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Estimating Augmented Trade Restrictiveness Indices to Evaluate Impacts of Non-Tariff Barrier for ASEAN Countries and Their Major Trading Partners

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ABSTRACT

This paper tries to empirically evaluate the effects of non-tariff barriers (NTBs) on trade inflow by constructing augmented trade restrictiveness indices (ATRI) for ASEAN countries and their major trading partners for the year 2016. This study employs econometric estimation to estimate the ad-valorem equivalent (AVE) for NTBs and then uses mathematical calculations to measure the ATRI of the respective countries and sectors. Findings show that the previous calculation of trade restrictiveness indices (TRI) is bias towards large positive values, and the current study has overcome these issues by making some modifications in the formula. Results illustrate that poorer countries had imposed more restricted trade policies. It is obvious that NTBs have a vital role in influencing trade flows as the ATRI recorded on average, 17% higher value when we consider the existence of NTBs. Ordinary Least Square (OLS) regression supports our hypothesis that an increase in ATRI leads to reduction in imports. Hence, detailed analysis of NTBs is deemed necessary as it shapes the international trade flow.

JEL Classification: F13, F14, F15
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INTRODUCTION

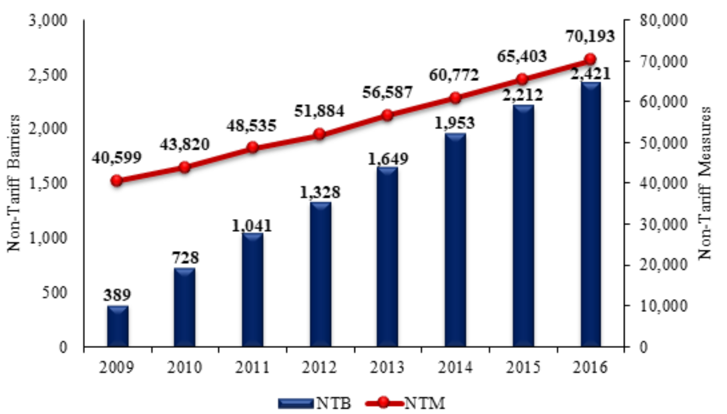
Trade costs have always been a major concern in trade policy literature as it shapes the international trade flow (Deardoff and Stern, 1998; Anderson and van Wincoop, 2004). These costs can exist in many forms and the most common are protection costs from implementation of tariff and non-tariff measures (NTMs). Countries have involved in various bilateral and regional trade agreements to overcome the protection costs, and these contributed significantly in reducing the average applied tariff in the economy (Hoekman and Nicita, 2011). However, the number of NTMs applied, coverage ratio and the number of countries utilizing NTMs are in an increasing trend (World Bank and IMF, 2008).

Extensive regulations helped contributed in trade slowdown as it incurs higher costs and making trade more difficult (Disdier et al., 2015). ASEAN faces the same issues, where although tariff had reduced substantially in the past few years, rising in NTMs disrupts the intra-regional trade flow (Vanzetti et al., 2018). Usage of complex NTMs such as technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures had increased significantly within ASEAN members. (Ing et al., 2016).

Despite the negative impacts of NTMs, prior measurements for trade barriers had failed to take into consideration the existence of NTMs and were based on the simple average and weighted average for all the tariff lines (Chen, 2014). The results can be misleading as they lack solid theoretical aspects and sufficient empirical proof to convince policymakers. Thus, the recent development of estimating the impact of trade barrier shift on restrictiveness indices. A study by Anderson and Neary (1994; 2003; 2005) had given a solid theoretical basis for estimating trade restrictiveness index (TRI). The study defined it as a uniform tariff that leads to similar aggregation with the current tariff structure. It is developed based on a general equilibrium model.

An alternative method in measuring overall trade cost and also analyzing the impact of trade barriers is by using Feenstra’s TRI (Anderson and Neary, 2005). TRI works as an indicator for the achievement of trade policy in enhancing economic growth (Edwards, 1998; Frankel and Romer, 1999) and firms' productivity (Melitz, 2003). Trade restrictiveness is also seen as a crucial input for policymakers and for researchers interested in having an in-depth understanding of the determinants and impact of trade barriers (Grossman and Helpman, 1994). Feenstra (1995) had formulated a simplified form of TRI that is based on a partial equilibrium model. It requires less information, which is tariff structure, import demand elasticity, and import values.

Kee et al. (2009) were among the first to estimate a fully comprehensive TRI based on Feenstra's (1995) framework by using an econometric approach. Their studies contribute to the literature by taking into account both tariff and non-tariff measures. However, they have failed to disaggregate the different aspects of NTMs impacts (Beghin, 2008). NTMs implementation is not necessarily disruptive to trade, it can also have other social motives in regulating domestic market to correct negative externalities and asymmetric information (Fugazza and Maur, 2008). Measures such as labelling requirements enable consumers to have more information on the content of the product while packaging requirements able to avoid use of unhealthy material for packaging. These types of NTMs can lead to higher demand for certain products.



