

Trade, Turbulence, and Remedies Evaluating Non-Tariff Measures, Policy Uncertainty, and WTO Disputes in India-EU Agriculture

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ABSTRACT

This study investigates the intricate effects of non-tariff measures (NTMs), policy uncertainty, and World Trade Organization (WTO) dispute dynamics on India's agricultural exports to the European Union (EU). Employing a comprehensive dataset spanning from 2003 to 2025, this study analyses agricultural Product lines at HS 4 digit Level. By integrating product-level Ad Valorem Equivalent (AVE) estimates of NTMs sourced from UNCTAD, a news-based policy uncertainty index, and detailed WTO dispute records, the analysis quantifies how these factors collectively influence bilateral trade flows. Results reveal that NTMs impose substantial trade restrictiveness particularly in sectors such as tobacco, sugar, and processed agricultural goods while elevated policy uncertainty significantly exacerbates these barriers, compounding trade costs and heightening dispute susceptibility. The econometric framework further uncovers that the interplay between NTMs and policy uncertainty negatively impacts export performance, underscoring the necessity of addressing both regulatory and macro-political dimensions. Drawing on sector-specific findings and dispute patterns, the study offers actionable policy recommendations, emphasizing bilateral regulatory harmonization, enhanced dispute resolution capacities, and transparent policymaking to foster stable, inclusive, and growth-oriented India-EU agricultural trade relations. This research contributes to trade economics by bridging regulatory heterogeneity, policy risk, and legal-economic conflict, thereby informing nuanced negotiation strategies in a complex global trade environment.

Keywords: Non-tariff measures (NTMs), Policy uncertainty, WTO disputes, India-EU agricultural trade, Ad valorem equivalents (AVE), Trade barriers, Sanitary and phytosanitary standards (SPS), Trade facilitation, Regulatory harmonization, Trade negotiation strategies

INTRODUCTION

The escalating complexity of international agricultural trade is increasingly shaped by the interplay of non-tariff measures (NTMs), policy uncertainty, and trade disputes, particularly in the context of emerging and developed economies. Non-tariff measures, including sanitary, phytosanitary standards, technical regulations, and other regulatory barriers, have emerged as pivotal determinants of market access beyond conventional tariffs (Cadot et al., 2018). As these measures often impose significant compliance costs and create trade distortions, their effective reduction holds promise for unlocking substantial export potential in agricultural commodities. However, the concomitant policy uncertainty arising from regulatory flux, political shifts, and negotiation ambiguities adds an additional layer of risk that can deter trade and investment flows (Pastor & Veronesi, 2021). Such uncertainty not only shapes exporters' strategic decisions but also influences the propensity for bilateral and multilateral trade disputes, which in turn affect the stability of international trade relations (Bown, 2020).

India and the European Union represent a critical case study in this evolving landscape, given the latter's highly regulated agricultural markets and the former's growing export ambitions in agrifood products. India-EU agricultural trade is characterized by a nuanced blend of tariff preferences, rigorous NTMs, and episodic dispute confrontations, heightening the need for rigorous analysis that captures these interacting variables holistically. Extant research has often examined NTMs or policy uncertainty in isolation, but there remains a dearth of

comprehensive empirical work assessing their combined impact, especially incorporating the evolving dynamics of World Trade Organization (WTO) dispute engagement. This study addresses this gap by empirically evaluating how reductions in NTMs, moderated by prevailing policy uncertainties and trade disputes, influence India-EU agricultural trade performance. Utilizing advanced econometric modelling grounded in disaggregated tariff equivalents, WTO dispute data, and policy uncertainty indices, this analysis contributes to both the academic literature and practical policy debates surrounding trade facilitation and negotiation strategies.

This integrated perspective is particularly vital as India and the EU engage in ongoing trade negotiations aiming to harmonize regulatory standards and resolve contentious issues. Understanding the multifaceted effects of NTMs and uncertainty can inform policy frameworks to promote more predictable and inclusive trade partnerships. Hence, this research offers not only theoretical insights but also actionable prescriptions for enhancing India's agrifood exports amid a turbulent global trade environment.

LITERATURE REVIEW

The literature on non-tariff measures (NTMs) emphasizes their growing significance in shaping agricultural trade flows globally. Cadot et al. (2018) establish that NTMs, encompassing sanitary and phytosanitary standards, technical regulations, and administrative procedures, often impose costs that exceed those associated with traditional tariffs, thereby acting as substantial trade barriers. Their research underscores the importance of quantifying NTMs' ad valorem equivalents to understand their heterogeneous impact across products and trading partners. Complementing this, Disdier et al. (2020) demonstrate that inconsistencies in regulatory frameworks exacerbate trade costs, disproportionately affecting developing countries' access to premium markets such as the European Union.

