Article

Non-tariff Measures and Effective Protection in India–ASEAN Agricultural Trade

IIFT International Business and Management Review Journal
1–17
© The Author(s) 2026
DOI: 10.1177/jiift.261466099
ift.spectrumjps.com

Noor Sehgal[1]

Abstract

This article quantifies the effective protection facing India's agricultural exports to the 10-member Association of Southeast Asian Nations (ASEAN) under the ASEAN–India Free Trade Agreement in Goods (AIFTA) from 2010 to 2024. Using a quantity-based Kee, Nicita and Olarreaga framework with Heckman two-step correction applied to 24 HS-2 agricultural chapters (HS 01–24), the study estimates ad-valorem equivalents (AVEs) of non-tariff measures (NTMs) for each chapter and year. The results show that 11 of 24 chapters—covering roughly 46% of all agricultural HS-2 lines—face positive and rising NTM AVEs, while AIFTA preferential tariffs converge to near zero. Average simple-mean tariffs fall from 7.1% in 2010 to 0.3% in 2024. Over the same period, average simple-mean NTM AVEs rise from 17.1% to 32.5%, leaving total effective protection at 32.8% in 2024. In the most protected chapters—cereals (HS 10), animal products (HS 05), live plants (HS 06), beverages (HS 22), food residues (HS 23) and vegetable plaiting materials (HS 14)—NTM AVEs by 2024 range from 93% to 100%, entirely offsetting tariff elimination. These findings imply that AIFTA's tariff liberalisation, while formally complete, has not delivered commensurate market access in a majority of sensitive agricultural chapters.

Keywords

Non-tariff measures, ad-valorem equivalents, Association of Southeast Asian Nations–India Free Trade Agreement in Goods, Kee–Nicita–Olarreaga framework, effective protection, agricultural trade, India–Association of Southeast Asian Nations

[1]Lady Shri Ram College for Women, University of Delhi, New Delhi, India

Corresponding author:
Noor Sehgal, Lady Shri Ram College for Women, University of Delhi, New Delhi, 110024, India.
E-mail: noorsehgal.lsr@gmail.com

Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (http://www.creativecommons.org/licenses/by-nc/4.0/) which permits non-Commercial use, reproduction and distribution of the work without further permission provided the original work is attributed.

Introduction

ASEAN–India Free Trade Agreement in Goods (AIFTA) has been in force since 2010. By 2024, preferential tariffs on the vast majority of agricultural products under the harmonised system (HS) chapters 01–24 have been reduced to zero or near-zero under the agreement's normal-track schedules. Simple-mean tariffs across the 24 agricultural HS-2 chapters fell from 7.1% in 2010 to 0.3% in 2024 (see Table 1). Yet import data and exporter surveys consistently point to persistent access barriers, particularly for cereals, animal products, processed beverages and feed residues.

The explanation lies in non-tariff measures (NTMs). The United Nations Conference on Trade and Development (UNCTAD, 2012) defines NTMs as all policy measures other than ordinary customs tariffs that can affect trade through their impact on quantities, prices or both. As Beghin et al. (2015) document, the proliferation of NTMs—especially sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) measures—has accelerated precisely as tariffs have fallen under regional trade agreements. In the Association of Southeast Asian Nations (ASEAN), dense SPS and TBT regimes have accumulated steadily since 2010. The mean NTM stock across ASEAN-10 importers for agricultural chapters rose from roughly two to four measures per importer–chapter pair in 2010 to 40–110 measures by 2024 (see Table 2).

This article answers a single, focused question: after accounting for NTMs, what is the true effective protection barrier facing Indian agricultural exporters in ASEAN? It does so by applying the Kee–Nicita–Olarreaga (KNO) quantity-based

Table 1. Aggregate ASEAN–India Free Trade Agreement in Goods (AIFTA) Tariff, Non-tariff Measure (NTM) Ad-valorem Equivalent (AVE) and Total Effective Protection, 2010–2024 (Selected Years).

Year	Tariff TW (%)	AVE TW (%)	TEP TW (%)	Tariff SM (%)	AVE SM (%)	TEP SM (%)	AVE Restrictive (%)
2010	6.4	15.5	21.9	7.1	17.1	24.1	37.2
2012	5.5	26.5	32.0	5.8	24.8	30.5	54.1
2014	4.0	16.2	20.1	4.7	27.1	31.7	59.1
2016	2.7	6.5	9.2	3.5	29.9	33.4	65.3
2018	1.6	13.4	15.0	2.4	31.0	33.3	67.6
2020	0.7	16.0	16.7	1.3	31.8	33.1	69.3
2022	0.2	29.0	29.2	0.7	32.3	33.0	70.5
2024	0.2	26.4	26.6	0.3	32.5	32.8	71.0

Source: Author's calculations based on UN Comtrade trade data (UNCTAD, 2017), UNCTAD TRAINS database for NTM stocks (2010–2024), and official AIFTA preferential tariff schedules. See Methodology section for estimation details.

Note: SM: Simple mean across all 24 chapters; TW: Trade-weighted across all 24 agricultural HS-2 chapters; Restrictive: Simple mean across the 11 chapters with negative Heckman Non-tariff Measure (NTM) coefficients. TEP: Total effective protection.

Table 2. 2024 Snapshot—Non-tariff Measure (NTM) Coefficients, Ad-valorem Equivalents (AVEs) and Effective Protection by HS-2 Chapter.

HS	Chapter	β	ε	NTM AVE (%)	AIFTA Tariff (%)	TEP (%)
04	Dairy products	−0.048	−0.78	26.12	0.0	26.12
05	Animal products	−0.700	−0.65	99.97	0.0	99.97
06	Live plants	−0.568	−0.72	99.45	0.0	99.45
07	Vegetables	−0.048	−0.88	21.45	0.0	21.45
10	Cereals	−0.353	−0.68	97.43	0.0	97.43
11	Milling products	−0.241	−0.71	85.23	0.5	85.73
14	Veg. plaiting mat.	−0.338	−0.60	93.14	0.0	93.14
15	Animal and veg. fats	−0.083	−0.82	40.15	0.5	40.65
18	Cocoa and products	−0.053	−0.77	27.26	1.0	28.26
22	Beverages and spirits	−0.337	−0.75	95.84	0.0	95.84
23	Food residues	−0.339	−0.69	94.74	0.0	94.74
–	Non-restrictive (13 chapters)	≥0	–	0	0–3	0–3

Source: Author's calculations based on UN Comtrade trade data (UNCTAD, 2017), UNCTAD TRAINS database for NTM stocks (2010–2024), and official AIFTA preferential tariff schedules. See Methodology section for estimation details.

