Research on World Agricultural Economy
https://journals.nasspublishing.com/index.php/rwae

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ASEAN's Ocean-Linked Merchandise and Trade Facilitation: A Quantitative Assessment of Regional Trade Flows

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ABSTRACT

Situated within the strategic context of the ASEAN Blue Economy Framework, this paper presents a quantitative assessment of the multifaceted influence of trade facilitation (TF) on ocean-linked merchandise trade. Using a gravity model with PPML estimation on panel data for nine ASEAN coastal countries and thirty-three global partners from 2017 to 2022, the analysis provides a distinct examination of intra-ASEAN and extra-ASEAN trade flows, employing an expanded classification of ocean-linked goods and updated TF metrics. The results consistently show that TF reforms significantly boost maritime commerce by minimizing border delays and transaction costs, with the trade-enhancing effects being more pronounced for trade with partners outside the ASEAN region. Among the different dimensions, effective governance and improved transparency were found to be particularly impactful catalysts for trade. However, the analysis also confirms that these positive trends were hindered by persistent impediments, such as geographical distance, and were significantly counteracted by adverse policy and economic shocks in 2019 and 2022. These findings underscore the necessity of a targeted TF strategy for ASEAN, focusing on strengthening governance and transparency to enhance efficiency, build supply chain resilience, and sustainably harness the region's strategic maritime potential.

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ARTICLE INFO
Received: 18 May 2025 | Revised: 12 June 2025 | Accepted: 20 June 2025 | Published Online: 18 August 2025
DOI: https://doi.org/10.36956/rwae.v6i4.2172

CITATION
Nguyen, M.H., Nguyen, T.P.L., Nguyen, C.T., et al., 2025. ASEAN's Ocean-Linked Merchandise and Trade Facilitation: A Quantitative Assessment of Regional Trade Flows. Research on World Agricultural Economy. 6(3): 1–16. DOI: https://doi.org/10.36956/rwae.v6i4.2172

Keywords: Trade Facilitation; Ocean-Linked Merchandise; Maritime Commerce; ASEAN; Gravity Model

1. Introduction

The sustainable development of the ocean economy, which covers 71% of the Earth's surface and is integral to global ecological balance is facing accelerated challenges, including volatile fuel costs, climate-induced sea-level rise, and ecological stresses on marine ecosystems such as coral reefs and fish stocks. As a strategic response, the Blue Economy concept, which emphasizes the sustainable and equitable use of ocean resources, has gained significant traction globally, particularly within ASEAN, as evidenced by the adoption of the ASEAN Blue Economy Framework [1]. This framework directly aligns the region's maritime economic activities with the United Nations' Sustainable Development Goals (SDGs), most notably SDG 14 (Life Below Water), but also extends to poverty reduction (SDG 1), food security (SDG 2), economic growth (SDG 8), and responsible consumption and production (SDG 12) [2]. Within this evolving paradigm, ocean-linked merchandise has become a critical trade category. Encompassing products extracted, produced, or shipped from ocean resources, and drawing upon classifications by Zheng and Tian [3] and UNCTAD's classification [4]. This includes diverse goods such as marine fisheries (harvested and farmed), seafood processing, sea minerals, port equipment and ship components, and high-tech oceanic manufactures. However, the very efficiency and sustainability of these commercial flows are critically dependent on robust maritime infrastructure, streamlined customs procedures, and integrated logistics systems [5–7], exposing this vital trade to significant vulnerabilities. These vulnerabilities are manifested within ASEAN through significant disparities in port capacity, logistics infrastructure quality, and digital automation levels among Member States, which hinder the equitable distribution of benefits [8, 9]. Furthermore, while digitalization is a key goal, the uncoordinated application of digital systems without robust oversight risks undermining maritime security and could inadvertently facilitate the overexploitation of vulnerable oceanic resources [10]. Moreover, the expansion of trade in sectors such as fisheries, aquaculture, or marine minerals, if not managed with stringent environmental safeguards, can exacerbate biodiversity loss and marine ecosystem degradation [11]. These multifaceted challenges underscore the complexity of achieving sustainable ocean governance, making the navigation of the intricate balance between promoting trade expansion and ensuring environmental security a critical policy priority for the region that demands robust empirical evidence.

In response to the need for more resilient and sustainable supply chains, global policy has shifted towards trade facilitation (TF)—a comprehensive suite of measures designed to simplify, standardize, and modernize cross-border administrative procedures [12–14]. For the Association of Southeast Asian Nations (ASEAN), TF is a cornerstone of its regional integration strategy and is pivotal to achieving the objectives of the ASEAN Economic Community (AEC). This commitment is demonstrated through foundational agreements like the ASEAN Trade in Goods Agreement (ATIGA), the dedicated ASEAN Trade Facilitation Framework (2017), and the Regional Comprehensive Economic Partnership (RCEP) [15, 16]. These high-level frameworks are operationalized via practical tools like the ASEAN Single Window (ASW) [17] and specific measures targeting customs streamlining [18] and documentation automation [19–21] to reduce trade transaction costs. The value of these initiatives is supported by evidence that TF can significantly curtail export-import costs [22] and is critical for enhancing competitiveness in global value chains [9–11]. However, despite the well-documented benefits for general commerce, a critical gap exists in understanding their effects on the sector at the heart of the region's Blue Economy. While existing studies suggest these measures benefit overall trade, their specific quantitative impact on ocean-linked merchandise remains significantly underexplored. Although some literature points to potential benefits like reduced compliance costs for high-value marine products [23, 24], a comprehensive analysis is lacking, highlighting a critical area for investigation.

Building on the established context of ASEAN's commitment to a sustainable Blue Economy and the identified research gap, this paper aims to achieve three primary objectives. Firstly, it aims to elucidate the theoretical channels through which trade facilitation influences ocean-linked merchandise trade and specifically explore how these mechanisms interact with ASEAN's regional integration goals and sustainable development imperatives. Secondly, the research will empirically assess the impact of specific TF dimensions on ocean-linked merchandise flows. This assessment will cover nine ASEAN coastal countries and their global partners, focusing on the periods 2017, 2019, and 2022, which encompass notable milestones such as the ASEAN Trade Facilitation Framework (2017), the ASEAN Trade in Services Agreement (ATISA) in 2019, and the implementation of the RCEP. Finally, the third objective is to propose targeted policy measures designed to help ASEAN governments and firms leverage TF to maximize economic gains from ocean-linked trade while simultaneously mitigating ecological risks and fostering sustainable ocean governance.

This research makes a significant contribution to the existing literature in several distinct ways. First, it applies a comprehensive classification of ocean-linked merchandise [3, 4], going beyond fisheries to include sea minerals, port equipment, and high-tech marine products. Second, it integrates updated TF metrics—drawing on the five-group framework proposed by Go [16]—into a gravity-based model [8, 25] to gauge the influence of customs modernization, transparency, and public-private coordination on maritime flows. Third, it extends the analytical lens to encompass both positive and negative externalities—considering how trade facilitation might simultaneously spur trade growth and exacerbate environmental and security concerns [10, 11, 26].

The remainder of this paper is structured as follows. Section 2 outlines the theoretical framework and hypotheses that guide our empirical design. Section 3 presents data sources and the gravity methodology. Section 4 discusses the main findings and their policy implications. Finally, Section 5 concludes by outlining broader lessons for sustainable ocean-linked merchandise trade in ASEAN and beyond.

