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Impacts of Tariffs, Non-tariff Measures and FTAs on Import Performance: Evidence from Thailand

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Abstract

This paper examines the impacts of trade policy in Thailand, focusing on both tariffs and non-tariff measures (NTMs), on total imports as well as disaggregated imports, which include finished products, capital goods, and raw materials, during the period from 2012 to 2021. Tariff protection is measured in terms of both the nominal and effective rates of protection, as well as the protection adjusted for FTA utilization rates. Non-tariff measures, particularly technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures, which have significantly increased over the past decade, are analyzed through various estimates. The results indicate that tariff protection, especially the effective rate of protection, has a stronger impact on import volume. Preferential tariff rates under free trade agreements play a crucial role in enhancing the positive effects of trade liberalization on import volume. NTMs, particularly TBTs, contribute to higher import demand, likely due to the expected higher quality of imports. These positive effects are more pronounced for imports from developed countries. Both tariffs and NTMs show varying impacts across different product categories, with the greatest effects observed in intermediate products, followed by finished products and capital goods.

Keywords

Trade Policy, Tariff, Non-tariff measures, Free Trade Agreement

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1. Introduction

In the past few decades, trade policies have continually evolved to spur trade and economic development. Initially, the focus of trade policy was on unilateral and multilateral trade liberalization, exemplified by the General Agreement on Tariffs and Trade (GATT), which later evolved into the World Trade Organization (WTO). Since the establishment of the WTO, the average global tariff has gradually decreased from 6.44% in 1995 to 2.59% in 2017. However, due to the large number of member countries, progress in liberalization under the WTO has been unsatisfactory, leading to a shift in political focus toward preferential trade agreements and bilateral free trade accords. The number of FTAs in effect worldwide has risen from 23 in 1995 to 196 in 2024. Moreover, non-tariff measures, particularly technical measures such as technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) regulations, have become more prominent, especially in the Asia-Pacific region. According to UNCTAD (2019, p. 4), the trade costs associated with NTMs are more than double those of ordinary customs tariffs. Anti-globalization sentiment, particularly since 2018, has also intensified due to disappointing outcomes of trade liberalization in terms of job creation and economic growth. Tariff escalation and protectionist sentiments to shield domestic industries have become more widespread. This trend is particularly evident in the manufacturing sector, as opposed to the agricultural sector, according to UNCTAD (2022).

The shift in trade policy focus raises an empirical question regarding its impact on trade performance, particularly the effects of tariffs, non-tariff measures (NTMs), and free trade agreements (FTAs) on imports. Several studies (e.g., Ahmed et al., 2016; Amiti & Konings, 2007; Cirera et al., 2021; Jongwanich & Kohpaiboon, 2017; Topalova & Khandelwal, 2011) have found that trade liberalization, in terms of tariff reductions, has helped boost imports and improve firm productivity. Increased product variety, higher market competition, and the technological transfer and spillover effects induced by trade liberalization are key reasons supporting openness to international trade. Regarding the impacts of FTAs, the effects on trade promotion remain inconclusive (Abbas, 2018; Karkanis & Fotopoulou, 2021). Similarly, the impact of NTMs on trade is ambiguous, with both positive and negative effects observed in the empirical literature (Akintola et al., 2021; Cadot et al., 2018).

The key objective of this paper is to examine the effects of trade policy tools on import performance, using Thailand as a case study during the period from 2012 to 2021. Thailand serves as a suitable case study because the country's policy changes over the past decades have mirrored global trade policy trends. Tariff rates (most favored nation, or MFN, rates) in Thailand have noticeably declined over the past three decades, from 19% in 2000 to 9% in 2020. However, an escalating tariff structure still exists, with higher rates on finished products than on raw materials.

This structure affects the effective rate of protection, making it differ from nominal tariff rates, as demonstrated by MFN rates (Figure 1). FTAs in Thailand were initiated in the early 2000s. From having only the ASEAN FTA in 2000, the country currently has 15 FTAs in effect as of 2024, with about 10 more under negotiation. Moreover, non-tariff measures (NTMs) have gradually increased from 466 in 2000 to 2,821 in 2020 (Figure 2).

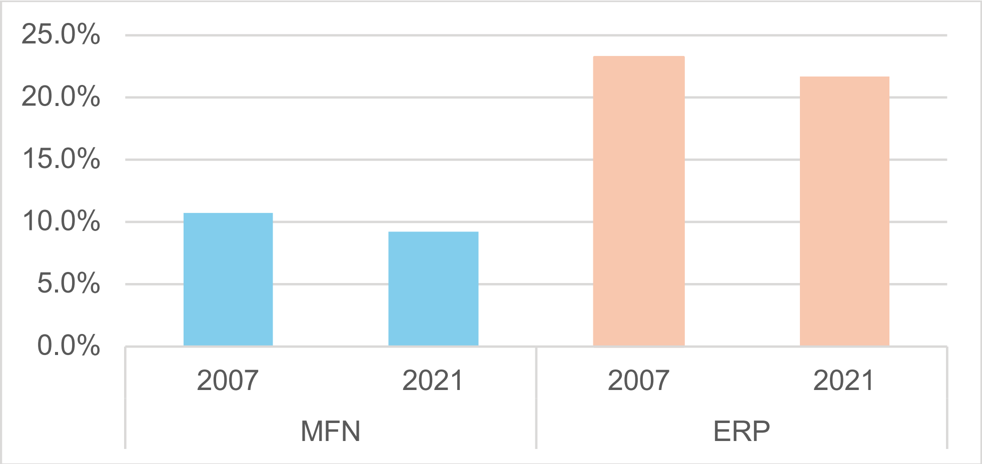

Figure 1 Average tariffs and ERP in Thailand, 2007-2021

Source: Author's compilation based on the Tariff Analysis Online (TAO) and the Thai Customs Department.

This study contributes to existing literature in two ways. First, it simultaneously examines both tariff and non-tariff policies and their impact on Thailand's import performance. In terms of tariff protection, both nominal and effective rates of protection are considered. Trade liberalization through in-effect FTAs is also explored, particularly through the use of preferential tariff rates and FTA utilization to adjust the nominal and effective rates of protection. This type of modification could broaden the perspective on Thailand's trade liberalization policies. So far, there have been no empirical studies that examine these trade policy tools together in influencing import performance. Jongwanich & Kohpaiboon (2020), Romyen et al. (2023) and Sarisae et al. (2023) examine the impacts of trade policy on key economic variables, including import performance. However, the trade policy tools considered in these studies are limited to tariffs, either nominal or effective tariff rates, and free trade agreements, excluding the role of non-tariff measures and preferential tariffs from FTAs in adjusting nominal and effective tariff rates. Second, total imports are disaggregated into finished goods, capital goods, and raw materials to examine the potentially different impacts of various trade policy tools on each category's performance. Most previous studies consider imports at an aggregate level, overlooking the potential differences in how trade policy affects different types of imports.

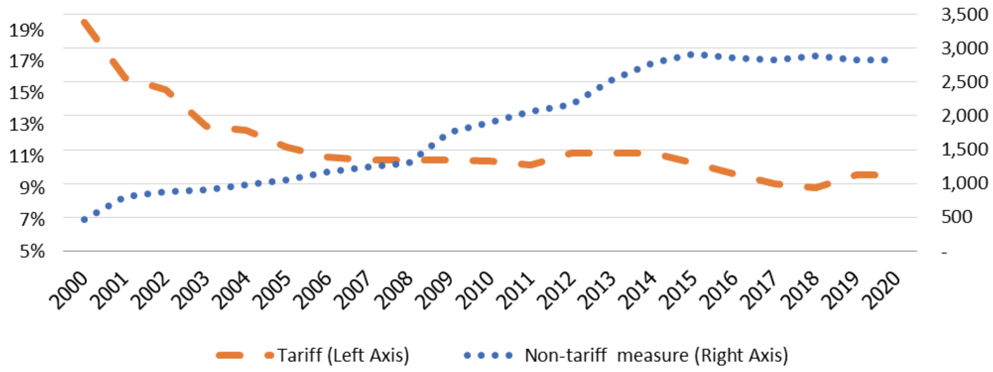

Figure 2 Thailand's tariffs and non-tariff measures, 2000-2020

Source: Author's compilation based on the Tariff Analysis Online (TAO) and TRAINS databases.

