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Trade facilitation and inclusive growth in ASEAN: Does reducing trade barriers benefit all?

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Abstract Amid deepening regional integration, the Association of Southeast Asian Nations (ASEAN) has prioritized trade facilitation (TF) as a strategic engine for inclusive development. This study empirically assesses the impact of specific TF measures on inclusive growth across 8 ASEAN economies and their 20 Asian trading partners. Employing an augmented structural gravity model estimated via Poisson Pseudo Maximum Likelihood (PPML), the analysis links OECD Trade Facilitation Indicators (TFI) with the UNCTAD Inclusive Growth Index (IGI). The findings reveal that digital modernization, institutional coordination, stakeholder engagement, and the simplification of procedures are significantly associated with higher inclusive growth outcomes. A notable disparity exists between high-performing members like Singapore and Malaysia, who leverage advanced TF infrastructure, and less-developed countries such as Lao PDR and Myanmar, who are constrained by institutional and structural barriers. The results confirm that while legal frameworks like FTAs are important, they are insufficient on their own; tangible inclusive gains are contingent on national implementation capacity and targeted reforms. By providing evidence-based insights, this study contributes to ASEAN's post-2025 agenda, underscoring the need for a next-generation TF strategy that moves beyond general cost reduction to prioritize the specific institutional and digital reforms empirically shown to foster broad-based participation.

Keywords: gravity model, trade costs, equitable development, regional integration, SMEs, ASEAN

1. Introduction

In the contemporary landscape of economic globalization, the Association of Southeast Asian Nations (ASEAN) has emerged as a region of significant geopolitical and economic dynamism. As the world's second most integrated area in Global Value Chains (GVCs) after Europe, over 40% of Asia's gross exports are linked to these networks, with ASEAN at its core (ADB, 2023). The region's economic growth has been remarkable, outpacing the global average at 4.8% in 2019 compared to the world's 2.3% (World Bank Group, 2024). However, this impressive top-line growth masks a persistent and concerning paradox: its benefits have not been distributed equitably. Despite significant trade performance, over 120 million people in ASEAN still live below the international poverty line, and many small enterprises and rural communities remain marginalized from the gains of globalization (Hamid & Fadillah, 2022). This reality poses a critical question for policymakers: how can the engine of economic growth be harnessed to foster development that is truly sustainable and inclusive for all?

In response to this challenge, ASEAN has strategically identified TF - defined by the OECD as the streamlining, updating, and standardization of trade procedures (OECD, 2009) - as a key policy instrument. This strategic focus is formally articulated in the ASEAN Trade Facilitation Strategic Action Plan (ATF-SAP) 2017-2025, which guides the region's reform efforts. The theoretical premise is compelling: high trade costs stemming from complex customs procedures and administrative hurdles act as significant barriers to market entry. These barriers disproportionately impact small and medium-sized enterprises (SMEs) and marginalized producers, who lack the resources and scale to navigate them effectively (Mendoza et al., 2018). By lowering these structural costs, TF reforms are expected to correct market imbalances and broaden economic participation, thereby promoting more equitable development (Bacchetta et al., 2021). However, the empirical evidence presents a more complex puzzle. While some studies suggest TF can yield positive, inclusive outcomes, such as poverty reduction in the China-ASEAN context (Wu, 2013), others caution that such benefits are not automatic. Research from South Asia indicates that marginalized groups can remain excluded despite general progress (De, 2009), and findings from Sub-Saharan Africa highlight the necessity of complementary policies to ensure gains are widely shared (Jouanjean et al., 2016).

This empirical ambiguity is particularly acute in the ASEAN context, a region characterized by immense diversity in development and institutional capacity. Much of the existing literature tends to treat ASEAN as a monolithic bloc, thereby overlooking the significant disparities between advanced economies like Singapore and developing ones like Indonesia (Yu & Song, 2023). Consequently, there is a critical scarcity of granular, evidence-based analysis assessing whether the theoretical benefits of TF genuinely translate into inclusive outcomes for the most vulnerable communities within the region. To address

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this pressing research gap, this study provides a comprehensive empirical assessment of the impact of specific TF measures on inclusive growth across the ASEAN development spectrum. By employing a robust methodology - an augmented gravity model estimated via PPML - and linking comprehensive datasets from the OECD (Trade Facilitation Indicators) and UNCTAD (Inclusive Growth Index), this paper moves beyond the monolithic view to offer nuanced, evidence-based insights into which specific dimensions of trade facilitation are most effective in driving inclusive growth, moving the policy debate from whether TF works to what kind of TF works best.

The remainder of this paper is organized as follows. Section 2 presents the literature review. Section 3 details the data and methodology, including the variables, data sources, and the application of the gravity model with the PPML estimator. Section 4 outlines the empirical findings, examining the relationship between TF and inclusive growth across ASEAN member states. Section 5 discusses the policy implications of the results to promote equitable and sustainable development. Finally, section 6 concludes the paper by summarizing key insights and suggesting directions for future research.

