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Promoting Trade Linkages: The Driving Force of Japan-ASEAN Cooperation in Global Value Chains

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Abstract

Japan-ASEAN trade relations have become a cornerstone of economic cooperation in the Indo-Pacific, shaped by strategic interests and growing interdependence. As Japan leverages ASEAN's expanding production capacity and consumer base, trade has flourished, particularly in manufacturing sectors such as automobiles, electronics, and chemicals. This dynamic partnership is driven not only by market forces but also by structured agreements like the ASEAN-Japan Comprehensive Economic Partnership (AJCEP) and the Regional Comprehensive Economic Partnership (RCEP), which foster trade liberalization and investment collaboration. Key determinants of trade include economic size, geographic proximity, and sectoral complementarities. ASEAN serves as a crucial link in Japan's global supply chains, providing raw materials and intermediate products while benefiting from Japanese technology and investment. Japanese multinational corporations have strategically integrated ASEAN economies into their production networks, enhancing industrial development and regional connectivity. Beyond economics, this trade relationship carries significant geopolitical weight. Japan sees ASEAN as an essential partner in maintaining regional stability and responding to shifts in global trade dynamics. As supply chains diversify and economic resilience becomes a priority, ASEAN presents Japan with an alternative trade and production network, reducing dependence on other markets. Future collaboration will be shaped by digital transformation, sustainability, and deeper integration, reinforcing ASEAN's role as a hub for global commerce while maintaining Japan's leadership in technology and investment. This evolving partnership will continue to drive regional economic cooperation and strategic alignment in an increasingly complex international landscape.

Keywords: Japan, ASEAN, Trade Integration, Economic Interdependence, Geopolitical Strategy.

Introduction

The evolution of Japan-ASEAN relations reflects a deepening diplomatic and economic partnership that has shaped regional dynamics. Beginning with five founding members in 1967— Indonesia, Malaysia, Singapore, the Philippines, and Thailand—ASEAN has expanded to ten nations, incorporating Brunei, Vietnam, Cambodia, Myanmar, and Laos. Japan's engagement with ASEAN formally started in 1973 through the ASEAN-Japan Forum on Synthetic Rubber, but a significant diplomatic milestone came in 1977 when Prime Minister Takeo Fukuda introduced the Fukuda Doctrine during the Japan-ASEAN Summit in Malaysia. This doctrine outlined three fundamental principles: Japan would not seek military power again, relations with Southeast Asia would be built on mutual trust and respect, and Japan would pursue an equal partnership with ASEAN (Lam, 2012). These commitments set the foundation for Japan's long-term approach to Southeast Asia, emphasizing stability, cooperation, and economic engagement.

In the post-Cold War period, Japan-ASEAN relations matured through increased economic

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interdependence and expanded cooperation in diverse sectors such as technology and human resources. One of the most defining agreements in this progression was the Japan-ASEAN Comprehensive Economic Partnership (JACEP), which came into force in January 2007. This agreement fostered trade liberalization, investment facilitation, and collaboration in intellectual property, agriculture, forestry, and fisheries. Japan also strengthened its economic ties with ASEAN nations through bilateral agreements, reinforcing its commitment to a mutually beneficial partnership.

Politically, Japan has actively participated in ASEAN-led multilateral frameworks, marking significant milestones in diplomatic relations. In 2004, Japan signed the Treaty of Amity and Cooperation (TAC), demonstrating its commitment to regional stability (Singh, 2017). In 2013, the 40th Anniversary of Japan-ASEAN Dialogue Relations was commemorated, further solidifying cooperation. Prime Minister Abe Shinzō underscored Japan's dedication by becoming the first Japanese leader to visit all ten ASEAN nations during the initial year of his tenure (2012-2013) (Singh, 2017). His leadership culminated in the second Japan-ASEAN Commemorative Summit, where both sides adopted a visionary statement emphasizing four core themes: Partners for Peace and Stability, Partners for Prosperity, Partners for Quality of Life, and Heart-to-Heart Partners. This framework reinforced Japan's strategic alignment with ASEAN, fostering diplomatic trust and economic collaboration.

Japan's ASEAN engagement remained a priority under later administrations. In October 2020, Prime Minister Yoshihide Suga reaffirmed this commitment by selecting Vietnam and Indonesia for his first overseas trip, signaling ASEAN's central role in Japan's foreign policy. This ongoing partnership highlights ASEAN's significance in Japan's regional strategy, serving both economic and geopolitical interests. As global dynamics shift, Japan-ASEAN relations continue to evolve, positioning ASEAN as a critical partner in Japan's pursuit of regional stability and economic integration.

Japan-ASEAN interactions extend beyond bilateral trade and are embedded in broader regional and international cooperation frameworks, including the Asia-Pacific Economic Cooperation (APEC), the World Trade Organization (WTO), and ASEAN Plus Three (ASEAN, Japan, China, and South Korea). Among these, two trade agreements - the Regional Comprehensive Economic Partnership (RCEP) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) - have been particularly influential.

Negotiations for RCEP commenced in 2012, aiming to integrate all ten ASEAN members with six external partners: Australia, China, India, Japan, South Korea, and New Zealand. However, in 2019, India withdrew due to concerns over domestic industry vulnerabilities and the risk of increasing trade imbalances, particularly with China. Despite this setback, Japan, ASEAN, and other member states remained committed, finalizing the agreement in Hanoi, Vietnam, on November 15, 2020. While RCEP has become the world's largest free trade agreement, covering approximately 30% of the global population and GDP, members continue to express openness to India's future return (Tani, 2020). If India were to rejoin, the FTA would expand to cover nearly half of the world's population and over a third of global GDP.

