ERIA Discussion Paper Series

No. 402

The Trade Restrictiveness Index and Its Impact on Trade Performance in Selected East Asian Countries

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September 2021

Abstract: *This paper aims to investigate the effect of non-tariff measures (NTMs) on trade in selected East Asian countries. In doing so, we first estimate the ad valorem equivalent (AVE) of NTMs and construct an augmented trade restrictiveness index (ATRI) by measuring the overall external regulations imposed by importing countries. Second, we analyse the effect of the AVE and trade restrictiveness index (TRI) of importing nations on the exports of various sub-sector products for each country in selected East Asian countries. Based on a standard gravity model framework, we perform a Poisson pseudo maximum likelihood (PPML) regression at the sectoral level (Harmonized System 2-digit) for total exports and major sub-sectors (agri-food, health, logistics, and*

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[§] This research was conducted as part of the Economic Research Institute for ASEAN and East Asia (ERIA) 'Impact of Non-tariff Measures on Trade and Competitiveness in East Asia' project. The authors are deeply indebted to the members of this project for their invaluable suggestions. The opinions expressed in this paper are the sole responsibility of the authors and do not reflect the views of ERIA.

manufacturing). The findings show that the ATRI has a negative and significant relationship towards bilateral exports for total exports, manufacturing, and logistics sub-sectors. The negative impacts of the ATRI also highlight that trade barriers play a significant role in bilateral exports. NTM restrictions (proxied by the calculated AVE of NTMs) imposed by importing countries have mixed results for technical and non-technical measures. Where technical measures have negative and significant impacts on bilateral exports for total exports, manufacturing, and health sub-sectors. This implies that implementation of technical NTMs such as sanitary and phytosanitary (SPS) and technical barrier to trade (TBT) measures in importing nations adversely affect bilateral exports for these sub-sectors. This is in line with our hypothesis, as exporters may face difficulties in meeting the current NTM specifications, leading to lower bilateral exports. In addition, the results show that most trade agreements have a positive and significant relationship with ASEAN and East Asia countries' bilateral exports, suggesting that free trade agreements enhance trade between countries.

Keywords: Trade restrictiveness index; Non-tariff measures; Gravity model

JEL Classification: F13; F14

1. Introduction

Several trade policy interventions (e.g. tariffs and non-tariff measures (NTMs)) have been enacted by importing countries in various sub-sectors, and could result in economic effects on traded goods. Evaluating the impact of tariffs is a major issue for governments because different tariffs are imposed on different types of goods. Furthermore, tariffs have a varied impact across the importing countries. NTMs are a popular form of government intervention in trade barriers as they are less visible and more diverse, can be implemented efficiently, and are more easily altered than rigid tariff schedules. Despite their increasing importance in trade regulations, the exact effects of NTMs on trade performance and competitiveness are still understudied. Therefore, there is a pressing need to develop a better understanding of the current NTMs.

Studies on non-tariff impacts are still limited for two reasons. First, some NTMs are less transparent than conventional tariffs. This is because most NTM policies are qualitative, which makes it difficult to assess their impact on trade, competitiveness, and macroeconomic variables. The causes of the lack of

understanding of the implication of trade NTMs are due to the intricacies of regulatory and varied policy mechanisms. Moreover, the effects of those measures on international trade are hard to generalise. Unlike tariffs, the data on NTMs are not just numbered, and the impacts on competitiveness and trade are usually indirect and mostly on a case-to-case basis.

Second, NTMs comprise all measures that alter international trade conditions – including rules and policies that restrict and assist trade. Nevertheless, NTMs have often been mistakenly presented as non-tariff barriers (NTBs). NTMs contain a wider set of measures than NTBs. NTBs mostly refer to governments' selective non-tariff measures, favouring local producers instead of non-local suppliers. The presumption that a country which imposes extensive NTMs will have low trade volumes, while a country which imposes a lower number of NTMs will have higher trade volumes, is not necessarily true. This is because NTMs are unequivocally distinct from NTBs, as their main purpose is to improve the quality of goods and services and to protect local producers. Meanwhile, NTBs inflict greater complications on trade, so they could probably harm the welfare of the countries involved. Therefore, it is imperative to recognise how NTMs affect trade in the case of the Association of Southeast Asian Nations (ASEAN) Member States (AMS) and East Asia countries to understand the relationship between NTMs and trade.

The existence of a single comprehensive measure that represents countries' current trade restriction levels could hinder the objective of reaching higher trade liberalisation. Policymakers need to have a better understanding of the current trade restrictions imposed for more meaningful and effective negotiations. A simple average tariff or weighted average tariff cannot capture the overall restrictions imposed by importing countries, as it is more focused on tariffs alone. Hence, how do we sum up the trade restriction level from NTMs and tariffs in a single measure?

Various authors have taken the initiative to utilise the simple partial equilibrium model for the trade restrictiveness index (TRI) of Feenstra (1995). One of the most referenced articles in this field is Kee, Nicita, and Olarreaga (2009), as it was the first study to test Feenstra's framework empirically and estimated the TRI for 88 countries at the tariff line, including both developing and developed countries. Some studies have calculated the TRI for a specific country, such as

Canada (Chen, Ma, and Xu, 2014), the United States (US) (Irwin, 2007), and China (Chen, 2014), and regional economies such as the European countries (Bureau et al., 2003).

Further analysis shows that only a small number of studies have taken into consideration the issue of NTMs. This is mainly due to the unavailability of data and difficulties in restructuring the data. Kee, Nicita, and Olarreaga (2006) and Beghin, Disdier, and Marette (2015) included NTMs in their studies. However, their analysis was more focused on the country-level TRI. This study attempts to fill the gap by investigating the impact of NTMs at the country and sectoral level using the latest data.

Estimation of the TRI imposed by importing countries has focused more on the aggregated import effects of the implementation of trade barriers – tariffs and NTMs. It is still not possible to answer fundamental questions regarding the impacts of trade restrictions imposed on goods exported by East Asia countries and AMS by importing economies. It is important to address this matter, as most trade policymakers are concerned about enhancing their exports to ensure sustainable economic growth. This study intends to extend the work done by Kee, Nicita, and Olarreaga (2009) by investigating the impacts of the TRI on the bilateral exports of various sub-sectors for AMS and East Asia countries.

This study has the following objectives: (i) to analyse the incidence of NTMs, cross-border trade flows, and trade patterns amongst AMS and East Asia countries; (ii) to estimate the ad valorem equivalent (AVE) of NTMs and to construct a TRI by measuring the overall external regulations in the form of tariffs and NTMs of importing countries towards AMS and East Asia countries; and (iii) to analyse the effect of the TRI of importing nations on the exports of various sub-sector products using a gravity model for each country in the ASEAN and East Asia regions.

2. Data Description

This study uses multiple data sets to answer each objective. For the first objective, we used time-series and cross-sectional data, focusing on the 10 AMS plus four East Asia countries and their five common major trading partners.[1] To calculate the TRI and investigate its impacts, this research uses average trade data from 2016 to 2018 for 98 countries – four East Asia countries, nine AMS (except the Lao People's Democratic Republic (Lao PDR) due to unavailability of data), and other countries – for around 4,709 products at the tariff line (Harmonized System (HS) 6-digit) for each country.[2]

Import and export value data were obtained from the UN Comtrade (n.d.) database. Due to the unavailability of data, we used the latest ad valorem tariff data from the International Trade Centre's MAcMap (ITC, n.d.). Data for NTMs were obtained from the TRAINS database (UNCTAD, n.d.) which was co-developed by the United Nations Conference on Trade and Development (UNCTAD) and the Economic Research Institute for ASEAN and East Asia (ERIA). The NTM data were disaggregated into non-technical measures and technical measures. Outward measures are excluded from the estimation; only inward policies are considered, which include measures implemented by the importing countries. A dummy variable is used to capture NTMs, where the value of the dummy is 1 if any NTM is being imposed for the specific tariff line, and zero otherwise.

The data for import demand elasticity were taken from Ghodsi, Grübler, and Stehrer (2016), which estimated the import demand elasticity for 167 countries for 5,124 products by using annual data from 1996 to 2014. Data for the gross domestic product (GDP), population, and agricultural land were obtained from the World Bank's World Development Indicators (World Bank, n.d.), while data for labour and capital were from the Penn World Table database (Feenstra, Inklaar, and Timmer, 2015). Data for common gravity variables (e.g. a common language, bilateral distance, and common borders) were obtained from the CEPII database (Mayer and Zignago, 2011).

[1] The four East Asia countries are China, Hong Kong, Japan, and the Republic of Korea. The five common major trading partners are Australia, Germany, India, the United Kingdom, and the United States.

