“Trade creation and export diversion: Thailand’s plastic and rubber under the ASEAN-China free trade agreement”

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TRADE CREATION AND EXPORT DIVERSION: THAILAND'S PLASTIC AND RUBBER UNDER THE ASEAN-CHINA FREE TRADE AGREEMENT

Abstract

This study aims to investigate the impact of the ASEAN-China free trade agreement on plastic and rubber trading, focusing on trade creation and export diversion. The collected data include 11 intra-bloc countries and 23 extra-bloc countries from 1990 to 2021, analyzed using STATA17. The gravity model is applied to the international trade framework. First, the unit root test is used to confirm the stationary nature of the data. Then, the methods are compared, employing fixed effects and a robust Poisson maximum likelihood estimator. The bilateral dummy variables are used to estimate the directional impact of trade agreements on export volume. The result demonstrates that the ASEAN-China free trade agreement establishes trade creation and export diversion. It has had a positive impact on the export value of plastic and rubber in Thailand over the past 30 years, but in terms of trade creation is less than export diversion. This means that exporting plastic and rubber to extra-bloc countries will gain more benefits than trading with member countries under the ASEAN-China free trade agreement. However, trading under the ASEAN-China free trade agreement may continue, but export volumes of plastic and rubber will decline. According to the findings, it can be suggested that Thailand's government has to have a comparative advantage in product and strong competitiveness. Meanwhile, the ASEAN-China free trade agreement should not only focus on trade tariffs but also improve customs clearance to reduce trade costs.

Keywords ASEAN-China, gravity model, economic indicators, plastic and rubber, international trade, bilateral dummy variables, export volume, trade tariffs

JEL Classification C19, C39, F15, F19

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INTRODUCTION

A free trade agreement (FTA) is one of the tools for reducing tariffs in international trade. Free trade agreement (FTA) has been used to be economic disclosure in globalization. It has become an important factor in boosting economic growth in many countries. The ASEAN-China free trade agreement (ACFTA) was used for trading among ASEAN and China member countries and was implemented in 2010. The aim of the agreement was to not only to reduce tariff and trade barriers but also encourage goods, services, and investment and boost economic growth between ASEAN countries and China. This paper delves into the impact of ACFTA on Thailand's plastic and rubber trade, dissecting the twin concepts of trade creation and export diversion.

According to Thailand, it is one of the world's leading manufacturers and exporters of plastic and rubber. Plastic is used in many countries around the world, and plastic pellet production has increased by 400 million tons, or 2.5%, from 2022 to 2023. The export value of plastic

pellets increased to 39 billion US dollars, or 6.74% of Thailand's GDP. Thai plastic and rubber are often used in many industries, such as packaging, electricity, construction, vehicle wheels, latex gloves, and hose and transportation. After COVID-19, plastic and rubber are also the most important materials for the medical industry. This means that plastic and rubber are two of the main export products and are very important for Thailand's economy. Moreover, ASEAN and China are all important importers and the biggest markets for Thailand. The ASEAN-China free trade agreement (ACFTA) is also successful in many countries, but some say that the ASEAN-China free trade agreement (ACFTA) damages the domestic economy and competitiveness. Moreover, exporters in many countries were faced with dumping prices on imported products.

1. LITERATURE REVIEW

The ASEAN-China Free Trade Agreement was one of the free trade agreement tools established in November 2001 and consisted of Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Cambodia, Lao PDR, Myanmar, Vietnam, and China. The aim of the agreement was to reduce tariff and trade barriers, encourage goods, services, and investment, and boost economic growth between ASEAN countries and China. The ACFTA agreement was separated into three main sections, including goods, services, and investment, which were signed in 2005, 2007, and 2010, respectively. Hence, only goods will be analyzed and examined in this study. Several researchers support the ACFTA, which has a positive impact on trade and the economy. The ACFTA led China's labor-intensive industries to become capital- and technology-intensive (Wong & Chan, 2002). Due to trading under the ACFTA, GDP had a dramatic increase in both ASEAN and China (Chirathivat, 2002). The welfare of trade and trade creation were increased among member countries (Park et al., 2008). The ACFTA trade agreement also brought many competitors from intra- and extra-bloc trading and increased trade flow (Sheng et al., 2012). However, the unstable political situation and the South China Sea dispute led China to be banned from many countries through the relationship between ASEAN and China. The ASEAN-China free trade agreement, therefore, is also used to establish a strong relationship between China and ASEAN. Furthermore, ACFTA has demonstrably led to trade creation for Thailand's plastic and rubber exports to China. The agreement eliminated or reduced tariffs, making Thai products more competitive in the Chinese market. Studies such as Jongwanich (2023) attest to a noteworthy surge in Thai exports to China subsequent to the ACFTA, specifically in manufactured goods and chemical products, including plastics and rubber. This growth can be linked to a rise in demand from Chinese companies and customers drawn by more affordable pricing and a greater selection of products (Park & Shin, 2012).