2. Materials and Methods

2.1. Data

This study employs a gravity model framework to analyze bilateral trade flows, specifically in ocean-linked merchandise, for the years 2017, 2019, and 2022. All data are secondary and derived from official, reputable sources recognized for their comprehensive coverage and established methodologies, thereby ensuring reliability, currency, and objectivity. Specifically, total bilateral trade value in ocean-linked merchandise (tradetotal), consistent with the classification scope detailed in the Introduction, is obtained from the UNCTADstat Data Centre (https://unctadstat.unctad.org/datacentre/). At the same time, real Gross Domestic Product for both exporting (GDPi) and importing (GDPj) nations is retrieved from the World Bank World Development Indicators (https://data.worldbank.org/indicator/NY.GDP.MKTP.CD).

In line with standard gravity model practice, geographical distance (dist) between country pairs is sourced from the CEPII database (https://www.cepii.fr/CEPII/en/welcome.asp). This distance variable serves as a proxy for transport costs, which tend to negatively influence trade. To measure each nation's trade facilitation performance, the study integrates Trade Facilitation Indicators (TFIs) published by the OECD (https://www.compareyourcountry.org/trade-facilitation). TFIs reflect areas such as simplification of border processes, transparency, and modernization efforts in customs procedures – factors particularly relevant to merchandise trade that rely on efficient cross-border flows. Notably, the granularity of these OECD indicators allows for the examination of specific TFA dimensions utilized in this study, such as transparency, procedures, governance, and cooperation, which are analyzed both individually and as a composite TFI.

Additionally, two standard control variables from CEPII - comlang_ethno (an indicator specifying whether at least 9% of the population in each country pair share a common language) and comcol (denoting whether the two countries had the same colonizer after 1945)—are included to account for cultural and historical ties. These variables have often been shown to affect bilateral trade

patterns by reducing informational and institutional barriers.

By drawing data from these internationally recognized economic and research institutions, the study ensures robust cross-country comparability and high-quality information for the empirical analysis. The specific years of 2017, 2019, and 2022 were chosen as they represent the most recent periods for which comprehensive and consistent data were available across all variables and countries in the sample. This timeframe is also strategically relevant, as it encompasses key policy events such as the ASEAN Trade Facilitation Framework (2017) and the implementation of the Regional Comprehensive Economic Partnership (RCEP), aligning the analysis with the research objective of assessing recent impacts.

2.2. Sample Coverage, Variable Specification, and Descriptive Statistics

The sample for this research encompasses nine ASEAN coastal countries: Vietnam, Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, and Thailand. Data on ocean merchandise trade were compiled for these ASEAN nations both for intra-ASEAN trade and trade with 33 other key global trading partners across various continents, including Australia, Austria, Belgium, Brazil, Canada, China, Chile, Denmark, Egypt, France, Finland, Germany, Greece, Hong Kong SAR, Italy, India, Ireland, Japan, South Korea, Mexico, New Zealand, the Netherlands, Pakistan, Russia, Saudi Arabia, Spain, South Africa, Sweden, Switzerland, Turkey, the United States, the United Arab Emirates, and the United Kingdom. The panel dataset covers the years 2017, 2019, and 2022, chosen to capture significant policy milestones and recent trade dynamics.

This study utilizes several key variables for estimating the gravity model. The dependent variable, tradetotal, represents the bilateral value of ocean-linked merchandise trade between an exporting country (i) and an importing country (j). Standard gravity model explanatory variables include the Gross Domestic Product (GDP) of the exporting country (GDP_i) and the importing country (GDP_j), as well as the geographical distance between them. Control variables include comlang_ethno (common language) and comcol (common colonizer). Year dummies for $year_{2019}$ and $year_{2022}$ are included to account for time-specific shocks.

The primary independent variables of interest are the Trade Facilitation Indicators (TFIs), sourced from the OECD. These indicators measure various aspects of a country's trade facilitation performance. For this analysis, specific TFI component scores for both the exporting country (i) and the importing country (j) are used to construct variables representing distinct dimensions of trade facilitation, as well as an overall TFI measure. **Table 1** details the classification of the OECD TFI sub-indicators used to construct these variables.

Specifically, the trade facilitation variables are constructed as follows:

- The overall TFI variable for a country pair (i, j) is defined as the geometric mean of the total TFI scores of country i and country j (i.e., $\sqrt{TFI_i * TFI_j}$).
- The TFI score is further disaggregated into four sub-group indicators based on the OECD classification (**Table 1**):
    - $transparency_{gm}$ (Transparency): Constructed as the geometric mean of the combined scores for OECD TFI sub-indicators A - Information Availability, B - Involvement of the Trade Community, and C - Advance Rulings, for both country i and country j.
    - $procedures_{gm}$ (Procedures): Constructed as the geometric mean of the combined scores for OECD TFI sub-indicators E - Fees and Charges, F - Documents, and G - Automation, for both country i and country j.
    - $governance_{gm}$ (Governance): Constructed as the geometric mean of the combined scores for OECD TFI sub-indicators D - Appeal Procedures, and K - Governance and Impartiality, for both country i and country j.
    - $cooperation_{gm}$ (Cooperation): Constructed as the geometric mean of the combined scores for OECD TFI sub-indicators H - Procedures (related to border agency cooperation), I - Internal Border Agency Cooperation, and J - External Border Agency Co-

operation, for both country i and country j.

This operationalization allows for an in-depth analysis of the distinct impacts of each group of TF measures on trade activities between ASEAN countries and their partners.

Table 2 provides a summary of the descriptive statistics. It is important to note that the statistics shown are for the variables in their original, non-logarithmic form. In the subsequent regression models, key variables such as trade value, GDP, and distance are log-transformed to allow for the interpretation of coefficients as elasticities, a standard practice in gravity modeling.

Furthermore, while some constructed Trade Facilitation Indicators (e.g., transparency_gm) exhibit relatively small standard deviations, this may reflect a degree of policy convergence among the trading partners included in the sample. The use of a geometric mean across country pairs and the inclusion of a diverse set of 33 global partners ensure sufficient variation for the model to estimate the distinct impacts of these trade facilitation dimensions.

Table 1. Classification of TFIs.

Group of Indicators	Detailed Description	OECD TFI
transparency	**(A)** Dissemination of trade and customs regulations through websites, handbooks, and information portals. **(B)** Active participation of the business community in consultation and feedback mechanisms. **(C)** Advance notice procedures regarding the classification, origin, and valuation of goods.	A - Information Availability B - Involvement of the Trade Community C - Advance Rulings
procedures	**(E)** Clear and fair import and export fees and charges. **(F)** Simplification and harmonization of documentation in accordance with international standards. **(G)** Automation of processes through electronic data exchange and risk management systems.	E - Fees and Charges F - Documents G - Automation
governance	**(D)** Procedures for appealing decisions made by customs authorities. **(K)** Transparency regarding the structure, functions, accountability, and ethical standards of customs administrations.	D - Appeal Procedures K - Governance and Impartiality
cooperation	**(H)** Simplification of inspection and clearance procedures; implementation of single-window mechanisms and authorized economic operator programs. **(I)** Domestic inter-agency cooperation among border control authorities. **(J)** Cooperation with border agencies of neighboring countries and international partners.	H - Procedures I - Internal Border Agency Cooperation J - External Border Agency Cooperation

Source: Authors.

Table 2. Descriptive statistics.