Similarly, the CPTPP, established in December 2018, has played a key role in shaping regional economic integration. Initially ratified by six nations - Mexico, Japan, Singapore, New Zealand, Canada, and Australia - the agreement endured a significant challenge when the United States withdrew under the Trump administration. Despite this, CPTPP remains one of the largest free trade agreements, accounting for 13.3% of global GDP (Nguyen & Truong, 2019). As an open

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framework, CPTPP welcomes new members who are willing to adhere to its principles. Several countries, including the United Kingdom, South Korea, and Thailand, have expressed interest in joining, while the agreement also remains open to the potential return of the United States under suitable conditions (Nguyen & Truong, 2019).

Japan and ASEAN play a pivotal role in navigating the challenges and opportunities within RCEP and CPTPP, ensuring the agreements remain resilient despite the withdrawals of key players such as the United States and India. Their leadership reinforces regional economic stability and fosters deeper integration, positioning both agreements as crucial mechanisms for maintaining competitiveness in the evolving global trade landscape.

Among the various dimensions of Japan-ASEAN cooperation, bilateral trade has emerged as a defining pillar of economic interdependence and regional integration. As globalization reshapes supply chains, Japan and ASEAN have cultivated a dynamic trade partnership that reflects both economic necessity and strategic foresight. According to United Nations Conference on Trade and Development (UNCTAD) data, Japan-ASEAN trade has expanded significantly, underscoring ASEAN's rising prominence in global commerce. In parallel, Taiwan has also strengthened its trade linkages with ASEAN, reinforcing the region's centrality in East Asian trade networks.

This study seeks to explore three critical aspects of Japan-ASEAN trade relations:

- Evolution of trade patterns – How has the structure of trade flows shifted, particularly in response to supply chain integration, technological advancements, and policy frameworks?

- Determinants of trade at aggregate and sectoral levels – What key economic, geopolitical, and structural factors drive Japan-ASEAN trade relations, influencing both overall trade volumes and specific industries?

- Future implications for economic diplomacy – How can both parties enhance trade cooperation, addressing challenges such as regional competition, sustainability, and digital transformation?

Academic literature has extensively examined East Asian trade relations, with studies by Athukorala (2005), Park (2009), Solís (2011), Truong et al. (2019b), and Hoang et al. (2020) providing insights into broader regional trade dynamics. Research specifically analyzing Japan's trade with ASEAN, such as Tiwari et al. (2003), Furuoka (2005), Belderbos & Zou (2006), and Rahman et al. (2008), highlights Japan's leading role in the East Asian production network. However, as South Korea and China intensify their economic engagements, Japan faces growing competition in maintaining its trade dominance. Meanwhile, ASEAN's major economies have progressively asserted themselves within regional supply chains, shaping a more multi-polar trade landscape.

Despite this wealth of literature, a gap remains in the comprehensive analysis of Japan-ASEAN trade patterns and determinants, particularly at both aggregate and sectoral levels. This study seeks to fill that gap by applying the gravity model with a Poisson Pseudo Maximum Likelihood (PPML) estimator, as developed by Santos Silva and Tenreyro (2006, 2011). By investigating trade activities over a 19-year period, we aim to identify structural trends, sector-specific dynamics, and underlying economic forces shaping Japan-ASEAN trade. Ultimately, this research will provide empirical insights and policy recommendations for strengthening future trade relations, ensuring Japan-ASEAN cooperation remains resilient in an era of shifting global economic power.

The structure of the remainder of this paper is as follows. Section 3 focuses on analyzing the patterns and dynamics of Japan-ASEAN trade, identifying key trends, sectoral specializations, and structural shifts in economic engagement between the two parties. This section explores the evolution of trade flows, highlighting changes in export-import compositions and the role of supply chain integration in shaping bilateral trade. Section 4 provides a detailed discussion of the econometric framework used in this study, outlining the methodological approach employed to examine Japan-ASEAN trade relations. This section elaborates on the theoretical foundations of the gravity model, describes the data sources and estimation techniques, and explains the rationale for utilizing the Poisson Pseudo Maximum Likelihood (PPML) estimator to address trade-related distortions and zero trade flows. Section 5 presents and interprets the empirical findings, offering insights into the key determinants of trade between Japan and ASEAN at both aggregate and sectoral levels. It critically evaluates the impact of various economic, geopolitical, and institutional factors on trade flows, shedding light on the underlying mechanisms driving trade expansion and industrial cooperation. Finally, Section 6 provides concluding remarks, summarizing the key findings of the study and discussing their implications for future Japan-ASEAN trade relations. It offers policy recommendations aimed at enhancing bilateral and regional trade cooperation, addressing challenges related to market access, supply chain resilience, and regulatory harmonization. This section also considers broader economic and strategic factors that will shape the trajectory of Japan-ASEAN trade integration in the coming years.

The Evolving Pattern of Japan-ASEAN Trade Relations

The trade relationship between Japan and ASEAN has experienced notable transformations over the years, reflecting broader shifts in regional and global economic dynamics. Japan-ASEAN trade expanded significantly, with total bilateral trade growing from 128 billion USD in 2000 to over 226 billion USD in 2018. During this period, Japan's exports to ASEAN increased from 68.9 billion USD to 114.4 billion USD, while imports from ASEAN rose from 59.5 billion USD to 112.1 billion USD. However, trade activity between the two entities has fluctuated, particularly in 2009, 2013, 2014, and 2015, indicating periods of economic instability and external challenges.