[2] Zainuddin, Khalid, and Sarmidi (2019) studied the AMS and their main trading partners, for a total of 30 countries. This study extends the sample to 98 countries for more comprehensive results, as we have taken into consideration all the countries in the world with available data. In addition, the latest average trade data from 2016 to 2018 are used, enabling us to overcome year-specific bias.

3. Methodology

Several approaches have been utilised to analyse the incidence of NTMs and assess their impact on international trade. The approaches encompass price gap calculation, simple inventory measures, and AVE estimates. Two indices are used in the simple method: the coverage ratio (CR) and the frequency index (FI). The frequency index only considers whether an NTM is present or absent, and gathers the products' percentages where the application of NTMs is one or multiple. The calculation of the frequency index is as below:

$$FI_j = \left[\frac{\sum D_i M_i}{\sum M_i}\right] \times 100 \qquad (1)$$

where a dummy variable is signified by *D*, in which it reflects the existence of one or multiple NTMs; and *M* signifies good *i* imports (another dummy variable). Meanwhile, the coverage ratio is the trade percentage that is subject to NTMs for import nations. It shows the measure of NTMs' importance in total imports (UNCTAD, 2013). The formula to calculate the coverage ratio is as follows:

$$CR_j = \left[\frac{\sum D_i V_i}{\sum V_i}\right] \times 100 \qquad (2)$$

where the dummy variable is signified by *D*, in which it reflects the existence of one of the multiple NTMs; and *V* signifies the import value of product *i*. Hence, the descriptive statistics of the NTMs' occurrence in relation to frequency (number of import products subject to NTMs) and coverage (value of import products subject to NTMs) are obtained through the utilisation of CR and FI. We also use raw data to measure the incidence of NTMs for AMS and East Asia countries. Key issues regarding the incidence of NTMs include the nation that tends to adopt them, the sector that is subject to them, the most usual form of NTMs, and their behaviour over the years.

Next, to construct the TRIs and the AVE of NTMs, this study employs a methodology similar to that used by previous studies. The methodology is based on a well-grounded theory and considers the various forms of trade protection, which can be categorised into tariff and non-tariff measures (Kee, Nicita, and Olarreaga,

2009; Niu et al., 2018; Zainuddin, Khalid, and Sarmidi, 2019). Consistent with Leamer (1988), this study's theoretical basis is in accordance with the n-good and n-factor general equilibrium model, where log-linear constant return to scale technologies and log-linear utilities were utilised.

We extend our model by including two NTM forms: non-technical measures (chapter C to chapter O) and technical measures (chapter A, chapter B, and chapter C).[3] Technical measures are related to product-specific characteristics such as technical parameters, attributes, and production processes. In general, the objective of these measures is to ensure food safety and standards, as well as national and environmental safety, and to protect the health of flora and fauna. Meanwhile, non-technical measures are related to trade terms such as trade guidelines, custom procedures, shipping policies, and taxation laws. As such, this study uses the model below:

$$ln\, m_{nc} = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c} NTM_{n,c}^T + \delta_{n,c} NTM_{n,c}^{NT} + \varepsilon_{n,c}\, ln\left(1 + t_{n,c}\right) + \mu_{n,c} \quad (3)$$

where m_{nc} is good *n* import value for country *c*; C_c^k signifies variable *k* that gives country-specific attributes; $NTM_{n,c}^T$ is a dummy variable indicating the existence of technical NTMs; $NTM_{n,c}^{NT}$ is a dummy variable that indicates the presence of non-technical NTMs; $\varepsilon_{n,c}$ is the import demand elasticity; $t_{n,c}$ is the ad valorem tariff of country *c* on good *n*; α_n is the tariff line dummy signifying the good-specific effect; $\alpha_{n,k}$ is the parameter that captures the country-specific effect; $\beta_{n,c}$ is the parameter that captures the effect of technical NTMs of country *c* on good *n* imports; $\delta_{n,c}$ is the parameter that captures the effects of non-technical NTMs in country *c* on good *n*; and $\mu_{n,c}$ is the error term.

[3] Chapter A refers to sanitary and phytosanitary measures (SPS); chapter B refers to technical barriers to trade (TBT); chapter C refers to pre-shipment inspection and other formalities (INSP); chapter D refers to contingent trade-protective measures (CTPM); chapter E refers to non-automatic licensing, quotas, prohibitions and quantity-control measures (QC); chapter F refers to price-control measures (PC); chapter G refers to finance measures; chapter H refers to measures affecting competition; chapter I refers to trade-related investment measures; chapter J refers to distribution restrictions; chapter K refers to restrictions on post-sales services; chapter L refers to subsidies; chapter M refers to government procurement restrictions; chapter N refers to intellectual property; and chapter O refers to rules of origin.

The impacts of tariffs on imports rely greatly on the elasticity of import demand, and this study will use the elasticity data from Ghodsi, Grübler, and Stehrer (2016). This study estimated the elasticities for 167 countries from 1996 to 2014.[4] The author then substituted this value into equation (3) and moved the term $\varepsilon_{n,c}\ ln(1 + t_{n,c})$ to the left side to address the endogeneity issues as mentioned by Trefler (1993) and Lee and Swagel (1997). Hence, we obtain equation (4):

$$\ln m_{nc} - \varepsilon_{n,c} \ln(1 + t_{n,c}) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c} NTM_{n,c}^T + \delta_{n,c} NTM_{n,c}^{NT} + \kappa_{n,c} \quad (4)$$

where $\kappa_{n,c}$ is the error term. Equation (4) shows that the impact of NTMs differs across countries and tariff lines. Note that most, if not all, the international databases – such as the World Integrated Trade Solution (WITS), UN Comtrade, and UNCTAD – do not provide time-varying NTM data. Hence, few structural adjustments need to be made to the parameter of equation (4) so that they can vary across tariff lines and countries where the degree of freedom does not run out. This adjustment is important to ensure that our estimation can capture the specific impact on product and country, which will be captured by their respective countries' factor endowments following the comparative advantage approach of Leamer (1988, 1990):

$$\beta_{n,c} = \beta_n + \sum_k \beta_{n,k}\, C_c^k \quad (5)$$

$$\delta_{n,c} = \delta_n + \sum_k \delta_{n,k}\, C_c^k \quad (6)$$

where $\beta_{n,k}$ and $\delta_{n,k}$ are the parameters of a specific product to be estimated. The variation in the country is the result of the interaction amongst comparative advantage variables; i.e. labour over GDP, agricultural land over GDP, capital over GDP, and GDP. Substituting equations (5) and (6) into equation (4), will lead to equation (7):

[4] It is assumed that the import demand elasticity does not change over time. Similar assumptions have been made by previous studies such as Kee, Nicita, and Olarreaga (2006) and Niu et al. (2018). Kee, Nicita, and Olarreaga (2009) estimated the TRI using NTM data in 2003, while Niu et al. (2018) estimated the AVE for NTM data from 1997 to 2015. Both studies used the elasticity data from Kee, Nicita, and Olarreaga (2008), which estimated the import demand elasticity for 117 countries during 1988–2001. Thus, it justified that there are no issues in using a different set of years.

$$\ln m_{nc} - \varepsilon_{n,c} \ln(1 + t_{n,c}) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + (\beta_n + \sum_k \beta_{n,k} C_c^k) NTM_{n,c}^T + (\delta_n + \sum_k \delta_{n,k} C_c^k) NTM_{n,c}^{NT} + \kappa_{n,c} \quad (7)$$

In addition, the current model faces endogeneity issues between NTMs and imports and also the zero trade flows issues. Thus, following Kee, Nicita, and Olarreaga (2009), we employed two-stage regression to overcome these econometric issues. In the first stage, we run instrumental variable regressions to overcome the endogeneity issues between NTMs and imports. This is followed by the second stage, where we estimated Poisson pseudo maximum likelihood (PPML) regression to overcome zero trade flow issues. The estimations for both stages are made for each product by using the HS 6-digit level (4,709 products), using 1996 as the classification year.