Due to export diversion, because of tariff benefits, commerce may be diverted from non-member nations to ASEAN members under the ACFTA. Some studies indicate that this impact may occur for certain items, while its full extent is still up for discussion. For instance, Arefin and Yamazaki (2015) reveal evidence of restricted trade diversion in a few specific industries. Potentially detrimental effects of export diversion for Thailand might materialize if non-member nations with robust plastic and rubber industries – like Vietnam or Malaysia – lose market share in China due to Thailand's gains from the ACFTA. On the other hand, Thailand's total trade growth may offset these losses, producing a favorable overall impact.

However, the negative impact of the ASEAN-China free trade agreement (ACFTA) on trading was found by a variety of studies. Trading under the ASEAN-China free trade agreement (ACFTA) had a huge negative impact on Indonesia's maize economy, which lost competitiveness (Ferianta et al., 2012). Ismanto and Krishnamurti (2014) found that the ACFTA has a negative effect on competitiveness and increases economic costs. Many countries are faced with dumping the international trade market. The imported price of the product was lower than the domestic market. Moreover, many ASEAN countries have been impacted in the investment section by China. Many foreign investors come to invest in China rather than ASEAN (Khalid & Zamil, 2005). The ACFTA

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also had a positive impact on only some products, such as agricultural goods, manufactured products, chemicals, and transport equipment (Yang & Martínez-Zarzoso, 2014). Damanto et al. (2021) found that exports under the ACFTA create trade in coffee, rubber, and palm oil but not for cocoa, which has trade diversion from extra-bloc trading, using data from 15 countries. Wahyudi and Fithra (2017) found trade creation and trade diversion in Indonesia's food and beverages under the ACFTA. It was also found that this trade agreement increases only export trade creation and import trade diversion in Thailand (Sawasdee, 2018). Soulivong (2020) also argues that the ASEAN-China trade agreement is not supported in any products, trade creation, or trade diversion for Thailand and other member countries.

In terms of export products, plastics, natural rubber, and synthetic rubber are export products that increase economic growth in Thailand. This study is the first to analyze the impact of the ACFTA on the export of plastic and rubber. Plastic and rubber are important materials in many manufactured industries, such as the automotive industry, medical device industry, construction industry, etc., which have several particular qualities. It helps many countries earn a variety of incomes, especially in ASEAN. However, COVID-19[1] has a huge effect on the export market. It is obviously seen that the export proportion has a gradual decrease over the past two years. But plastic and rubber are always the top 10 exports in Thailand.

From the World Integrated Solution (WITS) database in 2021, machinery and electricity have the highest product share in both import and export by 32%, followed by plastic and rubber, which reach 13%. Plastic and rubber are the second products that Thailand exports and imports from the whole world. Many countries use plastic and rubber as other manufactured materials and use them in many daily household items, such as medical equipment, etc. Therefore, plastic and rubber have become famous industries for enterprises and traders. Plastic and rubber have 13% of the total trade product share, which will increase and gain more benefits in the future. It can be predicted that Thailand's plastic and rubber have a comparative advantage over the products they export and distribute to several countries.

There are 204 partners that import plastic and rubber from Thailand in 2021. The top 10 partners are from ASEAN and China, including China, Malaysia, Vietnam, Indonesia, and the Philippines, respectively. The plastic and rubber trading codes are HS Codes 39–40. In addition, the benefit of the ACFTA for plastic and rubber trading under the ACFTA is defined as the goods of the normal track, which has reduced tax to 0% since 2010. Thailand exports products to China for around 23.50% of the total partner share, which earned 8.3 million US dollars in 2019. The Department of trade negotiations in Thailand revealed that the total proportion of using the ACFTA benefit per export value from Thailand to China is 19 million US dollars, or around 64% in 2020, which increases from 59% and 62% in 2018 and 2019, respectively. The majority of export plastic and rubber volumes are from ASEAN. Besides, Thailand gains export plastic and rubber volume from other partners of around 8.9 million (US$ thousand) at 25.32% of the total partner share. The ACFTA, therefore, is one of the trading tools that supports export and import to gain more benefits and reduce tariffs between ASEAN and China. The World Integrated Solution (WITS) statistical export plastic and rubber share from 1990 to 2021 also shows that, because of increasing demand, Thailand's exports of plastic and rubber to all partners have gradually increased over the past 30 years. After signing the ACFTA trade agreement in 2005, it was observed that exports of plastic and rubber have dramatically increased, accounting for roughly 16% of the total product share. This means that Thailand's plastic and rubber are not only interesting for ASEAN, but the whole world also imports plastic and rubber from Thailand. Thailand is not only signed into the ACFTA trade agreement but also signed with others such as AJCEP, ASEAN+1, AKFTA, etc. Thailand already had more than 23 trade agreements (FTAs) and more than 13 WTO agreements (Sawasdee, 2018).

