CHAPTER 6

Empirical Analysis

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CHAPTER 6

EMPIRICAL ANALYSIS

A. Background

In this section, we report results from an empirical exercise which attempts to isolate the impact of reductions in ATIGA tariffs (equivalently, increase in the margin of preference) in the evolution of intra-ASEAN trade. The empirical analysis consists of two steps. The first step is to quantify by how much AFTA/ATIGA increased intra-ASEAN trade. To this end, we estimate the gravity equation for worldwide bilateral trade during 1995–2018 using data for 222 countries. In this model, we introduce a variable taking the value of one if two countries are members of the AFTA/ATIGA, in addition to the standard indicator for membership of an RTAs. We estimate this gravity equation at the level of three-digit codes of the Harmonized System (HS) nomenclature (we call these 3-digit groupings 'products' for convenience). From this step, we obtain the magnitude of the trade creation effect of the AFTA/ATIGA for each three-digit product and each year. However, this trade creation effect of AFTA/ATIGA based on the gravity approach captures increases in intra-ASEAN trade due to not only the tariff liberalisation of AFTA/ATIGA but also all other events that have an influence on intra-ASEAN trade during the study period. These other influences could come from changes in technology of production in key sectors, development in important trade partners (e.g. trade conflict), global economic shocks that may have different impact on various sectors, to list a few. Whatever the source, the main issue is that some parts of the estimates of trade creation are not attributed to the utilisation of the ATIGA regime.

Thus, we take a second step to capture the trade creation effect attributed to the utilisation of the ATIGA regime. To do that, we examine how these trade creation effects are related to the actual utilisation of the ATIGA regime in intra-ASEAN trade, calculated from the Form D trade data shared by the AMS for this study. Utilisation is measured as the share of imports under the ATIGA regime out of total imports at the level of three-digit products. We compute the average of those shares amongst intra-ASEAN trade flows, called the ATIGA utilisation share in this study. This variable acts as the main explanatory variable to which we relate the trade creation effect using the econometric method of Ordinary Least Squares (OLS). In other words, we regress the trade creation effect estimated above on it. This allows us to compute the value of the trade creation effect predicted by the average ATIGA utilisation rate. This predicted value would show the trade creation effect attributed to the utilisation of ATIGA tariff rates. Since this step requires the data on ATIGA utilisation, in this second step analysis, we restrict the study years to 2010, 2014, and 2018 only. We present such a value by products and years.

A note is warranted on our use of three-digit product, which is slightly different from the 4-digit sub-headings of standard tariff nomenclature. This is used purely for analytical convenience. Two considerations led to this decision. One is to conduct analysis on as many product groupings as possible, which would lead to disaggregation. However, we also do not want to make it too fine-grained as many product lines at the 6- and 8-digit level have zero trade. Although using a 4-digit chapter heading, which has about 1,200 unique product categories, this would be too fine-grained for our estimation. However, 2-digit chapter headings with 97 product lines would be slightly too aggregated. Thus, we settle on 3-digit by using the first three digits of the subheading, which gives us about 170 product lines. Effectively, this process sub-divides some of the HS chapters into multiple categories, but not as finely as 4-digit. For example, for agriculture products, there are 14 2-digit chapters, but 21 3-digit classifications. Likewise, for processed food, there are 10 2-digit chapters, but 13 3-digit classifications.

Our data sources are as follows. We obtain the trade data for 229 countries from the CEPII, a database that makes available data for gravity estimation.[5] It is called 'BACI' database and is an updated version of the data provided in Gaulier and Zignago (2010). The database provides disaggregated data on bilateral trade flows for more than 5,000 products and 222 countries. Originally, the data are available at the six-digit level of the HS nomenclature. We aggregate these trade data at the three-digit level to reduce the occurrence of zero-value trade. We use the data reported in the HS1992 version to maximise the length of study years, which runs from 1995 to 2018. We restrict observations of country pair-year to those with positive values in total trade at a country pair-year-level.[6] Nevertheless, when we estimate our gravity equations by the three-digit code of the HS, the zero value appears. The RTA dummy variable is drawn from Egger and Larch (2008) and the version updated to 2017.[7] The RTAs include those under GATT Article XXIV and those based on the Enabling Clause. The RTA dummy takes the value of one if either type of RTAs is formed between a pair of countries.

5 This database can accessed from this link: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=37

6 Since the unit of trade values in the BACI database is US$1,000, 'positive values' mean that more than US$1,000 of trade is observed.

7 The data are available in https://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html.

B. Gravity modelling results

Technical details of the estimation procedure are provided at the end of this chapter. This section reports our estimation results. In the first step, we obtain the coefficients for ATIGA dummy variables for each product and years. Table **6-1** shows the summary statistics of the trade creation effect across the 170 products. We present the number of products, the mean, standard deviation, 25th percentile, 50th percentile (i.e. median), 75th percentile, minimum, and maximum amongst the coefficients in each year. The row labelled ATIGA depicts the estimated trade creation effect of ATIGA, while information on other ASEAN Plus One FTAs is also presented for comparison. While results for each year are available, we only show results for years 2010 and 2018, to mark the beginning of ATIGA and the last available data.

There are some noteworthy findings. In terms of mean values, ATIGA has the smallest estimates. In 2010, the average trade creation effect of ATIGA was −0.15, which can be interpreted as the average increase (negative value means a decline) in trade flow between trade partners due to membership in ATIGA. Thus, according to this result, members of ATIGA (i.e. ASEAN countries) on average had 15% less trade than other trade partners on average. The mean value for the year 2018 is even more negative at −0.33. AANZFTA and AIFTA, also have negative average values in both 2010 and 2018, in terms of both mean and median, which implies that most of the products have negative estimates in these three RTAs. On the other hand, AJCEP has the largest estimates. ACFTA also has relatively large estimates particularly in 2018. Thus, trade between AMS and China and AMS and Japan was strong and strengthened from 2010 to 2018.

