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## Article

# Sustaining International Trade with China: Does ACFTA Improve ASEAN Export Efficiency?

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**Abstract:** The business of international trade has never been identified as zero-sum. Yet, dependence on regional agreements to provide alternate means for countries to overlook shortcomings persists. China's recent rise up the trade value-chain has fostered an assumption that the regional agreement provides various advantages to exports from Association of Southeast Asian Nations (ASEAN) member countries. This paper provides an empirical assessment of the ASEAN-China Free Trade Area (ACFTA) impact on ASEAN export efficiency into the Chinese market, in pre and post eras. Using a structured gravity approach to estimate potential export pattern at aggregate and industry level, this research indicates that though not consistent across years, the ACFTA offers improvements to ASEAN exports to China. No clear effects of the ACFTA can be extrapolated from the years surrounding the initial signing (Article 8—2004). However, following its full enactment (2010), the ACFTA resulted in more sustainable trade from ASEAN members towards China, at both the industry and country levels. While seeing improvements in export efficiency during its era, ACFTA's facilitation of efficiency measures with China came at no expense to other major export destinations.

**Keywords:** ASEAN; ACFTA; structured gravity model; export efficiency

## 1. Introduction

Closeness in proximity (referring to the sharing of land, maritime borders, and the similarities in culture and long-standing economic exchanges) creates limitations for countries to capitalize on the otherwise comparative or location advantages; i.e., when trading partners comprise the same region. As in the ASEAN-China regional association (founded in 1967 by Indonesia, Malaysia, the Philippines, Singapore, and Thailand, principally to coordinate security policy during the Cold War, Association of Southeast Asian Nations (ASEAN) was significantly enlarged in the 1990s by the joining of low-income countries Cambodia, Laos, Myanmar and Vietnam. At a critical time of the Asian financial crisis (1997–1998), China and ASEAN forged a closer relationship. The two parties subsequently launched a currency swap initiative (the Chiang-Mai Initiative) and began negotiations on an ASEAN-China Free Trade Area (ACFTA), which entered into force in 2010), advantages in trade are likely held by the country which possesses the greater number of other competitive elements—access to natural resources that are restricted to competitors, highly skilled labor, access to new or proprietary technology, etc. (Zhang & Ow [1], Qin et al. [2], and Que et al. [3] report that the diversity between China and the ASEAN countries in terms of economic size, system and development strategy at country level is both a “pushing” force to stimulating the development of bilateral trade relations between these economies

and also a “resisting” force to limiting the trade expansion. The implementation of the Belt and Road initiative will offer opportunities for new complementarities and further reshape the patterns of trade, investment and infrastructure development in the region). In an environment of such homogeneous nature, it is expected that any gains resulting from comparative advantages, i.e., the production of an item more proficiently than another nation, are expected to be suppressed. Thereby fostering unsustainable long-term patterns of trade and suppressing the structural enhancement within the export sector of the disadvantaged country. Albeit, the formation of regional agreements can provide alternate means for countries to overlook these shortcomings to reach climatic levels of trade. Thus, the country which possesses these elements are likely to reap greater and more sustainable gains from trade.

Over the past decade, studies have attempted to explain the transitional changes in ASEAN trade with the Chinese economy, following the signing of the ASEAN-China Free Trade Agreement (ACFTA) (the framework agreement of the ACFTA was signed in November 2002, and the ACFTA was created in January 2010 aiming to build a strong economic partnership between ASEAN and China. In August 2014, ASEAN and China decided to upgrade the ACFTA). Assertions have been made that China possesses a direct influence on the export flows from amongst the ASEAN member countries. In 2004, Lall and Albaladejo [4] posited that, due to its climb up the global value chain, China will command the activities that have driven export growth thereby becoming a threat to East Asian economies.

Yet, Devadason [5] finds no supporting evidence that China has significantly affected the trade. The author, however, argues that while connections to China provide a better path for the growth of trade, ASEAN members are expected to remain relevant despite the ascendance of their larger Asian neighbor. This does not negate earlier findings, which suggest that ASEAN will likely face significant competition from Chinese suppliers within the durable product industries [4,6]. Furthermore, Park [7] alluded to evidence which suggests the significance and perseverance of an Asian exporter network to China is likely to persist. Arguably, the growth in China’s exports accelerated the exports of neighboring economies [8].

The purpose of this study is not to challenge or validate the comparative nominal growth in exports but to assess the sustainability of ASEAN exports into China since the implementation of the ACFTA from an export efficiency perspective by employing a stochastic gravity model framework. We define export efficiency as the gap between actual and potential export flow for each observation by following the popular idea of technical efficiency in production economics. According to Jomit [9], the potential export is the estimated maximum value of exports that may be attained using the most efficient trade policies observed (This definition offers no indication as to a country’s trade balance. Jomit’s efficiency is measured by the most optimal exports levels given existing conditions unadjusted). Given the importance of international trade in the economic development, it is critical for a nation to assess its export efficiency and potential for export growth in order to stress maximizing the potential gains from sustainable trade. This study will not only provide an enriched understanding of ASEAN’s efficiency performance and export pattern changes to China, but also suggest some policy measures to improve efficiency. In particular, this study addresses the question about if the ACFTA has resulted in an improvement in the efficiency performance of ASEAN exports to China.

Prior to and post the complete implementation of ACFTA, various studies have been conducted regarding its impact on the imports and exports of the member countries. Using various techniques of analysis—Computable General Equilibrium (CGE), Global Trade Analysis Project (GTAP), various trade and welfare indices, and the Gravity model—the bulk of studies conclude that both trade creation and diversion effects are impacts of the ACFTA [10–13]. The benefits of ACFTA are exclusive to member countries; however, whether from the perspective of either side of the border or a particular sector, both challenges and complementing factors are likely [14].

Previous studies also point to the potential increase in trade consequential to the ACFTA, albeit at the expense of trade with external trade partners [5]. However, this research begins with the unfamiliarity of previous research which sought to measure the efficiency of exports level with regards

to benchmark potentials, *ceteris paribus*. Under the ACFTA, earlier work of Tongzon [15] suggests that the provision of preferential market access helps the effectiveness of ASEAN exports to China when competing with developed countries in industries where China lacks a comparative advantage. Such unilateral/biased access to markets can lead to unsustainable long-run expectations. Can that be the region's outlook following ACFTA?

Not denying any positive economic impact from the FTA through exploits of economies of scale to some ASEAN member-states, Aslam [16] skeptically questions the size of the gains, contending that ACFTA does not ensure total gains to members and acknowledging that such trade gains arise can be derived under perfect competition (the traditional trade approach to regional integration assumes perfect competition in markets, which focuses on the implications of forming a region for a static allocation of resources) due to the re-allocation of domestic resources in line with a country's comparative advantage. In a group of countries with similar structures of production and exports, only countries with lower production cost will gain from trade; leading to an ultimate reduction in real export revenue in countries with lesser advantages [16]. Recent studies on market integration, which allow for imperfect competition (in imperfectly competitive markets, where firms can set prices, there may be collective gains if regional integration makes it possible to shift rents away from nonmember countries. These rents exist if firms can exercise market power and price above marginal cost. Forming a regional agreements increases the amount of competition in the market and this affects all firms that will find their ability to extract these rents eroded. Not only market power but also bargaining power can be increased by forming a regional trade agreements), economies of scale, and product differentiation, argue the pro-competitive effects of larger markets rather than comparative advantage [17]. The business of international trade has never been identified as zero-sum. However, maximizing gains while reducing costs incurred will always be the benchmark in measuring the worthiness of any agreement to parties involved.

This study contributes to the literature in two main facets: by estimating untapped export potential shares of ASEAN suppliers in the Chinese market, and making rational comparisons between actual and potential export shares, in pre and post ACFTA eras, deepening the insight into ASEAN gains or limitations from the ACFTA. The paper utilizes data between 2000 and 2018, which provides a complete scenario of ASEAN's integrated free trade association with China.

The rest of the paper is structured as follows: Section 2 provides an overview of the ASEAN-China exports relation. This is followed by a detailed description of the analytical methodology in Section 3. Empirical findings are discussed in Section 4, with rational conclusions in the final Section 5.

## 2. Export Performances

Economists continue to write extensively on the significance of exports to economic development. Following an analysis of low and middle developing countries, Kavoussi [18] revealed a strongly positive correlated effect between high economic growth and high rates of growing exports. However, the author also alluded to a likely diminishing impact according to the countries' state of development. The study by Tingwall and Ljungwall [19] supports the view, with empirical evidence from an export-led growth hypothesis, that exports contribute more to China's economic growth than in other countries. Therefore, this section provides a critical analysis of ASEAN's export performance, particularly to China, and its significance to development.

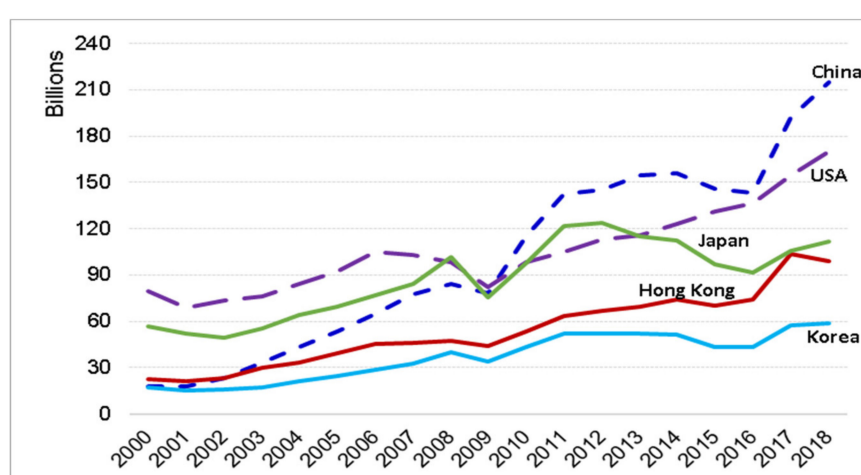
Despite individual differences, trade represents an integral component to the development and growth of ASEAN economies, as shown in Table 1. In one-half of the region's members, trade exceeds 100% of the country's GDP, led by Singapore (326.2%) by 2018. Notably, in that year's list of ASEAN extra-regional trade partners, China surpasses all others. USA, Japan, Hong Kong, and then Korea completed the top five individual countries. Evidence of the region's significant growth with China compared with individual countries is illustrated in Figure 1. After 2004, hyper-growth in trade with China was later dampened at the height of the 2008 crisis—a worldwide phenomenon. This represented a time where the regions excelled in price competition. Yet, this trade relationship

immediately rebounded to an upward trajectory a year later. The growth in exports beyond China displays no significant adverse impacts, providing preliminary insights into the sustainability of an ASEAN-China enhanced trade relationship. This is also contrary to previous assumptions that exports of all Asian economies are dependent on strong global growth.