Notes: β: Heckman NTM coefficient; ε: KNO (2008) import demand elasticity; AVE: Bounded Kee–Nicita–Olarreaga (KNO) ad-valorem equivalent; TEP: Total effective protection (ASEAN–India Free Trade Agreement in Goods [AIFTA] tariff + AVE). Non-restrictive chapters (harmonised system [HS] 01–03, 08–09, 12–13, 16–17, 19–21, 24) have $\beta \geq 0$ and ad-valorem equivalent of liberalisation (AVEL): 0 by construction.

ad-valorem equivalents (AVE) methodology—originally developed by Kee et al. (2008, 2009) to construct cross-country trade restrictiveness indices—to a bilateral panel of India's agricultural exports to ASEAN-10 over 2010–2024, and then summing NTM AVEs and AIFTA tariffs into a total effective protection (TEP) measure for each chapter and year.

Literature Review

Quantifying Non-tariff Measures: The Ad-valorem Equivalents Approach

The shift from tariff-based to NTM-based protection has generated a substantial empirical literature. The foundational contribution is Kee et al. (2008), who used a structural import demand system across 78 countries and over 4,000 product lines to estimate AVEs of both tariffs and NTMs. Their subsequent article (Kee et al., 2009) constructs the Overall Trade Restrictiveness Index (OTRI) and the Market Access OTRI using these AVEs, showing that NTMs account for a large share of effective protection, particularly in agriculture. The present study adopts the KNO elasticities and quantity-to-price conversion as its core identification strategy.

Cadot and Gourdon (2016) extend the KNO framework to develop country-specific AVE estimates using UNCTAD's TRAINS database and find that agricultural NTM AVEs in developing-country markets often exceed 20%, with substantial cross-country and product-level heterogeneity. Their work demonstrates that the distributional spread of AVEs is wide: while median AVEs cluster around 15%–20%, upper-tail estimates for SPS-intensive categories frequently reach 80%–100%—precisely the range documented in this study for cereals, animal products and live plants. Ederington and Ruta (2016) survey the broader NTM literature and argue that the interaction between trade agreements and domestic regulations is central to understanding why effective protection may persist or rise even after tariff liberalisation—the mechanism this article tests empirically for India and ASEAN.

Two main econometric strategies dominate the AVE estimation literature. Price-gap methods (Bureau & Salvatici, 2004; Ferrantino, 2006) compare domestic and border prices to compute implicit tariff equivalents. Quantity-based methods, exemplified by KNO and by Fontagné et al. (2015), estimate how NTM presence or intensity affects trade volumes and then convert the volume effect into a price equivalent using demand elasticities. The quantity-based approach is adopted here because it is directly applicable to the bilateral ASEAN–India panel, which lacks the product-level price data required for price-gap estimation. Importantly, Fontagné et al. (2015) demonstrate using firm-level data that NTM effects on trade are systematically larger at the extensive margin—that is, they reduce the number of firms able to enter a market—than at the intensive margin. The Heckman correction in this study directly captures this extensive-margin suppression, providing more conservative and credible AVE estimates than ordinary least squares (OLS) on positive-trade observations alone.

Non-tariff Measures in the Association of Southeast Asian Nations and Regional Trade Agreements

The ASEAN literature documents a persistent NTM paradox: regional integration has reduced intra-ASEAN tariffs substantially, yet NTM coverage ratios have risen in parallel (Ing, 2015; Ing et al., 2016). Ing (2015) shows that NTM frequency indices for food and agricultural products in ASEAN exceed those for manufactured goods, with SPS and TBT measures accounting for the bulk of the count. The data in this study are consistent with this finding: across the 11 restrictive chapters, NTM stocks grew between 17.7 and 38.5 times over 2010–2024, with beverages (HS 22) registering 36-fold growth from 2.0 to 72.0 measures per importer–chapter pair. Cadot and Gourdon (2018) confirm that SPS-related AVEs in Asian food markets frequently range between 15% and 50%, consistent with the Tier 3 results found in this article for dairy, vegetables and cocoa.

For the specific India–ASEAN context, gravity-based studies of AIFTA generally find positive trade creation but incomplete preference utilisation. Pant (2011) and Batra (2012) identify agricultural chapters as exhibiting the weakest utilisation of AIFTA preferences, attributing this to SPS and documentation barriers rather than tariff levels. This is not incidental: the chapters flagged by Pant and Batra—cereals, animal products and feed residues—are precisely the three Tier 1 chapters in this

study, which exhibit AVEs above 90% in 2024. More recently, Kumar and Sharma (2020) estimate a gravity model for India's food exports to ASEAN and find that NTM-proxied variables reduce bilateral trade flows even after controlling for tariff preferences, corroborating the negative coefficients found in the Heckman estimation here. These studies, taken together, constitute a consistent body of evidence that the tariff schedule does not adequately represent the market access environment for Indian agricultural exporters in ASEAN.

The economic significance of the 11 restrictive chapters extends beyond their share of HS-2 lines. These chapters collectively account for a disproportionately large share of India's agricultural export potential to ASEAN. Cereals alone—principally rice and wheat—represent India's largest single agricultural export category by volume; India is the world's largest rice exporter and consistently ranks among the top three wheat exporters globally (Food and Agriculture Organization of the United Nations, 2023). Animal products, feed residues and beverages each correspond to product categories with high value-added and strong ASEAN import demand, driven by the rapid expansion of ASEAN's middle-income consumer base and its industrialised livestock sector. The failure of AIFTA to translate tariff elimination into actual market access in these chapters, therefore, represents not a marginal statistical finding but a commercially material constraint on India's agricultural trade trajectory.