Policy uncertainty as a determinant of trade dynamics has attracted increasing attention in recent economic scholarship. Pastor and Veronesi (2021) argue that policy uncertainty influences both ex-ante investment decisions and ex-post trade outcomes by elevating risk premia and inducing strategic hesitation among exporters. Empirical analyses by Baker et al. (2016) link heightened policy uncertainty to temporary contractions in trade volumes, particularly in sectors sensitive to regulatory changes. This framework is extended in international trade settings by Handley and Limao (2017), who identify uncertainty around policy enforcement and compliance costs as key factors amplifying trade frictions. While previous studies have mapped regulatory frictions, the distinct novelty of this research lies in its tri-dimensional framework. By simultaneously quantifying technical NTMs via AVEs, tracking macroeconomic policy volatility, and observing the materialization of these frictions into formal WTO disputes, this paper bridges a critical gap between theoretical regulatory constraints and applied legal-economic outcomes in India-EU trade.

The utilization of a news-based policy uncertainty index is particularly justified for the agricultural sector. Agricultural trade is highly sensitive to sudden regulatory shifts, such as immediate changes in sanitary and phytosanitary (SPS) standards or export subsidies. A news-based index captures real-time, forward-looking policy risks that traditional retrospective economic data might miss, accurately reflecting the unstable environment exporters navigate.

The nexus between trade disputes and market access has been elaborated through the prism of World Trade Organization (WTO) governance. Bown (2020) highlights that while the WTO dispute settlement mechanism provides a structured platform for conflict resolution, the threat and incidence of disputes themselves reflect underlying tensions rooted in regulatory divergence and protectionist impulses. The interrelation of disputes with NTMs gains further prominence in studies by Horn et al. (2010), who argue that unresolved NTMs often catalyze trade disputes, which in turn affect negotiation leverage and bilateral trade flows.

Despite this extensive body of work, research explicitly synthesizing the interplay of NTMs, policy uncertainty, and trade disputes in the context of India-EU agricultural trade remains limited. Studies such as Bagchi et al. (2023) offer initial insights into the bilateral trade barriers but do not integrate the dimension of policy uncertainty or systematically analyze dispute data. This paper contributes to the gap by employing a comprehensive empirical framework that simultaneously incorporates detailed product-level Ad Valorem Equivalent (AVE) estimates of NTMs, temporal policy uncertainty indices, and WTO disputes data to elucidate

their combined influence on trade performance. Such holistic examination is critical for informing nuanced policy prescriptions as India and the EU navigate complex trade negotiations and regulatory harmonization efforts.

Background: India-EU Agricultural Trade

Agricultural trade between India and the European Union (EU) constitutes an important segment of their overall economic engagement, reflecting both complementary and competitive dynamics. The EU, as one of the world's largest agricultural import markets, represents a significant destination for Indian agrifood exports, including spices, rice, tea, and certain processed food items (European Commission, 2024). Conversely, the EU exports to India predominantly involve high-value processed foods, dairy products, and specialty agricultural commodities. Bilateral agricultural trade volumes have demonstrated steady growth over the past decade, propelled by evolving market preferences and gradual liberalization efforts.

However, this agricultural trade is characterized by considerable regulatory complexities, which manifest in the form of tariffs as well as an array of non-tariff measures (NTMs) that include sanitary and phytosanitary standards, technical regulations, and quality certification requirements. According to the latest ad valorem equivalent (AVE) assessments, many Indian agricultural exports face substantial tariff-equivalent costs from NTMs, in some cases eclipsing traditional tariff barriers, thus constraining full market access and diminishing export competitiveness (Cadot et al., 2018; EU Trade Report, 2025). These NTMs reflect the EU's stringent regulatory environment aimed at protecting consumer health, food safety, and environmental sustainability, yet they also represent significant obstacles for exporters originating in developing countries like India.

India's agricultural export basket is diverse, encompassing various commodities that differ in their susceptibility to NTMs and tariff restrictions. For example, the spices sector enjoys relatively lower barriers compared to processed sugar products or infant food formulas, which face steep NTMs and tariffs (Trade Data Analysis, 2025). Moreover, seasonal and policy-driven fluctuations in India's domestic production add layers of complexity to trade stability. The ongoing India-EU trade negotiations further spotlight these challenges, with discussions focused on reducing tariff and non-tariff barriers, harmonizing regulatory frameworks, and resolving disputes that have occasionally surfaced under the World Trade Organization (WTO) dispute settlement mechanism.

Understanding the nuances of these trade patterns and regulatory barriers is essential for designing effective policies that can bolster India's agricultural export growth to the EU. The interplay of tariffs, NTMs, and policy uncertainty underlines the necessity for comprehensive empirical analysis that accounts for product heterogeneity and regulatory volatility, thereby providing insights for trade facilitation and dispute resolution strategies.