**Table 1.** ASEAN Trade as % of GDP and Growth rate.

ASEAN Members	GDP Growth (%)					Trade (% of GDP)				
	2000	2005	2010	2015	2018	2000	2005	2010	2015	2018
Brunei Darussalam	2.8	0.4	2.6	−0.6	0.1	103.2	97.5	95.4	84.9	93.9
Cambodia	10.7	13.3	6.0	7.0	7.5	110.9	136.8	113.6	127.9	124.9
Indonesia	4.9	5.7	6.2	4.9	5.2	71.4	64.0	46.7	41.9	43.0
Lao PDR	5.8	7.1	8.5	7.3	6.2	68.8	71.8	84.7	85.8	-
Malaysia	8.9	5.3	7.4	5.1	4.7	220.4	203.9	157.9	131.4	130.5
Myanmar	13.7	13.6	9.6	7.0	6.2	1.2	0.3	34.7	47.4	-
Philippines	4.4	4.8	7.6	6.1	6.2	104.7	97.9	71.4	62.7	76.1
Singapore	9.0	7.4	14.5	2.9	3.1	364.4	420.4	369.7	329.5	326.2
Thailand	4.5	4.2	7.5	3.1	4.1	121.3	137.9	127.3	125.9	123.3
Vietnam	6.8	7.5	6.4	6.7	7.1	111.4	130.7	152.2	178.8	208.3

Source: The World Bank Online Databank—May 2020.



**Figure 1.** ASEAN Export Flow to Top 5 Destinations (2000–2018).

In 2000, the total value of commodity imports and exports between China and ASEAN was USD 36.2 billion, which ranked fifth in China's trade-values with major trading partners. According to CEPII, China's total value of imports from, and exports to, ASEAN stood at USD 531.6 billion. This followed significant annual growth during the periods 2002 to 2007, 2010, and 2011. These figures hint that the sustainable strength between these free trade members continues to increase, which could potentially be a result of the ACFTA. In 2018, China stood as ASEAN's largest trading partner (for both imports and export—see Figure 2) following the region's domestic trade while ASEAN was China's third-largest trading partner, behind the USA and the 28-member EU collective.

During the period 2000 to 2018, ASEAN exports to China increased exponentially year by year, up from USD 17.6 billion to USD 214.7 billion. The largest growth was recorded in 2010, an increase of 46.7% over the previous year; an increase similar to 44.8% recorded in 2000. An effect of the global financial crisis resulted in declined exports in 2009 by 6.9% (USD5.8 billion less), to Chinese consumers. In 2010, China-ASEAN Free Trade Area fully enactment deadline, ASEAN's exports to its partner rebounded with USD 114.9 billion, followed by a subsequent increase of 23.9% in 2011. Though with more modest rates, ASEAN export growth to China continued on an upward trajectory, and was a strong reminder of ASEAN's importance as an exporter to China. From an import perspective,

similar growth trends were exhibited (see Table 2). The value of imports originating from the Chinese mainland grew from USD 18.6 billion in 2000 to reach USD 316.8 billion in 2018; 47.5% larger than total exports.

**Table 2.** ASEAN Member-States Exports to China and the World (2000, 2005, 2010, 2015, 2018).

	<sup>1</sup> Exports to World (US\$B)					<sup>2</sup> Exports to China (US\$B)					Share of Exports to China (%)				
	2000	2005	2010	2015	2018	2000	2005	2010	2015	2018	2000	2005	2010	2015	2018
Brunei Darussalam	3.9	6.2	8.9	6.4	6.6	0.06	0.19	0.60	0.09	0.24	1.4	3.0	6.8	1.5	3.7
Cambodia	1.4	3.1	5.1	8.5	12.7	0.06	0.04	0.13	0.71	1.35	4.4	1.2	2.6	8.3	10.7
Indonesia	65.4	87.0	157.8	150.4	180.2	3.24	7.13	16.50	16.10	28.10	4.9	8.2	10.5	10.7	15.6
Lao PDR	0.3	0.6	1.7	3.7	5.3	0.00	0.01	0.73	1.45	1.61	0.7	2.5	41.6	39.8	30.4
Malaysia	98.2	141.6	198.6	200.0	247.5	3.13	9.61	26.40	27.90	36.10	3.2	6.8	13.3	14.0	14.6
Myanmar	1.6	3.8	8.7	11.4	16.7	0.04	0.07	0.77	4.64	4.93	2.7	2.0	8.9	40.6	29.6
Philippines	38.1	41.3	51.5	58.8	69.3	1.09	7.52	8.97	10.90	13.30	2.9	18.2	17.4	18.5	19.2
Singapore	137.8	229.6	351.9	351.6	413.0	5.31	16.80	32.10	43.20	44.30	3.8	7.3	9.1	12.3	10.7
Thailand	69.0	110.9	193.3	214.3	253.0	3.16	9.34	22.00	24.50	31.00	4.6	8.4	11.4	11.4	12.3
Vietnam	14.5	32.4	72.2	162.1	243.7	1.51	2.78	6.67	16.50	53.80	10.4	8.6	9.2	10.2	22.1

Source: <sup>1</sup> The World Bank Online Databank—May 2020. <sup>2</sup> CEPII Online Database—May 2020.

Exports originating from ASEAN member states have all grown exponentially, both towards China and the rest of the world. However, the growth in demand by the Chinese economy surpassed that of the rest of the world. In 2018, China's share of each member nation's export expanded at least 2.5 times when compared with 2000, excluding Vietnam. Prior to and following the ACFTA, Vietnam maintained a high dependence on the Chinese consumer for its export revenue (see Table 3).

**Table 3.** Model variables.

Variable	Observations	Mean	Std. Dev.	Min	Max
trdValue—bilateral export value (US\$ exports)	7,326,504	23323.76	458626.6	0	$1.55 \times 10^8$
lntrdValue—trdValue in natural log form (used in Ordinary Least Squares (OLS) technique)	7,326,504	4.568809	3.496805	0	18.86088
lnDistance—geographical distance trading countries (i and j), in kilometers	7,180,409	8.695605	0.8054378	4.107106	9.894045
dContig—trading countries (i and j) are contiguous	7,180,409	0.0315982	0.1749279	0	1
dLang—trading countries (i and j) share a common official language	7,180,409	0.1659112	0.3720009	0	1
dColony—trading countries (i and j) ever had a colonial link	7,180,409	0.0471064	0.2118664	0	1
dComcol—are currently in a colonial relationship	7,180,409	0.0575785	0.2329446	0	1
* dOFTA—country i possess a Free Trade relationship with country j, exclusive to the ACFTA	7,326,504	0.0104268	0.101578	0	1
* dACFTA—ASEAN country and China free trade agreement—ACFTA from year of signature	7,326,504	0.000243	0.0155851	0	1
dACFTA_after2010—ASEAN and China trade agreement after full enactment year of 2010	7,326,504	0.0019776	0.0444264	0	1
* dPSA—country i possess a Preferential System of Trade relationship with country j	7,326,504	0.0062267	0.0786634	0	1

\*—Variable lagged for 5 consecutive one-year periods.



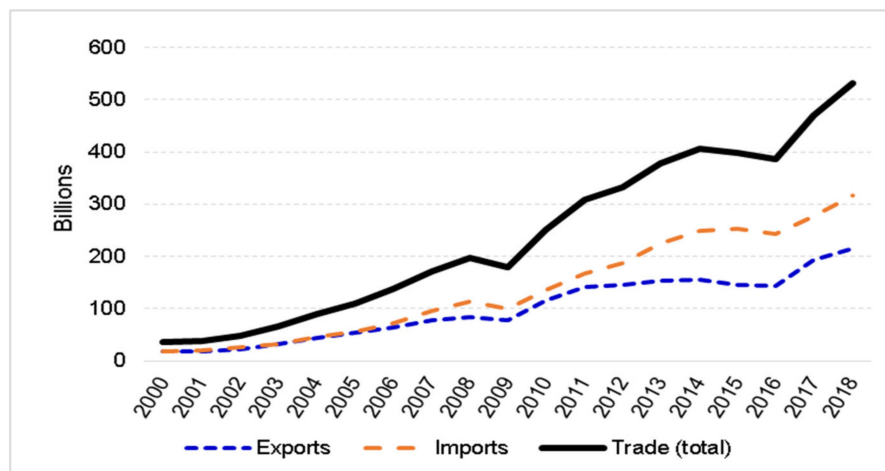


Figure 2. ASEAN Import and Exports with China (2000–2018), USD.

### 3. Method of Analysis

#### 3.1. Gravity Model

The gravity model continues to build and maintain a long history of evaluating bilateral trade patterns between geographical locations [20–22]. It was the work of Tinbergen that pioneered a series of applications in the early 1960s [23]. The original gravity model takes the form:

$$\text{Trade}_{ij} = \alpha \left( \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{\text{Dist}_{ij}^{\beta_3}} \right) \quad (1)$$

where  $i$  denotes the exporter, and  $j$ , the importer. The variable  $\text{Trade}_{ij}$  represents the volumes of bilateral trade flows, that is, the sum of exports and imports between partners  $i$  and  $j$ :  $\alpha$  is the proportionality constant term.  $\text{Dist}_{ij}$  represents the geographical distance between partners  $i$  and  $j$ .

Despite its frontier approach, this initial form of the model lacked a convincing microeconomic foundation. It was work by Anderson [24] that filled the void regarding microeconomic theory. The author provided quantitative support to gravity model by applying the Cobb-Douglas production function and Constant Elasticity Substitution, under the assumption that products are differentiated by region, known as the ‘Armington Assumption’ [25,26]. Ignoring price discrimination, Anderson explained that the share that country  $j$  expenditure on exports from  $i$ ,  $\phi_i$ , is equal for all  $j$  (i.e.,  $E_i$  varies only with  $\phi_i$ ). Country  $i$ ’s exports to  $j$ :

$$T_{ij} = \phi_i \alpha_j Y_j \quad (2)$$

Assuming tradable goods market equilibrium where

$$\phi_i Y_i = \alpha_j \sum_j Y_j \quad (3)$$

Thus:

$$T_{ij} = \frac{Y_i \phi_i Y_j \phi_j}{\sum_i \sum_j T_{ij}} = \frac{Y_i \phi_i Y_j \phi_j}{\sum_j Y_j \phi_j} \quad (4)$$

If  $T_{ij}$  is expressed as a function of income and population (and other factors), adding an error term and a constant, (Equation (4)) is expressed as follows (already a simple variant of the gravity model in which economic masses determine the trade flows, Anderson, through gradual modification, added the transportation cost,  $T_{ij}$ ):

$$T_{ij} = C \frac{Y_i f(Y_i, N_i) Y_j f(Y_j, N_j)}{\sum_j Y_j f(Y_j, N_j)} \varepsilon_{ij} \quad (5)$$

Assuming a linear form of  $f()$ , and replacing the denominator with  $Y_w$  (world trade income), yields:

$$T_{ij} = \left( \frac{C}{Y_w} \right) Y_i^{\beta_1} N_i^{\beta_1} Y_j^{\beta_2} N_j^{\beta_2} \varepsilon_{ij} \quad (6)$$

Following further contributions from Bergstrand [27–29] (Bergstrand [27–29] develops a relationship between trade theory and bilateral trade, and includes the supply side of the economy explicitly) to the gravity model, Anderson and van Wincoop [30] has become the main reference for subsequent work on the gravity (Equation (6)). Here, a simplified derivation of the model outlined by Baier and Bergstrand [30] will be used to derive the model for this analysis.