The remainder of this paper is organized as follows. Section 2 presents the analytical framework relevant to trade policy and import performance, followed by a discussion of variable measurement, data, and research methodology in Section 3. Section 4 provides a brief overview of the development of trade policy tools in Thailand, while Section 6 discusses the estimation results. The conclusions and policy implications are presented in the final section.

2. Literature Review

Traditional theoretical studies explaining the gains from trade are based on the concept of comparative advantage, as illustrated in the Ricardian and Heckscher-Ohlin models (Ohlin, 1933; Ricardian, 1821). Each country will specialize in different goods, reflecting differences in labor productivity, resource endowments (relative factor abundance), and production technology (relative factor intensity) in each country. From the different specializations, trade will create gains for both countries. The results from the Ricardian and Heckscher-Ohlin models have been confirmed by the Specific Factor Model, developed by Jones (1971) and Samuelson (1971).[1] While traditional

[1] They added the specific factor in the factor of production set to explain the short run that some factor cannot move freely as in Ricardian model. In this model, the factor specific owner to export sectors in each country has gained from trade. On the other hand, the factor specific owner in the import-competing sector has lost. The mobile factor like labor has either gain or lose. Therefore, the overall gain can occur only when those who gain from trade can compensate those who lose from trade.

models explain trade based on factor endowments, technology, and specialization under constant returns to scale, the trade theory introduced in the 1980s emphasized the importance of economies of scale in explaining gains from trade, or so-called intra-industry trade. The intra-industry trade is the term to call the two-way exchange of similar goods which has been explained in the monopolistic competition market. In this kind of market, increasing return to scale can explain gains from trade even in a situation of identical tastes, technology, and factor endowment. The model was further developed by Bernard et al. (2003) and Melitz (2003), who incorporated firm heterogeneity and confirmed potential gains from trade. However, many studies also discuss the adverse impacts of trade. The infant industry argument, the terms of trade argument, and the cost discovery argument are examples of discussions against trade liberalization (Krugman, 2018). For example, Chang & Andreoni (2016) and Pack & Saggi (2006) and argue that trade protection can play an important and effective role in supporting latecomer industrialization, mainly because of pervasive market failures. Such market breakdowns include coordination failure, in which firms do not invest until others undertake necessary related spending; dynamic scale economies and knowledge spillovers, whereby trade protection helps to determine future production possibilities under learning-by-doing economies; and information externalities, where governments can encourage the discovery of future business opportunities. Hausmann, Hwang & Rodrik (2007) and Hausmann & Rodrik (2003) also argue that, due to the externalities inherent in investment, without interventions such as subsidies or trade protection for innovative activities, investment levels of these products are likely to be suboptimal.

Previous studies examine the impacts of tariffs, but tend to be limited to productivity improvements, instead of import performance. For example, Amiti & Konnings (2007) estimate the effects of reducing input tariffs on firm productivity, separating importing firms from other firms by using Indonesian manufacturing census data from 1991 to 2001. Their results show that the productivity gains from reducing input tariffs are much higher than those from reducing output. Cirera et al. (2021) examine the effects of input and output tariffs on firm productivity in Brazil between 2000-2007. The results show that productivity gains from output tariff reductions are greater in exporting firms than in non-exporting firms. However, the effect of input tariff reductions does not differ between importing and non-importing firms. In Thailand, Jongwanich & Kohpaiboon (2020) investigate the effects of input and output tariffs on firm productivity between 1996-2016. Their results suggest that input tariff reductions can stimulate firm productivity, whereas output tariffs have no significant effect.

While FTAs have become more pervasive as a trade policy tool, few studies have examined their impacts on imports. Other studies have focused on issues such as trade creation (Agung et al., 2019;

Dadakas et al., 2020; Harada & Nishitateno, 2021; Jamil et al.,2022; Ramaswamy et al., 2021); trade diversion (Abbas, 2018; Chan, 2019; Jagdambe & Kannan, 2020); and export performance (Hettiarachchi, 2023; Jin 2023; Jongwanich, 2024; Masunda & Mhonyera, 2024; Sarisae et al., 2023). Jongwanich & Kohpaiboon (2020) used the effective rate of protection to understand impacts of trade protection on Thai manufacturing by incorporating water in tariff and preferential tariffs under FTAs. The results show that FTAs failed to improve firm productivity in Thailand.

Non-tariff measures (NTMs) are defined as policy measures other than ordinary customs tariffs that can potentially affect international trade in goods by changing quantities traded, prices, or both (UNCTAD, 2012). The classification, known as the International Classification of Non-Tariff Measures (ICNTM), has been established and updated over time. The latest version, published by UNCTAD (2016), categorizes NITMs into two main categories: (1) technical measures, including sanitary and phytosanitary measures (SPS), technical barriers to trade (TBT), pre-shipment inspection, and other formalities; and (2) non-technical measures, such as contingent trade-protective measures, non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS and TBT, price-control measures, and others.

Since the objectives of imposing NTMs are principally not involved with protection proposals, especially technical measures, impacts of NTMs on trade seem to be ambiguous. NTM policies can both increase demand of that product, called “market-creating effects” and create compliance cost to decrease import volume (Cadot et al. 2018). Two methods have been widely used to indicate trade protection from NTMs. On one hand, NTMs indicators to measure a number of regulations or intensity of regulations are applied. The most popular indicators are the coverage ratio (CR), the frequency index (FI), and the prevalence score (PS), which were used in Melo and Nicita (2018). On the other hand, NTM is quantified as ad-valorem equivalent (AVEs) in which two broad approaches have been used. First, it has been quantified based on price gap between imported prices affected by NTMs and NTMs-free imported prices (Cadot et al.,2018; Cadot & Ing, 2017). Second, NTMs have been quantified based on quantity, called the quantity-based approach. This approach quantifies by using trade data which is more available and accessible than price data (Akintola et al., 2021; Bratt, 2017).

Empirically, country and product characteristics are important in measuring NTM indicators and AVEs calculation (Dolabella, 2020). The result depends on the relative strength of compliance-cost versus demand-enhancing effects (Cadot et al., 2018). However, high-income countries often show lower AVEs than middle- and low-income countries (Akintola et al., 2021; Bratt, 2017; Ghodsi et al., 2016; Ronen, 2017).

Based on the literature, there have so far been no empirical studies examining these trade policy tools together in influencing import performance, especially in Thailand. In addition, the trade policy tools considered are limited to tariffs, either nominal or effective tariff rates, and free trade agreements, excluding the role of non-tariff measures and preferential tariffs from FTAs in adjusting nominal and effective tariff rates. The contributions of this study are built upon these gaps in literature.

Based on the literature survey, so far there have been no empirical studies that examine the combined effects of all trade policy tools, composing of tariffs (nominal and effective rates), FTAs and NTMs, on import performance, particularly in the context of Thailand. Existing studies tend to focus only on tariffs and free trade agreements, while ignoring the role of non-tariff measures and preferential tariffs under FTAs in adjusting nominal and effective tariff rates. This study aims to contribute to literature by addressing these gaps.

3. Methodology

As we discussed above, trade liberalization can be implemented through both tariffs (unilateral or PTAs/FTAs) and non-tariff measures. This section discusses measurements of these trade policy tools, and the empirical model applied in this study.

Regarding the trade policy tool, tariffs are a traditional tool that has been widely implemented to protect domestic industry. We measure the tariff protection by using the most favored nation (MFN)/applied tariff rate of each country. It can be used to measure the protection level in each sector/industry. Nominal rate of protection (NRP) is applied and is referred to as an estimation of the equivalent tariff that would lead to the total disparity between domestic and international prices due to the import tariff (USAID, 2008). However, NRP still cannot measure firms or industries' protection as it does not consider imported inputs or the supply chain of the production. The effective rate of protection (ERP) has been commonly used to measure the net effect of tariff measures (Balassa, 1965; Corden, 1966). The idea of ERP is to measure the difference between input tariffs and output tariffs in each industry. By subtracting the output tariff by input tariff, this concept evaluates the rate of protection for finished products. The evaluation utilizes the concept of input shares for each output, which has recently been formalized through the development of Input-Output (IO) tables. The formula for ERP is as follows:

Traditional ERP:
$$ERP_{jt} = \frac{T_{jt} - \sum_{i=1}^{n} a_{ijt} T_{it}}{1 - \sum_{i=1}^{n} a_{ijt}} \quad (1)$$

where T_{jt} is average tariff on finished product in sector j at time t

T_{it} is average tariff on product from sector i which has been used as intermediate input to produce product in sector j at time t

a_{ijt} is share of intermediate product form sector i which has been used to produce product in sector j at time t

To calculate the ERP in the Thai context, the detailed 180 sectors Thai IO table is applied. Tariff data are collected based on the Harmonized System (HS) Classification which contains around 5,000 products at the 6-digit level. The concordance from the United Nations Statistics Division (UNSD) is applied to match HS codes with ISIC 4-digit categories.