Another remarkable finding is that in terms of mean and median, the magnitude of the coefficients does not necessarily rise over time. Although the number of RTA-eligible products and the magnitude of tariff reduction tend to increase over time especially in ASEAN+1 FTAs, such a gradual increase does not produce a large additional effect. Last, the standard deviation is quite high in ATIGA, indicating that there is a massive difference in the magnitude of the coefficients across products. In sum, these results indicate the large trade creation effects of AJCEP, ACFTA, and AKFTA, compared with the effects of ATIGA, AIFTA, and AANZFTA. Therefore, consistent with the result in Magee (2008), the AFTA/ATIGA does not have positive trade creation effects in most sectors.

Table 6-1. Basic Statistics of gravity coefficients

		N	Mean	S.D.	p25	p50	p75	Min	Max
Year = 2010									
	ATIGA	173	−0.15	1.97	−1.17	−0.31	0.57	−5.18	10.06
	AANZ	173	−0.08	0.49	−0.26	−0.05	0.18	−2.76	1.60
	AC	173	−0.02	0.63	−0.41	−0.01	0.33	−1.58	2.23
	AI	173	−0.05	0.69	−0.34	−0.07	0.27	−3.80	3.56
	AJ	172	0.13	0.57	−0.12	0.09	0.33	−1.36	4.99
	AK	172	−0.08	0.60	−0.29	−0.03	0.19	−3.09	2.01
Year = 2018									
	ATIGA	170	−0.33	2.03	−1.34	−0.46	0.47	−5.25	10.50
	AANZ	173	−0.13	0.74	−0.40	−0.08	0.23	−3.75	3.30
	AC	173	0.17	0.79	−0.28	0.14	0.58	−1.98	3.16
	AI	173	−0.11	0.90	−0.44	−0.02	0.26	−4.71	3.22
	AJ	173	0.18	0.65	−0.14	0.14	0.50	−2.37	2.54
	AK	173	0.07	0.74	−0.26	0.05	0.43	−2.11	2.99

Source: Authors' calculation.

TABLE 6–2 reports the average magnitude of the coefficients in 2018 according to groups of products into sectors and the RTAs. We can see notable differences in their size across industries. The machinery industry has negative averages (except in AK), although ASEAN has developed sophisticated international production networks. One possible reason might be the frequent use of duty-drawback regimes in this industry rather than the use of RTA regimes. Another reason might be that RTAs reduced costs for horizontal-type or market-seeking foreign direct investment (FDI). The increase of such FDI results in reduced intra-ASEAN trade (Brainard, 1997). On the other hand, the transport equipment industry shows negative values in AANZFTA, ACFTA, and AIFTA but positive values in ATIGA, AJCEP, and AKFTA. The largest average in ATIGA can be found in precious metals. Other sectors with positive average trade creation effect are live animals, mineral products, textiles, and plastic or glass products.

Table 6-2. Average Coefficients in 2017 by Sections and RTAs

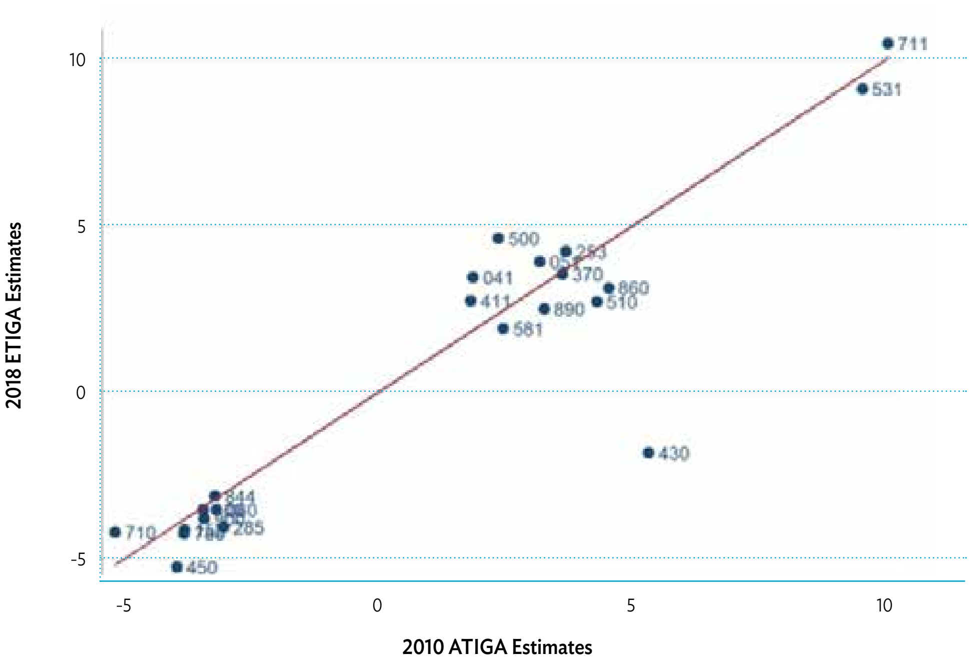
	ATIGA	AANZ	AC	AI	AJ	AK
Live animals	0.182	0.175	0.492	−0.809	0.231	−0.532
Vegetable products	−0.749	−0.242	−0.117	−0.037	0.487	0.401
Animal/vegetable fats and oils	−1.831	0.389	−0.964	−0.768	0.463	−0.092
Food products	−0.227	0.356	−0.276	−0.066	0.085	0.385
Mineral products	0.632	−0.254	0.147	0.200	−0.021	−0.042
Chemical products	−0.402	−0.257	−0.049	−0.106	−0.003	−0.208