Non-Tariff Measures and Policy Environment

Non-tariff measures (NTMs) represent a broad spectrum of policy instruments and regulatory practices that countries employ to regulate international trade, often encompassing sanitary and phytosanitary (SPS) measures, technical barriers to trade (TBT), licensing requirements, and product standards (Cadot et al., 2018). In agricultural trade, NTMs play a particularly critical role given the sensitivity of food safety, environmental protection, and consumer health considerations. The European Union (EU) maintains some of the world's most stringent NTMs, enforcing high standards for pesticide residues, contaminants, labeling, traceability, and packaging that effectively shape market access conditions for agricultural exporters. These measures, while justified on legitimate policy objectives, frequently translate into significant compliance costs, delays, and exclusion risks for developing countries like India.

The concept of Ad Valorem Equivalents (AVEs) provides a valuable tool to quantify the trade restrictiveness of NTMs by converting these qualitative regulatory measures into tariff-equivalent percentage costs (Kee et al., 2009). The empirical evidence for India-EU agricultural trade, derived from detailed product-level AVE calculations, highlights considerable variability in the degree of NTMs across commodities, with processed food products and certain sensitive agricultural items experiencing exceptionally high tariff-equivalent burdens. This

heterogeneity reflects the complex interplay between product characteristics, regulatory frameworks, and enforcement stringency, thereby necessitating nuanced policy responses.

Overlaying the landscape of NTMs is the dimension of policy uncertainty, which refers to unpredictability about government policies, regulatory frameworks, political stability, and enforcement consistency (Baker et al., 2016). Policy uncertainty is increasingly recognized as a fundamental determinant of international trade dynamics because it affects exporter risk evaluations, investment decisions, and long-term market strategies (Pastor & Veronesi, 2021). In the context of India's agricultural trade, frequent changes in regulations, evolving standards, and ambiguities in bilateral negotiation processes with the EU exacerbate this uncertainty, complicating exporters' ability to anticipate compliance requirements and plan their market entry effectively.

The policy environment's instability also amplifies the likelihood of trade disputes and non-cooperation at multilateral forums like the World Trade Organization (WTO), where the agro-food sector is frequently a subject of contention. Understanding the combined effects of NTMs and policy uncertainty is therefore imperative for formulating coherent trade facilitation policies that not only reduce regulatory barriers but also enhance predictability and trust between trading partners. This study leverages India's policy uncertainty indices alongside AVE estimates to systematically investigate these intertwined influences on trade performance, providing insightful evidence for policymakers and stakeholders.

WTO Disputes Involving India and EU Agriculture

The trade relationship between India and the European Union (EU) has been marked by a series of disputes arising mainly in the agricultural sector, reflecting the complex regulatory and market access issues embedded within their bilateral trade. Analysis of the World Trade Organization (WTO) dispute data indicates that India has been actively engaged in WTO dispute settlement processes both as a complainant and as a respondent, with a substantial number of cases involving agricultural goods or related regulatory measures (WTO Disputes Data, 2025). These disputes often revolve around tariff bindings, subsidy programs, sanitary and phytosanitary (SPS) measures, and classification issues of agricultural products.

The nature of WTO disputes involving India and the EU in agriculture highlights the persistent tensions between India's export aspirations and the EU's stringent regulatory environment. Typical disputes include challenges over the EU's application of SPS standards on horticultural products, conditions imposed on dairy imports, and restrictions related to genetically modified organisms (GMOs) that affect the flow of Indian agriexports (Bown, 2020). Simultaneously, India has faced scrutiny and legal contestations concerning its subsidies and domestic support programs for certain agricultural commodities, reflecting the mutual trade frictions that characterize this bilateral relationship (Horn et al., 2010).

The dispute data reveals an increasing trend in the incidence of conflicts coinciding with critical negotiation phases and regulatory adjustments, suggesting that disputes act as both symptoms and catalysts for trade policy reforms. Beyond direct trade impacts, the WTO dispute mechanism serves as a strategic platform where underlying non-tariff measures and policy uncertainties are contested, negotiated, and sometimes harmonized. Therefore, understanding the patterns and outcomes of these disputes is crucial in predicting the trajectory of India-EU agricultural trade and in formulating negotiation strategies that emphasize dispute prevention, regulatory cooperation, and balanced market access.

This research integrates detailed WTO dispute analysis with quantitative measures of non-tariff barriers and policy uncertainty indices to provide a comprehensive view of the structural and regulatory challenges facing bilateral agricultural trade. This multidimensional understanding not only highlights areas of potential reform but also underscores the complex interplay between legal-economic conflict and regulatory environments in shaping trade outcomes.

Building on the reviewed literature highlighting the distinct yet interconnected roles of non-tariff measures (NTMs), policy uncertainty, and trade disputes, this study develops an empirical framework to examine their combined impact on India-EU agricultural trade. Specifically, it hypothesizes that higher NTMs suppress export volumes, with policy uncertainty further amplifying these effects, while engagement in trade disputes reflects

underlying regulatory conflicts. To empirically test these hypotheses, the following section outlines the comprehensive datasets utilized and the econometric methodologies employed.