To observe the effects of input and output tariffs separately as a robustness check, we calculate the input tariff rate (ITR) and output tariff rate (OTR) following Amiti & Konning (2007). While the OTR represents the average MFN tariff rate in each sector, the ITR is calculated as follows:

Input tariff rate: $$ITR_{ijt} = \sum_{i=1}^{n} a_{ijt} * T_{it} \quad (2)$$

where T_{it} is the average tariff on product from sector i which has been used as intermediate input to produce product in sector j at time t

a_{ijt} is the share of intermediate product form sector i which has been used to produce product in sector j at time t

The second policy tool is free trade agreements (FTAs). We consider two measures to capture the impact of FTAs: tariff margins and utilization rates. As mentioned above, Thailand had 14 FTAs in effect during our consideration period (2012-2021) and each FTA had its own tariff schedule, which committed different preferential tariff rates. The tariff margin for each FTA at the 6-digit HS code level is calculated by comparing preferential tariffs with applied tariff rates.

Tariff Margin: $$Margin_{ijt} = T_{ijt,MFN} - PT_{ijt} \quad (3)$$

where T_{ijt} is the MFN tariff rate of product i from country j at time t

PT_{ijt} is the preferential tariff rate of product i from country j at time t

For the second measure, FTA utilization rate, defined as the share of imports under FTAs on the total imports which represent the amount of import value that has been used under each FTA, is calculated and used as a weight between MFN rate and preferential tariff rate. In other words, this study conducts the new tariff protection by combining the preferential tariff rate with MFN tariff rate by FTA utilization rate (T^*_{ijt}). This newly introduced tariff more accurately reflects the real import tariffs encountered by importers than either MFN or preferential tariff rates. Such a modification, therefore, enhances the precision impact of trade liberalization on Thailand's tariff structure. This study conducts the new tariff protection by using the following formula:

Tariff associated with FTA: $$T^*_{ijt} = \left(1 - \sum_{f=1}^{n} UR_f\right)T_{ijt} + \left(\sum_{f=1}^{n} UR_f\right)PT_{ijt} \quad (4)$$

where T_{ijt} is the MFN tariff rate of product i from country j at time t

PT_{ijt} is the preferential tariff rate of product i from country j at time t

UR_f is the utilization rate from free trade agreement f

Then, T^*_{ijt} is applied, instead of MFN, to recalculate ERP, ITR and OTR by using equations (1) and (2). All in all, we have two sets of variables to represent the tariff measurements, i.e., the first set of variables that are calculated from MFN (or T_{ijt}) in terms of ERP_{ijt}, ITR_{ijt}, and OTR_{ijt} the second set of variables that are calculated from T^*_{ijt}; i.e.,ERP^*_{ijt} , ITR^*_{ijt}, and OTR^*_{ijt}. Note that nominal rate of protection (NRP) has the same value as the output tariff (OTR).

Regarding the non-tariff measures, this study focuses only on technical measures, which have increased substantially over the past decades, including sanitary and phytosanitary measures (SPS), technical barriers to trade (TBT) and pre-shipment inspection and other formalities (Inspection), and applies both NTM indicators and ad-valorem equivalent (AVEs) to analyze the protection level from NTM. The indicators are the coverage ratio (CR) and the frequency index (FI). The formula can be expressed in following equation:

$$CR_{ij} = \frac{\sum_{i=1}^{hs} NTM_{ij}X_{ij}}{\sum_{i=1}^{hs} X_{ij}}\ x\ 100 \quad (5)$$

$$FI_{ij} = \frac{\sum_{i=1}^{hs} NTM_{ij}D_{ij}}{\sum_{i=1}^{hs} D_{ij}}\ x\ 100 \quad (6)$$

where NTM_{ij} is the dummy variable which is equal to 1 if Thailand imposed non-tariff measures on importer product i from country j and zero otherwise

X_{ij} is the value of imported product i from country j

D_{ij} is the dummy variable which is equal to 1 if Thailand import product i from country j

Ad-valorem equivalents (AVEs) are also applied using a quantity-based approach, since reliable price data are unavailable in Thailand. AVEs capture the impact of NTMs on trade across different countries and offer a more precise measure than NTM indicators alone. The ad-valorem equivalent approach is evaluated based on a gravity equation using a two-step estimation. First, the coefficient of NTMs, defined as the number of NTMs imposed on each product, derived from the trade equation is applied. Second, this coefficient is converted into the ad-valorem equivalent of non-tariff measures.

For the first step, the equation mainly uses the size of economies and the distance between them to explain bilateral trade flows. Then, natural logarithms are applied to obtain a log-linear equation. The gravity model, based on Tinbergen (1962), Shepherd (2013), and Cadot & Ing (2019), is employed as follows to determine the coefficient corresponding to the NTM variable in the model.[2]

$$\ln q_{ijt} = \beta_0 + \beta_1 T^{*}_{ijt} + \beta_2 \#NTM_{ijt} + \beta_3 G_{ijt} + \delta_i + \delta_{s(k)} + \varepsilon_{ijk} \quad (7)$$

where q_{ijk} is import volume of product i from country j to Thailand at time t

T^{*}_{ijt} is weighted average of the tariff rate associated with FTA rate (T*) in product i

$\#NTM_{ijt}$ is number of NTM in product i that impose by Thailand on country j at time t

G_{ij} is gravity variable which is distance, GDP and population of country j and language variable

δ_i is exporter fixed effect

$\delta_{s(k)}$ is sector fixed which using 4-digit level in ISIC

[2] Note that the estimation method to quantify ad-valorem equivalent of non-tariff measure is Poisson Pseudo Maximum Likelihood (PPML). The reason is that trade volumes have many zero values, and these zero values should not be neglected. For this reason, PPML provides us with more efficient estimators than ordinary least square (OLS), according to Head & Mayer (2014).

For the second step, the coefficient from equation (7) is applied to calculate the ad-valorem equivalent of non-tariff measures. To convert the coefficient, we use the following equation:

$$AVE_{NTM} = e^{\beta_2} - 1 \quad (8)$$

Empirical model

We explore the effect of trade policy on import performance in Thailand by focusing on tariffs, non-tariff measures, and free trade agreements. For tariff, T_{ijt}, ERP_{ijt}, ITR_{ijt}, *and* OTR_{ijt} are employed to represent tariff protection while there are three alternatives for non-tariff measure: coverage ratio (CR), the frequency index (FI), and ad-valorem equivalents (AVEs). The effect of FTAs has been proxied by two aspects: utilization rate and tariff margin. However, as we explain above, we also combined the effect of FTAs into tariff variable in terms of T^*_{ijt}, ERP^*_{ijt}, ITR^*_{ijt}, and OTR^*_{ijt}. Hence, our empirical model has been summarized as follows. To clarify, the dependent variable in Equation (7) is expressed in logarithmic form, as only the estimated coefficient is used to calculate the AVEs. In contrast, the dependent variable in Equation (9) is the total import volume measured in USD, in order to avoid the effects of foreign exchange rate fluctuations.

$$M_{ijt} = \beta_0 + \beta_1 Tariff_{ijt} + \beta_2 NTM_{ijt} + \beta_3 FTA_{ijt} + \beta_4 G_{jt} + \varepsilon_{ijt} \quad (9)$$

where M_{ijt} is the total imports volume of product i country j at time t

$Tariff_{ijt}$ is the tariff representative that Thailand imposes on product i of country j at time t, which is measured by T_{ijt}, ERP_{ijt}, ITR_{ijt} *and* OTR_{ijt}. Alternatively, tariff incorporating the effect of FTAs is employed (T^*_{ijt}), ERP^*_{ijt}, ITR^*_{ijt} and OTR^*_{ijt}.