Several factors have contributed to these fluctuations, including global economic downturns, Japan's modest growth rates, and intensified competition from other major players, particularly China, which has expanded its trade presence in ASEAN markets. Since 2016, Japan-ASEAN trade has shown signs of recovery, yet the total trade volume remains below the peak recorded in 2012.

ASEAN holds a crucial position in Japan's trade network, accounting for approximately 15 percent of Japan's total trade in 2018, making it Japan's third-largest trading partner after China and the United States. Conversely, Japan remains a significant trade partner for ASEAN, representing 8 percent of ASEAN's total trade in the same year, ranking fourth after China, the European Union, and the United States. These figures highlight the growing importance of ASEAN in Japan's external trade policies while reflecting ASEAN's increasing diversification in its trade relations.

As global trade continues to evolve, Japan-ASEAN trade relations are expected to adapt to changes in supply chains, technological advancements, and trade policy shifts. Strengthening this partnership will require economic diplomacy, investment facilitation, and coordinated efforts in regional trade integration to ensure long-term sustainability and mutual benefits.



Figure 1. Bilateral trade between Taiwan and ASEAN (US\$ billion). Source. WITS of World Bank Note. ASEAN = Association of Southeast Asian Nations.

The distribution of Japan's trade within ASEAN has undergone notable shifts, reflecting broader economic transformations and evolving regional dynamics. In 2000, Japan's exports primarily targeted major ASEAN economies, with Singapore standing out as the leading destination, accounting for 30.4% of Japan's total exports to the region. Malaysia and Thailand followed closely, comprising 20.2% and 19.9%, respectively, while the Philippines and Indonesia held shares of 14.9% and 11.0%. Other ASEAN nations played only a marginal role in Japan's export portfolio during this period.

By 2018, the composition of Japan's ASEAN export markets had changed significantly. Thailand emerged as Japan's most critical trade partner in ASEAN, accounting for 28.1% of exports, while Singapore's share dropped considerably to 20.4%. Vietnam gained prominence, becoming Japan's third-largest export destination at 14.3%, reflecting its rising role in regional trade networks. Indonesia and Malaysia followed with shares of 13.8% and 12.1%, respectively.

Japan's imports from ASEAN countries also witnessed a marked transformation between 2000 and 2018. Initially, Indonesia was Japan's largest supplier within ASEAN, contributing 27.5% of total imports, followed by Malaysia (24.3%), Thailand (17.8%), the Philippines (12.1%), and Singapore (10.8%). However, by 2018, Thailand had surpassed Indonesia as Japan's primary source of imports, reaching 22.5%. Indonesia's share dropped to 19.2%, while Vietnam expanded its presence significantly, accounting for 18.8% of Japan's imports from ASEAN. Malaysia also maintained a strong position, contributing 16.8% to Japan's total imports.

Overall, Japan's trade relationship within ASEAN remains concentrated in its largest economies, but the relative importance of individual member states has shifted. Thailand and Vietnam have become increasingly central to Japan's trade strategy, while Indonesia, Malaysia, and Singapore have seen a relative decline in their trade shares. These changes underscore the dynamic nature of Japan-ASEAN trade relations, influenced by economic development, investment flows, and shifts in production networks across the region.

The composition of Japan-ASEAN trade has undergone notable shifts over time, reflecting broader economic trends and adjustments in regional industrial structures. In 2000, Japan's

exports to ASEAN were overwhelmingly dominated by machinery and electrical products, which accounted for 57.8% of total shipments. Other significant export categories included metal goods at 8.7% and transportation equipment at 8.6%. By 2018, machinery and electrical products continued to hold the largest share, but their relative importance had diminished to 36.5%, marking a considerable decline. Meanwhile, the role of metals, miscellaneous goods, and transportation equipment had grown, with their shares reaching 14.5%, 14.1%, and 12.4%, respectively.

On the import side, machinery and electrical products remained the most prominent category, yet their share in Japan's imports from ASEAN dropped from 38.3% in 2000 to 27.3% in 2018. A similar trend was observed in fuel imports, which declined from 25.1% to 14.3% over the same period, signaling changes in Japan's energy sourcing and industrial demands. In contrast, miscellaneous goods, textiles, and clothing gained greater significance in Japan's import portfolio, accounting for 9.4% and 8.8% of total imports from ASEAN in 2018.

Overall, while machinery and electrical products have remained central to Japan-ASEAN trade relations, their relative dominance has declined due to diversification in trade patterns and shifts in regional production dynamics. These structural changes reflect ASEAN's evolving role in global supply chains and the increasing significance of other industrial sectors in shaping bilateral trade. Future trade policies will likely be influenced by technological advancements, regional integration efforts, and shifts in consumer and industrial demands.