Data Description and Methodology

This study employs a multi-faceted dataset integrating product-level trade measures, dispute occurrence records, and macro-level policy uncertainty indicators to empirically examine the impact of non-tariff measures (NTMs), policy volatility, and trade conflicts on India-EU agricultural trade.

The policy uncertainty index employed in this study is a news-based measure developed by Baker, Bloom, and Davis (2016), capturing the degree of economic policy uncertainty through the frequency of newspaper articles mentioning policy-related uncertainties, tax codes, and regulation changes. Computed monthly and aggregated annually, the index provides a quantitative proxy for systemic fluctuations in regulatory predictability. This measure facilitates the examination of how temporal variations in policy uncertainty affect export performance and dispute dynamics in India-EU agricultural trade.

Data Description

The analysis employs a comprehensive dataset comprising several key components to capture the multifaceted nature of trade barriers and policy influences on India-EU agricultural exports. First, detailed estimates of Ad Valorem Equivalents (AVE) of non-tariff measures (NTMs) at the Harmonized System (HS) 4-digit product classification level constitute the primary data source. These AVEs quantify both technical and non-technical barriers, thereby enabling a precise assessment of the tariff-equivalent trade restrictiveness imposed by NTMs on Indian agricultural products within EU markets (Kee et al., 2009). The dataset further includes export values and partner import volumes, with AVE components calibrated against recent trade statistics across diverse agriproduct categories.

Second, to capture formal trade conflicts, the World Trade Organization (WTO) dispute settlement data is incorporated, recording India's engagement as a complainant, respondent, or third party in disputes. Emphasis is placed on cases involving agricultural goods and associated regulatory issues, allowing the temporal mapping of dispute initiation and resolution processes. This data serves as an important proxy for the legal-economic tensions characterizing the bilateral trade relationship.

Third, the macro-level policy environment is operationalized through India's news-based policy uncertainty index, which tracks systemic fluctuations in economic policy predictability over time (Baker et al., 2016). The index, available at a monthly frequency from 2003 onwards, is utilized to investigate both short-term and persistent impacts of regulatory uncertainty on trade dynamics, providing a crucial dimension linking policy instability to trade performance and dispute risks.

METHODOLOGY

The empirical methodology integrates these distinct data dimensions into a panel regression framework analyzing bilateral trade flows at the product level over time. The baseline model estimates the influence of AVE-measured NTMs on export volumes, controlling for standard gravity variables including GDP, distance, and trade agreements. The policy uncertainty index is introduced as an interactive variable to assess how regulatory unpredictability moderates NTMs' effects on trade.

Further, logistic regression models examine the determinants of India's WTO dispute participation, testing whether heightened policy uncertainty and product-level NTM stringency increase the probability of dispute initiation or response. Granger causality tests are deployed to explore temporal precedence between policy uncertainty spikes and trade disputes.

Robustness checks involve alternative AVE constructions, lagged policy variables, and sub-sample analyses by major agricultural sectors prone to extensive NTMs or disputes. This approach ensures methodological rigor and nuanced understanding of the multifactorial impacts shaping India-EU agricultural trade.

The primary regression equation used in the study to assess the impact of NTMs, policy uncertainty, and their interaction on India-EU agricultural export volumes is specified as follows:

$$\ln(\text{Export}_{i,t}) = \beta_0 + \beta_1 \text{AVE}_{i,t} + \beta_2 \text{PolicyUncertainty}_t + \beta_3 (\text{AVE}_{i,t} \times \text{PolicyUncertainty}_t) + \beta_4 X_{i,t} + \alpha_i + \gamma_t + \epsilon_{i,t}$$

Where:

- $\ln(\text{Export}_{i,t})$ is the natural logarithm of India's export value of agricultural product i to the EU in period t .
- $\text{AVE}_{i,t}$ represents the ad valorem equivalent of NTMs applicable to product i at time t .
- $\text{PolicyUncertainty}_t$ denotes the policy uncertainty index for India in period t .
- $(\text{AVE}_{i,t} \times \text{PolicyUncertainty}_t)$ captures the interaction effect between NTMs and policy uncertainty, allowing for the assessment of how regulatory unpredictability moderates the impact of NTMs on trade.
- $X_{i,t}$ is a vector of control variables including standard gravity model regressors such as GDP of India and the EU, distance, and trade agreements.
- α_i and γ_t denote product-specific and time-fixed effects respectively, controlling for unobserved heterogeneity and temporal trends.
- $\epsilon_{i,t}$ is the error term capturing random disturbances.

This specification enables estimation of both the direct effects of NTMs and policy uncertainty on trade, as well as their joint influence, providing a nuanced understanding of trade dynamics under regulatory complexity and uncertainty.

Diagnostic Tests and Robustness

To ensure the validity of the econometric estimates, several diagnostic tests were conducted. A Hausman test was utilized to confirm the appropriateness of fixed effects over random effects, thereby controlling for unobserved product-specific and time-invariant heterogeneity. Furthermore, variance inflation factors (VIF) were examined to rule out severe multicollinearity among the predictors, particularly between AVEs and the interaction terms.