FTA_{ijt} is free trade agreement of product i on Thailand and country j at time t which measures by FTA utilization rate ($Utilization_{ijt}$) and FTA tariff margin ($Margin_{ijt}$)

NTM_{ijt} is non-tariff measures representative that Thailand imposed on product i of country j at time t which measured by CR, FI, and AVEs of technical measures; SPS_{ijt}, TBT_{ijt} and $Inspection_{ijt}$.

G_{jt}	is	gravity which is distance, GDP and population and language variable on product i of country j at time t.

As impacts of trade protection/liberalization on import performance vary among sub-sectors, this study disaggregates total imports into three sub-categories, composing of finished (*IMFinish*$_{ijt}$), capital (*IMCap*$_{ijt}$), and raw material (*IMRaw*$_{ijt}$) imports. Broad Economic Categories (BEC) rev.5 is applied to disaggregate imports into three categories and equation (10-12) is modified as follows[3].

$$\text{IMFinish}_{ijt} = \beta_0 + \beta_1 Tariff_{ijt} + \beta_2 NTM_{ijt} + \beta_3 FTA_{ijt} + \beta_4 G_{jt} + \varepsilon_{ijt} \quad (10)$$

$$\text{IMCap}_{ijt} = \beta_0 + \beta_1 Tariff_{ijt} + \beta_2 NTM_{ijt} + \beta_3 FTA_{ijt} + \beta_4 G_{jt} + \varepsilon_{ijt} \quad (11)$$

$$\text{IMRaw}_{ijt} = \beta_0 + \beta_1 Tariff_{ijt} + \beta_2 NTM_{ijt} + \beta_3 FTA_{ijt} + \beta_4 G_{jt} + \varepsilon_{ijt} \quad (12)$$

where	IMFinish_{ijt}	is	total import volume of finished product i from country j at time t
	IMCap_{ijt}	is	total import volume of capital product i from country j at time t
	IMRaw_{ijt}	is	total import volume of intermediate product i from country j at time t

Based on the literature, the estimated effects of tariffs and non-tariff measures (NTMs) can be either positive or negative. This is because tariffs have been measured in various ways, and NTMs may impose compliance costs but can also facilitate trade through quality control. However, trade liberalization policies, such as free trade agreements (FTAs), are generally expected to have a positive impact on trade flows.

To construct all tariff measures, we retrieve applied tariff rates from Tariff Analysis Online (TAO) which has provided tariff data since 1999. Preferential tariff rates and import utilization data are retrieved from the Thai Customs Department, Ministry of Finance. Input and output tables are obstained from the National Economic and Social Development Board (NESDB). For non-tariff measures, NTM data are retrieved from the Integrated Trade Intelligence Portal (I-TIP), which has provided NTM data since 1960. The gravity variables used to estimate the AVEs of NTMs are obtained from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) database.

[3] It is important to note that, in analyzing the impacts of trade policy tools on disaggregated imports, $Tariff_{ijt},\ NTM_{ijt},\ and\ FTA_{ijt}$ refer specifically to the values corresponding to each product category i.

Import data are retrieved from the UN Comtrade Database. See Table 1 for the data and their corresponding sources.

Regarding the estimation technique, the Poisson Pseudo Maximum Likelihood (PPML) estimation is applied to address the problem of zero trade flows between Thailand and its trading partners. Hence, the econometric procedure in this study follows the method of Silva & Tenreyro (2006), where the dependent variable is the level of import volume, while all other explanatory variables are in logarithmic form to estimate import equations (9-12). In addition, we use the PPMLHDFE (Poisson Pseudo-Maximum Likelihood with High-Dimensional Fixed Effects) estimation, which allows for high-dimensional fixed effects that are important for controlling time-varying factors in the large datasets.

It is worth noting that employing PPMLHDFE while controlling country fixed effects, year fixed effects, product fixed effects, and the country-year pair fixed effects under PPMLHDFE, the control variables gravity variable distance, GDP and population and language variable would have been dropped from the estimation results. The results are reported in terms of *the incident rate ratios* (IRR), which is calculated by exponentiating the Poisson regression coefficient. The ratios, which are less than 1 and statistically significant, show that policy measures could negatively influence import structure.

Table 1 Data and sources summarization.

Variables	Source
Tariff rate (T_{ijt} ERP_{ijt}, ITR_{ijt}, and OTR_{ijt})	Tariff Analysis Online (TAO)
Preferential tariff rates (PT_{ijt})	Thai customs department
Import volume (M_{ijt})	UN Comtrade Database
FTA utilization ($Utilization_{ijt}$)	Thai customs department
Gravity variable (G_{jt})	CEPII database
NTM data (SPS_{ijt}, TBT_{ijt} and $Inspection_{ijt}$)	the Integrated Trade Intelligence Portal (I-TIP)
Input and output table	Thailand National Economic and Social Development Board (NESDB)

Source: Author's compilation.

4. Tariff and NTMs: First look

This section provides a brief overview of trade policy in Thailand from 2007 to 2021. First, we examine tariff protection and free trade agreements (FTAs) in terms of tariff margins and utilization rates. Then, we discuss non-tariff policies, focusing on coverage, frequency, and ad-valorem equivalents (AVEs).

MFN tariff rates in Thailand have declined over the past few decades, following tariff reforms in the early 1990s and 2000s. The average tariff rate in Thailand decreased from 10.6% in 2007 to 9.2% in 2021. At the sectoral level, we calculate the nominal rate of protection (NRP) and the effective rate of protection (ERP) to represent the level of protection in each sector. The results show that NRP decreased across all sectors, using broad aggregation from NESDB, from 2007 to 2021 (Table 2). According to the NRP, the three most protected sectors are food manufacturing, construction, and agriculture. For ERP, the three most protected sectors are food manufacturing, construction, and textiles. Additionally, the ERP in the food manufacturing and textile industries has increased, which contrasts with the decrease in NRP. This may reflect the lower adjustments to tariffs on finished products compared to raw materials.

Table 2 NRP and ERP in Thailand over the periods 2007 - 2021.

16 Sector	NRP		ERP	
	2007	2021	2007	2021
Agriculture	21.5%	19.2%	30.9%	29.1%
Mining and Quarrying	1.1%	0.8%	-0.1%	-0.2%
Food Manufacturing	30.4%	28.4%	44.8%	48.3%
Textile Industry	16.4%	15.7%	37.8%	41.1%
Sawmills and Wood Products	13.6%	12.1%	34.0%	28.6%
Paper Industries and Printing	4.2%	4.0%	9.8%	9.9%
Rubber, Chemical and Petroleum Industries	7.3%	6.4%	19.5%	16.4%
Non-metallic Products	11.9%	10.7%	32.8%	29.7%
Metal, Metal Products and Machinery	8.5%	7.2%	20.1%	16.5%
Other Manufacturing	11.2%	8.6%	21.5%	18.9%
Public Utilities	0.0%	0.0%	-1.8%	-1.4%
Construction	26.3%	21.7%	52.9%	45.4%
Services	2.5%	2.5%	0.0%	-0.7%

Source: Author's calculations based on data from the Thai Customs Department and NESDC.

Since 2000, the number of in-effect free trade agreements (FTAs) has gradually increased from just the ASEAN Free Trade Agreement (AFTA) in 2000 to 15 FTAs in 2024. However, the additional 14 FTAs cover only 10 more countries, largely due to the overlapping nature of bilateral and multilateral agreements within ASEAN. China, Indonesia, and Vietnam are the three largest users of FTAs, with utilization rates of 43.2%, 37.4%, and 31.8%, respectively (Table 3). We found that countries with both bilateral and multilateral agreements tend to use bilateral agreements more frequently than multilateral ones. This is because bilateral agreements with Australia, New Zealand, and Japan provide preferential tariff treatment (PTA) on more products than the multilateral agreements within ASEAN.

Despite the large number of PTAs provided by each FTA, we found that FTA utilization in Thailand has not reached its full potential. By calculating FTA usage as the proportion of PTA utilization across all imported products at the HS 6-digit level, we found that only one-quarter of the FTAs were used in 2021. Only China utilized PTAs for more than half of its imports. This limited usage is attributed to other tax privileges in Thailand, such as Free Zones, Bonded Warehouses, Duty Drawback schemes, and the Board of Investment (BOI) incentives, which provide alternative benefits for import and investment activities.