Variable	Obs	Measurement	Mean	Std. Dev.	Min	Max
tradetotal	1,046	Billions of USD	0.26	0.61	0.00	5.74
transparency_gm	999	Index (0–2)	1.52	0.21	0.88	1.97
procedures_gm	1,068	Index (0–2)	1.47	0.24	0.69	1.95
governance_gm	1,068	Index (0–2)	1.52	0.24	0.68	1.95
cooperation_gm	1,068	Index (0–2)	1.24	0.20	0.69	1.70
TFI	1,068	Index (0–2)	1.31	0.27	0.54	1.85

Table 2. *Cont.*

Variable	Obs	Measurement	Mean	Std. Dev.	Min	Max
GDP_i	1,068	Billions of USD	373.00	331.00	12.10	1,320.00
GDP_j	1,068	Billions of USD	1,990.00	4,120.00	12.10	26,000.00
dist	1,068	Km	7,553.33	4,517.17	211.00	18,388.00
comlang_ethno	1,068	Binary (0/1)	0.12	0.32	0	1
comcol	1,068	Binary (0/1)	0.08	0.27	0	1
$year_{\_2019}$	1,068	Binary (0/1)	0.33	0.47	0	1
$year_{\_2022}$	1,068	Binary (0/1)	0.33	0.47	0	1

Note: GDP values are presented in billions of U.S. dollars for clarity. The **Table 2** displays raw values; key variables are log-transformed for the regression analysis.
Source: Authors' calculations using STATA software.

2.3. Empirical Strategy

The gravity model of trade stipulates that bilateral commerce generally increases with the economic size of the two trading nations and declines with distance [27]. Subsequent research has extended this model to accommodate various aspects of trade policies, price differentials, and firm-level heterogeneity [28–33]. In the present analysis, the model is augmented with TFIs from the OECD to capture transparency, customs procedures, governance, and inter-agency cooperation—factors deemed crucial for maritime merchandise flows.

To address common empirical challenges in trade analysis, such as the presence of zero-trade observations and heteroskedasticity, this study employs the Poisson pseudo maximum likelihood (PPML) estimator. As advocated by Santos Silva and Tenreyro [34], the PPML method is superior to traditional log-linear OLS because it estimates the gravity model in its correct multiplicative form and naturally includes zero-trade pairs, thus avoiding sample selection bias. This approach yields consistent results even when the data are over-dispersed and do not strictly follow Poisson distribution [35–37], making it the state-of-the-art method for gravity-based analyses.

The core gravity Equation (1) estimated via PPML is specified:

$$\begin{aligned} \text{Tradetotal}_{ijt} = \exp(&\beta_0 + \beta_1 \ln(\text{GDP}_{it}) \\ &+ \beta_2 \ln(\text{GDP}_{jt}) + \beta_3 \ln(\text{dist}_{ij}) + \beta_4 \ln(\text{TFI}_{ijt}) \\ &+ \beta_5 \text{transparency}_{ijt} + \beta_6 \text{procedures}_{ijt} \\ &+ \beta_7 \text{governance}_{ijt} + \beta_8 \text{cooperation}_{ijt} \\ &+ \beta_9 \text{comlang\_ethno} + \beta_{10} \text{comcol} \\ &+ \beta_{11} \text{year}_{\_2019} + \beta_{12} \text{year}_{\_2022} + \varepsilon_{ijt}) \end{aligned} \quad (1)$$

Where:

- Tradetotal_{ijt} is the bilateral value of ocean-linked merchandise from country i to country j in year t.
- ln(GDP) and ln(dist) are the logarithms of Gross Domestic Product and bilateral distance, respectively.
- TFI_{ijt} represents the key trade facilitation variable of interest. In separate regressions, this will be either the composite TFI score, or one of the four disaggregated dimensions (transparency, procedures, governance, or cooperation) as defined in Section 2.2.
- comlang_ethno and comcol are dummy variables for shared language and colonial ties.
- Year_t represents a set of year-specific dummy variables for 2019 and 2022 to capture time-specific shocks relative to the baseline year of 2017.

Building on the theoretical foundations, assumptions, and use of the gravity model discussed above, the research team anticipates the following variable effects as presented in **Table 3**.

Table 3. Anticipated effects of the variables.

Variable	Variable Description	Data Source	Expected Sign	Supporting Studies
tradetotal_{ijt}	Total value of ocean-linked merchandise traded between countries i and j in year t. (Unit: USD)	UNCTADstat Data centre (https://unctadstat.unctad.org/datacentre/)		

Table 3. *Cont.*

Variable	Variable Description	Data Source	Expected Sign	Supporting Studies
GDP_{it}	Gross Domestic Product of country i in year t. (Unit: USD)	The World Bank (https://data.worldbank.org /i ndictor/NY.GDP.MKTP.CD)	(+)	[38–40]
GDP_{jt}	Gross Domestic Product of country j in year t. (Unit: USD)	The World Bank (https://data.worldbank.org/i ndicator/NY.GDP.MKTP.CD)	(+)	
dist	Geographical distance between the most populous cities of the two countries. (Unit: km)	CEPII – Centre d'Études Prospectives et d'Informations Internationales (https://www.cepii.fr/CEP II /en/welcome.asp)	(−)	[41, 42]
TFI_{ijt}, $transparency_{ijt}$, $procedures_{ijt}$, $governance_{ijt}$, $cooperation_{ijt}$	Overall trade facilitation index / combined trade facilitation indicators of countries i and j in year t	OECD (https: //www.compareyourcountry .org/trade-facilitation)	(+)	[43, 44]
comlang_ethno	Binary variable indicating whether at least 9% of the population in the two countries share a common language	OECD (https: //www.compareyourcountry .org/trade-facilitation)	(+)	[45, 46]
comcol	Binary variable indicating whether the two countries had the same colonial ruler after 1945	OECD (https: //www.compareyourcountry .org/trade-facilitation)	(+)	[47–49]
$year_{\_2019}$	Binary variable indicating whether the analysis period is the year 2019	–	(−)	[50–54]
$year_{\_2022}$	Binary variable indicating whether the analysis period is the year 2022	–		

Source: Authors.

3. Results

This section presents the empirical findings from the gravity model estimations, which analyze the determinants of ocean-linked merchandise trade for the nine ASEAN coastal countries, their external partners, and among themselves. The Poisson Pseudo Maximum Likelihood (PPML) method was employed for all estimations, with standard errors clustered by country-pair to ensure robustness against heteroskedasticity and potential serial correlation. Diagnostic checks, including Variance Inflation Factors (VIF) for multicollinearity (**Appendix A**), confirmed the stability and reliability of the estimated coefficients.

Table 4 provides a comprehensive summary of the regression results. The models are presented in two main blocks: Columns (1) through (5) detail the estimations for ASEAN's trade with 33 external partners, while Columns (6) through (10) focus on intra-ASEAN trade dynamics.

Table 4. Summary of results.

	ASEAN Trade with External Partners					Intra-ASEAN Trade				
VARIABLES	**(1) Tradetotal**	**(2) Tradetotal**	**(3) Tradetotal**	**(4) Tradetotal**	**(5) Tradetotal**	**(6) Tradetotal**	**(7) Tradetotal**	**(8) Tradetotal**	**(9) Tradetotal**	**(10) Tradetotal**
$LN\_transparency_{\_gm}$	4.155*** (0.422)					2.946*** (0.591)				
$LN\_procedures_{\_gm}$		4.329*** (0.467)					2.542*** (0.517)			
$LN\_governance_{\_gm}$			4.939*** (0.672)					2.481*** (0.681)		

