

THESIS

POTENTIAL ECONOMIC IMPLICATIONS OF A U.S. – ASEAN FTA ON AGRICULTURE

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ABSTRACT

POTENTIAL ECONOMIC IMPLICATIONS OF A U.S. – ASEAN FTA ON AGRICULTURE

The Association of Southeast Asian Nations (ASEAN) is both an agricultural trade partner of the U.S. and a key contributor to the global agricultural market. The implementation of a free trade agreement (FTA) between the U.S. and ASEAN has the potential to reduce or eliminate tariffs on agricultural commodities. This research employs a computable general equilibrium modeling framework to simulate the economic implications of agricultural trade liberalization between the U.S. and ASEAN. Results focus on simulated changes in import quantities and prices, agricultural export sales, production, GDP, and welfare in the U.S. and ASEAN given the full elimination of tariffs on agricultural trade between the two partners. Results show that the U.S. is expected to generate a net welfare gain of \$1.9 billion, while the ASEAN region is likely to have a net welfare loss of \$415 million.

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INTRODUCTION

Tariff liberalization can add to or detract from regional welfare. The removal of an import tariff reduces the import price and drives consumer import demand in the importing region. Increases in consumer demand for foreign commodities drive export sales and production in the exporting region. As export sales increase, there is upward pressure on the Free on Board (FOB) export price. A country has a terms of trade gain when their FOB export prices increase relative to the FOB export prices for imports. Changes in the terms of trade is a driving factor of changes in regional welfare. The overall impact of tariff removal is largely dependent on the initial tariff rate and the value of trade between participating countries. This research evaluates the potential economic implications of a U.S.-ASEAN free trade agreement (FTA) on agricultural markets in participating countries through the complete elimination of tariffs on agricultural commodities traded between them.

There is a large body of work on the impact of trade policy changes on the economy overall. A common economic modeling framework used to assess the impacts of trade liberalization is a Computable General Equilibrium (CGE) model using the Global Trade Analysis Project (GTAP) framework. CGE models are economy-wide models that have the capacity to generate quantifiable results. The GTAP model can be used to simulate various trade liberalization scenarios that can address the effects of potential protectionist measures (Thompson and Leister., 2015; Park et al., 2012). In addition, the original GTAP sectors and regions can be aggregated or disaggregated to better assess the nature of the research question (Sulaiman et al., 2022; Perali et al., 2012; Diao et al., 2005). Lastly, the macroeconomic values in the GTAP database can be updated to project the database to a more representative economic

time period (Beckman and Countryman, 2021). The specific economic modeling framework used in this research is the GTAP model 6.2 with a modified version of the GTAP 10 database. This research builds on prior studies through the strategic disaggregation of the original GTAP 10 database agricultural sectors, the calculation of weighted average tariffs for each of the newly assigned sectors and regions, and the application of 2017 macroeconomic and tariff data.

This paper provides key background information on the ASEAN region to preface why an FTA between the U.S. and ASEAN has the potential to occur. The agricultural trade relationship between the U.S. and ASEAN is assessed to demonstrate how an FTA could impact the agricultural sector. The agricultural commodities traded between the U.S. and ASEAN member countries are outlined to provide context as to why some sectors are more affected by potential trade liberalization than others. Prior literature is reviewed to preface the contributions made by this research. The GTAP Model 6.2 and GTAP 10 database are detailed to provide insight into the assumptions and modifications made, and the scenario design is outlined to showcase how a hypothetical U.S.-ASEAN FTA is simulated. Lastly, results are reported to investigate the impacts of tariff liberalization across regions and sectors.

Trade liberalization is simulated through the complete removal of tariffs on all agricultural commodities traded between the U.S. and ASEAN. Results focus on percentage and absolute changes in import quantities and prices, export sales, production, real GDP, and welfare. The tariffs imposed on U.S. imports by the ASEAN region are collectively higher than the import tariffs imposed on ASEAN imports by the U.S. As a result, there is a greater decrease in ASEAN import prices for U.S. agricultural goods, which creates a greater increase in the demand for U.S. agricultural exports. The resulting changes in the terms of trade is a driving factor of changes in regional welfare, for both the U.S. and ASEAN countries. The U.S. is expected to

have a net welfare gain of \$1.9 billion, and the ASEAN region is expected to have a net welfare loss of \$415 million overall.

BACKGROUND

ASEAN is an intergovernmental organization that represents the economic and political union between the ten southeast Asian countries of Brunei Darussalam, Cambodia, Indonesia, Myanmar (Burma), Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. ASEAN was incepted on August 8, 1967, in Bangkok, Thailand, with the primary intent of fostering economic growth within the region. In 1992, ASEAN created the ASEAN Free Trade Area (AFTA) to remove intra-regional tariffs and non-tariff barriers between ASEAN member states. ASEAN has since established key economic relations and trade partnerships with nations around the globe, including Free Trade Agreements (FTAs) with Australia, New Zealand, China, India, Japan, South Korea, and Hong Kong, as well as economic relations with Russia, Canada, the European Union, and the U.S. (The ASEAN Secretariat, 2020).

U.S. agricultural trade with the ASEAN region has grown exponentially over the past 20 years. The U.S. exported \$15 billion in commodities to the ASEAN region in 2022, representing a growth of \$13.4 billion from 1992 to 2022 (Figure 1). The U.S. imported \$18.3 billion in commodities from the ASEAN region in 2022, representing a growth of \$16.5 billion from 1992 to 2022 (Figure 1). Over the same 20-year time frame, U.S. agricultural exports to the rest of the world grew by \$147.7 billion to reach a total of \$195.9 billion, while U.S. imports from the rest of the world grew by \$172.9 billion, to reach a total of \$199.3 billion in 2022 (Figure 2). The U.S. has historically been a net exporter of agricultural products; however, the U.S. is a net agricultural importer with ASEAN (Foreign Agricultural Service, 2022). The growth of U.S. agricultural trade can largely be attributed to the establishment of FTAs. FTAs are entered with the aim of reducing trade barriers, both tariff and non-tariff measures. The U.S. has 14

established FTAs that account for nearly half of all U.S. agricultural exports worldwide. The total value of U.S. exports to FTA partners is shown to increase post FTA implementation, and U.S. export growth to FTA countries is greater than to non-FTA countries overall (Foreign Agricultural Service, 2016).

The ASEAN region was the fourth largest destination for U.S. agricultural goods in 2022 after China (\$38.1 billion), Canada (\$28.7 billion), and Mexico (\$28.5 billion) (Figure 3). U.S. agricultural exports to the ASEAN region were purchased by the Philippines (\$4.1 billion), Vietnam (\$3.5 billion), Indonesia (\$3.3 billion), Thailand (\$1.5 billion), Singapore (\$1.4 billion), and Malaysia (\$1.1 billion). The remaining ASEAN member countries of Burma (Myanmar) (\$86.8 million), Cambodia (\$75.9 million), Laos (\$5.9 million), and Brunei (\$4.8 million), collectively imported less than \$174 million in the same year (Figure 4). The top U.S. commodities exported to the ASEAN region in 2022 were soybeans (\$2.2 billion) and dairy products (\$1.7 billion). Other U.S. commodities exported to the ASEAN region in 2022 include cotton (\$1.5 billion), wheat (\$1.5 billion), soybean meal (\$1.3 billion), and distillers' grains (\$807.4 million) (Figure 5). U.S. soybean exports were mostly purchased by Indonesia (\$1.2 billion), Vietnam (\$390 million), Malaysia (\$268.1 million), and Thailand (\$250 million), while U.S. dairy exports were mostly purchased by the Philippines (\$581.9 million), Indonesia (\$452.9 million), Vietnam (\$224 million), Malaysia (\$218.7 million), Singapore (\$115.9 million), and Thailand (\$112.6 million) (Appendix Figure 1).

The ASEAN region was the third largest source for U.S. agricultural imports in 2022, next to Mexico (\$43.4 billion) and Canada (\$37.6 billion) (Figure 6). U.S. imports from the ASEAN region were sourced from Indonesia (\$5.1 billion), Singapore (\$4.2 billion), Thailand (\$3.6 billion), Vietnam (\$2.6 billion), the Philippines (\$1.4 billion), and Malaysia (\$1.2 billion).

Very few imports came from the remaining ASEAN member countries in comparison (Figure 7). The top ASEAN commodities imported by the U.S. in 2022 were sugars, sweeteners, and beverage bases (\$4.2 billion), and vegetable oils (\$4.1 billion). Other ASEAN commodities imported by the U.S. in 2022 included tree nuts (\$1.3 billion), processed fruits and vegetables (\$1.1 billion), industrial alcohols and fatty acids (\$1.1 billion), dog and cat food (\$995 million), and rice (\$660 million) (Figure 8). U.S. imports of sugars, sweeteners, and beverage bases were primarily sourced from Singapore (\$4.1 billion), while U.S. imports of vegetable oils mostly came from Indonesia (\$3 billion), the Philippines (\$613.2 million), and Malaysia (\$448.4 million) (Appendix Figure 2).

The 2017 tariffs imposed by ASEAN on the U.S. are collectively higher than the 2017 tariffs imposed by the U.S. on the ASEAN region. The simple average of the sector-specific weighted average tariffs imposed by the ASEAN region on all U.S. agricultural commodities is 7.27% (Table 1), in comparison to the 1.2% imposed by the U.S. on all ASEAN agricultural commodities (Table 2). The impact of tariff liberalization is dependent on the size of the initial tariff rate and the value of trade. Each ASEAN member country has their own unique trade relationship with the U.S. and is therefore uniquely impacted by agricultural tariff liberalization. For example, Singapore imposes zero tariffs on all U.S. agricultural imports, while Thailand has import tariffs above 20% on ten of the U.S. agricultural sectors investigated in this research (Table 1). Likewise, the U.S. imposes near zero tariffs on all agricultural imports from Singapore, while the U.S. has a tariff of 23.38% on all dairy imports from Thailand (Table 2). Therefore, the liberalization of tariffs on agricultural commodities traded between the U.S. and ASEAN member countries is expected to have a greater impact on bilateral import prices for U.S. commodities in Thailand than in Singapore.

Thailand imposes the largest tariffs on U.S. commodities of any ASEAN member country. Thailand has an 81.89% tariff on U.S. dairy, an 80% tariff on U.S. soybeans, and a 61.8% tariff on U.S. vegetable oil. Other U.S. sectors that incur relatively high from Thailand include U.S. beef (50%), pork (38.94%), other meat (31.08%), other oilseeds (30.14%), rice (29.98%), other coarse grain (27%), and vegetables (21.51%). ASEAN member countries other than Thailand with high collective tariffs on U.S. agricultural products include Cambodia, the Philippines, and Vietnam. The most heavily tariffed U.S. sectors across all ASEAN member countries are other meat, pork, beef, dairy, soybeans, and other processed food (Table 1).

In contrast, the highest tariff imposed by the U.S. on an ASEAN member country for a single commodity, is a 23.38% tariff on U.S. imports of dairy from Thailand. Most U.S. import tariffs on ASEAN agricultural products are below 10% except for tariffs imposed on U.S. imports of sugar from the Philippines (17.96%), dairy from the Philippines (20.31%) and Malaysia (14.36%), other oilseeds from Brunei (12.44%), Lao (12.44%), Malaysia (12.44%), and Cambodia (11.81%), and U.S. imports of fishing and forestry from Vietnam (11.92%). The U.S. imposes the highest collective tariffs on agricultural imports from the Philippines, Malaysia, and Thailand. The ASEAN sectors that are most heavily tariffed by the U.S. are dairy, other oilseeds, and sugar (Table 2).