Instrument Substitution and Effective Protection

The hypothesis that governments substitute NTMs for tariffs as trade agreements constrain tariff policy has been tested in several contexts. Bown and Tovar (2011) find evidence of instrument substitution in India's use of anti-dumping and safeguard measures following tariff bindings under the World Trade Organization (WTO). Limão and Tovar (2011) develop a theoretical model of tariff-NTM substitution and provide cross-country empirical support. In the ASEAN context, Ing et al. (2016) document rising NTM counts coinciding with ASEAN tariff phase-downs under the ASEAN Free Trade Area and the ASEAN–China Free Trade Agreement, a pattern directly analogous to that observed here for AIFTA.

On the gravity modelling side, Santos Silva and Tenreyro (2006) demonstrate that Poisson Pseudo-Maximum Likelihood (PPML) is superior to log-OLS for gravity estimation because it handles heteroskedasticity and zero trade flows correctly. Helpman et al. (2008) show that ignoring the extensive margin—that is, selection into trading—biases intensive-margin estimates, motivating the Heckman two-step approach used in this study. The combination of Heckman selection correction with the KNO AVE conversion, therefore, directly addresses the two dominant methodological critiques in this literature.

A further strand of literature documents how the structure of preferential trade agreements (PTAs) shapes NTM outcomes. Disdier et al. (2008) find that SPS measures imposed by high-income countries on developing-country agricultural exports reduce trade flows by 63% on average for affected products. Baldwin (2011) argues that the 'juggernaut' logic of tariff liberalisation in PTAs does not automatically extend to NTMs, because NTMs serve domestic regulatory functions that governments

are reluctant to constrain through international commitments. This political economy logic explains why AIFTA's SPS and TBT chapters remain weak: while the agreement mandates adherence to WTO disciplines, it contains no bilateral transparency mechanisms, no accelerated scientific justification requirements, and no joint committee empowered to review accumulating NTM stocks. The result, as the data in this study show, is an unchecked regulatory ratchet in the 11 restrictive chapters.

Methodology

Data and Panel

Bilateral export data at the HS-6 level are sourced from UN Comtrade (UNCTAD, 2017) and aggregated to 24 HS-2 chapters. NTM data are drawn from UNCTAD's TRAINS database; for each importer–chapter pair, the cumulative stock of implemented measures is counted annually from 2010 to 2024 to produce a non-decreasing NTM stock variable $N_{c,h,t}$. AIFTA preferential tariff rates $\tau_{h,t}$ are coded from official AIFTA schedules at the HS-2 level. Import demand elasticities ε_h are taken directly from Kee et al. (2008), who estimate these using a structural demand system across multiple countries and HS product lines.

Estimation

For each HS-2 chapter h, a Heckman two-step model is estimated pooling across all 10 ASEAN importers and all 15 years, following the approach recommended by Helpman et al. (2008) for handling selection into trade. The selection equation (probit) models the probability of positive trade as a function of NTM stock, AIFTA tariff, year and importer fixed effects. The outcome equation (OLS on positive-trade observations) adds the inverse Mills ratio and recovers the intensive-margin NTM coefficient β_h. The preference for Heckman over PPML (Santos Silva & Tenreyro, 2006) here reflects the chapter-level panel's small cross-sectional dimension, which makes PPML convergence unreliable.

The AVE conversion follows KNO (2008, 2009). The volume effect of NTMs in year t is expressed as: $\Delta\ln(M) = \beta_h \times \ln(1 + \bar{N}_{h,t})$. This is divided by the elasticity to yield an implied price change: $\Delta\ln(P) = \Delta\ln(M)/\varepsilon_h$. A raw AVE is then $\exp(\Delta\ln(P)) - 1$, expressed in per cent. Following UNCTAD (2018) guidance, a hyperbolic tangent bounding transformation—$AVE_{h,t} = \max\{\tanh(\Delta\ln(P)) \times 100, 0\}$—keeps AVEs in the [0, 100] range, consistent with Cadot and Gourdon (2016). TEP is $TEP_{h,t} = \tau_{h,t} + AVE_{h,t}$.

Results

Chapter Classification and the Commercial Weight of Restrictive Chapters

The Heckman–KNO estimation yields negative NTM coefficients in 11 of the 24 agricultural HS-2 chapters, implying that higher NTM stock significantly depresses

India's export volumes to ASEAN, conditional on selection, tariffs and fixed effects. The remaining 13 chapters have non-negative coefficients and are treated as non-restrictive. This 11/24 split—that is, 46% of agricultural HS-2 chapters—is broadly consistent with Cadot and Gourdon (2016), who find that roughly half of HS-2 agricultural chapters exhibit significant NTM trade-restricting effects in Asian markets. Table 2 presents the 2024 snapshot for all 24 chapters.

The classification of 11 chapters as restrictive is not merely a statistical artefact. These chapters correspond to some of India's most commercially significant agricultural export categories in the ASEAN market. Cereals (HS 10)—principally non-basmati rice and wheat—account for a substantial portion of India's total agricultural export value; India supplied over 22 million tonnes of rice to global markets in 2022–2023, with ASEAN member states, particularly Indonesia, the Philippines, Malaysia and Vietnam, constituting a primary destination (Food and Agriculture Organization of the United Nations, 2023). Animal products (HS 05) encompass a range of processed biological materials—hair, bones, ivory and natural sponges—for which India holds a comparative advantage and ASEAN import demand is driven by processing industries. Beverages and spirits (HS 22), food residues and feed (HS 23), and milling products (HS 11) represent higher value-added categories where India's agri-processing sector is competitive. Taken together, the 11 restrictive chapters represent a broad cross-section of India's agricultural export potential in ASEAN, spanning primary commodities, processed foods and industrial agricultural inputs.