Table 3 Tariff margins, number of PTA and FTA utilization in 2021

Country	Margin	Number of PTA	Utilization (Overall)
AFTA			
Brunei	9.2%	5,387	0.0%
Cambodia	9.2%	5,387	18.6%
Indonesia	9.2%	5,387	37.4%
Laos	9.2%	5,387	19.5%
Malaysia	9.2%	5,387	23.2%
Myanmar	9.2%	5,387	14.5%
Philippines	9.2%	5,387	13.5%
Singapore	9.2%	5,387	7.3%
Vietnam	9.2%	5,387	31.8%
Australia			
- ASEAN - Australia - New Zealand	8.8%	5,336	4.7%
- Thai - Australia	9.2%	5,387	13.7%

Table 3 Tariff margins, number of PTA and FTA utilization in 2021 (Cont.)

Country	Margin	Number of PTA	Utilization (Overall)
New Zealand			
- ASEAN - Australia - New Zealand	8.8%	5,336	5.6%
- Thai - New Zealand	9.2%	5,387	14.6%
Japan			
- ASEAN - Japan	8.6%	5,209	1.7%
- Thai - Japan	8.9%	5,375	16.1%
India			
- ASEAN - India	7.5%	4,835	18.1%
- Thai - India	5.6%	113	0.1%
ASEAN - China	8.4%	5,337	43.2%
ASEAN - Korea	8.6%	5,289	19.9%
ASEAN - Hong Kong	5.2%	5,215	0.3%
Chile	9.1%	5,387	16.8%
Peru	6.6%	3,947	7.1%

Source: Author's calculations based on the Thai Customs Department.

As mentioned earlier, FTA utilization varies among countries. To evaluate tariff protection, especially in the 18 countries under consideration, we need to account for the effect of FTAs. We calculate T^* to represent the combination of preferential tariff agreements (PTA) and utilization in tariff protection. The calculation shows that when China complies with FTAs, its tariff rate decreases from 9.2% to 4.8%. Similarly, in Indonesia and Vietnam, tariff rates reduce to 6.9% and 7.1%, respectively. In terms of the effective rate of protection (ERP*), the reduction effect is twice as large as that of the nominal rate of protection (NRP*). The FTA privileges granted by China effectively reduce Thailand's protection by about 10.3% on average when FTA privileges are included in our analysis, followed by Indonesia and Vietnam at 9.1% and 6.8%, respectively (Table 4). These results demonstrate that utilizing FTAs can significantly reduce import costs from each country.

Between 2012 and 2021, Thailand imposed non-tariff measures (NTMs) on both agricultural and manufacturing products. Over this period, NTMs showed an increasing trend in both coverage ratio (CR) and frequency index (FI). On average, NTMs covered approximately 55% to 60% of all products between 2012 and 2021. These two indicators are nearly equal, with the frequency index (FI) being slightly lower than the coverage ratio (CR) throughout the period (Figure 3). This suggests that NTMs are relatively evenly distributed across products, regardless of their import value. NTM policies are imposed more heavily on products from least developed countries (LDCs), where both the coverage ratio and frequency index are highest, followed by developing countries and then developed countries.

Table 4 NRP & ERP calculation from tariffs associated with utilization FTA in 2021

16 Sector	NRP	NRP (Indonesia)	NRP (Vietnam)	NRP (China)	ERP	ERP (Indonesia)	ERP (Vietnam)	ERP (China)
001	19.2%	16.0%	16.4%	13.1%	29.1%	24.3%	24.9%	20.5%
002	0.8%	0.4%	0.7%	0.2%	-0.2%	-0.4%	-0.2%	-0.5%
003	28.4%	23.3%	20.3%	18.6%	48.3%	36.7%	30.9%	39.1%
004	15.7%	10.6%	11.5%	5.3%	41.1%	26.3%	29.5%	11.9%
005	12.1%	5.0%	6.8%	1.2%	28.6%	11.4%	15.9%	2.5%
006	4.0%	2.5%	2.9%	3.7%	9.9%	6.0%	6.7%	9.4%
007	6.4%	4.4%	4.9%	3.2%	16.4%	10.6%	11.7%	7.1%
008	10.7%	7.1%	6.1%	5.1%	29.7%	18.5%	15.3%	12.7%
009	7.2%	5.3%	5.7%	3.9%	16.5%	11.8%	12.8%	8.7%
010	8.6%	5.6%	6.1%	4.0%	18.9%	11.6%	12.6%	8.3%
011	0.0%	0.0%	0.0%	0.0%	-1.4%	-1.2%	-1.2%	-1.1%
012	21.7%	1.7%	14.7%	16.1%	45.4%	0.4%	31.0%	34.4%
015	2.5%	0.2%	0.0%	0.3%	-0.7%	-3.4%	-4.3%	-2.4%
016	24.5%	23.9%	23.5%	18.1%	64.0%	66.2%	64.6%	50.5%
Average	11.6%	7.6%	8.5%	6.6%	24.7%	15.6%	17.9%	14.4%

Note: (1) While the average MFN rate is 9.2%, the average T* rates for China, Vietnam, and Indonesia are 4.8%, 7.1%, and 6.9%, respectively. (2) The trade industry and transportation and communication industry are not applicable.

Source: Author's calculations based on the Thai Customs Department, NESDB, and UNCOMTRADE.

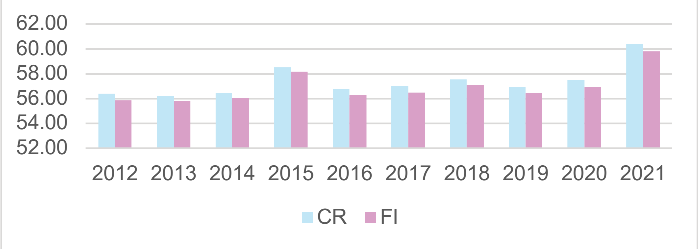

Figure 3 Coverage ratio and frequency index of NTM in 2012 -2021

Note: CR is coverage ratio; FI is frequency index.

Source: Author's calculations based on the I-TIP data.

At the sectoral level, the analysis of the coverage ratio and frequency index reveals that four sectors, i.e., vegetable products (Section 2), fats and oils (Section 3), prepared food and beverages (Section 4), and arms and ammunition (Section 19), have been fully covered by NTM policies[4] (Figure 4). The sector for optical, measuring, and medical or surgical instruments (Section 18) shows the largest increase in protection, with coverage rising by 30%, from 46.6% in 2012 to 75.2% in 2021. This increase may be attributed to the Medical Device Act BE 2019, which aimed to protect medical or surgical instruments (Chapter 90) during the COVID-19 pandemic. The second largest increase in NTM coverage occurred in the mineral products sector (Section 5), which rose from 86.7% in 2012 to 99.7% in 2021. This change was driven by the Excise Act B.E. 2017, which specifically affected ores, slag, and ash in Chapter 26. In conclusion, the two largest changes in NTM policies over the past decade stemmed from the Medical Device Act in 2021 and the Excise Act in 2017. However, neither of these policies shows any discrimination in terms of country coverage, meaning they do not specifically target any particular group of countries.