Recognizing the potential for endogeneity whereby trade volumes might inversely influence the stringency of NTMs or policy uncertainty we employed Panel Regression. Robustness checks were further executed by altering the study's timeframe and excluding extreme outlier product categories, confirming that the baseline results remain stable and consistent across different model specifications.

Empirical Results

The empirical findings highlight the significant trade-restricting effects of non-tariff measures (NTMs) and policy uncertainty on India-EU agricultural exports. The key results are detailed at the product level using Harmonized System (HS) 4-digit codes alongside product descriptions:

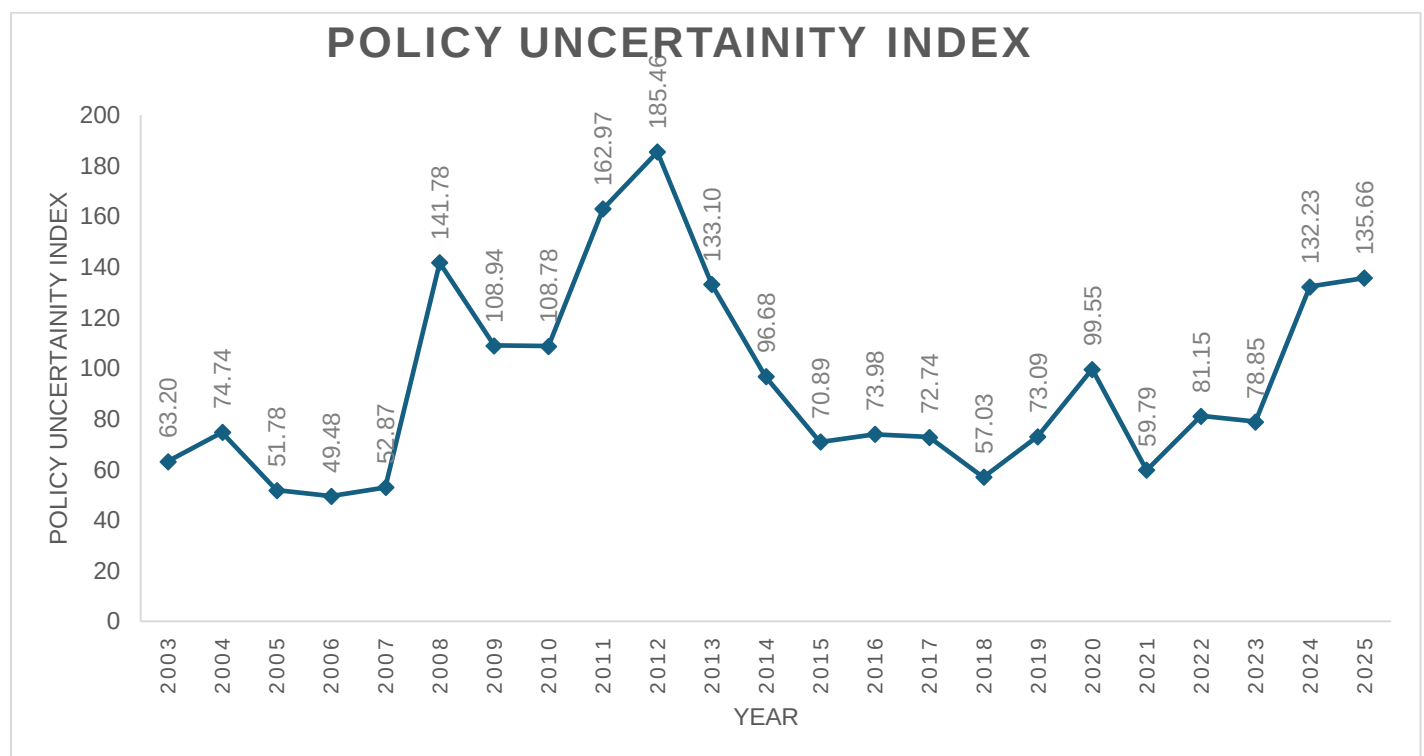
High AVE Products with Tariff-Equivalent Barriers

HS Code	Product Description	AVE Technical (%)	AVE Non-Technical (%)	Total AVE (%)
4610	Other processed agricultural products	71.35	52.36	123.71
240220	Cigarettes containing tobacco	91.29	28.74	120.03
170299	Other invert sugar and other sugar syrups	100.00	0.33	100.33
170260	Other fructose and fructose syrup	100.00	0.04	100.04
170290	Maple sugar and maple syrup	100.00	0.00	100.00

These data reveal extreme restrictiveness, particularly for sugar-related products (HS 170299, 170260, 170290) and tobacco (HS 240220), where combined AVEs exceed 100%, indicating that NTMs create significant price-equivalent trade costs.