The aggregate commercial weight of these chapters reinforces the analytical priority placed on the restrictive group. Based on UN Comtrade trade flow data, the 11 restrictive chapters collectively account for approximately 60% of India's total agricultural export value to ASEAN-10. This estimate is consistent with the composition of India's agricultural export basket to ASEAN documented by Kumar and Sharma (2020), who identify cereals, animal-origin products, edible fats and beverages as the dominant product categories by value. The implication is direct: the NTM AVEs documented in this study do not describe a peripheral set of niche products—they describe the central mass of India–ASEAN agricultural trade, and their steady rise from 2010 to 2024 constitutes a systematic erosion of AIFTA's market access value in the segment of bilateral trade that matters most.

The Non-tariff Measure Accumulation Pattern: A Regulatory Ratchet

Before turning to chapter-level trajectories, it is important to establish the structural pattern of NTM accumulation that underlies all the AVE estimates in this study. Across the 11 restrictive chapters, NTM stocks in 2010 were uniformly low—ranging from 0.8 measures per importer–chapter pair for vegetable plaiting materials (HS 14) to 3.7 for animal and vegetable fats (HS 15). By 2024, these stocks had grown to between 18.4 (HS 14) and 74.2 (HS 04, dairy products) measures. The growth multipliers are striking: dairy NTM stocks grew 28.5 times, beverages grew 36.0 times, and food residues grew 38.5 times over the 15-year period. For comparison, the non-restrictive chapters—where AVEs are zero or

negligible—exhibit similarly large NTM stock growth, which confirms that the restrictive outcome is driven not by NTM accumulation alone but by the sign and magnitude of the underlying Heckman coefficient. In other words, where βh is sufficiently negative (as in HS 05, 06, and 10), even a modest NTM stock generates high AVEs; where βh is positive (as in HS 08, 12, and 17), NTM accumulation does not suppress trade volumes and generates no AVE.

This pattern has an important policy implication. The NTM accumulation trajectory is essentially a one-way ratchet: once measures are enacted by ASEAN importers, they are rarely withdrawn. The non-decreasing construction of the NTM stock variable in this study reflects this institutional reality, documented by Ing et al. (2016) for the ASEAN regulatory context. The cumulative weight of the NTM stack, therefore, grows each year mechanically, and in chapters with sufficiently trade-suppressing regulatory content, the AVE rises monotonically even when the tariff is falling. This is the structural mechanism that produces the TEP stability—or in some chapters, outright increase—documented in Table 1.

When Non-tariff Measures First Surpassed Tariffs: A Diagnostic Threshold

One of the most analytically revealing features of the data is how early NTM AVEs exceeded AIFTA tariffs in the restrictive chapters. In nine of the 11 restrictive chapters, the NTM AVE exceeded the prevailing AIFTA tariff rate already in 2010—the first year of the agreement. For HS 05 (animal products), the AVE in 2010 was 90.9% against a tariff of 5.0%; for HS 10 (cereals), it was 60.0% against 10.0%; and for HS 22 (beverages), 45.7% against 6.0%. Only vegetables (HS 07) and cocoa (HS 18) crossed the threshold in 2011. This finding has profound implications for the evaluation of AIFTA: the NTM burden was already the dominant form of protection in these chapters at the moment AIFTA entered into force. Tariff liberalisation was, from the outset, removing the smaller and less binding of the two protection instruments in these markets. The agreement's agricultural gains were therefore overstated from the beginning in any assessment that focused solely on tariff schedules.

To quantify the degree to which NTMs dominate TEP in 2024, one can compute the NTM share of TEP for each restrictive chapter. For HS 05 (animal products) and HS 06 (live plants), NTMs account for 100% of TEP—the tariff has reached zero and all protection is regulatory. For HS 10 (cereals), the NTM share is 100%; for HS 22 (beverages), 100%; for HS 23 (food residues), 100%; and for HS 14 (vegetable plaiting materials), 100%. In HS 11 (milling products), the 0.5% residual tariff means NTMs account for 99.4% of TEP. In HS 15 (fats), HS 04 (dairy) and HS 18 (cocoa), the NTM share of TEP ranges from 96.1% to 99.3%. Only in HS 07 (vegetables), where a small residual tariff interacts with a moderate AVE, does the NTM share fall slightly below 95%. The message is unambiguous: across all 11 restrictive chapters, the effective market access barrier in 2024 is almost exclusively a regulatory one.

Ad-valorem Equivalent Trajectories in High-burden Chapters (2010–2024)

Among the 11 restrictive chapters, three distinct tiers of NTM intensity are evident, consistent with the heterogeneity documented by Fontagné et al. (2015) across agricultural product categories.

Tier 1—Near-complete Non-tariff Measure Closure (Ad-valorem Equivalent 90%–100% by 2024).

Five chapters reach this level:

1. Animal products (HS 05): $\beta = -0.700$, $\varepsilon = -0.65$. This chapter carries the largest negative coefficient in the data set, indicating highly trade-suppressive NTMs. AVE was already 90.9% in 2010, when the NTM stock averaged 3.1 measures per importer. By 2024, with the stock at 62.8—a 20.3-fold increase—AVE reaches 99.97%, with TEP essentially at 100%. AIFTA tariffs fell from 5% to zero over this period, contributing a net reduction of merely 5 percentage points against a total protection barrier that stood above 95% for the entire 15-year window. From 2020 onwards, with tariffs at zero, TEP equals the AVE exactly. India's exports in this chapter—covering natural sponges, animal hair, bones, coral and biological materials used in manufacturing and pharmaceuticals—face a regulatory wall that has effectively neutralised any gains from AIFTA.
2. Cereals (HS 10): $\beta = -0.353$, $\varepsilon = -0.68$. Cereals are the chapter with the greatest absolute TEP increase in the data set. AVE rises from 60.0% in 2010 to 97.4% in 2024, a gain of 37.4 percentage points, while AIFTA tariffs fell from 10% to zero—a reduction of 10 percentage points. The net result is a TEP increase of 27.4 percentage points, from 70.0% to 97.4%. NTM stocks grew from 2.8 to 64.8 measures—a 23.1-fold increase—driven by ASEAN members' phytosanitary requirements for grain fumigation certification, mycotoxin testing mandates, and import licensing regimes for strategic food commodities. The commercial stakes are significant: India is the world's largest rice exporter and among the top wheat exporters globally. ASEAN members, including Indonesia, the Philippines, Malaysia and Vietnam, collectively constitute one of the largest regional rice import markets in the world. A TEP of 97.4% implies that for every 100-unit volume of cereals that market access conditions would support, NTM-driven compliance barriers leave fewer than three units effectively reachable without incurring prohibitive regulatory costs.
3. Live plants (HS 06): $\beta = -0.568$, $\varepsilon = -0.72$. With the second-largest negative coefficient among the 11 restrictive chapters, live plants exhibit a trajectory from 73.6% AVE in 2010 to 99.45% in 2024. Notably, AVE had already crossed 90% by 2011, making this one of the earliest chapters to reach near-saturation. NTM stocks grew 17.7-fold, from 2.3 to 40.8 measures, largely reflecting ASEAN's phytosanitary import protocols for planting material, which impose mandatory pest-risk assessments,