Various studies use the gravity model to investigate the effects of economic integration and apply it to the international trade framework. The pre-

1 The coronavirus disease 2019 (COVID-19) is one of the virus SARS-CoV-2 disease and identify the first case in Wuhan, China in December 2019. It has a huge negative impact on export to EU and around the world except depend on robot's production (Bas et al., 2023).

vious study found that distance is one of the international trade factors that increases trade costs (Carrère et al., 2020). Laaser and Schrader (2002) used the gravity model to improve high-cost international trade and increase trading partners to earn more trade income between origin and destination countries. Freund (1998) stated that the gravity model is appropriate to analyze international trade. The gravity model shows the framework of trading (Djankov & Freund, 2002). Some said that the gravity model was not only used for estimated international trade but also for political factors such as domestic financial and political factors, border common issues, and historical analysis. Soloaga and Winters (2001) found that the new regionalism does not support trading among the EU and EFTA member countries. And they found only trade diversion by using the gravity model. Moreover, the gravity model is also used to estimate the relationship between economic indicators and exports. There are many different variables to use in economic indicators. For example, GDP, population, language, distance, exchange rate, and the bilateral trade dummy variables are used to analyze trade creation and diversion under the ACFTA trade agreement (Wanasin & Nantarat, 2017). This supports the results of Bassem and Samir (2015), who found that free trade agreements (FTA) greatly affect trade flow by using GDP, population, exchange rate, distance, and FTA dummy variables. Hiroyuki (2015) also used GDP, exchange rate, and the bilateral dummy variables to compare the FTA trade agreement and found only trade creation in trading under the ACFTA trade agreement. According to the previous studies, it seems that there are different variables used to investigate international trade under a free trade agreement. In this study, therefore, economic indicators will follow Yang and Martínez-Zarzoso (2014) and consist of gross domestic product (GDP), the number of populations, distance, and the proxy's variables (landlock and contiguity). FTA1 and FTA2 are used to be the bilateral trade dummy variables.

To illustrate that a free trade agreement is successful, it must prove that its efforts not only increase trade creation or diversion of products but that trading can support the domestic economy. The primary purpose of this review is to ascertain if there is compelling evidence that the impact of the ACFTA on export plastic and rubber value, focusing on trade creation (FTA1) and export diversion (FTA2), has had this result.

H1: *FTA1(ϕ_1) > 0, and FTA2 (ϕ_2) ≠ 1; then Trade creation is occurred.*

H2: *FTA2(ϕ_2) > 0, and FTA1 (ϕ_1) ≠ 1; then Export diversion is occurred.*

2. METHOD

To determine the correlation and impact of the ASEAN-China free trade agreement on exports of plastic and rubber in Thailand, the data have been collected from the World Bank (WDI), the WIST database, and the CEPII database. The gathered data consist of 34 countries (11 ACFTA-member countries and 23 non-ACFTA member countries) from 1990 to 2021. The gravity model is applied to analyze the international trade framework. The study will use STATA17 to analyze the panel data by using the fixed effect and a robust PPML.

First of all, to show the status of multicollinearity, variance inflation factors (VIF) will be used in the investigation, which will not be more than 5 (Hair, 1995). If the result of VIF is not more than 5, then the data will show the stationarity by using the cross-sectional IPS (CIPS), the cross-sectional Fisher-augment Dickey-Fuller unit root test (CADF), and the Fisher-Phillips-Perron unit root test (PP). After that, fixed effect regression and a robust PPML will be used to analyze in the next step. All the estimation frameworks will follow the research question and the hypotheses.

The dependent variable is Thailand's export volume of plastic and rubber. The economic indicators or independent variables include Thai gross domestic product (gdpth), a partner's gross domestic product (gdppa), the number of the Thai population (popth), the number of a partner's population (poppa), distance (dist), and the proxy variables (landlock and contiguity). FTA1 and FTA2 are used as the bilateral trade dummy variables. All data definitions and explanations of abbreviations are shown in Table 1.

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Table 1. Economic indicators and the bilateral dummy variable definition

Source: Own elaboration based on the World Bank (WDI), the WIST database, and the CEPII database.

Variables	Definitions	Unit
Plastic	The export volume of plastic and rubber between Thailand and partner countries	US$ Thousand
gdpth	Gross domestic product of Thailand	US$ Thousand
gdppa	Gross domestic product of partner countries	US$ Thousand
popth	The number of Thailand's population	The number
poppa	The number of partner countries' population	The number
dist	Distance between the Thai capital and partner countries' capital	Mile
landlock	Partner landlock countries	1 if landlock 0 is otherwise
contiguity	The contiguity zone between Thailand and partner countries	1 if contiguity 0 is otherwise
FTA1	Dummy variable	1 if ACFTA member 0 is otherwise
FTA2	Dummy variable	1 if a non-ACFTA member, 0 otherwise

The gravity model is used in this study to analyze the frameworks. The gravity model was utilized by Walter Isard in 1954 to explain bilateral trade between origin and destination countries as follows:

$$T_{ij} = C\frac{M_i M_j}{D_{ij}}, \tag{1}$$

where T_{ij} defines the total export value from country *i* to *j*. *C* is a constant, meanwhile, $M_i M_j$ means gross domestic product (GDP) of country *i* and country *j*. And D_{ij} is the distance from country *i* to country *j*.

