EFFECTS OF TARIFFS AND TRADE AGREEMENTS ON GLOBAL PALM OIL TRADE: A GRAVITY MODEL APPROACH

by

SHWETA ADHIKARI

(Under the Direction of Gopinath Munisamy)

ABSTRACT

Oil palm is the major source of edible oil consumed in the world. It is also a major feedstock for biofuels and livestock and has several industrial uses. This study examined the determinants of global palm oil trade with particular attention to the effect of trade and environmental policies using a gravity model and data from 1988-2020. Palm oil's dramatic trade growth in the past three decades can be attributed to the usual suspects, e.g., economic growth of hungry giants (China and India) and proximity, but trade and environmental policies have played an important role in recent years. Major trade agreements have been responsible for increasing palm oil trade by up to 8 percent of the global import value. Palm oil trade is also highly sensitive to current policy changes due to the Covid-19 pandemic and to potential future non-tariff measures aimed at protecting the environment.

INDEX WORDS: Palm oil, Gravity model, Trade policy, Trade agreements, Sustainability policy, Covid-19

EFFECTS OF TARIFFS AND TRADE AGREEMENTS ON GLOBAL PALM OIL TRADE: A GRAVITY MODEL APPROACH

by

SHWETA ADHIKARI

B.S., Agriculture and Forestry University, Nepal, 2018

M.S., The University of Georgia, 2021

A thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2021

EFFECTS OF TARIFFS AND TRADE AGREEMENTS ON GLOBAL PALM OIL TRADE: A GRAVITY MODEL APPROACH

by

SHWETA ADHIKARI

Major Professor:	Gopinath Munisamy
Committee:	Michael Adjemian
	William Secor

Electronic Version Approved:

Ron Walcott

Vice Provost for Graduate Education and Dean of the Graduate School

The University of Georgia

August 2021

DEDICATION

Dedicated to my parents

For Their Love and Endless Supports

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my major Professor Dr. Gopinath Munisamy, for his constant support and guidance throughout my graduate program. His invaluable advice and motivation kept me encouraged all the time. I would also like to thank my thesis committee members, Dr. Michael Adjemian and Dr. William Secor. My gratitude extends to Dr. Yangxuan Liu for her support.

I appreciate all the support I received from the Department of Agricultural and Applied Economics at the University of Georgia. Many thanks to Elena Krasovskaia, Bishal Gaire, Bishal Neupane, Swikriti Pandey, Shreena Pradhan, Sujan Paudel, and all my friends in Conner Hall. Special thanks to Sanam Parajuli for his tremendous support and encouragement.

Finally, I would like to offer my special gratitude to my parents and my siblings for their unwavering love and beliefs in me.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

1.1 Background Information

Oil seeds form a critical link in the global supply chain by virtue of their use in a range of activities – edible oil for consumers, livestock meal, oleochemicals for industrial use and biofuel for transportation. Among oil seeds, oil palm (*Elaeis guineensis*) is not only the major source of edible oil consumed in the world, but also a major ingredient in biofuel production. In addition, its by-product, palm kernel meal, is a major feed for livestock, especially in Asian countries. Not surprisingly, palm oil and related products are extensively traded across countries and carry high economic importance to major producers (Indonesia, Malaysia) and consumers (China, India). Global palm oil import grew by more than 600% in quantity from 1988 to 2020 (FAS, 2020). Moreover, livelihood of millions of smallholders and landless workers in Indonesia and Malaysia as well as the composition of Chinese and Indian diets are interlinked by the palm oil supply chain. Various factors have been cited as reasons for this surge in palm oil trade: Gross Domestic Product (GDP) growth among emerging economies hungry for more protein in their diets (China and India); price competitiveness relative to other edible oils such as soybean or rapeseed or canola oil; contiguity of producing, processing and consuming nations (most in Asia); trend towards biofuels to lower carbon emissions (European Union's import of palm oil for biofuel use); Regional Trade Agreements (RTAs) (Association of Southeast Asian Nations (ASEAN), China/India-ASEAN) and others.

Understanding the pattern of palm oil trade is critical, as noted above, for the food security and economic well-being of a large share of the global population. To date, most studies on the economics of palm oil and its trade have focused one or few major producing or consuming regions. The limited focus of previous studies obscures the more than 100 trade agreements specifying tariff and non-tariff measures (NTM) affecting palm oil trade, especially in light of the economic nationalism recent years. In addition, concerns about environmental effects of oil palm production point to potential barriers in the near-term, especially Europe's search for sustainability. This study aims to examine global palm oil trade and its determinants with a particular focus on trade and environmental policy. Moreover, the study is conducted at a finer product level: using six-digit Harmonized System (HS) during 1988-2020. By employing a gravity model of trade flows, commonly employed in the international trade literature, this study attempts to capture the effect of policies on trade while controlling for a host of other determinants like population and income growth, and distance between trade partners and any non-policy association among trading nations. In the case of policies, this study focuses on the effects of various trade agreements on palm oil trade, especially since 2010, the potential European Union (EU) ban on palm oil due to sustainability concerns and trade policy changes during the Covid-19 pandemic.

1.2 Problem Statement

Palm oil is the most widely consumed vegetable oil in the world, but its production is concentrated in specific regions only. A study by Pirker, Mosnier, Kraxner, Havlík, and Obersteiner (2016) found that the suitable land for the cultivation of palm oil is concentrated in twelve tropical countries only. This limitation has favored the rapid increase of concentrated production, but widespread distribution of this commodity via trade over the years. Palm oil was

one of the top ten most traded agricultural commodities in 2020 (FAS, 2020). In 2019, palm oil represented 0.16% share of total world trade (Simoes & Hidalgo, 2011). Despite this significance in global markets, very few studies have focused on palm oil trade especially in recent years. Previous literature mainly focused on the environmental and sustainability aspects of palm oil. A few studies that focus on trade have mainly been concentrated around two major exporters - Malaysia and Indonesia and the major importing country India. While palm oil has a wide footprint - e.g., palm oil is used in almost half of processed foods sold, many cosmetics and used widely in industries, - it has received very limited analytical and research interest.

Palm oil trade is influenced by a number of policy measures. Trading countries have engaged in various policy changes over the years which include the establishment of trade agreements, raising or lowering tariffs, countervailing duties and subsidies, sustainability policy priorities, inclusion of sanitary and phytosanitary measures and others. These policies have been implemented sometimes to facilitate the trade, while in other cases to protect some countries' own edible oil industries and in others to protect the environment. Due to data availability issues, frequent policy changes and an intricate supply chain, earlier studies have been restricted to a particular policy change in a particular country or time. Making policy assessments with such limited focus is likely to provide incomplete information to decision-makers in the palm oil supply chain, specifically, and the broader food-feed nexus of the global markets.

NTMs such as sanitary, phytosanitary measures and technical barriers to trade are instituted for non-trade policy objective such as environmental protection. There has been a long-standing concern that environmental policies often disguise protectionist NTMs (Devadason, 2020).

Devadason (2020) also reported a subtle protectionism arising from the opaque nature of these NTMs. For example, the impact of EU's biofuel policy on palm oil trade has not received much attention. EU's recent proposals include a complete ban of palm-based biofuel production and this policy likely affects many countries, e.g., Malaysia and Indonesia have filed a complaint at World Trade Organization (WTO) in anticipation of this policy change. This study reviews such agreements and policies, makes a quantitative transformation of these measures wherever possible and identifies the impact of these policies on palm oil trade.

The Covid-19 pandemic has seriously slowed down the global economy, but some segments – medicine, food – have experienced greater trade growth in 2020. This study further explores palm oil trade during the pandemic and the trade impact of any policy actions related to the pandemic.

1.3 Structure of the Thesis

The thesis is structured as follows.

Chapter one provides background and the statement of the problem to set the context of study objectives.

In chapter two previous literature on the origin of palm oil, distribution and economic importance is reviewed. This section also examines the trend of production and consumption pattern as well as trade pattern of palm and palm kernel oil. The next part of this chapter reviews trade and environmental policies affecting the palm oil sector. Finally, the model used in the study is introduced including information on model development, its importance and rationale.

Chapter three details the objective of this study and the rationale behind these objectives.

Chapter four includes the materials and methods used in this study along with the processing of the available data. It includes information on the types of data, sources and how they will be used in this study. Along with that, a more detailed description of the model used in analysis is provided.

Chapter five presents the results of this study. This section also discusses how the results compare to previous literature.

Chapter six is the policy simulation part of this study. This chapter includes the analysis of the effects of FTAs and simulations of the EU's potential sustainability ban on palm oil for biofuel use and Covid-19-related tariff reductions by India.

The final chapter concludes with suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

This chapter provides an overview of literature on four topics: background on palm oil with a brief history; production, consumption, and trade trends; current policies which potentially affect palm oil production, consumption, and trade; and the gravity model of trade.

2.1 Palm oil Origin, Distribution and Economic Importance

2.1.1 Palm oil origin and distribution

Some historians have recorded that palm oil originated from West Africa way before written history, but others have suggested South America to be the place of origin (Zeven, 1964). The palms with the greatest commercial importance are African oil palm *(Elaeis guineensis Jacq)*, which for a long time was limited to domestic use, i.e., cook special food by African women (Henderson & Osborne, 2000). Later in 15th century the Portuguese expeditions to the coastal region of West Africa discovered palm oil (Webster, Rimmer, Bennett, & Bradbury, 2004). For a long time, slave trade was the major activity in the West Africa region and only after 1807 AD when slavery was banned, British merchants considered agricultural products to export, palm oil being one of them (Henderson & Osborne, 2000). After the abolition of slavery, other markets like Germany, United States (US) and France also began importing oil palm from the region (Lynn, 2002).

In South East Asia, the tree was first introduced in 1848 in Indonesia (Purseglove, 1972) (Bakar, Sahri, & H'ng, 2008). During the 20th century, palm oil plantations were created in Asia

by the British and Dutch colonial rulers (Webster et al., 2004). Palm oil plantation in Malay peninsula and island of Sumatra replaced rubber grown earlier but discontinued due to lower productivity after World war I (Giacomin, 2018; Yacob, 2007). Commercial palm cultivation expanded in the tropical region after that introduction. Countries that produce oil palm for commerce include are Malaysia, Indonesia, Nigeria, Colombia, Cote d' Ivoire, Papua New Guinea, Thailand, Congo, Kenya, Liberia, Brazil, Guatemala, and Mexico.

2.1.2 Palm oil economic importance

Palm is a unique crop that produces oil from the fresh fruit bunches of which mesocarp produces crude palm oil (CPO) and seed produces palm kernel oil (PKO). These oils have different chemical composition and hence, used for different purposes. Palm oil was initially used as a source of vitamin and for medicinal uses (Lai, Tan, & Akoh, 2015). CPO is a rich source of vitamin E (600-1000 ppm) and its constituent carotenoids have pro-vitamin A activity which is an antioxidant (Basiron, 2002). Palm oil is now used widely as a vegetable oil since it has a peculiar solid content profile, is free from trans-fat, has good oxidative stability, contains antioxidant properties and is not genetically modified (Dian et al., 2017). PKO has high amount of lauric acid which contain saturated fatty acids and has industrial uses in soap production, confectionaries, manufacturing of oleochemicals and others (Bhattacharya, 2019). In 2019 more than 66% of total CPO and 75% of total PKO were consumed for food and industrial purposes, respectively (FAS, 2020). CPO is refined, bleached, and deodorized (RBD) at the palm oil refineries to produce refined palm oil (RPO) (Gee, 2007). Refining of palm oil gives liquid (olein) and solid (stearin) compounds. Palm olein is used in frying, snack foods, instant noodles, while palm stearin is used in making margarines, pastries and the mid fraction is used as a replacement of cocoa butter

(Barthel et al., 2018). Both olein and stearin are used to produce biodiesel as well ((LMC International as sourced by (Barthel et al., 2018)).

Oil palm is considered to be a highly profitable crop with yields per hectare much higher than other oilseed crops (soybean, sunflower) while the production costs are lower (Brack, Glover, & Wellesley, 2016). It can produce an average of 3.8 tons of crude oil per hectare of cultivation much higher than rapeseed producing 0.56 tons and soybean producing 0.35 tons per hectare (Gee, 2007). It is an important economic driver in the tropical region as it provides primary employment to a large share of the rural population (Sayer, Ghazoul, Nelson, & Boedhihartono, 2012). In 2017, oil palm production employed 5.50 million people directly and another 12 million indirectly in Indonesia (Nurfatriani, Sari, & Komarudin, 2019). In Guatemala, access to food improved as palm oil production increased and provided employment opportunities (Hervas & Isakson, 2020). Even for middle-income countries like Malaysia, palm oil's contribution to total GDP was 2.70% in 2019 (Statista, 2021). Similarly, other countries producing palm oil have found that global growth in consumption has provided employment and income opportunities, especially in rural areas.

2.2 Global Palm oil Production, Consumption and Trade

Global palm oil production dramatically increased from 9.47 million metric tons in 1988/89 to 72.27 million metric tons in 2019/2020. Similarly, the production of palm kernel oil increased from 1.20 million metric ton to 8.73 million metric tons during the same period. Malaysia was the largest producer until 2004 accounting for as high as 59.48% of global palm oil production, followed by Indonesia and Colombia. Since 2004, Indonesia substantially increased its palm and palm kernel oil production and has remained as the top producer. In 2019, Indonesia produced

42.50 million metric tons of palm oil which was more than double the production of second largest producer- Malaysia.

Similar to production patterns, Malaysia was the largest exporter of palm oil until 2008, after which Indonesia became the leader. Since 2014/2015, growth of Indonesian exports significantly outpaced that of Malaysia, creating a large export gap between these two competitors. These countries have been followed by Colombia, Papua New Guinea, and Thailand in recent years in terms of top global export of palm oil. Similarly, for palm kernel oil, along with Malaysia and Indonesia, Thailand, Colombia, and Guatemala are the top exporters.

On the consumption side, India and China fulfill more than 90% of their consumption requirements through import. Indonesia was the largest palm oil consumer from 1988 to 2011. Along with Indonesia, China, Malaysia, and Pakistan were among the top consumers until 1995. After 1995, due to its versatility and lower price, palm oil consumption increased substantially in India. India followed Indonesia on top global consumption ranking for a few years and became the largest importer.

Palm oil consumption in China was increasing at a decreasing rate in 1990s as soybean was gaining more popularity in China. However, China again became the top consumer after Indonesia in 2003 and remained in that position until 2009. During this time, China was also the leading importer. Indian consumption of palm oil started accelerating significantly in 2011 and exceeded Indonesian consumption to become world's largest consumer. This required substantial amount of palm oil import, making India the largest importer as well since then. However,

Indonesia's new policy to expand biofuel production led to its increasing domestic consumption since 2016. At present Indonesia, India, China, Malaysia, and Thailand are the major consumers of palm oil.

APPENDIX A provides data on major palm oil importing and exporting countries. All the above information has been derived from the data available at United States Department of Agriculture (USDA) Foreign Agricultural Service (FAS) Production Supply and Distribution Online. (USDA FAS, 2020)

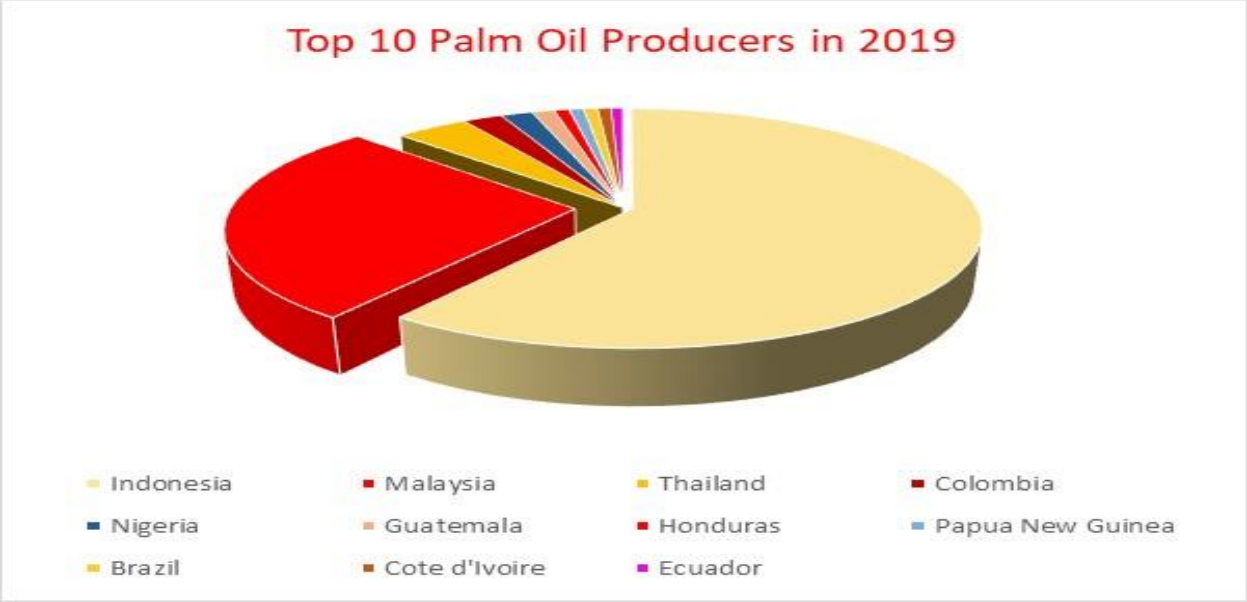


Figure 1: Top ten palm oil producing countries in 2019.