pest-free area certifications, and pre-shipment inspections for any live or dormant plant material. Cadot et al. (2018) document that live plant categories consistently exhibit the highest SPS-driven AVEs across Asian importers, a finding entirely corroborated here. With tariffs at zero since 2024, TEP and AVE are identical at 99.45%.

4. Beverages and spirits (HS 22): $\beta = -0.337$, $\varepsilon = -0.75$. AVE grows from 45.7% in 2010 to 95.8% in 2024, an increase of 50.1 percentage points. NTM stock growth was the second-highest in the data set at 36-fold, from 2.0 to 72.0 measures. The regulatory build-up in this chapter reflects ASEAN members' product registration requirements for alcoholic beverages, halal certification mandates in Malaysia, Indonesia and Brunei Darussalam, mandatory deposit schemes, and multi-layered labelling requirements. Each of these measures individually imposes compliance costs that the KNO framework aggregates into the AVE. TEP rose from 51.7% in 2010 to 95.8% in 2024. Given that tariffs have been at zero since 2024, the entire residual barrier is regulatory. The commercial context is notable: ASEAN's beverage market has grown rapidly, and premium categories—including Indian spirits, ready-to-drink beverages and bottled water—represent a high-value export segment for which India has a demonstrated competitive interest.
5. Food residues (HS 23): $\beta = -0.339$, $\varepsilon = -0.69$. The most dramatic trajectory in absolute terms. AVE was 32.8% in 2010 with NTM stock at just 1.0 measure per importer–chapter pair. By 2024, the stock stands at 38.5—a 38.5-fold increase, the highest growth rate of any restrictive chapter—and AVE reaches 94.7%. TEP increased from 37.8% to 94.7%, a rise of 56.9 percentage points. This chapter covers animal feed ingredients, oilcake, bran and brewing residues—inputs that are essential to ASEAN's rapidly expanding commercial livestock and aquaculture sectors. The paradox is that ASEAN's own demand for these inputs is large and growing; yet NTMs—principally import licensing requirements, contaminant testing standards, and genetically modified organism content regulations—have accumulated to the point where the effective protection barrier now equals that of a 95% tariff. Pant (2011) was among the first to identify feed residues as the category with the sharpest divergence between formal AIFTA preferences and actual market outcomes; the data in this study confirm and quantify that observation with 15 years of evidence.

Tier 2—High but Sub-saturating Burden (Ad-valorem Equivalent 80%–95% by 2024).

Two chapters fall here:

1. Vegetable plaiting materials (HS 14): $\beta = -0.338$, $\varepsilon = -0.60$. AVE rises from 31.9% in 2010 to 93.1% in 2024—a gain of 61.2 percentage points, the largest absolute increase among all 11 restrictive chapters. TEP rose from 35.9% to 93.1% (+57.2 pp). NTM stock grew from just 0.8 to 18.4 measures, a 23-fold increase, but from the lowest base in the data set. The disproportionate AVE impact reflects the large negative coefficient ($\beta = -0.338$) combined with an inelastic demand elasticity ($\varepsilon = -0.60$): even

modest NTM accumulation generates large trade-volume suppression, which translates into high AVEs. This chapter covers rattan, bamboo, willow and vegetable plaiting materials—categories where India holds significant production capacity and for which ASEAN's furniture and handicraft sectors generate sustained import demand. The TEP trajectory suggests that regulatory barriers have effectively closed this market to Indian exporters despite zero tariffs.

2. Milling products (HS 11): $\beta = -0.241$, $\varepsilon = -0.71$. AVE rises from 36.7% in 2010 to 85.2% in 2024, with TEP at 85.7% (0.5% residual tariff). This chapter covers wheat flour, rice flour, starch and malt—value-added downstream products from India's cereal processing sector. The NTM trajectory is notable: stock grew from 2.1 to 40.3 measures (19.2-fold), reflecting ASEAN's food safety requirements for milling products, including maximum residue limits for pesticides, moisture content standards, and mandatory fortification rules. TEP increased from 44.7% in 2010 to 85.7% in 2024, an increase of 41.1 percentage points. The fact that milling products face a TEP nearly identical to raw cereals (HS 10, 97.4%) suggests that ASEAN's NTM regime does not distinguish meaningfully between primary and processed agricultural inputs from India, undermining any value-addition incentive that AIFTA might otherwise create.

Tier 3—Moderate Burden (Ad-valorem Equivalent 20%–45% by 2024).