[4] The definition of 21 sections is following from Harmonized System (HS) nomenclature as follow: Section 1 Live Animals, Animal Products; Section 2 Vegetable Products; Section 3 Animal or Vegetable Fats and Oils and Their Cleavage Products, Prepared Edible Fats, Animal or Vegetable Waxes; Section 4 Prepared Foodstuffs, Beverages, Spirits, and Vinegar, Tobacco and Manufactured Tobacco Substitutes; Section 5 Mineral Products; Section 6 Products of the Chemical or Allied Industries; Section 7 Plastics and Articles Thereof, Rubber and Articles Thereof; Section 8 Raw Hides and Skins, Leather, Furskins, and Articles Thereof, Saddlery and Harness, Travel Goods, Handbags, and Similar Containers; Section 9 Wood and Articles of Wood, Wood Charcoal, Cork and Articles of Cork, Manufactures of Straw, of Esparto, or of Other Plaiting Materials, Basketware and Wickerwork; Section 10 Pulp of Wood or of Other Fibrous Cellulosic Material, Recovered (Waste and Scrap) Paper or Paperboard, Paper and Paperboard and Articles Thereof; Section 11 Textiles and Textile Articles; Section 12 Footwear, Headgear, Umbrellas, Sun Umbrellas, Walking-Sticks, Seat-Sticks, Whips, Riding-Crops, and Parts Thereof, Prepared Feathers and Articles Made Therewith, Artificial Flowers, Articles of Human Hair; Section 13 Articles of Stone, Plaster, Cement, Asbestos, Mica, or Similar Materials, Ceramic Products, Glass and Glassware; Section 14 Natural or Cultured Pearls, Precious or Semi-Precious Stones, Precious Metals, Metals Clad With Precious Metal, and Articles Thereof, Imitation Jewelry, Coin; Section 15 Base Metals and Articles of Base Metal; Section 16 Machinery and Mechanical Appliances, Electrical Equipment, Parts Thereof, Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers, and Parts and Accessories of Such Articles; Section 17 Vehicles, Aircraft, Vessels, and Associated Transport Equipment; Section 18 Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical, or Surgical Instruments and Apparatus, Clocks and Watches, Musical Instruments, Parts and Accessories Thereof; Section 19 Arms and Ammunition, Parts and Accessories Thereof; Section 20 Miscellaneous Manufactured Articles; Section 21 Works of Art, Collectors' Pieces, and Antiques.

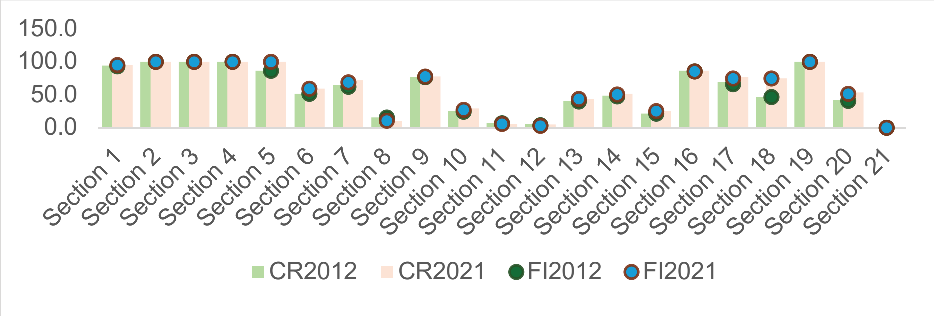

Figure 4 Coverage ratio of NTM by section in Thailand in 2012 and 2021

Note: Section 1-21 following from WCO HS Nomenclature.

See footnote 1 for definition of products in each section.

Source: Author's calculations based on the I-TIP data.

As mentioned earlier, the two key policies during this period are the Medical Device Act B.E. 2019 and the Excise Act B.E. 2017. The key difference between these two policies lies in the type of NTM implementation. The Excise Act of 2017 relied on pre-shipment inspections and other formalities (Inspect) to control imported products. In contrast, the Medical Device Act B.E. 2019 utilized technical barriers to trade (TBT) to regulate imported products. Another short-term policy that impacted the coverage ratio was the control on imported thermoplastics in 2015, which applied to all products in Chapter 39 for a year. However, this policy was repealed at the beginning of 2016. As a result, the sanitary and phytosanitary (SPS) coverage ratio for Chapter 39 in 2015 reached 100%. Apart from these three significant policies, no major changes in the NTM pattern were observed (Figure 5). Overall, Thailand has primarily relied on three types of NTMs to control imported products: SPS, TBT, and Inspect.

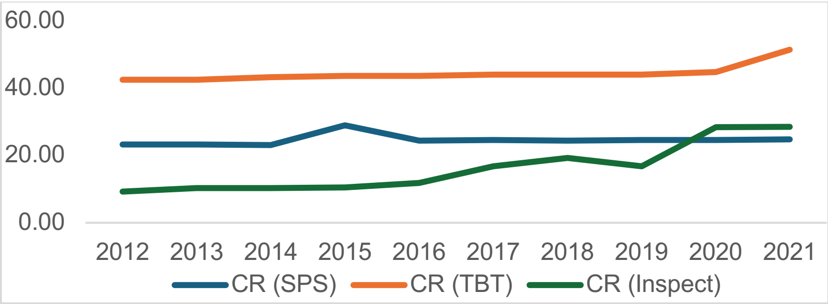

Figure 5 Coverage ratio of technical NTMs by type in Thailand in 2012 - 2021

Note: CR (SPS) is the coverage ratio of sanitary and phytosanitary; CR (TBT) is the coverage ratio of technical barrier to trade; CR (Inspec) is the coverage ratio of pre-shipment inspections and other formalities.

Source: Author's calculations based on the I-TIP data.

The ad-valorem equivalents (AVEs) of technical NTMs were calculated using equations (8) and (9). The results show that, on average, NTMs accounted for 4% of the tariff rate between 2012 and 2021 (Figure 6). The negative effects of NTMs are more pronounced in lower-income countries. The AVE of NTMs in developed countries is only about 0.5%, while it is 4% in developing countries and 8% in least-developed countries (LDCs). These results suggest that higher-income countries tend to manage non-tariff policies more effectively than lower-income countries. Furthermore, the results show that each type of NTM has had a distinct impact. SPS and TBT compliance costs have intensified over the years. The compliance cost for SPS increased from 4% between 2012-2014 to 9% between 2018-2021. Similarly, the compliance cost for TBT rose from 11% between 2012-2014 to 13% between 2018-2021. In contrast, the compliance cost for pre-shipment inspection and other formalities (Inspect) declined over the period under consideration.

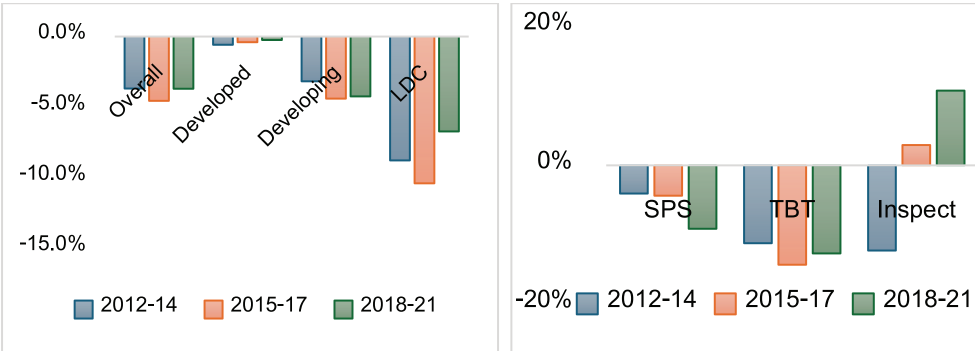

Figure 6 Ad-valorem equivalent of NTM in Thailand between 2012 - 2021

Source: Author's calculations based on the I-TIP data.

5. Empirical Results

As mentioned in Section 3, this study first examines the impact of tariffs and FTAs, followed by the inclusion of technical NTMs in the analysis. Four types of tariff rates are considered: *MFN, ITR, OTR* (equivalent to *NRP* as discussed above), and *ERP*. Two measures of FTAs are also included: tariff margins and FTA utilization. The results are presented in Table 5.[5] The findings show that the MFN rate may not effectively represent the impact of tariffs on import volume, especially compared to other measures of the tariff rate, such as ERP. A 1% increase in the MFN rate is associated with a 5.7% to 6.6% increase in import volume. In contrast, an increase in ERP tends

[5] It should be noted that the results have undergone a robustness check for potential endogeneity concerns by employing a lagged variable, which did not yield substantively different outcomes. Based on Baier & Bergstrand, 2007; Hayakawa, 2015, PPMLHDFE technique where high-dimension fixed effect is employed, could help redress concerns about endogeneity bias in the model, including free trade agreement variables. The results when lagged variables are employed is available upon request.

to decrease import volume by 0.7% to 0.9%, depending on the model specification. When input tariffs (ITR) and output tariffs (OTR) are considered separately, the coefficient for ITR is statistically insignificant, suggesting that a reduction in input tariffs, despite the negative coefficient, does not significantly reduce imports. On the other hand, output tariffs show a stronger and statistically significant effect, particularly when controlling the effect of free trade agreements (Table 5). The insignificance of ITR could be attributed to the aggregation of all imported products, which may mask the effects on intermediate products. As previous studies (e.g., Amiti & Konings, 2007) have shown, the significant effects of tariffs on intermediate products are more apparent when imports are disaggregated. This effect is confirmed in the results shown in Table 8. The free trade agreement variable demonstrates a clear positive impact on stimulating import volume in Thailand. We found that a 1% increase in FTA utilization rate positively influences import volume by 1.1%, while a 1% increase in tariff margins resulted in an approximate 2% increase in import volume.