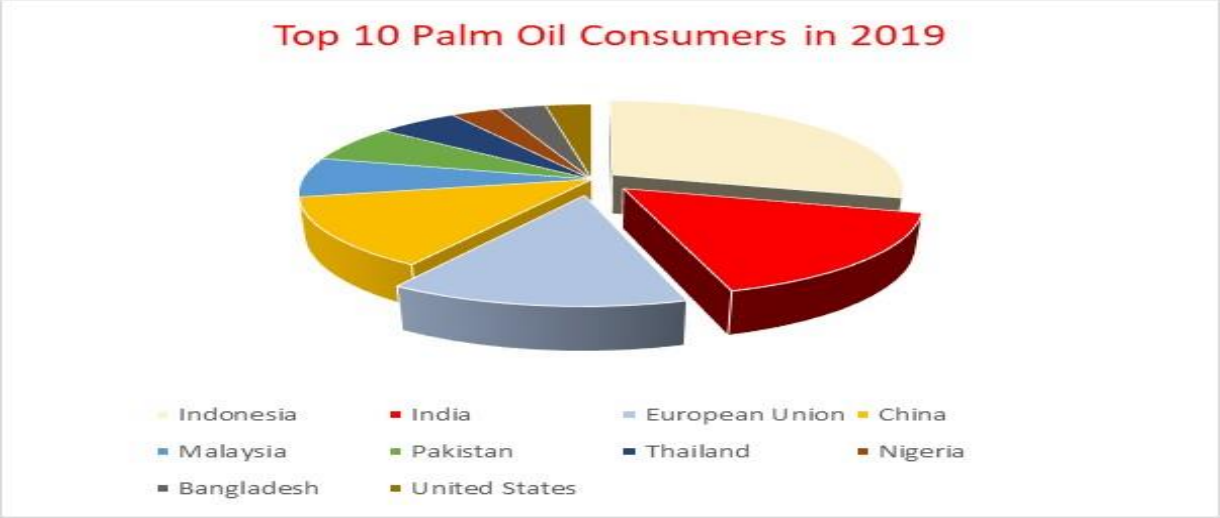
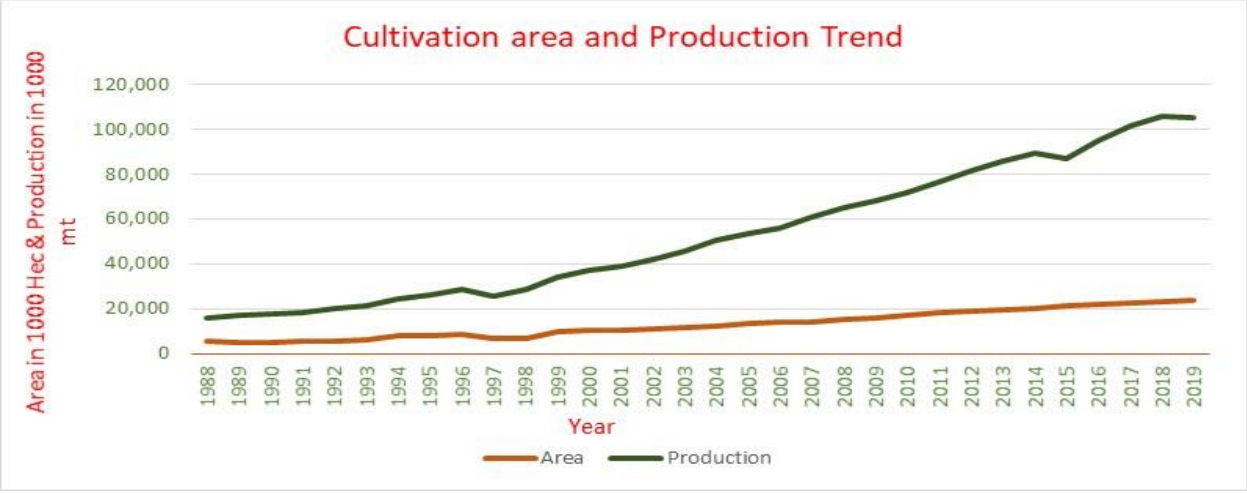


Figure 2: Top ten palm oil consuming countries in 2019.

United States was the top palm kernel oil consumer until 1990 followed by Indonesia and Malaysia. Later Malaysia became the top consumer until 2010 after which Indonesia became the major consumer. In 2019, Indonesia was the largest palm kernel oil consumer followed by Malaysia, China, Nigeria, and the United States.



Source: (FAS, 2020)

Figure 3: Palm oil cultivation area and production trend (1988 – 2019)

Increase in palm oil production is mainly due to the growth in the area of plantation ((Carter, Finley, Fry, Jackson, & Willis, 2007), (Basiron, 2002)). Abundance of labor, increase in foreign investments, trade and economic liberalization, policy deregulation and de-bureaucratization are factors associated with the expansion of production in some countries (Basiron, 2002).

2.3 Palm Oil Policies

Major trade policies include tariff and NTBs. Tariff is a tax levied by importing countries on goods and services. NTBs are any other barriers other than tariff barriers. According to United Nations Conference on Trade and Development (UNCTAD), NTBs include sanitary and phytosanitary measures, technical barriers to trade, pre-shipment inspection and formalities, trade protective measures, licensing, quotas, quality control, price control, sustainability measures and others.

2.3.1 Palm oil import policies

Palm oil has been subjected to various import policies. Usage of palm oil are quite distinct among the major palm players which is a reason behind various import policies. For instance, Palm oil is used mostly as food in Fiji and there was a tenfold increase in imports between 2000 to 2009 (Snowdon & Thow, 2013). Fiji in 2012 announced an increase in tariff duty on palm oil from 15 to 32% to reduce the consumer purchase as the oil contains saturated fat which can contribute to obesity (Coriakula et al., 2018). The largest importer India mostly uses palm oil for food but very

less in oleochemicals, China uses palm oil for food, feed and oleochemicals, EU uses it mainly for biofuel and then fuel and feed, Pakistan uses it for food as well as oleochemicals (ICCT, 2019).

Tariff implementation in vegetable oils has also been done by countries to protect their own domestic, crushing, and refining industries ((Amiruddin, 2003) and (In & Inder, 1997)). India which is relatively sensitive to price changes have frequently changed its tariff policies. Soybean and palm oil are the major vegetable oils that India swings between considering the global price situation (Carter et al., 2007). After the trade liberalization in 1994, Indian government started using tariffs to cope with the change in world prices. When the world prices were high in 1990 the Indian import tariff was considerably low which was increased after the prices fell (Carter et al., 2007). A research done by Cuevas García-Dorado (2019) at London School of Hygiene and Tropical medicine found that trade openness of palm oil in India can shift dietary patterns, make cheap calories and fats available, increase dietary diversity and reduces undernutrition.

.

2.3.2 Palm oil export policies

Exporters change the export duties considering the prices and their economies. Export tax levied by countries who have the market power have higher effects on price and trade volume compared to others (Rifin, 2014). For instance, some of the Malaysian companies permitted duty free exports of CPO in 2000 increasing the exports by 220.3% in 2001 compared to 2000 (Amiruddin, 2003). The palm oil export duty started in Malaysia since 1960 with the objective to raise government revenue ((Sally & Nasir, 1983); (Amiruddin, 2003)). Increase in production cost was embedded in the export tax in 1974 after which tariff was increased to 10% by Malaysia based

on the value of CPO purchased (Amiruddin, 2003). Amiruddin (2003) also noted that the tariff on RPO which got introduced in 1976 was completely abolished in 2001.

There are records of heavy duties imposed by Indonesia on the export of palm oil to ensure domestic supply during the high world oil prices (Amiruddin, 2003). Export was restricted in early 1980s to prevent domestic price increase and was later relaxed in the late 1980s after increased coconut oil production (Piggott, Parton, Treadgold, & Hutabarat, 1993). The government also tried to eliminate the 10% export tax imposed in 1989 to ease the export competition (Piggott et al., 1993). Between 1994 to 1997 Indonesian palm oil export was subjected to tariff ranging from 0 USD to 100.4 USD based upon the trade value (Rifin, 2014). In 1997 Indonesia reduced the export tax rates but the increase in price of domestic cooking oil and other basic commodities led the government to eliminate tariff-rate quotas, selective-export quotas and others (Gaskell, 2015). In 1998 there was a complete ban of export for three months due to economic crisis in Indonesia (Rifin, 2014). Gaskell (2015) reported that the ban was removed as the currency value grew in Indonesia.

Indonesia and Malaysia during the reduced world prices in 2018 decided to suspend their export duties while Argentina raised its export taxes (FAO, 2020). Indonesia simplified the customs procedures and Malaysia adopted tax scale adjustment, countertrade deals in palm oil, support to private sector, trade market explore mission and others (FAO, 2020).

2.3.3 Palm oil biofuel policies

Biofuel including biodiesel has captured the attention of the global community due to the rapid depletion of conventional fuel resources and environmental pollution (Singh et al., 2021). Biofuels are made of biomass materials and are the fuels used in transportation usually as a blend with conventional fuels (EIA, 2020). The most common liquid biofuel is ethanol made from grains followed by biodiesel which are made from oil plants like soybean and palm (Selin & Lehman, 2020). Compared to fossil fuel, production and combustion of ethanol and biodiesel produce 12% and 41% less greenhouse gases (GHGs) respectively (Hill, Nelson, Tilman, Polasky, & Tiffany, 2006). However, the industrial production of biofuels and ethanol is likely to produce more GHG that simply negates their advantage over fossil fuel. Similarly, the use of arable land that produce feed crop to produce biofuel feed has caused forest clearance and shifts of grasslands (Selin & Lehman, 2020). This study focuses on the palm oil biofuel policy.

Palm oil is considered to be a first-generation biofuel feedstock (Bowyer et al., 2018). RPO after the transesterification process can produce biodiesel and due to its rapid production process, high yield, high cetane number, large availability and cost effectiveness palm oil has a potential to satisfy future biofuel requirements (Singh et al., 2021). EU is the world's largest biofuel producer (USDA, 2019). EU's Renewable Energy Directive (RED) 2009/28/EC reported that the palm-oil biodiesel processed with methane capture, if produced with no net carbon emissions from land-use changes, can typically save up to 62% GHGs (EU, 2009).

In 2007, the European Council endorsed a mandatory target of 20% share of renewable energy and 10% biofuel share by the member states by 2020 as part of its RED (EU, 2009).

Coincidentally, biofuel industry in EU increased the use of palm oil by 365% between 2006-2012 (Gerasimchuk & Koh, 2013). Indonesia also mandated the use of palm oil in biofuel in 2018 (OECD-FAO, 2019). In 2019 Brazil, Finland, Indonesia, Malaysia, Thailand and the US also mandated the consumption of biodiesel or scheduled the implementation of the biodiesel policy which supported the growth of global uptake of palm oil feedstock (FAO, 2020). However, realizing the high risk of indirect land-use changes associated with GHG, in December 2018, revised RED 2018/2001/EU (RED II) was launched (Mayr, Hollaus, & Madner, 2021). RED II limited the count of energy produced from food-based crops towards renewable sources at 7%, but for palm oil the share will be 0% starting from 2021 (USDA, 2019). This directive reset the EU-wide renewable target and committed to begin reducing the use of oil palm by 2023 with a complete ban by 2030 and also allowed member states to establish their additional criteria (USDA, 2021). France was the first nation to bring the law of excluding oil palm from the biofuel scheme starting in January 2020 (Reuters, 2019). France will be joined by Austria and Netherlands to exclude palm oil from biofuel targets in mid-2022. Recently Belgium decided to ban biofuel and biogases from palm starting Jan 1st, 2022 (USDA, 2021). EU had also imposed anti-subsidy duty on biofuel against Indonesia and Argentina in 2018 affecting the palm oil trade (USDA, 2019).

2.3.4 Other relevant trade policies

Beside tariff implementation, countries have also signed trade agreements, tariff regimes, custom unions that have facilitated the trade and increased the trade openness among countries. Major palm oil exporting countries are in trade agreements with some of the major importers which has influenced the changes in export proportion over the years (Pujiati, 2014). Some of these agreements are Association of Southeast Asian Nations FTA (AFTA), ASEAN trade in Goods

Agreement (ATIGA), ASEAN-India (AIFTA), ASEAN-China (ACFTA), ASEAN-Japan, Malaysia-New Zealand FTA, North American FTA (NAFTA), Malaysia- Chile FTA, ASEAN-Korea FTA and others (Pujiati, 2014) and (Balu & Ismail, 2011). Arshad, Shamsudin, and Mohamed (2016) found that the tariff liberalization and reduction of export duty highly favored countries including India, China, Europe as well as rest of the world. Tariff reduction due to the ASEAN-China agreement increased the trade of palm oil products by 34.0% from 2005 to 2010 (Balu & Ismail, 2011).

Also, crisis have impacted trade of palm oil over the years. In 2009 the global economic crisis occurred reducing the purchasing power of importing countries (Purba, 2019). China reduced the import of palm oil got reduced in 2015 due to the devaluation of Yuan ((Jamilah, Sinaga, Tambunan, & Hakim, 2016); (Mawardati, Jamilah, & Syamni, 2021)). Recent Covid-19 has also shown impacts on palm oil trade and have resulted in policy changes by few importing countries. Mawardati et al. (2021) reported that the CPO export of Indonesia fell by about 20% between January to February 2020 compared to 2019 export. This is mainly due to the reduction of purchasing power of people in major importing countries India and China. China, Pakistan and Netherlands also observed reduction in palm import due to pandemic (Mawardati et al., 2021). To cope with the increased prices of such important import, India reduced the palm oil tariff by 10 percentage points in November 2020 (USDA, 2020).

2.4 Gravity Model in Trade Analysis

2.4.1 Gravity model development

Based on Newton's law of gravitation, the gravity model was introduced to analyzing trade patterns by Tinbergen (1962). He reported that the bilateral volume of trade can be described by the size of two trading economies and the distance between them (Tinbergen, 1962). Anderson (1979) developed a theoretical foundation of the gravity model based on Armingtonian assumption with a constant elasticity of substitution taking the effect of prices into account. Later, Bergstrand (1985) derived the gravity model from an imperfect competition framework in contrary to the assumption of perfect international product substitutability.

Eaton and Kortum (2002) developed an alternative generalized Ricardian gravity model on the supply side based on homogenous goods and iceberg transport cost, i.e., only a fraction of shipped goods reaching a destination. Chaney (2008) introduced firm heterogeneity into the gravity model. Chor (2010) extended the Eaton and Kortum (2002) framework where country and industry resource combinations defined comparative advantage. Gravity model started as an intuitive model but was provided with a series of microeconomic theoretical framework over the years. It has gained its reputation as one of the powerful empirical tools for trade policy analysis in recent years. The model can include variables like tariffs, regulatory policies, political and institutional characteristics of countries and have been applied to goods and services trade (Shepherd, Doytchinova, & Kravchenko, 2019).

2.4.2 Gravity equation

The traditional gravity equation is formulated as follows:

$$X_{ij}=GE_iI_j\emptyset_{ij}$$

X_{ij} is the trade value which is the monetary value of export from i to j, E_i is the exporter-specific factors which can be GDP, island status and others, I_j is the importer-specific factors, G is a variable that neither depends upon i nor on j and φ_{ij} represents the ease of access to the importer market by exporters.

Source: (WTO, 2012)

McCallum (1995) used the following estimation equation to analyze the US-Canada trade. He estimated the "border effect" in terms of gravity context (Anderson & Van Wincoop, 2003).

$$lnX_{ij} = \beta_1 + \beta_2 lnY_i + \beta_3 lnY_j + \beta_4 lnD_{ij} + \beta_5 ln\delta_{ij} + \epsilon_{ij}$$

X_{ij} is the trade value which is the monetary value of export from i to j. Y_i and Y_j are the GDP of countries i *and* j, D_{ij} is the distance between country i and j, δ_{ij} is the dummy variable that equals to 1 for interprovincial trade and zero otherwise. Result from this model showed an enormous border effect.

Later when Anderson and Van Wincoop (2003) integrated the control of relative trade cost in the gravity model.

$$X_{ij}= \frac{Y_iY_j}{Y}\left(\frac{t_{ij}}{\pi_i\emptyset_j}\right)^{1-\sigma}$$

The term relative trade cost $\left(\frac{t_{ij}}{\pi_i \emptyset_j}\right)^{1-\sigma}$ is composed of bilateral trade cost normally estimated using geographic and trade policy variables (distance, RTAs, tariffs), inward multilateral resistance and outward multilateral resistance (Yotov, Piermartini, Monteiro and Larch, 2016). Multilateral resistance (MR) is the barrier which each country face with all of its trading partners (Adam & Cobham, 2007). The multilateral resistance term provides the relative cost of trading with one country relative to other. Inward MR is the weighted-average of all the bilateral trade costs borne by consumers and outward MR is the weighted-average of all bilateral costs borne by producers (Larch and Yotov, 2016).

The equation above due to its multiplicative form becomes:

$$lnX_{ij} = \beta_1 + \beta_2 lnY_i + \beta_3 lnY_j + \beta_4 lnt_{ij} + \beta_4 ln\pi_{ij} + \beta_5 ln\varphi_{ij} + \epsilon_{ij}$$

where $\beta_4 = 1-\sigma$ and ε is the error term.

Anderson and Wincoop (2003) considered that trade is affected by the exporters trade cost towards the importers and in the above equation Y_i and Y_j are the GDP of countries *i* and *j*, t_{ij} is one plus tariff equivalent of overall trade cost, σ is the elasticity of substitution and π_i is the outward multilateral resistance and φ_j is inward multilateral resistance.

This equation suggests that trade barrier between *i* and *j* divided by the multilateral resistance terms affect the trade value after controlling for the size. An increase in trade barrier between j and other countries or increase in multilateral resistance of exporting country *i* will increase the import from country *i*. Generally, a number of variables are used to reflect the trade cost like island dummies, landlocked dummies, contiguity, common language, tariffs, and others (WTO, 2012).

2.4.3 Gravity model estimation

Due to the multiplicative nature of gravity model, logarithm of variables is taken in order to change it to a form that can be estimated by ordinary least squares (OLS) method. However, there are some challenges in estimating the gravity model. Treatment of multilateral resistance in the structural gravity model, handling of large number of zero trade values, dealing with inconsistent and biased estimates due to heteroskedasticity are some of the major issues (Yotov et al., 2016) Researchers have approximated MRs in various ways including remoteness indexes, using estimated trade costs, using fixed effects or just eliminating them (Yotov et al., 2016) Trade data has a lot of zero values as not all countries trade with each other and taking the logarithm would lead to deleting these zero values. To cope with all these problems Poisson Pseudo Maximum Likelihood (PPML) is used.

Pseudo maximum likelihood estimation method determines the estimate of the parameter values in a way that they can maximize the likelihood of the process described by the model to produce data which are actually observed. The Poisson distribution is the discrete probability distribution and since we have a lot of zero in the trade data, data can be considered to be in the passion distribution form. PPML estimator can capture the information in the zero trade flows (Yotov et al., 2016). PPML estimator also accounts for heteroskedasticity and allows the estimation of the model that has fixed effects that account for MRs (Yotov et al., 2016). Also, PPML allows us to calculate the effect of trade policies including tariffs and FTA and gives theoretically consistent results ((Anderson, Larch and Yotov, 2015) and (Larch and Yotov, 2016); (Yotov et al., 2016)).

CHAPTER 3

OBJECTIVES OF THE STUDY

The main objective of this study is to identify the drivers of the growth of palm oil trade with particular to attention to policy impacts. A theoretically consistent framework, i.e., gravity model, is employed to assess how economic and population growth along with physical and policy barriers (distance, tariffs) affect the global palm oil trade. In addition, effects of recent policy changes due to the Covid-19 pandemic and sustainability goals are examined. Together, the results have implications for the food security and overall well-being of producing and consuming countries. The specific objectives are as follows:

- To identify the major drivers of the exceptional growth of global palm oil trade over the past three decades
- To examine the role of trade policies, especially the impact of preferential tariff regimes on global palm oil trade.
- To study the potential impacts of recent or upcoming policy changes of major exporting and importing countries on global palm oil trade.

CHAPTER 4

MATERIALS, VARIABLE SELECTION AND METHODOLOGY

This chapter provides information on materials needed and appropriate methods to examine the drivers of global palm oil trader with a gravity model. Materials, i.e., data on palm oil trade and its drivers, and their processing are outlined first, followed by the specification of the gravity model for estimation purposes.