For the first stage, we used probit regression with density function for NTMs (technical and non-technical measures). This is because NTMs are dummy variables that are equal to 1 when there is at least one NTM present. We used the average presence of NTMs in the three closest countries where we retrieved the inverse Mills ratio and used it in the second stage. We inserted the inverse Mills ratio from the first stage for technical NTMs (IMR^T) and non-technical NTMs (IMR^{NT}) in the equation and regressed using PPML as follows:

$$\frac{m_{nc}}{(1+t_{n,c})^{\varepsilon_{n,c}}} = \exp\left[\alpha_n + \sum_k \alpha_{n,k} C_c^k + (\beta_n + \sum_k \beta_{n,k} C_c^k) NTM_{n,c}^T + \beta^T IMR^T + (\delta_n + \sum_k \delta_{n,k} C_c^k) NTM_{n,c}^{NT} + \beta^{NT} IMR^{NT}\right] \times \kappa_{n,c} \quad (8)$$

The estimated coefficient from equation (8) will be used to obtain $\beta_{n,c}$ and $\delta_{n,c}$ as per equations (5) and (6). Once the values for $\beta_{n,c}$ and $\delta_{n,c}$ have been estimated, this study will proceed to estimate the AVEs for NTMs. This is important in comparing the impacts of tariffs and NTMs. We followed the guideline provided by Yotov et al. (2016) to estimate the AVE as follows:

$$ave_{n,c}^{NTM^T} = \left[e^{\beta_{n,c}/(-\varepsilon_{n,c})} - 1\right] \times 100 \quad (9)$$

$$ave_{n,c}^{NTM^{NT}} = \left[e^{\delta_{n,c}/(-\varepsilon_{n,c})} - 1\right] \times 100 \quad (10)$$

where $ave_{n,c}^{NTM^T}$ and $ave_{n,c}^{NTM^{NT}}$ are the AVEs for technical and non-technical NTMs, respectively. The impacts of NTMs on imports can be translated into price

equivalents, based on the coefficient for NTMs and the import demand elasticity. Hence, by using equations (9) and (10), we can estimate the AVE for NTMs for all countries and products. Then, we proceed by calculating the overall protection level adopted by country *c* for good *n* import as follows:

$$T_{n,c} = t_{n,c} + ave_{n,c}^{NTM^T} + ave_{n,c}^{NTM^{NT}} \quad (11)$$

where $T_{n,c}$ is the overall protection level of country *c* for good *n*, $t_{n,c}$ is the ad valorem tariff for good *n* imposed by country *c*, and $ave_{n,c}^{NTB}$ is the ad valorem equivalent NTB imposed in country *c* for good *n*. Here, we calculate only for positive AVE as the implementation of NTMs increases the cost of production and thus leads to higher prices.. Once we have calculated the overall protection level of every country, we proceed to calculate the augmented trade restrictiveness index (ATRI).

The ATRI estimates the restrictiveness level in trade enforced by the importing country to restrict trade. It is an augmented version of the existing TRI formula to overcome the bias faced due to high positive AVE values for certain products, so it is suitable for estimating sectoral level restrictions. Thus, following Zainuddin, Khalid, and Sarmidi (2019), we first calculate the ATRI at the country level, as follows:

$$ATRI_c = \left(\frac{\sum_n m_{n,c} \varepsilon_{n,c} \left(\frac{T_{n,c}}{1+T_{i,n,c}} \right)^2}{\sum_n m_{n,c} \varepsilon_{n,c} \left(\frac{1}{1+T_{n,c}} \right)^2} \right)^{\frac{1}{2}} \quad (12)$$

where $m_{n,c}$ is the good *n* import value of country *c*, $\varepsilon_{n,c}$ is the elasticity of import demand for good *n* in country *c*, and $T_{n,c}$ is the overall protection level for good *n* in country *c*. A higher ATRI value indicates a higher restriction being imposed on goods imported by a country. We then proceed to calculate the ATRI for selected major sub-sectors: agri-food (1–22); health (30 and 90); logistics (86–89); and other manufacturing sectors (23–29, 31–85, 91–97).[5]

[5] The numbers in parentheses represent the respective HS 2-digit codes.

Next, to examine the effect of the ATRI imposed by importing nations on the exports of various sub-sector products for AMS and East Asia countries, this study employs the gravity model. Using the standard gravity model of trade, which includes economic size (usually through the use of GDP measurements) as well as the distance between countries, we also consider the estimated ATRI to measure the overall effect of trade barriers (tariff and non-tariff) imposed by importing countries. Tinbergen (1962) proposed the following gravity equation:

$$\ln Export_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln Dist_{ij} + \varepsilon_{ij} \qquad (13)$$

where ln denotes variables in the natural logs; $Export_{ij}$ is the export from country i to country j; GDP_i and GDP_j are the incomes for country i and country j, respectively; $Dist_{ij}$ is the distance from country i to country j; and ε_{ij} is the error term. We expand the model to include trade restrictiveness and a dummy for free trade agreements (FTAs) to obtain the effect of current trade policy. This is important in answering the main focus of this study – i.e. whether trade policy influences trade amongst AMS and East Asia countries. We also include a few other common gravity model variables and transform our model to exponent form as follows:

$$\begin{aligned} Export_{ijn} = \exp(&\beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln Pop_i + \beta_4 \ln Pop_j + \\ &\beta_5 \ln ATRI_{jn} + \beta_6 \ln Dist_{ij} + \beta_7 AFTA_{ij} + \beta_8 ACFTA_{ij} + \beta_9 AJCEP_{ij} + \\ &\beta_{10} AKFTA_{ij} + \beta_{11} CB_{ij} + \beta_{12} CL_{ij}) \times \varepsilon_{ij} \end{aligned} \qquad (14)$$

where Pop_i and Pop_j are the populations for country i and country j, respectively; $ATRI_{jn}$ signifies the trade restrictiveness index being imposed by country j for sub-sector n; $AFTA_{ij}$, $ACFTA_{ij}$, $AJCEP_{ij}$, and $AKFTA_{ij}$ is the dummy variable that is equal to one if country i and country j are in the ASEAN–China Free Trade Area (ACFTA), ASEAN–Korea Free Trade Agreement (AKFTA), ASEAN Free Trade Area (AFTA), or ASEAN–Japan Comprehensive Economic Partnership (AJCEP); CB_{ij} is the dummy variable that is equal to 1 if country i and country j share a

common border; and CL_{ij} is the dummy variable that is equal to 1 if country *i* and country *j* share a common language.

However, equation (14) is unable to answer the impact of separate NTMs (technical and non-technical) on exports. Thus, we substitute the trade restrictiveness variables with tariffs and AVEs for NTMs to obtain equation (15):

$$Export_{ijn} = \exp(\beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln Pop_i + \beta_4 \ln Pop_j + \beta_5 \ln Tariff_{jn} + \beta_6 \ln AVE\_T_{jn} + \beta_7 \ln AVE\_NT_{jn} + \beta_8 \ln Dist_{ij} + \beta_9 ASEAN_{ij} + \beta_{10} ACFTA_{ij} + \beta_{11} AJCEP_{ij} + \beta_{12} AKFTA_{ij} + \beta_{13} CB_{ij} + \beta_{14} CL_{ij}) \times \varepsilon_{ij} \quad (15)$$

where $Tariff_{jn}$ is the average tariff value imposed by country *j* for sector *n;* and AVE_T_{jn} and AVE_NT_{jn} are the average AVEs imposed by country *j* for sector *n* for technical and non-technical NTMs, respectively. Since not all the countries in the world trade with each other at the HS 2-digit level, there will usually be many zero trade flows in the trade data sets. Thus, to address the bias issue in the estimation results, similar to Santos Silva and Tenreyro (2006, 2011), we estimated equations (14) and (15) by using PPML.

Regressions are made at the sectoral level (HS 2-digit) for total exports and major sub-sectors (agri-food, health, logistics, and other manufacturing sectors). For each aggregation, we estimate equation (14) and (15), hence there will be 10 separate regressions. The regression results are able to answer our third objective, which is the impact of trade policy implemented by importing countries (98 trading partners) on the bilateral exports of AMS and East Asia countries.

From the estimated regression, we anticipate a positive correlation between bilateral exports and income. This is because an improvement in the importer's GDP will increase the demand for imported products as the market size increases. An increment in the exporter's GDP represents an increase in the market size, leading to higher production capacities and higher exports. Thus, an increase in the GDP of the exporting and importing nations will lead to higher bilateral exports. Hence, the estimated GDP coefficient is anticipated to have a positive sign. Next, for the estimation of the effect of population on exports, there can be either a

positive or negative impact. This is because large countries export more due to economies of scale, or export less due to absorption effects.

Distance, on the other hand, is expected to be negatively related to exports. This is due to transportation costs and all plausible trade costs. We expect negative values in the coefficient of the ATRI, thus supporting our hypothesis that a higher restrictiveness level restricts trade. The same is expected from the implementation of NTMs, as proxied by the AVE. Meanwhile, for the dummy coefficient of FTAs, we expect a positive value because a trade agreement should lead to higher trade volume between the countries involved. We also expect the coefficient for a common border and a common language to be positive, as discussed in past studies (Kea et al., 2019; Shirazi, Azarbaiejani, and Sameti, 2016; Zainuddin, Sarmidi, and Khalid, 2020).

4. Results & Findings

The outcome of this research is reported according to the research objectives. The first objective is to analyse the cross-border trade flows and trade patterns as well as the incidence of NTMs amongst AMS and East Asia countries. To attain this objective, we first discuss the trade pattern amongst AMS and East Asia countries (Table 1 and Figure 1).