Table 5 Results of separately effect of tariff and FTA

VARIABLES	(1)	(2)	(3)	(1)	(2)	(3)
Import						
T_{ijt}	1.057** (0.0271)			1.066** (0.0338)		
ERP_{ijt}		0.993 (0.00455)			0.991** (0.00440)	
OTR_{ijt}			0.947** (0.0245)			0.936** (0.0272)
ITR_{ijt}			0.957 (0.0733)			0.986 (0.0680)
$Utilization_{ijt}$	1.011*** (0.00101)	1.011*** (0.00104)	1.011*** (0.00103)			
$Margin_{ijt}$				1.007 (0.00656)	1.019** (0.00656)	1.020** (0.00824)
Constant	2.036e+07*** (3.349e+06)	3.193e+07*** (2.171e+06)	4.971e+07*** (1.611e+07)	1.973e+07*** (3.682e+06)	3.142e+07*** (2.268e+06)	4.682e+07*** (1.538e+07)
Observations	**368,491**	**368,228**	**368,228**	**881,712**	**881,372**	**881,372**

Note: Estimation results were obtained using the PPMLHDFE method. In all specifications, we control for country fixed effects, year fixed effects, product fixed effects, and the country-year pair fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered by exporter-year pairs, and product are shown in brackets. The results are reported in terms of the incident rate ratios (IRR), which is calculated by exponentiating the Poisson regression coefficient. The ratios, which are less than 1 and statistically significant, show that policy measures could negatively influence import structure. The standard error is also adjusted according to the IRR method.

Source: Author's estimations.

According to the explicit effect of utilization and tariff margin, we then use T* in which output tariff is adjusted by preferential tariff from each FTA. Results are reported in Table 6. The results show that tariff variable T*, ERP*, and OTR* had a significant negative relation with import volume and amplified the positive impacts of trade liberalization on import volume. Increasing 1% in tariff, in term of T*, decreases import volume by 5.1%, while increasing 1% in ERP* and OTR* lowers import volume by 3.6% and 11.2%, respectively. These results imply that FTA policy in Thailand could stimulate international trade between countries. On one hand, the result from T*, ERP*, and OTR* becomes statistically significant in explaining import volume so that ignoring other forms of trade liberalization in investigating the impacts of tariff measures could yield the biases of the results. On the other hand, input tariffs becoming statistically insignificant might be due to the relatively low level of input tariff in the country and as mentioned earlier. Additionally, as mentioned earlier, aggregating all imported products together could contribute to this insignificance.

Table 6 Results of combining the effect of tariff and FTA

VARIABLES	(1)	(2)	(4)
Import			
T^*_{ijt}	0.949*** (0.00734)		
ERP^*_{ijt}		0.964*** (0.00696)	
OTR^*_{ijt}			0.888*** (0.0200)
ITR^*_{ijt}			0.936 (0.0408)
Constant	2.699e+07*** (696,380)	3.175e+07*** (2.181e+06)	5.005e+07*** (9.289e+06)
Observations	**9,658,336**	**9,654,720**	**9,654,720**

Note: Estimation results were obtained using the PPMLHDFE method. In all specifications, we control for country fixed effects, year fixed effects, product fixed effects, and the country-year pair fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered by exporter-year pairs, and product are shown in brackets. The results are reported in terms of the incident rate ratios (IRR), which is calculated by exponentiating the Poisson regression coefficient. The ratios, which are less than 1 and statistically significant, show that policy measures could negatively influence import structure. The standard error is also adjusted according to the IRR method.

Source: Author's estimations.

Technical NTMs, including TBT, SPS, and Inspect, are included in the analysis along with tariffs adjusted by the impacts of FTAs. Alternatively, principal component analysis (PCA) is applied to incorporate all three types of technical NTMs. The results are presented in Table 7. The findings indicate that NTM policies, particularly TBT, enhance confidence in the quality of imported products, thereby stimulating import demand in Thailand. Imposing additional TBT can significantly increase import volume by 1.7%. In contrast, SPS and Inspect have an insignificant effect on import volume, despite their positive coefficients. The insignificance of SPS and pre-shipment inspections may stem from the fact that SPS measures are primarily imposed on agriculture and food imports, which are likely to be more protected than manufacturing products, while TBT measures are more commonly applied to manufacturing products. Previous studies, such as Jongwanich (2009) and Jouanjean et al. (2015), identified potential negative impacts of SPS on agriculture and food products. These results remain consistent when we replace the tariff measures with ERP*, OTR*, and ITR* in the analysis, and also when applying PCA. Overall, the positive impact of technical NTMs, especially TBT, aligns with findings in many previous studies (e.g., Akintola et al., 2021; Cadot et al., 2018).

Table 7 Results of combining the effect of tariff, FTA, and NTM by using PCA

VARIABLES	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Import						
T^{*}_{ijt}	0.949*** (0.00730)	0.949*** (0.00732)	0.949*** (0.00734)	0.949*** (0.00727)	0.949*** (0.00733)	0.949*** (0.00729)
SPS_{ijt}	1.014 (0.0106)			1.013 (0.0105)		
TBT_{ijt}		1.017** (0.00788)		1.018** (0.00833)		
$Inspection_{ijt}$			1.016 (0.0671)	0.959 (0.0693)		
$PCA\ (correlation)_{ijt}$					1.088* (0.0516)	
$PCA\ (covariance)_{ijt}$						1.018 (0.0112)
Constant	2.593e+07*** (1.064e+06)	2.519e+07*** (1.089e+06)	2.679e+07*** (989,404)	2.467e+07*** (1.405e+06)	2.667e+07*** (740,163)	2.532e+07*** (1.278e+06)
Observations	**9,658,336**	**9,658,336**	**9,658,336**	**9,658,336**	**9,658,336**	**9,658,336**

Note: PCA (covariance) is principal-component factors analysis using covariance; PCA (correlation) is principal-component factors analysis using correlation. Estimation results were obtained using the PPMLHDFE method. In all specifications, we control for country fixed effects, year fixed effects, product fixed effects, and the country-year pair fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels,

respectively. Standard errors clustered by exporter-year pairs, and product are shown in brackets. The results are reported in terms of the incident rate ratios (IRR), which is calculated by exponentiating the Poisson regression coefficient. The ratios, which are less than 1 and statistically significant, show that policy measures could negatively influence import structure. The standard error is also adjusted according to the IRR method.
Source: Author's estimations.

Tariffs and NTM policies show different effects on each type of product. We categorize imported products into three types: capital, intermediate, and finished products. The results show that intermediate products are the most sensitive to changes in tariff rates. A 1% increase in the tariff rate (in terms of T*) decreases the import volume of intermediate products by 6%. For finished products and capital products, a 1% increase in the tariff rate (in terms of *T**) decreases import volume by 4.7% and 4%, respectively (Table 8). These results imply that tariff policy in Thailand, including both standard tariffs and preferential tariffs from FTAs, can significantly influence imported products, particularly intermediate products. This suggests that tariff policies that promote greater liberalization can help integrate Thailand into global supply chains. Intermediate products are also the only category that shows a significant effect when technical NTMs are considered. While TBT plays a dominant role in this positive effect, controlling the quality of intermediate manufacturing products helps stimulate their import volume, which, in turn, could enhance overall production quality.

Table 8 Interpretation result by group of products.