Assume a sum of  $N$  countries with  $M$  varieties of goods. All consumers have identical constant-elasticity-of-substitution (CES) preference:

$$U_j = \left[ \sum_{i=1}^N C_{ij}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad j = 1, \dots, N \quad (7)$$

where  $U_j$  the utility of consumers in country  $j$ ,  $C_{ij}$  is the good consumed by people in country  $j$  imported from country  $i$ ,  $\sigma$  is the elasticity of substitution between “varieties”— $\sigma > 1$ ;  $N$  is the number of nations. Note that varieties are defined symmetrically, which allows us to ignore a variety index. Maximizing utility subject to a budget constraint can derive the demand for the good consumed in country  $j$  import from country  $i$ ,  $T_{ij}$ .

$$T_{ij} = \left( \frac{p_i \tau_{ij}}{P_j} \right)^{1-\sigma} Y_j \quad (8)$$

Here,  $p_i$  is the mill price of a variety of goods in country  $i$  (after transportation the price in market  $j$  becomes  $P_{ij} = p_i \tau_{ij}$ ),  $\tau_{ij}$  is the transportation cost, also referred to as the iceberg trade cost, for good shipped to country  $j$  from  $i$ .  $Y_j$  is country  $j$ 's income, and  $P_j$  is the price index associated with the CES demand structure:

$$P_j = \left[ \sum_{i=1}^N (p_i \tau_{ij})^{(1-\sigma)} \right]^{1/(1-\sigma)} = \left[ \sum_{i=1}^N P_{ij}^{(1-\sigma)} \right]^{1/(1-\sigma)} \quad (9)$$

where  $P_{ij}$  represents the price of goods produced in country  $i$  and sold in country  $j$ . Under the assumption that all goods are traded, allowing for the total output of country  $i$ ,  $Y_i$ , to equal total sales to all destination countries  $j$  (i.e., markets clear), we can write an expression for bilateral trade flow as:

$$T_{ij} = \left( \frac{\tau_{ij}}{\pi_i P_j} \right)^{1-\sigma} \left( \frac{Y_i Y_j}{Y_w} \right) \quad (10)$$

$$\pi_i = \left[ \sum_{j=1}^N (\theta_j / \tau_{ij}^{\sigma-1}) P_j^{1-\sigma} \right]^{1/(1-\sigma)} \quad (11)$$

$$P_j = \left[ \sum_{i=1}^N (\theta_i / \tau_{ij}^{\sigma-1}) \pi_i^{1-\sigma} \right]^{1/(1-\sigma)} \quad (12)$$

Note that  $\theta_i = Y_i / Y_w$ , while  $\pi_i$  represents what Anderson and van Wincoop [30] coined as the “multilateral resistance” term (multilateral resistance variables are crucial to understanding the effects of border barriers on bilateral trade [30]), which captures the  $N$ -body properties of the trade network. The authors noted that when influence trade is estimated, it is critical to include both inward and outward multilateral resistances into the regression.



Converting to a linear form, we get (this measures relationship between trade flow on the left side and trade cost, multilateral resistance, and GDP on the right side with in some time period):

$$\ln(T_{ij}) = (1 - \sigma) [\ln(\tau_{ij}) - \ln(\pi_i) - \ln(P_j)] + \ln(Y_i) + \ln(Y_j) + \ln(Y_w) \quad (13)$$

When trade incurs across some  $t$  periods, (Equation (13)) can be presented as:

$$\ln(T_{ijkt}) = (1 - \sigma) [\ln(\tau_{ijkt}) - \ln(\pi_{ikt}) - \ln(P_{jkt})] + \ln(Y_{it}) + \ln(Y_{jt}) + \ln(Y_{wt}) \quad (14)$$

As with preceding gravity (Equations (1)–(14)), trade cost contains both time-invariant variables and those that vary with time. Including these differentiated variables, fixed effects (both importer-year and exporter-year) (used to control for unobserved multilateral resistance [31] and ensure the theoretical restrictions implied by structural gravity, these time-variant fixed effects will absorb the inward/outward multilateral effects, importer's GDP, exporter's GDP, and world GDP. Note that the pair effects absorb all time-invariant pairs, which are usually found to be correlated with other time-invariant trade cost and are excluded from the model) and an error term  $\mu$ , disaggregated at an industry level, we get:

$$\ln(T_{ijkt}) = \beta_0 + \beta_1 \ln(Y_{it}) + \beta_2 \ln(Y_{jt}) + \beta_3 \ln(d_{ijk}) + \delta * TA_{ijkt} + FE_{ikt} + FE_{jkt} + FE_{ijk} + \mu_{ijkt} \quad (15)$$

Here,  $TA_{ijkt}$  capture bilateral trade agreements, in dichotomous form, that may exist between countries.  $FE_{ikt}$  is the exporter-year is fixed effects,  $FE_{jkt}$  is the importer-year fixed effect, while  $FE_{ijk}$  represents the cross-country pair effects (Anderson and van Wincoop [30] states implicitly that (Equation (14)) may yield biased estimates without the inclusion of implicit price indexes that are hard to measure empirically. Feenstra [32] proposes to control for implicit price indexes by exporter and importer fixed effects and include a parametric control similar to [33]).

### 3.2. Model Selection

In their recent survey of empirical works, Head and Mayer [34] highlight the economic foundation in the use of gravity model in a structural form; pointing to improve discoveries on the consequences of various aspects of trade patterns and development of economies over time. According to the authors, the enhanced value of the structural form is attributed to the characterization of the distribution across source-destination pair effects.

The structured gravity model (Equation (16)) used for the first stage in this paper to examine factors that affect trade exports and estimate exports potential  $\widehat{est\_exp}_{ijkt}$  is therefore inclusive of both time-variant and pair effects. The specification is as follows:

$$\widehat{est\_exp}_{ijkt} = \alpha_0 + \sum_{h=1}^3 \hat{\delta}_h TA_{ijkt-h} + FE_{ikt} + FE_{jkt} + \mu_{ijkt} \quad (16)$$

The second stage, to uncover the reachable export pace of the ASEAN nations, includes (Equation (17)). Here the dependent variable is logged only under the OLS estimation technique, which has been used in this research as a model stability benchmark due to the linear approach:

$$\begin{aligned} \text{export efficiency}(EE\_wA) &= \frac{\sum \widehat{exp}_{ijkt}}{(\text{actual}) \sum exp_{ijkt}} \\ \text{export effeciency}(EE\_nA) &= \frac{\sum \widehat{exp}_{ijkt-ACFTA}}{(\text{actual}) \sum exp_{ijkt}} \\ \text{agreement efficiency effect (AEE)} &= \frac{\sum \widehat{exp}_{ijkt-ACFTA}}{\sum \widehat{exp}_{ijkt}} \end{aligned} \quad (17)$$

Export efficiency  $> 1$  implies the existence of export space; thereby possibilities exist for the expansion of exports, to the Chinese market. A value below 1 is indicative of a trading environment which has surpassed expectations.

Acknowledging issues of zero trade and heteroscedasticity, if unaccounted could lead to biased results, and the significant rise in popularity in academic literature [35], this research's chosen technique of estimation is Poisson Pseudo Maximum Likelihood (PPML) Structured Panel (unlike linear estimators, PPML does not assume homoscedasticity and it remains valid under general forms of heteroscedasticity—dependent variable not logged). However, to add a measure of comparable stability to the expected coefficients, the OLS operator adopted by Guimaraes and Portugal [36] was included, using the same underlying specification.

#### 4. Data, Results, and Discussion

##### 4.1. Data

Capturing the lead trading partners of ASEAN, this paper analyses the value of bilateral exports for 46 countries (Country list includes: ARE-United Arab Emirates; ARG-Argentina; AUS-Australia; BEL-Belgium; BRA-Brazil; BRN-Brunei Darussalam; CAN-Canada; CHE-Switzerland; CHL-Chile; CHN-China; COL-Colombia; CRI-Costa Rica; DEU-Germany; ESP-Spain; FRA-France; GAB-Gabon; GBR-United Kingdom; HKG-Hong Kong; IDN-Indonesia; IND-India; ITA-Italy; JPN-Japan; KAZ-Kazakhstan, KGZ-Kyrgyzstan; KHM-Cambodia; KOR-Rep. of Korea; LAO-Lao People's Dem. Rep.; LBR-Liberia; MEX-Mexico; MMR-Myanmar; MUS-Mauritius; MYS-Malaysia; NLD-Netherlands; NOR-Norway; NZL-New Zealand; PAK-Pakistan; PAN-Panama; PHL-Philippines; PRT-Portugal; RUS-Russian Federation; SGP-Singapore; THA-Thailand; USA-USA; UZB-Uzbekistan; VEN-Venezuela; VNM-Vietnam) over the period 2000–2018; taken from the CEPII online BACI database (data can be obtained from [http://www.cepii.fr/CEPII/en/bdd\\_modele/presentation.asp?id=37](http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=37)). Using the UN Harmonized Commodity Description and Coding Systems (HS) and disaggregated at the second level, trade information for 97 industries (Table A1) was assimilated according to the imports (corresponding exports) of each country for each corresponding partner (i.e., recorded import values of a partner country will represent the export values of the exporter and vice versa. Notably, the trade values are inclusive of the Cost, Insurance, and Freight tax, which accounts for some of the cost associated with international trade) on the list; measured in units of US dollar. Currency inflation will be captured through the importer-year and exporter-year fixed effects model inclusion. Data used to capture cost associated with geography, which many authors refer to as traditional trade cost, is also taken from the CEPII database (data can be obtained from [http://www.cepii.fr/CEPII/en/bdd\\_modele/bdd.asp](http://www.cepii.fr/CEPII/en/bdd_modele/bdd.asp)), while information on recent trade agreements is acquired through the WTO Regional Trade Agreement database (data can be obtained from [https://www.wto.org/english/tratop\\_e/region\\_e/region\\_e.htm](https://www.wto.org/english/tratop_e/region_e/region_e.htm)). See Table 3 for the full list of variables used in this analysis, with additional descriptive statistics.