Source: Global Trade Alert (2018) & UNCTAD (2018)

Figure 1 Number of Global NTBs and NTMs Implemented

Some past studies had proven that NTMs can help to facilitate trade as some certification processes improve confidence in trade (Beghin et al., 2015 and Blind et al., 2013). It also facilitates technical regulation such as quality standards to help improving product quality; whereby this will lead to higher import demand (Jouanjean, 2012). However, some NTMs had been implemented with protectionist intent such as quota and extensive licensing requirements that increases cost of trade. These measures harms trade and were commonly known as non-tariff barriers (NTBs). Most past studies that calculated TRI had failed to take adequate action to differentiate between NTMs and NTBs and assume they have the same impact. Figure 1 shows that the number of NTMs and NTBs implemented globally has a continuous increasing trend since 2009. Although the number of NTMs implemented far exceeded NTBs, we are more concerns about NTBs as they harms trade.

The objective of this study is to empirically estimate the effects of non-tariff barriers on trade inflow by constructing ATRI for ASEAN countries and their major trading partners. These countries are involved in, or are in the process of signing trade agreements with ASEAN countries as mentioned in Appendix 1. Trade agreement theoretically contributed to higher degree of trade liberalization, thus selecting the sample countries help to see the current level of trade restrictiveness for each country. This study estimates the ATRI at country level and sectorial level for 3 major sectors namely agrifood, health and logistics. These sectors are among the top four priority sectors for the removal of NTBs (AEC Dialogue 2025, 2019).

This study attempts to fill the current gap in literature by focusing only on trade distortion effects as results of the implementation of NTBs. This is done by using data provided by Global Trade Alert (GTA). This is because it clearly defines non-tariff measures that were implemented to discriminate or distort trade. The results of this study can give insights for policymakers regarding the current restrictiveness level on country and sectoral level. Policy maker can thus use the informations to formulate strategies and plans towards higher degree of trade liberalization in the future.

This paper is structured as follows. Section 1 explains the issues and importance of the current study. Section 2 describes past studies that investigate the same topics; and gaps that are to be filled by this paper. Section 3 presents the methodology and data being employed. Section 4 explains the study's findings and the explanation. Section 5 discusses the conclusion and policy implications.

LITERATURE REVIEW

Empirical literature shows that there are diverse implications from the implementation and removal of trade barriers. This is because it depends on their effectiveness in addressing specific issues (Blonigen et al., 2014). Trade liberalizations have been proven to affect inflation (Tee et al., 2018), resource use (Armanita and Damayanti, 2018), welfare (Kikuchi, 2018 and Hoon et al., 2019) and various other aspects, which mostly are beneficial for a country. This encourages policy makers to move towards higher degree of trade liberalizations.

Discussion on tariff liberalization has been the common practices of empirical researchers in the past. However, it is now shifting towards NTMs as the economic rents from NTMs are usually transferred to the exporting country compared with tariff where it accrues to the government of importing country (Tan, 2005). Nonetheless, it is undeniable that both measures lead to lower welfare levels (Anderson et al., 2008; Hoon et al., 2019).

Although the average tariff had been commonly used as the measurements of a country trade restrictiveness, TRI are proven to be more comprehensive as the average tariff understates TRI by about 75 percent (Irwin, 2010). Boysen-Urban et al. (2019), Beghin et al. (2015) and Chen (2014) and international institutions such as World Bank, IMF and OECD are among those that have taken the initiative to follow the simple partial equilibrium model for trade-restrictive index by Feenstra (1995). One of the most referred articles in this field is Kee et al. (2009). The study is among the first to empirically estimate TRI for 78 countries at tariff line; consisting of developing and developed countries.

There are also some studies that are country-specific in calculating TRI, such as for Canada (Chen, 2014), United States (Irwin, 2010) and China (Chen et al., 2014); and for regional economies such as European Union countries (Boysen-Urban et al., 2019; Bureau et al., 2003). These studies shows that high income countries have lower restrictiveness compared to lower income countries. Chen et al. (2014) findings shows that WTO are effective in reducing NTMs and thus TRI for China. This support our arguments that FTA should have positive impacts on reducing TRI.

Besides, further investigation of past studies shows that only few studies have considered the issues of non-tariff measure (Kee et al., 2009; Beghin et al., 2015 and Kee and Nicita, 2016). This is highly due to the unavailability of data and the difficulties to restructure the data. Chen and Ma (2012) did not take into consideration the importance of NTMs due to the lack of NTMs being implemented in their focus group. However, Beghin et al. (2015) argues that prior literature had failed in considering the positive effects of NTMs implementation and their findings shows that NTMs decreases TRI for certain products. Thus, NTMs and NTBs should not be lump sum together.