Table 4. *Cont.*

	ASEAN Trade with External Partners					Intra-ASEAN Trade				
VARIABLES	**(1) Tradetotal**	**(2) Tradetotal**	**(3) Tradetotal**	**(4) Tradetotal**	**(5) Tradetotal**	**(6) Tradetotal**	**(7) Tradetotal**	**(8) Tradetotal**	**(9) Tradetotal**	**(10) Tradetotal**
$LN\_cooperation_{\_gm}$				3.624*** (0.550)					2.337*** (0.860)	
LN_TFI_{ijt}					4.544*** (0.591)					1.950*** (0.618)
LN_GDP_i	0.661*** (0.0480)	0.713*** (0.0466)	0.698*** (0.0473)	0.693*** (0.0477)	0.696*** (0.0452)	0.719*** (0.0774)	0.721*** (0.0697)	0.740*** (0.0835)	0.782*** (0.0856)	0.798*** (0.0898)
LN_GDP_j	0.825*** (0.0423)	0.846*** (0.0424)	0.817*** (0.0393)	0.895*** (0.0525)	0.835*** (0.0434)	0.759*** (0.0799)	0.729*** (0.0730)	0.762*** (0.0875)	0.794*** (0.0818)	0.809*** (0.0988)
LN_dist	−1.013*** (0.0708)	−1.079*** (0.0668)	−1.024*** (0.0648)	−1.183*** (0.0903)	−1.143*** (0.0737)	−0.794*** (0.141)	−0.847*** (0.133)	−0.897*** (0.127)	−0.972*** (0.144)	−0.919*** (0.142)
comlang_ethno	−0.158 (0.149)	−0.122 (0.147)	−0.0891 (0.142)	−0.0943 (0.165)	−0.108 (0.155)	−0.291** (0.131)	−0.204* (0.116)	−0.209 (0.163)	−0.366** (0.159)	−0.213 (0.183)
comcol	−0.116 (0.190)	−0.0787 (0.193)	−0.0676 (0.182)	−0.0237 (0.204)	−0.0342 (0.212)	0.295 (0.199)	0.298 (0.233)	0.284 (0.194)	0.378* (0.219)	0.415** (0.210)
$year_{\_2019}$	−0.640*** (0.0715)	−0.569*** (0.0572)	−0.596*** (0.0650)	−0.455*** (0.0618)	−0.593*** (0.0644)	−0.584*** (0.143)	−0.449*** (0.110)	−0.488*** (0.131)	−0.405*** (0.129)	−0.450*** (0.103)
$year_{\_2022}$	−0.683*** (0.0820)	−0.618*** (0.0623)	−0.614*** (0.0700)	−0.800*** (0.109)	−0.730*** (0.0826)	−0.660*** (0.136)	−0.501*** (0.0989)	−0.519*** (0.128)	−0.713*** (0.222)	−0.555*** (0.118)
Constant	16.72*** (0.629)	16.77*** (0.631)	16.13*** (0.648)	18.40*** (0.701)	17.63*** (0.618)	15.90*** (1.077)	16.61*** (1.190)	16.51*** (1.041)	17.40*** (1.131)	16.52*** (1.169)
Observations	982	1,046	1,046	1,046	1,046	196	211	211	211	211
R-squared	0.717	0.753	0.754	0.696	0.733	0.872	0.876	0.851	0.843	0.851

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0$.
Source: Authors' calculations using STATA software.

The empirical results consistently highlight the significant and positive impact of trade facilitation on promoting ocean-linked merchandise trade. Across all specifications, the trade facilitation indicators exhibit a strong, positive, and statistically significant relationship with trade volumes. For instance, trade transparency ($LN\_transparency_{\_gm}$) is associated with coefficients of 4.155 ($p < 0.01$) for external trade and 2.946 ($p < 0.01$) for intra-ASEAN trade. Similar robustly positive and significant effects are found for streamlined procedures, governance, and cooperation, with the overall composite TF indicator further confirming these trends. A noticeable pattern is that the magnitudes of these TF coefficients are generally larger for ASEAN's trade with external partners compared to intra-ASEAN trade.

The standard gravity model variables perform as theoretically expected. Both the exporter's GDP (LN_GDP_i) and the importer's GDP (LN_GDP_j) consistently show positive and highly significant coefficients across all models, indicating that larger economic mass promotes greater trade. Conversely, geographical distance (LN_dist) consistently exerts a strong, negative, and statistically significant influence on trade, underscoring its role as a key impediment to trade.

The results for other control variables are mixed. A shared mixed. A shared language (comlang_ethno) is generally statistically insignificant for ASEAN's external trade, although it shows a surprising negative and significant effect in some intra-ASEAN models. Shared colonial ties (comcol) are also largely insignificant for external trade but display a modest, sometimes statistically significant, positive relationship in the intra-ASEAN context.

A key finding is that the year-specific dummy variables for 2019 and 2022 are consistently negative and highly statistically significant across all models relative to the 2017 baseline. This robust result suggests that widespread shocks during these years had a substantial adverse impact on the value of ocean-linked merchandise trade for the ASEAN region.

4. Discussion

4.1. The Strong Positive Impact of Trade Facilitation on Ocean-Linked Trade

The empirical analysis reveals a striking positive impact of enhanced trade facilitation on ASEAN's ocean-linked merchandise trade, with trade transparency ($LN\_transparency_{\_gm}$) emerging as a particularly potent

driver. The estimated elasticity for transparency in ASEAN's external trade is substantial at 4.155, while for intra-ASEAN commerce, it stands at a significant 2.946 (**Table 4**, Columns 1 and 6). This suggests that a 1% improvement in the transparency index is associated with an approximate 4.16% increase in external ocean-linked trade value and a 2.95% increase in intra-ASEAN trade value, respectively. These findings are consistent with the literature [55–57], which underscores that greater transparency in trade regulations and procedures acts as a powerful catalyst for seaborne commerce by reducing customs-related uncertainty and minimizing the likelihood of shipment rejections. From a Blue Economy perspective, this is crucial not only for commercial efficiency but also for sustainability, as transparently tracking goods helps combat illegal, unreported, and unregulated (IUU) fishing and ensures the provenance of marine products. The larger elasticity observed for external trade compared to intra-ASEAN trade warrants attention, as it may imply that transparency yields greater marginal returns when ASEAN countries trade with global partners where information asymmetries are likely more pronounced. ASEAN's policy initiatives, such as the ASEAN Single Window (ASW) and the publication of comprehensive SPS standards for seafood [58] are practical illustrations of how enhancing regulatory transparency fosters the trust and predictability needed for ASEAN's burgeoning Blue Economy to thrive sustainably.

Following transparency, the streamlining of trade procedures (LN_procedures$_{gm}$) also emerges as a critical factor. The analysis reveals robust positive elasticities, with coefficients of 4.329 for ASEAN's external trade and 2.542 for intra-ASEAN flows (**Table 4**, Columns 2 and 7). This pattern aligns with established literature, which reports that simplified and automated customs procedures substantially reduce logistical overheads [59–61]. The more pronounced impact on external trade may again stem from the greater complexity of dealing with a wide array of global partners. Empirical evidence within the region, such as the implementation of the ASW and blockchain-based documents in Singapore and Malaysia [54], exemplifies this commitment to streamlining. Such innovations are vital for the Blue Economy because they lower procedural entry barriers, enhancing the participation of small and medium-sized enterprises (SMEs) in the ocean economy (related to SDG 8). Furthermore, more efficient procedures reduce delays and potential spoilage of perishable ocean products, such as seafood, directly aligning with the principles of responsible production and consumption (SDG 12).

Robust trade governance (LN_governance$_{gm}$) also strongly promotes ocean-linked trade, exhibiting the highest elasticity for ASEAN's external trade (4.939) (**Table 4**, Column 3). This finding is particularly noteworthy, suggesting that among the individual TF dimensions, strengthening governance and impartiality in customs administration [62] may offer the most significant returns for ASEAN in enhancing its trade with global partners. The pronounced effect highlights that fair and transparent border policies are crucial when navigating diverse international markets. Successful comprehensive trade agreements, such as AJCEP and EVFTA, which have boosted ASEAN's seafood exports [63], often rely on and reinforce such good governance principles.