A variety of studies also used multilateral resistance terms (MRTs) to measure trading factor variables. Some studies said that the main variables must be concerned with institution, culture, science, and geography as such lock land and common borders (Anderson, 2003).

To analyze trade creation and diversion, moreover, a dummy variable is used to identify trade agreement. FTA_{ij} was a dummy variable of trade agreement refereed intra-bloc and extra-bloc trading (Martínez-Zarzoso et al., 2009). Hence, this study will refer to *FTA*1 as the members of ACFTA and *FTA*2 as the non-ACFTA members.

Panel data will be used in this investigation. The fixed effect and a robust PPML will be used to control unbiased estimation and unobserved heterogeneity. The augment gravity formulation is as follows:

$$\begin{aligned} LNplastic_{ijt} &= \beta_0 + \beta_1 LNgdpth_{it} \\ &+ \beta_2 LNgdppa_{jt} + \beta_3 LNpopth_{it} \\ &+ \beta_4 LNpoppa_{jt} + \beta_5 LNdist_{ij} \\ &+ \phi_1 FTA1 + \phi_2 FTA2 + \pi_{ij} + u_{ijt}, \end{aligned} \tag{2}$$

where $LNplastic_{ijt}$ denotes the natural logarithm of export plastic and rubber value from Thailand (*i*) to trading partners (*j*) in *t* period. $LNgdpth_{it}$ and $LNgdppa_{jt}$ indicate the natural logarithm of gross domestic product (GDP) in Thailand (*i*) and trading partners (*j*) in *t* period. GDP is used to explain the demand or consumption of those countries, which will have a positive direction with trading.

Moreover, $LNpopth_{it}$ and $LNpoppa_{jt}$ are the natural logarithm of the number of demographics in Thailand (*i*) and trading partners (*j*) in *t* period. The number of populations can determine the economic scale. If the result shows a positive direction, this means over-demand will have strong purchasing power and consume the imported products rather than the domestic market. While overdemand can cause consumers to choose to consume their products rather than import products from other countries, as shown in the negative direction (Brada & Mendez, 1985). $LNdist_{ij}$ is the natural logarithm of the distance between Thailand (*i*) and destination countries (*j*). It is used to explain transportation costs, which will have a negative impact on trading. $FTA1$ and $FTA2$ are binary variables. If $FTA1$ takes 1, intra-bloc trading under the ACFTA trade agreement is better

than extra-bloc trading, and then trade creation is established. Otherwise, it is 0. However, if $FTA2$ takes 1, export diversion is established, and trading with non-ACFTA member countries is better than ACFTA member countries. Otherwise, it is 0. In addition, if FTA1>FTA2 indicates that there is pure trade creation, the trading benefit will only increase among intra-bloc countries (Yang & Martínez-Zarzoso, 2013). While FTA1<FTA2 means export diversion. Trading with non-member countries will yield more benefit than trading with member countries (Soloaga & Winters, 2001). π_{ij} demonstrates the proxy's variables (landlock and contiguity) between Thailand (*i*) and destination countries (*j*). u_{ijt} means the error term of Thailand (*i*) and trading partners (*j*) in *t* period.

In terms of methodologies, many studies used fixed-effect regression to avoid unobserved heterogeneity and investigate the model. However, the data still faces bias, and the proxies (landlock and contiguity) are always omitted variables. Some used the fixed effect to discover a large sample size. According to time-varying and country-pair, some also used fixed effects for estimation (Baier & Bergstrand, 2007). Hrvoje and Maja (2021) used fixed effect, robust PPML, and robust Tobit to investigate export, import, and trade flow under the CEFTA and EU trade agreements from 2000 to 2016. They found that CEFTA increases trade creation in export, import, and trade flow, whereas the EU establishes only trade diversion on import and trade flow. Jaime and David (2020) confirm that RTA supports trade creation on export. Moreover, GDP and population positively correlate with export volume by using fixed effects, robust PPML, and GMM estimators. However, Soulivong Soumatsa (2020) found that it does not have a trade benefit between intra-bloc and extra-bloc countries under the ACFTA trade agreement from 2001 to 2018 using OLS, fixed effected and CGE estimators.

A robust poisson maximum likelihood estimator (PPML) is used to solve the heteroskedasticity problem in the gravity model with the dummy variables (Santos et al., 2006). The bias had been increasing in the heteroskedasticity, which had a huge effect on slope parameters. However, if the sample size is too large, then the slope parameter would be small (Michael, 2018). This study has been affected by time-invariant and year-fixed. Hence, a robust PPML estimator is suitable for solving this problem (Larch, 2019). Although PPML would increase bias and heteroskedasticity problems, many studies have supported using this tool to estimate the gravity model in economic integration (Michael, 2018). Mika and Zymek (2018) used the PPML estimator to investigate the balance of bilateral trade among 153 countries between 1990 and 2013. Rossanto et al. (2021) found that there is trade creation in primary products and manufactured products among the ASEAN+6 members using the PPML estimator. Although trade creation, import diversion, and export diversion were created by four products trading under the ACFTA trade agreement, they decreased trade net flow. This result was estimated by PPML and the FTA dummy variable among 36 countries over 10 years. Yang and Martínez-Zarzoso (2014) also found trade creation in China trading under the ACFTA trade agreement among 31 countries by using panel data and PPML. Moreover, the ACFTA trade agreement had a huge positive impact on agricultural goods, manufactured products, chemicals, and transport equipment.