Not all NTMs will harm trade, only those we commonly referred as NTBs will really be harmful to international trade. Some NTMs that have been implemented to address the issues of asymmetric information will not restrict trade but further enhance it (van Tongeren et al. 2009). Thus, calculation of TRI by using NTMs instead of NTBs can lead to misleading interpretation. Hence, this study tries to fill the gap in the existing literature by only taking into consideration NTBs only and investigate its AVE; and thus the ATRI of the selected countries.

RESEARCH METHODOLOGY

This study employs the similar methodology employed by Kee et al. (2009); in which based on a well-grounded theory and considered various forms of trade protection that can be categorized into tariff and non-tariff measures. The theoretical basis of this research is based on n-good and n-factor general equilibrium model with log-linear utilities and log-linear constant return to scale technologies, following Leamer (1988).

The original model that Kee et al. (2009) employed captures two types of NTMs; which are domestic agricultural support and core non-tariff measure. However, we have noted that the impact of domestic agricultural support is insignificant for most countries; and the data for most countries in our sample are not available. In addition, there is a lack of emphasis on the differences between NTMs and NTBs. Hence, this study will be focusing on trade impeding non-tariff or commonly known as NTBs. The data from Global Trade Alert (GTA) will be used to capture the impact of non-tariff on trade and the effects vary by country and products traded. The model used in this study will follow that of Kee et al. (2009). It is as follows:

$$\ln m_{nc} - \varepsilon_{n,c} \ln\left(1 + t_{n,c}\right) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \left(\beta_n + \sum_k \beta_{n,k} C_c^k\right) NTB_{n,c} + \mu_{n,c} \tag{1}$$

Where m_{nc} is the import value of good n in country c, C_c^k are k variables that provide country-specific characteristics (agricultural land over GDP, capital over GDP, labor over GDP, and GDP), $NTB_{n,c}$ is a dummy variable that indicates the presence of NTBs, $\varepsilon_{n,c}$ is the import demand elasticity, $t_{n,c}$ is the ad-valorem tariff on good n in country c, α_n is the tariff line dummy that captures good specific effect, $\alpha_{n,k}$ is the parameter that captures country-specific effect, $\beta_{n,k}$ is the product-specific parameter to be estimated, and $\mu_{n,c}$ is the error term.

This study will run cross-section ordinary least square (OLS) linear regression on equation (1) for each product by using Harmonized System (HS) 2-digit level. Currently, there are 96 products at HS 2-digit and around 4,709 goods at the HS 6-digit level, using classification year 1996. The estimated coefficient from equation (1) will be used to obtain $\beta_{n,c}$ as per equation (2).

$$\beta_{n,c} = \beta_n + \sum_k \beta_{n,k} C_c^k \tag{2}$$

Where $\beta_{n,c}$ is the parameter that captures the impact of NTBs on imports of good n in country c. This equation enables this paper to capture product-specific impact and country-specific impact, which will be captured by the respective countries' factor endowments following Leamer's (1988; 1990) comparative advantage approach.

Once the value for $\beta_{n,c}$ has been obtained, this study will then proceed to estimate the ad-valorem equivalents for NTBs to make a parallel comparison between the tariff and NTBs. Here we used chain rule as follows:

$$\frac{\partial \ln m_{nc}}{\partial NTB_{n,c}} = \frac{\partial \ln m_{nc}}{\partial \ln p_{n,c}^{d}} \frac{\partial \ln p_{n,c}^{d}}{\partial NTB_{n,c}} \tag{3}$$

Where $p_{n,c}^{d}$ are the domestic price of goods *n* in country *c;* $\frac{\partial \ln m_{nc}}{\partial \ln p_{n,c}^{d}}$ and $\frac{\partial \ln p_{n,c}^{d}}{\partial NTB_{n,c}}$ are equivalent to the import demand elasticities($\varepsilon_{n,c}$) and ad-valorem equivalent for NTB ($ave_{n,c}^{NTB}$) respectively. In other words, the impacts of NTBs on imports can be translated into price equivalents, based on the cross differentiation of impacts of domestic price on imports and impacts of NTBs on domestic prices. Hence we can also write (3) as follows:

$$\beta_{n,c} = \varepsilon_{n,c} ave_{n,c}^{NTB} \tag{4}$$

Equation (4) then rearranged to obtain $ave_{n,c}^{NTB}$ as follows:

$$ave_{n,c}^{NTB} = \frac{\beta_{n,c}}{\varepsilon_{n,c}} \tag{5}$$

By using equation (5) we can estimate the AVE for NTBs for all countries and products. Then we proceed to calculate the overall level of protection imposed by country *c* on imports of good *n*, which is given by:

$$T_{1,n,c} = t_{n,c} \tag{6}$$
$$T_{2,n,c} = t_{n,c} + ave_{n,c}^{NTB} \tag{7}$$