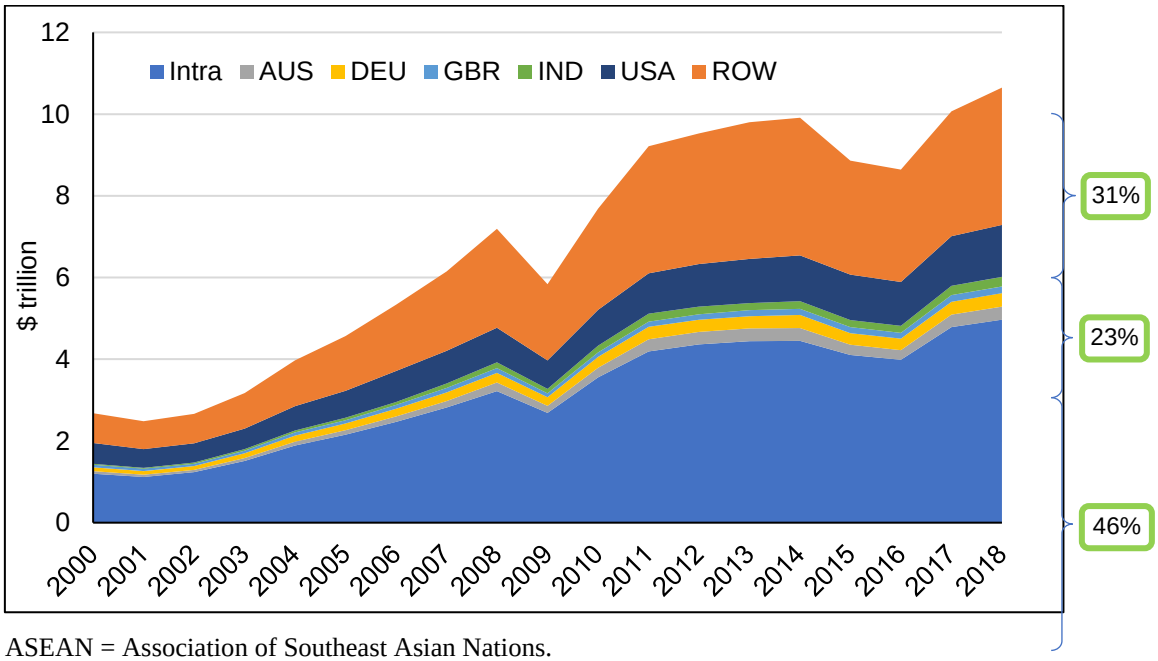
First, we identify the top export destinations for the AMS and four East Asia countries based on the average export values from 2016 to 2018. As can be seen from Table 1, the common top export destinations are within AMS and East Asia countries (orange-coloured area). The coloured boxes show other common export destinations – the US, Germany, the United Kingdom (UK), Australia, and India. Thus, we choose these five countries as the major trading partners to investigate the restrictions they impose in further analysis.

Table 1: Top 10 Export Destinations for AMS and East Asia Countries

ISO3	1	2	3	4	5	6	7	8	9	10
BRN	JPN	KOR	THA	IND	MYS	SGP	AUS	OAS	CHN	IDN
CHN	USA	HKG	JPN	KOR	VNM	DEU	IND	NLD	GBR	SGP
HKG	CHN	USA	IND	JPN	THA	OAS	SGP	VNM	DEU	GBR
IDN	CHN	JPN	USA	IND	SGP	MYS	KOR	PHL	THA	OAS
JPN	USA	CHN	KOR	OAS	HKG	THA	SGP	DEU	AUS	VNM
KHM	USA	GBR	DEU	JPN	CAN	CHN	THA	ESP	BEL	FRA
KOR	CHN	USA	VNM	HKG	JPN	OAS	IND	AUS	SGP	MEX
LAO	CHN	THA	VNM	IND	JPN	DEU	ARE	SWZ	GBR	CHE
MMR	CHN	THA	JPN	IND	SGP	KOR	DEU	USA	HKG	GBR
MYS	SGP	CHN	USA	JPN	HKG	THA	IND	IDN	AUS	VNM
PHL	JPN	USA	HKG	CHN	SGP	KOR	DEU	THA	OAS	NLD
SGP	CHN	HKG	MYS	IDN	USA	JPN	OAS	KOR	THA	VNM
THA	CHN	USA	JPN	HKG	VNM	AUS	MYS	IDN	SGP	PHL
VNM	USA	CHN	JPN	KOR	HKG	NLD	DEU	GBR	ARE	THA

AMS = ASEAN Member State, ASEAN = Association of Southeast Asian Nations, ISO = International Organization for Standardization.
Note: Country codes follow the ISO 3 codes (Appendix 1).
Sources: Author's calculations, based on UN Comtrade (n.d.).

Figure 1: ASEAN and East Asia Trade, 2000–2018



ASEAN = Association of Southeast Asian Nations.
Notes: Country codes follow the International Organization for Standardization (ISO) 3 codes (Appendix 1).
'Intra' represents trade within ASEAN and East Asia countries. 'ROW' represents trade with the rest of the world.
Source: UN Comtrade (n.d.)

After determining the top export destinations, we plotted the trade values from 2000 to 2018 (Figure 1). The increasing total trade trend shows that trade has become an important component of ASEAN and East Asia economic growth across time. On average, 46% of ASEAN and East Asia trade is amongst these countries (intra-regional), 23% of the trade is with selected major trading partners, and the remaining 31% of the trade is with the rest of the world. The increasing trend highlights the importance of analysing the current restriction levels and the impact of such restrictions on trade.

We then proceed to the second part of the first objective – to analyse the incidence of NTMs amongst AMS and East Asia countries. To achieve this objective, we first discuss the number of NTMs implemented (enforced by 2019) by each country (Table 2). China imposed the highest number of NTMs (7,256), followed by Thailand (3,276). The countries that imposed the lowest number of NTMs are Myanmar (267), Cambodia (367), the Lao PDR (520), and Brunei (562). Amongst the major trading partners, the US (6,757) and India (4,598) imposed the highest number of NTMs.

As explained earlier, NTMs that are implemented on imported goods can be categorised into two main groups: technical measures and non-technical measures. Technical barriers to trade (TBTs), sanitary and phytosanitary measures (SPS), and pre-shipment inspection and other formalities (INSP) fall under the technical measures category. Meanwhile, price control measures (PC), contingent trade-protective measures (CTPM), quality control measures (QC), and other measures (OTH) can be grouped into non-technical measures. Some NTMs are enforced on exported goods, and these measures are categorised as export-related measures (EXP).

Table 2: NTMs Implemented by Chapter for ASEAN, East Asia Countries, and Major Trading Partners

ISO3	SPS	TBT	INSP	QC	PC	OTH	CTPM	EXP	Total
BRN	178	245	1	55	24			59	562
KHM	49	131	1	53	15	1		117	367
IDN	239	432	55	83	19	13		130	971
LAO	56	141	18	75	56	2		172	520
MYS	324	372	6	49	29			140	920
MMR	80	51	6	36	20	10		64	267
PHL	363	357	26	209	40	18	2	207	1,222
SGP	136	301		63	44	1		69	614
THA	1,257	1,098	178	116	170	1	4	452	3,276
VNM	114	318	7	76	19	17	1	221	773
CHN	1,642	4,054	113	312	51	58		1,026	7,256
HKG	104	214	11	51	19			90	489
JPN	265	654	32	84	43	5		192	1,275
KOR	706	723	27	94	71	1		307	1,929
AUS	278	839	3	101	69	1		424	1,715
DEU	98	273	6	36		2		2	417
USA	98	273	6	36		2		2	417
IND	2,311	1,483	47	212	43	23		479	4,598
USA	3,244	2,583	481	191	39	1		218	6,757
Total	**11,542**	**14,542**	**1,024**	**1,932**	**771**	**156**	**7**	**4,371**	**34,345**
Percentage	34%	42%	3%	6%	2%	0%	0%	13%	

ASEAN = Association of Southeast Asian Nations; CTPM = contingent trade-protective measures; EXP = export-related measures; INSP = pre-shipment inspection and other formalities; ISO = International Organization for Standardization; NTM = non-tariff measure; OTH = other measures; PC = price control measures; QC = non-automatic licensing, quotas, prohibitions, and quantity-control measures; SPS = sanitary and phytosanitary; TBT = technical barrier to trade.
Notes: Country codes follow the ISO 3 codes (Appendix 1).
Source: Author's calculations, based on the TRAINS database (UNCTAD, n.d.).