The U.S. and ASEAN engage in substantial bilateral trade but have yet to establish an FTA. The establishment of an FTA between the U.S. and ASEAN would likely reduce or eliminate the import tariffs imposed on traded commodities. The impact of tariff liberalization is dependent on the initial tariff level imposed and the value of trade between participating countries. This paper addresses the potential economic impacts of the complete elimination of agricultural tariffs between the U.S. and ASEAN on the agriculture sector, and the economy

overall. Prior to detailing the methodology used, previous work is discussed to highlight how this research contributes to the existing literature.

REVIEW OF LITERATURE

A CGE model is a mathematical model that can be described as a system of equations representative of the whole economy. The capacity for a CGE model to generate quantifiable results makes it a useful modeling approach to assess economic shocks related to trade. In addition, CGE models are economy-wide, representing all agents within an economy and the economic activity between them. This allows researchers to simulate global changes in policy and assess economy-wide effects of economic shocks such as changes in trade policy. Lastly, CGE models are equilibrium models that satisfy market clearing constraints. Therefore, an economic shock can be applied through a change to an exogenous variable, and modelers can assess the economic impacts through the resulting percentage and absolute changes in the endogenous variables (Burfisher, 2016).

CGE models have been applied in a wide range of studies including the impacts of environmental changes on agricultural productivity and food security (Calzadilla et al., 2013; Sifiso et al., 2017; Babatunde et al., 2017), and the impacts of government policy on the economy and the environment (Farajzadeh and Bakhshoodeh, 2015; Sassi and Cardaci, 2013). Most relevant to the work done in this paper, CGE models are also commonly used to assess the economic impacts of trade war and trade policy (Beckman et al., 2019; Cui et al. 2019; Ortiz Valverde et al., 2019; Nguyen et al., 2021). More specifically, CGE models are used to assess the impacts of trade liberalization on certain economic sectors such as agriculture (Perali et al., 2012; Arita et al., 2017; Beckman et al., 2021).

A gravity model is a common alternative model used in trade policy analysis to assess trade potential and the effects of trade policy (Kabir et al., 2011; Jagdambe et al., 2020; Okabe et al.,

2014; Jagdambe et al., 2020). A gravity model can estimate the volume of trade flows between countries or regions based on economic factors such as GDP, distance, and other explanatory variables. A CGE model is a better fit for this research, as it allows for a wider assessment of the overall economic impact from changes in trade policy, such as percentage changes in prices or production. A second alternative to a CGE model, is a partial equilibrium model (Martinez-Gonzalez et al., 2007; Hoang et al., 2015; Vatankhah et al., 2019). A partial equilibrium model evaluates a single market or a suite of related markets and assumes *ceteris paribus*. By comparison, a general equilibrium model does not make this assumption and instead accounts for cross market interactions. A CGE model is more appropriate for this paper, as it accounts for inter-industry connections and provides a global economy-wide assessment of the impacts of agricultural trade liberalization between the U.S. and ASEAN.

This research contributes to existing literature through a unique sectoral disaggregation of the original GTAP agricultural sectors. In addition, a geographic aggregation of non-ASEAN regions is performed to focus results on the U.S. and ASEAN member countries. Similar aggregation and disaggregation methods have been used in other CGE modeling research. For example, Sulaiman et al. (2022) uses a Malaysia Input-Output Model to evaluate the impact of fuel subsidies on sectoral output and employment in Malaysia. To do this, the authors disaggregate the petroleum sector into three subsectors: petrol, diesel, and other fuel products for a total of 122 industries. A similar method is used by Diao, et al. (2005), who performs a sectoral aggregation of the agricultural sectors, while maintaining the maximum disaggregation of geographical regions in the GTAP 5 database to better evaluate the impacts of agricultural trade liberalization on developing countries. In contrast, Perali et al. (2012) evaluates the impact of world agricultural tariff liberalization on the European Union.

GTAP is the CGE modeling framework used in this research, and a commonly used framework to assess the economy-wide impacts of trade policy changes. The GTAP database can be modified to better address the nature of the research question. This study modifies the GTAP 10 database through the calculation and application of percentage changes in real GDP, population, and investment values from 2014 to 2017 to update the database to a representative year of 2017. Researchers often update the database to a more recent time frame, to account for major changes in the global economic environment. For example, Beckman and Countryman (2021) update the GTAP 10 database to a base year of 2020 to simulate the impacts of COVID-19 on the global economy. Like the approach taken in this research, the authors update the GTAP 10 database using percentage changes in agricultural production and trade from 2014 to 2020. Through the collection and application of data on pandemic-related changes in agricultural and non-agricultural sectors, they assess the impacts of COVID-19 through relative changes in GDP.

This research evaluates the potential impacts of agricultural trade liberalization between the U.S. and ASEAN and considers the extreme tariff liberalization scenario of a 100% reduction in import tariffs for all traded products in the agricultural sector. However, there have been numerous prior studies on the impacts of both interregional trade liberalization between countries within ASEAN (Devadason, 2010; Ariyasajakorn et al., 2009) and interregional trade liberalization between other countries and the ASEAN region (Ahmed, 2010; Thangavelu et al., 2021). These studies provide insight into the overall directional impact of tariff liberalization and the differences in impact between partial and full liberalization scenarios. Thompson and Leister (2015) evaluate the potential impacts of an exclusionary Transpacific Partnership Agreement (TPP) on the agricultural sector in the U.S. and Japan by employing the GTAP model. The authors model three tariff liberalization scenarios in a GTAP framework (5%, 25%, and 50%

tariff reductions) to simulate possible protectionist measures taken by Japan for the agricultural sector. The results of these scenarios are then compared to a full tariff liberalization scenario. Japan has higher initial tariffs than the U.S, leading to a greater increase in Japanese demand for U.S. commodities upon tariff liberalization. Under the full tariff liberalization scenario, the U.S. has a net increase in welfare of \$4.5 billion, while Japan has a net loss in regional welfare of \$13 billion. Park et al. (2012) evaluates the economic potential of the ASEAN-Korea Free Trade Area (AKFTA) by modeling the effects of eliminating all import tariffs and export taxes between participating countries. Their results show that although some countries gain more than others from trade liberalization, the benefits of trade creation, including welfare and output gains, outweigh the losses of trade diversion.

This paper makes three contributions to existing literature. The primary contribution is the strategic disaggregation of agricultural sectors to facilitate greater sector detail for the simulated economic impacts of a U.S.-ASEAN FTA. The original GTAP sectors are more highly aggregated and mask sector variation in tariffs. The disaggregation breaks down these sectors into more specific commodities like soybeans and oilseeds other than soybeans. This improves sector-specific information for starting tariff levels and provides a more detailed analysis of commodity-specific effects from trade liberalization. Given the agricultural focus of this work, nonagricultural sectors are combined into two broad categories including manufacturing and services.

A second contribution of this research is the use of macroeconomic values and tariff data to update the original GTAP 10 database to an economic environment representative of the year 2017. Due to the magnitude and complexity of information included in the GTAP database, new versions are only released every few years. Updating the database to a more recent

time frame is important to account for any major changes in the economic environment. Through updating macroeconomic factors such as population, GDP, or investment value, the researcher can account for economic growth or migration. In updating tariff data, the researcher can account for any trade policy changes or trade liberalization experienced between countries and regions.

Lastly, this research calculates and applies 2017 weighted average tariffs for each of the newly assigned sectors traded between regions. Each tariff rate is unique by commodity and trade relationship. For example, U.S. soybeans incur a different tariff rate than other oilseeds, for exports to Germany, and U.S. soybean exports to Germany face a different tariff rate than U.S. soybean exports to France. Each commodity also trades at a different volume between each country and region. For example, U.S. soybean exports to Germany have a different trade value than other oilseed exports to Germany, and U.S. soybean exports to Germany have a different trade value than U.S. soybean exports to France. Therefore, the weighted average tariff must be calculated and applied to account for both the variation in tariff rates across commodities and the unique trade values of each commodity per trade relationship.

METHODOLOGY

The specific economic modeling framework used in this research is the GTAP Model 6.2 with a modified version of the GTAP 10 database programmed with GEMPACK software (Aguiar et al., 2019; Hertel, 1997, GTAP 6.2 Model). The GTAP model is a comparative static, computable general equilibrium model. The GTAP model employs a database based on a global Social Accounting Matrix (SAM) that represents the state of an economy at a given point in time. Simulations can be run to compare the state of an economy before and after a trade policy change. The GTAP model is non-linear, but the GEMPACK software represents equations in linearized form so that changes in variables can be expressed as percentages. Prices within the model are evaluated relative to a numeraire price, or a price variable that is held fixed. Taxes in the model are ad valorem and applied as a percentage of the total import value (Burfisher, 2016; Hertel et al., 1997, GTAP 6.2 Model).

The GTAP model is composed of identity and behavioral equations. Identity equations describe the functions of the model such as the accounting relationships, market clearing constraints, and macroclosure of the model. The standard market clearing constraint equates all savings to investment expenditure, and the standard macroclosure is savings driven. Therefore, investment expenditure adjusts in response to a change in savings. Behavioral equations describe agent behavior within the model. The behavioral parameters determine the various elasticities of agent behavior and are therefore the key drivers of results within the model. Agents within the GTAP model can be defined as firms, households, and government. The GTAP model assumes perfect competition so that all agents optimize behavior and are price takers (Burfisher, 2016; Hertel et al., 1997, GTAP 6.2 Model).

Final demand (u_r) is represented at the regional level by an aggregate Cobb Douglas utility function, and is composed of private household demand, government consumption, and savings (Figure 9).

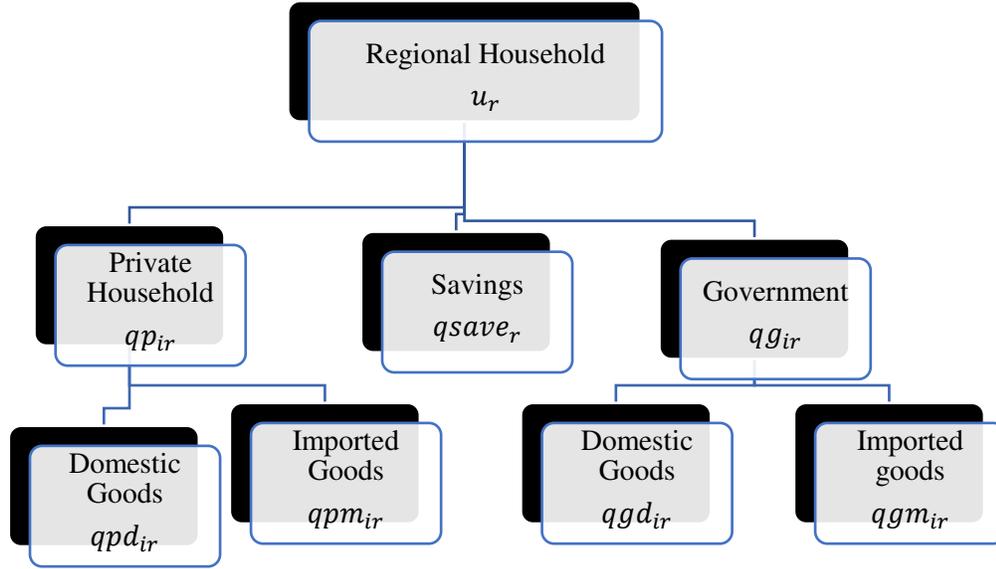


Figure 9. Demand Structure in the GTAP Model

Private household demand (qp_{ir}) can be characterized by a per capita Constant Difference of Elasticities (CDE) utility function (Eq. 1).