Where $T_{1,n,c}$ and $T_{2,n,c}$ are the overall level of protection for good *n* in country *c*, $t_{n,c}$ is the ad-valorem tariff for good *n* impose by country *c*, and $ave_{n,c}^{NTB}$ is the ad-valorem equivalent NTBs imposed in country *c* for good *n*. This study calculates $T_{1,n,c}$ and $T_{2,n,c}$ separately to highlight the importance of considering NTBs and the potential misleading information if we depend on tariff alone. Once we have calculated the overall protection level in every country, we will proceed to calculate the Trade Restrictiveness Index (TRI). The TRI estimates the restrictiveness level in trade enforced by importing countries to restrict trade. Kee et al. (2009) used the following formula to calculate TRI:

$$TRI_c = \left(\frac{\sum_n m_{n,c} \varepsilon_{n,c} \left(T_{i,n,c}\right)^2}{\sum_n m_{n,c} \varepsilon_{n,c}} \right)^{\frac{1}{2}} \tag{8}$$

Where $m_{n,c}$ is the import value for good *n* in country *c*, $\varepsilon_{n,c}$ is the import demand elasticity for good *n* in country *c*, and $T_{i,n,c}$ is the overall level of protection for good *n* in country *c* and *i* equals to one when we consider tariff only and equals to two when consider both tariff and NTB. Higher TRI value indicates that higher restriction is being imposed for goods imported by a country. However, this study found issues with this formula as the weight will not work for $T_{i,n,c}$ higher than 1. Some of the developing nations have high ad-valorem equivalent for tariff and this will cause their $T_{i,n,c}$ to rise, leading to a bias estimation. This limitation causes Kee et al. (2009) formula to serve its purpose in calculating TRI for a single product; but not for all products or few products in certain industries. Thus, this study proposes an augmented trade restrictiveness indices (ATRI) by expanding Feenstra's (1995) original formula:

$$TRI = \left[\frac{\sum_i \left(\frac{\delta QM_i}{\delta p_i}\right) (p_i^0 t_i)^2}{\sum_i \left(\frac{\delta QM_i}{\delta p_i}\right) (p_i^0)^2} \right]^{\frac{1}{2}} \tag{9}$$

Where QM_i is the import quantity for product i, p_i is the domestic price for product i, p_i^0 is the world price for product i and t_i is the tariff rate for the product i. Domestic price can be obtained by $p_i = p_i^0(1 + t_i)$. This study substituted the domestic price in equation (9) to obtain the following:

$$TRI = \left[\frac{\sum_i \left(\frac{\delta QM_i}{\delta p_i}\right)\left(\frac{p_i}{1 + t_i}\right)^2 (t_i)^2}{\sum_i \left(\frac{\delta QM_i}{\delta p_i}\right)\left(\frac{p_i}{1 + t_i}\right)^2}\right]^{\frac{1}{2}} \tag{10}$$

Equation (10) was rearranged to obtain the following:

$$TRI = \left[\frac{\sum_i QM_i p_i \left(\frac{\delta QM_i}{\delta p_i}\right)\frac{p_i}{QM_i}\left(\frac{1}{1 + t_i}\right)^2 (t_i)^2}{\sum_i QM_i p_i \left(\frac{\delta C_i}{\delta p_i}\right)\frac{p_i}{QM_i}\left(\frac{1}{1 + t_i}\right)^2}\right]^{\frac{1}{2}} \tag{11}$$

As generally known, $QM_i p_i$ is the import value ($m_{n,c}$), $\left(\frac{\delta QM_i}{\delta p_i}\right)\frac{p_i}{QM_i}$ is the elasticity of import demand ($\varepsilon_{n,c}$), and t_i is equivalent to the overall level of protection, ($T_{n,c}$) in considering both tariff and non-tariff. Thus, equation (11) will be known from here forth as ATRI and can also be written as:

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

This final formula is almost similar to those used by Kee et al. (2009) with some differences in the total protection calculation. Higher TRI value shows higher restrictiveness being imposed by those countries on all imported goods in certain industries. Improvement done in the weight influences the ATRI's interpretation. Therefore, if ATRI is equal to zero this means no restrictions being imposed by the importing countries; and if ATRI exceeds one, the degree of restrictiveness is very high.

Results obtained are then used to estimate the impact of ATRI on trade:

$$\ln m_c = \delta_0 + \delta_1 \ln GDP_c + \delta_2 \ln POP_c + \delta_3 ATRI_c + \varepsilon_c \tag{13}$$

Where m_c is the total import for country c; GDP_c is the income for country c; POP_c is the population for country c; $ATRI_c$ is the augmented trade restrictiveness indices for country c; and ε_c is the error term. For this regression, we focussed on ATRI that includes both tariff and NTBs. We estimate the equation in cross-sectional data for the year 2016.