3. RESULTS

This study focuses on the impact of the ASEN-China free trade agreement (ACFTA) on Thai's export plastic or rubber over 30 years by using a fixed effect and a robust PPML. STATA17 is an important tool to discover the data. Table 2 shows the strongly balanced and distributed data by descriptive statistics. Moreover, Variance inflation factors (VIF) also confirm the status of multicollinearity. The result of the unit root will examine the stationarity of the data, as shown in Table 3. Table 4 will explain the results of the fixed effect and a robust PPML.

The descriptive statistics in Table 2 demonstrate the data of 34 countries, which consists of 11 ACFTA member countries and 23 non-ACFTA member countries from 1990 to 2021. The dependent variable is the logarithm of export plastic and rubber volume (*LNplastic*) in Thailand. There are 8 independent variables in the model combined with Thailand's GDP, a partner's GDP, Thai population, a partner's population, distance, landlock, and contiguity. FTA1 and FTA2 are dummy vari-

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Table 2. Descriptive statistics

Source: The STATA17 output.

Variables	Obs.	Mean	SD	Min	Max
LNplastic	1079	11.449	1.895	2.141	16.08
LNgdpth	1088	26.150	0.573	25.170	27.023
LNgdppa	1085	26.597	1.836	20.579	30.780
LNpopth	1088	17.984	0.067	17.851	18.087
LNpoppa	1088	17.253	1.698	12.463	21.069
LNdist	1088	8.417	0.991	6.264	9.721
landlock	1088	.088	0.284	0	1
contiguity	1088	.118	0.322	0	1
FTA1	1088	.184	0.388	0	1
FTA2	1088	.441	0.497	0	1

Note: *LNplastic*: the logarithm of the export of plastic and rubber volume, *LNgdpth*: the logarithm of Thailand's gross domestic product, *LNgdppa*: the logarithm of a partner's gross domestic product, *LNpopth*: the logarithm of the number of the Thai population, *LNpoppa*: the logarithm of the number of a partner's populations, *LNdist*: the logarithm of the distance between the Thai capital and partner countries' capital, *Landlock*: partner land lock countries, *contiguity*: the contiguity zone between Thailand and partner countries, *FTA1*: the bilateral trade dummy variables of ACFTA member countries, *FTA2*: the bilateral trade dummy variables of non-ACFTA member countries.

ables that define trade creation and export diversion. Moreover, the natural logarithm form will be used to avoid heteroscedasticity, keep panel-balanced data, and compare the previous researcher's studies by the variable in this estimation. This study also uses STATA17 to analyze the data and show the status of multicollinearity by VIF. The variance inflation factor (VIF) is 3.67, which is less than 5. This means that it has no multicollinearity in those variables and can be used to estimate in the next step (Hair, 1995).

Table 2 shows that the missing observation is the cause of the data limitation. The value of total exports of plastic and rubber is approximately 11.44%. The averages of Thailand's GDP and its partner's GDP are 26% and 26.6%, respectively. The statistics also indicate roughly 17% of Thai and partners' populations affect the export volume. The distance value is nearly the minimum of the statistics, about 8.4%, which has a negative impact on export volume. Furthermore, the averages of landlock and contiguity are 0.08% and 0.12%, respectively, which is nearly the minimum value. It can be predicted that landlock and contiguity are two of the proxy's factors that can have a negative impact on export volume. FTA1 and FTA2 are also approximately 0.19% and 0.44%, respectively.

Table 3 shows the result of stationarity at levels I(0) and the first difference I(1) in the data by using the different unit root tests of cross-sectional IPS (CIPS), cross-sectional Fisher-augment Dickey-Fuller unit root test (CADF), and Fisher-Phillips-Perron unit root test (PP). This indicates that the data is stable and can be used to analyze a fixed effect and a robust PPML in the next step, which is shown in Table 4.

Table 3. The result of the panel unit root test

Source: The STATA17 output.

Variable	CIPS		CADF		PP–test	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
LNplastic	–4.9831***	–19.2452***	226.6280***	–19.2452***	176.2314***	922.6834***
LNgdpth	–1.4051	–8.3856***	63.8755	202.1207***	24.3234	244.5290***
LNgdppa	–0.2678	–11.4818***	61.3954	307.4504	47.4217	436.6119***
LNpopth	2.8230	12.4598***	22.0617	0.7986	25.0879	727.8651***
LNpoppa	1.3039	2.9085	138.6525***	92.2182***	136.7158***	297.5480***
LNdist	3.3332	–21.0087***	140.7954***	705.8552***	226.8720***	1385.1082***

Note: 1) *** Significant at 1%; ** significant at 5%; and * significant at 10%. 2) *LNplastic*: the logarithm of the export of plastic and rubber volume, *LNgdpth*: the logarithm of Thailand's gross domestic product, *LNgdppa*: the logarithm of a partner's gross domestic product, *LNpopth*: the logarithm of the number of the Thai population, *LNpoppa*: the logarithm of the number of a partner's population, *LNdist*: the logarithm of the distance between Thailand's capital and partner countries' capital.