4.1 Materials

In this study, HS 1511 (palm oil and its fractions whether refined or not, but not chemically modified) and its major components HS 151110 (palm oil and its fractions, crude, not chemically modified) and HS 151190 (palm oil, refined but not chemically modified) are studied. Both value of exports and imports, and quantity trade are collected from 1988 to 2019 - 32 years of bilateral trade value between 195 countries - according to the date of recognition by the United Nations (UN). All the variables needed to implement the gravity model are described in the following.

4.1.1 United States International Trade Commission (USITC) Gravity Data

Dynamic gravity dataset from the year 1988 to 2019 characterizing the relationships among 195 trade partners is taken from the United States International Trade Commission (USITC) version 2 dataset. Data on GDP, population, distance, contiguity, region, WTO membership and language from the dataset have been taken from the USITC dataset used. The missing GDP and population data are filled from the World Bank Development Indicators dataset. Other missing

data are filled using the previous years' latest available data from within the dataset. Observations that do not have data on GDP, population and distance have been dropped. Out of 1,165,926 142,804 observations have been dropped because of missing data.

GDP

GDP is the total gross value of goods and services added by all the residents of the country along with added taxes minus any subsidies not included in the value. Nominal GDP has been used in the research which is also known as current dollar GDP. It takes price changes and inflation into account. Dollar figures of GDP are converted from domestic currencies using that years' official exchange rate. Most of the researches use current GDP as trade values are also in current USD. Ciuriak and Kinjo (2006), Mehchy, Nasser, and Schiffbauer (2015), Folfas (2011) are some of the researches that use current GDP. Folfas (2011) has mentioned that the use of current GDP is most proper considering the trade flow also measured in current prices. The researcher has mentioned the disadvantage of using GDP in Purchasing Power Parity that it distorts the difference between countries which is not a problem while using Current GDP (Folfas, 2011).

USITC gravity dataset has GDP data that comes from two datasets: Penn World Tables (PWT) and World Bank Dataset (WDI). These sources cover nominal GDP data for about 90% of the observations (Gurevich et al., 2018). Although USITC has World Bank as one of the sources, recently updated dynamic gravity dataset did not contain all the GDP data available in the World Bank. The missing data on nominal GDP was filled using Current (US dollar) GDP data from the World Bank.

Population

Population counts all the residents regardless of legal status or citizenship and is a mid-year estimate. Population estimates are usually based on national censuses. USITC gravity dataset sources population data from Penn World Table which provides data collected from the World Bank and UN databank. Missing data has been filled using World Bank Development Indicators like in the case of GDP, the current version of USITC dynamic gravity dataset does not contain all the population data available.

Distance

The geographic distance in USITC dynamic gravity model is measured based on the methodology developed by Mayer and Zignago (2011) (Gurevich et al. (2018)). Distance is measured by using major cities of economic activity and their population for each pairing of countries. The method typically averages distance between various city-pairs of the two countries, weighted by population. USITC sources distance data from the basic version of Simplemaps.com's "World Cites Database" which collects data from multiple country sources, population data from U.N. Statistics Division's World Statistic Pocketbook, CIAs World Factbook and UNDESA. Country pairs with no distance data have been dropped.

Contiguity

Contiguity implies that the destination (importer) and origin (exporter) countries share a common border in a particular year. Countries can be bordering river or a stretch of land to be contiguous to each other. USITC does not consider countries to be contiguous if countries are separated by water body other than river like lake or oceans. Contiguity takes a value of 1 if the

countries are contiguous and 0 otherwise. Contiguity represents ease of trade as countries can trade with one another via land transportation.

Region

USITC distinguishes countries into the following regions: Africa, Caribbean, Central America, Central Asia, East Asia, Eurasia, Europe, Middle East, North America, Pacific, South America, South Asia, Southeast Asia, and Southern Pole. Importer and Exporter pair take value of 1 if the countries are in the same region and 0 otherwise.

WTO membership

WTO membership data in USITC dynamic gravity model is based on information published by the WTO. The variable WTO joint membership is a dummy variable that takes the value of 1 when both exporter and importer countries are members of WTO in the given year.

Common Language

USITC used data from the CIA World Factbook to find commonly spoken language. Languages spoken within each country are broken down according to population percentage speaking those language as first language and then ordered according to prevalence. According to USITC there are 375 languages which are spoken commonly. The variable common language takes the value of 1 if a language spoken by at least some residents of the exporting country is spoken by some residents of the importing country or vice versa.

4.1.2 UN Comtrade trade value

Bilateral trade data is downloaded from the UN Comtrade website for a total of 37,617 pairs of countries for 32 years depending upon the recognition by the UN. Trade value data using the current exchange rate are converted from the national currencies to US dollar using that year's exchange rate or using monthly market rates and trade volume (UN, 2020b).

Commodities code in HS reported according to the recent classification are converted to the earliest classification Standard International Trade Classification (SITC) revision 1 by UN Comtrade. Import data are recorded as CIF (cost insurance and freight) and exports as FOB (Free on Board) (WITS, 2010). Import data are generally more accurate than export as imports generate tariff revenues (WITS, 2010). Import data in USD for each country for all the three commodities (HS 1511, HS 151110, and HS 151190) has been used in the study. Missing data taken from UN Comtrade are filled with zero considering no trade happened between the two countries in a particular year.

4.1.3 Tariff data

As noted in section 2.3, tariff is a tax levied by government on goods and services imported from other countries. Ad valorem tariff is a tariff amount that is based on the monetary value of transaction. It is generally calculated as a percentage of the value of the goods or services. Most countries maintain ad valorem tariffs, while the other type - specific tariff ($/unit) – is less common. Furthermore, countries have a ceiling on tariffs referred to as the bound rate, but generally apply a lower level than that ceiling termed as applied tariffs. Applied tariffs have been used in this study to analyze the effect on trade patterns.

Tariff data for each pair of country for different years has been collected from several sources. The Most favored nation (MFN) tariff data from 1988 to 2014 has been taken from the UNCTAD data provided by the World Bank database (The World Bank Group, 2016). Simple average tariff rates are taken from the database. WTO RTA database also provides the MFN tariff data which has been used to acquire data of the year above 2014 and to fill missing UNCTAD data. Data for the regions like EU, ASEAN that have similar tariff applied for all the countries within the region has been collected according to the year of entry of country in the region.

WTO data portal providing statistical indicators related has been used to download the applied tariff that includes the FTA, PTA, RTA, Duty Free Tariff for Least Developed Countries (LDCs) tariffs. Additional data on these applied tariffs have been taken from different FTA tariff tools including, Canada Tariff Finder, FTA tariff tool provided by United States International Trade Administration (USITA), ASEAN Tariff finder, Indian Trade Portal, New Zealand Foreign Affairs and Trade Tariff Finder and Australian Government FTA Portal.

4.2 Variable Selection and Summary Statistics

4.2.1 Variable selection

Independent variables – gravity variables and policy measures – have been transformed to natural logarithms while dependent variable has been kept as such, i.e., value. Gravity model is exponential so having logged regressors and the dependent variable in levels creates a log-log model with coefficient estimates directly yielding elasticities. Trade within the country has been omitted in the model.

Fixed effects accounts for both inward and outward sources of multilateral resistances and unobserved and unconstrained heterogeneity across each importer and exporter that vary with time (Anderson and van Wincoop, 2003). Both importer-time and exporter-time effects have thus been added to the study. Importer-year and exporter-year fixed effects are formed by multiplying importer dummy by the year dummy and exporter dummy by the year dummy. Some variables that vary by exporter but constant across importers and time, or that vary by importer but constant across exporters and time show perfect collinearity with the fixed effects due to this. Thus, these variables are transformed to another variable that varies bilaterally across exporter-importer pair.

Individually, exporter's GDP per capita and importer's GDP per capita are highly collinear with exporter-time and importer-time fixed effects, respectively. Hence the variable is transformed by adding GDP of importer and exporter and dividing by total population of the two countries. The created variable total GDP per capita for each year varies bilaterally across each country pair solving the issue of collinearity. Logarithm of total GDP per capita is taken to add to the model. Similarly, exporter's WTO status and importer's WTO status are transformed by creating WTO dummy for pairs with both nations recognized by WTO in a particular year.

Logarithm of distance and applied tariff are added to the model. Additional variables included in the model are contiguity, common language, and same region. These dummies control whether country pairs are adjacent to each other and have common languages. As noted earlier, the dependent variable - trade value - is also used in its linear form. Table 1 provides summary statistics on the dependent and independent variables.

Table 1: Summary Statistics of the variables

Variable	Observation	Mean	Std. Dev.	Min	Max
Total GDP per capita	1,016,858	9229.80	12871.64	70.10	170,602.30
distance	1,016,858	7948.71	4522.32	75.82	19,734.64
Trade Value (Crude Oil)	1,016,858	222965.70	16600000	0	4280854598
Trade Value (Refined Oil)	1,016,858	233044.80	9794019	0	2504643508
Trade Value (Palm oil HS4)	1,016,858	377358.80	20100000	0	5197955072
Applied Tariff (Crude Oil)	54,139	12.53	18.52	0.00	204.42
Applied Tariff (Refined Oil)	98,190	8.370	13.75	0	204.42
Applied Tariff (Palm oil HS4)	9,271	16.28	25.01	0	204.42
Contiguity dummy	1,016,858	0.02	0.13	0	1
WTO joint dummy	1,016,858	0.50	0.50	0	1
Com Language dummy	1,016,858	0.36	0.49	0	1
Same region dummy	1,016,858	0.16	0.37	0	1

4.3 Methodology

The specific gravity model estimated in this study is:

$$Trade_{eit}=\alpha_0+\alpha_1 lnGDP_{eit}+\alpha_2 lnDistance_{eit}+\alpha_3 lnTariff_{eit}+\alpha_4 Contiguity_{eit}$$

$$+\alpha_5 WTOmembers_{eit}+\alpha_6 sameregion_{eit}+\alpha_7 samelanguage_{eit}+u_{eit}$$

Where,

- e = exporting countries, i = importing countries t = 1988, 1989….2019, e ≠ i,
- lnGDP is GDP per capita from combining the GDP of importing and exporting countries and dividing by the sum of the population of countries e and i.
- lnDistance is the logarithm of distance between the exporter and importer
- lnTariff is the logarithm of tariff applied by importing country on the exporter
- Contiguity is the dummy variable which takes a value of 1 if the two countries are contiguous
- WTO membership is a dummy variable for both countries being WTO members.
- Same region is the dummy variable that takes the value of 1 if the two countries are in the same region
- Same language is the dummy variable that takes the value of 1 if some of the residents of exporter and importer countries speak the same language.

Extensive tests are conducted to arrive at this specification. Along with above variables several other variables have been added to the model to observe the fit. Collinearity between variables was tested. Different functional forms have also been tested: log-log model, log-Lin model and reciprocal model were tested. Pair-wise fixed effects were also added to the model but variables that do not vary with country pairs were omitted. Hence, exporter-year and importer-year fixed effects are used. GDP per capita, contiguity, WTO membership, same region and same language variables are expected to have positive effects on trade value. Distance and tariff are expected to have negative effects on the import value of palm oil. The most consistent model that represents the impact of all the variables have been specified. OLS estimation was also carried out and eventually PPML allowed for the most consistent estimation along with high R-square.

CHAPTER 5

GRAVITY MODEL RESULTS AND DISCUSSION

In this chapter, results from the estimation of the gravity model are presented for the two HS-6-digit palm oil commodities, and the HS-4-digit aggregation. Then, the results are discussed in the context of current trends and prior literature on palm oil trade.

5.1 Gravity Model Results

5.1.1 Crude palm oil (HS- 151110)

Recall that the coefficients on logged regressors are elasticities as the gravity model is exponential implying the regression to be of the log-log form. Note also that the PPML model corrects for heteroskedasticity. Gravity modeling of CPO shows an expected result for almost all the variables in table 2. The coefficient estimates of the logarithm of total GDP per capita carries a positive sign and is statistically significant. The result shows that an increase in the combined GDP per capita (exporter and importer) by 1% increases the trade value by 0.76%. The coefficient estimates of logarithm of distance variable shows that an increase in distance by 1% decreases the trade by 1.06%. The result is significant at level 0.01. Logarithm of tariff coefficient shows negative effect in trade value and is statistically significant at 95% confidence interval. Increase in tariff by 1% decreases the trade value by 0.75%.

Contiguity dummy coefficient has a positive sign and is statistically significant at 10%. Trade between contiguous countries is higher than the noncontiguous countries. Common language dummy also has positive and significant effect. Country pairs that have common language trade more CPO than countries with no common language. Same region dummy has negative but insignificant effect on CPO trade.

Table 2: Crude palm oil gravity results (HS 151110)

Variable	**Parameter**	**Std. Err.**	**z-value**	**P>z**
Intercept	20.21	1.69	11.93	0.00
Total GDP Per Capita (log)	0.76	0.12	6.59	0.00***
Distance(log)	-1.06	0.12	-8.92	0.00***
Tariff (log)	-0.75	0.23	-3.34	0.00***
Contiguity dummy	0.55	0.32	1.74	0.08*
WTO membership dummy	4.03	0.72	5.62	0.00***
Common Language Dummy	0.94	0.11	8.42	0.000***
Same Region Dummy	-0.36	0.73	-0.50	0.62

*p<0.1. **p<0.05, ***p<0.01; N = 54139, Pseudo R-square = 0.97

Notes: The model include importer-time and exporter-time fixed effects.

5.1.2 Refined palm oil (HS- 151190)

Table 3 shows the gravity model estimates for RPO trade. Again, GDP per capita positively affects the total trade of RPO, with an elasticity of 0.94 and statistical significance. Distance coefficient is negative and statistically significant. An increase in distance by 1% reduces

the trade between countries by 1.13%. Similarly tariff coefficient is significant and the elasticity shows that the trade is negatively affected by tariff. An increase in average tariff by 1% decreases the trade in RPO by 0.45%.

The coefficient on contiguity shows that the adjacent countries trade more of refined palm oil than the non-adjacent ones and this effect is statistically significant. Similarly, WTO membership, same region, and common language dummies also positively influence trade flows. Members with both countries recognized by WTO trade more than the countries that are not within WTO membership or have only one of the countries with WTO membership. Common language dummy showe that trade increases for a country pair which has a common language.

Table 3: Refined palm oil gravity results (HS 151190)

Variable	**Parameter**	**Std. Err.**	**z-value**	**P>z**
Intercept	18.80	1.21	15.53	0.00
Total GDP Per Capita (log)	0.94	0.09	11.06	0.00***
Distance(log)	-1.13	0.10	-11.72	0.00***
Tariff (log)	-0.45	0.07	-6.95	0.00***
Contiguity dummy	0.42	0.15	2.76	0.01***
WTO membership dummy	2.19	0.65	3.38	0.00***
Common Language Dummy	0.75	0.09	8.97	0.00***
Same Region Dummy	1.65	0.18	8.99	0.00***

*p<0.1. **p<0.05, ***p<0.01; N = 98190, Pseudo R-square = 0.96

Notes: The model include importer-time and exporter-time fixed effects.

5.1.3 Palm oil (HS 1511)

The gravity model for palm oil and its fractions whether refined or not, but not chemically modified (HS 1511) shows a positive and highly significant relationship between trade and GDP per capita. An increase in the combined GDP per capital of exporter and importer increases all palm oil trade value by 1.24%. Distance and tariff have significantly negative effect on trade flows. For every 1% increase in distance between countries, trade value decreases by 0.73%. If tariff increases by 10% for country pairs, trade value decreases by 6.61 percentage points. WTO memberships, common language and same region positively affect the trade between countries. WTO member countries trade more than the countries that are not WTO members. Countries within the same region, trade more palm oil than countries that do not fall under the same region.

Table 4: Palm oil gravity results (HS 1511)

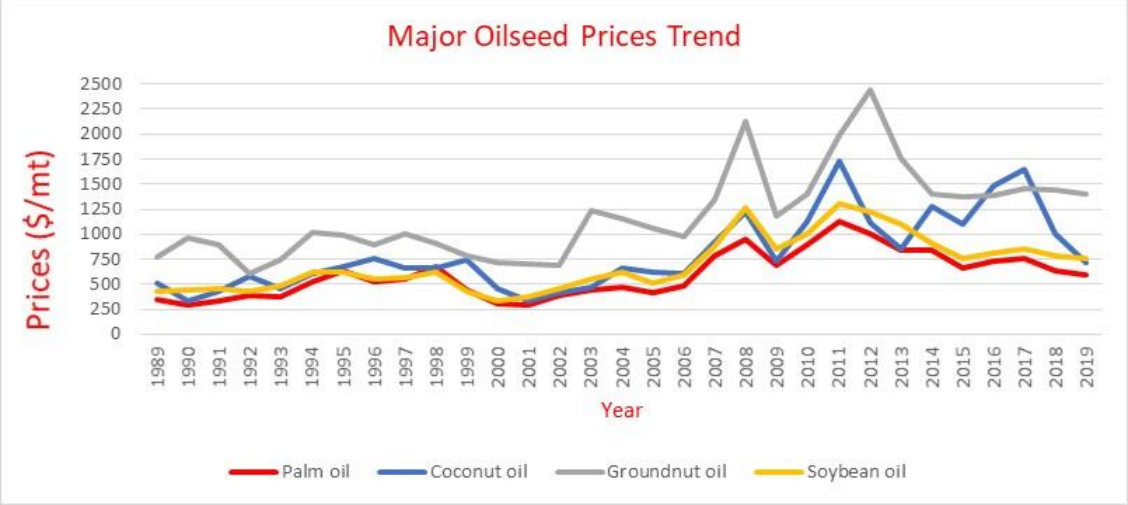
Variable	**Parameter**	**Std. Err.**	**z-value**	**P>z**
Intercept	15.36	1.43	10.73	0.00
Total GDP Per Capita (log)	1.24	0.09	13.66	0.00***
Distance(log)	-0.73	0.11	-6.66	0.00***
Tariff (log)	-0.66	0.10	-6.46	0.00***
Contiguity dummy	0.10	0.14	0.71	0.36
WTO membership dummy	1.74	0.68	2.55	0.01**
Common Language Dummy	1.07	0.08	13.66	0.00***
Same Region Dummy	0.54	0.18	2.96	0.00***

*p<0.1. **p<0.05, ***p<0.01; N = 9,271, Pseudo R-square = 0.96

Notes: The model include importer-time and exporter-time fixed effects.

5.2 Discussion

Major palm oil importing and exporting countries are some of the world's largest and fast-growing economies. As noted earlier, India, China, and EU are some of the top importing countries. Along with Pakistan, they accounted for much of the imports in early 90s (FAS, 2020). In 2019, these three countries together made up more than 78% of total imports across all countries (UN, 2020a). Palm oil is attractive to highly populated and developing countries like India and China because of its affordability. Figure 4 shows that palm oil prices in US$ per ton have been the lowest compared to other major edible oils, e.g., soybean oil.