Table 2 also shows detailed information on the types of NTMs implemented for AMS and East Asia countries as well as the other major trading partners. We can conclude that the usual NTM chapters adopted are TBTs (42%) and SPS (34%), totalling 14,542 and 11,542, respectively. Detailed overviews show that these high numbers are largely contributed by China, the US, India, and Thailand. The least adopted NTM is CTPM, which is only implemented by three countries – Thailand (4), the Philippines (2), and Viet Nam (1).

The number of EXP adopted is also quite high, at 4,371, but the measures are implemented by the respective countries on their exported goods. Thus, for further analysis, we only focus on import-related measures as they are the main concern of

our study. The high number of NTMs emphasises their relative importance in shaping the trade flow. Thus, concerns should be shifted more towards NTMs and their impact.

However, it is important to understand that these figures represent only the number of measures implemented, not the number of products or trade values affected by these measures. In other words, countries that have adopted a higher number of NTMs are not necessarily more restrictive than those with a lower number of NTMs. To have a better understanding of the spread and weight of the respective NTMs, we need to look at the coverage ratio and frequency index.

The percentage of imported products that is subject to at least one NTM is called the frequency index. On the other hand, coverage ratios are the percentages of import values subject to NTMs enforced by an importing country. Thus, the frequency index and coverage ratios can show us the spread of NTMs across products and the weight, respectively. We then proceed to calculate the frequency index and coverage ratios for AMS and East Asia countries (Table 3). We group NTMs into non-technical and technical measures, and report the coverage ratio and frequency index for the tariff to make comparisons.

From the frequency index, we can conclude that Indonesia; Cambodia; the Lao PDR; Myanmar; the Philippines; China; the Republic of Korea (henceforth, Korea); and India are amongst countries that imposed tariffs on almost all imported goods. For technical NTMs, Cambodia, Viet Nam, China, Germany, and the UK imposed technical NTMs on almost all imported goods. China also imposed non-technical NTMs on most imported goods, followed by the Lao PDR, Myanmar, and Korea.

We should rely more on coverage ratio values than the frequency index. This is in line with the explanation in previous sections that coverage ratios are better than the frequency index, as the former considers import value as weightage. Thus, we can have insights into the import value affected by tariffs and NTMs. In terms of the coverage ratio, almost all imported values in Cambodia and Myanmar are subject to tariffs. For technical NTMs, Cambodia, Viet Nam, China, Korea, Germany, the UK, and the US had the highest coverage ratio. For non-technical

NTMs, Cambodia, the Lao PDR, Myanmar, China, and Korea had the highest coverage ratio.

Table 3: Tariff and NTM Frequency Index and Coverage Ratio

Country Code	Frequency Index			Coverage Ratio		
	Tariff	Technical NTM	Non-Technical NTM	Tariff	Technical NTM	Non-Technical NTM
BRN	0.044	0.276	0.415	0.104	0.414	0.583
IDN	0.882	0.509	0.640	0.641	0.479	0.726
KHM	0.876	0.945	0.739	0.856	0.951	0.861
LAO	0.869	0.368	0.978	0.674	0.650	0.983
MMR	0.967	0.286	0.979	0.955	0.514	0.986
MYS	0.392	0.394	0.442	0.375	0.500	0.413
PHL	0.879	0.658	0.556	0.590	0.625	0.748
SGP	0.000	0.433	0.418	0.001	0.558	0.555
THA	0.657	0.355	0.287	0.504	0.384	0.393
VNM	0.667	0.977	0.668	0.576	0.891	0.589
CHN	0.932	1.000	0.999	0.508	1.000	1.000
HKG	0.000	0.276	0.311	0.000	0.134	0.135
JPN	0.481	0.633	0.633	0.267	0.735	0.793
KOR	0.853	0.849	0.869	0.740	0.875	0.897
AUS	0.550	0.628	0.578	0.569	0.807	0.794
DEU	0.745	0.937	0.617	0.611	0.957	0.717
GBR	0.744	0.937	0.618	0.598	0.909	0.704
IND	0.964	0.466	0.579	0.705	0.625	0.723
USA	0.610	0.764	0.389	0.494	0.856	0.449

ISO = International Organization for Standardization, NTM = non-tariff measure.
Notes: Country codes follow the ISO 3 codes (Appendix 1). Highlighted cells are those with high values, almost equal to 1.
Source: Author's calculations, based on the TRAINS database (UNCTAD, n.d.) and World Bank (n.d.).

Although the tariff frequency index and coverage ratio of Hong Kong and Singapore are equal to zero, they both imposed some NTMs and that causes a higher coverage ratio for both types of NTMs. Furthermore, by looking at the number of NTMs alone (Table 2), we can see that Myanmar only has 203 measures, while India has 4,119 measures. However, in terms of the frequency index and coverage ratio for non-technical NTMs, Myanmar had higher values than India. Hence, depending on the number of measures alone is not sufficient.

We then proceed to the second objective, which is comprised of two parts. The first part is to estimate the NTMs' AVE. The second part is to construct the ATRI by measuring the overall external regulations in the form of tariffs and NTMs from importing countries to AMS and East Asia countries. To complete the first part, we regressed two-stage regression at the product level to obtain the coefficient of NTMs and the AVE for each product.

Table 4 provides the average estimated AVE for technical and non-technical NTMs as well as the ATRI by country. Here, we only report for ASEAN, four East Asia countries, and major trading partners. Detailed results for all countries in our sample are provided in Appendix 2. Based on Table 4, we find that the average values for the estimated AVE for technical and non-technical NTMs are 0.529 and 0.586, respectively. These values are higher than the average tariff value (0.074) for selected sample countries.

Table 4: Average AVE for NTMs and ATRI by Country

Country code	AVE		ATRI
	T	NT	
BRN	0.791	0.843	0.181
IDN	0.516	0.490	0.215
KHM	0.414	0.666	0.294
MMR	0.364	0.468	0.282
MYS	0.625	0.467	0.238
PHL	0.347	0.451	0.252
SGP	0.909	0.779	0.321
THA	0.554	0.482	0.276
VNM	0.414	0.486	0.285
CHN	0.492	0.477	0.338
HKG	0.824	0.921	0.223
JPN	0.478	0.515	0.447
KOR	0.409	0.622	0.407
AUS	0.546	0.562	0.350
DEU	0.452	0.619	0.273
GBR	0.449	0.662	0.301
IND	0.414	0.548	0.431
USA	0.520	0.495	0.339

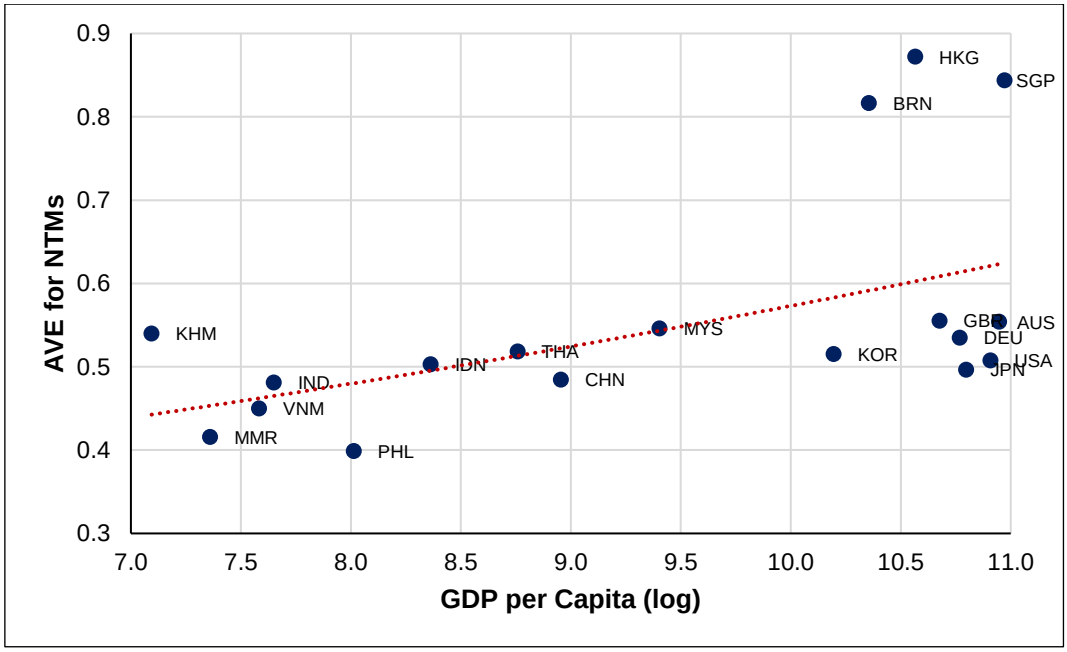
ATRI = augmented trade restrictiveness index, AVE = ad valorem equivalent, NTM = non-tariff measure.
Notes: Country codes follow the International Organization for Standardization (ISO) 3 codes (Appendix 1).
T and NT represent technical and non-technical NTMs, respectively.
Source: Author's calculations.