Table 4. The result of a fixed effect and a robust PPML

Source: The STATA17 output.

Variables	(1)	(2)
	FIXED	PPML
LNgdpth	0.149**	0.003
	(0.075)	(0.009)
LNgdppa	0.754***	0.067***
	(0.055)	(0.004)
LNpopth	3.430***	0.395***
	(0.818)	(0.111)
LNpoppa	1.119***	0.026***
	(0.240)	(0.004)
LNdist	–19.208***	–0.084***
	(6.106)	(0.007)
FTA1	0.407***	0.011
	(0.102)	(0.011)
FTA2	0.168**	0.031***
	(0.077)	(0.010)
landlock		–0.083***
		(0.011)
contiguity		–0.078***
		(0.010)
Constant	65.803	–6.497***
	(50.606)	(1.825)
Observations	1,040	1,040
R-squared	0.778	0.788
Number of country code	34	
Country *FE*	Yes	
Year *FE*	Yes	

Note: 1) Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1. 2) *LNplastic*: the logarithm of the export of plastic and rubber volume, *LNgdpth*: the logarithm of Thailand's gross domestic product, *LNgdppa*: the logarithm of a partner's gross domestic product, *LNpopth*: the logarithm of the number of the Thai population, *LNpoppa*: the logarithm of the number of a partner's population, *LNdist*: the logarithm of the distance between Thailand's capital and partner countries' capital, *Landlock*: a partner's landlock countries, *contiguity*: the contiguity zone between Thailand and partner countries, *FTA1*: the bilateral trade dummy variables of ACFTA member countries, *FTA2*: the bilateral trade dummy variables of non-ACFTA member countries.

Table 4 shows the impact of the ACFTA trade agreement on export of plastic and rubber value in Thailand from 1990 to 2021. This estimation shows the difference between the fixed effect (1) and a robust PPML (2). The fixed effect is used to control the unobserved heterogeneity problem; hence, landlock and contiguity are the omitted variables and are not considered in regression. The value of R-squared is 78%; observation is 1,040. All of the variables positively affect the value of exported plastic and rubber in Thailand, except distance. If Thailand's GDP increases, the export value will increase by more than 15%. Partner's GDP positively impacts export value of over 75%. The number of populations in Thailand and partner countries shows it positively affects export value, which is more than 100%. Because of the increasing cost, the distance has a negative effect on trading by over 190%. Long transport distances will bring the transportation cost higher. Moreover, the fixed effect results show either intra-bloc or extra-bloc trading is important for exporting plastic and rubber in Thailand, which means this activity creates trade creation and export diversion. FTA1 and FTA2 have a positive direction, with significant export volume at the 5% level. FTA1 and FTA2 have a 40% and 17% effect on exports, respectively. It is established for all trade creation and diversion.

However, a robust PPML is used to solve bias and heterogeneity problems. Therefore, the result will be different from others. The proxy variables (landlock and contiguity) are not omitted variables. The value of R-squared is 79%; observation is 1,040. The result of a robust PPML shows that Thailand's GDP has no significant effect on export value. But if partner GDP gradually increases by 1%, the export value of plastic and rubber will increase by 17%. Meanwhile, other variables have a positive effect and are significant on the export values, except distance, landlock, and contiguity. It is obviously seen that landlock and contiguity are two of the distance variables; hence, those variables also have a negative effect on export values. If the distance increases by 1%, it will decrease trade benefits and increase transportation costs by around 8% in intra- and extra-bloc trading. All intra- and extra-bloc trading positively affects the export value of plastic and rubber in Thailand. But FTA2 shows that export diversion is more important than trade creation and gains more trade benefits.

Table 4 shows the positive relationship between economic indicators and exported plastic and rubber volume over 30 years at significant 1%, 5%, and 10% levels. It also illustrates that economic indicators increase exports of plastic and rubber in Thailand, except for distance and the proxy variables (landlock and contiguity). The distance, landlock, and contiguity have a negative impact on exports, which increases trade costs and reduces trade benefits. The result of the fixed effect is not concluded by landlock and contiguity. Therefore, this shows that trading under the ACFTA among member countries is more beneficial than trading outside. In fact, all fac-

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tors are important for trade. The negative direction of landlock and contiguity indicates that transport costs greatly affect trade benefits. This also shows that trading with extra-bloc countries has a positive direction and is significant with an export volume of plastic and rubber at the 1% level, as shown in the result of a robust PPML. The dummy results of FTA1 and FTA2 demonstrate that the ASEAN-China free trade agreement (ACFTA) establishes all of the trade creation and export diversion for Thailand's exports of plastic and rubber, which FTA1<FTA2.