	ATIGA	AANZ	AC	AI	AJ	AK
Plastics and rubber	−1.024	0.216	0.355	0.243	0.051	0.189
Leather products	−0.113	−1.118	0.448	−0.919	−0.135	0.032
Wood products	−1.642	−0.215	0.163	−0.181	0.301	0.268
Paper products	−0.927	0.083	0.335	−0.445	0.304	0.090
Textiles	0.010	0.048	0.497	0.166	0.501	0.279
Footwear	−0.256	0.112	1.007	−0.606	0.918	1.005
Plastic or glass products	0.578	−0.180	0.671	−0.055	0.248	0.033
Precious metals	3.150	−0.475	0.311	0.464	0.040	−0.399
Base Metal	−1.032	−0.273	0.161	0.119	−0.028	−0.101
Machinery	−0.177	−0.245	−0.028	−0.094	−0.031	0.115
Transport equipment	0.167	−0.290	−0.011	−0.358	0.002	0.381
Precision machinery	−1.219	−0.073	−0.175	−0.274	0.116	0.047
Miscellaneous	0.402	−0.365	0.443	−0.429	0.249	−0.180

Source: Authors' calculation.

FIGURE 6-1 presents the correlation between ATIGA coefficients in 2010 and 2018 for the top and bottom products to check how these coefficients changed while ATIGA came into effect. Product codes are displayed. The red line indicates the location of points if the ATIGA coefficients were to be the same in both years. Points above the line are those that slightly increased the trade creation effect and points below it are those with a slight reduction. We find that coefficients changed very little, except for Furskin articles (product, 430), the coefficient of which declined from 5% trade creation effect in 2010 to −2 trade creation effect in 2018. The biggest coefficients are found in certain precious metals (product 711) and woven fabrics. Interestingly, other types of precious metals (product 710) have the most negative ATIGA coefficients. Another product with very negative trade creation effect is cork (product 450). Overall, the coefficients are remarkably stable over time, meaning that ATIGA did not create drastic change in the structure of ASEAN trade. It is possible that the fundamental factors that drive trade amongst AMS have not changed enough yet to register significant evolution of trade at this level.

Figure 6-1. **Highest and lowest ATIGA coefficients in 2010 and 2018**



Source: Authors' calculation

C. Utilisation effects

The next step is to estimate the utilisation effect. To do that, we need the data on the utilisation of RTA regimes. Although we estimate the gravity equation for ATIGA and all ASEAN+1 FTAs by employing the standard trade data, the analysis at this step is restricted to ATIGA due to the need to use of FTA utilisation data. We obtained the data on ATIGA utilisation and total imports from each AMS at a HS eight-digit level for use in this study. However, there are some missing data. For example, the data on total imports are missing or show somewhat strange values in some cases. Therefore, we obtain those in Malaysia from the Global Trade Atlas maintained by the IHS Markit and those in Lao PDR, Myanmar, and Thailand from the BACI database. With these data, we compute the utilisation variable.

It is noteworthy how we compute utilisation more specifically. As explained before, for each product we take the simple average of the ATIGA import shares amongst all pairs of the AMS. However, those shares are missing in some pairs because of no imports, i.e. the denominator of the share is zero. Therefore, we try two measures of utilisation. One is the simple average amongst all pairs where the RTA import shares can be defined. Namely, country-pairs with no imports are not included in the computation of average shares. We call this measure 'Type I.' The other is to replace the missing shares with a value of zero and then to take the simple average. We call this measure 'Type II.' Naturally, the Type II measure takes a smaller value than the Type I measure. One may take the latter measure as a more appropriate one because we estimate gravity equations for all pairs, including those with zero valued trade. However, it is not necessarily so because singleton observations are also dropped in the gravity estimation. Thus, we try both two measures.

There are some more data issues. First, based on data availability, we focus on 2010, 2014, and 2018. Thus, the study years in the second step include only these 3 years. Second, the data for 2014 are not available in Lao PDR. Thus, we use the figures in 2012 for Lao imports in 2014. Similarly, we use the figures in 2013 for Malaysian imports in 2010. For the imports of Brunei and Lao PDR in 2010, we use their respective figures in 2009. Third, we do not have the ATIGA utilisation data in Singapore's imports though we have the data on total imports obtained from the BACI database. In Singapore, only six products (defined at an HS eight-digit level) have positive MFN tariffs. Those products exist only in HS 220. Therefore, we set the shares in Singapore's imports to zero for all products (with positive total imports in the case of the Type I measure) except for HS 220. The shares in Singapore's imports in HS 220 are set to 0.3, which is the average in other AMS' imports in HS 220. As a result, we can cover all country pairs in ATIGA in the computation of utilisation.

The estimation results using OLS are reported in **TABLE 6–3**. We use the Type I measure in column (I) and the Type II measure in column (II). In both columns, the coefficient for utilisation is estimated to be significantly positive, indicating that the higher average utilisation shares lead to the larger magnitude of the trade creation effect in the gravity estimates. Its coefficient is large when using the Type II measure. Based on the finding in Hayakawa (2020), which is that increases in ASEAN imports from China between 2000 and 2015 reduced intra-ASEAN trade by 20%, we also introduce the average share of imports from China out of total imports from the world (China share). The results are shown in columns (III) and (IV). Although the coefficient for the China share is insignificantly estimated, utilisation again has significantly positive coefficients. This leads us to conclude that in products where there is greater ATIGA utilisation, the trade creation effect is larger.

Table 6-3. Regression Results of the Coefficients for Utilisation: OLS

	(I)	(II)	(III)	(IV)
Utilisation	1.433**	2.325**	1.421**	2.249**
	[0.573]	[0.967]	[0.573]	[0.969]
China share			0.648	0.586
			[0.516]	[0.518]
Type	I	II	I	II
Number of obs	515	515	515	515
Adj R–squared	0.9367	0.9366	0.9368	0.9366

Source: Authors' calculation.