The data used in this study were obtained from various national and international sources. For data of the 2016 import value, authors had obtained them from UN Comtrade (2018) database. Meanwhile, for all HS six-digit products, the 1996 classification was used. The sources for tariff data are World Bank World Integrated Trade System (2018) and UNCTAD TRAINS (2018). Additionally, it was ad-valorem tariff for 2016, except for Myanmar and Thailand as there are no data available for 2016. Hence, we used the ad-valorem tariff for 2015.

Authors obtained the latest NTBs from the Global Trade Alert (2018) database for the year 2017; and specifically followed Felbermayr et al. (2017) in choosing measures that are classified as NTBs. Dummy value was used for NTBs, where the value of dummy is 1 if there are any NTBs being imposed for specific tariff line, and zero otherwise. The data for elasticity of import demand were taken from Ghodsi et al. (2016); which had estimated the import demand elasticity for 167 countries for 5,124 products by using annual data from 1996 until 2014. Data for GDP and agricultural land were obtained from the World Bank (2018a; 2018b) database, while data for labor and capital obtained from the Penn World Table database (Feenstra et al., 2015).

RESULTS

Unlike most conventional economic studies that run a regression to see the relationship between variables, this study conducts OLS regressions to obtain the value of AVE for NTBs. Therefore, it proceeds by using a mathematical calculation to obtain the trade restrictiveness indices. We estimated 97 linear regressions by HS 2-digit to obtain the ad valorem equivalent for NTBs. Although some countries implemented higher number of NTBs, it depends on whether the tariffs are imposed on the same kind of products with different non-tariff classification or different affected jurisdiction. Therefore, it is imperative that we have a clear view on the frequency ratio.

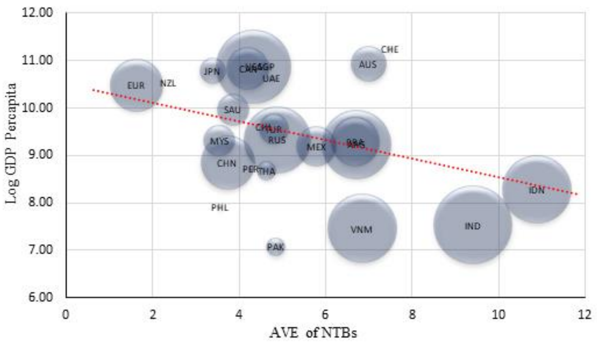
NTBs frequency ratio represent shares of HS-6 products that are affected by at least 1 NTB. It is noticed that although the United States and Vietnam have a wide gap in terms of the number of NTBs implemented, their frequency ratios are almost identical. This shows that most NTBs implemented in the United States are for the same products and multiple-jurisdiction country.

Table 1 Number of NTBs and Frequency Ratio by Country.

Country	No. of NTBs	NTBs Frequency Ratio
Argentina	752	0.41
Australia	426	0.11
Brazil	1004	0.21
Brunei Darussalam	0	0.00
Canada	682	0.16
Switzerland	8	0.00
Chile	8	0.00
China	1760	0.25
European Union	481	0.24
Hong Kong	0	0.00
Indonesia	1561	0.41
India	1211	0.53
Japan	128	0.06
Cambodia	0	0.00
Lao PDR	0	0.00
Mexico	310	0.13
Myanmar	0	0.00
Malaysia	200	0.08
New Zealand	4	0.00
Pakistan	186	0.03
Peru	10	0.00
Philippines	19	0.00
Russian Federation	1771	0.38
Saudi Arabia	776	0.08
Singapore	34	0.01
Thailand	83	0.03
Turkey	246	0.08
United Arab Emirates	17	0.00
United States	5838	0.48
Vietnam	137	0.41

Source: Author's calculation.

Based on this estimation, we can see the relationship between the calculated AVE for NTBs with the log of GDP per capita in Figure 2. It is clear that there is a negative correlation between AVE of NTBs and country income. This supports the general notion that the lower the trade barrier in a country (more liberalized), the better the economic condition.



Note: Bubble size represent NTBs frequency ratio.
Source: Author's calculation.

Figure 2 Plot of GDP Percapita and Average Ad-Valorem Equivalent for NTBs

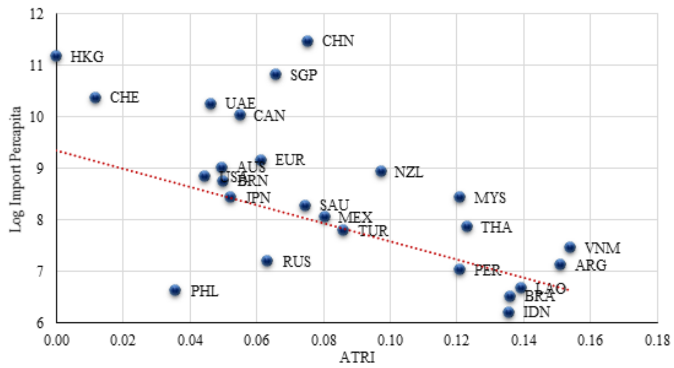
We then proceed to mathematical estimation to calculate ATRI as can be seen in Table 2. We also report the simple frequency ratio for non-zero tariff and non-tariff barriers. The table shows that 23 out of the selected 30 nations have more than 40 percent of their import products being subjected to tariff. Meanwhile for NTBs, only Argentina, India, Indonesia, United States and Vietnam have more than 40 percent frequency ratio.