Japan's exports to ASEAN			Japan's ASEAN	imports	from
	2000	2018	2000	2018	
Animal	0.07	0.45	4.50	1.72	
Chemicals	5.23	6.24	2.04	5.20	
Food Products	0.18	0.50	2.96	4.78	
Footwear	0.01	0.03	0.55	1.88	
Fuels	0.32	2.06	25.11	14.36	
Hides and Skins	0.04	0.09	0.27	0.90	
Machinery and Electric Products	57.85	36.59	38.37	27.32	
Metals	8.71	14.58	2.98	5.17	
Minerals	0.08	0.18	1.96	2.10	
Miscellaneous	5.48	14.18	4.59	9.41	
Plastic or Rubber	4.21	5.71	3.09	6.08	
Stone and Glass	2.20	3.82	1.19	2.53	
Textiles and Clothing	1.59	1.80	3.31	8.80	
Transportation	8.62	12.48	0.67	2.75	
Vegetable	0.10	0.16	2.16	2.72	
Wood	0.83	1.14	6.24	4.27	

Table 1. Japan' Trade with ASEAN By Sectors (%)

Source: Author's estimation using WITS of World Bank

Note. ASEAN = Association of Southeast Asian Nations.

The paper examines Japan-ASEAN trade across different stages of processing, including capital goods, consumer goods, intermediate goods, and raw metals, which define the complexity of a nation's trade structure and its role in global production networks. The estimation results, presented in Figures 2 and 3, illustrate key trends. Regarding exports, Figure 2 highlights Japan's initial emphasis on capital goods in its trade with ASEAN, reflecting its advanced economy. However, the proportion of capital goods declined significantly from 68.4% in 2000 to 53.6% in 2020. In contrast, intermediate goods gained prominence, reaching 28.8% by 2018, followed by consumer goods, which accounted for 15.7% that same year. Despite Japan's abundant natural resources, its exports of raw materials to ASEAN remained minimal throughout 2000–2018. On the import side, Japan's trade with ASEAN was dominated by consumer goods, rising from 36.6% to 44.51% between 2000 and 2018. Meanwhile, the share of capital goods in Japan's imports showed a downward trend, settling at 27.2% in 2018. During this period, the proportion of intermediate goods and raw materials exhibited only minor fluctuations. (See Figures 2, 3).



Figure 2. Japan's Exports to ASEAN By Stages of Processing

Source. WITS of World Bank

Note. ASEAN = Association of Southeast Asian Nations.



Figure 3. Japan's' Imports from ASEAN By Stages of Processing

Source. WITS of World Bank

Note. ASEAN = Association of Southeast Asian Nations.

Overall, being as a developing economy, Japan's exports to ASEAN largely concentrates on manufacturing goods, particularly capital goods such as machinery and electric products, transportation products. On the contrary, as ASEAN has developing member states, its export structure to Japan includes a significant part of consumer goods and fuels.

Econometric Specification: Gravity Equation

The gravity model stands as one of the most influential and widely applied frameworks in international economics (Yotov et al., 2016). It is broadly recognized as the empirical cornerstone for analyzing the key determinants of bilateral trade flows (Anderson, 2011). Following this well-established approach, we adopt the gravity model framework developed by Anderson and Wincoop (2003) to quantitatively assess trade exchanges between Japan and ASEAN member states from 2000 to 2018. This methodology allows for a systematic evaluation of trade dynamics, accounting for economic size, distance, and other relevant factors shaping bilateral trade relationships.

The traditional gravity equation takes a form as follow:

YiEj

Xij = G

Тij

, (1)

where, Xij presents trade flow between i and j; G is inverse of world production and equals to 1/Y; Yi depicts the domestic gross production of country i; Ej is the total expenditure of country j; Tij is total trade costs induced with trade activities between i and j which is calculated as

 $Tij = (tij/(\Pi iPj))\sigma - 1.$

From equation (1), the log-linear form of the Anderson and Wincoop gravity equation can be exhibited as following:

$$lnXij,t = lnEj,t + lnYt + (1 - \sigma)lntij,t - (1 - \sigma)lnPj,t - (1 - \sigma)\Pi i,t + \epsilon ij,t,$$
(2)

where, tij,t is a vector of geographic and trade policy variables in year t such physical distance between i and j or tariffs induced by imported or exported countries; Pj,t is a proxy of internal multilateral resistance term imposed by importing country j; $\Pi i,t$ is external multilateral resistance term executed by exporting country i; and finally, $\epsilon ij,t$ is error terms (see Anderson and Wincoop (2003) for more detailed descriptions).

In our study, we apply the enhanced Anderson and Wincoop gravity equation to examine the fundamental factors influencing bilateral trade between Japan and ASEAN. The equation is presented as follows:

 $lnXijt = \Phi 0 + \Phi 1 lnYit + \Phi 2 lnYjt + \Phi 3 lnDij + \Phi 4 \sum lnMTRi, j, t + \Phi 5 \sum dummy$

 $+\epsilon ij,t,$ (3)

In this equation, *Yit* and *Yjt* represent the domestic gross production of Japan (denoted as country i) and each ASEAN member state (country j) in a given year t. *Dij* signifies the trade barrier associated with the geographical distance between Japan and its ASEAN trading partners. The term *MTRi,j,t* refers to a vector capturing both inward and outward multilateral resistances, which are imposed by Japan and ASEAN nations and become effective in year t. Lastly, *dummy* serves as a representative proxy for dummy variables.