Then, by using the estimation results above, we compute the utilisation effect for each product. It is computed by multiplying utilisation by its coefficient reported in columns (I) and (II) in **TABLE 6-3**. Then, we further take an exponential and subtract the value of one. The resulting utilisation effect shows by what percentage intra-ASEAN trade increased due the utilisation of ATIGA tariffs. The summary statistics of the utilisation effect are shown in **TABLE 6-4**. Notice that we can compute the utilisation effect also for the three-digit codes that we did not obtain the gravity estimates for as long as the average utilisation share is available. Thus, the number of observations slightly increases compared with that in **TABLE 6-3** (169 for each year).

Table 6-4. Basic Statistics of Utilisation effects of ATIGA

		N	Mean	S.D.	p25	p50	p75	Min	Max
Year = 2010									
	Type I	173	0.16	0.09	0.10	0.15	0.21	0	0.38
	Type II	173	0.13	0.09	0.06	0.12	0.19	0	0.39
Year = 2014									
	Type I	173	0.24	0.16	0.13	0.21	0.35	0	0.69
	Type II	173	0.21	0.16	0.09	0.19	0.31	0	0.67
Year = 2018									
	Type I	173	0.33	0.24	0.16	0.29	0.46	0	1.12
	Type II	173	0.31	0.25	0.12	0.25	0.44	0	1.26

Source: Authors' calculation.

The means of the utilisation effect show the increase by around 15% in 2010, by around 25% in 2014, and by about 35% in 2018. The rise of the utilisation effect from 2010 to 2018 is based on the rise in utilisation of ATIGA tariffs. For example, utilisation rises in food products by nearly 30 percentage points from 2010 to 2018. **TABLE 6-5** lists the top 25 products in terms of the Type I utilisation effect in 2018. It shows that food products tend to have high effects, mostly around a 100% increase. Overall, high effects can be found in agricultural goods and food products. Thus, the introduction of ATIGA preferential tariffs contributed to increasing intra-ASEAN trade particularly in those industries. Chemical products and plastic/glass products also have relatively high effects.

Table 6-5. Top 25 Products in ATIGA Utilisation Effects in 2018 (Type I)

		Gravity	Utilisation		Utilisation effect	
HS	Section	Coef.	I	II	I	II
190	Food products	−0.38	0.52	0.35	1.12	1.26
180	Food products	0.77	0.48	0.25	0.99	0.81
200	Food products	−0.68	0.47	0.30	0.96	1.01
110	Vegetable products	−0.82	0.46	0.26	0.94	0.83
210	Food products	−1.15	0.46	0.31	0.92	1.04
151	Animal/vegetable fats and oils	−1.84	0.45	0.27	0.91	0.88
170	Food products	0.13	0.45	0.29	0.90	0.94
220	Food products	−0.63	0.44	0.28	0.88	0.92
81	Vegetable products	1.73	0.43	0.22	0.86	0.69
330	Chemical products	−0.35	0.42	0.28	0.83	0.90
150	Animal/vegetable fats and oils	0.47	0.39	0.16	0.74	0.45
90	Vegetable products	−2.66	0.37	0.22	0.70	0.68
441	Wood products	−0.87	0.37	0.24	0.70	0.75
701	Plastic or glass products	1.10	0.37	0.22	0.69	0.65
340	Chemical products	0.45	0.36	0.23	0.67	0.71
940	Miscellaneous	0.32	0.35	0.24	0.66	0.75
80	Vegetable products	0.43	0.35	0.20	0.65	0.58
481	Paper products	−0.08	0.34	0.25	0.63	0.77
71	Vegetable products	0.36	0.34	0.19	0.62	0.54
870	Transport equipment	−1.02	0.34	0.24	0.62	0.74
40	Live animals	−1.51	0.34	0.19	0.62	0.55
871	Transport equipment	−2.38	0.33	0.22	0.61	0.68
160	Food products	0.11	0.33	0.19	0.61	0.54
690	Plastic or glass products	−0.57	0.32	0.17	0.59	0.50
681	Plastic or glass products	0.26	0.32	0.18	0.58	0.52

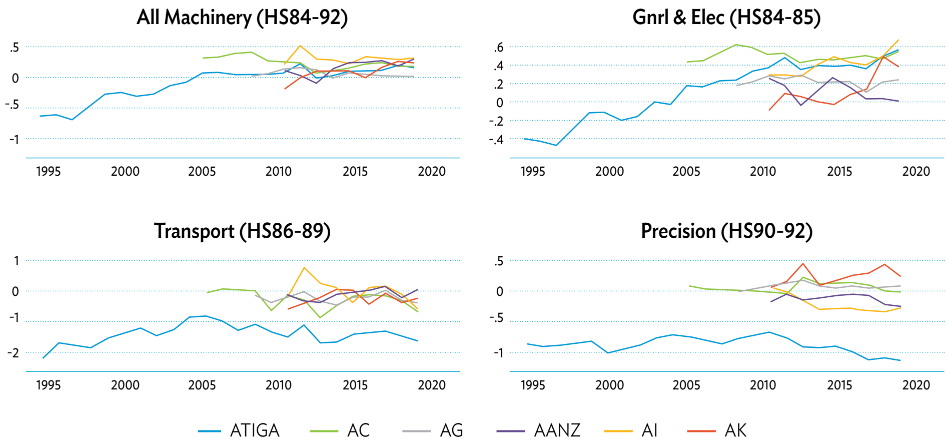
Source: Authors' calculation.