$$\text{Eq. 1: } qp_{ir} - pop_r = \sum_k^K EP_{ikr} pp_{kr} + EY_{ir}(yp_r - pop_r)$$

qp_{ir} = private household demand for commodity i in region r

pop_r = regional population

EP_{ikr} = elasticity of private household demand for commodity i given a price of commodity k in region r

pp_{kr} = private consumption price for commodity k in region r

EY_{ir} = income elasticity of private household demand for commodity i in region r

yp_r = regional private consumption expenditure in region r

The Cobb-Douglas utility function has fixed expenditure shares. Therefore, national income can be aggregated and allocated proportionately across final demand. Whereas the CDE function is non-homothetic, meaning that consumer spending shares are not constant, and consumers will purchase more luxury goods as income increases. The percentage change in private household demand is driven by the cross-price elasticity of demand between goods i and k in region r (EP_{irk}), and the income elasticity of demand for good i in region r (EY_{ir}). Private household consumption can be broken down into the demand for domestic goods (qpd_{ir}) (Eq. 2) and the demand for foreign goods (qpm_{ir}) (Eq. 3).

$$\text{Eq. 2: } qpd_{ir} = qp_{ir} + ESUBD_i * (pp_{ir} - ppd_{ir})$$

qpd_{ir} = private household demand for imports of commodity i in region r

qp_{ir} = private household demand for commodity i in region r

$ESUBD_i$ = elasticity of substitution between domestic and imported goods

pp_{ir} = private consumption price for commodity i in region r

ppd_{ir} = price of domestic good i for private consumption in region r

$$\text{Eq. 3: } qpm_{ir} = qp_{ir} + ESUBD_i * (pp_{ir} - ppm_{ir})$$

qpm_{ir} = private household demand for imports of commodity i in region r

qp_{ir} = private household demand for commodity i in region r

$ESUBD_i$ = elasticity of substitution between domestic and imported goods

pp_{ir} = private consumption price for commodity i in region r

ppm_{ir} = price of imports of commodity i for private consumption in region r

Likewise, government consumption can be broken down into the demand for domestic (qgd_{ir}) (Eq. 4) and foreign goods (qgm_{ir}) (Eq. 5).

$$\text{Eq. 4: } qgd_{ir} = qg_{ir} + ESUBD_i * (pg_{ir} - pgd_{ir})$$

qgd_{ir} = government household demand for imports of commodity i in region r

qg_{ir} = government household demand for commodity i in region r

$ESUBD_i$ = elasticity of substitution between domestic and imported goods

pg_{ir} = government consumption price for commodity i in region r

pgd_{ir} = price of domestic good i for government consumption in region r

$$\text{Eq. 5: } qgm_{ir} = qg_{ir} + ESUBD_i * (pg_{ir} - pgm_{ir})$$

qgm_{ir} = government household demand for imports of i in region r

qg_{ir} = government household demand for commodity i in region r

$ESUBD_i$ = elasticity of substitution between domestic and imported goods

pg_{ir} = government consumption price for commodity i in region r

pgm_{ir} = price of imports of i for government consumption in region r

Firms operate under a nested Constant Elasticity of Substitution (CES) production structure composed of behavioral equations that describe factor demands by firms (Figure 10).

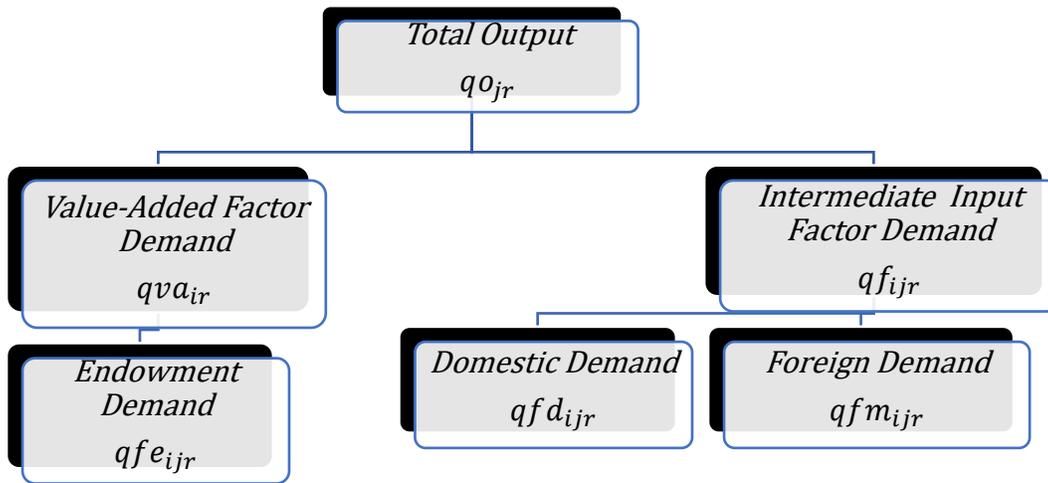


Figure 10. Firm Demand for Inputs

Total output for an industry j in region r (qo_{jr}) is dependent on the demand for value-added goods j in region r (qva_{jr}) and the demand for intermediate goods i for use by industry j in

region r (qf_{ijr}). Factor demand for endowments i used by industry j in region r (qfe_{ijr}) (Eq. 6) is dependent on the factor substitution elasticity parameter ($ESUBVA_j$), which determines how easily a producer will substitute between the three factors of production: land, labor, and capital.

$$\text{Eq. 6: } qfe_{ijr} = -afe_{ijr} + qva_{jr} - ESUBVA_j(pfe_{ijr} - afe_{ijr} - pva_{jr})$$

qfe_{ijr} = demand for endowment i for use in industry j in region r

afe_{ijr} = primary factor i augmenting technical change by industry j in region r

qva_{jr} = value added in industry j in region r

$ESUBVA_j$ = elasticity of substitution between factors in production of value added in industry j

pfe_{ijr} = firms' price for endowment i in industry j in region r

pva_{jr} = firm's price of value added in industry j in region r

Endowments are non-tradable inputs, and are therefore non-transferable across regions. In contrast, the demand for intermediate inputs (qf_{ijr}) can be broken down into the demand for domestic intermediate inputs (qfd_{ijr}) (Eq. 7) and the demand for foreign intermediate inputs (qfm_{ijr}) (Eq. 8) (Burfisher, 2016; Hertel et al., 1997, GTAP 6.2 Model).

$$\text{Eq. 7: } qfd_{ijr} = qf_{ijr} - ESUBD_i * (pfd_{ijr} - pfi_{jr})$$

qfd_{ijr} = domestic good i demanded by industry j in region r

qf_{ijr} = demand for commodity i for use by industry j in region r

$ESUBD_i$ = elasticity of substitution between domestic and imported goods

pfd_{ijr} = price index for domestic purchases of i by industry j in region r

pfi_{jr} = firms' price for commodity i for use by industry j of region r

$$\text{Eq. 8: } qfm_{ijr} = qf_{ijr} - ESUBD_i * (pfm_{ijr} - pfi_{jr})$$

qfm_{ijr} = demand for commodity i demanded by industry j in region r

qf_{ijr} = demand for commodity i for use by industry j in region r
 $ESUBD_i$ = elasticity of substitution between domestic and imported goods
 pfm_{ijr} = price index for imports of commodity i by industry j in region r
 pf_{ijr} = firms' price for commodity i for use by industry j of region r

Each agent within the economy can source foreign and domestic goods. Trade occurs when goods are imported from foreign countries to meet private household, government, or firm demand. The decision by agents to source domestic or foreign goods is dependent on the Armington Elasticity Parameter, or the elasticity of substitution between domestic and foreign goods ($ESUBD_i$). The larger the Armington elasticity parameter, the more motivated a consumer will be to shift consumption from imported to domestic commodities for a relative change in price (Burfisher, 2016; Hertel et al., 1997, GTAP 6.2 Model).

Each equation is composed of exogenous and endogenous variables. The model closure describes which variables are considered exogenous or endogenous. In this research, import tariffs are defined as exogenous, while prices and quantities are defined as endogenous, assuming the standard GTAP long run model closure. The simulation performed in this research reduces the ad valorem import tariff rate to zero for all agricultural commodities traded between the U.S. and ASEAN. Results in this research focus on simulated changes in agricultural import quantities and prices, agricultural export sales, production, GDP, and regional welfare.

The price variables evaluated in this research include bilateral import prices for agricultural goods i supplied from region r to region s (pms_{irs}) (Eq. 9), as well as the market price of composite agricultural imports i in region r (pim_{ir}).

$$\text{Eq. 9: } pms_{irs} = tm_{is} + tms_{irs} + pci_{irs}$$

pms_{irs} = domestic price for good i supplied from region r to region s

tm_{is} = change in tariff on imports of good i into region s

tms_{irs} = change in tariff on imports of i from region r into region s

$pcif_{irs}$ = Cost, Insurance, and Freight (CIF) world price of commodity i supplied from region r to region s

The bilateral price for imports (pms_{irs}) is inclusive of the Cost, Insurance, and Freight (CIF) world price of a commodity i supplied from region r to region s ($pcif_{irs}$), and the ad valorem import tariff on commodity i from region r into region s (tms_{irs}). Import tariffs are levied as a percentage of the CIF import value. Therefore, tariffs levied on commodities with higher CIF import values will have a greater impact. The market price of composite imports is the trade-weighted sum of all bilateral import prices for a good i in region r (pim_{ir}). Therefore, a decrease in the bilateral price for imports will drive down the market price of composite imports.

The quantity variables evaluated in this research include the changes in the total output for agricultural commodities i in region r (qo_{ir}), aggregate imports of agricultural commodities i into region s (qim_{is}), and export sales of agricultural commodities i from region r to region s (qxs_{irs}) (Eq. 4) (Burfisher, 2016; Hertel et al., 1997, GTAP 6.2 Model).

$$\text{Eq. 4: } qxs_{irs} = -ams_{irs} + qim_{is} - ESUBM_i(pms_{irs} - ams_{irs} - pim_{is})$$

qxs_{irs} = export sales of commodity i from region r to region s

ams_{irs} = import augmenting technical change for commodity i from region r in region s

$ESUBM_i$ = elasticity of substitution among imports of commodity i in the Armington structure

pms_{irs} = domestic price for good i supplied from region r to region s

pim_{is} = market price of composite import i region s

The percentage and absolute changes in real gross domestic product (GDP) in region r (gdp_r), and the absolute changes in welfare in region r (EV_r), are also assessed. In this model, GDP is represented by the total expenditure within a region and is dependent on private household expenditure, government expenditure, the value of commodity output, and the foreign balance of trade. Regional welfare is measured by equivalent variation and is expressed in USD Millions. Equivalent variation measures the change in income needed to achieve the new level of utility at pre-shock prices. The decomposition of welfare in the GTAP Model 6.2 includes changes in allocative efficiencies, endowments, technical change, population, terms of trade, the balance of investment and savings, and preferences. In this model, regional welfare is impacted by changes in the terms of trade, investment and savings, and allocative efficiency. Terms of trade is a comparison of FOB export prices. There is a gain in the terms of trade when an exporting region's FOB export price increases relative to the FOB export price of the region they are importing from. Import tariffs are not directly linked to FOB export prices. However, the removal of tariffs drives down bilateral import prices, and increases the quantity demanded for imports. The shift in consumption to foreign goods increases export sales and puts upward pressure on FOB export prices in the exporting region (Burfisher, 2016; Hertel et al., 1997, GTAP 6.2 Model).