Despite its extensive use in international trade analysis, the gravity equation faces several estimation challenges, including multilateral resistances, zero trade observations, and heteroscedasticity. Baldwin and Taglioni (2006) highlight that the unobservable nature of multilateral resistance can lead to significant estimation errors, often termed "gold medal errors." The issue of zero trade arises due to the transformation of trade data into logarithmic form, which results in the exclusion of zero-trade observations from the sample. Meanwhile, Santos Silva and Tenrevro (2006) demonstrate that cross-sectional trade flow data inherently suffers from heteroscedasticity, potentially leading to biased and inconsistent estimates. To address these challenges, this paper first applies the Anderson and Wincoop (2003) variation of the gravity equation, which effectively accounts for multilateral resistance (Egger, 2002; Yotov et al., 2016). Additionally, compiling trade data into a panel dataset helps mitigate heteroscedasticity to some extent (Gujarati, 2009). For a more robust estimation, we employ the Poisson Pseudo-Maximum The Likelihood (PPML) estimator, originally introduced and effectively implemented by Santos Silva and Tenreyro in 2006, has been further validated through their later research in 2011, reinforcing both its theoretical soundness and empirical reliability in gravity model estimation. Due to its proven effectiveness, the PPML estimator has gained widespread recognition for addressing significant estimation challenges (Hoang et al., 2020; Yotov et al., 2016). The gravity model specification is outlined as follows:

 $Xijt = \Phi 0 + \Phi 1 lnYit + \Phi 2 lnYjt + \Phi 3 lnDij + \Phi 4 \sum lnMTRi, j, t + \Phi 5 \sum dummy + \epsilon ij, t.$ (4)

650 Promoting Trade Linkages: The Driving Force of Japan-ASEAN Data and Analysis

This study utilizes trade data from 2000 to 2018, expressed in US dollars, retrieved from UNCTAD's official database. It includes both aggregate trade figures and sub-sectoral trade flows, classified by industry and processing stage. Key macroeconomic indicators such as Japan's gross domestic product (GDPi), ASEAN member states' GDP (GDPj), logistics performance index (logistics), and economic openness (openness) are sourced from the World Bank's World Development Indicators. Additionally, the gravity model variables—geographical distance (distance) and landlocked status (landlocked)—are obtained from CEPII.

Following conventional trade theory, GDPi and GDPj are expected to have positive effects on trade flows, while distance and landlocked status may impose constraints, exerting a negative influence. However, advancements in technology, transportation, and deeper economic integration have significantly mitigated traditional geographical barriers.

To reflect this evolving trade dynamic, we construct a distance index (distindex), a weighted measure incorporating the logistic performance index of each trading partner. This refined proxy for geographical distance captures the interplay between infrastructure efficiency and trade accessibility, ensuring a more accurate assessment of modern trade flows. The distance index (distindex) then is calculated as follow:

distindex =

distance

logistics

(5)

where distance denotes geographical distance, and logistics presents logistic performance index. Clearly, a country having a higher logistic performance index would strongly encourage the trade activities among countries. As a result, indexing the degree of national logistic development in the traditional distance will relatively lessen the biases in estimating gravity model equation with the traditional distance. Note that data on logistic performance index are continuously collected from 2006 for each two-year period, meaning that we do not have full by-year set for the whole period of study. To deal with this problem, we replace the data of year t for year t-1 if year t-1 has no observation. Remarkably, we only would like to figure out the role of logistic development on the physical distance to trade. Thus, our solution for unobservable data of logistic index on the one side does not affect the role of traditional distance, on the other side, works out the effect of logistic change on physical distance.

Theory of international economics shows that small countries tend to trade more relative to big countries since they are lack of resources for producing goods. Thus, we insert the trade open index (openness) which is measured by total trade over GDP to seize the economic insights. The openness index (openness) is defined as follow:

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openness = \sqrt{tradopeni * tradopenj}, (6)
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where *tradopeni* and *tradopenj* are trade openness index of Japan and each nation of ASEAN respectively in year t. It is a fact that small countries are conventionally more relying on foreign markets, but relative larger members of ASEAN such Vietnam, Thailand, Indonesia and Philippines is under the strategy of export-driven growth. Thus, openness in our perspective is to have supportive effects on trade for both sub-sections and a whole one.

To account for trade liberalization in bilateral trade flows, the model incorporates two key variables: mutual free trade agreements between ASEAN and Japan (aseanplus) and individual trade agreements between Japan and specific ASEAN member states (fta). Data for these variables are sourced from the official ASEAN website and Japan's Ministry of Economy, Trade and Industry. Both variables are expected to positively influence trade flows.

Additionally, the model includes a dummy variable (incometype) as a proxy for a country's economic development. This variable takes a value of 1 for middle- or high-income countries and 0 otherwise. It is anticipated that incometype will have a supportive effect on trade flows. The classification for this variable is based on data obtained from the World Bank Country and Lending Group database.

Results and Discussion

Aggregate Trade and Its Components

The estimation results for aggregate trade flows, obtained using both Ordinary Least Squares (OLS) and Poisson Pseudo-Maximum Likelihood (PPML) approaches for comparison, are presented in Table 1. To assess the adequacy of the estimators, we compare R-squared values and the number of statistically significant coefficients across the two methods. The PPML estimator appears more appropriate and consistent than OLS, as it yields higher R-squared values and more meaningful coefficient estimates. Accordingly, all subsequent interpretations are based on PPML results. Furthermore, estimations incorporating the distance index (distindex), which weights geographical distance by the logistics performance index, prove more robust than those relying solely on traditional geographical distance (distance). Consequently, the paper's findings primarily stem from results using distindex rather than distance. Notably, some variables—such as distindex and openness—exhibit statistical significance and align with expected signs in aggregate trade analysis. However, their effects differ when trade flows are disaggregated into imports and exports. This reinforces the validity of the estimation strategy, which provides a holistic trade perspective while distinguishing the individual influences of key factors on specific trade components.