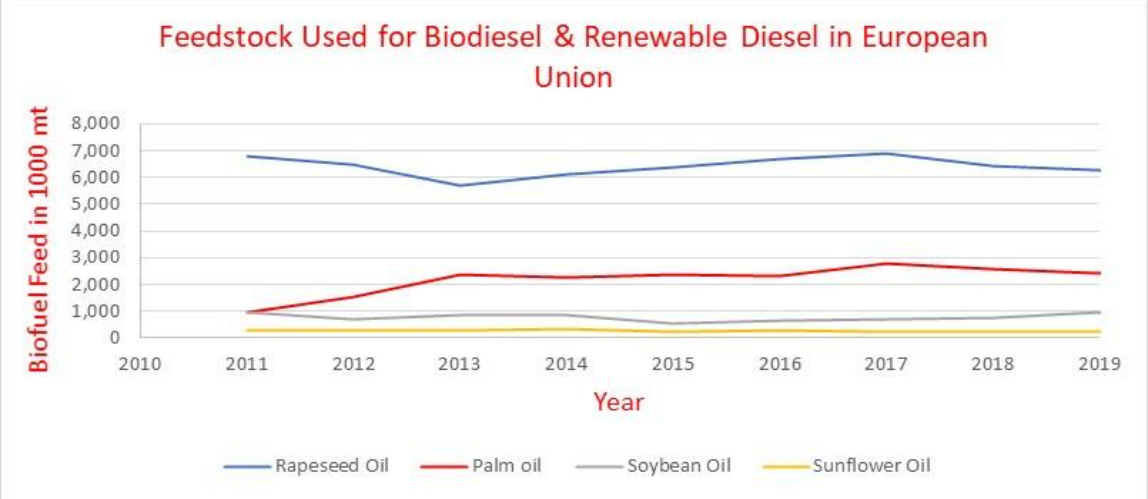


Source: (*Global Economic Prospects*, 1989-2019)

Figure 4: Major oilseeds prices trend (1989 – 2019)

EU on the other hand due to its RED launched in 2009 was driven towards the usage of palm oil in biofuel to meet sustainability goals. The total European consumption of palm oil has increased at an average annual rate of 7.22%, most of which is imported (FAS, 2020). Palm oil

contains high amount of palmitic and oleic acid and has higher heating value which are desirable properties of feedstock used to produce biodiesel (Zahan and Kano, 2018). It is the second most used feedstock in EU after rapeseed mainly due to the winter stability of rapeseed, but lower price of palm oil has always remained an attractive factor (figure 5).



Source: (USDA, 2019)

Figure 5: Amount of feedstock used in biofuel and renewable biodiesel in EU (2010-2019)

Some other reasons why global palm oil trade increased over the years include the desirable nutritional properties of palm oil, usage in cosmetics and cleaning products and increase in demand for oleochemicals. It is the most versatile oil used by more than 3 billion people. While developed countries are already consuming more protein-based diet the shift of people in the developing and emerging economies towards has increased the demand of cheap oils like oil palm. The wide consumption requirement is however fulfilled by producers from merely 12 tropical countries of the world. These tropical countries have absolute advantages in producing palm oil given their appropriate climate and topographical conditions. Most of the produce is destined to export to the

consuming countries. Large exports from emerging economies like Indonesia and Malaysia to EU, China, and India justify the positive relation of GDP and trade value identified in this study. With the rise in GDP and thereby income, demand can increase. Income growth has increased the affordability of protein-based diet across countries especially the developing ones and this shift further increase the intake of edible oil. Silva and Tenreyro (2006) in their study confirmed the positive effect of importers and exporters' GDP when traditional gravity equation is estimated by using PPML. Other researches covering agriculture and oilseeds trade have also shown similar effect of GDP and GDP per capita. Wang (2016) found the positive effect of GDP on palm, rapeseed, sunflower and soybean oil trade. Zahniser, Pick, Pompelli, and Gehlhar (2002) also observed the positive effect of importing countries' GDP on the US agricultural export between year 1989-93 using gravity model. Kavallari, Maas, and Schmitz (2010) in their study of German olive oil imports also found that the GDP per capita of trading countries have positive impact on the olive oil import.

Researchers have found that geographical distance negatively impact trade between countries (Umana Dajud, 2013, Borchert & Yotov, 2017). An implication can be drawn that being close certainly favor palm oil sector and exporting economies. Largest importers India and China are relatively closer to the largest exporters: Indonesia and Malaysia. Besides, countries in South East Asia like Singapore also participate in processing of imported palm and exporting to other countries. South Asian and European countries in recent years are also involved in vertical trade of RPO. Lower transportation cost between neighboring countries appears to be responsible for inducing trade of palm oil between closely located nations. The negative effect of distance is higher

in case of refined than crude. The concentration of palm oil production in some countries only justifies the lower effect of distance on trade value of crude palm than refined palm.

Also, contiguous countries trade more of refined as well as crude palm oil. Even being the largest producer, Indonesia does not have processing mills and exports a large proportion of CPO to Malaysia for refining. Some of the other major palm oil players which are contiguous to each other are Indonesia and Papua New Guinea, Guatemala and Mexico, Thailand and Malaysia, Singapore and Malaysia, Peru and Colombia, Honduras, and Guatemala. The observed trade patterns are indeed consistent with this study's estimated positive effect of contiguity dummy and negative effect of distance on trade value of both refined and CPO. Yotov et al. (2016) in the trade policy analysis guide also document distance to be a trade barrier and sharing common border can help facilitate the trade. PPML estimation with importer-time and exporter-time fixed effect shows that an increase in distance by 0.841% reduces the trade by 1% and contiguous countries trade more than non-contiguous countries (Yotov et al., 2016). Other researches have shown similar effects of distance and contiguity. Priyati (2018) found the elasticity of distance between exporting and importing countries to be about negative 79%. Kim (2010) found that having common border impart positive advantage to trade. Wang (2016) also found the negative effect of distance on trade value of rapeseed, palm and sunflower oil and also mentioned that the result is supported by majority of studies on agricultural food crops. Kavallari et al. (2010) showed that distance between trading countries have negatively affected the olive oil import in Germany.

Membership within WTO is assumed to increase trade volumes and also to divert trade from non- WTO members to WTO member countries (Larch, Monteiro, Piermartini, & Yotov,

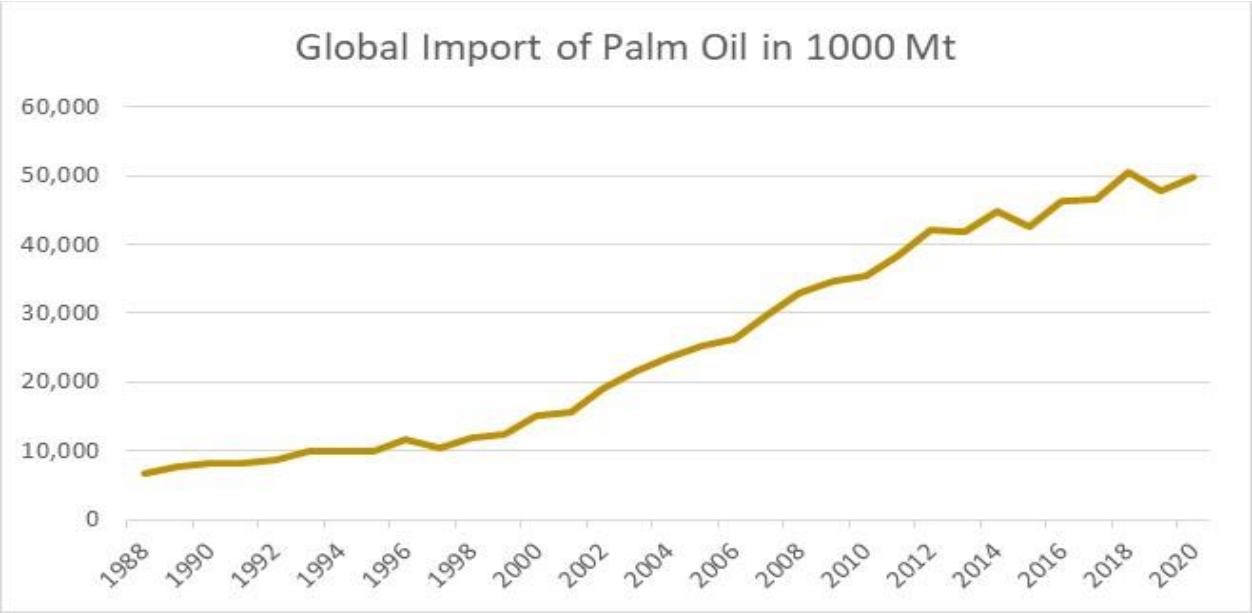
2019). MFN is highly prioritized by WTO (WTO) and it is the status in which countries enjoy the best trade terms when all partners are treated equally by every country. Kim (2011) found that since 1999, membership within WTO increased trade by establishing a rule-based multilateral trading system and enforcement framework. Table 5 provides a sample of list of major importers and exporters with their WTO membership year.

Table 5: World Trade Organization membership date of some of the exporters and importers

Importers	**Year**	**Exporter**	**Year**
India	1 January 1995	Indonesia	1 January 1995
Pakistan	1 January 1995	Malaysia	1 January 1995
Spain	1 January 1995	Netherlands	1 January 1995
Italy	1 January 1995	Papua New Guinea	9 June 1996
United States	1 January 1995	Colombia	30 April 1995
Netherlands	1 January 1995	Guatemala	21 July 1995
Russian Federation	22 August 2012	Germany	1 January 1995
Malaysia	1 January 1995	Honduras	1 January 1995
Germany	1 January 1995	Nepal	23 April 2004
Japan	1 January 1995	Thailand	1 January 1995
Pakistan	1 January 1995	Ecuador	21 January 1996
Turkey	26 March 1995	Singapore	1 January 1995

Source: ("Understanding the WTO: The Organization, Members & Observers,")

Most of these major palm oil exporters and importers were WTO members when it was created in 1995 and trade of palm oil grew significantly after 1996 which justifies the positive WTO membership coefficient. For example, in 1996, import of palm oil increased by 15% more than previous year (FAS, 2020).



Source: (FAS, 2020)

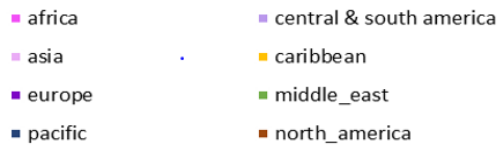
Figure 6: Global palm oil import (1988 – 2020)

All the fourteen regions classified by the USITC gravity data have major amounts of import from the South East Asian region followed by Central and Southern America. Figure 7 below shows that all regions import CPO mostly from Asia followed by Central and Southern America between 1988-2019. The negative coefficient of same region, implying higher trade value between countries if they are not in the same region appears consistent with the observed pattern of trade. Intraregional trade also happens in this major production region but because palm oil is extremely versatile and consumed all over the world, lot of interregional trade occurs. To fulfill the

consumption requirement, non-producing regions import from producing region, creating bigger effect of interregional trade.

However, in case of RPO figure 7 shows that Central and South American region, and Asian region have significant level of trade within the region. The intraregional trade is so high in case of RPO that justifies the positive coefficient of same region.

One of the major reasons for the difference in the effect of regions on world trade is the availability of processing facilities. Fresh fruit bunches need to be milled within 24 hours of harvest to prevent the formation of fatty acids which lower the commercial value of processed palm (Gbadebo - Smith). Major proportion of initial processing take place in Indonesia, Malaysia, and Singapore (Pacheco, Gnych, Dermawan, Komarudin, & Okarda, 2017). This has increased internal regional trade of CPO. While the RPO which is refined, bleached, and deodorized from CPO mainly done by large companies like Unilever, nestle are fragmented across the world (Pacheco et al., 2017). For instance, Wilmar has edible oil refineries in Europe, Africa, and East Asia while palm oil plantation and mills are concentrated in South East Asia and Africa only (Wilmar). Palm oil supply chain is more like an hourglass with few numbers of refiners sourcing palm oil from a large numbers of palm oil mills (Kate, Kuepper, & Piotrowski, 2020). Wang (2016) has reported that common border does not increase the palm oil trade and thus is not influenced by regional factor which has been observed in case of CPO in this study.



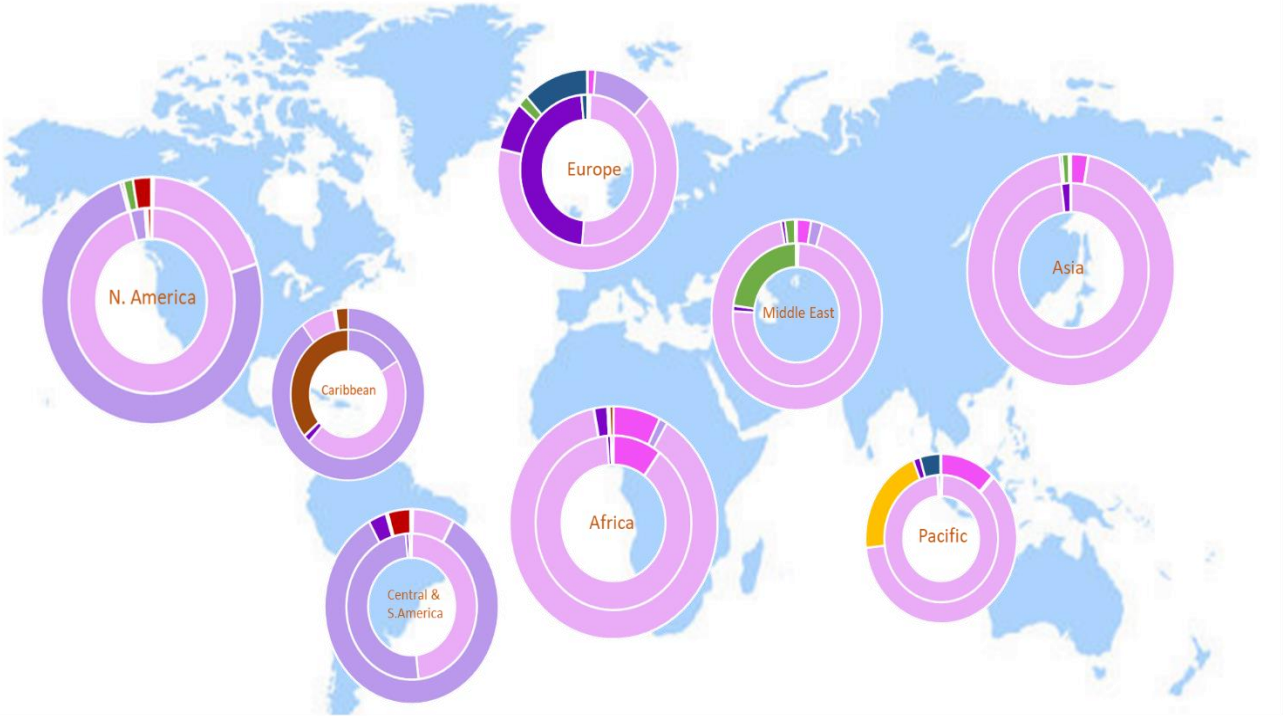


Figure 7: Total Palm oil trade flow from 1988 to 2019 between regions.

Outer ring is the CPO and inner ring is RPO. (World map: iStock by Getty Images), Data: (UN, 2020a)

Same language has also shown positive effect on the trade of both refined and CPO. Yotov et al. (2016) also reported the positive effect of common language on the trade value when PPML estimation with fixed effects was used. Other research has also shown that if enough people are to speak the same language, more trade happen between countries as trade becomes cheaper and easier with easy communication ((Fidrmuc & Fidrmuc, 2016), Wang (2016)). Wang (2016) reported that language facilitate communication required during economic transaction.

Tariffs are the taxes usually levied by the importing country. Tariff increases the price of imports increasing the domestic prices of goods and thus, countries import less of the commodity. This also increases the domestic supply of palm oil importing countries. Palm oil which is mainly popular in the major importing countries due to its prices is highly affected by the change in tariffs as price increases. Countries increase import tariff according to the global price of the commodity. Indian import which is relatively more sensitive to price changes has changed the import tariffs frequently over the years (Carter et al., 2007). For instance, in the 1990's the tariffs on all edible oils was relatively low due to high world oil prices, which later was increased when prices declined (Carter et al., 2007). Increase or decrease in such tariffs decreases or increases imports. Tariff liberalization policies executed in India was responsible for a substantial increase in imports since the mid-1990s (Dohlman, Persaud, & Landes, 2003).

Countries also impose taxes to promote domestic production. Sub-Saharan countries including Nigeria, Ghana, Tanzania, and Kenya have practiced this kind of protection measures which have reduced the import and promoted the production of palm oil within the country (Nordin). To reduce the import Nigeria imposed 35% of tariff duty on palm oil since 2008 (Gourichon, 2019). Government of Tanzania increased its palm oil import tariff from 10% to 25% in 2018 (UNIDO, 2019). In 2019 the import of palm oil to Tanzania from Malaysia was reduced to zero. (MPOB as cited by (Nordin)). United States, which approved the use of palm oil in biodiesel produced from the facilities constructed before 2010, also observed a decrease in palm biodiesel imports once the anti-dumping tariffs was imposed on Indonesian biodiesel (Searle, 2019). Availability of alternate edible oil sources often boosts this import reduction as countries opt for alternate edible oil, especially produced inside the country, sources as tariff increases.

These instances of reduced imports as tariffs increase and vice versa are well captured by the gravity model in this study, which identified a negative coefficient of tariffs. Both refined and CPO trade have been impacted by tariff by a significant amount and liberalization of those tariffs have helped increase the trade which will be discussed further.

CHAPTER 6

TRADE AGREEMENTS AND RECENT POLICIES SIMULATION

6.1 Trade Agreements

Under the original General Agreement of Trade and Tariffs (GATT) countries impose MFN tariff on each other but are also allowed exceptions as part of a separate agreement (regional or preferential) with other countries. To interact preferentially with countries, form local 'blocs' which enhances the trade as countries consider the geographical proximity, policy alignment and other factors. These agreements differentiate partners into MFN (applied tariff) nations and preferential/free (trade agreements) nations (FTA tariffs). Countries have signed trade agreements, preferential tariff regimes and customs union to facilitate the trade with other countries. Several bilateral, multilateral and RTAs are currently in effect affecting palm oil trade. These liberalization attempts aim to create better market access and also include trade facilitation; harmonization of sanitary and phytosanitary measures, and technical barriers; and protection of intellectual property rights (Balu & Ismail, 2011). Previous research has shown that the preferential system of trade can increase trade flows (Rose, 2004).

Palm oil exports from Indonesia and Malaysia, especially CPO, have shown some sharp trends in the last three decades. For example, India, ASEAN, EU, China, and other South Asian Countries all show a spike in CPO import from both Indonesia and Malaysia during 2010 to 2012 (figure 8 and 9). China's import value of CPO from Malaysia and Indonesia had witnessed a significantly increased in 2008 as well.