D. Additional Analyses: Gravity for Machinery

In this section, we estimate the gravity equation for machinery industries, distinguishing between finished goods and intermediate goods. In Asia, international production networks have developed in machinery industries since the 1990s. Such networks have been called ‘Factory Asia’ (Baldwin, 2008). To further examine their role in trade by the AMS, we estimate equation (2) for finished machinery goods and machinery parts separately. Machinery goods are defined as those in general or electric machinery (HS84–85), transport equipment (HS86–89), and precision machinery sectors (HS90–92). Kimura and Obashi (2010) carefully classified HS six-digit codes in these industries into finished products and intermediate products. By using this list, we decompose total trade in each machinery industry and aggregate to finished machinery goods and machinery parts in each industry.

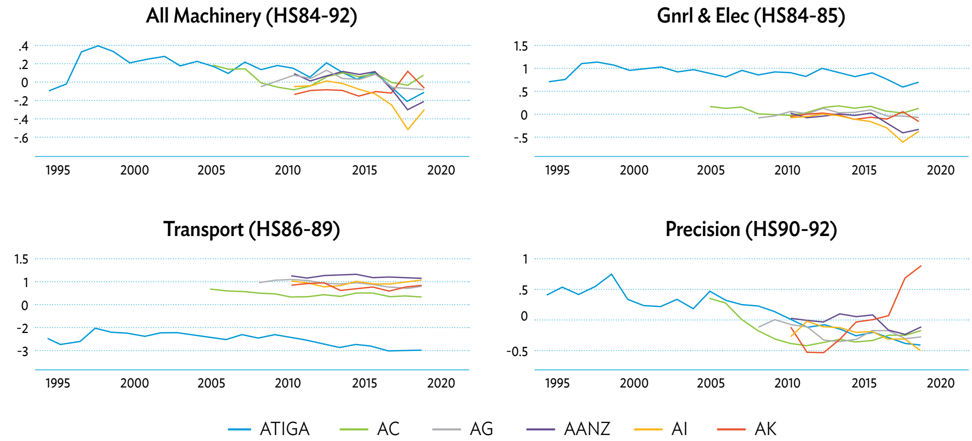
We show the changes of coefficients in **FIGURES 6-2** and **6-3**. In the case of ATIGA, machinery parts are likely to have positive coefficients, while the coefficients in finished machinery goods tend to be negative. Nevertheless, in the 2010s, those became positive in general or electric finished machinery goods and negative in precision machinery parts. On the other hand, for both finished machinery goods and machinery parts, the coefficients for ATIGA were mostly negative in the transport equipment industry. This last finding may contradict our previous findings, which show the positive mean for ATIGA in transport equipment. This difference is due to the coefficients for ATIGA in HS 860 and HS 890 being rather large and positive, whereas the other three-digit codes in transport equipment have negative coefficients. Thus, taking the average of three-digit-level products yields a positive average. This again emphasises the fact that the trade creation effect of ATIGA is very specific to certain sectors or products.

Figure 6-2. Gravity Estimates for Finished Machinery Goods



Source: Authors’ calculation.

Figure 6-3. **Gravity Estimates for Machinery Parts**



Source: Authors' calculation.

E. Determinants of ATIGA Utilisation Rates

In this subsection, we examine the utilisation rates of ATIGA tariffs provisions. Unlike our analysis in the previous section, we restrict the study products to only those that have ad-valorem rates in both MFN tariffs and ATIGA tariffs and where ATIGA tariffs are lower than MFN tariffs. Then, we compute the share of imports under the ATIGA regime out of total imports, i.e. ATIGA utilisation rates. We identify the eligibility, i.e. whether or not ATIGA tariffs are lower than MFN tariffs, at an HS eight-digit level. If multiple rates are available within an HS eight-digit code, we use the lowest rates. Singapore as an importer is dropped because of the unavailability of data on imports under the ATIGA regime. Due to the data limitation, we focus on 2018 in this subsection.

The ATIGA utilisation rates for 2018 are shown in **TABLE 6-6**.[8] Brunei, Cambodia, Lao PDR, and Myanmar have low utilisation rates when importing. Other countries including Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam, have relatively high utilisation rates when importing. It is also interesting that Singapore has relatively low utilisation rates when exporting even though it is known for efficient trade facilitation. Given that Singapore is characterised as the centre of the entrepôt trade, the low utilisation rates may indicate lower use of back-to-back certificates of origin (or movement certificate). In addition, unlike the case of importing, Cambodia and Lao PDR have relatively high utilisation rates when exporting to some countries.

[8] We use tariff rates in Lao PDR for 2017 to identify the eligibility of the ATIGA regime to keep the consistency of HS versions between tariff data and trade data.

Table 6-6. **ATIGA Utilisation Rates in 2018 (%)**

	Importer								
	BRN	IDN	KHM	LAO	MMR	MYS	PHL	THA	VNM
BRN		15		0	0	44	93	12	72
IDN	33		1	19	62	63	80	74	75
KHM	0	49		0	19	10	75	64	85
LAO		75	3		0	92	74	63	33
MMR	0.3	65	0.1	0		13	74	42	80
MYS	23	80	4	11	29		59	34	52
PHL	0	76	0.3	63	63	76		50	39
SGP	2	55	6	0.04	4	22	29	37	58
THA	11	87	10	10	33	71	77		68
VNM	35	82	3	0.5	24	51	65	68	

Note: Products are restricted to those that have ad-valorem rates in both MFN tariffs and ATIGA tariffs and where ATIGA tariffs are lower than MFN tariffs, i.e. MOP is positive.

Source: Author's computation.