Some countries even have zero NTBs frequency ratios such as Brunei, Hong Kong, Cambodia, Lao and Myanmar. This is due to no import-related NTBs being implemented and further investigation shows that they only implemented NTMs and some other export-related measures, hence they have zero frequency ratio for NTBs. Countries like Singapore maintained a low level of frequency ratio for tariff and NTBs. The most liberalized country in our sample is Hong Kong as it does not impose any tariffs or NTBs on all traded commodities. On the opposite, Argentina, Brazil and India are among the few countries that have a high average tariff.

Table 2 Augmented Trade Restrictiveness Indices Calculation for 30 Countries.

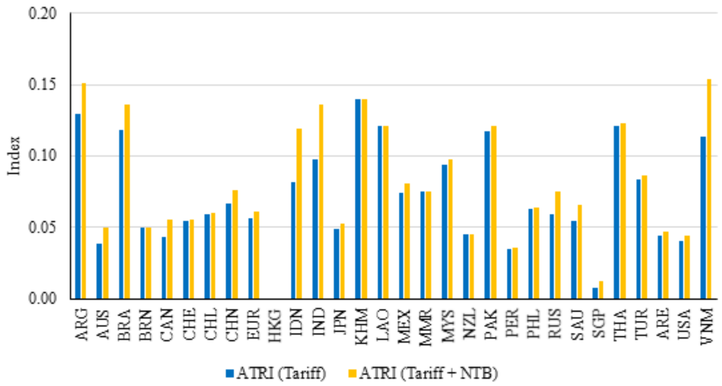
Country	**Simple Frequency Ratio Non-Zero Tariff**	**Simple Frequency Ratio of NTB**	**Average Tariff**	**Average AVE NTB**	**ATRI (Tariff only)**	**ATRI (Tariff + NTB)**
ARG	0.9301	0.4099	13.6519	6.7171	0.1298	0.1512
AUS	0.5415	0.1115	2.7215	6.9962	0.0382	0.0498
BRA	0.9320	0.2054	13.6846	6.6872	0.1180	0.1360
BRN	0.2102	0.0000	1.3674	0.0000	0.0499	0.0499
CAN	0.2211	0.1552	2.1329	4.2052	0.0436	0.0557
CHE	0.7772	0.0023	6.6032	7.4918	0.0548	0.0550
CHL	0.9964	0.0015	5.9783	4.5842	0.0594	0.0596
CHN	0.9280	0.2493	10.7208	3.7392	0.0662	0.0755
EUR	0.6708	0.2419	5.2769	1.6284	0.0567	0.0614
HKG	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
IDN	0.8908	0.4075	8.4738	10.8849	0.0819	0.1187
IND	0.9514	0.5260	12.8569	9.4140	0.0975	0.1357
JPN	0.4547	0.0569	3.1985	3.3813	0.0484	0.0524
KHM	0.8416	0.0000	11.0174	0.0000	0.1393	0.1393
LAO	0.9868	0.0000	8.2613	0.0000	0.1210	0.1210
MEX	0.4842	0.1334	6.6318	5.7908	0.0736	0.0806
MMR	0.9684	0.0000	5.7062	0.0000	0.0746	0.0746
MYS	0.3880	0.0828	7.0108	3.5404	0.0936	0.0973
NZL	0.3583	0.0006	2.1042	2.3663	0.0450	0.0450
PAK	0.9994	0.0295	12.1601	4.8507	0.1171	0.1210
PER	0.3283	0.0025	2.5252	4.2798	0.0345	0.0359
PHL	0.9720	0.0021	6.6573	3.5609	0.0631	0.0633
RUS	0.8161	0.3818	6.5325	4.8778	0.0589	0.0746
SAU	0.8915	0.0843	5.0261	3.8553	0.0542	0.0659
SGP	0.0004	0.0053	0.1013	4.6490	0.0077	0.0119
THA	0.6536	0.0297	11.3502	4.6339	0.1205	0.1230
TUR	0.7401	0.0758	9.6200	4.7989	0.0834	0.0860
ARE	0.8955	0.0030	4.7609	4.7448	0.0437	0.0464
USA	0.5056	0.4799	3.0685	4.3397	0.0405	0.0444
VNM	0.6683	0.4088	10.3799	6.8390	0.1134	0.1540

Source: Author's calculation.



Source: Author's calculation.
Figure 3 Plot of Import Percapita and Augmented Trade Restrictiveness Indices.