In conclude, economic indicators have a positive and negative correlation with the export of plastic and rubber. However, the ACFTA trade agreement varies to show the direction, value, and benefits of trading, and trading with non-member countries will gain more trade benefits. Therefore, based on the result, Hypothesis 2 (H2) is accepted.

4. DISCUSSION

The study shows that economic indicators have a huge effect on export values, which supports previous research (Yang & Martínez-Zarzoso, 2014). The findings also confirm the impact of the ASEAN-China (ACFTA) free trade agreement on the export of plastic and rubber in Thailand, which creates trade creation and export diversion.

According to Table 4, the main result is separated into two distinct techniques. In column (1), equation (2) is estimated by a fixed effect, which considers time-varying and country-pairs (Baier & Bergstrand, 2007). Column (2) indicates the result of a robust PPML technique, including the proxies of trade costs (landlock and contiguity). The data comprises 11 ACFTA-member countries and 23 non-ACFTA-member countries from 1990 to 2021. Gross domestic product (GDP) is an important economic factor showing a country's trading ability, revenue, and economy. Moreover, it indicates productivity and consumer power, according to the findings of Vivek and Athanasios (2004). Thailand's GDP positively affects Thailand's exports of plastic and rubber. As a result, it demonstrates increased export ability and productivity. Partners' GDP or revenue significantly and positively affects the value of exporting plastic or rubber in Thailand. If the revenue from partner trading increases, they will have strong purchasing power to buy more Thai plastic and rubber.

The number of demographics can indicate economic scale, consumption, and country size. An increasing population brings economic growth to many countries. Furthermore, the population also identifies human capital, labor capacity, and market size. Hence, the result of the positive direction can be explained by the fact that Thailand's population has enough human capital, export abilities, and high productivity. If Thailand's population increases, it will lead to an increase in export volume of more than 40%, while the positive direction of the partner's population can be explained by overconsumption of Thai products rather than their domestic market. Therefore, they have strongly purchased power to consume imported products, according to Tejvan (2021).

Controlling costs is one of the challenges for many exporters. The cost is also concerned with the distance between the origin's countries and the destination's countries. To gain more benefits from trading, several exporters can afford to decrease transportation costs. Some said that improving infrastructure brings more facilities and supports trading. However, some said that landlocks or contiguity make it easier for exporters to transfer goods to importers and reduce transportation costs. However, no study can confirm the real process of solving the transportation cost problem. According to Table 4, distance, landlock, and contiguity have a negative effect on the export value and any commerce (Jason, 2015), which means that trading under an ACFTA trade agreement cannot help exporters decrease the distance cost. And it also declines trade benefits.

The ACFTA dummy variables are also used in many international trade studies, which can indicate trade creation and diversion (Yang & Martínez-Zarzoso, 2013). This study, therefore, uses dummy variables combined with FTA1 and FTA2 to investigate trade creation and export diversion under the ACFTA trade agreement. The result shows that trade agreements lead to trade creation and export diversion regarding FTA1<FTA2. This means that Thailand has to focus on trading with member and non-member countries. However, if Thailand

exports plastic and rubber to non-member countries, then it will yield more benefits than trading with member countries (Soloaga & Winters, 2001). According to Table 4, the result of fixed effect shows the ACFTA has a huge effect on the export of plastic and rubber value of roughly 40% but shows no significant result in a robust PPML. Meanwhile, trading with non-member countries (FTA2) always positively and significantly impacts export value in the fixed effect and a robust PPML. In this case, it seems that exports of plastic and rubber under the ACFTA can be continued, but the benefit and export volume will not be better than trading outside. In addition, sustainability trends are coming up, such as the measurement of carbon border adjustment mechanisms (CBAM)[2] in Europe for traders, trading with only eco-friendly products by the WTO, and uncertainty about the green economy in the new ACFTA agreement[3]. These new trade barriers will come soon (Lim et al., 2021). As a result, the export volume of plastic and rubber under the ACFTA is expected to decline, causing a significant impact and damage to the domestic economy in the future.

The estimation result in Table 4 strongly confirms that economic indications have a huge impact on the export of plastic and rubber. Most variables have a strongly positive and negative direction in trading. In addition, the export diversion result can confirm the trading change under the ACFTA free trade agreement. Therefore, if the government is not more concerned with the trading of plastic and rubber and considers the disadvantages of the ACFTA, it will lose a lot of trade benefits through its impact on the domestic economy and competitiveness (Ferianta et al., 2012).

In future research, the conclusion of the green economy trend and the up-to-date ASEAN-China free trade agreement (ACFTA) will show the trading changes more clearly. It will study more about the differences in commodities under different trade agreements to compare the most beneficial agreement for Thailand. The implication of trade agreements on export value, comparative advantage, time period, and import activity will also be relevant in the research.

CONCLUSION

The purpose of the study is to investigate the impact of the ASEAN-China free trade agreement (ACFTA) on export plastic and rubber values, focusing on trade creation and export diversion from 1990 to 2021.