Data quality is a significant contributor to any regression's outcome; yet, the treatment of zero or missing trade has long been and remains a contentious issue of debate, see Santos Silva and Tenreyro [37]. Haveman and Hummels [38] emphasize the appearance of zero trade is a common phenomenon in a trade matrix, as the minority of countries trade all products. The level of disaggregation data use expectedly captures a significant number of missing trade flows (i.e., zeros). Therefore, the authors propose an estimation technique where missing trade values are assumed to take a value of zero—a possible compensation for observation error when the flow is very small [29]. Additionally, Helpman, Melitz, and Rubinstein [39] suggest that zero trade is a practical result when an exporting country is below necessary productive levels to serve a foreign market.

##### 4.2. Estimate Results

Displayed in Table 4 are the regression results used to project potential exports value between partnering trading nations. To reduce the possibilities of spurious results, and a measure of robustness

evaluation, the sampled (in each test the sample size exceed seven million) control variables were tested across varying model specifications prior to the final approach being selected. Moving from the parsimonious to the more detailed specification, using the two techniques of analysis and controlling for time-variant effects, columns one through four contains the results of all preliminary tests. From the results presented, the level of consistency in variable outcomes in the level of significance and direction of expected impact ensures the appropriateness of the model selection, primarily through the estimated control variables. Ultimately, the results confirm that distance, contiguity, common language, direct colonial relationships past and present, regional agreements, and the impact of external shocks such like the global crisis are significant to the flow of commodity exports between countries.

Confirmed throughout the model evaluations in columns one to four using both techniques, the control variables identified as bilateral trade (distance, contiguity, language, and other colonial relationship variables) and multilateral (regional agreements) cost variables are consistent with that of previous researchers. However, results from the first PPML regression indicate adverse effects on commodity exports between a country and its colonial master. However, the opposite is consistent across all other test and techniques.

It is worthy of note that results confirm that the initial impact of the global financial crisis, which originated in the West, provided a boost to commodity exports of the sample countries (see Appendix A for additional regression results). The increase in export flow across the ASEAN region to its leading destinations during 2008 suggests a measure of rather than a lack of global integration of the region's financial systems. Further, the region may be seen as an unconfirmed source haven during a crisis period, arguably for its known comparatively cheaper products.

The final PPML and preferred estimation model approach extends to further capture existing country-pair relationships that influence the flow of trade—including both time-variant and invariant fixed effects. Consistent with World Bank's [40] research on regional agreements effect on trade, free trade agreement may ultimately impose negative impacts on the flow of trade exports. Additionally, where significant, the annual direct impacts of the following regional agreement are as expected. The multilateral resistance at the industry level are captured Exporter-Industry-Time FE and Importer-Industry-Time FE. To ensure the robustness of the results, we adopted a second estimation approach presented in Appendix B.

#### 4.3. Export Potential

In the second stage of the analysis, the export potentials of industries are calculated to assess the level of deviation, by partnering nations. At the aggregate level, estimates imply very little fluctuation in export-flows between actual and potential from the ASEAN members into China. Using five interval years of 2000, 2005, 2010, 2015, and 2018, the region's exports performance remains relatively efficient with measurement mostly approximating values of 1.0. No clear effects of the ACFTA can be extrapolated from the years following the initial signing (2004) or the full enactment (2010). Ultimately, any adjustment to the trade patterns of ASEAN member has been marginal variation from the expected trade in the absence of the ACFTA. Thus, the agreement itself offers positives to the trade performance of signatories (see Figure 3 and Table 5). Compared with the values of 2000, the 2018 efficiency exports of all ASEAN members to China indicated improvements, excluding Brunei. Worthy of note are the sizeable improvements demonstrated by the Philippines, Cambodia, Lao, Myanmar, Malaysia, and Vietnam under the ACFTA, with the remaining member-countries exhibiting consistent patterns of efficiency.

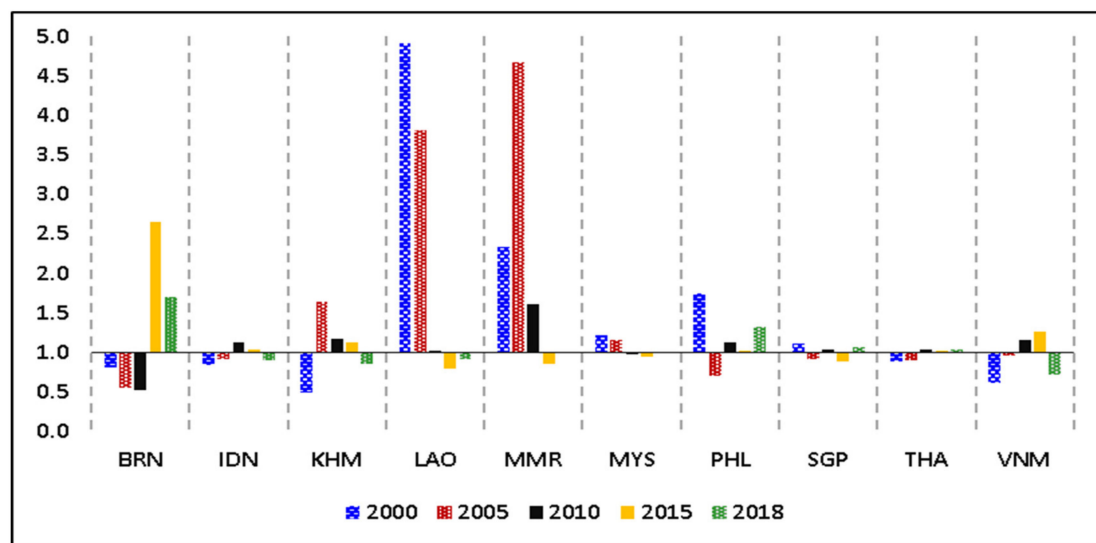
Table 4. Regression Results.

Variables	PPML (Structured)				OLS (Robust)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Distance	−0.792 *** (0.00360)	−0.793 *** (0.00365)	−0.789 *** (0.00365)		−1.571 *** (0.000965)	−1.565 *** (0.000973)	−1.554 *** (0.000990)	
dContiguity	0.700 *** (0.00991)	0.691 *** (0.00999)	0.683 *** (0.00995)		0.492 *** (0.00508)	0.495 *** (0.00508)	0.495 *** (0.00507)	
dLanguage	−0.00328 (0.00970)	0.00307 (0.00982)	0.00685 (0.00985)		0.576 *** (0.00215)	0.578 *** (0.00215)	0.583 *** (0.00215)	
dColony	0.155 *** (0.0126)	0.159 *** (0.0126)	0.170 *** (0.0125)		1.348 *** (0.00363)	1.349 *** (0.00363)	1.345 *** (0.00361)	
dComColony	−0.148 *** (0.0284)	−0.152 *** (0.0286)	−0.140 *** (0.0283)		0.689 *** (0.00348)	0.686 *** (0.00348)	0.682 *** (0.00347)	
dACFTA		0.0941 (0.0580)	0.0988 (0.0571)	0.0181 (0.0311)		−0.123 ** (0.0420)	−0.128 ** (0.0420)	−0.0789 ** (0.0259)
dACFTA_I1			0.0441 (0.0553)	−0.0128 (0.0305)			−0.0818 (0.0425)	−0.0467 (0.0255)
dACFTA_I2			0.0134 (0.0531)	−0.0643 * (0.0281)			−0.0760 (0.0435)	−0.114 *** (0.0256)
dACFTA_I3			0.0765 (0.0528)	−0.0663 * (0.0282)			−0.0813 (0.0431)	−0.212 *** (0.0241)
dACFTA_I4			0.0306 (0.0536)	−0.0618 * (0.0250)			−0.165 *** (0.0434)	−0.215 *** (0.0249)
dACFTA_I5			−0.0341 (0.0560)	−0.0991 *** (0.0251)			−0.0709 (0.0416)	−0.115 *** (0.0248)
dACFTAafter2010		−0.0558 ** (0.0200)	−0.0601 ** (0.0200)	−0.0699 *** (0.0175)		−0.246 *** (0.0146)	−0.258 *** (0.0146)	−0.0984 *** (0.00957)
dOFTA		0.715 *** (0.0371)	0.526 *** (0.0480)	0.210 *** (0.0159)		0.764 *** (0.00923)	0.635 *** (0.0112)	0.138 *** (0.00628)
dOFTA_I1			0.357 *** (0.0472)	0.138 *** (0.0158)			0.545 *** (0.0122)	0.109 *** (0.00702)
dOFTA_I2			0.303 *** (0.0441)	0.0309 * (0.0137)			0.615 *** (0.0112)	0.0679 *** (0.00653)
dOFTA_I3			0.452 *** (0.0622)	0.0370 * (0.0173)			0.703 *** (0.0144)	0.0919 *** (0.00821)

Table 4. Cont.

Variables	PPML (Structured)				OLS (Robust)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
dOFTA_14			0.350 *** (0.0697)	0.0365 (0.0192)			0.477 *** (0.0158)	0.0557 *** (0.00921)
dOFTA_15			0.238 *** (0.0668)	−0.0505 ** (0.0174)			0.462 *** (0.0160)	0.0170 (0.00938)
dPSA		−0.430 *** (0.0482)	−0.330 *** (0.0580)	−0.139 *** (0.0194)		−0.495 *** (0.0123)	−0.474 *** (0.0142)	−0.121 *** (0.00811)
dPSA_11			−0.103 (0.0617)	−0.0636 ** (0.0203)			−0.418 *** (0.0155)	−0.0810 *** (0.00889)
dPSA_12			−0.0682 (0.0644)	0.0406 * (0.0203)			−0.509 *** (0.0151)	−0.0584 *** (0.00878)
dPSA_13			−0.261 *** (0.0768)	0.0502 * (0.0240)			−0.716 *** (0.0178)	−0.0836 *** (0.0103)
dPSA_14			−0.165 * (0.0757)	−0.00885 (0.0231)			−0.474 *** (0.0190)	−0.0396 *** (0.0113)
dPSA_15			0.0478 (0.0712)	0.0817 *** (0.0207)			−0.398 *** (0.0189)	−0.0194 (0.0112)
Constant					18.04 *** (0.00845)	17.98 *** (0.00852)	17.88 *** (0.00869)	4.567 *** (0.000471)
Observations	7,162,146	7,162,146	7,162,146	7,306,539	7,180,409	7,180,409	7,180,409	7,326,504
R-squared	0.869	0.869	0.870	0.988	0.691	0.692	0.692	0.872
Exporter-Industry-Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Importer-Industry-Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Exporter-Importer-Industry FE	No	No	No	Yes	No	No	No	Yes

Standard errors in parentheses. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .



**Figure 3.** Results: Individual ASEAN Member Export Efficiency with China (2000, 2005, 2010, 2015, and 2018).

Figure 4 presents the efficiency patterns of the nine (9) largest exporting industries as of 2018. Ranked by least efficient: 84-Nuclear reactors, boilers, machinery, and mechanical appliances; 27-Mineral fuels, mineral oils, and products of their distillation; 15-Animal or vegetable fats and oils, and their cleavage products; prepared animal fats; 40-Rubber and articles thereof; 26-Ores, slag, ash; 85-Electrical machinery and equipment, and parts thereof; 90-Optical, photo, and cinematographic, measuring, medical, and surgical instruments; 29-Organic chemicals; 39-Plastics and articles thereof. By 2018, the efficiency of exports of these industries to China showed improvements, excluding 39-Plastics and articles thereof and 84-Nuclear reactors, boilers, machinery, and mechanical appliances. Appendix A provides a comprehensive list of all categorized exports within the sample data. Export commodities categorized by industries also indicated efficient (or increasingly efficient) exporting patterns to the Chinese market. Notably by 2018, 65 of the 96 listed industries showed improved export efficiency as a result of the ACFTA, when compared with an estimate void of an agreement. These improvements, both at the country-level and industry-level are expected to be beneficial for a sustainable trade relation between China and ASEAN in the long run.

A more in-depth analysis of individual member states reveals a slightly alternate view in performance. For most individual member exports, though indicative of fluctuations over time, deviations from potential level are minimal by 2018; this excludes Brunei Darussalam. Notwithstanding earlier periods in ASEAN, China trade relations where the country appears in a state of substantial over-trading with the Chinese economy, export performance remains fluid. The year 2018 was another significant period in Brunei Darussalam-China exports. Though a better performance relative to the efficiency of exporting in 2015, the country remains 72% below its potential. The size of commodities trade between this individual country and China is among the lowest across members, despite the possibilities for increased gains. It is worthy to acknowledge the continuous improvement displayed in exports originating from within the Lao People's Democratic and Myanmar. Similar results are depicted in Figure 2.

Combined results of this research indicate that though some adjustments to export flows have been realized in member states, the impact of the ACFTA compared with earlier years offers indicative improvements to commodity export optimality from within ASEAN towards the Chinese market. These results do not nullify any increases in nominal value as a consequence of the ACFTA. Yet, signs show that China's existing trade relationship with ASEAN fosters an unhampered environment for commodity exports, contradicting the warnings of some researchers in the context of sustainable export efficiency.



**Table 5.** Results: ASEAN Export Efficiency with China (2000, 2005, 2010, 2015, and 2018).

	2000			2005			2010			2015			2018		
	EE_wA	EE_nA	AEE	EE_wA	EE_nA	AEE	EE_wA	EE_nA	AEE	EE_wA	EE_nA	AEE	EE_wA	EE_nA	AEE
Brunei Darussalam	0.75	0.75	1.00	0.54	0.49	0.907	0.48	0.49	1.021	2.71	2.51	0.926	1.72	1.59	0.924
Indonesia	0.78	0.78	1.00	0.90	0.82	0.911	1.05	1.08	1.029	1.06	0.97	0.915	0.92	0.85	0.924
Cambodia	0.46	0.46	1.00	1.62	1.48	0.914	1.08	1.11	1.028	1.13	1.04	0.920	0.85	0.79	0.929
Lao People's Dem	4.86	4.86	1.00	3.47	3.17	0.914	0.98	1.01	1.031	0.79	0.73	0.924	0.92	0.85	0.924
Myanmar	2.17	2.17	1.00	4.57	4.17	0.912	1.51	1.56	1.033	0.86	0.80	0.930	1.01	0.93	0.921
Malaysia	1.15	1.15	1.00	1.16	1.06	0.914	0.90	0.93	1.033	0.97	0.90	0.928	1.01	0.94	0.931
Philippines	1.65	1.65	1.00	0.70	0.64	0.914	1.05	1.08	1.029	1.05	0.97	0.924	1.36	1.25	0.919
Singapore	1.04	1.04	1.00	0.92	0.84	0.913	0.96	0.99	1.031	0.90	0.83	0.922	1.09	1.01	0.927
Thailand	0.83	0.83	1.00	0.90	0.82	0.911	0.97	1.00	1.031	1.04	0.96	0.923	1.06	0.98	0.925
Vietnam	0.57	0.57	1.00	0.94	0.86	0.915	1.08	1.11	1.028	1.28	1.18	0.922	0.72	0.66	0.917

Note: EE\_wA—Export Efficiency based on current ACFTA effects; EE\_nA—Export Efficiency void of ACFTA; and AEE—Export efficiency (gap) resulting from ACFTA (agreement vs. no agreement).

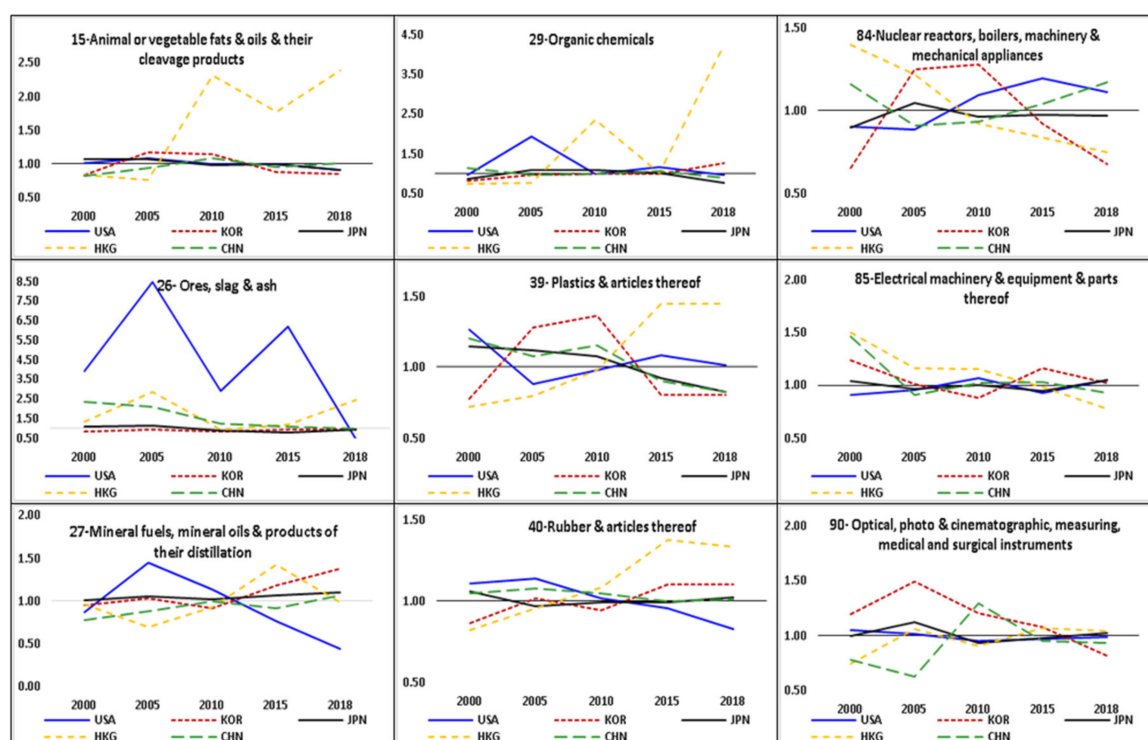


Figure 4. Export Flow of ASEAN Top Nine Exporting Industries (to leading export destinations).

Finally, Table 6 displays estimates of export potential for other selected trading partners (Hong Kong, Japan, Korea, and the USA). Results suggest no lasting impacts on export performance for ASEAN countries. Some exporting nations like Brunei Darussalam and Myanmar (towards the USA) displayed significant declines across isolated periods (2010); however, both countries rebounded by 2015. By 2018, all member states were exporting at more efficient (or similar) levels. Comparing export efficiency across the region's major partners, exports toward the Chinese market is now amongst the most optimal; ensuring greater stability and importance to the ASEAN-China partnership. Thus, any increased deviation away from optimal levels (export efficiency values below/above unity) presents unsustainable long-term challenges. The findings ultimately challenge Tongzon's [15] and Devadason's [5] inferences of a free trade system preventing ASEAN from reaching optimal exports, thereby restricting their ability to trade effectively with the more developed countries.

Table 6. ASEAN Export Flow Efficiency with other Top Trading Partners (Hong Kong, Japan, Korea, and USA).

Exporter	USA					Japan				
	2000	2005	2010	2015	2018	2000	2005	2010	2015	2018
Brunei Darussalam	0.77	0.62	12.74	1.44	0.74	1.14	1.17	0.91	0.93	0.76
Indonesia	1.09	1.10	0.97	0.91	0.93	1.02	1.01	1.00	1.03	0.96
Cambodia	0.69	0.67	0.75	1.35	1.59	3.14	1.53	1.41	0.74	0.72
Lao People's Dem	1.00	3.79	0.52	1.77	0.71	3.34	3.52	1.41	0.96	0.72
Myanmar	0.30	-	42.63	1.35	1.09	3.13	1.17	0.94	0.72	1.09
Malaysia	1.02	0.83	1.11	1.08	1.08	0.97	1.16	0.95	0.93	1.09
Philippines	0.84	1.10	1.00	1.01	1.00	1.11	1.07	1.08	0.82	0.94
Singapore	0.78	1.02	0.97	1.22	0.97	0.98	1.09	1.10	0.89	0.79
Thailand	0.93	0.99	1.07	0.98	0.98	1.20	1.00	1.02	0.92	0.85
Vietnam	4.25	1.18	0.97	0.94	1.00	0.97	1.02	0.96	0.97	1.16

Table 6. Cont.

	Hong Kong					Rep. of Korea				
	2000	2005	2010	2015	2018	2000	2005	2010	2015	2018
Brunei Darussalam	5.47	7.28	0.30	0.64	0.47	1.06	1.14	0.91	0.87	1.63
Indonesia	0.91	0.99	0.88	1.21	0.98	0.98	0.94	0.91	1.10	1.10
Cambodia	1.10	0.99	1.10	0.78	0.80	5.46	5.55	1.25	0.81	0.87
Lao People's Dem	0.63	7.06	0.92	1.21	0.86	1.36	1.74	1.71	0.78	0.75
Myanmar	1.24	0.38	0.78	0.93	0.79	2.73	1.17	0.77	0.79	1.65
Malaysia	1.09	0.92	1.01	1.10	0.67	0.82	1.01	0.99	1.08	1.04
Philippines	1.16	1.13	1.16	1.16	0.82	0.86	1.07	0.89	1.01	1.06
Singapore	1.44	1.12	1.08	0.93	0.81	1.21	1.16	0.97	1.05	1.12
Thailand	1.13	1.08	0.93	1.01	0.98	1.05	1.09	1.11	0.95	0.95
Vietnam	0.95	1.15	0.91	1.04	1.03	1.82	2.24	1.12	1.00	0.78

## 5. Conclusions

As a benefit, regional associations offer sustainable means for countries to overcome their shortcomings to reach higher net gains from trade. However, researchers continue to debate the varied impacts of the ACFTA, noting a significant influence originating from the larger Chinese market. This study seeks to make rational comparisons between actual and potential export shares, in a pre/post ACFTA era, deepening the insight into its impact on ASEAN export flow efficiency into China.