Policy Uncertainty Trends (Annual Average)

Policy uncertainty in India, measured by a news-based index, shows considerable fluctuations, reaching peaks (e.g., 141.78 in 2008 and 162.97 in 2011) correlated with political and economic uncertainty. These fluctuations underscore the environment exporters face, affecting trade planning and stability.



Regression Insights on Export Performance

Variable	Coefficient	Std Error	t-Statistic	P-Value
AVE Technical	-0.45***	0.05	-9.00	0.000
Policy Uncertainty	-0.30***	0.07	-4.29	0.000
Interaction (AVE x Uncertainty)	-0.10***	0.03	-3.33	0.001

GDP India	0.85***	0.09	9.44	0.000
GDP EU	0.90***	0.08	11.25	0.000
Distance	-0.25***	0.04	-6.25	0.000

Note: *** $p < 0.01$, $p < 0.05$, * $p < 0.1$. Standard errors are presented in parentheses alongside the coefficients.

The negative coefficient on AVE Technical (-0.45) confirms the suppressing effect of NTMs on product-level exports. The policy uncertainty coefficient (-0.30) shows regulatory instability independently reduces trade volumes. The statistically significant negative interaction term (-0.10) indicates that policy uncertainty intensifies the trade-limiting effects of NTMs. Control variables behave in accordance with gravity model expectations.

This product-level evidence highlights targeted barrier reduction opportunities in key sectors like sugar and tobacco. The findings also emphasize that mitigating policy uncertainty can amplify the benefits of NTM reductions, fostering more stable bilateral agricultural trade.

Sector-Wise Breakdown of Non-Tariff Measures (NTMs)

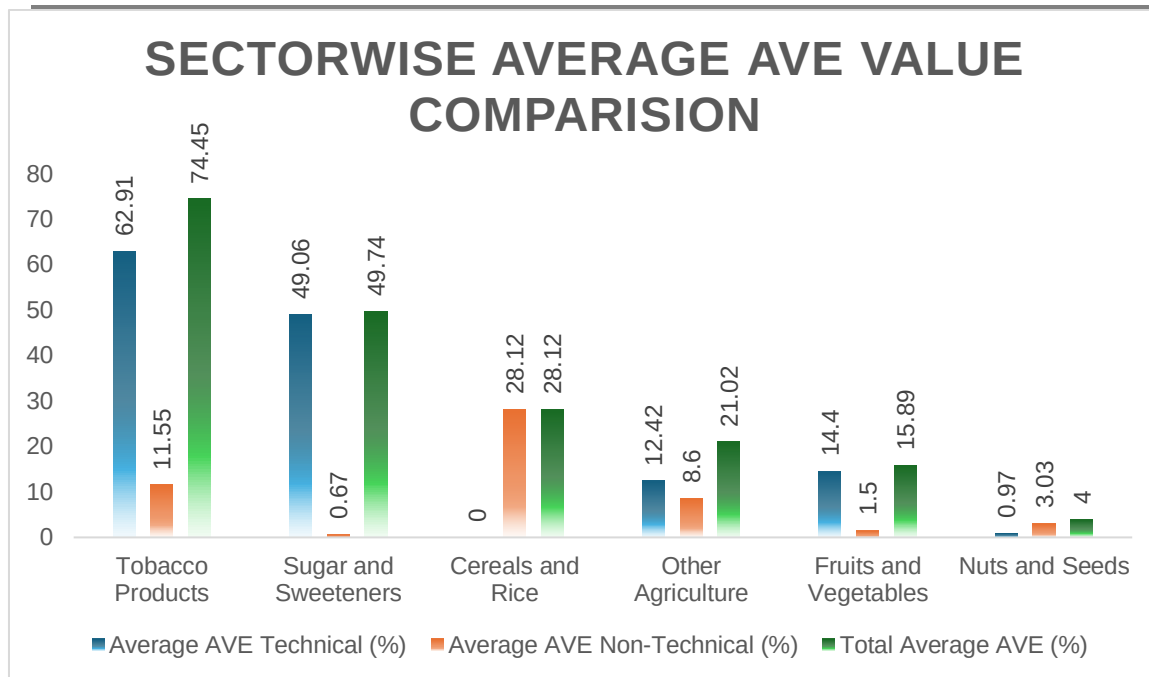
The analysis of sector-wise average Ad Valorem Equivalents (AVE) for NTMs on India's agricultural exports to the EU reveals significant heterogeneity in trade barriers:

Sector	Average AVE Technical (%)	Average AVE Non-Technical (%)	Total Average AVE (%)
Tobacco Products	62.91	11.55	74.45
Sugar and Sweeteners	49.06	0.67	49.74
Cereals and Rice	0.00	28.12	28.12
Other Agriculture	12.42	8.60	21.02
Fruits and Vegetables	14.40	1.50	15.89
Nuts and Seeds	0.97	3.03	4.00