The GTAP model provides the structure of the bilateral trade information included in the GTAP database. Results are expressed in percentage and absolute changes relative to the base scenario and focus on changes in bilateral import prices, aggregate market prices and quantities, domestic production, real GDP, and regional welfare. This research uses the GTAP model 6.2 with a modified version of the GTAP 10 database to investigate the effects of full tariff liberalization on agricultural trade between the U.S. and ASEAN member countries.

DATA

This research uses a modified version of the GTAP 10 Database, which is a global economic database representative of the 2014 economy for 121 countries and 20 aggregate regions, across 65 sectors (Aguiar et al., 2019). The GTAP database is composed of values of production, intermediate, and final goods and services. Values are represented in USD millions and organized in a multi-region Social Accounting Matrix (SAM). The GTAP database also stores values of bilateral trade flows and trade information, as well as tax and tariff information. In addition, it is composed of world economic data that makes it representative of a specific economic time frame.

To evaluate the effects of agricultural trade liberalization on the U.S. and ASEAN member countries, the database is first aggregated to the 32-regions shown in Appendix Table 3. The U.S., each ASEAN member country, primary trade partners of ASEAN, and countries pertinent to agricultural trade with the U.S., are left independent. The remaining countries and regions are grouped together by geographic region.

Next, to provide a more comprehensive analysis of the agricultural sectors in the U.S. and ASEAN, the database is aggregated to the 23-sectors described in Appendix Table 4 and includes 21 agricultural sectors and 2 nonagricultural sectors. Similar agricultural commodities, such as “processed rice” and “paddy rice”, are grouped together under a representative sector, “rice.” Some sectors like, “forestry” and “fishing”, are combined to create a broader category, “forestry and fishing”. Lastly, five of the agricultural sectors are disaggregated into separate commodity groups. The sector, “coarse grain” is split into “corn” and “other coarse grain”; “vegetables and fruits” are separated into two sectors, “vegetables” and “fruits”; “oilseeds” are

now “soybeans” and “other oilseeds”; “other animal products” is split into “hogs” and “other animal products”; and “other meat” is now divided into “pork” and “other meat.” The disaggregation of agricultural sectors allows for a more detailed assessment of the impacts of tariff liberalization on specific commodities, and how trade reform for certain agricultural commodities drive broader economy-wide impacts.

To account for major changes in the global economic environment since 2014, the database is updated to reflect 2017 tariff data and macroeconomic variables. Tariff data at the harmonized system (HS) 6 level for 2017 is sourced from the Center for Global Trade Analysis. To update macroeconomic variables, the percentage changes in real GDP, population, and investment from 2014 to 2017 are applied as exogenous shocks and are described in Appendix Table 5. GDP and population data are sourced from the World Bank (2022) and investment data come from the International Monetary Fund (2022).

Using the 2017 tariff data, weighted average tariffs are then calculated for each of the new sectors that are split from the standard GTAP database. The weighted average import tariff for a GTAP sector i on a GTAP exporting region r by GTAP importing region s (WAT_{irs}) is calculated to obtain an aggregate weighted average bilateral tariff for each new GTAP sector (Eq. 8).

$$\text{Eq. 8: } WAT_{irs} = \sum_{m=1}^X \sum_{t=1}^N \sum_{u=1}^K \left(\frac{ADV_{mxt_n u_k} * Value_{mxt_n u_k}}{Value_{it_n u_k}} \right)$$

wat_{irs} = weighted average import tariff on a commodity i from region r to region s

i = GTAP sector

r = exporting region

s = importing region

$m_x = m_1, m_2, \dots, m_X = \text{HS6 sectors}$

$t_n = t_1, t_2, \dots, t_N =$ exporting countries

$u_k = u_1, u_2, \dots, u_K =$ importing countries

$ADV_{m_x t_n u_k}$ = ad valorem import tariff rate imposed on HS6 sector m of GTAP sector i from exporting country t in exporting region r to importing country u in importing region s

$Value_{m_x t_n u_k}$ = value of trade for HS6 sector m of GTAP sector i from an exporting country t in exporting region r to importing country u in importing region s

$Value_{i t_n u_k}$ = total value of trade for GTAP sector i from exporting country t in exporting region r to importing country u in importing region s

The 2017 interregional weighted average tariffs on trade between ASEAN member countries, and the weighted average tariffs on trade between the U.S. and ASEAN member countries for all GTAP sectors and regions defined in the model are included in Appendix Table 6. The 2017 weighted average tariffs for all agricultural commodities traded between the U.S. and ASEAN are described in the background section and detailed in Tables 1 and 2. Each GTAP sector is composed of HS6 level products m , each GTAP exporting region r is composed of individual countries t , and each GTAP importing region s is composed of individual countries u . Therefore, the weighted average import tariff for a GTAP sector is averaged across each HS6 product, exporting country, and importing country, to calculate a value that is representative of the tariff imposed for the GTAP sector on the exporting region by the importing region.

The GTAP database is composed of the economic data employed in tandem with the GTAP model. This research modifies the original GTAP 10 database sectors for key agricultural products, updates the database from 2014 to 2017 using macroeconomic data for all regions and tariffs data for bilateral trade for each of the newly disaggregated sectors. After the database is updated, the full tariff liberalization scenario is simulated through the complete elimination of all agricultural tariffs between the U.S. and ASEAN.

RESULTS AND DISCUSSION

This section describes the simulated impacts of agricultural tariff liberalization between the U.S. and ASEAN, including overall impacts on participating and non-participating countries and changes in key endogenous variables discussed in the Methods section. The removal of agricultural import tariffs between the U.S. and ASEAN leads to a net welfare gain for the U.S., a net welfare loss for the ASEAN region, and a net welfare loss to the rest of the world. The removal of an import tariff drives down the bilateral import price of that commodity in the importing region. Table 3 presents the percentage changes in the ASEAN import prices on commodities sourced from the U.S. ($pms_{i,U.S.,ASEAN}$). The drop in ASEAN import prices for U.S. commodities is of greater magnitude than the drop in U.S. import prices for ASEAN commodities, in part due to the higher initial tariffs imposed on the U.S. by the ASEAN region. Thailand has the largest tariffs imposed on U.S. commodities in the ASEAN region, including an 81.89% tariff on U.S. dairy, an 80% tariff on U.S. soybeans, a 61.8% tariff on U.S. vegetable oil, and a 50% tariff on U.S. beef. Therefore, it is not surprising that Thailand has the greatest decreases in import prices for U.S. commodities when tariffs are removed. Price changes for U.S. products imported into Thailand include a 44.98% decrease in the price of U.S. dairy, a 44.06% decrease in the price of U.S. soybeans, a 38% decrease in the price of U.S. vegetable oil, and a 33.27% decrease in the price of U.S. beef. Import prices for U.S. commodities in ASEAN also drop by more than 20% for Cambodia imports of beef (-25.86%), pork (-25.86%), and other meat (-25.86%), Indonesia imports of other meat (-22.55%), Malaysia imports of rice (-28.47%), the Philippines imports of other meat (-28.35%), extraction and mining (-24.34%), and corn (-21.54%), and Thailand imports of pork (-27.96%), other meat (-23.64%), rice (-23.03%), other

oilseeds (-22.91%), other coarse grains (-21.19%). The initial tariff rates imposed on these U.S. commodities by ASEAN countries are also above 20%.

Table 4 shows the percentage changes in U.S. import prices for agricultural commodities supplied from the ASEAN region ($pms_{i,ASEAN,U.S.}$). In response to the removal of U.S. import tariffs on ASEAN commodities, there is a decrease in the U.S. import price for most agricultural commodities. U.S. tariffs are above 10% on other oilseeds from Brunei (12.44%), Cambodia (11.61%), Lao (12.44%), and Malaysia (12.44%). Likewise, U.S. import prices decrease by more than 10% for other oilseeds from Brunei (-11.13%), Cambodia (-11.32%), Lao (-11.95%), and Malaysia (-11.32%). The U.S. tariff on sugar imports from the Philippines is 17.96%. The removal of this tariff drives down the U.S. import price for sugar on from the Philippines by 15.04%. U.S. tariffs on dairy imports from Malaysia (14.36%), the Philippines (20.31%), and Thailand (23.38%) are also relatively high. The liberalization of these tariffs translates to a decrease in the U.S. import price for dairy from Malaysia (-12.84%), the Philippines (-17%), and Thailand (-21.83%) of similar magnitude. The U.S. import price for soybean imports from Thailand (-12.15%) and vegetable oil imports from Thailand (-10.80%), also decrease by more than 10%. However, the initial U.S. tariff rate on soybean imports from Thailand is 0%, and the initial U.S. tariff rate on vegetable oil imports from Thailand is .46%. U.S. import prices increase for U.S. rice imports from Brunei (.04%) and Singapore (.02%), U.S. soybean imports from Brunei (.08%) and Indonesia (.14%), and a number of U.S. imports from Thailand including wheat (.05%), corn (.82%), other coarse grains (.93%), vegetables (.12%), fruit and nuts (.30%), other oilseeds (2.05%), and forestry and fishing (.34%).

The market price for aggregate imports refers to the weighted average price of all import prices for a commodity imported into a country region, as opposed to the import price for a

commodity imported from a select country or region. The market price for aggregate imports is therefore driven down by a decrease in bilateral import prices. Table 5 displays the percentage changes in the market prices for aggregate imports into the U.S. and ASEAN (pim_{ir}). ASEAN market prices for imports remain unchanged or decrease for most all commodities. The largest decreases in the market price for imports in the ASEAN region include soybeans imported into Thailand (-29.48%), dairy imported into Thailand (-20.41%), other meat imported into Indonesia (-15.02%), the Philippines (-22.47%), and Vietnam (-12.10%), and vegetable oil imported into Thailand (-21.51%). The U.S. market price for imports decreases for all commodities except for vegetables (.02%) and cattle (.01%). The U.S. market price for imports does not decrease by more than 1% for any single sector.

Aggregate imports refer to the total quantity of a commodity imported into a country or region, as opposed to the quantity of a commodity imported from a select country or region. The demand for aggregate imports reflects the change in the market price for aggregate imports. As the market price for aggregate imports goes down, demand for aggregate imports is incentivized. Table 6 reports the percentage change in the aggregate quantity of imports for agricultural commodities in the U.S. and ASEAN (qim_{is}). There is an increase in the U.S. aggregate quantity of imports for each sector, including U.S. imports of vegetable (.29%) and cattle (.48%). U.S. demand increases by greater than 1% for rice imports (1.72%), wheat (1.33%), soybeans (4.65%), other oilseeds (3.49%), sugar (1.85%), dairy (1.6%), and vegetable oil (1.34%). The largest percentage increases in ASEAN imports are a 149.4% increase in other meat in the Philippines and a 96.43% increase in imports for other meat in Lao. Other ASEAN member countries with increases in imports greater than 20% include Cambodia imports of beef (20.29%) and pork (23.89%), Lao imports of vegetable oil (21.12%), Thailand imports of rice (32.86%)

and dairy (55.19%), and Vietnam imports of other meat (29.41%). These larger percentage changes in imports into ASEAN are in response to the larger decreases in ASEAN import prices for these commodities as a result of tariff liberalization.