Analysis of actual and calculated export potentials, before and following the implementation of the ACFTA, show that the majority of ASEAN members' export efficiency to China improved. Deviation from optimality is only seen within the smaller members—predominantly Brunei Darussalam. At the level of the industry, the export efficiency for two-thirds of the productions sectors from ASEAN member countries to China also displayed improvements. As the region's internal trade draws closer to its potential, implications are that industries will face greater competition that may question their survival. Therefore, a prudent step by the governments of ACFTA, particularly the smaller nations, would be to give greater attention to enhancing the industries that possess a comparative advantage (extra-regionally) and best utilizes available competitive elements (regionally). The impact of the ACFTA is expected to benefit the long-run sustainable trade relationship between ASEAN members and China, therefore increasing their collective bargaining power on the global market.

This study ultimately provides no evidence that supports previous researchers regarding the ACFTA's negative impact on ASEAN trade relation with other major destinations. It can be concluded that during the review period, the ACFTA facilitates the improvement of export optimality for ASEAN products into China, at no expense to other major destinations. Thus, the long-term sustainability of the ACFTA for member-nations appears well intact. Notably, any improvement to ACFTA should include those industries that fail to reap average benefits from the terms, as a primary focus.

To further the understanding of the ASEAN-China relation resulting from ACFTA, extensions to this research point to an assessment of ACFTA's tariff and non-tariff segregated implications across member countries. More specifically, whether the benefits established in this research are channeled through an increase in the volume of traded items or through an increase in product variations. According to Lall and Albaladejo, this can eventually lead to regional instability due to increase in imperfect competition and unbalanced export market share.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

Table A1. Ninety-seven (HS2) Commodity Classifications Used in the Analysis.

Code	Product Details	Code	Product Details	Code	Product Details
01	Animals; live	34	Soap, organic surface-active agents; washing, lubricating, polishing	67	Feathers & down, prepared; & articles made of feather or of down;
02	Meat & edible meat offal	35	Albuminoidal substances; modified starches; glues; enzymes	68	Stone, plaster, cement, asbestos, mica or similar materials;
03	Fish & crustaceans, molluscs & other aquatic invertebrates	36	Explosives; pyrotechnic products; matches; pyrophoric alloys;	69	Ceramic products
04	Dairy produce; birds' eggs; natural honey; edible prod. of animal origin	37	Photographic or cinematographic goods	70	Glass & glassware
05	Animal originated products; not elsewhere specified or included	38	Chemical products n.e.s.	71	Natural, cultured pearls; prec., semi-precious stones; prec. metals
06	Trees & other plants, live; bulbs, roots & the like	39	Plastics & articles thereof	72	Iron & steel
07	Vegetables & certain roots & tubers; edible	40	Rubber & articles thereof	73	Iron or steel articles
08	Fruit & nuts, edible; peel of citrus fruit or melons	41	Raw hides & skins (other than furskins) & leather	74	Copper & articles thereof
09	Coffee, tea, mate & spices	42	Articles of leather; saddlery & harness; travel goods	75	Nickel & articles thereof
10	Cereals	43	Furskins & artificial fur; manufactures thereof	76	Aluminium & articles thereof
11	Products of the milling industry; malt, starches, inulin, wheat gluten	44	Wood & articles of wood; wood charcoal	78	Lead & articles thereof
12	Oilseeds & oleaginous fruits; miscellaneous grains, seeds & fruit, industrial or medicinal	45	Cork & articles of cork	79	Zinc & articles thereof
13	Lac; gums, resins & other vegetable saps & extracts	46	Manufactures of straw, esparto or other plaiting materials;	80	Tin; articles thereof
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	47	Pulp of wood or other fibrous cellulosic material; recovered (waste & scrap) paper or paperboard	81	Metals; n.e.s., cermetes & articles thereof
15	Animal or vegetable fats & oils & their cleavage products; prepared animal fats	48	Paper & paperboard; articles of paper pulp, of paper or paperboard	82	Tools, implements, cutlery, spoons & forks, of base metal; parts thereof
16	Meat, fish or crustaceans, molluscs or other aquatic invertebrates	49	Printed books, newspapers, pictures, and other printing industry products	83	Metal; miscellaneous products of base metal
17	Sugars & sugar confectionery	50	Silk	84	Nuclear reactors, boilers, machinery & mechanical appliances;
18	Cocoa & cocoa preparations	51	Wool, fine or coarse animal hair; horsehair yarn & woven fabric	85	Electrical machinery & equipment & parts thereof
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	52	Cotton	86	Railway, tramway locomotives, rolling-stock & parts thereof
20	Preparations of vegetables, fruit, nuts or other parts of plants	53	Vegetable textile fibres; paper yarn & woven fabrics of paper yarn	87	Vehicles; other than railway or tramway rolling stock, & parts
21	Miscellaneous edible preparations	54	Man-made filaments	88	Aircraft, spacecraft & parts thereof
22	Beverages, spirits & vinegar	55	Man-made staple fibres	89	Ships, boats & floating structures
23	Food industries, residues & wastes thereof; prepared animal fodder	56	Wadding, felt & nonwovens, special yarns; twine, cordage, ropes & cables	90	Optical, photo & cinematographic, measuring, medical/surgical instru
24	Tobacco & manufactured tobacco sub	57	Carpets & other textile floor coverings	91	Clocks & watches & parts thereof
25	Salt; sulphur; earths, stone; plastering materials, lime & cement	58	Fabrics; special woven fabrics, tufted textile fabrics, lace, tapestries	92	Musical instruments; parts & accessories of such articles
26	Ores, slag & ash	59	Textile fabrics; impregnated, coated, covered or laminated	93	Arms & ammunition; parts & accessories thereof
27	Mineral fuels, mineral oils & products of their distillation	60	Fabrics; knitted or crocheted	94	Furniture; bedding, mattresses, cushions & stuffed furnishing
28	Inorganic chemicals; organic & inorganic compounds	61	Apparel & clothing accessories; knitted or crocheted	95	Toys, games & sports requisites; parts & accessories thereof
29	Organic chemicals	62	Apparel & clothing accessories; not knitted or crocheted	96	Miscellaneous manufactured articles
30	Pharmaceutical products	63	Textiles, made up articles; sets; worn clothing & worn textile articles; rags	97	Works of art; collectors' pieces & antiques
31	Fertilizers	64	Footwear; gaiters & the like; parts of such articles	99	Commodities not specified according to kind
32	Tanning or dyeing extracts; tannins & their derivatives	65	Headgear & parts thereof		
33	Essential oils & resinoids; perfumery, cosmetic or toilet preparations	66	Umbrellas, walking-sticks, seat sticks, whips, riding crops; & parts thereof		

Table A2. OLS Regression Results.

VARIABLES	(1)	(2)	(3)
lnDistance	−1.571 ***	−1.565 ***	−1.554 ***
dContiguity	0.492 ***	0.491 ***	0.492 ***
dLanguage	0.576 ***	0.576 ***	0.581 ***
dColony	1.348 ***	1.348 ***	1.345 ***
dComColony	0.689 ***	0.687 ***	0.683 ***
dGFC	−0.0282 ***	−0.0278 ***	−0.0178 ***
dACFTA		0.0109	0.00755
dACFTA_I1			0.0141
dACFTA_I2			0.0212
dACFTA_I3			−0.0101
dACFTA_I4			−0.100 *
dACFTA_I5			−0.0639
dOFTA		0.764 ***	0.635 ***
dOFTA_I1			0.546 ***
dOFTA_I2			0.617 ***
dOFTA_I3			0.674 ***
dOFTA_I4			0.480 ***
dOFTA_I5			0.464 ***
dPSA		−0.497 ***	−0.476 ***
dPSA_I1			−0.422 ***
dPSA_I2			−0.508 ***
dPSA_I3			−0.692 ***
dPSA_I4			−0.482 ***
dPSA_I5			−0.401 ***
dCU		1.046 ***	0.620 ***
Constant	18.04 *** (0.00845)	17.98 *** (0.00852)	17.88 *** (0.00869)
Observations	7,180,409	7,180,409	7,180,409
R-squared	0.691	0.692	0.692
Exporter Industry Time FE	YES	YES	YES
Importer Industry Time FE	YES	YES	YES
Importer Exporter Industry FE	No	No	No

Standard errors in parentheses. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Table A3.** Results: ASEAN Export Efficiency with China (ranked by 2018 potential exports to China).