According to the result, a positive and significant relationship exists between economic indicators and export value except for distance and the proxy variables (landlock and contiguity) from 1990 to 2021. The distance factor and the proxies have a negative impact on the export of plastic and rubber volume in Thailand, which are two of the trade costs that can reduce trade benefits and revenue. Hence, it is normal that those variables have an inverse correlation with the export value. Moreover, the results of the bilateral dummy variables, including FTA1 and FTA2, confirm that trade agreements not only increase trade benefits and reduce tariffs but also support trade between member countries and non-member countries. The result of FTA1<FTA2 indicates that it establishes export diversion more than trade creation in plastic and rubber in Thailand. Therefore, it can be concluded that the ACFTA can be continued in trading but will not gain more trade benefits than trading with non-member countries.

The result of this paper draws the attention of Thailand's government and trade agreement. Thailand's government has to establish strong relationships with member and non-member countries to gain more benefits. The government should participate in different free trade agreement communities to support

2 In European, the Carbon Border Adjustment Mechanism (CBAM) is the main important measurement of the European Green Deal, which is used to reduce pollution from export products. The CBAM measurement was declared on July 1, 2021, and is used to control high-risk carbon products including steel, cement, electricity, fertilizer, and aluminum. It charges enterprises 80 euros per carbon ton. This measurement will also be used in the plastic and rubber industries in 2027, and it will be an important recognized issue for the whole world in the future (Lim et al., 2021).

3 The ASEAN-China (ACFTA) Free trade agreement is up-to-date to raise more concern about the digital economy, green economy, supply chain connectivity, competition, consumer protection, and MSMEs (Department of Trade and Negotiation, 2023).

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all of the different products and help exporters expand the market. Because of the strong and significant result in distance, improving infrastructure will help exporters reduce trade costs and gain more benefits. Moreover, the government should prepare for the changes in plastic and rubber trading, such as by creating a comparative advantage in products with eco-friendliness and strong competitiveness.

Regarding trade agreements, the ACFTA should focus on trade tariffs and improve customs clearance to reduce trade costs. Moreover, the ASEAN-China free trade agreement should focus more on strong punishment and protect the product license and copyright for exporters from the imported countries. It can also support a comparative advantage in products for member countries.

AUTHOR CONTRIBUTIONS

Conceptualization: Sasawalai Tonsakunthaweeteam.
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Formal analysis: Sasawalai Tonsakunthaweeteam.
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Writing – review & editing: Sasawalai Tonsakunthaweeteam.

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APPENDIX A

Table A1. The ASEAN-China (ACFTA) Free Trade Agreement

Member countries	Non-member countries
Brunei Darussalam	Japan
Indonesia	Hong Kong SAR, China
Malaysia	United States
the Philippines	Australia
Singapore	Switzerland
Thailand	India
Cambodia	Netherlands
Lao PDR	Korea, Rep.
Myanmar	Austria
Vietnam	United Kingdom
China	Belgium
	Denmark
	Finland
	France
	Germany
	Italy
	Egypt, Arab Rep.
	Saudi Arabia
	United Arab Emirates
	Mexico
	South Africa
	Canada
	Brazil
	New Zealand

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APPENDIX B

Table B1. Abbreviations

Abbreviation	Decoding
ACFTA	ASEAN-China free trade agreement
FIXED	Fixed effect
PPML	Robust Poisson Maximum Likelihood Estimator
GMM	The Generalized Method of Moment
FTA1	The bilateral trade dummy variables (Trade Creation)
FTA2	The bilateral trade dummy variables (Export Diversion)
GDP	Gross domestic product
FTA	Free Trade Agreement
EFTA	European Free Trade Association
RTA	Regional Economic Integration
CEFTA	The Central European Free Trade Agreement
EU	The European Union
NAFTA	North American Free Trade Agreement,
AKFTA	ASEAN-Republic of Korea Free Trade Agreement
AFTA	ASEAN Free Trade Area
AJCEP	ASEAN-Japan Comprehensive Economic Partnership Agreement
ASEAN+6	FTA ASEAN PLUS 6
CBAM	The Carbon Border Adjustment Mechanism
MSMEs	Micro, Small and Medium Enterprise
CEPII	The CEPII database
WTO	World Trade Organization
WITS	World Integrated Solution Database
WDI	World Bank
VIF	Variance inflation factors
CIPS	The cross-sectional IPS
CADF	The cross-sectional Fisher-augmented Dickey-Fuller
PP	The Fisher-Phillips-Perron
CGE	Computable General Equilibrium
OLS	Ordinary Least Squares
Obs.	Observation
SD	The standard deviation
Min	Minimum
Max	Maximum
LNplastic	The natural logarithm of exports of plastic and rubber
LNgdpth	The natural logarithm of Thailand's GDP
LNgdppa	The natural logarithm of a partner's GDP
LNpopth	The natural logarithm of the number of Thailand's population
LNpoppa	The natural logarithm of the number of partner's population
LNdist	The natural logarithm of distance
LNtrade	The natural logarithm of trade share