2. Literature review

2.1. Conceptual foundations: framing the discourse

2.1.1. The evolving definition of trade facilitation

A coherent analytical framework requires clear operational definitions for its core constructs. The concept of trade facilitation (TF) has evolved from a narrow focus on customs and administrative procedures (Grainger, 2008) to a broader, more holistic understanding that encompasses wider trade cost issues like transport infrastructure, logistics, and the overall business environment (OECD, 2009). This study adopts the comprehensive definition advanced by the OECD, which frames TF as the streamlining, updating, and standardization of all cross-border trade procedures. The effectiveness of TF is contingent on several key components, including the simplification and harmonization of trade procedures to reduce costs and enhance competitiveness (Sahoo et al., 2017), the quality of physical transportation infrastructure (Sénquiz-DÍaz, 2021), and the critical role of institutional quality (Agyei & Idan, 2022). Within ASEAN, these components are manifested in concrete initiatives such as the development of the National and ASEAN Single Windows (NSW/ASW) to streamline procedures (Indira & Kusumasari, 2020; Ming Chow, 2018) and the ASEAN Trade in Goods Agreement (ATiGA) as the legal backbone for regional harmonization (Tevini, 2016).

2.1.2. The multidimensional nature of inclusive growth

Concurrently, the concept of inclusive growth has moved to the forefront of development economics. It is defined not merely by the pace of economic expansion, but as broad-based growth that allows all segments of society, particularly the poor and marginalized, to participate in and benefit from development (World Bank, 2008). The objective is to create jobs and equal opportunities rather than simply redistributing income post-facto (OECD, 2008). Measuring such a multifaceted concept is challenging. While various indices exist, this study utilizes the UNCTAD Inclusive Growth Index (IGI), a robust and statistically sound tool designed for contemporary development analysis. The IGI incorporates a wide range of developmental indicators across pillars such as the economy, living conditions, and equality, often using principal component analysis (PCA) to ensure a comprehensive and balanced measure (Mitra & Das, 2018; Mkrtchyan et al., 2025).

2.2. The economic case for trade facilitation: a review of its impacts

2.2.1. Impact on trade costs and flows

A substantial body of literature has established a strong, positive relationship between trade facilitation and macroeconomic performance. The primary mechanism is the reduction of trade costs; simplifying and harmonizing international trade procedures directly lowers the expenses and time associated with cross-border transactions (Alaamshani et al., 2022). These cost reductions, in turn, have been shown to significantly boost trade flows and export performance (Iwanow & Kirkpatrick, 2007). While these foundational findings are critical, they primarily address aggregate economic gains, leaving open the more complex question of how such benefits are distributed across society.

2.2.2. Impact on employment

The impact of trade facilitation on labor markets is nuanced and often contradictory. On one hand, by improving export performance, TF reforms can lead to net job creation in export-oriented industries, with studies in countries like Bangladesh and Vietnam showing particular benefits for female workers (Jenkins & Sen, 2006). On the other hand, the broader trend of trade liberalization has, in some developing regions, harmed manufacturing employment and contributed to deindustrialization, highlighting that the employment effects are not uniformly positive (Busse et al., 2024).

2.2.3. Impact on poverty and inequality

The direct link between TF and social welfare is a critical area of research. Evidence suggests that simplifying trade procedures, measured by the number of documents and days required for trade, can directly decrease both poverty and inequality in low- and middle-income countries (Nguyen Viet, 2015). However, this positive outcome is heavily mediated by institutional context. The inequality-reducing effects of trade are significantly stronger in countries with high-quality institutions and low levels of corruption, while in countries with poor governance, trade can exacerbate inequality (Reinecke & Schmerer, 2018).

2.3. The empirical puzzle: connecting trade facilitation to inclusive growth

The theoretical argument for TF as a driver of inclusive growth is compelling. High trade costs and complex procedural requirements do not affect all economic actors equally; they impose a disproportionate burden on small and medium-sized enterprises (SMEs) and rural communities who lack the resources and scale to navigate them effectively. By lowering these structural barriers, TF reforms can expand economic participation for these previously marginalized groups (Bacchetta et al., 2021). However, the empirical evidence reveals that this theoretical relationship is highly context-dependent, presenting a complex puzzle. While some studies show positive, pro-poor outcomes (Osabohien et al., 2022; Wu, 2013), others suggest that benefits are conditional on complementary policies (Jouanjean et al., 2016) and strong institutions (Agyei & Idan, 2022), or that marginalized groups can still be excluded (De, 2009).

This puzzle is particularly relevant in the ASEAN context, where significant implementation challenges persist. Despite initiatives like the ASEAN Single Window, member states exhibit wide disparities in TF performance (Pellan & Wong, 2013). The persistence of non-tariff barriers (Sukegawa, 2021) and high logistics costs (Nguyen et al., 2016), coupled with a consensus-based decision-making process known as the "ASEAN Way" that can slow reforms (Wisuttisak & Phanthamitr, 2024), suggests that the theoretical benefits of TF may not be fully realized across the region.

2.4. Methodological considerations in the literature

The gravity model is the workhorse theoretical and empirical framework for analyzing bilateral flows. It posits that trade between two countries is proportional to their economic size and inversely related to the distance between them (Kreinovich & Sriboonchitta, 2018; Van Bergeijk, 2010), and has been widely applied due to its strong empirical performance.

Despite its popularity, estimating the gravity model with traditional log-linear Ordinary Least Squares (OLS) presents significant econometric challenges. The two most critical issues are the presence of heteroscedasticity in trade data and the inability of log-linear models to handle zero trade flows. Ignoring these issues can lead to biased and inconsistent estimates.