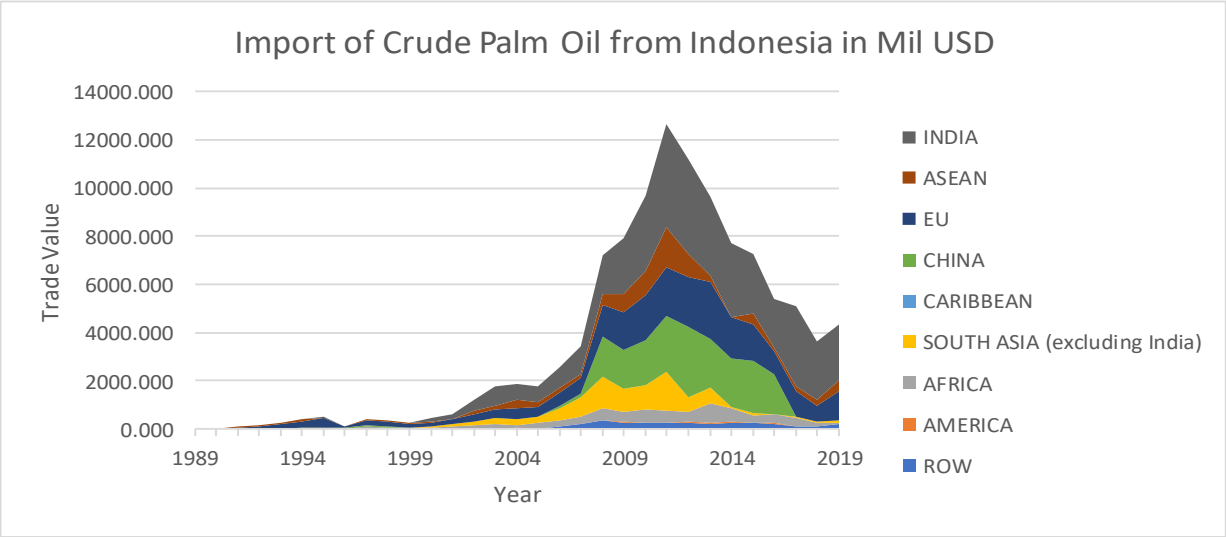


Figure 8: Import value of crude palm oil from Indonesia by major regions and countries (1989 – 2019)

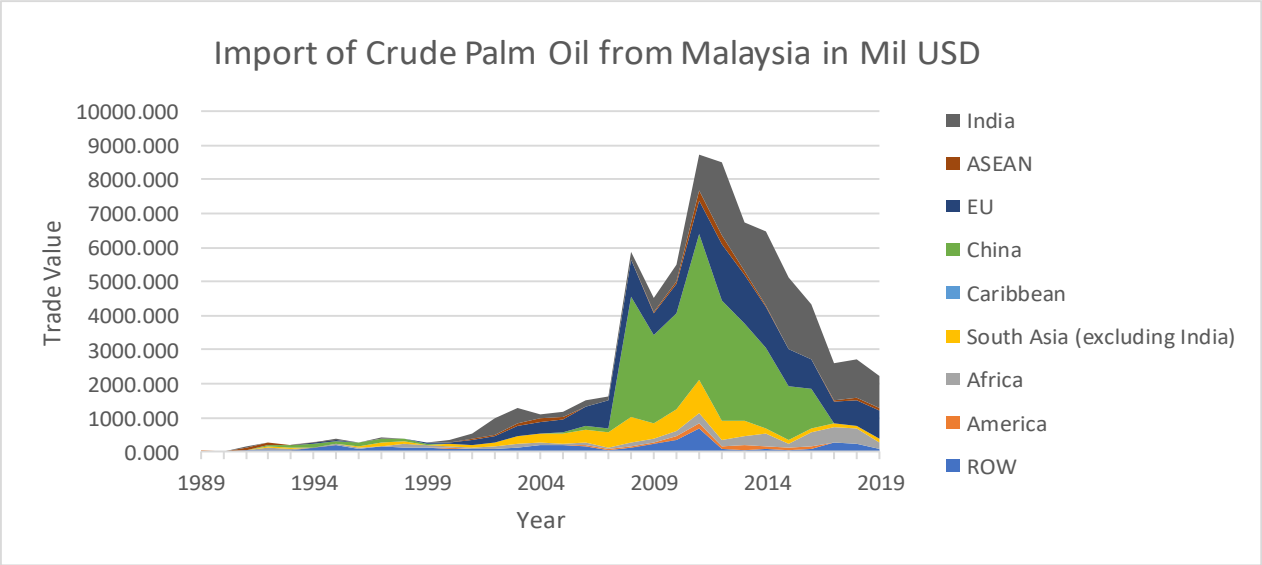


Figure 9: Import value of crude palm oil from Malaysia by major regions and countries (1989 – 2019)

These changes were partly influenced by the trade agreements established by ASEAN (Pujiati, 2014). Especially, between the year 2010-2020 some of the major palm oil players have

also signed some important agreements to facilitate the existing trade. Bilateral trade agreement between Malaysia and Japan signed in 2006 caused a growth of palm oil exports from 0.47 million tons to 0.51 million tons between 2005 to 2014 (MPOB (2005-2014) as cited by Olatunji and dan Pengurusan (2015)).

South Asian countries like Bangladesh and Nepal export RPO to India on a zero-tariff rate utilizing the advantages of South Asian FTA (Duke & Das, 2020). EU has trade agreements with several pacific States, which supply palm oil and palm kernel oil. Papua-New Guinea, one of the top exporters to EU among pacific states, maintains a duty FTA with EU for major agricultural products including palm oil (*Papua New Guinea Trade Policy Framework*, 2006).

To see the effect of trade agreements on global palm oil trade some of the major FTAs for refined as well as crude palm oil have been identified (Appendix B & C). Effects have been simulated using the trade elasticities from the gravity models and the difference between MFN and preferential tariffs.

6.1.1 Crude palm oil FTA simulation

Table 6: Crude palm oil FTA simulation

FTA	implemented year	MFN tariff	FTA tariff	% Change	Prior year trade value in Mil USD	Elasticity	elasticity *% change	Trade (FTA implemented countries in implemented year) in Mil USD	Total trade (implemented year) in Mil USD	FTA induced trade %
ASEAN-India	2010	60.37	39.89	-33.92%	2751.35	-0.75	0.26	703.67	17789.00	3.96
ATIGA	2010	21.50	1.07	-95.01%	818.17	-0.75	0.72	586.14	17789.00	3.30
SAFTA	2004	59.51	25.16	-57.72%	2.23	-0.75	0.44	0.97	3632.75	0.03
US-Colombia	2012	10.00	0.00	-100.00%	4.20	-0.75	0.75	3.17	23652.26	0.01

An agreement between ASEAN and India (AIFTA) trade came into effect on 1st January 2010. The average MFN tariff imposed by India on ASEAN countries and ASEAN on India before the trade agreement came into effect is 60.37% (2010 – 2019), while the new AIFTA tariff is 39.90%. The difference between these two tariffs multiplied by the tariff elasticity and further multiplied by the prior year trade value (2009) gives the trade value that occurred due to implementation of AIFTA. Table 6 shows that AIFTA is responsible of more than 703 million USD of trade increase in 2010 which is about 3.96% of the global crude palm oil trade value. Similarly, ASEAN trade in goods agreement (ATIGA) which was implemented in 2010 was responsible for an increase of more than 586 million USD of palm oil trade among ASEAN countries. Table 6 also shows that ATIGA induced trade was 3.30% of global trade of palm oil in 2010. South Asian FTA (SAFTA) that came into force in 2004 was signed by seven South Asian countries and later joined by Afghanistan. The MFN tariff among these countries averages out to 59.51% and FTA (SAFTA) tariff averages to 21.50%. Lower FTA tariff was responsible for an increase of trade value by 0.44% in 2004 from 2003 among South Asian countries. The implementation of FTA induced a smaller 0.03% of total global palm oil trade compared to AIFTA or ATIGA. Colombia which is one of the major exporters of palm oil signed an FTA with the United States in 2012. Before the average MFN tariff between these two nations was 10% which was completely removed in 2012. The FTA became responsible for about 0.01% increase of global palm oil trade. Apart from the FTA effects presented in table 6, many other agreements that have preferential treatment of palm oil include ASEAN-New Zealand- Australia, Chile-US, US-Bahrain, US-Oman FTAs.

Detailed information on these trade agreements is in the appendices B & C.

6.1.2 Refined palm oil FTA simulation

Table 7: Refined palm oil FTA simulation

FTA	Implementation year	MFN tariff	FTA tariff	% Change	Prior year trade value in Mil USD	Elasticity	elasticity *% change	Trade (FTA implemented countries in implemented year) in Mil USD	Total trade in implemented year) in Mil USD	FTA induced trade %
EU-Colombia	2012	16.40	10.46	-36.21	8.16	-0.45	0.16	1.33	17193.95	0.01
ASEAN-India	2010	55.86	42.23	-24.40	748.26	-0.45	0.11	82.01	11776.43	0.70
EU-Pacific States	2009	12.80	1.98	-84.53	369.86	-0.45	0.38	140.39	13879.26	1.01
ATIGA	2010	14.80	3.39	-77.09	488.48	-0.45	0.35	169.05	11776.43	1.44

Tables 7 computes FTA effects similar to that in table 6, but for RPO. Four trade agreement's effects are computed: between EU (one of the major importers of RPO) and Colombia (one of the major exporters); Papua New Guinea and EU; South East Asian Countries and India; and within ASEAN countries. ATIGA implemented in 2010 has MFN tariff average of 14.80% between 2010-2019 and FTA tariff of 3.39%. The difference of 77.08% when multiplied with the elasticity from the gravity model gives the percentage change in trade due to FTA. This difference was responsible for growth of more than 169 million USD worth of trade in 2010 from 2009. As a result, ATIGA was responsible for about 1.44% of total trade among all countries. Similarly, EU-Pacific States FTA between Papua New Guinea and EU implemented in 2009 increased RPO trade by more than 140 million USD, accounting for 1.01% of global trade. AIFTA, which is the trade agreement between largest exporter and largest importer, was responsible for 0.70% of total trade that happened in 2010. Although EU-Colombia pair had a 36.22% difference between MFN and FTA tariff, trade created by their agreement accounted for about 0.01% only of global trade.

Wang (2016) in his study of factors influencing four types of vegetable oil trade found that mutual FTAs between palm oil partners generate more than 77% palm oil trade on average compared to the partners who do not have FTAs. Baryshpolets and Devadoss (2021) found that Deep and Comprehensive Free Trade Area (DCFTA) increased the exports of the sunflower oil from Ukraine to EU by 80%. According to the theory of preferential trade both exporting and importing economies can improve welfare through such agreements. It reduces or removes the tariff which further reduces the price, and more trade happens than before- the situation of trade creation. On the other hand, the abolition of tariff shifts the importing market from higher price to lower hence creating diversion of trade.

6.2 Policy Effects Simulation

6.2.1 Covid-19 and palm oil trade

Countries during crisis like Covid-19 already face a lot of import restrictions disrupting the supply chain. This can result in food insecurity, medical emergencies, and economic downturn. As noted earlier to restrain the rising food prices due to Covid-19, India reduced the palm oil tariff by 10 percentage points in November 2020 (USDA, 2020). In 2019, out of total 3.56 billion of USD of India's palm oil imports, Indonesia and Malaysia accounted for 92% (UN, 2020a). Considering this significant value of imports from these top two exporters, 10% reduction of tariff shows following effect on trade flows (table 8 and 9). Indian tariff for Malaysia and Indonesia for CPO was 37.50% in 2019.

Table 8: Change in Indian tariff due to Covid-19

Original Tariff	New Tariff	Change	% Change
37.50	27.50	-10.00	-26.67

Table 9: Crude palm oil tariff change policy simulation

Elasticity	-0.75
% Change in Value of Imports	20.11
Base Value of Import from Malaysia and Indonesia (2019) in mil USD	3286.61
Change in Trade value in mil USD	660.91

Above results show that a decrease in tariff by 10 percentage points increases the value of imports of CPO by India from Indonesia and Malaysia by more than 660 million USD. Tariff reduction by India alone, increases the global trade value of palm oil by 7.75% considering 2019 data. According to an article from a major newspaper (The Hindu Business Line, 2021), in the first quarter of oil year 2021, the CPO import jumped 24% due to this policy change which is quite consistent with above results.

6.2.2 EU sustainability policy simulation

Tariffs are commonly used by countries to limit the trade. Having said that there are a number of NTMs imposed by countries in various circumstances. UNCTAD defines NTMs as policy measures other than the ordinary tariffs that can potentially affect the international trade of goods and services. As noted in 2.3 NTMs can change quantities traded, prices or both. NTMs include technical measures such as sanitary, phytosanitary, environmental measures along with policies like quotas, export restrictions, price controls and behind the board measures like competition, government procurements and others. These measures intend to overcome the effects of negative externalities and reduce the impacts of market imperfections ((Van Tongeren, Beghin and Marette, 2009); (Cadot, Gourdon and& Van Tongeren, 2018)).

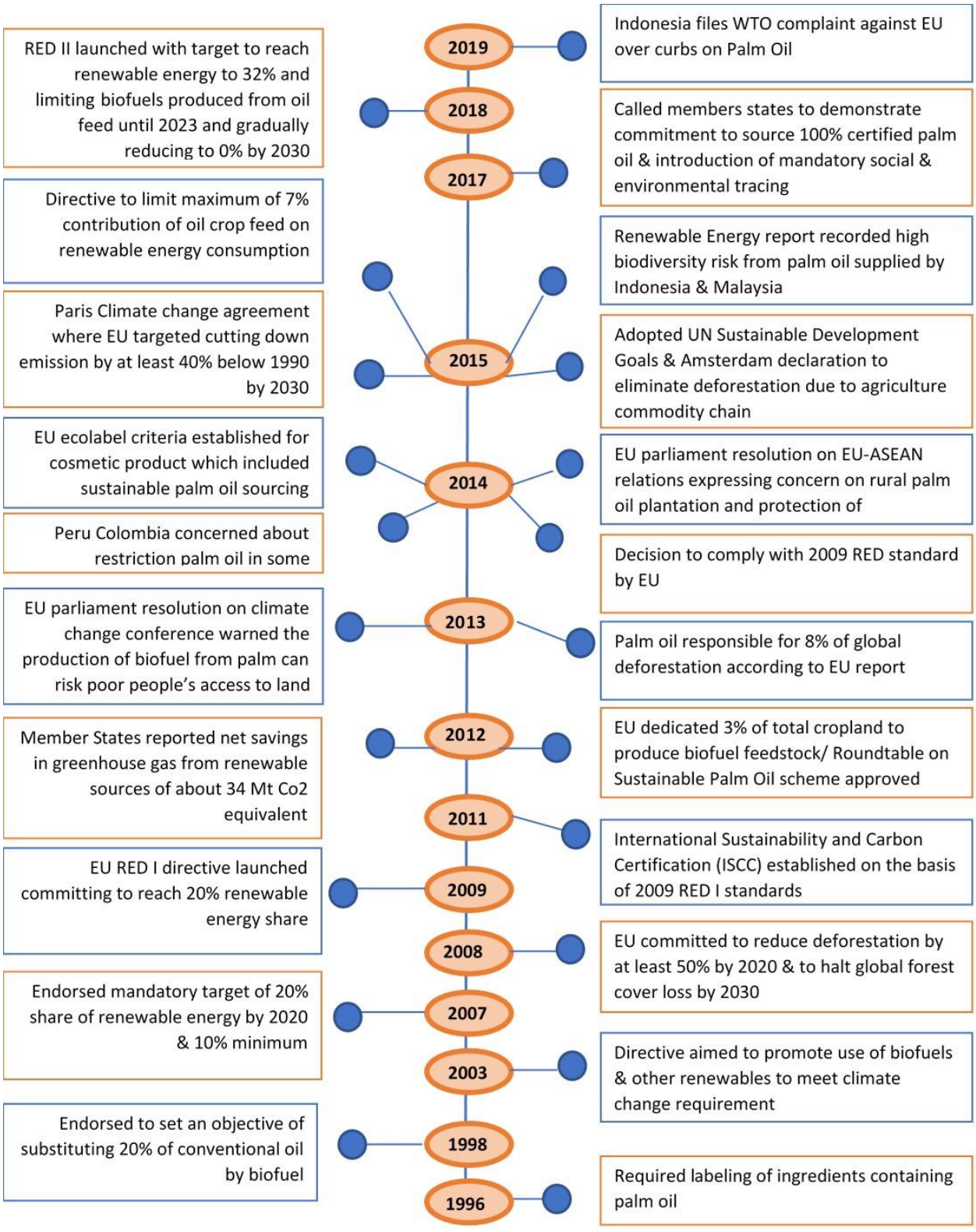
EU has imposed sustainability barriers on palm oil that is used in biofuel. EU is the world's largest biodiesel producer (USDA, 2019). It is the second largest palm oil importer and has been said to be a reference market for Indonesia as it influences the decisions of other buyers of palm oil ((Tyson and Meganingtyas (2020), Lingga (2019)). The RED 2009/28/EC launched in 2009

substantially increased the import of palm oil as member states had to comply with the target to achieve a renewable energy rate of 20% of total energy consumption.

At the end of 2018, RED II was launched to address indirect land-use change (ILUC) emission. The directive set limit of the level of palm oil-based biofuel to the level of use of 2019 until 2023 for EU member countries and gradually phase out the usage of ILUC-risk biofuels including palm oil in biofuels use by 2030 (European Commission, 2018). This directive however does not completely stop EU countries to import palm oil for biofuel but only stops considering the palm oil biofuel as a renewable energy source (Jong, 2019). Malaysia and Indonesia however describe this policy as a "ban of palm oil" and "crop apartheid" (Hinkes, 2020). Following the news of EU policy of palm oil ban in 2018, exporters in Malaysia joined forces to improve their sales in other markets (FAO, 2020). According to Transport and Environment (2018), about 65% of the palm oil imported in EU was used for energy of which 53% was used in biofuel (Muzi, 2019). In 2019, the quantity of usage of palm oil in biofuel increased by 7% than the previous year in EU (Bannon, 2020). Figure 9 provides a timeline of EU's RED I and II.

EU Trade Policy Related to Palm oil Timeline

Table 10: EU trade policy related to palm oil timeline



NTMs have effects similar to the ordinary tariffs. These barriers are often estimated using ad valorem equivalents (AVEs) equivalents. AVEs can proxy for the custom duties calculated as a percentage of the value of the product. AVEs of NTMs for EU are taken from the World Bank, which computed these measures for various commodities and countries based on a sample of NTMs collected between 2012 and 2016. The AVEs provided by the World Bank are based on the estimation method developed in the work of Kee and Nicita (2016) which in turn was built upon the work of Looi Kee, Nicita, and Olarreaga (2009). In their method they consider sanitary and phytosanitary measures like labeling, hygiene, pesticide residue limits, testing and others along with technical barriers including requirements of labelling, product quality, packaging, and certifications. For RPO, EU's AVE was 5.25% according to the World Bank (The World Bank Group, 2019).

Considering the addition of NTMs on top of the previously applied import tariffs, EU sustainability barrier has been simulated below in table 10 and 11.