Furthermore, trade cooperation (LN_cooperation$_{gm}$) significantly facilitates ocean-linked trade, with estimated elasticities of 3.624 for external trade and 2.337 for intra-ASEAN trade (**Table 4**, Columns 4 and 9). This echoes studies highlighting that deeper collaborative arrangements yield efficiency gains [64, 65]. The early positive impacts of RCEP on ASEAN's exports to China and South Korea [66] serve as an illustration. This highlights how effective TF cooperation is a prerequisite for co-managing shared ocean resources sustainably, a central tenet of the Blue Economy framework and relevant to SDG 17.

The composite Trade Facilitation Index (LN_TFI$_{gm}$) confirms the multifaceted benefits of TF, showing high elasticities of 4.544 for ASEAN's external trade and 1.950 for intra-ASEAN flows (**Table 4**, Columns 5 and 10). This is consistent with studies indicating that comprehensive improvements across TF dimensions collectively reduce transit times and boost export opportunities for ocean-linked merchandise [67, 68].

4.2. Interpreting Core Gravity Variables and Other Factors

The standard gravity variables perform primarily as theoretically expected. Consistent with numerous studies [38–40], partner GDP (LN_GDP_j) generally shows a more substantial positive impact on ASEAN's maritime trade than exporter GDP (LN_GDP_i), highlighting that demand from key external and regional markets is a crucial driver for the region's ocean economy exports.

On the negative side, geographic distance (LN_dist) consistently depresses trade flows for ASEAN's external and intra-regional segments, with values typically ranging from −1.183 to −1.013 externally and −0.972 to −0.794 regionally. These outcomes align with the foundational Gravity Model of Trade [27] and parallel the findings of Natale et al. [41] and Tsiotas and Ducruet [42], confirming that longer shipping routes, higher freight costs, and logistical complexity remain significant trade barriers. The dummy variables for common language (comlang_ethno) and shared colonial ties (comcol) prove largely insignificant in the ASEAN-world regressions. This suggests that in the modern era, historical and cultural ties are less central to maritime commerce than integrated supply chains and multinational FTAs.

4.3. Explaining the Negative Shocks of 2019 and 2022

A key finding that warrants a detailed explanation is the consistently negative and significant coefficients for the year of 2019 and 2022 dummy variables. This robust result indicates that widespread trade disruptions in these periods had an adverse impact that overshadowed the gains from facilitation efforts. Between 2017 and 2019, heightened SPS checks, including the EU's clampdown on Illegal, Unreported, and Unregulated (IUU) fishing [69] and Indonesia's stricter mineral export policies [70] created new obstacles. Vietnam, for instance, received an IUU "yellow card" in 2019, resulting in a 35% estimated reduction in its seafood exports to the EU [71]. From 2020 onward, COVID-19 introduced additional barriers: port congestion in Vietnam and Indonesia resulted in over 30% of seafood shipments being delayed [22], while global supply chains remained fragile throughout 2021. Transport costs rose three- to fivefold from pre-pandemic levels [72], particularly constraining low-margin fisheries and mineral exporters. By 2022, more rigorous ESG standards imposed by the EU and the U.S. blocked or returned numerous shipments of palm oil, shrimp, and tuna from Malaysia, Indonesia, and Thailand [73–75]. These events demonstrate how external shocks and evolving non-tariff barriers can substantially affect trade volumes.

4.4. Policy Implications and Recommendations

Beyond the specific coefficient estimates, the findings of this study prompt a broader strategic discussion on the dynamics of ocean-linked trade within the ASEAN region. The region's nine coastal states possess considerable maritime potential, bolstered by advantageous geography and ongoing investments in port infrastructure. The general improvements observed in TF scores across these nations between 2017 and 2022 signify a clear commitment to policy reforms aimed at reducing trade barriers and strengthening logistics systems [6, 8]. The positive and significant coefficients found for various TF dimensions in this study lend robust empirical support to the notion that such reforms are indeed trade-enhancing. Countries like Vietnam, Indonesia, and Cambodia, which have demonstrated notable progress in both TF implementation and overall trade growth, exemplify the potential synergies between domestic reform agendas and external trade liberalization. However, to fully realize this potential, ASEAN must move beyond a generic view of trade facilitation and adopt a more strategic approach tailored to the unique complexities and vulnerabilities of the ocean economy.

A primary challenge identified is the region's vulnerability to external shocks and over-reliance on global markets, which can expose ASEAN economies to greater risks during crises [76]. From a regional integration perspective, trade facilitation should, therefore, be strategically deployed not just to connect ASEAN to the world but to connect ASEAN more deeply with itself. It is recommended that the bloc prioritizes using TF measures to build resilient intra-regional value chains for key ocean-linked products. This could involve creating

simplified and harmonized customs procedures specifically for marine products traded within the bloc, or streamlining the rules of origin for marine-derived inputs used in regional processing under frameworks such as the ASEAN Trade in Goods Agreement (ATIGA) and the RCEP. Such policies would foster a more robust internal market, providing a critical buffer against global volatility and strengthening the region's collective food and resource security.

Furthermore, while TF aims to reduce trade costs, this can create uneven outcomes, potentially displacing smaller domestic firms if not managed inclusively. To address this, it is recommended that the implementation of new digital trade platforms, such as the ASEAN Single Window (ASW), be accompanied by a dedicated "ASEAN Blue SME" capacity-building program. This initiative should focus on providing technical training and resources to small and medium-sized enterprises in the fisheries, aquaculture, and maritime tourism sectors, enabling them to utilize digital tools effectively, meet international standards, and access new markets. This ensures that the benefits of streamlined trade are distributed more equitably, fostering inclusive growth that aligns with broader development goals.

Critically, the pursuit of increased ocean commerce must be reconciled with the principles of the Blue Economy and the region's sustainability commitments, particularly SDG 14. Escalating trade volumes in ocean-based sectors, even when efficiently facilitated, can intensify environmental pressures, including resource depletion and pollution [26]. Therefore, TF must be re-envisioned as a tool not only for promoting speed but also for enforcing sustainability. A specific recommendation is to enhance the ASW by incorporating a "Digital Product Passport" for seafood and other marine products. This system would carry verifiable, blockchain-enabled data on a product's origin, catch method, and sustainability certifications. Such a mechanism would empower customs authorities to automatically grant preferential treatment or "Green Lane" access to verifiably sustainable products while flagging high-risk shipments for inspection. This transforms TF from a potential environmental risk into a powerful instrument for promoting responsible trade.

Finally, the risk that streamlined processes might be exploited for illicit activities, such as transshipment fraud, requires a governance-focused response [77]. Simply making trade faster without making it smarter can create new security loopholes. It is therefore recommended that ASEAN bolster its TF initiatives with enhanced data analytics and risk management capabilities. By leveraging machine learning algorithms to analyze trade data flowing through the ASW, authorities could identify anomalous patterns, such as unusual shipping routes or mismatched cargo declarations, that indicate potential fraud or smuggling. This data-driven approach enables more targeted, risk-based inspections, allowing authorities to enhance security while facilitating the flow of legitimate commerce. This holistic strategy—integrating resilience, inclusivity, sustainability, and security—is essential for ensuring that trade facilitation truly serves the long-term strategic interests of the ASEAN Blue Economy.

5. Conclusion

An empirical assessment of the relationship between trade facilitation and ASEAN's ocean-linked merchandise trade was conducted for the period 2017–2022, within the context of the region's growing commitment to a sustainable Blue Economy. Employing a gravity model with disaggregated facilitation indicators enables a more nuanced understanding of this critical nexus, moving beyond a general appraisal of trade efficiency.