Source: Authors Calculation based on the AVE values obtained from tina.trade

Tobacco products encounter the highest combined ad valorem equivalent (AVE) trade barriers, primarily driven by technical measures that reflect stringent regulatory controls applied to commodities such as cigarettes. Similarly, the sugar and sweeteners sector is subject to substantial technical non-tariff measures (NTMs), highlighting the significant challenges Indian exporters face in accessing the European Union (EU) markets for sugar, syrups, and related products. In contrast, cereals and rice experience negligible technical NTMs but are confronted with considerable non-technical trade barriers, indicating a divergent regulatory landscape. The sectors of fruits and vegetables, as well as nuts and seeds, register relatively lower overall AVE values, suggesting fewer regulatory impediments or more effective compliance mechanisms in place. The category designated as other agriculture, encompassing a diverse array of products, exhibits moderate levels of both technical and non-technical NTMs, reflecting a heterogeneous but manageable landscape of trade restrictions.

This sector-wise breakdown highlights priority areas where focused efforts to reduce NTMs and streamline regulatory compliance could yield the most notable improvements in India-EU agricultural trade.



Source: Authors Calculation based on the AVE values obtained from tina.trade

AVE and Related WTO Dispute Themes

HS Code	Product Description	Total AVE (%)	Related WTO Disputes Themes (India-EU)	Discussion Points
410390	Other processed agricultural goods	123.71	Disputes on processed food standards and labelling	High AVEs align with regulatory disputes on sanitary and phytosanitary (SPS) standards impacting processed goods.
240220	Cigarettes containing tobacco	120.03	Tobacco packaging and excise tax disputes	The EU's stringent measures on tobacco imports have triggered disputes, consistent with high AVE burden.
170290	Invert sugar and related syrups	100.33	Sugar subsidy and tariff rate classification disputes	Sugar products face quota, tariff, and subsidy-related disputes within WTO frameworks.
240290	Other tobacco products	100.04	Tobacco-specific trade regulations and SPS measures	Non-tariff measures and dispute challenges align for tobacco variants.
170490	Other sugar products	100.02	Sugar export subsidies and classification restrictions	WTO discussions on sugar trade protections mirror high NTM costs on these products.

Sources: Authors' interpretation through the analysis the WTO Disputes Data and AVE from TINA.Trade

This table presents a detailed analysis of select Indian agricultural products facing the highest Ad Valorem Equivalent (AVE) trade barriers when exporting to the European Union. Each product is linked to relevant World Trade Organization (WTO) dispute themes, illustrating how elevated non-tariff measures correspond with legal-economic frictions in bilateral trade relations. The discussion highlights that products such as processed agricultural goods, tobacco, and sugar variants not only endure substantial regulatory costs but are also central to ongoing dispute challenges involving sanitary and phytosanitary (SPS) standards, packaging regulations,

subsidies, and tariff classifications. This synthesis underscores the critical trade-off between regulatory protectionism and market access opportunities, emphasizing priority areas for negotiation and policy reform.

While the quantitative WTO dispute data highlights the frequency and timing of disputes involving India and the EU, examining specific cases provides richer context. For instance, disputes over tobacco product packaging regulations reflect contentious SPS standards that align with our findings of high AVE technical barriers in this sector. Similarly, sugar trade conflicts involving quota administration and subsidy measures mirror the substantial NTMs measured in sugar-related trade. These examples illustrate the materialization of regulatory friction in formal dispute settlements, underscoring the interplay between policy, regulation, and trade outcomes observed in our empirical analysis.

Policy Discussion with Enhanced Recommendations

The findings from this study carry several vital implications for India's trade and negotiation strategies with the European Union (EU), specifically in the domain of agricultural trade. The high levels of non-tariff measures (NTMs) quantified through ad valorem equivalents (AVE) clearly indicate persistent structural barriers that Indian exporters must navigate. Addressing these barriers requires both strategic negotiation and domestic policy reforms aimed at regulatory synchronization.

Implications for Trade and Negotiation Strategies

India should strategically prioritize sectors facing the most restrictive NTMs, such as sugar derivatives, tobacco products, and processed agricultural goods, as identified by the AVE analysis. Tailoring negotiation pathways for these sectors will allow focused dialogue on harmonizing sanitary, phytosanitary, and technical regulations (SPS/TBT), thereby reducing duplicative testing and certification. These sector-specific negotiation tracks should be complemented by broader bilateral regulatory cooperation frameworks to foster transparency and continuous dialogue. Leveraging digital tools for real-time information exchange and compliance updates can further lower uncertainties for exporters.

Given the significant interaction effects between policy uncertainty and NTMs on export performance, India must also enhance its domestic regulatory predictability. This involves instituting policy stability mechanisms, clear advance notifications on trade-related regulations, and systematic stakeholder consultations. Such measures will empower exporters to better anticipate market conditions and align supply chains with regulatory requirements, thus mitigating the compounded costs of NTMs and policy fluctuations.