Table 11: Change in tariff due to Ad valorem equivalent of EU Non-tariff measures

Tariff Mean EU- ASEAN	AVE of NTB	Total	% Change
5.720	5.25	10.97	91.70

Table 12: EU sustainability barrier simulation

Elasticity	-0.45
% Change in Value of Imports	-41.26
Base Value of Import from ASEAN (2010-2016)	9235.90
Change in Trade value in mil USD	-3811.02

The above simulation shows that if there is an implementation of 5.25% of additional barriers to the current tariffs, total tariffs increase by more than 91%. Using the elasticity of the RPO (0.45) and the increment of 91.70% of tariffs, table 11 shows the large decrease in the trade value, i.e., 41.26%. If the total import of RPO from ASEAN region between 2010 to 2016 is considered, the above change due to NTMs can amount to more than USD 3 billion of trade. Alternatively, this is the value of trade that will not be reduced from the total value of palm oil that EU would have imported from ASEAN if there were no NTMs.

EU is looking to completely ban palm oil usage in sustainable biofuel by 2030. Such NTMs will likely be responsible for a higher decline in the trade value. This trade-inhibiting barrier reduces the export and increase the domestic prices to source more supplies from domestic producers. Since EU is one of the largest consumers of palm oil, exporters (Indonesia and Malaysia) can expect surpluses with falling world market prices. The later has a negative welfare impact on the exporters with job and income losses. Having said that there will be more stock for domestic market as well as other countries. For instance, Indonesia itself has mandated the use of palm oil in fuel production. Excess stock can provide domestic fuel industries lower priced product. Besides, EU can shift palm oil imports into the food sector and remain a large importer.

CHAPTER 7

SUMMARY AND CONCLUSION

Palm oil is a very high-yielding, profitable and affordable oil consumed widely in agriculture, industry and transportation sectors. Due to concentrated production and wide consumption via international trade, palm oil has become an indispensable link of the global supply chain. This study examined the determinants of global palm oil trade with particular attention to the effect of trade and environmental policies while controlling for a host of other determinants like population and income growth, and distance between trade partners and any non-policy association among trading nations.

Before the establishment of Generalized Agreement on Trade and Tariff (GATT), palm oil trade was limited within a few production regions and countries around them. However, as countries opened up to trade, palm oil trade grew faster than the total trade in goods and services. Using data from 1988-2020 on trade, economic variables such as GDP, population and others, and measures of trade policy such as applied/FTA tariffs and non-tariff measures, this study estimated a gravity model of trade patterns. A number of data and measurement issues were satisfactorily addressed, and extensive statistical tests were conducted to estimate the final version of the model.

While proximity and countries' economic growth affected palm oil trade, several policies implemented by major actors in recent years have significantly contributed to observed patterns of

trade. Among the key determinants, GDP per capita positively affected palm oil trade as countries with fast-growing GDP like India, China, Indonesia and EU are some of the major actors in the palm oil supply chain. Distance between countries, often a proxy for transportation costs (and hence, with implications for infrastructure policies) has negative effects on the import of both refined and crude palm oil. WTO membership of trade partners has highly facilitated the trade. Similarly, having a common language or being contiguous to a trade partner increased palm oil trade. As expected, the tariff of the importing country has a significant negative effect on refined and palm oil trade. Importer- time and exporter- time effects in the model has controlled for all other potential effects (e.g., substitutability) that can affect palm oil trade. In terms of economic significance, distance had the largest elasticity in both refined and crude palm oil trade models, followed by GDP per capita and tariff.

To reduce barriers to trade, countries have established bilateral or regional preferential agreements or arrangements. The estimates from the gravity model allow for evaluating the effects of a selected set of (major) agreements. This study found that some major agreements have been responsible for increasing palm oil trade by up to 8% of global import value. Also, the estimated gravity model allows simulation of recent or upcoming policy changes either expanding or limiting trade. For example, recent liberalization by India, due to the Covid-19 pandemic, is found to be responsible to increase palm oil trade by up to 20% of India's import value. On the other side, EU's potential ban on palm-based biofuel production has large negative effects on palm oil trade with implications for jobs and income of millions in Indonesia, the major exporter.

To conclude, palm oil's dramatic trade growth in the past three decades can be attributed to the usual suspects, e.g., economic growth of hungry giants (China and India) and proximity, but trade and environmental policies are also important determinants of trade. With increasing protein consumption in large and fast-growing economies, this cheaper edible oil and its meal have a critical role in the quality of their diets. Palm oil remains a viable feedstock for biofuels and a critical oleochemical for industrial use. However, trade and environmental policies – tariffs, non-tariff measures such as the sustainability ban – can greatly impact the pattern of trade and the welfare of a large share of the world population. Future studies can improve on measuring policies, especially the anticipated changes and their effects.

REFERENCES

Adam, C., & Cobham, D. (2007). *Modelling multilateral trade resistance in a gravity model with exchange rate regimes.* Paper presented at the Centre for dynamic macroeconomic analysis conference papers.

Amiruddin, M. N. (2003). Palm oil products exports, prices and export duties: Malaysia and Indonesia compared. *Oil Palm Industry Economic Journal*, *3*(2), 15-20.

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. *The American economic review*, *69*(1), 106-116.

Anderson, J. E., Larch, M., & Yotov, Y. (2015). Estimating general equilibrium trade policy effects: GE PPML.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American economic review*, *93*(1), 170-192.

Arshad, M., Shamsudin, M. N., & Mohamed, Z. A. (2016). AFTA and its implication to the export demand of Indonesian palm oil.

ASEAN Tariff Finder. Retrieved from https://tariff-finder.asean.org/.

Bakar, E. S., Sahri, M. H., & H'ng, P. (2008). Anatomical characteristics and utilization of oil palm wood. *The formation of wood in tropical forest trees–a challenge from the perspective of functional wood anatomy*, 161-178.

Balu, N., & Ismail, N. (2011). Free trade agreement–the way forward for the malaysian palm oil industry. *Oil Palm Industry Economic Journal*, *2*, 26-35.

Bannon, E. (Producer). (2020, July 23). Record levels of palm oil in diesel as 'burning food for fuel' madness continues. *Transport & Environment*. Retrieved from https://www.transportenvironment.org/news/record-levels-palm-oil-diesel-%E2%80%98burning-food-fuel%E2%80%99-madness-continues

Barthel, M., Jennings, S., Schreiber, W., Sheane, R., Royston, S., Fry, J., . . . McGill, J. (2018). *Study on the Environmental Impact of Palm Oil Consumption and on Existing Sustainability Standards: Final Report and Appendices*: Publications Office of the European Union.

Baryshpolets, A., & Devadoss, S. (2021). The effects of EU–Ukraine free trade agreement on the world's sunflower complex. European Review of Agricultural Economics.

Basiron, Y. (2002). Palm oil and its global supply and demand prospects. *Oil Palm Industry Economic Journal, 2*(1), 1-10.

Bergstrand, J. H. (1985). The gravity equation in international trade: some microeconomic foundations and empirical evidence. *The review of economics and statistics*, 474-481.

Bhattacharya, A. (2019). *Effect of high temperature on crop productivity and metabolism of macro molecules*: Academic Press.

Borchert, I., & Yotov, Y. V. (2017). Distance, globalization, and international trade. *Economics letters, 153*, 32-38.

Bowyer, J., Howe, J., Levins, R., Groot, H., Fernholz, K., Pepke, E., & Henderson, C. (2018). Third generation biofuels implications for wood-derived fuels. In: Dovetail Partners, Inc. Minneapolis, MN.

Brack, D., Glover, A., & Wellesley, L. (2016). Agricultural Commodity Supply Chains.

Cadot, O., Gourdon, J., & Van Tongeren, F. (2018). Estimating Ad Valorem Equivalents of Non-Tariff Measures: Combining Price-Based and Quantity-Based Approaches.

Canada Tariff Finder. Retrieved from https://www.tariffinder.ca/en/.

Carter, C., Finley, W., Fry, J., Jackson, D., & Willis, L. (2007). Palm oil markets and future supply. *European Journal of Lipid Science and Technology*, *109*(4), 307-314.

Chaney, T. (2008). Distorted gravity: the intensive and extensive margins of international trade. *American Economic Review*, *98*(4), 1707-1721.

Chor, D. (2010). Unpacking sources of comparative advantage: A quantitative approach. *Journal of International Economics*, *82*(2), 152-167.

Ciuriak, D., & Kinjo, S. (2006). Trade specialization in the gravity model of international trade. *Trade policy research*, *2005*, 189-197.

Coriakula, J., Moodie, M., Waqa, G., Latu, C., Snowdon, W., & Bell, C. (2018). The development and implementation of a new import duty on palm oil to reduce non-communicable disease in Fiji. *Globalization and health*, *14*(1), 1-9.

Cuevas García-Dorado, S. (2019). *The nutritional and economic effects of palm oil trade liberalisation in India: A policy analysis.* London School of Hygiene & Tropical Medicine,

Devadason, E. S. (2020). "New Protectionism" in ASEAN. *Journal of Asia-Pacific Business*, *21*(1), 57-76. doi:10.1080/10599231.2020.1708232

Dian, N., Hamid, R., Kanagaratnam, S., Isa, W. A., Hassim, N. A. M., Ismail, N. H., . . . Sahri, M. M. (2017). Palm oil and palm kernel oil: Versatile ingredients for food applications. *Journal of Oil Palm Research*, *29*(4), 487-511.

Dohlman, E. N., Persaud, S. C., & Landes, R. (2003). *India's edible oil sector: Imports fill rising demand*: US Department of Agriculture, Economic Research Service.

Duke, G., & Das, A. (2020, May 12). India suspends import licenses for refined palm oil on alleged rule of origin violations: government.

Eaton, J., & Kortum, S. (2002). Technology, geography, and trade. *Econometrica, 70*(5), 1741-1779.

EIA. (2020). Biofuels explained, Ethanol and biomass-based diesel.

EU. (2009). Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. *Official Journal of the European Union, 5*, 2009.

European Commission. (2018). Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast). In *Official Journal of the European Union*: European Commission.

FAO. (2020). *Oilcrops Complex: Policy Changes and Industry Measures Annual Compendium*. Retrieved from Rome, Italy:

FAS, U. (2020). Production, Supply and Distribution (PS&D). In *Market and Trade Data*: United States Department of Agriculture, Foreign Agricultural Service.

Fidrmuc, J., & Fidrmuc, J. (2016). Foreign languages and trade: evidence from a natural experiment. *Empirical Economics, 50*(1), 31-49.

Folfas, P. (2011). FDI between EU member states: gravity model and taxes. *Warsaw: Warsaw School of Economics–Institute of International Economics*, 1-16.

FTA Portal. Retrieved from https://ftaportal.dfat.gov.au/. from Australian Government

Gaskell, J. C. (2015). The role of markets, technology, and policy in generating palm-oil demand in Indonesia. *Bulletin of Indonesian Economic Studies, 51*(1), 29-45.

Gbadebo - Smith, O. (Producer). An Investor's Guide to Palm Oil. *Toptal - Finance*. Retrieved from https://www.toptal.com/finance/market-research-analysts/palm-oil-investing

Gee, P. T. (2007). Analytical characteristics of crude and refined palm oil and fractions. *European Journal of Lipid Science and Technology, 109*(4), 373-379.

Gerasimchuk, I., & Koh, P. Y. (2013). The EU biofuel policy and palm oil: cutting subsidies or cutting rainforest. *The International Institute for Sustainable Development, Geneva, Switzerland,(http://www. iisd. org/gsi/sites/default/files/bf_eupalmoil. pdf)*.

Giacomin, V. (2018). The emergence of an export cluster: traders and palm oil in early twentieth-century Southeast Asia. *Enterprise & Society, 19*(2), 272-308.

Global Economic Prospects. (1989-2019). Retrieved from

Gourichon, H. (2019). Analysis of incentives and disincentives for palm oil in Nigeria. *Gates Open Res, 3*.

Gurevich, T., Herman, P., Abbyad, N., Demirkaya, M., Drenski, A., Horowitz, J., & Kenneally, G. (2018). The Dynamic Gravity Dataset: Technical Documentation. In: Washington, DC: US International Trade Commission.

Henderson, J., & Osborne, D. J. (2000). The oil palm in all our lives: how this came about. *Endeavour, 24*(2), 63-68.

Hervas, A., & Isakson, S. R. (2020). Commercial agriculture for food security? The case of oil palm development in northern Guatemala. *Food Security, 12*(3), 517-535.

Hill, J., Nelson, E., Tilman, D., Polasky, S., & Tiffany, D. (2006). Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels. *Proceedings of the National Academy of sciences, 103*(30), 11206-11210.

Hinkes, C. (2020). Adding (bio) fuel to the fire: Discourses on palm oil sustainability in the context of European policy development. *Environment, Development and Sustainability, 22*(8), 7661-7682.

ICCT. (2019). International policy and market drivers of Indonesian palm oil demand. In: The International Council of Clean Transportation.

In, F., & Inder, B. (1997). Long-run relationships between world vegetable oil prices. *Australian journal of agricultural and resource economics, 41*(4), 455-470.

Indian Trade Portal. Retrieved from https://www.indiantradeportal.in/.

ITA. Retrieved from https://beta.trade.gov/fta. from International Trade Administration, US Department of Commerce.

Jamilah, J., Sinaga, B. M., Tambunan, M., & Hakim, D. B. (2016). The Impact of China's Economic Slowdown and Yuan Devaluation on Indonesia's Agricultural Trade Performance. *Journal of Economics and Finance, 20*(3), 325-345.

Jong, H. N. (2019). Europe, in bid to phase out palm biofuel, leaves fans and foes dismayed. In: Mongbay.

Kate, A. t., Kuepper, B., & Piotrowski, M. (2020). NDPE Policies Cover 83% of Palm Oil Refineries; Implementation at 78%.

Kavallari, A., Maas, S., & Schmitz, P. M. (2010). Evidence on Euromediterranean trade integration: The case of German olive oil imports. *German Journal of Agricultural Economics, 59*(670-2016-45880), 40-46.

Kee, H. L., & Nicita, A. (2016). *Trade frauds, trade elasticities and non-tariff measures.* Paper presented at the 5th IMF-World Bank-WTO Trade Research Workshop, Washington, DC, November.

Kim, M. H. (2010). Does the WTO promote trade? Further evidence. *The Journal of International Trade & Economic Development, 19*(3), 421-437.

Kim, M. H. (2011). Do we really know that the WTO increases trade? Revisited. *Global Economy Journal, 11*(2).

Lai, O.-M., Tan, C.-P., & Akoh, C. C. (2015). *Palm oil: production, processing, characterization, and uses*: Elsevier.

Larch, M., Monteiro, J.-A., Piermartini, R., & Yotov, Y. (2019). On the effects of GATT/WTO membership on trade: They are positive and large after all.

Larch, M., & Yotov, Y. (2016). General equilibrium trade policy analysis with structural gravity.

Looi Kee, H., Nicita, A., & Olarreaga, M. (2009). Estimating trade restrictiveness indices. *The Economic Journal, 119*(534), 172-199.

Lynn, M. (2002). *Commerce and economic change in West Africa: The palm oil trade in the nineteenth century* (Vol. 93): Cambridge University Press.

Mawardati, Jamilah, & Syamni, G. (2021). The impact of the economic crisis on Indonesian palm oil exports: a long term simulation analysis. *IOP Conference Series: Earth and Environmental Science, 694*(1), 012012. doi:10.1088/1755-1315/694/1/012012.

Mayer, T., & Zignago, S. (2011). Notes on CEPII's distances measures: The GeoDist database.

Mayr, S., Hollaus, B., & Madner, V. (2021). Palm oil, the RED II and WTO law: EU sustainable biofuel policy tangled up in green? *Review of European, Comparative & International Environmental Law, n/a*(n/a). doi:https://doi.org/10.1111/reel.12386

McCallum, J. (1995). National borders matter: Canada-US regional trade patterns. *The American Economic Review, 85*(3), 615-623.

Mehchy, Z., Nasser, R., & Schiffbauer, M. (2015). Trade determinants and potential of Syria: using a gravity model 'with an estimation of the Syrian crisis' impact on exports'. *Middle East Development Journal, 7*(2), 226-251.

Muzi, N. (Producer). (2019, July 26). Almost two-thirds of palm oil consumed in the EU is burned as energy - new data. *Transport and Environment*. Retrieved from https://www.transportenvironment.org/press/almost-two-thirds-palm-oil-consumed-eu-burned-energy-new-data

Nordin, I. Sub-Saharan Palm Oil Import Duties And Its Impact On Palm Oil Imports.

Nurfatriani, F., Sari, G. K., & Komarudin, H. (2019). Optimization of crude palm oil fund to support smallholder oil palm replanting in reducing deforestation in Indonesia. *Sustainability, 11*(18), 4914.

OECD-FAO. (2019). *Oilseeds and oilseed products*. Retrieved from

Olatunji, T. M., & dan Pengurusan, F. E. (2015). The Malaysia–Turkey Bilateral Trade Agreement: Impacts on Palm Oil Industry. *Prosiding Persidangan Kebangsaan Ekonomi Malaysia Ke, 10*, 295.

Pacheco, P., Gnych, S., Dermawan, A., Komarudin, H., & Okarda, B. (2017). *The palm oil global value chain: Implications for economic growth and socialand environmental sustainability* (Vol. 220): CIFOR.

Palm Oil- Southeast Asia. (2020, April 28). *Chain Reaction Research, Sustainability Risk Analysis*. Retrieved from https://chainreactionresearch.com/report/ndpe-policies-cover-83-of-palm-oil-refineries-implementation-at-75/

Papua New Guinea Trade Policy Framework (UNCTAD/DITC/TNCD/2003/10). (2006). Retrieved from New York and Geneva:

Piggott, R. R., Parton, K. A., Treadgold, E. M., & Hutabarat, B. (1993). *Food price policy in Indonesia*. Retrieved from

Pirker, J., Mosnier, A., Kraxner, F., Havlík, P., & Obersteiner, M. (2016). What are the limits to oil palm expansion? *Global Environmental Change, 40*, 73-81.

Priyati, R. Y. (2018). Determinants of global palm oil demand: a gravity approach. *Economic Journal of Emerging Markets, 10*(2), 148-164.

Pujiati, R. (2014). *The Impact of Free Trade Agreements on Commodity Trade Flows (Case Study: International Palm Oil Trade).* Master Thesis. Postgraduate School, Bogor Agricultural University, Bogor.

Purba, S. (2019). The Impact of the Increase in Petroleum Prices on CPO Demand for Biodiesel and Some Aspects of the Indonesian Palm Oil Industry. *Ranggagading Scientific Journal, 12*(2), 176-185.

Purseglove, J. (1972). Tropical crops: monocotyledons Longman Group.

Reuters. (2019, OCTOBER 11, 2019). In blow to Total, France upholds law banning palm oil from biofuel scheme. *Reuters*.

Rifin, A. (2014). The effect of crude palm oil export tax on export and prices. *ASEAN Journal of Economics, Management and Accounting, 2*(1&2), 82-95.

Rose, A. K. (2004). Do we really know that the WTO increases trade? *American economic review, 94*(1), 98-114.

Sally, S., & Nasir, M. A. (1983). A Research Paper on the Duty Structure of Palm Oil Products.

Sayer, J., Ghazoul, J., Nelson, P., & Boedhihartono, A. K. (2012). Oil palm expansion transforms tropical landscapes and livelihoods. *Global Food Security, 1*(2), 114-119.