OLS									PPML			
Variable	lnexp	Lnexp	lnimp	lnimp	Intrad	Intrad	export	export	impor	impor	trade	trade
	ort	ort	ort	ort	e	e	(7)	(8)	t	t	(11)	(12)
	(1)	(2)	(3)	(4)	(5)	(6)			(9)	(10)		
lngdpi	0.448	0.469	0.352	0.363	0.459	0.466	1.028 *	1.111 *	0.882 *	0.839 *	0.942 **	0.953 **
lngdpj	0.826 ***	0.827 ***	0.889 ***	0.881 ***	0.795 ***	0.790 ***	0.748 ***	0.760 ***	0.526 ***	0.529 ***	0.629 ***	0.632 ***
lndistanc e	-0.497		-0.861		-0.426		- 0.677 **		0.391 *		-0.069	
Indistind		-0.687		-0.405		-0.278		-		0.504		-
ex								0.962 ***		**		0.120 *
aseanplu	-0.137	-0.132	-0.013	-0.001	-0.017	-0.009	-	-	-0.004	-0.010	-	-
s –							0.522	0.525			0.284	0.285

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							***	***			***	***
fta	- 0.360 ***	- 0.362 ***	- 0.445 ***	- 0.442 ***	- 0.366 ***	- 0.364 ***	0.197	0.186	- 0.288 **	- 0.288 **	-0.025	-0.027
incomet ype	1.565 ***	1.472 ***	1.623 ***	1.600 ***	1.819 ***	1.800 ***	1.438 ***	1.286 ***	2.425 ***	2.477 ***	1.907 ***	1.885 ***
landlock ed	-0.728	-0.745	- 1.449 **	- 1.402 **	- 1.130 **	- 1.117 **	- 0.964 ***	- 0.978 ***	- 1.355 ***	- 1.344 ***	- 1.202 ***	- 1.205 ***
openness	0.010 ***	0.009 **	0.005	0.005	0.008 ***	0.008 ***	0.018 ***	0.016 ***	- 0.007 ***	- 0.005 ***	0.006 ***	0.005 ***
constant s	0.767	1.439	4.920	0.591	1.069	-0.523	-2.256	-1.611	- 8.284 **	- 8.355 **	-5.018	-4.821
fixed effects	yes	Yes	yes	yes	yes	Yes	yes	yes	yes	yes	yes	yes
Observat ions	190	190	190	190	190	190	190	190	190	190	190	190
R- squared	0.7 <mark>3</mark> 8 6	0.7 <mark>3</mark> 7 4	0.753 4	0.753 8	0.7 <mark>8</mark> 3 7	0.783 7	0.774	0.776 8	0.821 9	0.823 7	0.840 5	0.840 7
legend: * *** p<0.0	[*] p<0.0)01	5; ** p	<0.01;									

Table 1. Results under OLS and PPML for Aggregate Trade Flows

The estimated coefficients for Japan's and ASEAN member states' GDP are statistically significant and align with expected signs, confirming their positive impact on mutual trade flows—both in total trade and its components (exports and imports). These findings, extensively supported in empirical literature, indicate that Japan's GDP has a stronger effect on trade flows than that of individual ASEAN nations. Specifically, Japan's GDP coefficients (1.111 for exports, 0.882 for imports, and 0.953 for total trade) exceed those of ASEAN economies (0.760, 0.529, and 0.632, respectively), highlighting Japan's dominant influence in bilateral trade. Since GDP serves as both a measure of economic size and development level, larger economies naturally exhibit greater consumption capacity. Given Japan's significantly higher GDP relative to ASEAN nations, its economic scale plays a more decisive role in trade. This assertion is further reinforced by the statistically significant coefficient of the income type variable (*incometype*), which shows positive effects on cumulative trade (1.885), exports (1.286), and imports (2.477). These results suggest that Japan trades more actively with higher-income ASEAN countries, emphasizing its strong leverage in regional trade negotiations.

The impact of geographical distance (*distance*) on trade between Japan and ASEAN reveals a contrasting effect—negatively influencing exports (-0.677 and -0.962 without and with logistics weighting, respectively) while exerting a positive influence on imports (0.391 and -0.504 without and with logistics weighting). The variable is statistically significant for aggregate trade estimation only when weighted by the logistics performance index (*distindex*), with a coefficient of -0.120. These findings align with recent perspectives on the limitations of traditional distance in gravity model estimations, as technological advancements, improved transportation, and rapid

economic integration have significantly altered trade dynamics (Yotov, 2016; Mayer & Zignago, 2011). Notably, by incorporating the logistics performance index, the estimated results for *distindex* show substantial enhancements. A one-percent improvement in logistics performance can reduce the trade barrier of physical distance by approximately 0.285 percent for exports from Japan to ASEAN and 0.113 percent for imports from ASEAN to Japan. Additionally, the estimations contribute to the growing literature emphasizing the crucial role of logistics development in international trade (Gani, 2017). Given Japan's advanced logistics infrastructure relative to ASEAN, the beneficial impact of efficient logistics outweighs the traditional negative effect of geographical distance. This explains why *distindex* has a positive effect on Japan's imports from ASEAN while maintaining a negative effect on Japan's exports to ASEAN nations.