Next, we explore the association of ATIGA utilisation rates with tariff margins. To do that, we estimate the following equation:

$$Utilization\ rates_{ijp} = \gamma \times Margin_{jp} + \boldsymbol{\delta} + \varepsilon_{ijp}. \quad (4)$$

The dependent variable is an ATIGA utilisation rate when exporting HS eight-digit level product p from countries i to j in 2018. It lies in the unit interval, [0, 1]. Note that this variable is different from *Utilisation* in equation (3). The measure here is defined at a bilateral-basis. $Margin_{jp}$ is the difference between MFN tariffs and ATIGA tariffs. For example, if those tariff rates are 10% and 0%, respectively, this variable takes 0.1, i.e. (10−0)/100. Since our study countries include only the members of ATIGA, this variable does not differ by exporting countries. $\boldsymbol{\delta}$ is a vector of various fixed effects. The study country pairs are the same as those shown in Table 6. Also, we restrict the study products only to those that have ad-valorem rates in both MFN tariffs and ATIGA tariffs and where ATIGA tariffs are lower than MFN tariffs.

The estimation results by using the OLS method are reported in Table 7. We cluster the standard errors by country pairs. All specifications include country pair fixed effects. Furthermore, in columns (I) and (III), we control for product fixed effects. In columns (II) and (IV), we introduce exporter-product fixed effects. These product-level fixed effects completely absorb the effects of rules of origin on the ATIGA utilisation rates. One data issue is that the HS version is HS 2012 in the import data in Lao PDR but is HS 2017 in those in the other countries. Therefore, in columns (I) and (II), we define products in the fixed effects at a six-digit level of HS 2012 by using the converter table at a six-digit level between HS 2012 and HS2017. In columns (III) and (IV), on the other hand, we drop observations where Lao PDR is an importer and then define products in the fixed effects at an eight-digit level of HS 2017. Naturally, the number of observations differs by specifications because the singleton observations are dropped.

Table 6-7. Regressions of ATIGA Utilisation Rates on Tariff Margin: OLS

	(I)	(II)	(III)	(IV)
Margin	0.246***	0.229***	0.215***	0.202***
	[0.049]	[0.043]	[0.050]	[0.042]
Lao PDR	Incl.	Incl.	Excl.	Excl.
Country pair FE	X	X	X	X
Product FE	X		X	
Exporter-product FE		X		X
Adjusted R-squared	0.2986	0.3763	0.3115	0.4096
No. of observations	92,538	85,831	85,030	71,142

Notes: The dependent variable is the ATIGA utilisation rates, which lie in a unit interval, [0, 1]. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. Standard error clustered by country pair is reported in parentheses. In columns (I) and (II), we define products in fixed effects (FE) at an HS six-digit level. In columns (III) and (IV), where Lao PDR as an importer is not included, products in the FE are defined at an HS eight-digit level.

Source: Author's estimations.

All columns show that the coefficient for the tariff margin is estimated to be significantly positive. Thus, as well-documented in the literature, ATIGA tariffs are more utilised in trading products with greater tariff margins. For example, column (IV) indicates that a one-percentage-point rise in tariff margin raises the ATIGA utilisation rate by 0.2 percentage points. To examine the non-linear relationship between the utilisation rate and tariff margin, we introduce dummy variables indicating various ranges of tariff margin instead of its continuous variable. The results are reported in Table 8. The base range is the range of (0, 0.01]. Although the statistical significance differs by specifications, no results show significant coefficients for the range of (0.01, 0.03]. This result may indicate that due to the compliance costs in rules of origin, firms require a tariff margin to be greater than 3% in their use of the ATIGA regime.

Table 6-8. Regressions of ATIGA Utilisation Rates on Category Variables on Tariff Margin: OLS

	(I)	(II)	(III)	(IV)
1 for 0.01 < Margin ≤ 0.03	0.001	0.001	−0.0002	−0.001
	[0.012]	[0.010]	[0.013]	[0.011]
1 for 0.03 < Margin ≤ 0.06	0.034*	0.033***	0.029	0.023*
	[0.017]	[0.011]	[0.018]	[0.014]
1 for 0.06 < Margin ≤ 0.10	0.034*	0.030***	0.029	0.024*
	[0.017]	[0.011]	[0.018]	[0.012]
1 for 0.10 < Margin ≤ 0.15	0.028	0.031**	0.019	0.018
	[0.019]	[0.013]	[0.021]	[0.015]
1 for 0.15 < Margin ≤ 0.20	0.067***	0.065***	0.061***	0.056***
	[0.021]	[0.014]	[0.022]	[0.015]
1 for 0.20 < Margin ≤ 0.30	0.071***	0.066***	0.057***	0.053***
	[0.018]	[0.013]	[0.019]	[0.014]
1 for 0.30 > Margin	0.094***	0.091***	0.084***	0.078***
	[0.022]	[0.015]	[0.024]	[0.016]
Lao PDR	Incl.	Incl.	Excl.	Excl.
Country pair FE	X	X	X	X
Product FE	X		X	
Exporter-product FE		X		X
Adjusted R-squared	0.2993	0.3771	0.3122	0.4104
No. of observations	92,538	85,831	85,030	71,142

Notes: The dependent variable is the ATIGA utilisation rates, which lie in a unit interval, [0, 1]. The base category in Margin is when margin lies in (0, 0.01]. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. Standard error clustered by country pair is reported in parentheses. In columns (I) and (II), we define products in fixed effects (FE) at an HS six-digit level. In columns (III) and (IV), where Lao PDR as an importer is not included, products in the FE are defined at an HS eight-digit level.

Source: Author's estimations.