Searle, S. (2019). *International policy and market drivers of Indonesian palm oil demand*. Retrieved from

Selin, N. E., & Lehman, C. (2020). Biofuel. In *Encyclopaedia Britannica*.

Shepherd, B., Doytchinova, H., & Kravchenko, A. (2019). The gravity model of international trade: a user guide [R version]. *United Nations ESCAP*.

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics, 88*(4), 641-658.

Simoes, A., & Hidalgo, C. (2011). *he Economic Complexity Observatory: An Analytical Tool for Understanding the Dynamics of Economic Development.* . Paper presented at the Twenty-Fifth AAAI Conference on Artificial Intelligence.

Singh, D., Sharma, D., Soni, S., Inda, C. S., Sharma, S., Sharma, P. K., & Jhalani, A. (2021). A Comprehensive Review on 1st-Generation Biodiesel Feedstock Palm Oil: Production, Engine Performance, and Exhaust Emissions. *BioEnergy Research, 14*(1), 1-22.

Snowdon, W., & Thow, A. M. (2013). Trade policy and obesity prevention: challenges and innovation in the P acific I slands. *Obesity reviews, 14*, 150-158.

Statista. (2021). *Contribution of the palm oil industry to the gross domestic product (GDP) of Malaysia from 2015 to 2019*.

Tariff Finder. Retrieved from https://www.tariff-finder.govt.nz/. from New Zealand Foreign Affairs and Trade

The World Bank Group. (2016). UNCTAD - Trade Analysis Information System (TRAINS).

The World Bank Group. (2019). AVE of NTM by importing countries.

Tinbergen, J. (1962). Shaping the world economy; suggestions for an international economic policy.

Tyson, A., & Meganingtyas, E. (2020). The Status of Palm Oil under the European Union's Renewable Energy Directive: Sustainability or Protectionism? *Bulletin of Indonesian Economic Studies*, 1-44. doi:10.1080/00074918.2020.1862411

Umana Dajud, C. (2013). Political proximity and international trade. *Economics & Politics, 25*(3), 283-312.

UN. (2020a). *UN Comtrade*

UN (Producer). (2020b). What is UN Comtrade? *United Nations International Trade Statistics Knowledgebase*. Retrieved from https://unstats.un.org/unsd/tradekb/knowledgebase

Understanding the WTO: The Organization, Members & Observers. *World Trade Organization*. Retrieved from https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm

UNIDO. (2019). *The palm oil value chain in Tanzania, Diagnostics, investment models and action plan for development and innovation*. Retrieved from

USDA. (2019). *EU 28: Biofuels Annual* (NL9022). Retrieved from

USDA. (2020, December 10). Oilseeds: World Market and Trade. *India Tariff Cut Boosts Palm Oil Imports*.

USDA. (2021). *FAS GAIN Voluntary Report* (BE2021-0005). Retrieved from

Van Tongeren, F., Beghin, J., & Marette, S. (2009). A cost-benefit framework for the assessment of non-tariff measures in agro-food trade.

Wang, J. (2016). Analysis and comparison of the factors influencing worldwide four kinds of vegetable oil trade: Based on Gravity model. *Modern Economy, 7*(02), 173.

Webster, R., Rimmer, L., Bennett, C., & Bradbury, A. (2004). *Greasy Palms: Palm Oil, the Environment and Big Business:[summary Report]*: Friends of the Earth.

Wilmar (Producer). Global Presence. *Wilmar* Retrieved from https://www.wilmar-international.com/about-us/global-presence?businesssegment=oil-palm-plantations-mills

WITS (Producer). (2010). Mirror Data with UN Comtrade. *WITS, Online Help, The World Bank* Retrieved from https://wits.worldbank.org/wits/wits/witshelp/content/data_retrieval/T/Intro/B2.Imports_Exports_and_Mirror.htm#:~:text=In%20UN%20COMTRADE%2C%20imports%20are,10%25%20to%2020%25%20difference.

WTO (Producer). Understanding the WTO: Basics. *World Trade Organization*. Retrieved from https://www.wto.org/english/thewto_e/whatis_e/tif_e/tif_e.htm

WTO. (2012). *A Practical Guide to Trade Policy Analysis*: WTO & UNCTAD.

Yacob, S. (2007). Model of Welfare Capitalism? The United States Rubber Company in Southeast Asia, 1910—1942. *Enterprise & Society*, 136-174.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., & Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*: World Trade Organization Geneva.

Zahan, K. A., & Kano, M. (2018). Biodiesel production from palm oil, its by-products, and mill effluent: a review. *Energies*, *11*(8), 2132.

Zahniser, S. S., Pick, D., Pompelli, G., & Gehlhar, M. J. (2002). Regionalism in the western hemisphere and its impact on US agricultural exports: a gravity-model analysis. *American Journal of Agricultural Economics*, *84*(3), 791-797.

Zeven, A. (1964). On the origin of the oil palm (Elaeis guineensis Jacq.). *Grana*, *5*(1), 121-123.

APPENDICES

A. Major Palm Oil Producers, Consumers, Importers and Exporters (1988-2019)

Years	Producers	Consumers	Exporters	Importers
1988	Malaysia, Indonesia, Nigeria, Colombia	Indonesia, China, Malaysia, Nigeria	Malaysia, Indonesia, Singapore, PNP	China, Singapore, Indonesia, Pakistan
1989	Malaysia, Indonesia, Nigeria, Cote d' Ivoire	Indonesia, China, Malaysia, India	Malaysia, Indonesia, Singapore, Netherlands	China, Pakistan, India, Netherlands
1990	Malaysia, Indonesia, Nigeria, Cote d' Ivoire	Indonesia, China, Malaysia, Nigeria	Malaysia, Indonesia, Singapore, PNP	China, Singapore, Pakistan, United Kingdom
1991	Malaysia, Indonesia, Nigeria, Colombia	Indonesia, EU-15, Malaysia, Pakistan	Malaysia, Indonesia, Singapore, PNP	EU-15, Pakistan, Singapore, China
1992	Malaysia, Indonesia, Nigeria, Cote d' Ivoire	Indonesia, EU-15, Malaysia, Nigeria	Malaysia, Indonesia, Singapore, PNP	EU-15, Singapore, Pakistan, China
1993	Malaysia, Indonesia, Nigeria, Colombia	Indonesia, EU-15, Malaysia, China	Malaysia, Indonesia, Singapore, China	EU-15, China, Pakistan, Singapore
1994	Malaysia, Indonesia, Nigeria, Cote d' Ivoire	Indonesia, EU-15, China, Pakistan	Malaysia, Indonesia, Singapore, China	EU-15, China, Pakistan, Singapore
1995	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, EU-15, Malaysia, China	Malaysia, Indonesia, Singapore, PNP	EU-15, China, Pakistan, Singapore
1996	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, EU-15, Malaysia, India	Malaysia, Indonesia, Singapore, PNP	EU-15, China, India, Pakistan
1997	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, EU-15, India, Malaysia	Malaysia, Indonesia, Singapore, PNP	EU-15, India, China, Pakistan
1998	Malaysia, Indonesia, Nigeria, Colombia	Indonesia, India, EU-15, Malaysia	Malaysia, Indonesia, Singapore, PNP	India, EU-15, China, Pakistan
1999	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, India, EU-15, Malaysia	Malaysia, Indonesia, PNP, Singapore	India, EU-15, China, Pakistan
2000	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, India, EU-15, China	Malaysia, Indonesia, PNP, Thailand	India, EU-15, China, Pakistan
2001	Malaysia, Indonesia, Nigeria, Thailand	Indonesia- EU-15, India, China	Malaysia, Indonesia, PNP, Singapore	EU-15, India, China, Pakistan

2002	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, India, China, EU-15	Malaysia, Indonesia, PNP, UAE	India, China, EU-15, Pakistan
2003	Malaysia, Indonesia, Nigeria, Thailand	Indonesia, China, EU-15, India	Malaysia, Indonesia, PNP, Jordan	China, EU, India, Pakistan
2004	Malaysia, Indonesia, Nigeria, Thailand	China, Indonesia, EU, India	Malaysia, Indonesia, PNP, Jordan	China, EU, India, Pakistan
2005	Indonesia, Malaysia, Nigeria, Thailand	China, EU, Indonesia, India	Malaysia, Indonesia, PNP, UAE	China, EU, India, Pakistan
2006	Indonesia, Malaysia, Thailand, Nigeria	China, EU, Indonesia, India	Malaysia, Indonesia, PNP, UAE	China, EU, India, Pakistan
2007	Indonesia, Malaysia, Thailand, Nigeria	China, EU, Indonesia, India	Malaysia, Indonesia, PNP, Thailand	China, EU, India, Pakistan
2008	Indonesia, Malaysia, Thailand, Nigeria	India, China, EU, Indonesia	Indonesia, Malaysia, PNP, UAE	China, India, EU, Pakistan
2009	Indonesia, Malaysia, Thailand, Nigeria	China, India, Indonesia, EU	Malaysia, Indonesia, PNP, Benin	China, India, EU, Pakistan
2010	Indonesia, Malaysia, Thailand, Nigeria	Indonesia, India, China, EU	Malaysia, Indonesia, PNP, UAE	China, India, EU, Pakistan
2011	Indonesia, Malaysia, Thailand, Nigeria	India, China, EU, Indonesia	Indonesia, Malaysia, PNP, UAE	India, China, EU-15, Pakistan
2012	Indonesia, Malaysia, Thailand, Nigeria	India, Indonesia, EU, China	Indonesia, Malaysia, PNP, Thailand	India, EU, China, Pakistan
2013	Indonesia, Malaysia, Thailand, Nigeria	Indonesia, India, EU, China	Indonesia, Malaysia, Benin, PNP	India, EU, China, Pakistan
2014	Indonesia, Malaysia, Thailand, Colombia	India, Indonesia, EU, China	Indonesia, Malaysia, PNP, Benin	India, EU, China, Pakistan
2015	Indonesia, Malaysia, Thailand, Colombia	Indonesia, India, EU, China	Indonesia, Malaysia, Guatemala, PNP	India, EU, China, Pakistan
2016	Indonesia, Malaysia, Thailand, Colombia	India, Indonesia, EU, China	Indonesia, Malaysia, Guatemala, PNP	India, EU, China, Pakistan
2017	Indonesia, Malaysia, Thailand, Colombia	Indonesia, India, EU, China	Indonesia, Malaysia, Guatemala, Colombia	India, EU, China, Pakistan
2018	Indonesia, Malaysia, Thailand, Colombia	Indonesia, India, China, EU	Indonesia, Malaysia, Guatemala, Colombia	India, EU, China, Pakistan
2019	Indonesia, Malaysia, Thailand, Colombia	Indonesia, India, EU, China	Indonesia, Malaysia, Guatemala, Colombia	India, EU, China, Pakistan

Source: FAS (2020)

B. Major FTAs, MFNs, preferential tariffs, and year of implementation (crude palm oil)

Importer	Exporter	Agreements	MFN	FTA tax	Year
Armenia	UK	Armenia-EU Comprehensive and Enhanced Partnership Agreement	3	1	2017
Malaysia	Singapore	ASEAN Free Trade Agreement (AFTA)	5	0	1992
Malaysia	Thailand	ASEAN Free Trade Agreement (AFTA)	5	0	1992
Thailand	Brunei	ASEAN Free Trade Agreement (AFTA)	20	0	1992
Thailand	Cambodia	ASEAN Free Trade Agreement (AFTA)	20	0	1999
Thailand	Indonesia	ASEAN Free Trade Agreement (AFTA)	5	0	1992
Thailand	Laos	ASEAN Free Trade Agreement (AFTA)	20	0	1997
Thailand	Malaysia	ASEAN Free Trade Agreement (AFTA)	10.78	0	1992
Thailand	Myanmar	ASEAN Free Trade Agreement (AFTA)	20	0	1997
Thailand	Philippines	ASEAN Free Trade Agreement (AFTA)	20	0	1992
Thailand	Singapore	ASEAN Free Trade Agreement (AFTA)	20	0	1992
Thailand	Viet Nam	ASEAN Free Trade Agreement (AFTA)	20	0	1995
Brunei	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Cambodia	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	7	0	2010
Cambodia	Indonesia	ASEAN Trade in Goods Agreement (ATIGA)	7	0	2010
Cambodia	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Cambodia	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	7	0	2010
Cambodia	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	7	0	2010
Indonesia	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Indonesia	Cambodia	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010

Indonesia	Malaysia	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Indonesia	Myanmar	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Indonesia	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Indonesia	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Indonesia	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Indonesia	Viet Nam	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Laos	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Cambodia	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Indonesia	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Malaysia	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Myanmar	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Laos	Viet Nam	ASEAN Trade in Goods Agreement (ATIGA)	10	0	2010
Malaysia	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Myanmar	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Cambodia	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Indonesia	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Laos	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Malaysia	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010

Myanmar	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Myanmar	Viet Nam	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Philippines	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Cambodia	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Indonesia	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Laos	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Malaysia	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Myanmar	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Philippines	Viet Nam	ASEAN Trade in Goods Agreement (ATIGA)	15	0	2010
Singapore	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	1	0	2010
Thailand	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Cambodia	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Indonesia	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Laos	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Malaysia	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Myanmar	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Thailand	Viet Nam	ASEAN Trade in Goods Agreement (ATIGA)	143	0	2010
Viet Nam	Brunei	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Cambodia	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010

Viet Nam	Indonesia	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Laos	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Malaysia	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Myanmar	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Philippines	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Singapore	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Viet Nam	Thailand	ASEAN Trade in Goods Agreement (ATIGA)	5	0	2010
Australia	Philippines	ASEAN-Australia-New Zealand Free Trade Area (AANZFTA)	1	0	2010
Cambodia	China	ASEAN-China Free Trade Area (ACFTA)	7	5	2003
Indonesia	China	ASEAN-China Free Trade Area (ACFTA)	5	0	2003
Laos	China	ASEAN-China Free Trade Area (ACFTA)	10	5	2003
Myanmar	China	ASEAN-China Free Trade Area (ACFTA)	3	1	2003
Philippines	China	ASEAN-China Free Trade Area (ACFTA)	15	0	2003
Viet Nam	China	ASEAN-China Free Trade Area (ACFTA)	5	0	2003
India	Brunei	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
India	Cambodia	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
India	Indonesia	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
India	Malaysia	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
India	Myanmar	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
India	Philippines	ASEAN-India Free Trade Area (AIFTA)	100	77	2010
India	Singapore	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
India	Thailand	ASEAN-India Free Trade Area (AIFTA)	100	76	2010

India	Viet Nam	ASEAN-India Free Trade Area (AIFTA)	100	76	2010
Thailand	India	ASEAN-India Free Trade Area (AIFTA)	143	143	2010
Cambodia	Rep. of Korea	ASEAN-Korea Trade in Goods Agreement	7	0	2005
Laos	Rep. of Korea	ASEAN-Korea Trade in Goods Agreement	10	2	2005
Myanmar	Rep. of Korea	ASEAN-Korea Trade in Goods Agreement	3	1	2005
Rep. of Korea	Indonesia	ASEAN-Korea Trade in Goods Agreement	3	0	2005
Rep. of Korea	Malaysia	ASEAN-Korea Trade in Goods Agreement	3	0	2005
Rep. of Korea	Philippines	ASEAN-Korea Trade in Goods Agreement	3	0	2005
Rep. of Korea	Singapore	ASEAN-Korea Trade in Goods Agreement	3	0	2005
Rep. of Korea	Thailand	ASEAN-Korea Trade in Goods Agreement	3	0	2005
Thailand	Rep. of Korea	ASEAN-Korea Trade in Goods Agreement	143	0	2005
Viet Nam	Rep. of Korea	ASEAN-Korea Trade in Goods Agreement	5	0	2005
Chile	USA	Chile- USA Free Trade Agreement	6	5.3	2004
Armenia	Ukraine	Commonwealth of Independent States Free Trade Agreement	3	1	2011
Ukraine	Uzbekistan	Commonwealth of Independent States Free Trade Agreement	2	1	2011
Rep. of Korea	India	Comprehensive Economic Partnership Agreement	3	0	2009
Costa Rica	USA	Dominican Republic-Central America FTA (CAFTA-DR)	4.7	4.4	2004
Dominican Rep.	USA	Dominican Republic-Central America FTA (CAFTA-DR)	10	0	2004
El Salvador	USA	Dominican Republic-Central America FTA (CAFTA-DR)	5	4.6	2004
Guatemala	USA	Dominican Republic-Central America FTA (CAFTA-DR)	5	4.5	2004
Honduras	USA	Dominican Republic-Central America FTA (CAFTA-DR)	5	4.6	2004
Nicaragua	USA	Dominican Republic-Central America FTA (CAFTA-DR)	11.67	4.6	2004

India	Burkina Faso	Duty Free Tariff Preference for LDC	100	50	2008
India	Burundi	Duty Free Tariff Preference for LDC	100	50	2008
India	Central African Rep.	Duty Free Tariff Preference for LDC	100	50	2008
India	Chad	Duty Free Tariff Preference for LDC	100	50	2008
India	Comoros	Duty Free Tariff Preference for LDC	100	50	2008
India	Ethiopia	Duty Free Tariff Preference for LDC	100	50	2008
India	Gambia	Duty Free Tariff Preference for LDC	100	50	2008
India	Guinea	Duty Free Tariff Preference for LDC	100	50	2008
India	Guinea-Bissau	Duty Free Tariff Preference for LDC	100	50	2008
India	Niger	Duty Free Tariff Preference for LDC	100	50	2008
India	Rwanda	Duty Free Tariff Preference for LDC	100	50	2008
India	Senegal	Duty Free Tariff Preference for LDC	100	50	2008
India	Seychelles	Duty Free Tariff Preference for LDC	100	90	2008
India	Somalia	Duty Free Tariff Preference for LDC	100	50	2008
India	Sudan	Duty Free Tariff Preference for LDC	100	50	2008
India	Togo	Duty Free Tariff Preference for LDC	100	50	2008
India	Tonga	Duty Free Tariff Preference for LDC	100	90	2008
India	Ukraine	Duty Free Tariff Preference for LDC	100	50	2008
India	United Rep. of Tanzania	Duty Free Tariff Preference for LDC	70	50	2008
India	Yemen	Duty Free Tariff Preference for LDC	100	50	2008
India	Zambia	Duty Free Tariff Preference for LDC	100	50	2008
United Rep. of Tanzania	India	Duty Free Tariff Preference for LDC	25	0	2008