The findings affirm that trade facilitation is indeed a potent catalyst for maritime commerce in the ASEAN region. However, the analysis reveals a more complex picture than one of simple, uniform benefits. The trade-enhancing effects of TF measures, while consistently positive, appear highly contingent on the trading context, proving more impactful in relations with external partners than within the intra-ASEAN sphere. This suggests that while regional integration has progressed, significant gains are still to be made by reducing friction in global trade. Furthermore, the significant adverse impacts observed during the 2019 and 2022 shock period underscore a crucial vulnerability: the benefits of trade facilitation can be easily overshadowed by geopolitical and economic disruptions, highlighting the need for re-

silience to be a core component of trade policy.

A primary contribution of this work, therefore, is its illustration of how trade facilitation can be strategically applied to the specific challenges of the ocean economy, moving beyond simply confirming its general effectiveness. The use of a broad classification of ocean-linked goods alongside detailed TF metrics provides a direct empirical basis for more targeted policymaking. The results imply that for ASEAN, TF should be viewed less as a technical instrument for cost reduction and more as a strategic lever for positioning itself within the global Blue Economy. The substantial observed impact of governance, for instance, suggests that building a reputation for regulatory stability is as vital as physical infrastructure in attracting high-value, sustainable maritime investment.

While the findings offer a valuable macro-level perspective, certain limitations of the analysis delineate a clear agenda for future research. The use of aggregated country-level data, for instance, naturally raises questions about firm-level heterogeneity. To what extent do these TF benefits translate to enhanced competitiveness for the small and medium-sized enterprises (SMEs) that form the backbone of many coastal communities? Future work using firm-level data would be invaluable. Similarly, a deeper investigation into the specific impacts of emerging digital TF tools on sustainable practices in the fisheries and aquaculture sectors would offer critical insights. Answering these questions will be essential for translating the potential of trade facilitation into the resilient, inclusive, and sustainable development of ASEAN's ocean economy.

Author Contributions

Conceptualization, T.T., L.N., and H.V.; methodology, T.T., L.N., and L.M.; software, T.N.; validation, L.N., L.M., and V.L.; formal analysis, T.N. and H.N.; investigation, L.M., V.L., and H.V.; resources, H.V.; data curation, T.N.; writing – original draft preparation, H.N., T.T., H.N., and V.L.; writing – review and editing, H.N. and T.T.; visualization, L.M.; supervision, T.T. and H.N.; project administration, T.T. and H.N. All authors have read and agreed to the published version of the manuscript.

Funding

This work received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the reported results in this study are available upon request from the corresponding author. The datasets analyzed or generated during the study are not publicly available due to privacy and ethical restrictions. However, data can be made available for academic research purposes upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflict of interest.

Appendix A

Table A1. Results of multicollinearity test.

Variable	VIF (Transparency)	VIF (Procedures)	VIF (Governance)	VIF (Cooperation)	VIF (TFI)
year$_{2022}$	1.91	1.55	1.76	1.93	1.89
year$_{2019}$	1.72	1.45	1.66	1.52	1.65

Table A1. *Cont.*

Variable	VIF (Transparency)	VIF (Procedures)	VIF (Governance)	VIF (Cooperation)	VIF (TFI)
LN_transparency_gm	1.69	–	–	–	–
LN_procedures_gm	–	1.44	–	–	–
LN_governace_gm	–	–	1.98	–	–
LN_cooperation_gm	–	–	–	1.81	–
LN_TFI	–	–	–	–	1.88
LN_GDP$_i$	1.24	1.15	1.49	1.11	1.20
LN_GDP$_j$	1.27	1.25	1.28	1.25	1.26
LN_dist	1.33	1.40	1.34	1.49	1.44
comlang_ethno	1.16	1.15	1.12	1.17	1.14
comcol	1.21	1.21	1.20	1.21	1.20
Mean VIF	1.44	1.32	1.48	1.43	1.46

Source: Authors' calculations using STATA software.

References

[1] ASEAN Indonesia, 2023. ASEAN Blue Economy Framework. Available from: https://asean.org/wp-content/uploads/2023/09/ASEAN-Blue-Economy-Framework.pdf (cited 11 March 2025).

[2] World Bank Group, 2017. The potential of the blue economy: increasing long-term benefits of the sustainable use of marine resources for small island developing states and coastal least developed countries. Available from: https://documents1.worldbank.org/curated/en/523151496389684076/pdf/115545-1-6-2017-14-48-41-BlueEconomyJun.pdf (cited 11 March 2025).

[3] Zheng, L., Tian, K., 2021. The contribution of ocean trade to national economic growth: a non-competitive input-output analysis in China. Marine Policy. 130(1), 104559. DOI: https://doi.org/10.1016/j.marpol.2021.104559

[4] UNCTAD, 2021. Towards a harmonized international trade classification for the development of sustainable oceans-based economies. United Nations Conference on Trade and Development: Geneva, Switzerland. DOI: https://doi.org/10.18356/9789210053082

[5] de Sá Porto, P., Canuto, O., Morini, C., 2015. The impacts of trade facilitation measures on international trade flows. The World Bank: Washington, DC, USA. pp. 1–18.

[6] Otsuki, T., 2011. Quantifying the benefits of trade facilitation in ASEAN. Osaka School of International Public Policy, Osaka University: Osaka, Japan.

[7] Wilson, J.S., Mann, C.L., Otsuki, T., 2005. Assessing the benefits of trade facilitation: a global perspective. The World Economy. 28(6), 841–871. DOI: https://doi.org/10.1111/j.1467-9701.2005.00709.x

[8] Layton, B., 2008. Trade Facilitation: A Study in the Context of the ASEAN Economic Community Blueprint. In: Soesastro, H. (ed.). Deepening Economic Integration in East Asia – The ASEAN Economic Community and Beyond. ERIA: Chiba, Japan. pp. 76–100.

[9] Hollweg, C., Wong, M.H., 2013. Regulatory Restrictions in Logistics Services. In: Dee, P. (ed.). Priorities and Pathways in Services Reform Part I — Quantitative Studies, 1st ed. World Scientific Publishing Co. Pte. Ltd.: Singapore. pp. 111–141.

[10] Bacrot, C., Faure, M.A., 2024. Red Sea crisis and implications for trade facilitation in Africa. UNCTAD Transport and Trade Facilitation Newsletter. Available from: https://unctad.org/news/red-sea-crisis-and-implications-trade-facilitation-africa (cited 11 March 2025).

[11] Food and Agriculture Organization of the United Nations (FAO), 2022. The state of agricultural commodity markets 2022: The negative externalities of trade. Available from: https://openknowledge.fao.org/server/api/core/bitstreams/5b1d7bed-225a-444b-a041-c0844060a73c/content (cited 11 March 2025).

[12] Hoekman, B., Mattoo, A., English, P. (eds.), 2002. Development, Trade, and the WTO: A Handbook. The World Bank: Washington, DC, USA.

[13] OECD Trade Committee Working Party, 2001. Business benefits of trade facilitation. Report no. TD/TC/WP(2001)21/FINAL, 10 April 2002.

[14] ADB, 2013. Designing and implementing trade facilitation in Asia and the Pacific 2013 update. Available from: https://www.adb.org/sites/default/files/publication/27530/trade-facilitation-reference-book-2013.pdf (cited 11 March 2025).