Thus, a high dependency on tariffs alone could lead to a false conclusion. This is because, although most countries have reduced their tariff rates substantially, more NTMs have been implemented with a higher protection cost – as can be seen from the estimated AVE. This also emphasises the importance of considering NTMs when calculating TRIs. From the reported ATRI values, we can see that the most liberalised nations are Brunei (0.181), Indonesia (0.215), and Hong Kong (0.223). Japan (0.447) is the most restricted nation, followed by India (0.431) and Korea (0.407).

Our analysis found that the average values of the ATRI for all our sample countries are equal to 0.287. We can also see that Cambodia, Singapore, and China imposed higher trade restrictions than the world average, closely followed by Viet Nam, Myanmar, and Thailand. However, for the major common trading partners, all except Germany imposed a higher ATRI than the world average. When we compare these values with the coverage ratios obtained earlier, we can conclude that a country with a high coverage ratio does not necessarily have a high ATRI; rather, it depends on the AVE for those NTMs. A higher AVE for NTMs will lead to a higher ATRI.

We then proceed to investigate the relationship between the AVE for NTMs and income per capita in our sample. Figure 2 shows the scatterplot between the average AVE for NTMs (both technical and non-technical measures) and GDP per capita. We can see that there is a positive relationship between the AVE for NTMs and GDP per capita, as countries with a higher GDP per capita record a higher AVE for NTMs.

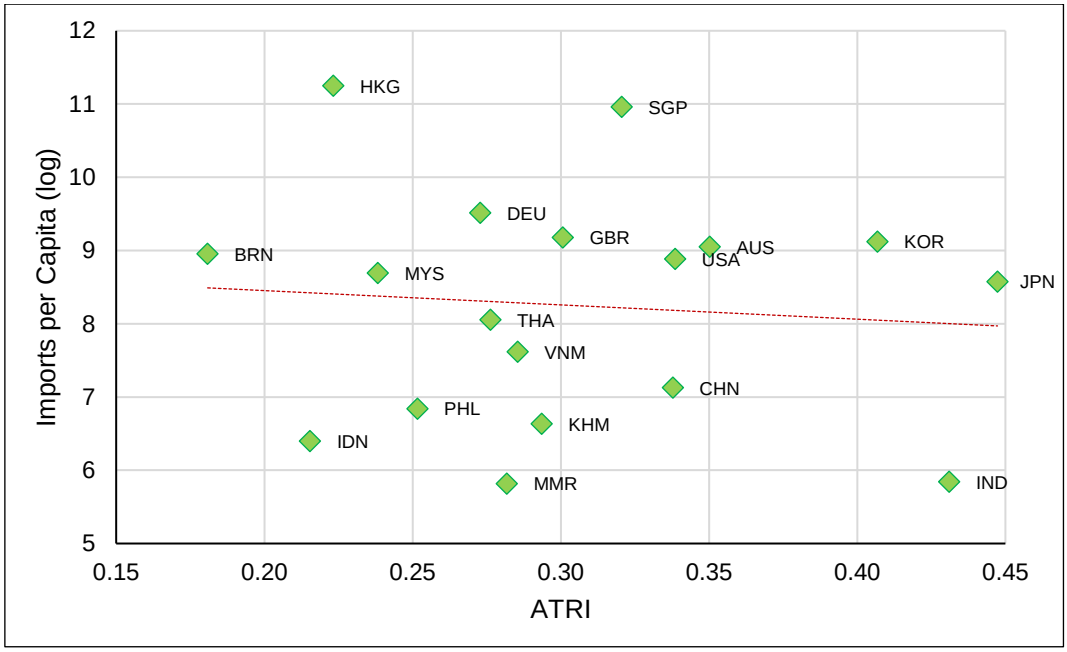
Figure 2: AVE for NTMs and GDP per Capita



AVE = ad valorem equivalent, GDP = gross domestic product, NTM = non-tariff measure.
Note: Country codes follow the International Organization for Standardization (ISO) 3 codes (Appendix 1).
Source: Author's calculation.

It is also important to investigate the relationship between the restrictions imposed (ATRI) and the imports per capita (Figure 3). However, we are unable to conclude that a solid relationship exists between the ATRI and imports per capita for our focus countries. Thus, further analysis is needed to ascertain the impacts of the ATRI on imports (or exports from an exporter's perspective). This is important to prove whether higher restrictions imposed lead to lower imports from other countries. This is similar to our hypothesis that the restrictions being imposed hinder the movement of goods, and thus disrupt countries from enjoying the optimal benefits of FTAs.

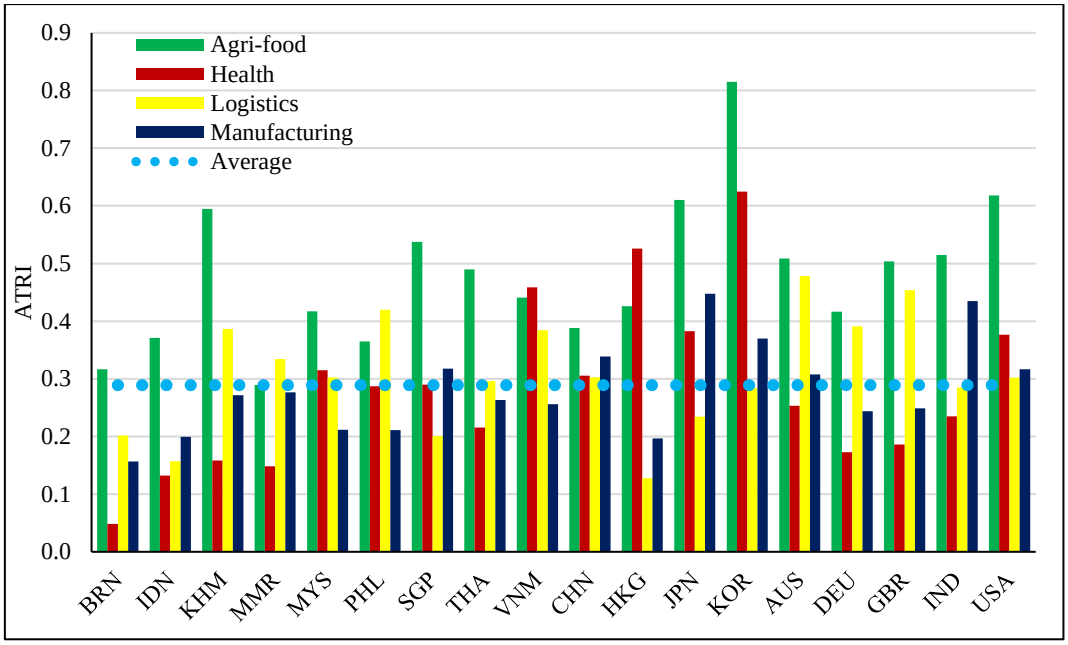
Figure 3: ATRI and Imports per Capita



ATRI = augmented trade restrictiveness index.
Note: Country codes follow the International Organization for Standardization (ISO) 3 codes (Appendix 1).
Source: Author's calculation and World Bank (n.d.)

We then proceed to calculate the ATRI by sector – agri-food, health, logistics, and other manufacturing sectors. We can see that the agri-food sector is the most restricted in most countries, and exceeds the average ATRI at the country level. When we look by country, we can see that the values for Korea are higher than for most other countries. These findings can help policymakers identify focus sectors in trade agreement negotiations.

Figure 4: ATRI by Sector



ATRI = augmented trade restrictiveness index.
Notes: Country codes follow the International Organization for Standardization (ISO) 3 codes (Appendix 1). The dotted line represents average ATRI values for the respective group.
Source: Author's calculation.

Furthermore, the varying average ATRI values show that not all NTMs are bad for trade. Some NTMs had a lower AVE than others. Some even had positive trade-enhancing impacts. Hence, the varying outcome shows that the impacts of NTMs on bilateral trade depend on the purpose of the NTMs' implementation. Thus, it is important to understand how the ATRI affects bilateral exports, especially for AMS and East Asia countries.

The third and final objective estimates the impacts of restrictions imposed by importing countries on bilateral exports for AMS and East Asia countries. We estimated 10 different gravity models to compare the impacts between the aggregated trade barrier (ATRI) and the different kinds of restrictions (tariffs and NTMs) imposed. Table 5 shows the descriptive results for the variables selected in the model.