The Poisson Pseudo-Maximum Likelihood (PPML) estimator has emerged as the state-of-the-art solution to these problems. Its advantages are well-documented: it provides consistent and robust estimates in the presence of heteroscedasticity (MartíŃnez-Zarzoso, 2013); it naturally includes observations with zero trade values, thereby avoiding sample selection bias (Bosquet & Boulhol, 2014); it has the desirable "adding-up" property where the sum of estimated flows equals the actual sum (Arvis & Shepherd, 2013); and its coefficients can be directly interpreted as elasticities (LeSage & Satici, 2016).

A sophisticated understanding requires acknowledging the ongoing scholarly conversation around PPML. Researchers have noted that in certain cross-sectional applications, the robust standard errors of PPML estimates can be downward biased (Pfaffermayr, 2019, 2023), leading to the development of bias-correction techniques and alternative estimators for specific situations (Pfaffermayr, 2020).

Despite these advanced nuances, the PPML estimator remains overwhelmingly recommended in contemporary trade literature as the most reliable and robust method for estimating gravity equations (Silva & Tenreyro, 2006). Its ability to address the core issues of heteroscedasticity and zero trade flows makes it the appropriate choice for this study.

2.5. Synthesis and definitive identification of the research gap

The existing literature thus establishes that the link between trade facilitation and inclusive growth is theoretically sound but empirically contingent and fraught with implementation challenges, particularly within ASEAN. While the macroeconomic benefits of TF are well-documented, its impact on the multifaceted dimensions of inclusive growth is empirically ambiguous globally and faces specific hurdles in the ASEAN context. This leads to a critical research gap. There is a pressing need for a study that: 1) Disaggregates TF to examine the distinct impacts of its specific components; 2) Uses a Comprehensive Outcome Measure by employing a holistic measure of inclusive growth (IGI) rather than just trade flows; 3) Is Context-Specific, focusing explicitly on the diverse ASEAN region to avoid the "monolithic bloc" fallacy (Yu & Song, 2023); and 4) Is Methodologically Robust, utilizing an appropriate and well-justified analytical approach. This study is meticulously designed to fill this precise, multi-faceted gap, thereby creating a seamless and compelling transition to the methodology section.

3. Data and methodology

3.1. Model specification

The study utilizes panel data from 8 ASEAN economies and 20 Asian trading partners for the year 2023. The selected timeframe is particularly relevant as it coincides with the implementation of the ASEAN Trade Facilitation Strategic Action Plan (ATF-SAP) 2017-2025. As detailed in Table 1, this plan aims to reduce trade costs and enhance transparency to promote inclusive growth. Table 2 provides a comprehensive summary of all variables, their descriptions, and corresponding data sources used in the analysis.

Table 1 Mapping OECD Trade Facilitation Indicators to ASEAN Trade Facilitation Objectives.

Objective (Summarized)	ATF -SAP	Detailed description	OECD TFI
Easy (A, C, E, F, H)	Competitive movement of goods (Objective 1) Institutional coordination (Objective 5) Monitoring mechanisms (Objective 6)	Enhancing institutional coordination, streamlining procedures, improving access to trade-related information, and ensuring consistent implementation of TF measures across ASEAN.	A- Information availability C- Advance rulings E- Fees and charges F- Formalities - Documents H- Formalities - Procedures
Dialog (B, D, I, J)	Addressing development gaps (Objective 4) Private sector engagement (Objective 3)	Addressing NTMs/NTBs, promoting private sector engagement (especially MSMEs), and fostering cooperation among ASEAN Member States to ensure equitable participation in TF	B- Involvement of the trade community D- Appeal procedures I- Internal cooperation J- External cooperation
Enhance (K)	Minimizing NTMs and NTBs (Objective 2) Improving policy effectiveness (Objective 6)	Strengthening monitoring and evaluation mechanisms to assess the effectiveness of TF policies, ensuring responsiveness to business needs and trade efficiency improvements.	K- Consularization
Modernization (G)	Implementing international best practices (Objective 7)	Encouraging the adoption of TF practices aligned with international standards (e.g., WTO, WCO) and leveraging technology to streamline processes.	G- Formalities - Automation

Table 2 List of variables.

Variable	Description	Measure	Source
IGI_{it}	Inclusive growth index	Scale from 1 to 100	UNCTAD
$easy_i$ $easy_j$	Trade efficiency and coordination	Scale from 0 to 2	Authors' calculation based on OECD TFI
$enhance_i$ $enhance_j$	Policy and trade barriers		Authors' calculation based on OECD TFI
$dialog_i$ $dialog_j$	Private sector and cooperation		Authors' calculation based on OECD TFI
$modernization_i$ $modernization_j$	Automation and digitalization		Authors' calculation based on OECD TFI
gdp_i gdp_j	Gross domestic product	US$	World Bank
dist	Geodesic distance between most populated cities	Km	CEPII
fta_wto	1 if pair currently engaged in a regional trade agreement		CEPII

To start with, the study employs the gravity model, a widely used and standard framework in international economics for describing bilateral trade flows (Kreinovich & Sriboonchitta, 2018; Van Bergeijk, 2010). At its core, the gravity model posits that the volume of trade between two nations is positively correlated with their economic size and negatively correlated with the geographic distance between them.

The selection of control variables is firmly grounded in the gravity model's theoretical and empirical foundations (Oguledo & Macphee, 1994). We include the Gross Domestic Product of both the exporting (GDP_i) and importing (GDP_j) countries to represent economic size, geographical distance (dist) as a proxy for trade frictions, and a binary variable (fta_wto) to capture the effects of trade agreements. The expected signs for these variables are summarized in Table 3, and the overall conceptual framework is presented in Figure 1.