VARIABLES	capital product		intermediate product.		finished product.	
	(1)	(2)	(1)	(2)	(1)	(2)
Import						
T^{*}_{ijt}	0.960*** (0.00752)		0.940*** (0.0159)		0.953*** (0.00711)	
ERP^{*}_{ijt}		0.963*** (0.0132)		0.955*** (0.0101)		0.969*** (0.00609)
$PCA\ (correlation)_{ijt}$	1.367 (0.401)	1.351 (0.380)	1.075 (0.0645)	1.111* (0.0648)	1.040 (0.0639)	1.069 (0.0662)
Constant	2.256e+07*** (975,905)	2.858e+07*** (4.661e+06)	3.661e+07*** (1.767e+06)	4.718e+07*** (4.554e+06)	1.790e+07*** (1.640e+06)	1.777e+07*** (1.837e+06)
Observations	**1,287,687**	**1,287,687**	**6,071,400**	**6,067,800**	**2,810,385**	**2,808,580**

Note: PCA (correlation) is principal-component factors analysis using correlation. Estimation results were obtained using the PPMLHDFE method. In all specifications, we control for country fixed effects, year fixed effects, product fixed effects, and the country-year pair fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered by exporter-year pairs, and product are shown in brackets. The results are reported in terms of the incident rate ratios (IRR), which is calculated by exponentiating the Poisson regression coefficient. The ratios, which are less than 1 and statistically significant, show that policy measures could negatively influence import structure. The standard error is also adjusted according to the IRR method.
Source: Author's estimations.

When imports from developed and developing countries are considered separately, the results reveal a positive and significant impact of NTM only for imports from developed countries (Table 9). This suggests that NTM policies in Thailand may establish higher product standards, leading to higher compliance costs for exporters from LDCs (Least Developed Countries) and developing countries compared to those from developed countries. Specifically, technical NTMs tend to increase imports from developed countries by 14.1%. In contrast, the implementation of NTM policies does not significantly affect imports from developing countries or LDCs. However, the relationship between NTM policies and imports from these two groups of countries differs. While the NTM coefficient shows a positive relationship with imports from developing countries, it has a negative relationship with imports from LDCs. This may indicate that the compliance costs are higher for LDCs than for developing countries. Tariff policies also show the most significant effect on imports from LDCs, followed by those from developing countries. A 1% increase in tariffs (adjusted by preferential tariffs, i.e., T*) reduces imports from LDCs by 9.3%, and from developing countries by 7.3%. In contrast, the effect on imports from developed countries is much smaller, decreasing by only 1.3%, and is statistically insignificant. These results suggest that imports from LDCs and developing countries are more price-sensitive, while the higher quality of imports from developed countries results in a relatively lower impact from tariffs imposed by Thailand. The results obtained using ERP* and ITR* measures are consistent with those from *T**.

Table 9 Interpretation result by country groups

VARIABLES	Overall	Developed countries	Developing Countries	Least Developed countries
Import				
T^{*}_{ijt}	0.949***	0.987	0.927***	0.907***
	(0.00733)	(0.0110)	(0.0119)	(0.0194)
$PCA\ (correlation)_{ijt}$	1.088*	1.141**	1.045	0.718
	(0.0516)	(0.0648)	(0.0652)	(0.270)
Constant	2.667e+07***	2.086e+07***	4.499e+07***	1.227e+08***
	(740,163)	(1.124e+06)	(1.670e+06)	(2.593e+07)
Observations	**9,658,336**	**2,608,092**	**4,884,064**	**1,311,052**

Note: PCA (correlation) is principal-component factors analysis using correlation. Estimation results were obtained using the PPMLHDFE method. In all specifications, we control for country fixed effects, year fixed effects, product fixed effects, and the country-year pair fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered by exporter-year pairs, and product are shown in brackets. The results are reported in terms of the incident rate ratios (IRR), which is calculated by exponentiating the Poisson regression coefficient. The ratios, which are less than 1 and statistically significant, show that policy measures could negatively influence import structure. The standard error is also adjusted according to the IRR method.

Source: Author's estimations.

6. Conclusions and Policy Inferences

This study examined the effects of tariffs, non-tariff measures, and free trade agreements on import volume in Thailand. The study showed that tariff protection in Thailand decreased significantly between 2012 and 2021, but the level of protection in certain sectors, especially for finished products, increased during this period. The effective rate of protection (ERP) was nearly twice as high as the nominal rate of protection (NRP) across all sectors. Although Thailand engaged in 14 free trade agreements during this period, effectively reducing tariff margins under these agreements, the average utilization rate remained below 25%. Interestingly, in countries that had both bilateral and multilateral agreements, the utilization rate for bilateral agreements was significantly higher than for multilateral agreements. China, Vietnam, and Indonesia were the top three countries benefiting from preferential tariff rates to reduce tariff protection in Thailand. Non-tariff measures (NTMs) in Thailand have increased substantially since 2012, covering around 60% of all products. Sanitary and phytosanitary (SPS) measures, along with technical barriers to trade (TBT), are the two primary policy tools in the country. The relatively even distribution of NTMs across both high- and low-value imported products is evident from the close movement of the coverage ratio and frequency index.

The results show that the nominal tariff rate does not accurately represent the actual tariff protection in the country, while the effective rate of protection (ERP) reveals a greater impact on import volume. Preferential tariff rates under free trade agreements also play an important role in amplifying the positive impacts of trade liberalization on import volume, although the utilization rate remains relatively low. The results further indicate that non-tariff measures (NTMs) enhance confidence in the quality of imported products, stimulating demand for imports in Thailand, especially with regard to technical barriers to trade (TBT). The insignificance of sanitary and phytosanitary (SPS) measures and pre-shipment inspection (Inspect) could be due to the fact that SPS measures are primarily applied to agricultural and food imports, which are typically more protected than manufacturing products, while TBT measures are more commonly required for manufacturing products. Additionally, tariffs and NTM policies show differing effects on various product categories. Intermediate products are the most sensitive to changes in tariff rates, followed by finished products and capital goods, respectively. In country-specific analysis, the positive and significant impact of NTMs is observed only in developed countries. This suggests that NTM policies, which raise product standards, are likely to impose higher compliance costs on exporters from LDCs and developing countries compared to those from developed countries. Regarding tariff measures, their negative and significant impact on imported products from LDCs and developing countries reflects the price sensitivity of these products, while the relatively higher quality of imports from developed countries leads to insignificant effects of tariffs imposed by Thailand.

Three policy inferences can be drawn from this study. First, while the effective rate of protection (ERP) is important in assessing the impacts of trade liberalization on imports, focusing solely on reducing input tariffs while leaving output tariffs unchanged may not yield favorable results. Lowering input tariffs can boost firms' productivity by providing access to previously unavailable or higher-quality inputs. However, it may also reduce firms' incentives to improve productivity due to the increased level of effective protection. Therefore, both input and output tariffs must be considered jointly to ensure that trade is liberalized effectively. In other words, the ERP should be given greater importance and incorporated more actively into policy discussions. To improve Thailand's tariff structure, various government agencies, including the Customs Department, the Department of Foreign Trade, the Office of Industrial Economics, and the Fiscal Policy Office, should be involved and work in coordination to design and analyze the potential benefits and costs of such systematic adjustments.

Second, as Free Trade Agreement (FTA) negotiations are expected to further drive trade liberalization, tariff cuts under the FTA should be implemented comprehensively, with minimal exceptions. Additionally, encouraging greater utilization of FTAs should be prioritized. Government agencies such as the Department of Foreign Trade (DFT) should provide information concerning preferential tariffs and, if possible, the tariff margins across in-effect FTAs to domestic firms. This information would assist them to efficiently compare costs and benefits from utilizing FTAs, especially costs concerning RoOs.

Finally, regarding non-tariff measures (NTMs), while they help improve product quality and safety, enhancing transparency, promoting harmonization, and preventing arbitrary safety standards are crucial for better market performance. These measures can help reduce transaction costs and trade friction. Improving these aspects is expected to lead to higher-quality imported products, as more efficient producers will be able to expand their exports to Thailand. Therefore, the government should encourage domestic firms to strengthen their supply-side capacity, including technological upgrading, to compete with foreign products that can comply with the NTMs imposed by Thailand.

7. Limitations and Future research

It is noteworthy that this study did not explore the effects of trade policies on firm productivity. In addition, this study considers only technical NTMs, as no explicit changes in non-technical measures were identified in Thailand between 2012 and 2021. However, after the Trump 2.0 policy, non-technical measures in NTMs will become more crucial for both trade negotiation and trade flows. Therefore, the findings from this study are intended to serve as a reference point and foundation for future research.

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