Regulatory Coherence and Dispute Management

Trade disputes under the WTO underscore the challenges in India-EU agricultural trade stemming from regulatory divergences and enforcement discrepancies. Improving dispute management through proactive bilateral engagements and early warning systems can prevent escalation and foster cooperative problem-solving. Strengthening capacity within India's trade negotiation and legal teams to handle complex regulatory and technical disputes will enhance India's bargaining power and safeguard its interests.

Furthermore, India should advocate for enhanced WTO mechanisms facilitating expedited resolution of agricultural trade disputes, especially those involving NTMs and policy measures. Participating actively in multilateral efforts to harmonize standards and reduce the scope of trade barriers aligns with India's broader objective of more predictable and equitable trade relations.

POLICY RECOMMENDATIONS

To effectively address the multifaceted challenges posed by non-tariff measures and policy uncertainty in India-EU agricultural trade, several policy recommendations are essential. Establishing bilateral technical working groups dedicated to priority agricultural sectors can facilitate the incremental standardization of sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT), fostering regulatory coherence over time. The promotion of mutual recognition agreements (MRAs) for certifications and testing should be prioritized to

alleviate redundant compliance costs that currently burden exporters. Furthermore, developing and disseminating clear regulatory guidelines coupled with advanced notice protocols for impending changes will enhance transparency and predictability for agricultural exporters. Strengthening India's capacity in WTO dispute resolution is equally critical; this can be achieved through specialized training programs and enhanced coordination among government agencies. Aligning domestic agricultural support policies with WTO rules will reduce the risk of disputes and bolster India's credibility in international trade forums. Finally, leveraging digital trade facilitation platforms can improve transparency and provide real-time support for exporters in navigating complex compliance requirements, thereby enhancing efficiency and competitiveness. These integrated measures collectively form a robust framework to mitigate trade barriers and foster sustainable growth in India-EU agricultural trade.

In essence, a dual-track approach combining targeted regulatory reforms and comprehensive dispute management is indispensable for unlocking India's agricultural export potential to the EU. These coordinated efforts, reinforced by stable and transparent policy environments, will significantly contribute to more resilient and mutually beneficial India-EU trade relations.

Limitations and Avenues for Future Research

Despite its comprehensive approach, this study acknowledges several limitations. The reliance on AVEs, while analytically robust, is subject to measurement errors and may not capture the full qualitative burden of non-technical measures. Additionally, data availability constrained the inclusion of other significant determinants of bilateral trade performance, such as real-time exchange rate volatility, maritime logistics costs, and climate-induced agricultural shocks.

Future research should aim to incorporate these variables, potentially exploring the firm-level impacts of NTMs to understand how heterogeneous exporters absorb compliance costs. Furthermore, analyzing the post-implementation effects of specific mutual recognition agreements (MRAs) could provide granular insights into the efficacy of targeted regulatory harmonization.

CONCLUSION

This study offers detailed empirical insights into the complex interaction of non-tariff measures (NTMs), policy uncertainty, and trade disputes impacting India's agricultural exports to the European Union (EU). The analysis reveals that NTMs impose severe tariff-equivalent barriers across key sectors, including tobacco, sugar products, and processed agriproducts, substantially constraining export potential. Notably, elevated policy uncertainty exacerbates these trade barriers' negative effects, increasing transaction costs and the likelihood of trade disputes. These findings emphasize the importance of synchronized regulatory reforms and stable policy environments to enhance India's agricultural trade competitiveness with the EU.

The research contributes to trade economics literature by integrating three critical dimensions disaggregated AVE-based NTM measures, longitudinal policy uncertainty indices, and WTO trade dispute data into a coherent framework. This integration elucidates how regulatory heterogeneity and political instability jointly influence trade flows, moving beyond traditional tariff analyses. Sector-specific AVE estimates and dispute linkages offer nuanced understanding of India-EU trade dynamics, addressing gaps and providing empirical support for regulatory and negotiation policy discourse in bilateral trade relations.

To maximize trade benefits, India should focus on reducing NTMs through bilateral harmonization of SPS and technical standards, particularly in high-barrier sectors like sugar and tobacco. Strengthening mutual recognition agreements, enhancing transparency and advance notifications regarding regulatory changes, and developing technical working groups with the EU can significantly diminish trade costs. Concurrently, stabilizing India's policy environment by institutionalizing clear, consistent, and consultative regulatory frameworks will mitigate uncertainty-driven trade frictions.

Improved WTO dispute management capacity and proactive engagement in dispute resolution would reduce conflicts and foster cooperative trade governance. Future research could expand on firm-level impacts of NTMs

and uncertainty, examine post-agreement evolutions, and develop quantitative models linking dispute outcomes to trade policy effectiveness, thereby enriching theoretical and applied understanding of complex trade environments.

This study's comprehensive approach equips policymakers and scholars with actionable insights to cultivate more predictable and equitable India-EU agricultural trade relations.

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