[15] The Center for WTO and International Trade - VCCI, 2025. Upgrading ATIGA into a modern agreement, providing good support for businesses. Available from: https://trungtamwto.vn/an-pham/

28853-nang-cap-atiga-thanh-hiep-dinh-hien-dai-ho-tro-tot-cho-doanh-nghiep (cited 11 March 2025). (in Vietnamese)

[16] Go, E., 2018. Contribution and effectiveness of trade facilitation measures. IEG, World Bank. Available from: https://ieg.worldbankgroup.org/sites/default/files/Data/reports/tradefacilitation_literaturereview.pdf (cited 7 March 2025).

[17] Das, S.B., 2017. ASEAN Single Window: Advancing trade facilitation for regional integration. ISEAS – Yusof Ishak Institute Perspective 72. Available from: https://www.iseas.edu.sg/wp-content/uploads/pdfs/ISEAS_Perspective_2017_72.pdf (cited 13 March 2025).

[18] World Trade Organization, 2018. Speeding up trade: Benefits and challenges of implementing the WTO Trade Facilitation Agreement. Available from: https://www.wto.org/english/res_e/booksp_e/world_trade_report15_e.pdf (cited 14 March 2025).

[19] World Trade Organization, 1947. General Agreement on Tariffs and Trade (GATT 1947). Available from: https://www.wto.org/english/docs_e/legal_e/gatt47_e.htm (cited 14 March 2025).

[20] Duc, P.M., Mishra, D., Cheong, K.C., et al., 2013. Trade facilitation, value creation and competitiveness: Policy implications for Vietnam's economic growth. Available from: https://documents1.worldbank.org/curated/en/234631468319757413/pdf/Trade-facilitation-value-creation-and-competitiveness-policy-implications-for-Vietnams-economic-growth.pdf (cited 14 March 2025).

[21] World Trade Organization (WTO), 2017. World Trade Report 2017: Trade, technology and jobs. WTO. Available from: https://www.wto.org/english/res_e/booksp_e/world_trade_report17_e.pdf (cited 16 March 2025).

[22] World Bank, 2020. Supporting countries in unprecedented times: Annual report 2020. World Bank Group. Available from: https://documents1.worldbank.org/curated/en/585151601566378168/pdf/Main-Report.pdf (cited 14 March 2025).

[23] Chan, S.W., 2024. Trade facilitation measures that are necessary, but not sufficient, to improve trade across borders performance. Revista Científica Administrar Lo Público. 1(1), 19–36. DOI: https://doi.org/10.15517/alp.2024.57736

[24] Erokhin, V., Tianming, G., Ivolga, A., 2021. Cross-country potentials and advantages in trade in fish and seafood products in the RCEP member states. Sustainability. 13(7), 3668. DOI: https://doi.org/10.3390/su13073668

[25] Duval, Y., Utoktham, C., Kravchenko, A., 2018. Impact of digital trade facilitation on trade costs. ARTNeT Working Paper Series. 174, 27–42.

[26] Bin, P., 2009. Enhancing export competitiveness through trade facilitation in Asia. Available from: https://www.unescap.org/sites/default/d8files/3-ENHA~1_0.PDF (cited 17 March 2025).

[27] Tinbergen, J., 1962. Shaping the world economy: Suggestions for an international economic policy. The Economic Journal. 76(301), 92–95. DOI: https://doi.org/10.2307/2229041

[28] Helpman, E., Melitz, M., Rubinstein, Y., 2008. Estimating trade flows: trading partners and trading volumes. Quarterly Journal of Economics. 123(2), 441–487. DOI: https://doi.org/10.1162/qjec.2008.123.2.441

[29] Anderson, J.E., van Wincoop, E., 2003. Gravity with gravitas: a solution to the border puzzle. American Economic Review. 93(1), 170–192. DOI: https://doi.org/10.1257/000282803321455214

[30] Anderson, J., 1979. A theoretical foundation for gravity equation. American Economic Review. 69, 106–116.

[31] Bergstrand, J., 1985. The gravity equation in international trade: some microeconomic foundations and empirical evidence. Review of Economics and Statistics. 67(3), 474–481. DOI: https://doi.org/10.2307/1925976

[32] Krugman, P., 1990. Increasing returns and economic geography. NBER Working Paper No. 3275. Available from: https://www.nber.org/system/files/working_papers/w3275/w3275.pdf (cited 20 March 2025).

[33] Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica. 71(6), 1695–1725.

[34] Silva, J.M.C.S., Tenreyro, S., 2006. The log of gravity. The Review of Economics and Statistics. 88(4), 641–658. DOI: https://doi.org/10.1162/rest.88.4.641

[35] Gourieroux, C., Monfort, A., Trognon, A., 1984. Pseudo maximum likelihood methods: Theory. Econometrica. 52(3), 681–700. DOI: https://doi.org/10.2307/1913471

[36] United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), 2013. Alternative gravity model estimators. Available from: https://www.unescap.org/sites/default/files/6%20-%204.%20Alternative%20Gravity%20Model%20Estimators_0.pdf (cited 20 March 2025).

[37] Motta, V., 2019. Estimating Poisson pseudo-maximum-likelihood rather than log-linear model of a log-transformed dependent variable. RAUSP Management Journal. 54(4), 508–518. DOI: https://doi.org/10.1108/RAUSP-05-2019-0110

[38] Korinek, J., Sourdin, P., 2009. Maritime transport costs and their impact on trade. Available from:

https://www.researchgate.net/publication/265119237_MARITIME_TRANSPORT_COSTS_AND_THEIR_IMPACT_ON_TRADE (cited 20 March 2025).

[39] Nepal, S.R., Thapa, B.S., 2021. Trade balance and its determinants in South Asian countries: a panel data analysis. Economic Journal of Nepal. 44(3–4), 53–78. DOI: https://doi.org/10.3126/ejon.v44i3-4.55073

[40] Zhang, J., 2023. Economic influencing factors of trade volume between China and RCEP member states. Proceedings of Business and Economic Studies. 6(3), 14–19. DOI: https://doi.org/10.26689/pbes.v6i3.5082

[41] Natale, F., Borrello, A., Motova, A., 2015. Analysis of the determinants of international seafood trade using a gravity model. Marine Policy. 60, 98–106. DOI: https://doi.org/10.1016/j.marpol.2015.05.016

[42] Tsiotas, D., Ducruet, C., 2021. Measuring the effect of distance on the network topology of the global container shipping network. Scientific Reports. 11(1), 1–16. DOI: https://doi.org/10.1038/s41598-021-00387-3

[43] Alfarajat, M.H., Masron, T.A., 2024. The effect of trade facilitation measures on import in developing countries. Applied Economics. 56(52), 6547–6563. DOI: https://doi.org/10.1080/00036846.2023.2274310

[44] Masood, A., Martínez-Zarzoso, I., 2024. Trade effects of trade facilitation revisited. Economics Letters. 234, 111477. DOI: https://doi.org/10.1016/j.econlet.2023.111477

[45] Franco, C., Maggioni, D., 2022. Does international trade favor proximity in cultural beliefs? Eurasian Economic Review. 12(3), 449–477. DOI: https://doi.org/10.1007/s40822-022-00212-w

[46] Lee, J., 2015. Culture, network, and international trade. Journal of International Logistics and Trade. 13(2), 21–31. DOI: https://doi.org/10.24006/jilt.2015.13.2.21

[47] Berthou, A., Ehrhart, H., 2014. Trade networks and colonial trade spillovers. Banque de France Working Paper no. 526, December 2014.

[48] Campbell, D.L., 2010. History, culture, and trade: a dynamic gravity approach. MPRA Paper No. 24014. Available from: https://mpra.ub.uni-muenchen.de/24014/ (cited 28 March 2025).