Table 7 displays the absolute change in the value of agricultural commodities imported into the U.S. and ASEAN (QIM_{iS}). The absolute change in the value of agricultural commodities imported is dependent on the initial value of imports in the importing country or region. For example, there is a 6.07% increase in the value of soybeans imported into Thailand and a 32.86% increase in the value of rice into Thailand. The absolute change in the value of rice imported into Thailand is \$4 million, whereas the absolute change in the value of soybeans imported into Thailand is \$133.8 million. The aggregate value of imports in the ASEAN region increases by more than \$100 million for soybean imports into Thailand (\$133.8 million), dairy imports into Thailand (\$480.3 million), extraction and mining imports into the Philippines (\$874.33 million), vegetable oil imports into Thailand (\$549.66 million), and other processed food imports into Indonesia (\$107.8 million) and Malaysia (\$116.4 million). In comparison, the aggregate value of imports into the U.S. increases by over \$10 million for 15 out of the 21 agricultural sectors investigated in this research, including a \$1.3 billion increase in extraction and mining imports and a \$623.7 million increase in other processed food imports.

The percentage change in the bilateral quantity of agricultural export sales between the U.S. and ASEAN is driven by the percentage change in the bilateral import price of agricultural commodities traded between the U.S. and ASEAN. Table 8 reports the percentage change in the quantity of U.S. agricultural export sales to ASEAN ($qxs_{i,U.S.,ASEAN}$). ASEAN import prices for U.S. commodities decrease by a greater percentage than U.S. import prices for ASEAN commodities. Therefore, the percentage of U.S. export sales to ASEAN increase by more than

the percentage of ASEAN export sales to the U.S. U.S. export sales to ASEAN increase by more than 100% for commodities with ASEAN import prices that decrease by more than 20%. The U.S. sectors with the largest percentage increases in export sales to ASEAN include a 2051.51% increase in U.S. extraction and mining exports to the Philippines, a 2007.3% increase in U.S. dairy exports to Thailand, a 1761.73% increase in U.S. beef exports to Thailand, a 1202.5% increase in U.S. pork exports to Thailand, and a 1126.68% increase in U.S. other meat exports to Thailand. These changes are driven by the large decreases in ASEAN import prices for these U.S. commodities because of tariff liberalization. For example, the bilateral import price for the Philippines imports of U.S. extraction and mining decreased by 24.34% in response to the elimination of the initial 32.35% tariff imposed by the Philippines on U.S. extraction and mining. Table 9 displays the absolute change in the value of U.S. agricultural export sales to ASEAN ($QXS_{i,U.S.,ASEAN}$). U.S. export sales to the ASEAN region increase by a net value of \$8.8 billion in comparison to a \$1.5 billion increase in ASEAN export sales to the U.S. The U.S. commodities with the largest increase in export sales to the ASEAN region include a \$2.1 billion increase in U.S. vegetable export sales to Thailand, and a \$1.7 billion increase in U.S. extraction and mining exports to the Philippines.

Table 10 reports the percentage change in the quantity of ASEAN agricultural export sales to the U.S. ($qXS_{i,ASEAN,U.S.}$). The greater the decline in the U.S. import price for agricultural commodities from ASEAN countries, the greater potential for an increase in export sales from ASEAN to the U.S. ASEAN country export sales to the U.S. increase by more than 50% for commodities with U.S. import prices that decrease by more than 10%. The commodities with the largest increase in export sales from ASEAN to the U.S. include dairy exports from Thailand (479.51%), the Philippines (287.44%), and Malaysia (171.11%), sugar exports from the

Philippines (135.28%), and vegetable oil from Thailand (113.64%). Table 11 reports the absolute change in the value of ASEAN country agricultural export sales to the U.S. ($QXS_{i,ASEAN,U.S.}$). Again, the absolute change in value is dependent on the initial value of exports. Therefore, a small percentage change in the value of exports can equate to a large absolute change in the value of exports if the initial value of trade is high. For example, a 19.11% increase in Thailand export sales of other processed foods to the U.S. translates to a \$662 million increase in the value of other processed food exports sold to the U.S. By contrast, a 479.51% increase in Thailand export sales of dairy to the U.S. translates to a \$31.35 million increase in the value of dairy exports sold to the U.S.

An increase in export sales contributes to an upward pressure on domestic production in the exporting country or region. Table 12 shows the percentage change in the agricultural output of commodities in both the U.S. and ASEAN countries (qo_{ir}). U.S. production increases for all agricultural commodities except for rice (-.13%), other coarse grains (-.08%), other crops (-.18%), forestry and fishing (-.04%), and extraction and mining (-.13%). The greatest percentage increase in U.S. production is for vegetable oil (6.76%), soybeans (1.93%), and other meat (1.0%). Changes in production in the ASEAN region is more varied. The greatest percentage increase in ASEAN production is for vegetable oil production in Thailand (6.36%). Other ASEAN commodities with an increase to production of more than 1% include wheat production in Myanmar (2.67%) and Vietnam (2.07%), other coarse grain production in Thailand (2.51%), other oilseed production in Thailand (4.81%), sugar production in the Philippines (2.97%), forestry and fishing production in Thailand (1.37%), vegetable oil production in the Philippines (1.07%), and other processed food production in Thailand (4.73%). In contrast to the U.S., some ASEAN member countries have percentage decreases in production of greater than 20%. For

example, soybean production in Thailand is reduced by 25.88%, and other meat production in Vietnam goes down by 22.91%. Tariffs can act as protective barriers to foreign competition in the importing country. When tariffs are removed and imports of foreign commodities increase, consumption of domestically produced goods decreases, leading to a decrease in domestic production.

Table 13 shows the absolute change in the value of agricultural production in the U.S. and ASEAN (QO_{ir}). The value of production in the U.S. increases by more than \$1 billion for vegetable oil (\$2 billion), dairy (\$1.2 billion), and soybeans (\$1 billion). U.S. production also increases by more than \$100 million for other meat (\$949.3 million), other processed food (\$761 million), other animal products (276.8 million), corn (\$253.2 million), beef (\$250.3 million), pork (\$194.6 million), fruit and nuts (\$167.9 million), cattle (\$105.4 million), and hogs (\$104.6 million). The largest increase in the value of production for a commodity in the ASEAN region is a \$1.8 billion increase in other processed food production in Thailand. The only other ASEAN commodities to have an increase in the value of production greater than \$100 million, include vegetable oil production in Thailand (\$212.7 million), other processed food production in Vietnam (\$113.7 million), and sugar production in the Philippines (\$107.3 million). U.S. production increases by a net value of \$6.9 billion, while the ASEAN region has a net decrease in production of \$268 million overall.

Table 14 reports the percentage ($qgdp_r$) and absolute changes in the value of real GDP ($QGDP_r$) for the U.S., ASEAN member countries, and the 21 other countries and regions specified in this model. In response to the agricultural tariff liberalization between the U.S. and ASEAN, the actual percentage changes in overall GDP are relatively small and correspond to relatively small absolute changes in the value of GDP for both the U.S. and ASEAN. GDP is a

function of private household expenditure, government consumption, firm production, and net exports within a given region. The U.S. has a simulated \$138 million decline in GDP, while the ASEAN region has a \$161.48 million increase in GDP. The Philippines has a \$223.5 million increase in GDP, offsetting the \$117.2 million decrease in GDP from Thailand.

Table 15 displays the decomposition of changes in regional welfare, as well as the overall changes in regional welfare, measured as equivalent variation (EV_r). Equivalent variation represents the change in consumer income needed to achieve the new level of utility at pre-shock prices. Positive equivalent variation represents an increase in welfare. The overall change in regional welfare is dependent on changes in allocative efficiency, endowment, technical change, population, terms of trade, investment and savings, and preferences. As a result of tariff liberalization, the U.S. is expected to have a \$1.9 billion increase in regional welfare. In contrast, the ASEAN region is expected to have a collective net loss in welfare of \$417.2 million, and the rest of the world is expected to have a collective net loss in welfare of \$1.3 billion. Some ASEAN member countries like Cambodia, Lao, Myanmar, the Philippines, and Vietnam, have an increase in welfare, while other ASEAN member countries like Brunei, Indonesia, Malaysia, Singapore, and Thailand, have a decrease in welfare. The gain in U.S. welfare is mostly driven by a \$1.4 billion terms of trade gain. The Philippines has a \$100 million increase in welfare, driven by a \$223.4 million increase in allocative efficiency, and is the largest contributor to regional welfare in the ASEAN region. Thailand and Indonesia are the primary detractors in welfare within the ASEAN region. Thailand has a \$438.5 million loss in welfare, driven by a \$309.4 million loss in terms of trade, and Indonesia has a \$110.88 million loss in welfare, driven by a \$110 million loss in terms of trade. This is mostly due the large initial tariffs imposed by Thailand and Indonesia, along with the overall value of U.S. commodities imported by these

countries. Major trade partners of the ASEAN region including Australia, New Zealand, China and Hong Kong, and Russia, as well as trade partners of the U.S. including Canada and Mexico, have a loss to regional welfare as a result of tariff liberalization. Trade policy changes have different effects on national economies when considering impacts on GDP and welfare within regions and across regions around the world. Therefore, it is important to assess how trade liberalization will not only impact participating countries, but trade partners outside of the FTA as well.

CONCLUSION

This research evaluates the potential economic implications of a U.S.-ASEAN free trade agreement (FTA) on agricultural markets through the complete elimination of tariffs on the agricultural commodities traded between the U.S. and ASEAN. The original GTAP database is modified to provide a more detailed analysis of commodity-specific effects from trade liberalization. Results focus on percentage and absolute changes in bilateral import prices, market prices for aggregate imports, aggregate quantities of imports, export sales, domestic production, real GDP, and regional welfare in participating countries. Percentage and absolute changes in real GDP and regional welfare for the rest of the world are also evaluated to assess the impacts of trade liberalization between participating and non-participating countries.

Results indicate that the U.S. is the primary benefactor of the full trade liberalization scenario in terms of regional welfare. The larger initial tariffs imposed by ASEAN member countries on U.S. commodities drives a greater decrease in ASEAN import prices for U.S. commodities upon the full elimination of tariffs on agricultural commodities traded between the U.S. and ASEAN. Imports for U.S. commodities in ASEAN member countries increase by more than U.S. imports of ASEAN commodities, because of tariff liberalization. U.S. FOB export prices increase relative to ASEAN FOB prices. This results in a \$1.4 billion terms of trade gain for the U.S., which contributes to a \$1.9 billion increase in total regional welfare. U.S. production of agricultural commodities also increases to meet export demand by a total value of \$6.9 billion. However, the U.S. has a loss of \$138 million in GDP overall.

The ASEAN region has a net gain of \$161.5 million in GDP, but a net loss in regional welfare of \$415 million. The removal of tariffs reduces the cost of imports for consumers in the

importing country, but also detracts from government revenue, and reduces protection of domestic firms from foreign competition. In contrast, export sales increase and production is incentivized in the exporting region. As a result, ASEAN imports from the U.S. increase and production within the ASEAN region decreases by a net value of \$269 million. The absolute change in the value of export sales from the ASEAN region to the U.S. increases by \$1.5 billion. However, relative to the \$8.8 billion increase in U.S. export sales to the ASEAN region, ASEAN member countries have a net terms of trade loss of \$495.5 million, which contributes to the net loss in regional welfare. The removal of agricultural import tariffs on trade between the U.S. and ASEAN increases bilateral trade between participating countries but detracts from trade with the rest of the world. The decrease in imports from the rest of the world into the U.S. and ASEAN puts downward pressure on FOB export prices in non-participating countries, which results in a \$907 million decrease in terms of trade and contributes to a net decrease in regional welfare of \$1.3 billion for the rest of the world. However, real GDP for the rest of the world increases by \$100.4 million.