E. Conclusion from gravity analysis

This chapter examined the effects of ATIGA on intra-ASEAN trade. We first estimated the gravity equation with ATIGA dummy variables and found that their coefficients were negative during our study period. This result implies that the total trade creation effect of ATIGA had been negative. Second, we quantified the trade creation effect attributed only to the utilisation of ATIGA tariffs. To do that, we regressed the gravity estimated above on the average share of imports under the ATIGA regime amongst ASEAN country-pairs. Then, we found that the utilisation of ATIGA tariffs increased intra-ASEAN trade in 2018 by approximately 35%. In particular, agriculture and food industries have the largest effects, followed by chemical products and plastic/glass products. These relatively large effects are based on the active use of ATIGA tariffs in those industries. Last, we conducted two additional analyses. One is to estimate the gravity equation for finished machinery goods and machinery parts separately. Our finding is that the coefficients for the ATIGA dummy tend to be positive in machinery parts but negative in finished machinery goods. The other is to examine the utilisation rates of the ATIGA regime. We found their positive relationship with the preference margin. Firms are more likely to utilise ATIGA tariffs when trading products with a greater margin of preferences. Due to the compliance costs in rules of origin, however, firms require a tariff margin to be greater than 3% in their use of the ATIGA regime. Since the utilisation of ATIGA tariffs contributes to increasing intra-ASEAN trade, it is the right way to encourage the further utilisation of ATIGA tariffs. Lowering compliance costs for rules of origin contributes to enhancing firms' utilisation of ATIGA tariffs.

Technical Appendix to the chapter (Empirical Methodology)

Our empirical analysis consists of two steps. The first step is to quantify the trade creation effect by estimating the gravity equation. To evaluate the effects of regional trade agreements (RTAs), most studies employ a gravity equation with an RTA dummy variable, which takes the value of one if two countries belong to the same RTA and the value of zero otherwise (RTA_{ijt}). Specifically, it is given as follows:

$$\ln X_{ijt} = \alpha \times RTA_{ijt} + \mathbf{Z}'_{ij}\boldsymbol{\beta}_1 + \mathbf{Z}'_{it}\boldsymbol{\beta}_2 + \mathbf{Z}'_{jt}\boldsymbol{\beta}_3 + \epsilon_{ijt}, \quad (1)$$

where X_{ijt} is export values from countries *i* to *j* in year *t*. $\mathbf{Z}_{ij}$, $\mathbf{Z}_{it}$, and $\mathbf{Z}_{jt}$ are vectors of time-invariant country pair, time-variant exporter, and time-variant importer characteristics, respectively. The time-invariant country pair characteristics include geographical distance, language similarity, and cultural similarity. GDP and multinational resistance terms[9] are examples of time-variant exporter and importer characteristics. ϵ_{ijt} is a disturbance term. The coefficient for the RTA dummy indicates the trade creation effects of RTAs, that is, the average effects of RTAs on trade amongst RTA member countries.

There are three empirical issues regarding estimation. First, it is challenging to find a good proxy variable for price indices or multilateral resistance terms (Anderson and van Wincoop, 2003). As suggested in Feenstra (2002), since those elements differ by countries, not by country-pairs, most studies control for them by introducing exporter-year and importer-year fixed effects. The second issue is the treatment of zero-valued trade. As Melitz (2003) suggested, trade values can be systematically zero. However,

[9] The multilateral resistance term indicates the price index that consists of prices of all goods available in a country, including imported goods. Since it takes non-monetary trade costs into account, it is not the same as consumer price index.

taking logarithms of trade values drops such observations from the sample, leading to the elimination of potentially useful information and yielding to a sample selection bias. To overcome this issue, recent studies employ the Pseudo-Poisson Maximum Likelihood (PPML) technique (Silva and Tenreyro, 2006) or the extended technique of Heckman two-step estimation (Helpman, Melitz, and Rubinstein, 2008).

The last is an endogeneity issue on the RTA dummy variable. It is, without a doubt, not an exogenous random variable: countries systematically and purposefully decide whether to conclude a RTA. Furthermore, the elements that influence international trade also affect decisions on a RTA's conclusion. For example, the geographically close countries tend to have not only more trade due to lower transportation costs but also a higher probability of forming RTAs due to closer economic or cultural ties. Hence, there would be unobservable elements that affect both the RTA dummy and the magnitude of trade. Without accounting for the endogeneity of the RTA dummy, estimating the gravity equation using the RTA dummy through ordinary least squares (OLS) results in biased estimates. Baier and Bergstrand (2007) closely examined this endogeneity issue in the RTA dummy and demonstrated that the most plausible estimates of RTA effects on international trade are obtained from the gravity estimation using panel data with time-invariant country-pair fixed effects.

In this study, we address all of the three issues by employing the approaches proposed above. Specifically, our gravity equation is given as follows:

$$X_{ijpt} = \exp\{\alpha_p \times RTA_{ijt} + ATIGA_{ijt} \times \mathbf{Y'}_t \boldsymbol{\beta}_p^{ATIGA} + AANZ_{ijt} \times \mathbf{Y'}_t \boldsymbol{\beta}_p^{AANZ} + AC_{ijt} \times \mathbf{Y'}_t \boldsymbol{\beta}_p^{AC} + AI_{ijt} \times \mathbf{Y'}_t \boldsymbol{\beta}_p^{AI} + AJ_{ijt} \times \mathbf{Y'}_t \boldsymbol{\beta}_p^{AJ} + AK_{ijt} \times \mathbf{Y'}_t \boldsymbol{\beta}_p^{AK} + \delta_{ijp} + \delta_{ipt} + \delta_{jpt}\} + \epsilon_{ijpt}. \quad (2)$$

We estimate this model by the three-digit code of the HS, which is called product hereafter and is indicated by a subscript p. Namely, we regress approximately 170 equations.[10] X_{ijpt} is export values of product p from countries i to j in year t. δ_{ijp}, δ_{ipt}, and δ_{jpt} are respectively the time-invariant country pair-product, time-variant exporter-product, and time-variant importer-product fixed effects. The endogeneity issue is addressed by the time-invariant country pair-product fixed effects. GDP and multinational resistance (e.g. price index) are controlled for by the time-variant exporter-product and importer-product fixed effects. These fixed effects control for exporter's international competitiveness and importer's demand size. ϵ_{ijpt} is a disturbance term. We estimate this equation using the PPML technique.