Table 3 Variable expectation.

Variables	Expected sign	References
TF	+	(De, 2009; Bacchetta et al., 2021; Jouanjean et al., 2022)
dist	-	(Ismail & Mahyideen, 2015; Jouanjean et al., 2022)
gdp	+/-	(De, 2009; Yu & Song, 2023; Anand et al., 2013)
fta_wto	+	(Bacchetta et al., 2021; Jouanjean et al., 2022)

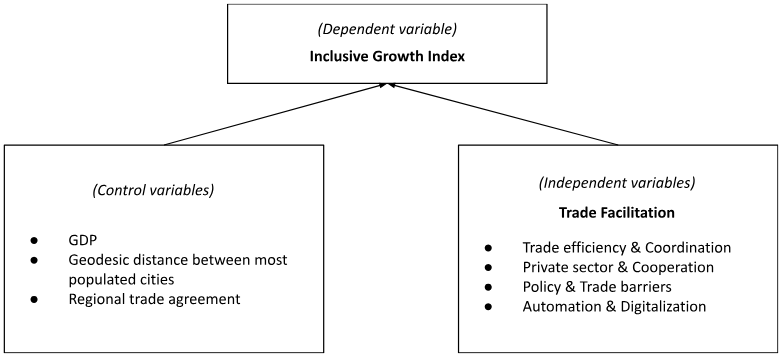

Figure 1 Conceptual framework.

Equation (1) is customized to quantify the influence of TF on inclusive growth within the ASEAN context as follows::

$$IGI_{it} = \beta_0 + \beta_1 lndist + \beta_2 lngdp_i + \beta_3 lngdp_j + \beta_4 fta\_wto + \beta_5 REM\_EXP + \beta_6 REM\_IMP + \beta_7 lnTF_j + e_{it} \quad (1)$$

Where i represents the 8 ASEAN countries, j shows 20 Asian partners, t refers to the observation year in 2023. The dependent variable, IGI_it, represents the inclusive growth score for each ASEAN country i. To cope with unobserved multilateral resistances, the model incorporates remoteness indices (REM_EXP and REM_IMP), following the approach of Baier & Bergstrand (2007).

$$REM\_EXP_{i,t} = (\sum_j dist_{ij}/\frac{Y_{j,t}}{Y_t}) \quad (3)$$

$$REM\_IMP_{j,t} = (\sum_j dist_{ij}/\frac{Y_{i,t}}{Y_t}) \quad (4)$$

Furthermore, trade flow data often contain zero-trade observations and heteroskedasticity, which can lead to biased estimates when using traditional log-linear OLS methods. To overcome these challenges, this study employs the PPML estimator. This method has become the modern standard for estimating gravity models as it provides consistent results in the presence of heteroskedasticity (MartíŃnez-Zarzoso, 2013) and naturally includes zero trade flows, thus avoiding the sample selection bias of traditional log-linear models (Bosquet & Boulhol, 2014; Silva & Tenreyro, 2006). A key advantage of the PPML estimator is that its coefficients on logged variables can be directly interpreted as elasticities (LeSage & Satici, 2016). Additionally, it possesses the desirable "adding-up" property, ensuring that the sum of the estimated trade flows equals the sum of the actual trade flows (Arvis & Shepherd, 2013).

3.2. Data Sources and Descriptive Statistics

This study constructs a cross-sectional dataset for the year 2023, comprising 8 ASEAN member states and their 20 key Asian trading partners. This sample is appropriate for assessing the contemporary impact of trade facilitation on inclusive growth within a dynamic regional context.

The dependent variable, the IGI, is sourced from the United Nations Conference on Trade and Development (UNCTAD). This index provides a comprehensive measure of development outcomes on a scale from 1 to 100. The primary independent variables are the Trade Facilitation Indicators (TFIs). To align our empirical analysis directly with the region's policy priorities, these indicators, constructed from OECD data, are grouped into four components corresponding to the strategic objectives of the ATF-SAP, as detailed in Table 1: trade efficiency and coordination (easy), private sector and cooperation (dialog), policy and trade barriers (enhance), and automation and digitalization (modernization). Standard gravity model control variables are included to account for other factors influencing the outcome. Economic size is represented by the Gross Domestic Product (GDP) for both reporting and partner countries, sourced from the World Bank. Geographical distance (dist), a proxy for trade costs, is obtained from the CEPII database as the geodesic distance between the most populated cities. Finally, a binary variable (fta_wto) indicates the presence of a formal regional trade agreement between a country pair.

Table 4 presents the descriptive statistics for all variables. The mean IGI score for the sample is 36.53, with a wide range from 19.9 to 76.1, highlighting the significant heterogeneity in inclusive development outcomes across the observed country-pairs. Similarly, the substantial standard deviations for both GDPi (3.87E+11) and GDPj (3.54E+12) reflect the considerable

economic diversity within the sample, which includes both highly developed economies and emerging markets. The average distance between trading partners is approximately 3,980 km, with a large standard deviation that indicates diverse geographical relationships. The mean of the binary variable fta_wto is 0.42, indicating that approximately 42% of the country-pairs in our sample operate under a formal regional trade agreement or WTO framework.