The estimated coefficients for trade agreements challenge conventional empirical literature, revealing unexpected results. Specifically, the coefficient for *aseanplus*, which represents trade agreements between Japan and ASEAN as a bloc, is statistically significant but negatively impacts total trade (-0.285) and exports (-0.525), while showing no significant effect on imports. Similarly, *fta*, reflecting bilateral free trade agreements between Japan and individual ASEAN nations, is statistically significant for imports but carries a negative coefficient (-0.288), while remaining insignificant for total trade and exports. These findings suggest that bilateral trade agreements do not necessarily enhance trade flows between Japan and ASEAN, contrary to widely held assumptions.

Several factors help explain this phenomenon. First, Japan and ASEAN nations actively participate in multilateral economic frameworks such as the WTO, RCEP, and APEC, which absorb or overlap the benefits of bilateral FTAs, reducing their standalone impact (Baldwin, 2006). Second, Japanese multinational corporations play a dominant role in ASEAN's production and trade networks, creating strong intra- and inter-enterprise linkages that lessen the direct role of formal trade agreements. Lastly, geographical proximity between Japan and ASEAN naturally facilitates trade, decreasing the necessity for additional bilateral agreements. Collectively, these factors suggest that regional integration, corporate-driven trade structures, and geographical closeness play a more decisive role in shaping Japan-ASEAN trade dynamics than bilateral FTAs.

Regarding trade openness, the estimated coefficients are statistically significant, showing a positive sign for total trade (0.005) and exports (0.016) but a negative expectation for imports (-0.005). Since both Japan and most ASEAN countries follow an export-driven growth strategy, the share of trade relative to GDP tends to be substantial. At the aggregate level, it is understandable that a higher openness degree fosters trade activities. However, it is intriguing to note that the effects of openness differ between exports and imports. This may stem from the fact that most ASEAN countries than for Japan. Consequently, higher openness levels tend to strongly support Japan's exports to ASEAN (or ASEAN's imports from Japan) while having a limited effect on Japan's imports from ASEAN.

Finally, our estimations indicate that being a landlocked country significantly impedes bilateral trade. The estimated coefficients for *landlocked* are statistically significant and negative, at -0.978, -1.344, and -1.205 for imports, exports, and total trade, respectively. These results demonstrate that nations without direct access to the sea face considerable constraints in engaging in international trade, reinforcing the well-documented disadvantages of geographic isolation in global commerce.

654 Promoting Trade Linkages: The Driving Force of Japan-ASEAN Sub-Sectors of Imports and Exports

Building on the previous discussion, the PPML estimator proves to be the most appropriate approach, and using the distance index (*distindex*) enhances the robustness and significance of the estimations. Therefore, the gravity equations for the sub-sectors of imports and exports between Japan and the ASEAN bloc are estimated exclusively under the PPML framework, incorporating *distindex* rather than conventional geographical distance.

Detailed results for trade flows categorized by stage-of-processing sub-sectors are presented in Table 2, while estimations for HS-2-digit sub-sectors are included in the Appendix for organizational purposes. Notably, the findings for HS-2-digit classifications exhibit a similar degree of heterogeneity as those observed in the stage-of-processing sub-sectors. Given this consistency, the subsequent discussion will focus primarily on the estimated results of trade flows categorized by stage-of-processing, providing a clearer perspective on trade dynamics between Japan and ASEAN.

Variable		Export				Import		
	exx1	exx2	exx3	exx4	imm1	imm2	imm3	imm4
Lngdpi	1.397**	1.066***	1.397**	1.397**	0.404	0.628	0.644	2.076***
Lngdpj	0.772***	0.740***	0.772***	0.772***	0.797***	0.297***	0.967***	0.628***
Indistindex	- 1.061***	- 0.782***	- 1.061***	- 1.061***	- 2.494***	1.362***	0.788**	1.336***
aseanplus	- 0.734***	-0.238*	0.734***	- 0.734***	- 0.605***	0.646***	524***	-0.352
Fta	0.232	0.028	0.232	0.232	-0.046	- 0.667***	0.245*	-0.154
incometype	1.260***	0.655*	1.260***	1.260***	3.803***	2.754***	2.699***	3.556***
landlocked	- 1.029***	- 0.801***	1.029***	- 1.029***	-0.990	- 1.848***	0.866***	0.304
openness	0.015***	0.019***	0.015***	0.015***	0.010***	- 0.011***	0.001	-0.031***
constants	-3.786	-4.097	3.786	-3.786	11.671*	-12.534*	13.407**	- 26.698***
fixed effects	yes	yes	yes	Yes	yes	yes	yes	yes
Observations	190	190	190	190	190	190	190	190
R-squared	0.7337	0.8436	0.7337	0.7337	0.6457	0.6589	0.808	0.899
legend: *p<0 p<0.001	.05; ** p<	0.01; ***						

Table 2. Results under PPML for Sub-Sectors of Imports and Exports

The estimated results in Table 2 indicate that while the key determinants of aggregate trade and its components—imports and exports—also influence sub-sectoral trade flows between Japan and ASEAN, their effects vary significantly in magnitude and direction. This suggests a high degree of heterogeneity among different industries, highlighting that trade relations between Japan and ASEAN are concentrated in specific categories of goods rather than evenly distributed

across sectors. Consequently, factors that shape trade flows at the macro level may not fully explain the complexities of trade patterns at the micro level, underscoring important policy implications for each country's trade strategy, which will be explored further in subsequent discussions.