Export Industry Code	2000		2003		2006		2009		2012		2015		2018	
	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA
67	0.41	0.41	0.53	0.53	0.26	0.26	0.91	0.93	0.68	0.63	1.31	1.21	5.58	5.15
97	0.72	0.72	0.28	0.28	0.90	0.89	10.53	10.84	2.81	2.59	2.36	2.18	3.10	2.86
45	0.21	0.21	0.48	0.48	0.70	0.69	0.52	0.54	1.68	1.55	3.42	3.16	2.24	2.07
89	61.77	61.77	0.47	0.47	0.28	0.28	0.30	0.31	12.12	11.19	2.45	2.26	2.08	1.92
37	0.34	0.34	0.42	0.42	0.75	0.74	1.32	1.36	2.15	1.98	2.68	2.47	1.92	1.78
79	0.65	0.65	0.74	0.74	1.87	1.85	0.45	0.47	0.97	0.90	0.83	0.76	1.87	1.73
19	1.26	1.26	0.70	0.70	0.58	0.57	0.61	0.63	1.00	0.92	0.97	0.89	1.85	1.71
66	0.84	0.84	2.54	2.54	4.49	4.43	4.37	4.50	2.63	2.43	0.65	0.60	1.84	1.70
51	1.25	1.25	0.42	0.42	0.84	0.83	1.57	1.62	1.52	1.40	0.73	0.67	1.71	1.58
57	1.71	1.71	1.24	1.24	0.36	0.36	0.52	0.54	3.29	3.04	3.29	3.04	1.60	1.48
91	0.78	0.78	0.63	0.63	0.85	0.84	1.18	1.22	0.47	0.43	1.15	1.06	1.54	1.42
70	0.80	0.80	0.60	0.60	1.00	0.99	0.65	0.67	1.00	0.92	1.23	1.14	1.44	1.33
88	0.63	0.63	1.94	1.94	0.53	0.53	0.91	0.94	1.04	0.96	0.93	0.86	1.38	1.27
82	1.29	1.29	0.80	0.80	0.96	0.95	0.72	0.74	1.51	1.39	1.53	1.41	1.34	1.24
06	0.97	0.97	0.87	0.87	0.90	0.89	0.59	0.61	0.99	0.91	1.64	1.51	1.32	1.22
08	0.66	0.66	0.75	0.75	0.76	0.75	0.78	0.81	0.97	0.90	1.03	0.95	1.32	1.22
12	0.44	0.44	1.20	1.20	1.34	1.32	0.96	0.99	1.23	1.13	0.97	0.90	1.28	1.19
32	0.66	0.66	0.67	0.67	0.92	0.91	1.06	1.09	1.04	0.96	1.03	0.95	1.25	1.16
78	1.56	1.56	1.29	1.29	0.93	0.92	1.33	1.37	0.77	0.71	0.95	0.88	1.25	1.15
68	0.48	0.48	0.56	0.56	0.75	0.74	1.06	1.09	1.02	0.94	1.11	1.03	1.24	1.14
84	1.10	1.10	1.22	1.22	1.03	1.02	0.87	0.90	0.90	0.83	1.08	1.00	1.21	1.12
75	0.75	0.75	0.99	0.99	2.02	2.00	1.61	1.65	0.83	0.77	0.72	0.67	1.20	1.10
63	3.23	3.23	3.37	3.37	1.69	1.66	1.47	1.52	0.73	0.68	0.85	0.79	1.16	1.08
76	0.93	0.93	0.80	0.80	1.31	1.29	0.64	0.66	1.79	1.65	0.72	0.67	1.15	1.06
73	1.22	1.22	1.09	1.09	1.20	1.18	1.36	1.40	1.05	0.97	0.82	0.75	1.15	1.06
44	0.46	0.46	0.59	0.59	1.10	1.09	1.03	1.06	0.93	0.86	1.09	1.01	1.14	1.06
09	0.85	0.85	0.88	0.88	1.05	1.03	0.98	1.01	1.03	0.95	0.99	0.92	1.14	1.06
07	2.58	2.58	0.97	0.97	1.01	1.00	0.95	0.98	0.98	0.90	0.95	0.88	1.14	1.05
21	1.41	1.41	2.37	2.37	1.52	1.50	1.02	1.05	1.03	0.95	0.91	0.84	1.13	1.04
27	0.72	0.72	0.80	0.80	1.12	1.11	0.92	0.94	1.10	1.02	0.93	0.86	1.09	1.00
24	0.46	0.46	1.07	1.07	0.37	0.36	0.84	0.86	2.00	1.85	1.08	1.00	1.08	1.00
31	26.28	26.28	1.15	1.15	4.32	4.27	0.46	0.47	2.58	2.39	0.67	0.62	1.04	0.96
14	0.81	0.81	0.72	0.72	0.93	0.92	1.22	1.25	0.97	0.90	1.03	0.96	1.04	0.96
50	0.79	0.79	1.43	1.43	0.72	0.71	5.34	5.50	3.43	3.17	0.87	0.80	1.03	0.95



Table A3. Cont.

Export Industry Code	2000		2003		2006		2009		2012		2015		2018	
	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA
15	0.79	0.79	1.12	1.12	0.82	0.81	1.05	1.09	1.08	1.00	0.96	0.89	1.03	0.95
38	0.85	0.85	0.83	0.83	0.92	0.91	0.98	1.01	1.11	1.02	1.03	0.95	1.02	0.94
40	1.00	1.00	1.07	1.07	1.04	1.03	1.00	1.03	0.99	0.92	1.01	0.93	1.02	0.94
53	2.62	2.62	1.85	1.85	1.40	1.38	0.78	0.81	0.94	0.87	0.93	0.85	0.99	0.92
26	2.10	2.10	1.83	1.83	1.48	1.46	1.46	1.50	0.76	0.70	1.10	1.02	0.99	0.92
11	1.70	1.70	1.37	1.37	1.08	1.06	0.98	1.01	0.99	0.92	0.99	0.91	0.99	0.91
22	1.42	1.42	0.67	0.67	0.74	0.73	0.64	0.66	0.93	0.85	1.42	1.31	0.99	0.91
17	0.92	0.92	1.02	1.02	0.53	0.52	0.91	0.94	0.84	0.78	0.96	0.89	0.97	0.90
41	1.07	1.07	0.65	0.65	0.90	0.89	1.09	1.13	1.13	1.05	1.06	0.98	0.97	0.90
35	0.81	0.81	0.82	0.82	0.95	0.94	1.08	1.12	1.02	0.94	1.10	1.02	0.97	0.89
01	0.61	0.61	1.57	1.57	0.77	0.76	0.98	1.01	1.62	1.50	1.17	1.08	0.95	0.88
80	1.78	1.78	1.93	1.93	1.68	1.65	0.91	0.94	0.87	0.80	0.96	0.88	0.95	0.88
85	1.38	1.38	1.10	1.10	0.94	0.92	1.01	1.04	0.98	0.91	1.05	0.97	0.94	0.87
90	0.72	0.72	0.78	0.78	0.73	0.72	1.22	1.26	1.20	1.11	0.97	0.90	0.94	0.87
43	2.34	2.34	25.47	25.47	8.11	8.01	24.61	25.35	2.62	2.42	1.01	0.94	0.94	0.87
18	1.00	1.00	0.99	0.99	0.90	0.89	1.12	1.16	0.95	0.88	1.13	1.04	0.94	0.87
03	0.49	0.49	1.01	1.01	1.72	1.70	1.34	1.38	1.20	1.10	0.94	0.87	0.93	0.86
30	0.11	0.11	0.08	0.08	0.39	0.38	2.12	2.18	1.92	1.77	0.61	0.56	0.93	0.86
64	4.01	4.01	3.21	3.21	1.75	1.73	1.04	1.07	1.04	0.96	0.94	0.87	0.93	0.86
33	0.89	0.89	0.95	0.95	1.51	1.49	1.38	1.42	1.03	0.95	0.95	0.88	0.92	0.85
46	0.75	0.75	0.69	0.69	1.42	1.40	1.05	1.08	0.94	0.87	0.85	0.78	0.92	0.85
29	1.07	1.07	0.88	0.88	0.98	0.97	1.17	1.20	1.05	0.97	1.10	1.01	0.91	0.84
94	1.10	1.10	1.31	1.31	1.40	1.38	1.57	1.62	1.25	1.16	0.78	0.72	0.91	0.84
10	0.99	0.99	1.06	1.06	0.66	0.66	1.21	1.24	1.03	0.95	1.21	1.12	0.89	0.83
54	1.19	1.19	1.15	1.15	1.18	1.16	1.04	1.07	0.92	0.85	0.90	0.83	0.88	0.81
81	0.55	0.55	0.62	0.62	1.40	1.39	1.47	1.52	0.92	0.85	1.50	1.39	0.87	0.80
05	1.49	1.49	1.08	1.08	1.00	0.99	1.27	1.31	1.53	1.42	1.22	1.12	0.85	0.79
28	1.27	1.27	1.72	1.72	1.91	1.89	1.60	1.65	1.81	1.67	0.72	0.66	0.85	0.78
34	0.97	0.97	0.96	0.96	0.99	0.97	0.93	0.95	0.93	0.86	1.16	1.07	0.85	0.78
39	1.13	1.13	1.02	1.02	1.17	1.15	1.14	1.17	1.01	0.93	0.93	0.86	0.84	0.78
48	0.54	0.54	0.69	0.69	0.76	0.75	1.19	1.23	1.45	1.34	1.85	1.71	0.83	0.77
47	0.52	0.52	0.86	0.86	0.98	0.97	1.08	1.12	1.25	1.16	1.05	0.97	0.83	0.77
59	1.45	1.45	1.10	1.10	1.00	0.99	1.13	1.17	1.02	0.94	1.12	1.04	0.82	0.76
52	0.72	0.72	1.00	1.00	2.46	2.43	1.11	1.14	1.47	1.36	0.87	0.80	0.81	0.75

Table A3. Cont.

Export Industry Code	2000		2003		2006		2009		2012		2015		2018	
	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA	EE_wA	EE_nA
56	2.62	2.62	1.14	1.14	1.27	1.26	1.30	1.34	0.89	0.82	1.09	1.01	0.80	0.74
61	3.36	3.36	2.51	2.51	3.03	2.99	1.93	1.99	1.11	1.03	0.85	0.79	0.80	0.74
92	1.70	1.70	1.70	1.70	1.21	1.20	2.30	2.37	1.10	1.01	0.81	0.75	0.80	0.73
62	2.58	2.58	3.95	3.95	3.07	3.03	1.87	1.93	1.09	1.01	0.88	0.81	0.80	0.73
83	1.09	1.09	0.94	0.94	0.99	0.98	0.72	0.74	1.12	1.03	0.89	0.82	0.79	0.73
42	1.80	1.80	2.45	2.45	1.38	1.37	1.40	1.45	1.53	1.41	0.90	0.83	0.78	0.72
95	2.05	2.05	1.16	1.16	0.35	0.34	0.97	1.00	2.85	2.64	0.93	0.86	0.78	0.72
74	0.65	0.65	0.81	0.81	0.80	0.79	1.31	1.35	1.40	1.29	1.18	1.09	0.76	0.70
86	1.30	1.30	17.66	17.66	1.94	1.91	2.64	2.72	2.58	2.38	0.90	0.83	0.73	0.67
23	0.67	0.67	1.41	1.41	1.10	1.08	1.13	1.16	1.05	0.97	1.31	1.21	0.73	0.67
96	3.79	3.79	2.82	2.82	0.87	0.85	1.42	1.46	0.91	0.84	0.79	0.73	0.72	0.67
16	1.13	1.13	1.77	1.77	2.57	2.54	1.61	1.66	2.37	2.19	1.08	0.99	0.72	0.66
58	1.77	1.77	2.34	2.34	1.19	1.18	0.97	1.00	0.94	0.86	0.63	0.58	0.71	0.66
55	0.96	0.96	1.00	1.00	0.96	0.95	1.20	1.24	1.20	1.11	0.95	0.88	0.71	0.66
87	0.51	0.51	0.85	0.85	0.83	0.82	1.27	1.31	1.32	1.21	1.03	0.95	0.71	0.65
71	1.01	1.01	0.66	0.66	1.06	1.05	1.74	1.80	3.93	3.63	0.73	0.67	0.70	0.65
20	0.93	0.93	1.99	1.99	1.31	1.29	1.66	1.71	1.35	1.24	1.00	0.92	0.70	0.64
65	1.98	1.98	0.97	0.97	2.10	2.07	2.26	2.33	0.87	0.80	1.37	1.27	0.65	0.60
69	1.57	1.57	1.55	1.55	1.63	1.61	0.94	0.96	1.17	1.08	1.05	0.97	0.65	0.60
13	1.62	1.62	1.04	1.04	1.35	1.33	1.48	1.53	1.27	1.17	0.85	0.78	0.64	0.59
60	2.85	2.85	1.50	1.50	1.18	1.17	1.61	1.66	1.53	1.42	1.12	1.04	0.62	0.57
49	3.78	3.78	4.72	4.72	3.17	3.13	2.00	2.06	1.07	0.99	0.60	0.55	0.62	0.57
04	1.66	1.66	0.46	0.46	1.64	1.62	1.47	1.51	2.96	2.73	0.87	0.80	0.58	0.54
02	0.18	0.18	0.21	0.21	1.98	1.96	1.19	1.22	3.02	2.79	1.74	1.60	0.57	0.53
72	1.01	1.01	0.80	0.80	1.85	1.83	1.66	1.71	1.82	1.68	1.13	1.04	0.56	0.52
25	1.11	1.11	0.90	0.90	1.06	1.04	0.93	0.96	2.07	1.91	1.28	1.18	0.55	0.51
36	2.14	2.14	0.61	0.61	0.90	0.89	1.88	1.94	1.71	1.58	0.97	0.90	0.49	0.45
93	22.19	22.19	0.59	0.59	0.65	0.65	43.99	45.32	13.19	12.18	4.27	3.95	0.04	0.04