Table 4 Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. dev.	Skewness	Kurtosis
IGI	216	19.9	76.1	36.525	13.1931	1.002	0.943
GDP_i	216	1.58E+10	1.37E+12	4.67E+11	3.87E+11	1.276	1.198
GDP_j	200	6.59E+09	1.78E+13	1.30E+12	3.54E+12	4.130	16.619
dist	216	316	8813	3979.98	2201.900	0.392	-0.799
fta_wto	216	0	1	0.42	0.494	0.340	-1.902
Valid N (listwise)	200						

3.3. Data preprocessing and robustness checks

The initial dataset was processed to handle missing values. Following a listwise deletion approach, observations with incomplete data for key variables were excluded, resulting in a final balanced sample of 200 observations for the regression analysis.

To ensure the stability of the model and the reliability of the coefficient estimates, a multicollinearity diagnostic was performed using the Variance Inflation Factor (VIF). While the conventional threshold for concern is often cited as a VIF value of 10, the results indicated potential collinearity for $lneasy_{ij}$ (VIF = 11.99) and $lndialog_{ij}$ (VIF = 9.96) (Table 6). Despite this, a deliberate decision was made to retain both variables in their respective models. This decision is grounded in strong theoretical reasoning, as these variables capture conceptually distinct dimensions of trade facilitation: $lneasy_{ij}$ represents procedural efficiency, whereas $lndialog_{ij}$ reflects institutional cooperation. Furthermore, the high statistical significance of their coefficients suggests that their individual relationships with the dependent variable are robust enough to be statistically discernible.

Finally, in line with best practices for empirical research, we acknowledge the potential limitations of our analytical approach. While the PPML estimator addresses key issues like heteroscedasticity and zero trade flows, we recognize the possibility of endogeneity from other sources, such as reverse causality. Moreover, we are aware of the ongoing scholarly conversation regarding the nuances of the PPML estimator, particularly the potential for downward bias in robust standard errors in certain cross-sectional applications (Pfaffermayr, 2019, 2023). While fully addressing these advanced econometric issues is beyond the scope of this cross-sectional study, they represent important avenues for future research.

4. Results

4.1. Inclusive growth landscape in Asia and ASEAN

An analysis of the IGI across Asia reveals a landscape of stark contrasts, underscoring the uneven impact of development policies and trade reforms throughout the continent (Figure 2). The performance spectrum is remarkably wide, ranging from exceptionally high scores in economies like Singapore and Israel to profoundly low scores in others such as Nepal, Pakistan, and India. This striking divergence suggests that while regional integration and trade liberalization have created opportunities for growth, the capacity to translate these opportunities into equitable and broad-based outcomes remains highly varied. For ASEAN, which sits at the heart of this dynamic region, this disparity is not just an external observation but an internal reality, reflecting a complex and multi-layered development challenge.

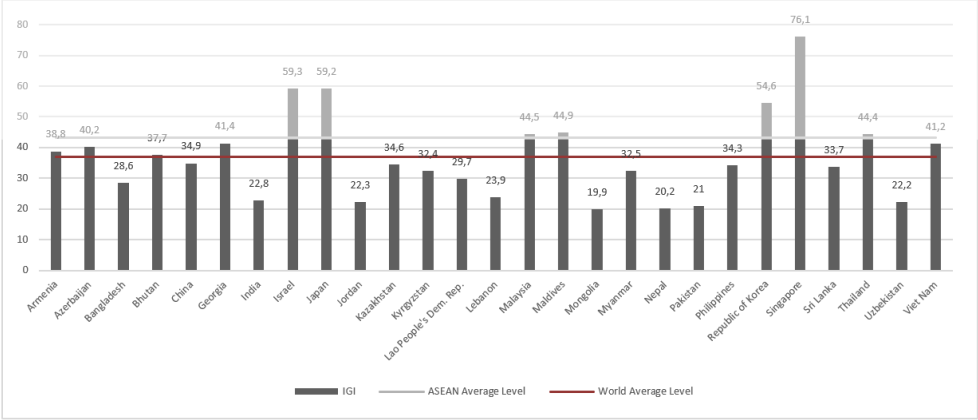

Figure 2 IGI performance on selected Asian countries.

Within ASEAN itself, a clear three-tiered pattern emerges, telling a story of a region moving at different speeds (Figure 3). At the top tier, Singapore stands as a clear outlier and regional benchmark with an IGI score of 76.1. This exceptional performance signifies a successful translation of advanced trade facilitation infrastructure and consistent economic policy into tangible, inclusive development. Occupying the middle tier are economies like Malaysia (44.5) and Vietnam (41.2). While both have made significant strides in global value chain integration and customs modernization, their moderate IGI scores indicate a persistent gap between strong trade expansion and the broader goal of shared prosperity, particularly in addressing regional inequalities and ensuring access to opportunities. At the lower end of the spectrum, countries such as the Philippines (34.3), Myanmar (32.5), and Lao PDR (29.7) exhibit weak IGI performance. Their scores point to deep-seated structural and institutional constraints that impede the broad-based distribution of gains from trade, suggesting that liberalization alone is insufficient to foster inclusive growth without foundational institutional capacity.