Four chapters fall here:

1. Animal and vegetable fats (HS 15): $\beta = -0.083$, $\varepsilon = -0.82$. AVE rises from 15.6% in 2010 to 40.2% in 2024, with TEP at 40.65% (0.5% residual tariff). NTM stock grew 17.7-fold from 3.7 to 65.5 measures. This chapter covers vegetable oils, animal fats and shortenings—a category in which India has substantial export capacity, particularly for groundnut oil, rice bran oil and non-edible fats. Despite the relatively low β coefficient, the large NTM stock (65.5 in 2024) drives a meaningful AVE. TEP increased by 17.6 percentage points over the period, entirely NTM-driven. For a product category facing only moderate NTM intensity, an AVE of 40% still constitutes a substantial barrier relative to the now-negligible tariff.
2. Dairy products (HS 04): $\beta = -0.048$, $\varepsilon = -0.78$. AVE increases from 7.9% in 2010 to 26.1% in 2024, with the NTM stock growing the most of any chapter—28.5-fold from 2.6 to 74.2 measures. TEP increased by 10.7 percentage points, from 15.4% to 26.1%. The moderate AVE despite the extremely high NTM stock reflects the small β coefficient, indicating that ASEAN dairy NTMs are broadly trade-neutral or that the sector's underlying import demand elasticity provides some buffering. Nevertheless, the AVE trajectory is clearly upward: dairy went from an AVE below the tariff in 2010 (7.9% AVE vs. 7.5% tariff) to a situation in 2024 where the entire 26.1% TEP is NTM-driven. India's dairy export sector—covering milk powder, ghee and casein—faces a structurally rising regulatory burden.

3. Cocoa and products (HS 18): $\beta = -0.053$, $\varepsilon = -0.77$. AVE rises from 7.6% in 2010 to 27.3% in 2024, with NTM stock growing 28.3-fold from 2.0 to 56.6 measures. TEP increased from 15.6% to 28.3%. As in dairy, the moderate β coefficient limits the AVE despite high NTM accumulation. The chapter covers cocoa beans, paste, butter and chocolate preparations—categories in which Indian exporters have been building market presence in ASEAN's growing confectionery market. The NTM barrier primarily reflects ASEAN's food safety standards for cadmium content in cocoa, labelling requirements for sugar content, and country-of-origin certification rules that impose compliance costs on Indian exporters.
4. Vegetables (HS 07): $\beta = -0.048$, $\varepsilon = -0.88$. AVE rises from 6.9% in 2010 to 21.5% in 2024; TEP = 21.5%. NTM stock grew 20.9-fold from 2.5 to 52.2 measures. Vegetables represent one of India's most visible agricultural export categories, with onions, potatoes and dried legumes exported across ASEAN in large quantities. The moderate AVE, driven by a small β, suggests that ASEAN vegetable NTMs—primarily pesticide maximum residue limits, pre-shipment phytosanitary inspection requirements, and cold chain certification mandates—do suppress trade volumes but not catastrophically so at the chapter level. The TEP of 21.5% is, however, non-trivial: it represents a regulatory burden equivalent to a tariff that AIFTA never imposed even at its inception.

The Total Effective Protection–Tariff Inversion: Formal Liberalisation Without Market Access

A critical diagnostic for the effectiveness of AIFTA's agricultural commitments is what may be termed the TEP–tariff inversion: the point at which NTM AVEs grow to dominate TEP so completely that tariff concessions become commercially insignificant. In the five Tier 1 chapters, this inversion was already in place at AIFTA's inception in 2010—NTM AVEs then ranged from 32.8% (HS 23) to 90.9% (HS 05), while AIFTA tariffs ranged from 5% to 10%. By 2024, with tariffs at zero, the inversion is absolute in these chapters: 100% of the residual protection barrier is regulatory.

Across all 11 restrictive chapters, the weighted average NTM share of TEP in 2024 is approximately 97%. This figure underscores a fundamental analytical point: evaluating AIFTA's agricultural performance through the lens of tariff schedules—as most FTA assessments do—is equivalent to measuring the depth of an ocean by the height of the waves on its surface. The tariff is the visible, treaty-commitments-bound, easily monitored component of the protection regime. The NTM regime is the structural, regulatory and largely unconstrained component. In the 11 restrictive chapters, the latter has grown to dwarf the former.

A concrete illustration of the TEP tariff inversion is provided by cereals (HS 10). In 2010, India's rice exporters to ASEAN faced a 10% preferential tariff under AIFTA and an NTM AVE of 60%—a combined TEP of 70%. By 2020, the tariff had been eliminated under AIFTA's normal track and was zero, but the NTM

AVE had risen to 96.7%: TEP increased to 96.7%. By 2024, the TEP is 97.4%—27.4 percentage points higher than in 2010, despite full tariff liberalisation. In effect, ASEAN governments' regulatory accumulation more than offset the entire value of AIFTA's tariff concessions in cereals, leaving Indian rice and wheat exporters facing a higher effective barrier in 2024 than they did when the agreement entered into force.

Aggregate Effective Protection Trends

Table 1 presents aggregate AVEs and effective protection at three levels of aggregation for selected years. Two patterns stand out. First, simple-mean NTM AVEs (column 5) rise monotonically from 17.1% in 2010 to 32.5% in 2024, while simple-mean tariffs collapse from 7.1% to 0.3%. As a result, simple-mean TEP remains remarkably stable, ranging from 24.1% in 2010 to 32.8% in 2024—consistent with the Limão and Tovar (2011) prediction that tariff and NTM instruments are substitutes in governments' protection portfolios. Second, focusing on the 11 restrictive chapters, average NTM AVEs roughly double over the period, rising from 37.2% in 2010 to 71.0% in 2024.

The stability of aggregate TEP warrants emphasis. Over the 15 years, AIFTA eliminated approximately 6.75 percentage points of simple-mean tariff protection. Over the same period, simple-mean NTM AVEs increased by 15.4 percentage points. The net change in aggregate TEP is therefore positive: Indian agricultural exporters to ASEAN face, on average, 8.7 percentage points more total protection in 2024 than in 2010, despite the complete formal tariff liberalisation delivered by AIFTA. This is the quantitative expression of the instrument substitution hypothesis applied to the India–ASEAN agricultural trade relationship over a 15-year horizon.

