise in demand and production adjustments in India. The stabilization that follows implies market balanced tendencies between the two trading partners. The broad upper range after 2030 indicates the possibility of volatile international price reactions to the change in India policy and demand changes.

Conclusion

This research aimed to assess if the tariff cuts implemented by the ASEAN-India Free Trade Agreement have notably affected India's black pepper imports from Vietnam. Data from econometric modeling shows that while tariff liberalization aimed to enhance regional welfare, it has inadvertently heightened India's reliance on Vietnamese pepper. Despite reduced tariffs that lowered import expenses and improved consumer access, the local production system faced high production costs, outdated crop varieties, and vulnerability to disease and found it difficult to stay competitive. The VAR findings indicate significant short-term relationships among consumption, production, export volume, and price fluctuations, implying that disturbances in any part of the Indian pepper market quickly spread across the whole system. The VECM, on the other hand, identifies a notable long-term equilibrium mainly influenced by domestic consumption, suggesting that the market undergoes gradual adjustments over time while staying structurally susceptible. Forecasts indicate that both demand and prices will probably see significant increases until around 2030, before facing a downturn and growing uncertainty, highlighting ongoing volatility in India's market standing. The findings suggest that merely reducing tariffs is not enough to secure competitive results for India in AIFTA. In the absence of structural reforms like enhanced crop varieties, bolstered supply chains, and focused assistance for farmers, India's pepper industry will keep falling behind Vietnam. Consequently, preserving the advantages of regional trade while protecting local industries necessitates an all-encompassing strategy and combining tariff policies with targeted investments aimed at boosting productivity, improving technology, and diversifying markets. This research offers a commodity-focused viewpoint on AIFTA's effects and highlights the necessity for data-driven approaches to strengthen India's agricultural resilience in a more open trading environment.

References

Ahmed, S. (2010). India-ASEAN Free Trade Agreement: A sectoral analysis. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1698849

Association of Southeast Asian Nations & Republic of India. (2009, August 13). *Agreement on Trade in Goods under the Framework Agreement on Comprehensive Economic Cooperation between the Association of Southeast Asian Nations and the Republic of India*. https://commerce.gov.in/wp-content/uploads/2020/06/MOC_636205354502532516_ASEAN-India_Trade_Goods_Agreement.pdf

Cariappa, A. A., & Chandel, B. (2020). Why are the pepper prices declining? An analysis of changing production and trade scenario in India. *Journal of Plantation Crops*, 60–69. https://doi.org/10.25081/jpc.2020.v48.i1.6219

Chandran, S. (2018). Trade Impact of the India-ASEAN Free Trade Agreement (FTA): An Augmented Gravity Model analysis. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3108804

Jagdambe, S., & Kannan, E. (2020). Effects of ASEAN-India Free Trade Agreement on agricultural trade: The gravity model approach. *World Development Perspectives*, *19*, 100212. https://doi.org/10.1016/j.wdp.2020.100212

Jagdambe, S., & Mouzam, S. M. (2019). Evaluating the Trade, Revenue and Welfare Implication of Plantation Crops under ASEAN–India FTA. *Journal of Asian Economic Integration*, *1*(2), 224–241. https://doi.org/10.1177/2631684619882864

Khati, P., & Kim, C. (2022). Impact of India's Free Trade Agreement with ASEAN on Its Goods Exports: A Gravity Model Analysis. *Economies*, *11*(1), 8. https://doi.org/10.3390/economies11010008

Khurana, R., & Nauriyal, D. K. (2017). ASEAN-India Free Trade Agreement: Evaluating trade creation and trade diversion effects. *Journal of East-West Business*, *23*(3), 283–307. https://doi.org/10.1080/10669868.2017.1322548

Kumar, J. S., & Shobana, D. (2025). The Role of Climate Change in Shaping Maize Production Trends in India: A CAGR Analysis. *International Journal of Research and Innovation in Social Science*, *VIII*(XII), 2410–2426. https://doi.org/10.47772/ijriss.2024.8120200

Oanh, N. T. H. (2017). How Free Trade Agreements Affect Exports and Imports in Vietnam. *VNU Journal of Science Economics and Business*, *33*(5E). https://doi.org/10.25073/2588-1108/vnueab.4126

Rachman, D. R., & Hartono, D. (2023). Trade creation and diversion effects of AIFTA implementation. *EFFICIENT Indonesian Journal of Development Economics*, *6*(2), 168–186. https://doi.org/10.15294/efficient.v6i2.67002

Sabu, S. S., & Anil, K. (2024). Evaluating the ASEAN-India FTA: Implications for India's Black Pepper trade. *Plant Science Today*, *11*(sp3). https://doi.org/10.14719/pst.4688

Sabu, S. S., Kuruvila, A., & Devi, P. I. (2024). Navigating Changes: Trends and challenges in the Indian black pepper trade. *Indian Journal of Agricultural Economics.*, *79*(4), 928–943. https://doi.org/10.63040/25827510.2024.04.003

Saikia, C., & Gogoi, M. (2024). Trends and Patterns in Indo-ASEAN Agricultural Trade: Evidence from India (2013-2022). *Archives of Current Research International*, *24*(11), 275–284. https://doi.org/10.9734/acri/2024/v24i11969

Singh, L. B. (2021). Impact of India-ASEAN Free Trade Agreement: An Assessment from the Trade Creation and Trade Diversion Effects. *Foreign Trade Review*, *56*(4), 400–414. https://doi.org/10.1177/00157325211021503

VEERAMANI, C., & SAINI, G. K. (2011). Impact of ASEAN-India Preferential Trade Agreement on Plantation Commodities: A Simulation Analysis. *Economic and Political Weekly*, *46*(10), 83–92. http://www.jstor.org/stable/41151946

Yogesh, M. S., * & Dr. S. Mokshapathy. (2013b). Production and export performance of black pepper. In *International Journal of Humanities and Social Science Invention* (Vols. 2–2, Issue 4, pp. 36–44). https://www.ijhssi.org/papers/v2(4)/version-4/G243644.pdf

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