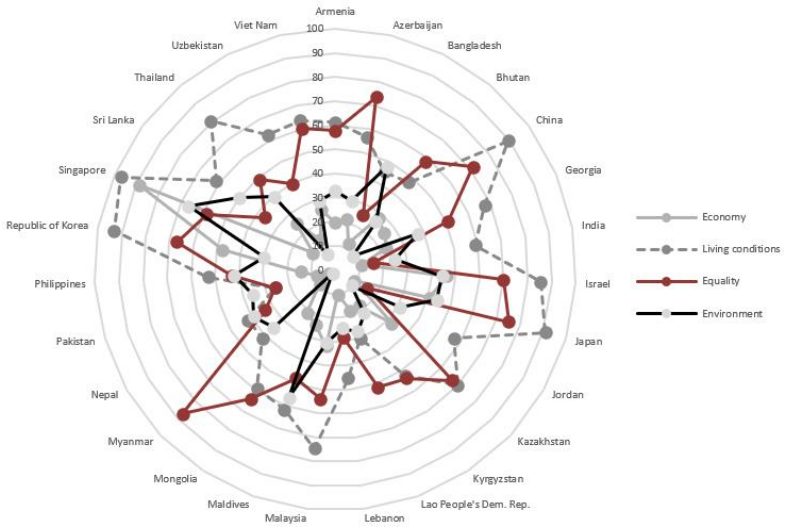

Figure 3 IGI Indicators (Economy, Living conditions, Equality & Environment) performance on selected Asian countries.

Synthesizing these findings offers several key insights into the region's development landscape. First, there appears to be a notable decoupling between economic scale and inclusive growth. The contrast between a major economy like India (22.8) and a smaller, high-performing one like Singapore (76.1) suggests that trade volume or GDP size alone does not guarantee inclusive outcomes, and that underlying structural or institutional factors likely play a crucial role. Second, the performance of the leading economies points toward the importance of a comprehensive policy environment where trade liberalization is integrated with strong institutional frameworks and modern infrastructure. This observation raises a pertinent question for the subsequent analysis: which specific policy levers within the broader trade agenda are most influential? It therefore becomes relevant to examine the components of trade facilitation more closely to better understand their respective roles in fostering a more equitable and integrated ASEAN.

4.2. Experimental results

Table 5 reports the results from the gravity model estimated via PPML, revealing a robust and positive relationship between various dimensions of trade facilitation and inclusive growth. Across all four model specifications, the core trade facilitation variables demonstrate a positive and statistically significant relationship with the IGI, highlighting their distinct and substantial contributions. In model (1), the simplification of procedures ($lneasy_{ij}$) shows a large and highly significant coefficient (1.437, $p < 0.001$), providing strong evidence that reducing administrative burdens is an effective lever for promoting inclusive outcomes. The coefficient for institutional dialogue ($lndialog_{ij}$) in model (2) is particularly noteworthy for its magnitude (1.862, $p < 0.001$), suggesting the exceptional importance of stakeholder engagement and cooperation in building a predictable and trustworthy trade environment. Similarly, the enhancement of border management ($lnenhance_{ij}$) has a significant positive effect (0.610, $p < 0.001$), while digital modernization ($lnmodernization_{ij}$) in model (4) underscores the transformative potential of infrastructure upgrades in expanding market access (0.732, $p < 0.001$).

The results for the standard gravity model controls offer further insights. The coefficient for distance (lndist) is negative and statistically significant across most specifications (e.g., -0.244, $p < 0.001$ in model 3), which is consistent with gravity theory and confirms that geographical distance remains a significant barrier to inclusive growth. A noteworthy finding is the consistently negative and significant relationship between the exporter's economic size (lngdpi) and the IGI. This counter-intuitive result may suggest that larger economies do not automatically translate their scale into more inclusive outcomes,

possibly due to issues of internal inequality or a concentration of trade benefits that require specific policies to mitigate. In contrast, the economic size of the importing country ($lngdp_j$) is generally not statistically significant.

Table 5 The experimental result of inclusive growth

	(1)	(2)	(3)	(4)
	IGI	IGI	IGI	IGI
lndist	-0.139*	0.176**	-0.244***	-0.159*
	(-2.17)	(-2.90)	(-4.04)	(-2.54)
$lngdp_i$	-0.123***	-0.0769**	-0.0304	-0.104***
	(-4.76)	(-3.19)	(-1.31)	(-4.48)
$lngdp_j$	-0.0339*	-0.0120	-0.000393	-0.0170
	(-2.33)	(-0.91)	(-0.03)	(-1.31)
fta_wto	0.193**	-0.0154	0.296***	0.139
	(2.59)	(-0.17)	(4.40)	(1.73)
REM_EXP	0.000000200*	0.000000176*	0.000000443***	0.000000180*
	(2.48)	(2.05)	(7.53)	(2.31)
REM_IMP	3.78e-09	2.53e-09	5.02e-09	6.04e-09*
	(1.49)	(1.01)	(1.92)	(2.47)
$lneasy_{ij}$	1.437***			
	(7.38)			
$lndialog_{ij}$		1.862***		
		(6.14)		
$lnenhance_{ij}$			0.610***	
			(8.16)	
$lnmodernization_{ij}$				0.732***
				(8.30)
_cons	7.765***	6.541***	5.117***	7.259***
	(10.25)	(9.25)	(7.89)	(10.61)
N	200	200	200	200

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6 Variance Inflation Factor (VIF) results for the inclusive growth regression model.