The relationship between import percapita and ATRI can be explored in Figure 3. This figure shows that the lesser trade restriction being imposed by a country, the higher import in that country. Figure 4 shows both the ATRI for tariff only and tariff and non-tariff. In terms of tariff only, the most liberalized country is Hong Kong, and followed by Singapore. Hong Kong does not impose any tariffs on all its imported goods, hence zero-tariff leads to zero ATRI. Meanwhile for Singapore, most of the imported goods have zero tariffs except a few such as alcoholic drinks and tobacco; and this causes its ATRI (tariff only) to be among the lowest.



Source: Author's calculation.
Figure 4 Augmented Trade Restrictiveness Indices by Countries.

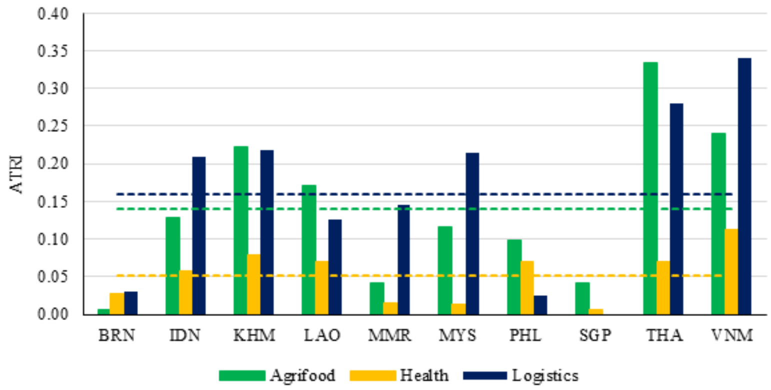
Among the selected 30 countries, only seven countries (Argentina, Brazil, Cambodia, Lao, Pakistan, Thailand and Vietnam) have ATRI that is higher than 0.1. However, if we look at ATRI that takes into account NTBs as well, we can see that 12 out of 30 countries have ATRI that is higher than 0.1. Moreover, five and out of these 12 countries have ATRI that is higher than 0.15. This clearly shows that ATRI that does not take into consideration the existence of NTBs has been underestimated. Even the most liberalized countries in terms of tariff (Hong Kong and Singapore) still have a positive ATRI.

Table 3 shows that Turkey, Thailand and India are the most restricted countries among the selected 30 countries in agrifood trade. This is followed by Cambodia, Vietnam and Mexico where these countries have ATRI exceeding 0.2 in agrifood trade. Most countries show low restrictiveness index in the health sectors. Whereas, for the logistics sector, Pakistan records the highest ATRI, followed by Vietnam and Thailand with index values of 0.4, 0.3 and 0.3 respectively. The sectorial ATRI gives better insight into sectorial restrictiveness level and overcomes the limitation in prior studies. Figure 5 illustrates sectorial ATRI where the dotted line represents ASEAN's average ATRI. It can be seen that Cambodia, Thailand and Vietnam have higher ATRI than the average of ASEAN for all sectors. 4 out of the 10 ASEAN countries recorded higher ATRI than the average for agrifood sector.

Table 3 ATRI for Sectors Agrifood, Health, and Logistics.

Country	**ISO3**	**Sectors**		
		Agrifood	**Health**	**Logistics**
Argentina	ARG	0.1412	0.1068	0.1947
Australia	AUS	0.0950	0.0232	0.0729
Brazil	BRA	0.1103	0.1386	0.2213
Brunei Darussalam	BRN	0.0059	0.0282	0.0302
Canada	CAN	0.0590	0.0194	0.0702
Switzerland	CHE	0.1501	0.0028	0.0195
Chile	CHL	0.0620	0.0600	0.0556
China	CHN	0.1102	0.0968	0.1863
European Union	EUR	0.1664	0.0203	0.0589
Hong Kong	HKG	0.0000	0.0000	0.0000
Indonesia	IDN	0.1293	0.0580	0.2098
India	IND	0.3427	0.0881	0.1216
Japan	JPN	0.1182	0.0051	0.0145
Cambodia	KHM	0.2221	0.0783	0.2187
Lao PDR	LAO	0.1716	0.0702	0.1255
Mexico	MEX	0.2160	0.0623	0.0946
Myanmar	MMR	0.0415	0.0152	0.1462
Malaysia	MYS	0.1156	0.0130	0.2154
New Zealand	NZL	0.0332	0.0163	0.0726
Pakistan	PAK	0.1008	0.1224	0.4145
Peru	PER	0.0302	0.0383	0.0415
Philippines	PHL	0.0985	0.0699	0.0252
Russian Federation	RUS	0.1167	0.0775	0.0573
Saudi Arabia	SAU	0.0661	0.0315	0.0733
Singapore	SGP	0.0417	0.0062	0.0000
Thailand	THA	0.3350	0.0695	0.2795
Turkey	TUR	0.3456	0.0125	0.0734
United Arab Emirates	UAE	0.0359	0.0311	0.0581
United States	USA	0.0589	0.0259	0.0591
Vietnam	VNM	0.2405	0.1128	0.3405

Note: ATRI reported here are those that include both tariff and NTBs.