## Appendix B

A DID analysis and decomposition of ACFTA's impacts for importers and exporters as follow:  
From the gravity model we have

$$X_{ij} = \left( \frac{\tau_{ij}}{\Pi_i P_j} \right)^{1-\delta} \left( \frac{Y_i Y_j}{Y_w} \right) \quad (A1)$$

where

$$\Pi_i = \left[ \sum_{j=1}^N (\theta_j / \tau_{ij}^{\sigma-1}) P_j^{1-\sigma} \right]^{1/(1-\sigma)} \quad (A2)$$

$$P_j = \left[ \sum_{i=1}^N (\theta_i / \tau_{ij}^{\sigma-1}) \Pi_i^{1-\sigma} \right]^{1/(1-\sigma)} \quad (A3)$$

$\theta_i$  denotes  $Y_i/Y_w$ , that is the share of country  $i$ 's GDP relative to all the countries.  $\Pi_i$  and  $P_j$  are usually known as multilateral resistance.  $\Pi_i$  is the outward multilateral resistance which measures how difficult for country  $i$  to export goods relative to the rest of the world.  $P_j$  is the inward multilateral resistance that measures how difficult for country  $j$  to import goods relative to the rest of the world.

The overall margin (OM) are defined as follow. Here,  $X_{wj}$  represents all the countries export to country  $j$ .

$$OM_{ij} = \frac{X_{ij}}{X_{wj}} = \left( \frac{\tau_{ij}}{\Pi_i P_j} \right)^{1-\delta} \left( \frac{Y_i Y_j}{Y_w} \right) \frac{1}{X_{wj}} \quad (A4)$$

Following Baier and Bergstrand's method to linearly approximate the multilateral resistances noted in (Equations (A5) and (A6)). They are presented as:

$$\ln(\Pi_{it}) = \left[ \sum_{j=1}^N \theta_j \ln(\tau_{ijt}) - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \ln(\tau_{kmt}) \right] \quad (A5)$$

$$\ln(P_{jt}) = \left[ \sum_{i=1}^N \theta_i \ln(\tau_{ijt}) - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \ln(\tau_{kmt}) \right] \quad (A6)$$

The two-stage estimation is as follows:

First stage:

$$\ln(OM_{ijt}) = \alpha_{o0} + \beta_{o1} \ln(d_{ij}) + \beta_{o2} \cdot g_{ij} + \delta_o \cdot \text{tariff}_{ijt} + \varphi_{o1} I_{it} + \varphi_{o2} I_{jt} + \varepsilon_{(om)ijt} \quad (A7)$$

Thus, the regression in the second stage for exporters is as follows:

$$\begin{aligned} \varphi_{o1} I_{it} = & \alpha_{oi} + \beta_{oi1} \overline{\ln(d_{ij})} + \beta_{oi2} \overline{\text{border}_{ij}} + \beta_{oi3} \overline{\text{lang}_{ij}} + \beta_{oi4} \overline{\text{tariff}_{ijt}} + \gamma_{oi} \text{nontariff}_{it} + \\ & \varphi_{oi1} \ln(Y_{it}) + \varphi_{oi2} \ln(Y_{wt}) + \mu_{(om)it} \end{aligned} \quad (A8)$$

The second stage for importers is as follow:

$$\begin{aligned} \varphi_{oj2} I_{jt} = & \alpha_{oj} + \beta_{oj1} \widetilde{\ln(d_{ij})} + \beta_{oj2} \widetilde{\text{border}_{ij}} + \beta_{oj3} \widetilde{\text{lang}_{ij}} + \beta_{oj4} \widetilde{\text{tariff}_{ijt}} + \gamma_{oj} \text{nontariff}_{jt} + \\ & + \varphi_{oj1} \ln(Y_{jt}) + \varphi_{oj2} \ln(Y_{wt}) + \mu_{(om)jt} \end{aligned} \quad (A9)$$

where:

$$\overline{\ln(d_{ij})} = \left[ \sum_{j=1}^N \theta_j \ln(d_{ij}) - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \ln(d_{km}) \right] \quad (A10)$$

$$\overline{\text{border}_{ij}} = \left[ \sum_{j=1}^N \theta_j \text{border}_{ij} - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \text{border}_{km} \right] \quad (A11)$$

$$\overline{\text{lang}_{ij}} = \left[ \sum_{j=1}^N \theta_j \text{lang}_{ij} - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \text{lang}_{km} \right] \quad (A12)$$

$$\overline{\text{tariff}}_{ijt} = \left[ \sum_{j=1}^N \theta_j \text{tariff}_{ijt} - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \text{tariff}_{kmt} \right] \quad (\text{A13})$$

$$\widetilde{\ln(d_{ij})} = \left[ \sum_{i=1}^N \theta_i \ln(d_{ij}) - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \ln(d_{km}) \right] \quad (\text{A14})$$

$$\widetilde{\text{border}}_{ij} = \left[ \sum_{i=1}^N \theta_i \text{border}_{ij} - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \text{border}_{km} \right] \quad (\text{A15})$$

$$\widetilde{\text{lang}}_{ij} = \left[ \sum_{i=1}^N \theta_i \text{lang}_{ij} - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \text{lang}_{km} \right] \quad (\text{A16})$$

$$\widetilde{\text{tariff}}_{ijt} = \left[ \sum_{i=1}^N \theta_i \text{tariff}_{ijt} - \frac{1}{2} \sum_{k=1}^N \sum_{m=1}^N \theta_k \theta_m \text{tariff}_{kmt} \right]. \quad (\text{A17})$$

There will be two effects for ACFTA via DID approach: First is the tariff effect, which will be presented in stage one. Another is the non-tariff effect, which is in stage two.

Results are as follows:

**Table A4.** Stage I—Aggregate impact on ASEAN-China bilateral margins.

Variables	Overall Margin
Tariff (average)	−0.0238 ** (0.0115)
ln(Distance)	−0.639 *** (0.0190)
Contiguity	0.800 *** (0.0186)
Common Language	0.0710 *** (0.0249)
Shard WTO membership	(0.111)
Observations	82,905
R-squared	0.865

Standard errors in parentheses. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Table A5.** Stage II ACFTA's impact for exporters.

Dep. var.: $\Delta$ it	(A1)	(B1)
Exporter-year coefficients	OM	OM
acfta_Trade in Goods	0.0365 (0.0837)	−0.0401 (0.0838)
acfta_Dispute Settlement	−0.0405 (0.0911)	−0.0733 (0.0924)
acfta_2nd Protocol to Amend TiG	0.124 (0.128)	0.136 (0.125)
acfta_Protocol for Technical Barriers	−0.0727 (0.0740)	0.0224 (0.0745)
acfta_Protocol for Trade facilitation	0.0115 (0.0602)	0.0360 (0.0608)
Global Financial Crisis	0.207 ** (0.0907)	0.270 *** (0.0905)
Importers' GDP share weighted tariff	−0.128 (0.118)	0.164 (0.115)
Importers' GDP share weighted language	0.00439 (0.0105)	0.00158 (0.0104)
Importers' GDP share weighted contiguity	0.0115 ** (0.0052)	0.0162 *** (0.0052)

Table A5. Cont.

Dep. var.: <i>_lit</i>	(A1)	(B1)
Exporter-year coefficients	OM	OM
Importers' GDP share weighted ln(distance)	−0.501 (0.614)	−1.180 * (0.642)
Importers' GDP share weighted WTO members		−0.0020 *** (0.0003)
ln(sample World's GDP)	−0.920 (0.789)	−1.884 ** (0.809)
ln(Exporter's GDP)	0.646 (0.821)	1.635 * (0.848)
Constant	9.492 (8.716)	16.45 * (8.845)
Observations	19,943	19,918
R-squared	0.217	0.232

Standard errors in parentheses. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

Table A6. Stage II ACFTA's impact on importers.

Dep. var.: <i>_ljt</i>	(A1)	(B1)
Importer-year coefficients	OM	OM
acfta_Trade in Goods	−0.164 *** (0.0346)	−0.161 *** (0.0347)
acfta_Dispute Settlement	−0.00979 (0.0378)	−0.00417 (0.0385)
acfta_2nd Protocol to Amend TiG	−0.185 *** (0.0402)	−0.107 ** (0.0447)
acfta_Protocol for Technical Barriers	−0.00281 (0.0298)	−0.0163 (0.0304)
acfta_Protocol for Trade facilitation	0.122 *** (0.0229)	0.0849 *** (0.0239)
Global Financial Crisis	−0.121 *** (0.0344)	−0.105 *** (0.0349)
Importers' GDP share weighted tariff	0.00889 (0.0376)	0.271 *** (0.0513)
Importers' GDP share weighted language	−0.00319 (0.00201)	0.000557 (0.00204)
Importers' GDP share weighted contiguity	0.00654 *** (0.00128)	0.000142 (0.00197)
Importers' GDP share weighted ln(distance)	0.0677 (0.152)	−0.273 (0.171)
Importers' GDP share weighted WTO members		0.00226 *** (0.000621)
ln(sample World's GDP)	0.396 (0.241)	0.545 ** (0.257)
ln(Exporter's GDP)	−0.177 (0.276)	−0.344 (0.303)
Constant	−5.838 *** (1.712)	−3.664 ** (1.722)
Observations	22,590	22,553
R-squared	0.070	0.093

Standard errors in parentheses. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

In the second stage, ACFTA denotes variables for Trade in Goods, Dispute Settlement, 2nd Protocol to Amendment, Protocol for Technical Barriers, and Protocol for Trade facilitation. Those are dummy variables which represent various stages of progression regarding the ACFTA.

In stage one, we can see a direct effect caused by cutting tariff via ACFTA in Table A4, where a 1% decline in tariff will increase the trade by 2.4%. In stage two, Tables A5 and A6 present the non-tariff effects for exports and imports. The reason for insignificant of the coefficients is due to requiring further decomposition into extensive and intensive margins of trade (which will lead to the opposite effect in two margins and cancel with each other; hence, with insignificant results on overall margins). That requires another decomposition of Tables A5 and A6 into the extensive margin and intensive margin.

The above represents adjoin empirical results to this paper. However, such an assessment will be developed in another paper, as this is beyond the scope of this particular study.

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