The U.S. has engaged in prior trade negotiations with ASEAN for the Trans-Pacific Partnership (TPP). Although the U.S. did not go through with the TPP, this research provides information to consider for future decisions on a potential U.S. free trade agreement with the ASEAN region, as well as U.S. trade negotiations with other countries and regions around the globe. Policy implications of FTAs are such that tariff liberalization can have both positive and negative impacts on national economies, depending on the relative changes in tariff rates and the value of trade between countries or regions. Therefore, in negotiating trade policy, it is important to evaluate the potential impacts on multiple economic measures and assess the trade-offs between them. In addition, FTAs can increase bilateral trade between participating countries, but

detract from trade with non-participating countries. Therefore, it is important to consider the impacts of new FTAs on existing trade relationships as well.

While this research investigates full tariff liberalization, it is common for countries to maintain various protectionist measures in trade negotiations, resulting in partial tariff liberalization outcomes with an FTA, as opposed to the full liberalization scenario considered in this research. The impacts of a partial liberalization scenario will be of lesser magnitude than the full liberalization scenario. However, the results generated in this research can provide an upper bound for simulated impacts from a U.S.-ASEAN FTA. More research could consider historical protectionist measures maintained by certain countries or regions, and partial liberalization scenarios could be simulated to provide more insight on how continued protectionist measures could impact prices, quantities, production, real GDP, and welfare within a potential U.S.-ASEAN FTA. In addition, this research does not alter the original Armington elasticity parameters assigned to each commodity in the GTAP 10 database. However, additional simulations could assess how changes in consumer price sensitivity for foreign and domestic goods could impact the results of tariff liberalization amongst participating countries. Lastly, this research assumes a long run time horizon and perfect competition amongst firms. However, it is possible that firms will operate under different market conditions. Therefore, further research could simulate how different market assumptions could alter the impact of tariff liberalization.

In summary, the complete removal of agricultural tariffs on trade between the U.S. and ASEAN leads to a simulated increase in overall agricultural trade between the U.S. and ASEAN while agricultural trade with the rest of the world is reduced. However, despite increases in ASEAN export sales to the U.S., the ASEAN region is expected to have a net decrease in regional welfare. This loss is in large part due to the terms of trade loss experienced by Thailand

as a result of the large initial import tariffs imposed on U.S. commodities. In contrast, the U.S. is expected to have an increase in regional welfare as a result of the large uptick in U.S. export sales to the ASEAN region post tariff liberalization. The net benefit from the increase in U.S. welfare outweighs the loss in U.S. GDP, to make the U.S. the primary benefactor of a U.S.-ASEAN FTA with a full tariff liberalization scenario. Future agricultural trade negotiations between the U.S. and the ASEAN region are possible. This research provides an upper bound for the potential impacts of agricultural trade liberalization and can be used to assess the possible gains and losses that could be realized from engaging in an FTA.

TABLES & FIGURES

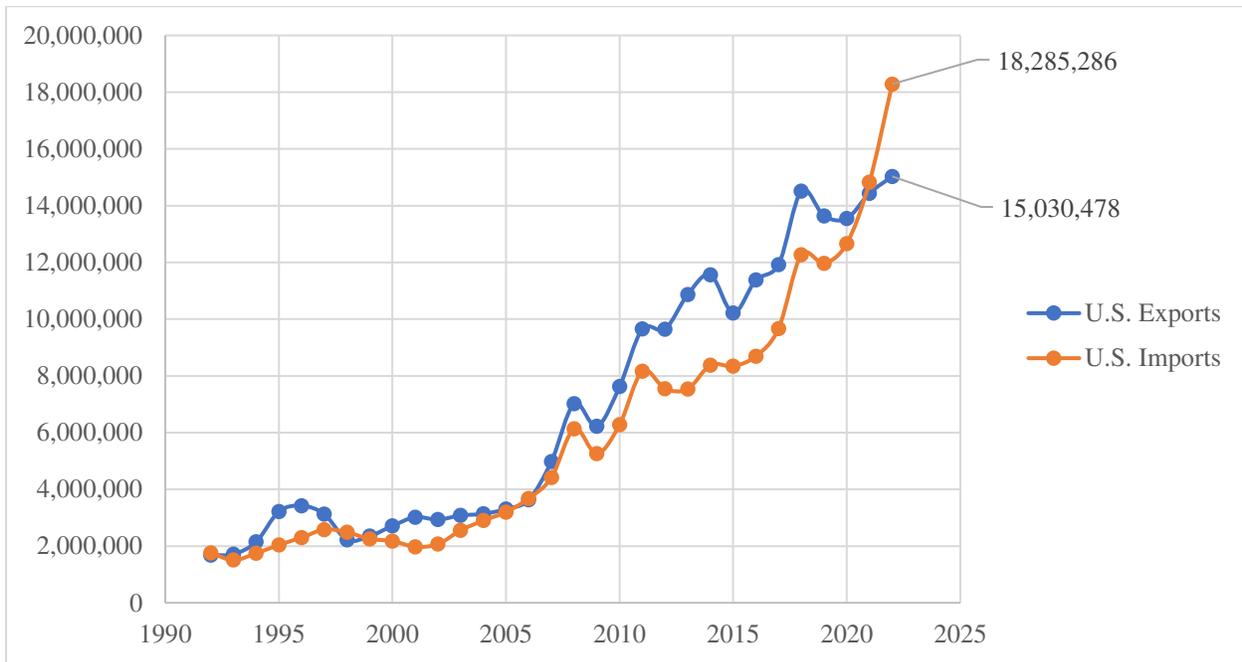


Figure 1. The Value of U.S.-ASEAN Agricultural Exports and Imports from 1992 to 2022 (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: ASEAN is a region composed of the ten Southeast Asian Nations: Brunei Darussalam, Cambodia, Indonesia, Myanmar (Burma), Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. This figure displays the trade value of U.S. and ASEAN agricultural trade in USD thousands over a 20-year time horizon.

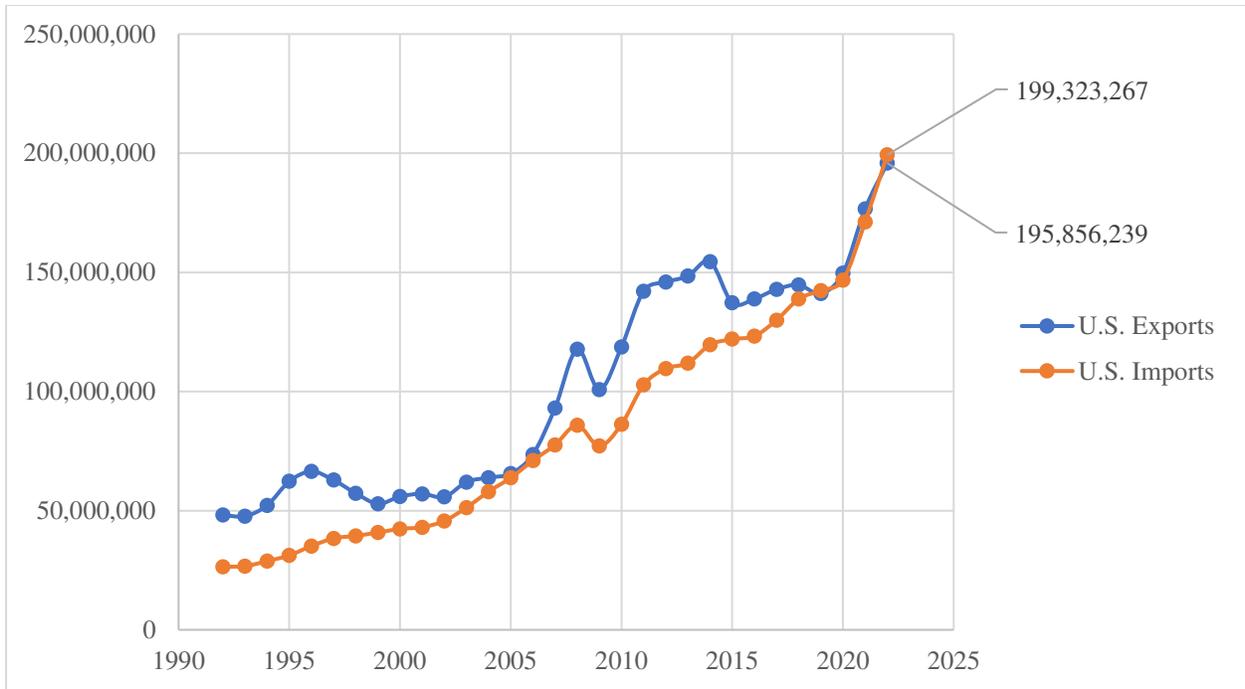


Figure 2. The Value of U.S. Agricultural Exports and Imports from 1992 to 2022 (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This figure displays the value per year of U.S. world agricultural imports and exports in USD thousands over a 20-year time horizon.