Table 5: Descriptive Statistics for Variables Used

Variable	Observation	Mean	Std. Dev.	Min	Max
$Export_{ijn}$	130,464	36,448	829,975	0	148,000,000
$\ln GDP_i$	130,464	26.4033	1.9546	23.23817	30.1403
$\ln GDP_j$	130,464	25.5956	1.9000	21.1518	30.6055
$\ln Pop_i$	130,464	17.3882	1.9035	12.95846	21.0496
$\ln Pop_j$	130,464	16.4794	1.5671	12.95846	21.0496
$\ln ATRI_{jn}$	128,561	−1.5416	0.8919	−8.51839	2.2992
$\ln Tariff_{jn}$	130,464	0.0787	0.0872	0	1.5159
$\ln AVE\_T_{jn}$	130,464	0.2238	0.2954	0	2.8177
$\ln AVE\_NT_{jn}$	130,464	0.2793	0.2849	0	3.1824
$\ln Dist_{ij}$	130,464	9.0029	0.6735	5.7543	9.8940
ASEAN	130,464	0.0596	0.2368	0	1
ACFTA	130,464	0.0140	0.1174	0	1
AJCEP	130,464	0.0140	0.1174	0	1
AKFTA	130,464	0.0140	0.1174	0	1
CB	130,464	0.0235	0.1516	0	1
CL	130,464	0.0552	0.2283	0	1

Std. Dev. = standard deviation.
Source: Author's calculation and World Bank (n.d.).

As explained earlier, we estimated our model using PPML regression, and the estimation results can be seen in Table 6. Overall, we can justify that our results are in line with the gravity model theory. This is because most of the coefficients correspond to the expected signs. For example, the importer and exporter's incomes have positive and significant relationships with bilateral exports. The exporter's population has a positive and significant relationship in most models, while the importer's population is negative and significant in most models.

If we look at the common gravity variables, we can see that the results are as expected and in line with gravity theory. Distance has a negative relationship with bilateral exports. This shows that greater bilateral distance increases transportation costs, and thus leads to lower trade. Countries that share a common border and a common language are proven to contribute to bilateral exports, as we found a positive and significant relationship.

The variables that we are most interested in are those related to trade policy. We included several variables for these criteria – FTA dummies and trade barriers – represented by the ATRI, tariffs, and the AVE for NTMs. Our main purpose in including the FTA dummy is to enable us to measure the impacts of past FTAs between ASEAN and East Asia countries. Our estimation result shows that most FTAs have a positive and significant relationship with ASEAN and East Asia countries' bilateral exports. This supports the idea that FTAs enhance trade between countries.

In terms of the restrictions, model 1 (total exports), model 5 (manufacturing), and model 9 (logistics) shows that higher restrictions lead to lower bilateral exports as the coefficient for the ATRI is negative and significant. This means that when the ATRI increases by 1%, total bilateral exports for AMS and East Asia countries decrease by 0.14%. For the manufacturing and logistics sectors, however, a 1% increase in the ATRI causes bilateral exports for AMS and East Asia countries to reduce by 0.17% and 0.43%, respectively.

The negative impacts of the ATRI also highlight that trade barriers play an important role in bilateral trade flows. Thus, we proceed to analyse restrictions separately based on tariffs and the AVE for NTMs. In terms of tariffs, model 2 (total exports) and model 4 (agri-food) show a negative and significant relationship. When tariffs increase by 1%, bilateral exports for ASEAN and East Asia decrease by 1.3% for total exports and 1.8% for agri-food sectors. This shows that the latter are more affected by tariffs imposed.

The results also show that the AVE for technical NTMs had negative and significant impacts on bilateral exports for model 2 (total exports), model 6 (manufacturing), and model 8 (health). A 1% increase in the AVE for technical NTMs caused bilateral exports for both the manufacturing and health sectors to decrease by about 1.3%. This might be due to exporters' difficulties in meeting current NTM specifications.

Table 6: Estimation Results Based on PPML Model

Variable	Total exports		Agri-food		Manufacturing		Health		Logistics	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln GDP_i$	0.882***	0.878***	0.051	0.046	0.896***	0.892***	2.069***	2.060***	0.512**	0.499**
$\ln GDP_j$	0.928***	0.901***	0.668***	0.593***	0.924***	0.919***	0.951***	1.046***	1.032***	0.965***
$\ln POP_i$	0.017	0.017	1.095***	1.100***	-0.004	-0.006	-0.881***	-0.884***	0.621***	0.642***
$\ln POP_j$	-0.129***	-0.084***	0.046	0.146*	-0.114***	-0.081**	-0.126*	-0.118	-0.268***	-0.205**
$\ln ATRI_{jn}$	-0.136***		0.044		-0.167***		0.332		-0.426***	
$\ln Tariff_{jn}$		-1.012*		-1.853***		-0.681		-2.595		-0.590
$\ln AVE\_T_{jn}$		-0.905**		0.447		-1.259**		-1.319***		0.128
$\ln AVE\_NT_{jn}$		0.609***		0.408		0.613**		0.482		0.106
$\ln Dist_{ij}$	-0.592***	-0.569***	-0.811***	-0.888***	-0.640***	-0.611***	-0.712***	-0.799***	0.191**	0.151
CB	0.690***	0.698***	0.456***	0.387**	0.636***	0.654***	0.876***	0.862***	0.882***	0.896***
CL	1.051***	1.014***	0.824***	0.772***	1.071***	1.030***	0.916***	0.812***	1.026**	1.260**
ASEAN	0.903***	0.774***	0.281	0.037	0.854***	0.695***	-0.168	-0.602	2.690***	2.732***
ACFTA	0.202*	0.122	0.245	0.134	0.169	0.073	0.028	-0.052	0.530	0.476
AJCEP	0.886***	0.758***	0.518**	0.499**	0.985***	0.817***	0.719***	0.593***	0.682***	0.839***
AKFTA	1.152***	1.091***	0.211	0.463**	1.262***	1.184***	1.158***	1.195**	0.501	0.647
Constant	-35.349***	-34.056***	-26.012***	-25.406***	-34.036***	-34.142***	-49.629***	-49.428***	-44.065***	-40.932***
Observations	128,561	13,0464	29,788	29,898	90,772	92,412	2,718	2,718	5,283	5,436
R^2	0.627	0.640	0.234	0.244	0.661	0.684	0.788	0.793	0.838	0.788

PPML = Poisson pseudo maximum likelihood.
Notes: *, **, and *** are significant at levels 10%, 5%, and 1%. We used the export value as the dependent variable for all models. The country fixed effect and product fixed effect are included in all models.
Source: Author's calculation.

Interestingly, the opposite is true for non-technical NTMs, where there is a positive and significant relationship in model 2 (total export) and model 6 (manufacturing). This means that, when non-technical NTMs increase, firms' ability to adapt and meet the current measures (e.g. trade guidelines, custom procedures, shipping policies, and taxation laws) leads to higher exports. This might be due to the varying nature of NTMs, as although some will lead to higher prices, they can still help to boost trade if the restriction policies are necessary. Past studies have shown that certain NTMs help in reducing the negative externalities of free trade (Beghin, Disdier, and Marette, 2015).

5. Key Findings and Policy Implications

This study analysed the incidence of NTMs, cross-border trade flows, and trade patterns amongst AMS and East Asia countries. Based on the analysis, although the average tariff trends have been declining for most countries, the high number of NTMs in force emphasises the need to shift our focus towards NTMs. Then, we proceeded to estimate the NTMs' AVE by-product and observed that the average values for the estimated AVE for technical and non-technical NTMs are 0.529 and 0.586, respectively, which are higher than the average tariff value (0.074) for the selected sample countries.

This suggests evidence of a substitution effect between these two import policy instruments. In other words, countries that impose more NTM restrictions replace tariffs to achieve similar objectives. We then proceeded to calculate the ATRI and found that some countries imposed higher trade restrictions than the average for the selected countries. Next, we calculated the ATRI for the major sub-sectors to have a better understanding of the variety of restrictions. We can see that agri-food is the most restricted sector for most countries, and it exceeded the average ATRI at the country level. This finding can help policymakers identify focus sectors in FTA negotiations.

To understand the impacts of these restrictions imposed by importing countries on bilateral exports for ASEAN and East Asia, we used PPML regression on total exports and various sub-sectors using the gravity model framework. We included several trade policy variables – FTA dummies and trade barriers represented by the ATRI, tariffs, and the AVE for NTMs – to understand their

respective roles. From the findings, we observe that the results are as expected and in line with the gravity theory. Distance has a negative relationship with bilateral exports. This shows that a greater distance increases transportation costs, and thus leads to lower trade. Countries that share a common border and a common language are proven to contribute to bilateral exports, as we found a positive and significant relationship. Our estimation result shows that most FTAs have a positive and significant relationship with AMS and East Asia countries' bilateral exports. This supports the idea that FTAs enhance trade between countries.