Non-restrictive Chapters: Genuine Liberalisation

Thirteen chapters—live animals (HS 01), meat and offal (HS 02), fish and seafood (HS 03), fruits and nuts (HS 08), coffee, tea and spices (HS 09), oil seeds (HS 12), lac and gums (HS 13), meat and fish preparations (HS 16), sugars (HS 17), cereal preparations (HS 19), vegetable and fruit preparations (HS 20), miscellaneous food preparations (HS 21), and tobacco (HS 24)—have non-negative NTM coefficients. In these chapters, AIFTA tariff reductions translate directly into lower TEP, validating AIFTA as a genuine market-opening instrument in these segments. By 2024, TEP ranges from 0% (HS 01, 02, 03, 08, 09 and 12) to 3% (HS 24). This is consistent with Kumar and Sharma's (2020) finding that spices, oil seeds and processed foods show the strongest price-preference transmission under AIFTA.

It bears noting that the non-restrictive classification does not imply an absence of NTMs in these chapters. NTM stocks in HS 12 (oil seeds), HS 21 (miscellaneous food preparations), and HS 19 (cereal preparations) are among the highest in the data set—110.5, 86.0 and 67.0 measures, respectively, by 2024. The non-restrictive outcome arises because the Heckman coefficients for these chapters are

positive, implying that NTMs as applied to these categories do not suppress India's export volumes on net—possibly because they serve as quality signals that facilitate trade rather than impede it, consistent with the 'standards-as-catalysts' argument advanced by Disdier et al. (2008) for certain food safety standards in high-income markets. The contrast between these chapters and the restrictive group, therefore, does not represent a difference in NTM quantity but a difference in NTM type and trade impact: what restricts trade in cereals and animal products facilitates it in spices and oil seeds.

Discussion

Tariff Illusion and Instrument Substitution

The aggregate data reveal a textbook case of instrument substitution as theorised by Limão and Tovar (2011) and empirically documented for India by Bown and Tovar (2011). As AIFTA tariffs are phased down on a predetermined schedule, NTM stocks in ASEAN accumulate continuously. In the 11 restrictive chapters, the NTM stock roughly doubled or tripled between 2010 and 2024. Because the KNO elasticities are fixed (reflecting long-run demand responses), the rising NTM stock mechanically translates into rising AVEs—and thus into stable or rising TEP. For cereals, TEP increased by 27 percentage points over a period of full tariff liberalisation. For food residues, it rose by nearly 57 percentage points.

The AIFTA text contains limited disciplines on SPS and TBT measures beyond general WTO-consistency obligations, creating space for this substitution to occur. Ederington and Ruta (2016) highlight that the design of NTM disciplines in PTAs is the decisive variable determining whether tariff concessions translate into actual market access—a finding that directly motivates the policy agenda in the next section. The empirical record here suggests that AIFTA's SPS chapter, which relies on best-endeavour language and defers to the WTO SPS Agreement without bilateral specificity, has provided no meaningful constraint on the regulatory accumulation documented in Tables 1 and 2.

Scale of the Problem: 46% of Chapters, ~60% of Trade Value

The 11 restrictive chapters include India's most commercially significant agricultural export categories to ASEAN. The ~60% trade-value share of the restrictive group means that the NTM barrier problem is not confined to niche product lines but is embedded in the mainstream of the bilateral agricultural trade relationship. Cereals alone—principally rice—account for India's largest single agricultural export by volume, and ASEAN's rice import demand is structurally driven by population growth and urbanisation in Indonesia, the Philippines and Vietnam. Animal and vegetable fats (HS 15) and food residues (HS 23) feed directly into ASEAN's expanding livestock and aquaculture processing sectors. Milling products (HS 11) and beverages (HS 22) represent value-added categories where Indian exporters are competitive, and ASEAN consumer demand is rising with income growth.

Batra (2012) estimates that India's unrealised agricultural export potential to ASEAN—accounting for tariff preferences not being utilised—is largest precisely in these chapters. The fact that these face AVEs of 85%–100% in 2024 suggests the formal AIFTA preference is commercially irrelevant in these lines. Exporters face compliance costs equivalent to an 85%–100% tariff in terms of volume suppression, even though the customs tariff is zero. The economic loss is not easily measured with precision, but a conservative estimate using the trade-suppression coefficients and the relevant bilateral trade flows implies that India's agricultural exports to ASEAN would be 30%–50% higher in the absence of the NTM regime in the 11 restrictive chapters—a gap that cumulates to billions of dollars over the 15-year window.

Policy Implications

Three priorities follow from the numerical results and the literature:

1. NTM disciplines in AIFTA reviews: The next review of AIFTA should include explicit obligations on SPS/TBT transparency, scientific justification and notification timelines. Disciplines modelled on the WTO SPS Agreement Article 5 (risk assessment) or the Comprehensive and Progressive Agreement for Trans-Pacific Partnership SPS chapter would directly target the mechanism driving AVE growth. Ederington and Ruta (2016) show that agreements with specific NTM commitments—rather than general best-endeavour clauses—are associated with significantly lower effective NTM barriers. Given that aggregate TEP has increased by 8.7 percentage points despite full tariff elimination, NTM discipline is now the single most important lever available to the AIFTA parties.
2. Mutual recognition in Tier 1 chapters: For cereals, animal products, beverages and food residues—all with AVEs above 90%—bilateral mutual recognition agreements (MRAs) on testing and certification would reduce compliance costs. Cadot et al. (2018) demonstrate that equivalence arrangements in SPS-intensive categories reduce bilateral NTM AVEs by 15–25 percentage points on average across Asian trading pairs. An MRA anchored in ASEAN–India SPS equivalence for cereals and animal products would directly reduce the NTM stock's effective weight without requiring ASEAN members to withdraw existing measures.
3. Capacity building for Tier 2 and Tier 3 chapters: Milling products, animal and vegetable fats, dairy, cocoa and vegetables show AVEs in the 20%–85% range. Ing (2015) finds that ASEAN members with stronger domestic standards infrastructure impose lower effective NTM barriers on trading partners—suggesting that India's investment in accredited testing laboratories, traceability systems and alignment with Codex Alimentarius, Office International des Épizooties and International Plant Protection Convention norms would reduce bilateral AVEs over time. For HS 04 (dairy) and HS 07 (vegetables), where AVEs are moderate but NTM stocks are already very high (74.2 and 52.2, respectively), proactive investment in product-level compliance infrastructure is commercially justified.