Variable	VIF	1/VIF
$lneasy_{ij}$	11.99	0.083378
$lndialog_{ij}$	9.96	0.100421
$lnmodernization_{ij}$	6.81	0.146832
REM_EXP	6.04	0.165482
fta_wto	5.43	0.184084
lndist	4.63	0.215860
$lngdp_i$	3.28	0.304615
REM_IMP	2.41	0.415178
$lngdp_j$	2.37	0.421398
$lnenhance_{ij}$	1.49	0.671918
Mean VIF	5.44	

Regarding institutional and policy variables, the fta_wto indicator is positive and significant in models (1) and (3), but not uniformly so across all specifications. This suggests that while legal frameworks like FTAs contribute positively, their effectiveness in fostering inclusive growth may be contingent upon, or enhanced by, the specific on-the-ground trade facilitation measures in place. Finally, the remoteness variables (REM_EXP and REM_IMP) are positive and generally significant, supporting the hypothesis that a country's trade efficiency relative to all other global partners is an important factor influencing its inclusive growth outcomes.

5. Discussion

The empirical results provide robust support for this study's central hypothesis that trade facilitation is a multidimensional driver of inclusive growth, offering a nuanced understanding that moves beyond treating TF as a monolithic policy. The distinct, significant, and positive impacts of the four TF components confirm our conceptual framework and allow for a deeper interpretation of the mechanisms connecting trade policy to equitable development. The large coefficients on procedural simplification (lneasyij) and institutional dialogue (lndialogij) empirically validate the argument that lowering administrative barriers is a fundamental mechanism for promoting equity. By reducing the fixed costs of trade that disproportionately burden SMEs and informal actors, these reforms expand economic participation. This finding aligns with broader research which posits that strong institutional quality and good governance are preconditions for translating trade

openness into inclusive growth, as has been argued in the context of Sub-Saharan Africa (Agyei & Idan, 2022). Furthermore, the powerful impact of digital modernization ($lnmodernization_{ij}$) provides an optimistic, contemporary update to the existing literature. While earlier work in South Asia highlighted that marginalized groups in remote areas could remain excluded from the benefits of trade (De, 2009), our findings suggest that modern, digitally-focused TF - supported by quality transport and logistics infrastructure (Sénquiz-DÍaz, 2021) - may be more effective at overcoming the geographical barriers that previously entrenched exclusion. This is particularly relevant for the region, where initiatives like the ASEAN Single Window (ASW) represent the practical application of these transformative modernization efforts (Ming Chow, 2018).

Beyond the direct effects of TF, the results for the gravity model's control variables reveal the persistent role of structural barriers and a notable paradox concerning economic scale. The consistently negative and significant coefficient on distance (lndist) confirms established gravity theory, underscoring that physical separation remains a potent barrier to inclusive growth by increasing trade costs. This finding is consistent with studies that highlight the particular disadvantages faced by remote and landlocked economies, where the benefits of trade are harder to realize (Jouanjean et al., 2016). More striking is the negative and significant coefficient on the exporter's GDP ($lngdp_i$), which presents a paradox. This result challenges the conventional assumption that larger economies automatically foster more inclusive outcomes. It suggests that without targeted policies and strong redistributive institutions, the benefits of economic scale may become concentrated among established firms or sectors, failing to "trickle down" and potentially exacerbating relative inequalities. This interpretation aligns with literature that has identified how intra-country inequality can dilute the inclusive potential of aggregate economic expansion (Anand et al., 2013).

Finally, our findings on the impact of formal trade agreements (fta_wto) offer a sophisticated, policy-relevant insight into the relationship between legal commitments and on-the-ground outcomes. The variable's inconsistent significance across models does not imply that FTAs are unimportant. Rather, it suggests that the *de jure* existence of a trade agreement is insufficient, on its own, to guarantee inclusive growth. The results indicate that the *de facto* implementation of specific TF measures is what truly unlocks the inclusive potential of these legal frameworks. This aligns with the broader literature emphasizing the need for "complementary policies" to ensure the benefits of trade liberalization are widely shared (Iwanow & Kirkpatrick, 2007). This insight is especially critical for ASEAN. Our findings empirically ground the challenges documented in the literature, such as the gap between the legal commitments of the ASEAN Trade in Goods Agreement (ATiGA) (Tevini, 2016) and the real-world implementation hurdles caused by significant performance disparities among members (Pellan & Wong, 2013) and a consensus-based decision-making process that can slow reforms (Wisuttisak & Phanthamitr, 2024). Ultimately, our analysis confirms that tangible inclusive gains are contingent not just on signing agreements, but on building the domestic capacity to implement them effectively.

6. Policy implications

6.1. Overarching strategic direction: from cost reduction to an inclusive facilitation ecosystem

The findings of this study offer critical, evidence-based guidance for the future of ASEAN's trade policy, particularly for the post-2025 agenda that will build upon the successes of the ATF-SAP 2025. Our empirical results, taken as a whole, strongly advocate for a strategic evolution in ASEAN's approach: from a narrow focus on *trade cost reduction* to a broader, more ambitious mission of fostering a truly *inclusive trade ecosystem*. The evidence that specific facilitation measures - particularly those related to institutional quality and digital modernization - are powerful drivers of inclusive growth suggests that the next generation of policy should prioritize not just the efficiency of trade flows, but also the equity of their outcomes.