Notably, the gross domestic product (GDP) of Japan and ASEAN member states is statistically significant and positively associated with trade flows, confirming that larger economic scales lead to higher export volumes. However, an intriguing finding emerges—Japan's GDP does not appear to influence its imports of capital goods, consumer goods, or intermediate goods from ASEAN, as the estimated coefficients for these categories are statistically insignificant. Instead, Japan's GDP is only significantly linked to its imports of raw materials. In contrast, ASEAN countries' GDP behaves as expected, affecting trade flows consistently. This pattern likely stems from ASEAN's comparative advantage in raw materials, such as natural resources, whereas Japan excels in producing technologically sophisticated goods. As a result, Japan's GDP has minimal impact on the consumption of manufactured imports from ASEAN but plays a critical role in its demand for raw materials. This distinction reinforces the structural differences in Japan-ASEAN trade and offers insights into the nature of specialization in their economic relationship.

The estimated results for the *distance index* and *income type* variables in sub-sectoral trade flows of exports and imports largely align with those observed in aggregate trade data. However, the effects at the micro level appear more pronounced due to higher coefficient values, suggesting that additional factors influencing bilateral trade are captured in sub-sector-specific models but not reflected in the broader aggregate framework.

Similar patterns emerge with the variables *landlocked* and *openness*, albeit with moderated intensity compared to aggregate trade estimations. The logistics performance index, incorporated into the distance index, may dilute the traditional effects of physical distance, while the impact of trade openness might be softened due to the export-driven growth strategies pursued by both Japan and ASEAN nations.

Regarding trade agreements, the estimated results for *aseanplus* and *fta* indicate notable heterogeneity in sub-sector trade estimations. Interestingly, while *aseanplus* is statistically significant across most sub-sectors except raw materials, it displays mixed effects—positively influencing Japan's exports of intermediate goods and imports of consumer goods, yet negatively affecting Japan's exports of capital goods, intermediate goods, and raw materials, as well as imports of capital and intermediate goods from ASEAN. On the other hand, the estimated effects of *fta* are significant only for Japan's imports of intermediate and consumer goods, with other sub-sector trade flows remaining statistically insignificant.

These results reflect the economic disparities among ASEAN member states, where bloc-wide trade agreements often fail to fully accommodate the distinct needs and trade priorities of individual countries. Achieving uniform trade policies across ASEAN is challenging due to structural differences in economic development and sectoral composition. Moreover, as discussed earlier, Japan-ASEAN trade is concentrated in specific industries, meaning that the benefits of FTAs may be limited to certain sectors rather than broadly applicable to all. Consequently, the effectiveness of trade agreements varies across industries, reinforcing the need for targeted trade policies to maximize their impact.

Over the past decades, trade between Japan and ASEAN has experienced fluctuations, reflecting periods of instability in regional trade development. These shifts can be attributed to unfavorable regional and global economic conditions, Japan's relatively slow economic growth, and increasing trade engagements between ASEAN and other partners. Despite these challenges, Japan-ASEAN trade has shown notable improvement in recent years, though trade exchange values remain below the peak recorded in 2012. Japan's trade with ASEAN has primarily centered on its largest member states, with Thailand and Vietnam emerging as key trading partners.

In terms of trade composition, Japan—an advanced economy—has focused its exports to ASEAN on capital goods, including machinery and electronic products. On the other hand, ASEAN nations export a mix of consumer goods such as textiles and clothing, as well as fuels, to Japan. Using the gravity model with the PPML method, this study finds that economic size and per capita income are the primary determinants of Japan-ASEAN trade flows, with Japan's GDP exerting a more pronounced influence. Additionally, geographical distance—traditionally considered a trade barrier—can be significantly offset by improvements in logistics performance.

Interestingly, the formation of bilateral FTAs between Japan and individual ASEAN countries appears to have a limited impact on trade promotion, likely due to broader economic cooperation mechanisms and the established production networks of Japanese multinationals in the region. Furthermore, trade openness has a positive effect on total trade and exports between Japan and ASEAN, reinforcing the importance of open trade policies. However, landlocked status remains a significant impediment to trade, restricting market access for countries without direct sea connections. These findings highlight the evolving dynamics of Japan-ASEAN trade and underscore the importance of infrastructure, economic scale, and multilateral cooperation in shaping future trade relations between the two regions.

At the sub-sector level, this study finds that many determinants of aggregate trade—along with imports and exports—also influence Japan-ASEAN trade flows at a more granular level. However, the impact varies in both magnitude and direction, highlighting the heterogeneous nature of trade relations across different industries. In other words, Japan-ASEAN trade exhibits a tendency toward concentration in specific product groups rather than uniform distribution across sectors.

Based on empirical evidence, several policy implications emerge. First, improving logistics performance should be a priority to mitigate the negative effects of geographical distance and landlocked status, with Japan's infrastructure development initiatives in ASEAN playing a crucial role in addressing these challenges. Second, given the limited impact of existing FTAs on trade expansion between Japan and ASEAN, both parties should explore new trade platforms with deeper commitments to liberalization and investment facilitation. Third, reducing development disparities among ASEAN member states could enhance trade outcomes at both aggregate and sectoral levels, and Japan's support—particularly through its official development assistance (ODA) programs—could contribute meaningfully to this process. Finally, a dynamic approach to selecting product categories for export and import promotion would ensure adaptability in trade strategies, aligning with evolving economic trends and regional priorities. These findings emphasize the need for strategic interventions to enhance Japan-ASEAN trade

efficiency, particularly through logistics, deeper economic integration, and targeted sectoral policies.

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