10 We choose the analysis at an HS three-digit level. For example, when we estimate equation (2) at an HS four-digit level, the coefficients for ATIGA cannot be estimated in many products because of the existence of many zero-values in intra-ASEAN trade.

The dummy variables on RTAs by AMS are defined as follows. $ATIGA_{ijt}$ takes the value of one if both countries are members of the AFTA/ATIGA. Note that the dummy variable of RTA_{ijt} does not cover the AFTA/ATIGA to isolate the trade creation effect of the AFTA/ ATIGA from that of the other RTAs. To investigate its time-series change, $ATIGA_{ijt}$ is interacted with a vector of year dummy variables, $\mathbf{Y}_t$. A vector $\boldsymbol{\beta}_p^{ATIGA}$ indicates the trade creation effect of the AFTA/ATIGA in a product according to years. Like the ATIGA, we introduce the interaction terms of five ASEAN+1 FTA dummy variables with year dummy variables; ASEAN–China FTA (ACFTA), ASEAN–Republic of Korea FTA (AKFTA), ASEAN–Japan RTA (AJCEP), ASEAN–Australia–New Zealand FTA (AANZFTA), and ASEAN–India FTA (AIFTA). Note that these variables on ASEAN+1 FTAs do not take the value of one between the AMS to capture the increase of intra-ASEAN trade solely by the coefficients in the ATIGA dummy. For example, AC takes the value of one for trade between one of the AMS and China, but not for trade between the AMS. AANZ examines trade with Australia or New Zealand while *AI*, *AJ*, and *AK* explore trade with India, Japan, and the Republic of Korea, respectively. In addition, these dummy variables can be the value of one after 2004 in *AC*, after 2007 in *AJ*, after 2009 in *AANZ*, *AI*, and *AK*. We do not take into account the existence of bilateral RTAs between AMS and plus-one countries. Lastly, the RTA dummy variable does not take the value of one when ASEAN+1 FTA dummy variables do so.

There are two noteworthy points. First, we define the dummy variables on RTAs with plus-one countries based on the entry year of plurilateral RTAs. For example, a bilateral RTA entered into force between Thailand and Australia in 2005 while AANZFTA did in 2010. As defined above, our dummy variable on the RTA between Australia and AMS has taken the value of one since 2010 to keep consistency across AMS. Thus, although we label RTA dummy variables by using the name of plurilateral RTAs, their coefficients indicate the trade creation effects of not only plurilateral RTAs but also existing other RTAs. Second, the above estimates on the trade creation effect include the effects of not only the RTA utilisation but also all the other events that have an influence on intra-member trade during the study period. Namely, some parts of the estimates are not attributed to the utilisation of the RTA regime. This fact is inevitable because we cannot control all possible events directly. Although the gravity estimates are still invaluable since such parts include the effects of the non-tariff measure (NTM) changes, we may be interested in the effects of solely utilising RTA tariff rates.

Against this backdrop, the second step intends to capture the trade creation effect attributed to the utilisation of the RTA regime, which hereafter is called 'utilisation effect.' To this end, we examine how the trade creation effects estimated above are related to the utilisation rate of the RTA regime. In this analysis, due to the data limitation, we focus on ATIGA and estimate the following equation by using the simple OLS method:

$$\hat{\beta}_{pt}^{ATIGA} = \gamma \times Utilization_{pt} + \delta_p + \delta_t + \varepsilon_{pt}. \quad (3)$$

Subscripts *p* and *t* indicate HS three-digit code and year, respectively. $\hat{\beta}_{pt}^{ATIGA}$ is obtained by estimating equation (2). δ_p and δ_t are fixed effects for HS three-digit codes and years, respectively. We construct *Utilisation* as follows. We first compute the share of imports under the ATIGA regime out of total imports for each country pair at the HS three-digit level.[11] Then, we take the simple average of those shares amongst all pairs of the AMS according to the three-digit codes and years, which is named '*Utilisation*.'

The use of a simple average is to keep consistency with the estimates of the trade creation effect. These estimates for each product are obtained by regressing trade values at a country-pair level by using the simple OLS method and thus indicate the simple average of trade creation effects amongst all pairs of the AMS. Therefore, we also compute *Utilisation* by taking a simple average. For a similar reason, when computing *Utilisation*, we include the products that are ineligible under the ATIGA regime or for which ATIGA tariff rates are not available. In this sense, our measure of *Utilisation* is a bit different from 'RTA utilisation rates' used in the literature, which does not include RTA-ineligible products in the computation. To distinguish from the RTA utilisation rate, we call our measure the 'RTA utilisation share.' The utilisation effect is computed as $\exp(\hat{\gamma} \times Utilization_{pt}) - 1$.

It is invaluable to discuss further what we do in this second step. We can interpret the model specified in equation (3) as indicating the decomposition of the total trade creation effect. For simplicity, suppose that the trade creation effect of ATIGA comes from two sources: one is tariff reduction, the other is the change of NTM. The right-hand side of equation (3) consists of the effects from these two sources. Obviously, the effect of tariff reduction is captured by a variable of Utilisation. Although NTMs differ by AMS, we suppose that the differences in NTMs come mainly from products. Thus, we assume that their effects are controlled by HS three-digit fixed effects. In sum, by estimating equation (3), we intend to decompose the total trade creation effect of ATIGA into the effects attributed to the utilisation of ATIGA tariffs and those based on the NTM changes. Later, we also assume that the total trade creation effect of ATIGA depends on imports from China.

[11] It is desirable to include not only the imports under the ATIGA regime but also those under the ASEAN+1 FTA regimes when computing Utilisation. However, we do not have the data on the latter imports.