6.2. Priority area 1: deepening institutional and procedural reforms

Our results empirically identify the institutional and procedural dimensions of trade facilitation as the most potent levers for driving inclusive growth. Given the outsized impact of institutional dialogue revealed in our findings, the highest returns on inclusivity can be achieved by prioritizing the establishment and strengthening of formal public-private dialogue platforms. These should not be viewed as supplementary activities but as core strategic assets for ensuring that policy design is responsive to the real-world needs of SMEs, agricultural producers, and other marginalized groups, a point reinforced by literature emphasizing the importance of institutional quality for development outcomes (Agyei & Idan, 2022).

Similarly, the powerful impact of procedural simplification found in our analysis provides a clear mandate to accelerate efforts to reduce administrative burdens. For policymakers, this means moving aggressively to fully implement and harmonize National Single Windows (NSW) and achieve a fully operational and interoperable ASEAN Single Window (ASW). As prior research has shown, the success of these platforms is pivotal for streamlining trade administration and is contingent on continued political backing and robust legal frameworks (Indira & Kusumasari, 2020; Ming Chow, 2018).

6.3. Priority area 2: a 'connectivity for inclusion' approach to modernization

This study's findings reveal both the transformative, positive impact of modernization and the persistent, negative barrier of distance. This duality calls for a strategic investment approach framed as 'Connectivity for Inclusion'. To counteract

the "distance penalty" that disproportionately affects landlocked members and remote communities, investments in digital and physical infrastructure must be strategically channeled to promote equity. This means moving beyond upgrading primary economic hubs to also focus on developing secondary logistics corridors, expanding digital trade access in underserved regions, and improving multi-modal infrastructure. Such a strategy aligns with existing literature that highlights the need to harmonize logistics policies to reduce costs and enhance connectivity across the entire ASEAN region (Nguyen et al., 2016).

6.4. Priority area 3: from agreements to actionable implementation

Our results for the formal trade agreements variable, which showed a positive but not uniformly significant impact, provide a crucial policy insight: the legal existence of a trade agreement is insufficient, on its own, to guarantee inclusive growth. This finding empirically demonstrates that *implementation is paramount*. Therefore, we recommend that all future and current trade agreements, including the ongoing implementation of the ASEAN Trade in Goods Agreement (ATiGA), must be coupled with dedicated capacity-building programs, technical assistance, and clear monitoring benchmarks. This ensures that *de jure* commitments translate into *de facto* inclusive outcomes. This recommendation is strongly supported by a wide body of literature that calls for "complementary policies" to ensure the benefits of trade are widely shared (Iwanow & Kirkpatrick, 2007) and is particularly salient for ASEAN, given the documented challenges of performance disparities and implementation delays within the bloc (Pellan & Wong, 2013; Wisuttisak & Phanthamitr, 2024).

6.5. Tailored strategies for lower-income ASEAN members

While the above recommendations apply to the region broadly, our model allows for specific, evidence-based strategies for less-developed members, such as Lao PDR and Myanmar. Given the particularly strong, positive finding for institutional dialogue in our model, the highest returns on inclusivity for these members can be achieved by prioritizing the creation of accessible forums where SMEs, agricultural cooperatives, and women-led businesses can directly contribute to trade policy design. Based on the strong impact of procedural simplification, a second priority should be an aggressive reduction of bureaucratic red tape through initiatives like reducing required trade documents and ensuring all fees are transparent and accessible online. Finally, to counteract the "distance penalty" identified in our results, a 'Connectivity for Inclusion' approach is vital, channeling investments in modernization toward secondary logistics corridors to integrate remote areas into regional value chains.

7. Conclusions

This study set out to determine if reducing trade barriers in ASEAN benefits all. Our empirical evidence suggests that the answer is nuanced: while trade liberalization provides a foundation, it is the specific, on-the-ground trade facilitation measures - particularly those that strengthen institutional quality and advance digital modernization - that are the true engines of inclusive growth. This research confirms that key components of trade facilitation are strongly and positively associated with higher inclusive growth outcomes. Conversely, our findings show that structural barriers like geographical distance continue to hinder inclusive development, and that formal legal frameworks such as Free Trade Agreements do not automatically guarantee that the benefits of trade are shared broadly

This paper contributes to the existing literature and policy discourse in three principal ways. First, it provides granular, ASEAN-focused empirical evidence by disaggregating trade facilitation not arbitrarily, but according to the bloc's own strategic policy framework (ATF-SAP), thereby identifying which official objectives matter most for inclusivity. Second, by highlighting the significant performance disparities within the bloc, our research challenges the "monolithic bloc" fallacy often present in regional studies and underscores the need for context-specific policy solutions. Finally, our findings contribute a crucial nuance to the policy debate by demonstrating that the de facto implementation of TF measures is a more significant driver of inclusive outcomes than the mere de jure existence of trade agreements.

While this study provides valuable insights, its limitations define important boundaries for interpretation and offer clear directions for future research. The primary limitation is the cross-sectional nature of our data. This static approach, while providing a detailed snapshot for 2023, cannot capture the dynamic, time-dependent nature of TF reforms. Consequently, our analysis is unable to distinguish between potential short-term adjustment costs and the long-term inclusivity gains of these reforms - a critical distinction for policymakers.

Future research should therefore prioritize longitudinal studies using panel data to track the effects of TF reforms over time. Additionally, expanding the analytical scope to include firm-level or sector-specific dynamics would provide a more granular understanding of how different types of businesses and communities are affected. Ultimately, for ASEAN to realize its vision of a truly integrated and equitable economic community, the policy focus must continue to evolve - from simply signing agreements and opening borders to actively building the institutional and digital bridges that ensure everyone can cross them.

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

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