[49] Mitchener, K.J., Weidenmier, M., 2008. Trade and Empire. The Economic Journal. 118(533), 1805–1834. DOI: https://doi.org/10.1111/j.1468-0297.2008.02192.x

[50] Mike, J., 2022. Challenges of Cargo Shipping in 2022. Harvard Dataverse. DOI: https://doi.org/10.7910/DVN/9OQEPK

[51] IW-Forschungsgruppe Gesamtwirtschaftliche Analysen und Konjunktur, 2019. Economy is treading water: IW Economic Forecast and IW Business Survey Winter 2019. IW Trends No. 4, 18 december 2019. (in German)

[52] Handley, K., Kamal, F., Monarch, R., 2025. Rising import tariffs, falling exports: when modern supply chains meet old-style protectionism. American Economic Journal: Applied Economics. 17(1), 208–238. DOI: https://doi.org/10.1257/app.20210051

[53] Manggabarani, N., 2022. Intra-ASEAN trade stagnation in the 2015 AEC Period: domestic factors and interdependence. Jurnal Ilmiah Universitas Batanghari Jambi. 22(1), 607–613. DOI: https://doi.org/10.33087/jiubj.v22i1.1903 (in Indonesian)

[54] UNCTAD, 2023. Development prospects in a fractured world: Global disorder and regional responses. Available from: https://unctad.org/system/files/official-document/tdr2022_en.pdf (cited 28 March 2025).

[55] Kerr, W.A., 2008. Trade Agreements: The Important Role of Transparency. Estey Centre Journal of International Law and Trade Policy. 9(1), 1–11.

[56] Moïsé, E., 2011. Transparency Mechanisms and Non-Tariff Measures: Case Studies. OECD Trade Policy Papers, No. 111. OECD Publishing: Paris, France. DOI: https://doi.org/10.1787/5kgf0rzzwfq3-en

[57] Trajano, E., Vicente, M., 2007. The transparency principle and an early warning system to overcome information barriers to trade. EJIS-Electronic Journal of Information Systems Edition. 11, 1–6.

[58] Doanh, P.H., Hòa, P.N., 2023. The Strong Impacts of the ASEAN Economic Community on Vietnam's Economy. Available from: https://tapchinganhang.gov.vn/nhung-tac-dong-manh-me-cua-cong-dong-kinh-te-asean-toi-nen-kinh-te-viet-nam-10631.html (cited 29 March 2025). (in Vietnamese)

[59] Bourdet, Y., Persson, M., 2010. Completing the EU Customs Union: The Effects of Trade Procedure Harmonization. IFN Working Paper No. 848. Available from: https://www.econstor.eu/handle/10419/81390 (cited 29 March 2025).

[60] Oğuz, S., 2024. The impact of customs procedures on global competitiveness: an investigation with structural equation modelling. Fiscaoeconomia. 8(3), 1264–1278. DOI: https://doi.org/10.25295/fsecon.1458266

[61] Wilson, N., 2007. Examining the Trade Effect of Certain Customs and Administrative Procedures. OECD Trade Policy Papers, No. 42. OECD Publishing: Paris, France. DOI: https://doi.org/10.1787/278266703766

[62] Bloom, N., Manova, K., Sun, S.T., et al., 2018. Multinationals, Offshoring, and the Decline of U.S. Manufacturing. Centre for Economic Performance: London, UK.

[63] JETRO, 2017. JETRO global trade and investment report 2017: Global economy reaching turning point. Available from: https://www.jetro.go.jp/ext_images/en/news/releases/2017/a62b8a37b416f089/1.pdf (cited 30 March 2025).

[64] Chang, S.M., Huang, Y.Y., Shang, K.C., et al., 2020. Impacts of regional integration and maritime transport on trade: with special reference to RCEP. Maritime Business Review. 5(2), 143–158. DOI: https://doi.org/10.1108/MABR-03-2020-0013

[65] Massijaya, N.K., Na, W., Novianti, T., 2019. The impacts of Indian Ocean Rim Association (IORA) economic integration on Indonesian Macro and sectoral economy. International Journal of Scientific Research in Science, Engineering and Technology. 6(1), 144–149. DOI: https://doi.org/10.32628/IJSRSET196140

[66] ASEAN, 2022. Annual Report 2021–2022: Addressing Challenges Together. Available from: https://asean.org/wp-content/uploads/2022/08/LAYOUT-ANNUAL-REPORT-2021-2022-11-28-spread_compressed.pdf (cited 30 March 2025).

[67] Luan, X., Kim, J., Tan, S.R., et al., 2023. An Empirical Study on the Impact of Trade Facilitation on Chinese Exports to South American Countries: The Case of Commodities and Electronic Products. In: Eijdenberg, E.L., Mukherjee, M., Wood, J. (eds.). Innovation-Driven Business and Sustainability in the Tropics. SEIGOP 2023. Springer: Singapore. DOI: https://doi.org/10.1007/978-981-99-2909-2_3

[68] Wilson, J.S., Mann, C., Otsuki, T., 2003. Trade Facilitation and Economic Development: Measuring the Impact. Policy Research Working Paper Series, No. 2988. The World Bank: Washington, DC, USA.

[69] European Commission, 2015. Tackling illegal, unreported and unregulated (IUU) fishing. Available from: https://ec.europa.eu/newsroom/mare/items/22691/cs (cited 30 March 2025).

[70] Guberman, D., Schreiber, S., Perry, A., 2024. Export restrictions on minerals and metals: Indonesia's export ban of nickel. U.S. International Trade Commission. Available from: https://www.usitc.gov/publications/332/working_papers/ermm_indonesia_export_ban_of_nickel.pdf (cited 30 March 2025).

[71] Vietnam Association of Seafood Exporters and Producers, World Bank, 2021. A trade-based analysis of the economic impact of non-compliance with illegal, unreported and unregulated fishing: the case of Vietnam. Vietnam Association of Seafood Exporters and Producers: Hanoi, Vietnam.

[72] UNCTAD, 2021. Trade and development report 2021, from recovery resilience: the development dimension overview. Available from: https://unctad.org/system/files/official-document/tdr2021_en.pdf (cited 30 March 2025).

[73] European Parliament, 2022. Annual report: public access to documents – 2022. European Parliament. Available from: https://www.europarl.europa.eu/RegData/publications/rapports_annuels/2022/P9_AR(2022)ATD_EN.pdf (cited 30 March 2025).

[74] U.S. Food and Drug Administration, 2024. Enhancing the safety of imported shrimp through regulatory partnerships. Available from: https://www.fda.gov/food/conversations-experts-food-topics/enhancing-safety-imported-shrimp-through-regulatory-partnerships (cited 2 April 2025).

[75] International Trade Centre (ITC), 2021. International Trade Centre (ITC). UN System SDG Implementation – United Nations Sustainable Development Goals. Available from: https://sdgs.un.org/un-system-sdg-implementation/international-trade-centre-itc-44301 (cited 2 April 2025).

[76] Djalante, R., Nurhidayah, L., Van Minh, H., et al., 2020. COVID-19 and ASEAN responses: comparative policy analysis. Progress in Disaster Science. 8, 100129. DOI: https://doi.org/10.1016/j.pdisas.2020.100129

[77] Hồng, T., 2023. 2022: Handled 139,758 cases of smuggling, trade fraud and counterfeit goods. Available from: https://baodantoc.vn/nam-2022-xu-ly-139758-vu-viec-vi-pham-buon-lau-gian-lan-thuong-mai-va-hang-gia-1677051723092.htm (cited 3 April 2025). (in Vietnamese)