Our findings also show that the ATRI has a negative and significant relationship with bilateral exports for total exports, manufacturing, and logistics sub-sectors. The negative impacts of the ATRI also highlight that trade barriers play a significant role in bilateral exports. We then focused on tariffs and NTMs separately to understand their impact on bilateral exports. Tariffs had negative and significant impacts on total exports and agri-food sub-sectors.

NTM restrictions (proxied by the calculated AVE of NTMs) imposed by importing countries had mixed results for technical and non-technical measures. Technical measures have negative and significant impacts on bilateral exports for total exports, manufacturing, and health sub-sectors. This is in line with our hypothesis that exporters may face difficulties in meeting the current NTM specifications, leading to lower bilateral exports.

However, we found that non-technical NTMs have a positive and significant relationship with total exports and manufacturing sub-sectors. Although it contradicts our hypothesis, this outcome is supported by Beghin, Disdier, and Marette (2015), who found that some NTMs help to overcome negative externalities. Jaffee and Henson (2004) clarified that NTMs can restrict or enhance trade, depending on the purpose of their implementation. Previous research has proven that NTMs help to overcome asymmetric information in the market (van Tongeren, Beghin, and Marette, 2009), where reputation and certification processes increase consumer confidence in trade (Blind, Mangelsdorf, and Wilson, 2013). Quality standards improve reputation, contributing to higher trade flows (Jouanjean, 2012). Moreover, transparency in FTAs can facilitate trade flows (Lejárraga, Shepherd, and van Tongeren, 2013). Thus, empirical evidence supports the trade-facilitating effects of the implementation of NTMs.

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Appendix 1

List of Countries

No.	Country	ISO3	No.	Country	ISO3
1	Algeria	DZA	50	Latvia	LVA
2	Argentina	ARG	51	Lebanon	LBN
3	Australia	AUS	52	Lithuania	LTU
4	Austria	AUT	53	Luxembourg	LUX
5	Bahrain	BHR	54	Malaysia	MYS
6	Belgium	BEL	55	Mali	MLI
7	Benin	BEN	56	Malta	MLT
8	Bolivia	BOL	57	Mauritania	MRT
9	Botswana	BWA	58	Mauritius	MUS
10	Brazil	BRA	59	Mexico	MEX
11	Brunei Darussalam	BRN	60	Morocco	MAR
12	Bulgaria	BGR	61	Myanmar	MMR
13	Burkina Faso	BFA	62	Nepal	NPL
14	Cambodia	KHM	63	Netherlands	NLD
15	Cameroon	CMR	64	New Zealand	NZL
16	Canada	CAN	65	Nicaragua	NIC
17	Cape Verde	CPV	66	Niger	NER
18	Chile	CHL	67	Nigeria	NGA
19	China	CHN	68	Oman	OMN
20	Colombia	COL	69	Pakistan	PAK
21	Costa Rica	CRI	70	Panama	PAN
22	Croatia	HRV	71	Paraguay	PRY
23	Czechia	CZE	72	Peru	PER
24	Denmark	DNK	73	Philippines	PHL
25	Ecuador	ECU	74	Poland	POL
26	El Salvador	SLV	75	Portugal	PRT
27	Estonia	EST	76	Qatar	QAT
28	Finland	FIN	77	Republic of Korea	KOR
29	France	FRA	78	Russia	RUS
30	Gambia	GMB	79	Saudi Arabia	SAU
31	Germany	DEU	80	Senegal	SEN
32	Ghana	GHA	81	Singapore	SGP
33	Greece	GRC	82	Slovakia	SVK
34	Guatemala	GTM	83	Slovenia	SVN
35	Honduras	HND	84	Spain	ESP
36	Hong Kong	HKG	85	Sri Lanka	LKA
37	Hungary	HUN	86	State of Palestine	PSE
38	India	IND	87	Sweden	SWE
39	Indonesia	IDN	88	Switzerland	CHE
40	Ireland	IRL	89	Thailand	THA
41	Israel	ISR	90	Togo	TGO
42	Italy	ITA	91	Tunisia	TUN
43	Ivory Coast	CIV	92	Turkey	TUR
44	Jamaica	JAM	93	United Arab Emirates	ARE
45	Japan	JPN	94	United Kingdom	GBR
46	Jordan	JOR	95	United States	USA
47	Kazakhstan	KAZ	96	Uruguay	URY
48	Kuwait	KWT	97	Viet Nam	VNM
49	Kyrgyzstan	KGZ	98	Zimbabwe	ZWE

ISO = International Organization for Standardization.
Source: International Organization for Standardization (n.d.).

Appendix 2

Average AVE for NTMs and ATRI by Country

Country Code	AVE		ATRI	Country Code	AVE		ATRI
	T	NT			T	NT	
BRN	0.791	0.843	0.181	HND	0.691	0.801	0.157
IDN	0.516	0.490	0.215	HRV	0.399	0.681	0.294
KHM	0.414	0.666	0.294	HUN	0.414	0.632	0.220
MMR	0.364	0.468	0.282	IRL	0.451	0.632	0.272
MYS	0.625	0.467	0.238	ISR	0.344	0.513	0.352
PHL	0.347	0.451	0.252	ITA	0.504	0.697	0.352
SGP	0.909	0.779	0.321	JAM	0.583	0.718	0.340
THA	0.554	0.482	0.276	JOR	0.504	0.689	0.267
VNM	0.414	0.486	0.285	KAZ	0.499	0.501	0.309
CHN	0.492	0.477	0.338	KGZ	0.517	0.562	0.258
HKG	0.824	0.921	0.223	KWT	1.928	0.539	0.279
JPN	0.478	0.515	0.447	LBN	0.894	0.739	0.362
KOR	0.409	0.622	0.407	LKA	0.630	0.540	0.238
AUS	0.546	0.562	0.350	LTU	0.349	0.645	0.264
DEU	0.452	0.619	0.273	LUX	0.390	0.818	0.311
GBR	0.449	0.662	0.301	LVA	0.385	0.736	0.335
IND	0.414	0.548	0.431	MAR	0.355	0.515	0.333
USA	0.520	0.495	0.339	MEX	0.637	0.409	0.164
ARE	0.428	0.513	0.395	MLI	0.513	0.581	0.312
ARG	0.433	0.448	0.300	MLT	0.342	0.787	0.261
AUT	0.415	0.651	0.267	MRT	0.522	0.616	0.280
BEL	0.465	0.667	0.293	MUS	0.321	0.552	0.281
BEN	0.474	0.555	0.406	NER	0.429	0.680	0.571
BFA	0.350	0.682	0.219	NGA	0.356	0.605	0.193
BGR	0.363	0.553	0.226	NIC	0.436	0.734	0.166
BHR	0.471	0.645	0.360	NLD	0.417	0.675	0.276
BOL	0.761	0.632	0.162	NPL	0.385	0.586	0.435
BRA	0.441	0.629	0.258	NZL	0.584	0.504	0.272
BWA	0.454	0.618	0.548	OMN	0.681	0.511	0.288
CAN	0.422	0.480	0.339	PAK	0.518	0.500	0.209
CHE	0.543	0.536	0.376	PAN	0.675	0.959	0.178
CHL	0.448	0.701	0.211	PER	0.620	0.388	0.136
CIV	0.994	0.494	0.312	POL	0.482	0.583	0.241
CMR	0.435	0.761	0.267	PRT	0.414	0.793	0.355
COL	0.445	0.453	0.263	PRY	0.630	0.456	0.263
CPV	0.732	0.665	0.348	PSE	0.366	0.497	0.332
CRI	0.617	0.674	0.156	QAT	0.459	0.730	0.217
CZE	0.376	0.692	0.256	RUS	0.505	0.470	0.294
DNK	0.409	0.725	0.288	SAU	0.492	0.512	0.360
DZA	0.415	0.533	0.262	SEN	0.342	0.953	0.245
ECU	0.531	0.575	0.237	SLV	0.497	0.940	0.181
ESP	0.502	0.683	0.335	SVK	0.341	0.581	0.246
EST	0.395	0.704	0.278	SVN	0.385	0.683	0.272
FIN	0.413	0.638	0.279	SWE	0.396	0.664	0.290
FRA	0.480	0.731	0.326	TGO	1.057	0.692	0.257
GHA	0.386	0.565	0.377	TUN	0.435	0.540	0.382
GMB	1.176	0.558	0.284	TUR	0.536	0.523	0.250
GRC	0.438	0.775	0.298	URY	0.518	0.627	0.221
GTM	0.891	0.968	0.120	ZWE	0.370	0.621	0.283

ATRI = augmented trade restrictiveness index, AVE = ad valorem equivalent, NTM = non-tariff measure.
Note: T and NT represent technical and non-technical NTMs, respectively.
Source: Author's calculation.

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