Ukraine	Turkey	EU- Ukraine Deep and Comprehensive Free Trade Agreement	2	1	2016
Ukraine	UK	EU- Ukraine Deep and Comprehensive Free Trade Agreement (DCFTA)	2	1	2016
Austria	UK	European Union Trade Agreement	2	1.9	1995
Belgium	UK	European Union Trade Agreement	2	1.9	1973
Bulgaria	UK	European Union Trade Agreement	2	1.9	2007
Croatia	UK	European Union Trade Agreement	2	1.9	2013
Cyprus	UK	European Union Trade Agreement	2	1.9	2004
Czechia	UK	European Union Trade Agreement	2	1.9	2004
Denmark	UK	European Union Trade Agreement	2	1.9	1973
Estonia	UK	European Union Trade Agreement	2	1.9	2004
Finland	UK	European Union Trade Agreement	2	1.9	1995
France	UK	European Union Trade Agreement	2	1.9	1973
Germany	UK	European Union Trade Agreement	2	1.9	1973
Greece	UK	European Union Trade Agreement	2	1.9	1981
Hungary	UK	European Union Trade Agreement	2	1.9	2004
Italy	UK	European Union Trade Agreement	2	1.9	1973
Latvia	UK	European Union Trade Agreement	2	1.9	2004
Lithuania	UK	European Union Trade Agreement	2	1.9	2004
Luxembourg	UK	European Union Trade Agreement	2	1.9	1973
Malta	UK	European Union Trade Agreement	2	1.9	2004
Netherlands	UK	European Union Trade Agreement	2	1.9	1973
Poland	UK	European Union Trade Agreement	2	1.9	2004

Portugal	UK	European Union Trade Agreement	2	1.9	1986
Slovakia	UK	European Union Trade Agreement	2	1.9	2004
Slovenia	UK	European Union Trade Agreement	2	1.9	2004
Spain	UK	European Union Trade Agreement	2	1.9	1986
Sweden	UK	European Union Trade Agreement	2	1.9	1995
Turkey	UK	European Union Trade Agreement	31.2	15.6	2004
Japan	Australia	Japan-Australia Economic Partnership Agreement (JAEPA)	3.5	0	2014
Rep. of Korea	Australia	Korea-Australia Free Trade Agreement (KAFTA)	3	2	2014
Canada	USA	North American Free Trade Agreement (NAFTA)	6	0	1994
Mexico	USA	North American Free Trade Agreement (NAFTA)	8	0	1994
Russian Federation	UK	Partnership and Cooperation Agreement (PCA)	3	1	
India	Bhutan	SAFTA & Bhutan - India Free Trade Agreement	70	0	2004
India	Afghanistan	South Asian Free Trade Agreement (SAFTA)	100	0	2011
India	Nepal	South Asian Free Trade Agreement (SAFTA)	70	0	2004
India	Sri Lanka	South Asian Free Trade Agreement (SAFTA)	70	0	2004
Nepal	India	South Asian Free Trade Agreement (SAFTA)	10	5	2004
Bhutan	India	South Asian Preferential Trade Agreement (SAPTA)	30	0	1997
Thailand	India	Thailand- India Free Trade Agreement	20	0	2004
Canada	Australia	Trans-Pacific Partnership (CPTPP)	6	0	2004
Ukraine	Switzerland	Ukraine-EFTA	2	1	2010
Morocco	USA	United States- Morocco Free Trade Agreement	2.5	0	2006
Bahrain	USA	United States-Bahrain Free Trade Agreement	5	0	2006

Colombia	USA	United States-Colombia Trade Promotion Agreement (TPA)	20	0	2012
Peru	USA	US- Peru Free Trade Agreement	6	4.8	2009
Rep. of Korea	USA	US-Korea Free Trade Agreement	3	0	2007
Oman	USA	US-Oman Free Trade Agreement	5	0	2009

C. Major FTAs, MFNs, preferential tariffs, and year of implementation (refined palm oil)

Importer	**Exporter**	**Agreements**	**MFN**	**FTA tax**	**Year**
Morocco	Egypt	Agadir Agreement FTA	25	0	2007
Morocco	Egypt, Jordan, Tunisia	Agadir Agreement FTA	25	0	2007
Armenia	Ukraine	Armenia- Ukraine FTA	3	0	1994
Armenia	Ukraine, Kazakhstan, Moldova	Armenia- Ukraine, Kazakhsthan, Moldova FTA	3	0	1994
Armenia	Kazakhstan	Armenia-Kazakhstan FTA	3	0	1999
Armenia	Moldova	Armenia-Moldova FTA	3	0	1993
Indonesia	New Zealand	ASEAN - Australia - New Zealand FTA & EIA	5	0	2010
China	Brunei, Cambodia, Indonesia, Malaysia, Myanmar	ASEAN - China FTA	9	7	2005
Indonesia	India	ASEAN - India FTA & EIA	5	0	2010
Laos	India	ASEAN - India FTA & EIA	10	5	2010
Laos	India	ASEAN - India FTA & EIA	10	5	2010
Laos	India	ASEAN - India FTA & EIA	10	3	2010
Laos	India	ASEAN - India FTA & EIA	10	2	2010
Malaysia	India	ASEAN - India FTA & EIA	5	4	2010
Malaysia	India	ASEAN - India FTA & EIA	5	3	2010
Malaysia	India	ASEAN - India FTA & EIA	5	2	2010
Malaysia	India	ASEAN - India FTA & EIA	5	0	2010
Myanmar	India	ASEAN - India FTA & EIA	3	1	2010
Myanmar	India	ASEAN - India FTA & EIA	3	0	2010

Philippines	India	ASEAN - India FTA & EIA	15	14.5	2010
Philippines	India	ASEAN - India FTA & EIA	15	14.2	2010
Philippines	India	ASEAN - India FTA & EIA	15	13.93	2010
Philippines	India	ASEAN - India FTA & EIA	15	13.66	2010
Philippines	India	ASEAN - India FTA & EIA	15	13.39	2010
Philippines	India	ASEAN - India FTA & EIA	15	13.12	2010
Philippines	India	ASEAN - India FTA & EIA	15	12.86	2010
Philippines	India	ASEAN - India FTA & EIA	15	12.59	2010
Philippines	India	ASEAN - India FTA & EIA	15	12.32	2010
Viet Nam	India	ASEAN - India FTA & EIA	30	7.5	2010
Indonesia	Japan	ASEAN - Japan FTA	5	0	2009
Indonesia	Japan	ASEAN - Japan FTA	5	1.7	2009
Indonesia	Japan	ASEAN - Japan FTA	5	0	2009
Japan	ASEAN	ASEAN - Japan FTA	2.5	0	2008
Malaysia	Japan	ASEAN - Japan FTA	5	0	2009
Philippines	Japan	ASEAN - Japan FTA	15	10	2009
Philippines	Japan	ASEAN - Japan FTA	15	8	2009
Philippines	Japan	ASEAN - Japan FTA	15	7	2009
Philippines	Japan	ASEAN - Japan FTA	15	6	2009
Philippines	Japan	ASEAN - Japan FTA	15	4	2009
Philippines	Japan	ASEAN - Japan FTA	15	3	2009
Philippines	Japan	ASEAN - Japan FTA	15	1	2009
Philippines	Japan	ASEAN - Japan FTA	15	0	2009
Viet Nam	Japan	ASEAN - Japan FTA	30	3	2009
Indonesia	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	5	0	2010
Laos	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	10	4	2010
Laos	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	10	3	2010
Laos	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	10	1	2010
Laos	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	10	0	2010
Malaysia	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	5	0	2010
Myanmar	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	3	1	2010
Philippines	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	15	5	2010
Rep. of Korea	Cambodia	ASEAN - Rep. of Korea FTA & EIA	2	0	2010
Rep. of Korea	Myanmar	ASEAN - Rep. of Korea FTA & EIA	2	0	2010

Viet Nam	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	5	0	2010
Viet Nam	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	7	0	2010
Viet Nam	Rep. of Korea	ASEAN - Rep. of Korea FTA & EIA	30	0	2010
Indonesia	Brunei Darussalam	ASEAN Free Trade Agreement (AFTA)	5	0	1992
Cambodia	Australia	ASEAN-Australia-New Zealand FTA & EIA	7	1	2009
Cambodia	China	ASEAN-China FTA & EIA	7	5	2005
Japan	Brunei Darussalam	ASEAN-Japan FTA	2.5	0	2008
Rep. of Korea	Bangladesh	Asia Pacific Trade Agreement (APTA) - Accession of China PSA	2	0	2002
Rep. of Korea	Sri Lanka	Asia Pacific Trade Agreement PSA & EIA	2	0	1976
Rep. of Korea	Australia	Australia-Rep of Korea FTA & EIA	2	1	2014
Canada	Chile	Canada - Chile FTA & EIA	11	0	1997
Canada	Colombia	Canada - Colombia FTA & EIA	11	0	2011
Canada	Costa Rica	Canada - Costa Rica FTA	11	0	2002
Canada	Honduras	Canada - Honduras FTA & EIA	11	2.5	2014
Canada	Panama	Canada - Panama FTA & EIA	11	0	2013
Canada	Peru	Canada - Peru FTA & EIA	11	3.3	2009
Canada	Rep. of Korea	Canada- Rep of Korea FTA & EIA	11	1.8	2015
Colombia	Canada	Canada-Colombia Free Trade Agreement (FTA)	20	5.71	2011
Canada	Israel	Canada-Israel FTA	11	3.3	1997
Canada	Jordan	Canada-Jordan FTA	11	3.3	2012
Antigua and Barbuda	Barbados	Caribbean Community and Common Market (CARICOM) CU & EIA agreement	40	0	1973
Costa Rica	El Salvador	Central American Common Market (CACM) CU	5	0	1961
Costa Rica	Chile	Chile - Central America FTA & EIA	14	0	2002
Japan	Chile	Chile - Japan FTA & EIA	2.5	0	2007
Thailand	Chile	Chile - Thailand FTA & EIA	143	0	2015
Viet Nam	Chile	Chile - Viet Nam FTA	30	11.7	2014

China	Chile	Chile- China FTA & EIA	9	7	2006
China	New Zealand	China - New Zealand FTA & EIA	9	7	2008
Rep. of Korea	Canada	China- Rep of Korea FTA & EIA	2	0	2015
Burundi	Dem. Rep. of the Congo	Common Market for Eastern and Southern Africa (COMESA) CU	14	4	2009
Mexico	Costa Rica	Costa Rica - Mexico FTA & EIA	20	6	1995
Colombia	USA	Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR) & EIA	20	0	2006
India	Benin	Duty Free Tariff Preference for LDC	54	27	2008
Benin	Ghana	Economic Community of West African States (ECOWAS) CU	16.6667	0	1995
Austria	Ecuador	Ecuador Accession to EU-Colombia- Peru Agreement	12.8	0	2017
Norway	Costa Rica	EFTA - Central America FTA & EIA	14.4	0	2013
Norway	Egypt	EFTA - Egypt FTA	14.4	0	2007
Norway	Georgia	EFTA - Georgia FTA & EIA	14	0	2017
Norway	Jordan	EFTA - Jordan FTA	14.4	7.2	2002
Norway	Mexico	EFTA - Mexico FTA & EIA	14.4	7.2	2001
Norway	Montenegro	EFTA - Montenegro FTA	14	7	2012
Norway	Morocco	EFTA - Morocco FTA	14.4	7.2	1999
Norway	North Macedonia	EFTA - North Macedonia FTA	14.4	7.2	2002
Norway	Rep. of Korea	EFTA - Rep. of Korea FTA & EIA	14.4	0	2006
Norway	Lesotho	EFTA - SACU FTA	14.4	0	2008
Norway	Singapore	EFTA - Singapore FTA & EIA	46.9398	7.2	2003
Norway	Tunisia	EFTA - Tunisia FTA	14.4	0	2005
Norway	Turkey	EFTA - Turkey FTA	14.4	7.2	1992
Norway	Ukraine	EFTA - Ukraine FTA & EIA	14.4	7.2	2012
Norway	Israel	EFTA- Israel FTA	14.4	7.2	1993
Norway	Albania	EFTA-Albania FTA	14.4	0	2009
Canada	Iceland	EFTA-Canada	11	0	2008
Norway	Canada	EFTA-Canada FTA	14.4	7.2	2008
Norway	Chile	EFTA-CHILE FTA	14.4	7.2	2003
Norway	Colombia	EFTA-Colombia FTA & EIA	14.4	0	2008
Mexico	Iceland	EFTA-Mexico	20	0	2000

Norway	Peru	EFTA-Peru FTA	14.4	0	2011
Botswana	Iceland	EFTA-SACU	10	0	2006
Turkey	Egypt	Egypt- Turkey FTA	31.2	25.4	2007
Austria	Antigua and Barbuda	EU - CARIFORUM FTA & EIA	12.8	0	2008
Austria	El Salvador	EU - Central America FTA & EIA	12.8	0	2012
Austria	Colombia	EU - Colombia and Peru FTA & EIA	12.8	0	2012
Croatia	CÃ´te d'Ivoire	EU - Côte d'Ivoire (FTA)	12.8	0	2013
Belgium	Seychelles	EU - Eastern and Southern Africa States FTA	12.8	0	2009
Belgium	North Macedonia	EU - North Macedonia FTA & EIA	12.8	0	2001
Bulgaria	Rep. of Korea	EU - Rep. of Korea FTA & EIA	12.8	0	2011
Bulgaria	Ukraine	EU - Ukraine FTA & EIA	12.8	3.2	2014
Belgium	Papua New Guinea	EU- Pacific States FTA	12.8	0	2009
Botswana	United Kingdom	EU- SADC FTA	10	0	2016
Austria	Canada	EU-Canada FTA & EIA	12.8	0	2016
Austria	Chile	EU-Chile FTA	12.8	0	2002
Slovakia	Canada	EU-Chile FTA & EIA	12.8	0	2016
Austria	CÃ´te d'Ivoire	EU-Cote D Ivoire FTA	12.8	0	2008
Austria	Madagascar	EU-Eastern and Southern Africa States	12.8	0	2009
Austria	Egypt	EU-Egypt FTA	12.8	3.2	2001
Austria	Georgia	EU-Georgia FTA & EIA	12.8	0	2014
Austria	Ghana	EU-Ghana FTA	12.8	0	2016
Austria	Iceland	EU-Iceland	12.8	0	1995
Austria	Israel	EU-Israel FTA	12.8	0	1995
Japan	Austria	EU-Japan FTA & EIA	2.5	0	2019
Austria	Jordan	EU-Jordan FTA	12.8	0	1997
Austria	Mexico	EU-Mexico FTA & EIA	12.8	0	1997
Austria	Moldova	EU-Moldova FTA & EIA	12.8	0	2014
Austria	Montenegro	EU-Montenegro FTA & EIA	12.8	0	2007
Austria	Morocco	EU-Morocco FTA	12.8	3.2	1996
Austria	North Macedonia	EU-North Macedonia FTA & EIA	12.8	0	2001
Austria	Norway	EU-Norway FTA	12.8	0	1995
Austria	Samoa	EU-Pacific States Accession of Samoa	12.8	0	2018
Austria	Fiji	EU-Pacific States FTA	12.8	0	2014

Armenia	Croatia	Eurasian Economic Union (EAEU) - Accession of Armenia	3	1.1	2014
Kyrgyzstan	Viet Nam	Eurasian Economic Union (EAEU) - Viet Nam FTA & EIA	3	1.1	2016
Austria	Rep. of Korea	EU-Rep. of Korea FTA & EIA	12.8	0	2010
Hungary	Iceland	European Economic Area	12.8	0	2004
Norway	Iceland	European Free Trade Association (EFTA)	14.4	7.2	1960
Serbia	Austria	EU-Serbia FTA & EIA	1	0	2008
Austria	Botswana	EU-South African Development Community FTA	12.8	0	2016
Switzerland	France	EU-Switzerland Liechtenstein	187.979	0	1972
Austria	Tunisia	EU-Tunisia FTA	12.8	3.2	1995
Austria	Turkey	EU-Turkey CU	12.8	0	1995
Austria	Ukraine	EU-Ukraine FTA & EIA	12.8	0	2014
Belgium	Viet Nam	EU-Viet Nam FTA & EIA	12.8	3.2	2019
Bahrain	Singapore	GCC-Singapore FTA (GSFTA)	5	0	2008
Russian Federation	Georgia	Georgia - Russian Federation FTA	3	0	1994
Armenia	Georgia	Georgia- Armenia FTA	3	0	1995
Bahrain	Kuwait	Gulf Cooperation Council (GCC) CU	5	0	2003
Japan	India	India - Japan FTA & EIA	2.5	0	2011
Rep. of Korea	India	India- Rep of Korea FTA & EIA	2	0	2010
Japan	Mexico	Japan - Mexico FTA & EIA	2.5	0	2005
Japan	Mongolia	Japan - Mongolia FTA & EIA	2.5	0	2016
Japan	Peru	Japan - Peru FTA & EIA	2.5	0	2012
Japan	Australia	Japan- Australia FTA & EIA	2.5	0	2014
Japan	Switzerland	Japan-Switzerland FTA & EIA	2.5	0	2009
Russian Federation	Kyrgyzstan	Kyrgyz Republic - Russian Federation FTA	3	0	1993
Mexico	Chile	Latin American Integration Association (LAIA) PSA	20	14.4	1980
Costa Rica	Mexico	Mexico - Central America FTA & EIA	5.5	0	2013

Mexico	El Salvador	Mexico - El Salvador (Mexico - Northern Triangle) FTA & EIA	20	17.5	2001
Canada	Mexico	North American Free Trade Agreement (NAFTA)	11	0	1994
Bahrain	Egypt	Pan-Arab Free Trade Area (PAFTA)	5	0	1998
Costa Rica	Peru	Peru-Costa Rica FTA	14	8	2013
Turkey	Rep. of Korea	Rep. of Korea - Turkey FTA	46.8	24.8	2013
Russian Federation	Kazakhstan	Russian Federation - Belarus - Kazakhstan CU	3	0	1997
Costa Rica	Singapore	Singapore-Costa Rica Free Trade Agreement (SCRFTA)	14	0	2013
India	Afghanistan	South Asian Free Trade Agreement (SAFTA)	7.5	0	2011
India	Bhutan	South Asian Free Trade Agreement (SAFTA) & Bhutan - India Free Trade Agreement	80	0	2004
Botswana	Angola	Southern African Development Community (SADC) FTA	10	0	1996
Uruguay	Israel	Southern Common Market (MERCOSUR) - Israel FTA	10	3.8	2009
Turkey	United Kingdom	Turkey - EU CU	31.2	25.4	1995
Turkey	Israel	Turkey - Israel FTA	31.2	25.4	1997
Turkey	Malaysia	Turkey - Malaysia FTA	31.2	25.4	2015
Turkey	Morocco	Turkey - Morocco FTA	31.2	25.4	2006
Turkey	North Macedonia	Turkey - North Macedonia FTA	31.2	25.4	2000
Turkey	Tunisia	Turkey - Tunisia FTA	31.2	25.4	2005
Turkey	Georgia	Turkey- Georgia FTA	31.2	25.4	2007
Turkey	Albania	Turkey-Albania FTA	31.2	25.4	2006
Bahrain	USA	United States - Bahrain FTA & EIA	5	0	2006
Colombia	USA	United States - Colombia FTA & EIA	20	0	2012
Israel	USA	United States - Israel FTA	8	0	1985
Morocco	USA	United States - Morocco FTA & EIA	25	22.5	2006
Oman	USA	United States - Oman FTA & EIA	5	0	2009
Chile	USA	US - Chile FTA & EIA	6	5.3	2004
Rep. of Korea	USA	USA- Rep of Korea FTA & EIA	2	0	2012