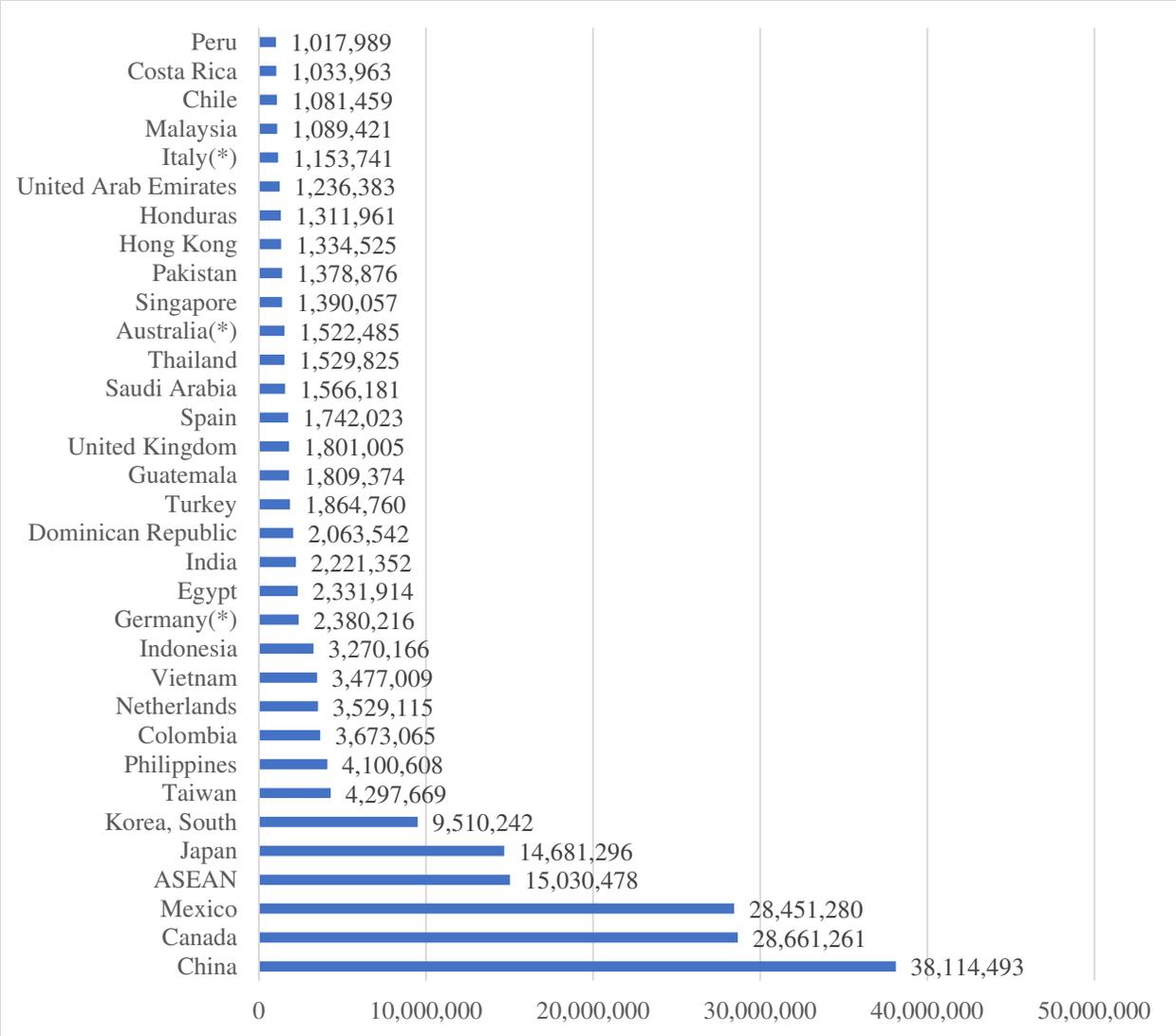


Figure 3. Top U.S. Agricultural Export Partners (2022) (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This figure shows the top U.S. export partners for agricultural commodities in 2022. ASEAN is a region composed of the 10 Southeast Asian Nations: Brunei Darussalam, Cambodia, Indonesia, Myanmar (Burma), Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

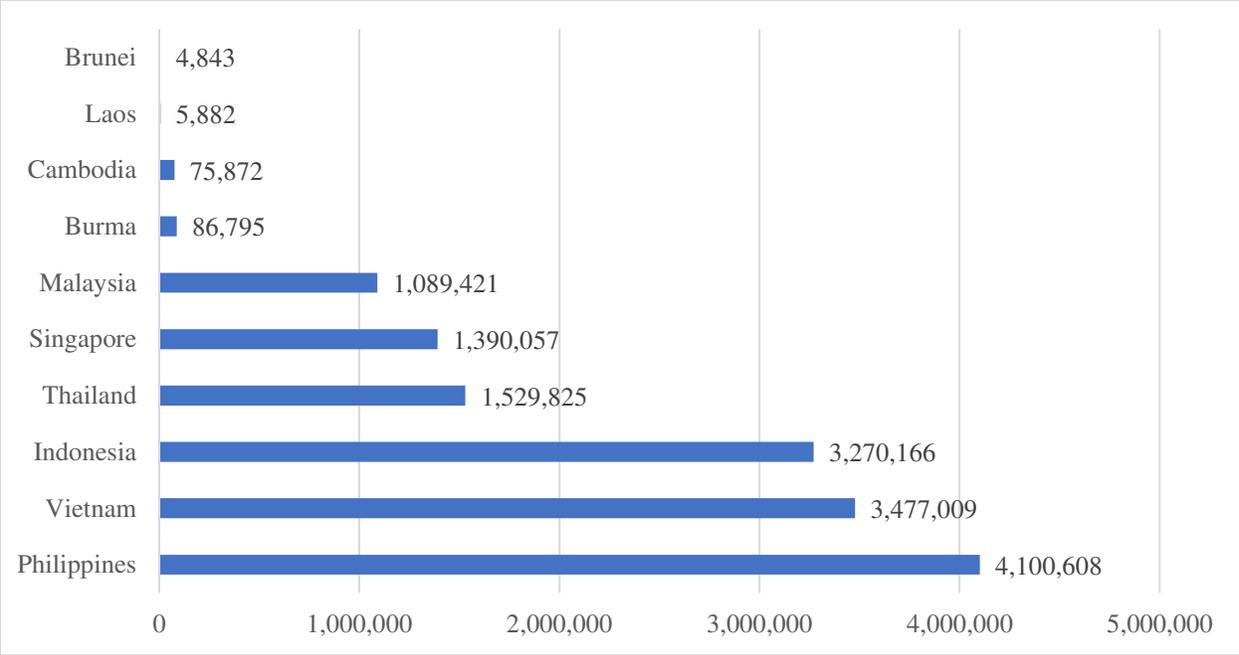


Figure 4. U.S. Agricultural Export Value by ASEAN Member Country 2022 (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This chart depicts the value of U.S. agricultural exports in USD thousands to each of the 10 ASEAN member countries in 2022.

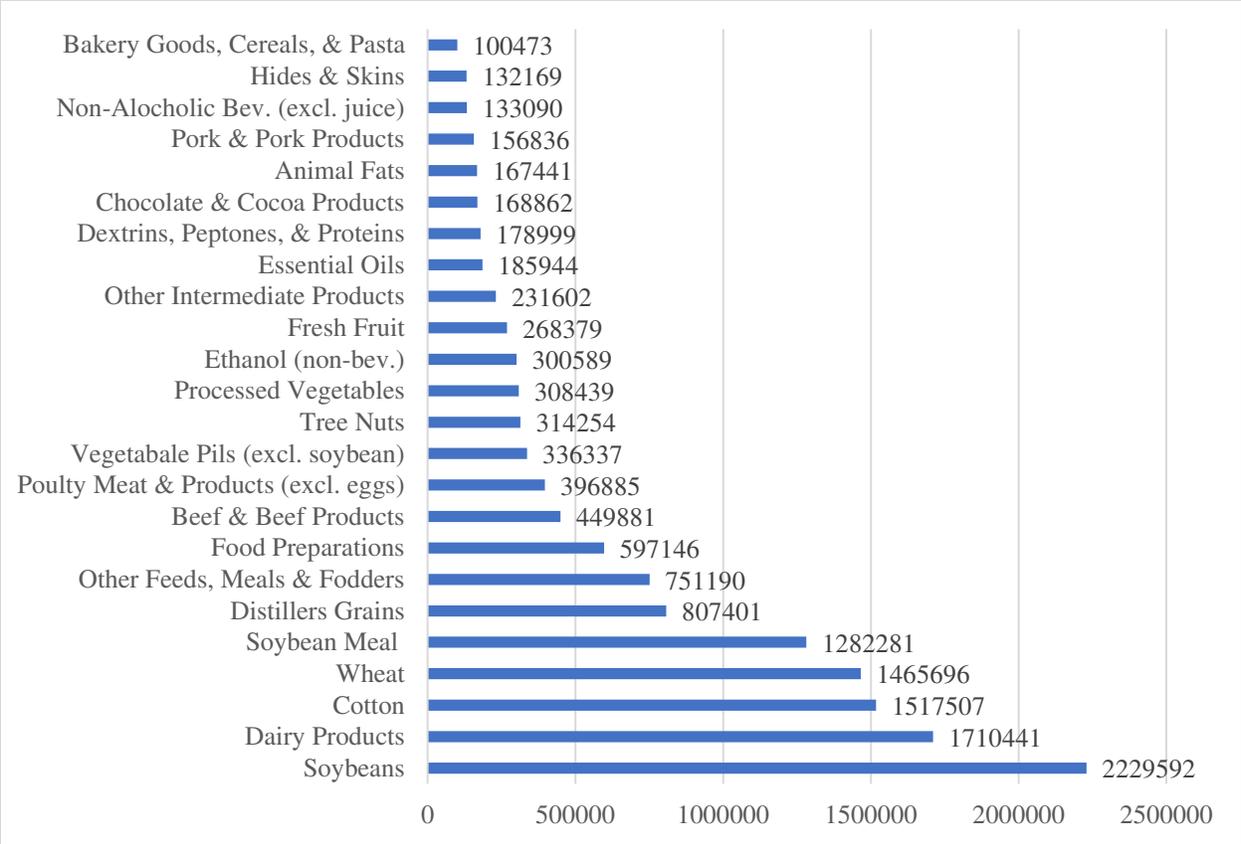


Figure 5. Top U.S. Agricultural Exports to ASEAN (2022) (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This chart depicts the top U.S. agricultural commodities exported to the ASEAN region by value of exports in USD thousands in 2022.

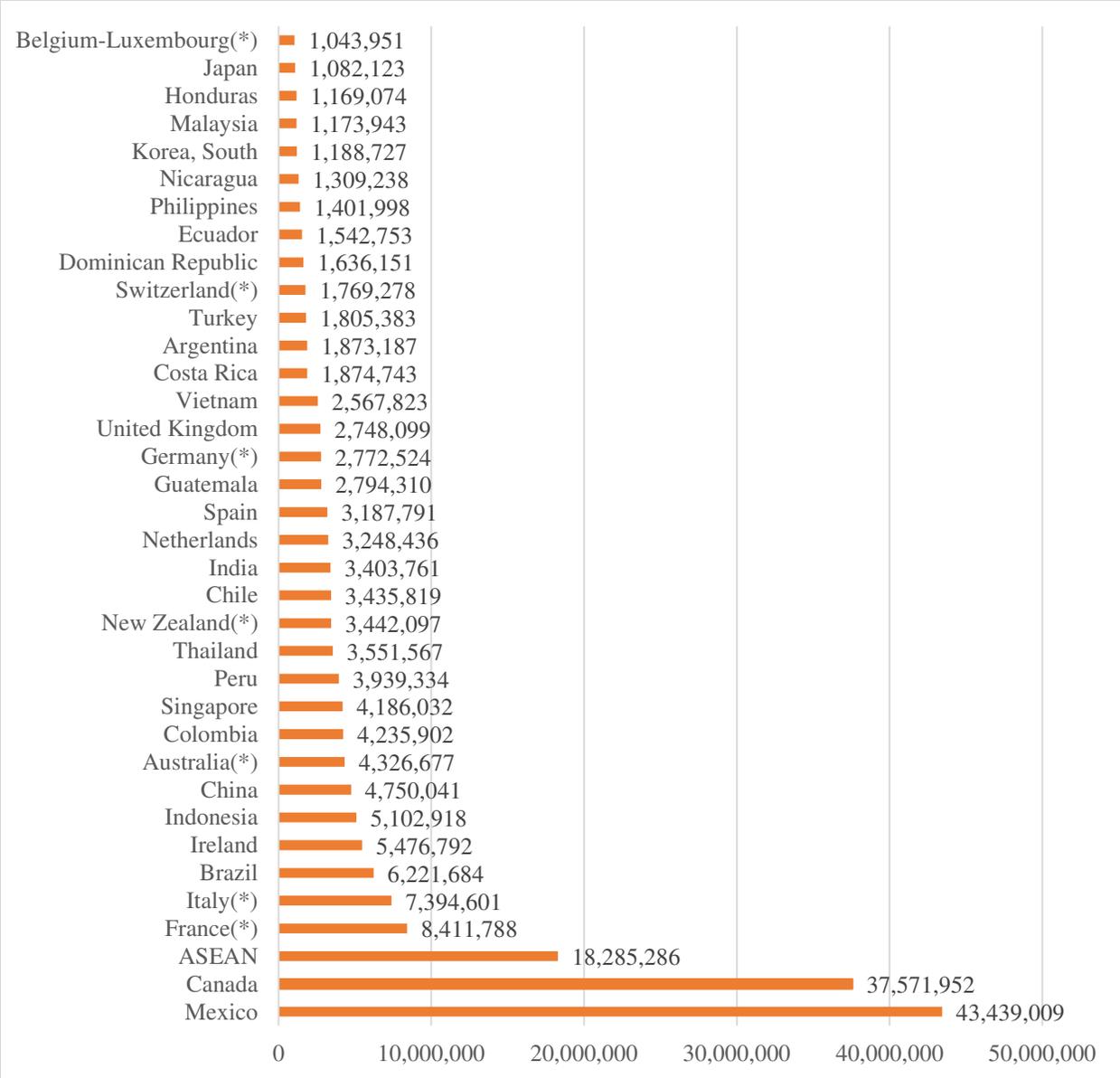


Figure 6. Top U.S. Agricultural Import Partners (2022) (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This chart shows the top U.S. world agricultural import partners by value of trade in USD thousands in 2022. ASEAN is a region composed of the 10 Southeast Asian Nations: Brunei Darussalam, Cambodia, Indonesia, Myanmar (Burma), Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