Note: The dotted line represents average for ASEAN. ATRI reported here are those that include both tariff and NTBs.

Figure 5 Sectorial Augmented Trade Restrictiveness Indices for ASEAN Countries.

The potential of ATRI estimates lies within their ability to inform policymakers of the impact of trade barrier. Thus, we proceed to estimate a linear regression model as can be seen in the table below. Regression estimation result shows that ATRI has a negative relationship with import. This is because, as 0.01 index increases in a country, ATRI will lead to a reduction in import by 7.3 percent. Our model has passed all the diagnostic tests and they showed that the results obtained are reliable. Thus, our model is able to support the idea that tariff and non-tariff barriers had been used to limit imports in the selected sample countries. Future research can utilize these results for detailed sectorial econometric and non-econometric studies.

Table 4 Regression Estimation Results

Dependent Variable: $\ln m_c$		
Variables	Coefficient	Std. Error
Constant	3.0828	2.4208
$\ln GDP_c$	0.9384***	0.1134
$\ln POP_c$	-0.1540	0.1062
$ATRI_c$	-7.3250**	3.5700
Diagnostics	Statistics	
R^2	0.7937	
χ^2_{Auto}	0.7925	
χ^2_{Norm}	0.0750	
χ^2_{Hetero}	0.9084	
χ^2_{RESET}	1.0573	
CUSUM	Stable	
$CUSUM^2$	Stable	

Note: *, ** and *** shows significance level at 10%, 5% and 1% respectively. We used ATRI that included both tariff and NTB.

CONCLUSION AND POLICY RECOMMENDATION

This article estimates the ad valorem equivalent for the non-tariff barrier and the trade restrictiveness indices based on the Feenstra's (1995) framework; and methodological approach applied by Kee et al. (2009). The author proposed augmented improvements in the mathematical calculation for TRI to avoid estimation bias towards large positive ad-valorem values. This improvement had proven to be necessary in avoiding the over-estimation of TRI.

Unlike previous studies that depend on non-tariff measures (Kee et al., 2009), this study specifically used data from Global Trade Alert to strictly concentrate on trade distortion effects of non-tariff measures (also known as a non-tariff barrier). Early estimation gives an alarming sign to policymaker. This is because the NTBs frequency ratios shows that 5 out of selected 30 countries had more than 40% of their tariff line (HS-6) being subjected to NTBs.

Overall results show that all of the developed nations had relatively lower trade protection except for Turkey, compared with developing nations. Furthermore, cross-sector ATRI calculation shows that agrifood sector is the most restricted sector. Hence, this provides negotiation options for policymakers towards being a more liberalized and open economy; and thus leading to higher-income nation as proven by the scatter plot between trade barriers and GDP.

Results also explain the relationship between country income and trade restrictiveness where we can see that poorer countries had more restricted trade policies. This supports the idea that, a country that is more liberalized will import more; and thus leading to higher exports. This will eventually contribute to the income of the nations as they can gain more compared with the highly restricted countries. It is clear that NTBs plays an important role in influencing trade flows as the ATRI recorded on average, 17% higher value when we take into consideration the existence of NTBs. Singapore recorded the highest differences, as it shows that the value for ATRI with NTBs is 55 percent greater than those without NTBs. Hence, a separate detailed analysis of NTMs and NTBs is deemed necessary as it shapes the international trade flow.

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APPENDIX

List of Countries with Regional and Bilateral Trade Agreement

Country	ISO3	ASEAN	RCEP	CPTPP	Bilateral	None
Argentina	ARG					✓
Australia	AUS		✓		✓	
Brazil	BRA					✓
Brunei Darussalam	BRN	✓	✓	✓		
Canada	CAN			✓		
Switzerland	CHE				✓	
Chile	CHL			✓		
China	CHN		✓		✓	
European Union	EUR				✓	
Hong Kong	HKG				✓	
Indonesia	IDN	✓	✓			
India	IND				✓	
Japan	JPN		✓	✓		
Cambodia	KHM	✓	✓			
Lao PDR	LAO	✓	✓			
Mexico	MEX			✓		
Myanmar	MMR	✓	✓			
Malaysia	MYS	✓	✓	✓		
New Zealand	NZL		✓	✓	✓	
Pakistan	PAK				✓	
Peru	PER			✓		
Philippines	PHL	✓	✓			
Russian Federation	RUS				✓	
Saudi Arabia	SAU					✓
Singapore	SGP	✓	✓	✓		
Thailand	THA	✓	✓			
Turkey	TUR				✓	
United Arab Emirates	UAE					✓
United States	USA				✓	
Vietnam	VNM	✓	✓	✓		

Note: Bilateral refers to countries that had bilateral relationship with ASEAN countries.