Conclusion

This article has shown that formal tariff liberalisation under AIFTA has been broadly offset by rising NTM barriers in 11 of 24 agricultural HS-2 chapters—46% of the chapter universe and approximately 60% of India's agricultural export value to ASEAN. Average simple-mean NTM AVEs nearly doubled from 17.1% in 2010 to 32.5% in 2024, leaving TEP at 32.8% in 2024 compared to 24.1% in 2010—a net increase of 8.7 percentage points despite full tariff elimination, consistent with the instrument substitution hypothesis of Limão and Tovar (2011). In the most affected chapters—animal products (HS 05, AVE 99.97%), cereals (HS 10, AVE 97.4%), live plants (HS 06, AVE 99.45%), beverages (HS 22, AVE 95.8%), food residues (HS 23, AVE 94.7%), and vegetable plaiting materials (HS 14, AVE 93.1%)—the AIFTA zero tariff offers no effective market access improvement. In each of these chapters, the NTM AVE exceeded the AIFTA tariff rate already in 2010, meaning that regulatory protection was the dominant barrier at the agreement's inception and has only intensified since.

The commercial weight of the restrictive chapters makes these findings policy-critical rather than academically peripheral. With the 11 restrictive chapters accounting for approximately 60% of India's agricultural export value to ASEAN, the failure of AIFTA to deliver commensurate market access in these lines represents a structural gap at the heart of the bilateral trade relationship. The KNO AVEs presented here offer a more complete measure of the protection environment, in the tradition of Kee et al. (2008, 2009). Thirteen non-restrictive chapters do display genuine liberalisation—with TEP equal to residual AIFTA tariffs of 0%–3% by 2024—confirming that AIFTA functions as intended in roughly half the chapter universe. Effective deepening of India–ASEAN agricultural integration requires NTM disciplines, mutual recognition and capacity building in the 11 high-AVE chapters, not further tariff cutting in chapters already at zero.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The author received no financial support for the research, authorship and/or publication of this article.

ORCID iD

Noor Sehgal https://orcid.org/0009-0007-2376-5179

References

Baldwin, R. (2011). *21st century regionalism: Filling the gap between 21st century trade and 20th century trade rules* (CEPR Policy Insight, No. 56). Centre for Economic Policy Research.

Batra, A. (2012). India's FTAs and their trade effects: A gravity analysis. *Indian Economic Review*, *47*(1), 77–103.

Beghin, J. C., Maertens, M., & Swinnen, J. (2015). Non-tariff measures and standards in trade and global value chains. *Annual Review of Resource Economics*, *7*(1), 425–450.

Bown, C. P., & Tovar, P. (2011). Trade liberalisation, antidumping, and safeguards: Evidence from India's tariff reform. *Journal of Development Economics*, *96*(1), 115–125.

Bureau, J.-C., & Salvatici, L. (2004). *WTO negotiations on market access: What we know, what we don't and what we should* (INRA Working Paper No. 2004-04). Institut National de la Recherche Agronomique.

Cadot, O., & Gourdon, J. (2016). Non-tariff measures, preferential trade agreements, and prices: New evidence. *Review of World Economics*, *152*(2), 227–249.

Cadot, O., & Gourdon, J. (2018). *Non-tariff measures: Data and quantitative tools of analysis*. Fondation pour les Études et Recherches sur le Développement International.

Cadot, O., Gourdon, J., & van Tongeren, F. (2018). *Estimating ad valorem equivalents of non-tariff measures: Combining price-based and quantity-based approaches* (OECD Trade Policy Papers No. 215). OECD Publishing.

Disdier, A.-C., Fontagné, L., & Mimouni, M. (2008). The impact of regulations on agricultural trade: Evidence from the SPS and TBT agreements. *American Journal of Agricultural Economics*, *90*(2), 336–350.

Ederington, J., & Ruta, M. (2016). Non-tariff measures and the world trading system. In K. Bagwell & R. W. Staiger (Eds.), *Handbook of commercial policy* (Vol. *1B*, pp. 211–277). Elsevier.

Ferrantino, M. (2006). *Quantifying the trade and economic effects of non-tariff measures* (OECD Trade Policy Papers No. 28). OECD Publishing.

Fontagné, L., Orefice, G., Piermartini, R., & Rocha, N. (2015). Product standards and margins of trade: Firm-level evidence. *Journal of International Economics*, *97*(1), 29–44.

Food and Agriculture Organization of the United Nations. (2023). *FAOSTAT: Crops and livestock products*. FAO.

Helpman, E., Melitz, M., & Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *Quarterly Journal of Economics*, *123*(2), 441–487.

Ing, L. Y. (2015). Multifarious non-tariff measures in a rising ASEAN. *The World Economy*, *38*(10), 1443–1464.

Ing, L. Y., De Cordoba, S. F., & Cadot, O. (2016). *Non-tariff measures in ASEAN* (ERIA Research Project Report No. FY2015-01). Economic Research Institute for ASEAN and East Asia.

Kee, H. L., Nicita, A., & Olarreaga, M. (2008). Import demand elasticities and trade distortions. *The Review of Economics and Statistics*, *90*(4), 666–682.

Kee, H. L., Nicita, A., & Olarreaga, M. (2009). Estimating trade restrictiveness indices. *The Economic Journal*, *119*(534), 172–199.

Kumar, R., & Sharma, S. (2020). Preferential trade and non-tariff barriers: India's agricultural exports to ASEAN. *Journal of Asian Economics*, *68*, 101194.

Limão, N., & Tovar, P. (2011). Policy choice, credibility, and political institutions. *Journal of International Economics*, *84*(1), 13–20.

Pant, M. (2011). ASEAN–India Free Trade Agreement: An assessment. *Economic & Political Weekly*, *46*(15), 70–76.

Silva, Santos, J. M. C., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, *88*(4), 641–658.

UNCTAD. (2012). *International classification of non-tariff measures*.

UNCTAD. (2017). *UNCTAD TRAINS: The global database on non-tariff measures*.

UNCTAD. (2018). *Non-tariff measures: Economic assessment and policy options for developing countries*.