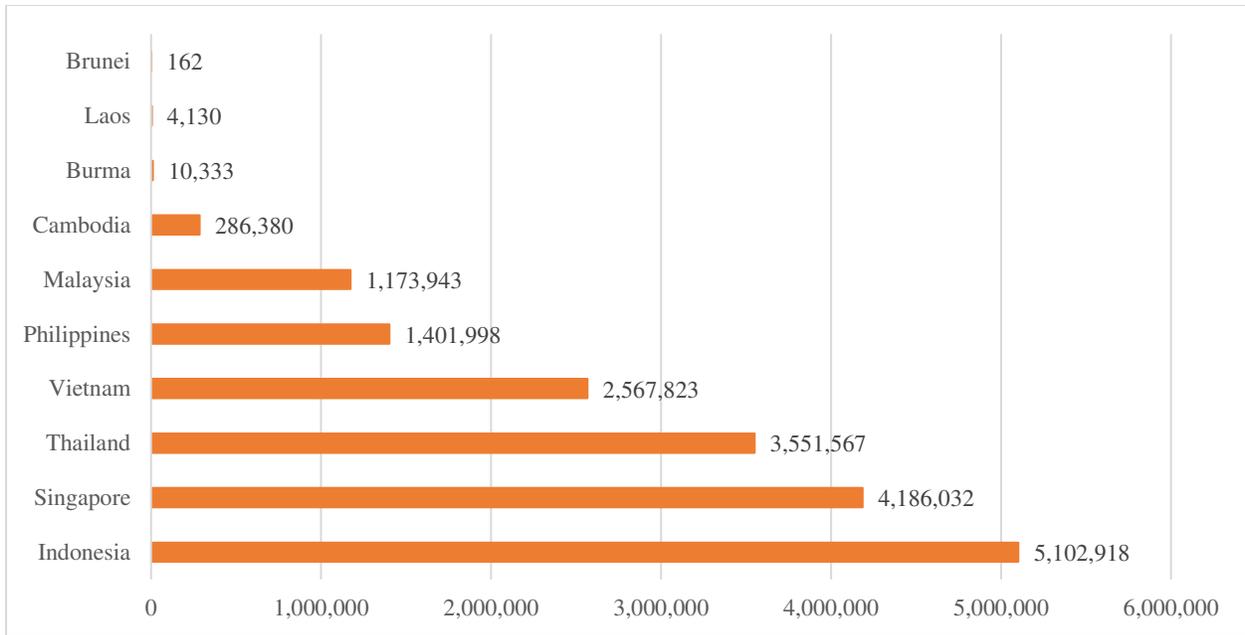


Figure 7. U.S. Agricultural Import Value by ASEAN Member Country in 2022 (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This figure displays the total value of U.S. agricultural imports in USD thousands for each of the 10 ASEAN member countries in 2022.



Figure 8. Top U.S. Agricultural Imports from ASEAN (2022) (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This figure displays the value of the top agricultural commodities imported by the U.S. in USD thousands from the ASEAN region in 2022.

Table 1. 2017 ASEAN Weighted Average Import Tariffs on U.S. Agricultural Commodities (%)

tms_i,U.S.,ASEAN	Importing Country, s									
Commodity, i	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.00	7.00	0.00	5.00	39.86	4.87	0.00	0.00	29.98	0.00
Wheat	0.00	0.00	3.00	0.00	0.00	5.00	4.35	0.00	0.00	5.00
Corn	0.00	7.00	5.00	0.00	0.00	0.00	27.67	0.00	11.84	17.50
Other Coarse Grains	0.00	0.00	4.71	0.31	0.00	3.33	2.45	0.00	27.00	0.24
Vegetables	0.00	3.56	9.63	5.00	0.02	1.79	17.76	0.00	21.51	12.09
Fruit and Nuts	0.00	7.00	5.05	13.08	2.45	17.48	6.39	0.00	18.70	11.37
Soybeans	0.00	15.00	0.00	0.00	0.00	3.00	1.00	0.00	80.00	0.00
Other Oilseeds	0.00	10.28	5.00	1.00	2.20	3.00	8.31	0.00	30.14	10.00
Sugar	0.00	6.99	5.02	0.00	0.09	2.53	2.52	0.00	12.16	5.27
Other Crops	0.38	4.81	0.03	0.00	0.40	10.91	1.28	0.00	0.30	0.03
Cattle	0.00	0.00	0.40	0.00	0.00	0.00	5.25	0.00	0.26	0.02
Hogs	0.00	15.00	3.33	8.33	0.02	1.25	20.33	0.00	0.00	0.00
Other Animal Products	0.00	13.72	3.20	10.00	1.52	4.99	2.26	0.00	1.37	2.07
Dairy	0.00	20.56	5.17	0.00	0.77	3.98	1.65	0.00	81.89	4.77
Forestry and Fishing	0.00	7.21	1.66	0.00	1.32	0.00	4.74	0.00	6.53	3.81
Extraction and Mining	0.00	0.00	9.46	13.60	2.29	6.26	32.35	0.00	2.83	18.47
Beef	0.00	35.00	5.00	0.00	0.00	14.91	8.37	0.00	50.00	14.43
Pork	0.00	35.00	5.00	12.69	0.00	15.00	24.26	0.00	38.94	12.24
Other Meat	0.00	35.00	29.23	14.07	1.77	3.21	39.69	0.00	31.08	20.10
Vegetable Oil	0.00	0.98	2.79	5.54	1.18	1.61	1.02	0.00	61.80	1.45
Other Processed Food	6.77	9.83	7.56	15.81	21.80	7.02	8.52	0.00	11.92	7.81

Source: Center for Global Trade Analysis (2022)

Note: This table displays the weighted average ad valorem import tariffs imposed on each U.S. agricultural commodity imported by each of the 10 ASEAN member countries in 2017. The weighted average import tariff is calculated by multiplying the value of trade by the tariff value for each good within a sector and dividing it by the total value of trade for the entire commodity for each trade unique relationship across country and region as defined in the model.

Table 2. 2017 U.S. Weighted Average Import Tariffs on ASEAN Agricultural Commodities (%)

tms_i,ASEAN,U.S.	Exporting Country, r									
Commodity	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.00	0.00	0.79	4.77	0.00	0.00	0.62	0.00	0.61	5.24
Wheat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corn	0.12	0.00	0.00	0.12	0.12	0.00	0.00	0.00	0.00	0.20
Other Coarse Grains	0.37	0.00	0.31	0.37	1.00	0.00	0.31	0.00	0.65	0.37
Vegetables	5.08	0.24	0.01	5.08	1.83	0.00	0.31	0.00	0.13	1.75
Fruit and Nuts	1.80	0.00	0.00	0.03	1.98	0.00	0.02	0.00	0.10	0.04
Soybeans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Oilseeds	12.44	11.81	0.00	12.44	12.44	0.00	0.00	0.00	0.00	0.00
Sugar	0.00	0.00	4.65	0.00	6.51	1.02	17.96	0.00	9.30	6.07
Other Crops	0.00	0.00	0.17	0.06	2.02	0.00	0.04	0.03	0.72	0.04
Cattle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hogs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Animal Products	0.78	0.00	0.01	0.50	0.46	0.00	0.13	0.00	0.48	0.65
Dairy	0.00	0.85	0.00	0.00	14.36	0.00	20.31	0.00	23.38	0.00
Forestry and Fishing	0.00	0.00	0.09	0.00	0.03	0.11	0.06	0.19	0.04	11.92
Extraction and Mining	0.16	0.00	0.15	0.00	1.68	0.00	3.59	0.00	0.33	0.53
Beef	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pork	0.35	0.00	0.00	0.35	0.35	0.00	0.05	0.00	0.05	0.35
Other Meat	3.46	0.00	2.27	3.46	4.00	0.00	3.88	0.00	0.86	1.82
Vegetable Oil	0.00	0.00	0.18	0.00	0.16	0.00	0.00	0.00	0.46	0.01
Other Processed Food	0.00	1.10	0.72	3.28	2.65	0.03	2.70	0.50	3.31	1.78

Source: Center for Global Trade Analysis (2022)

Note: This table displays the percentage value of the U.S. weighted average ad valorem import tariffs imposed on each agricultural commodity for each of the ten ASEAN member countries in 2017. The weighted average import tariff is calculated by multiplying the value of trade by the tariff value for each good within a sector and dividing it by the total value of trade for the entire commodity for each trade unique relationship across country and region as defined in the model.

Table 3. Percentage Change in the Bilateral Import Price for Agricultural Commodities Supplied from the U.S. to ASEAN

pms_i,U.S.,ASEAN	Import Region, s									
Commodity, i	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.05	-6.50	0.05	-4.72	-28.47	-4.60	0.05	0.05	-23.03	0.05
Wheat	0.28	0.28	-2.67	0.28	0.25	-4.53	-3.93	0.25	0.25	-4.53
Corn	0.17	-6.37	-4.59	0.19	0.18	0.18	-21.54	0.18	-10.43	-14.74
Other Coarse Grains	0.09	0.10	-4.41	-0.21	0.09	-3.13	-2.30	0.09	-21.19	-0.14
Vegetables	0.13	-3.31	-8.67	-4.63	0.11	-1.63	-14.97	0.13	-17.60	-10.67
Fruit and Nuts	0.21	-6.34	-4.61	-11.36	-2.18	-14.69	-5.80	0.21	-15.57	-10.01
Soybeans	0.71	-12.40	0.69	0.74	0.69	-2.24	-0.30	0.69	-44.06	0.69
Other Oilseeds	0.33	-9.01	-4.45	-0.64	-1.84	-2.60	-7.37	0.33	-22.91	-8.79
Sugar	-0.03	-6.56	-4.81	-0.03	-0.12	-2.49	-2.49	-0.03	-10.87	-5.03
Other Crops	-0.29	-4.50	0.07	0.10	-0.30	-9.75	-1.17	0.09	-0.20	0.06
Cattle	0.16	0.16	-0.25	0.16	0.14	0.12	-4.84	0.15	-0.13	0.14
Hogs	0.15	-12.90	-3.10	-7.55	0.12	-1.08	-16.79	0.16	0.15	0.15
Other Animal Products	0.15	-11.93	-2.97	-8.96	-1.36	-4.61	-2.10	0.15	-1.21	-1.90
Dairy	0.08	-16.98	-4.84	0.08	-0.69	-3.75	-1.54	0.09	-44.98	-4.48
Forestry and Fishing	0.11	-6.62	-1.53	0.11	-1.20	0.10	-4.42	0.11	-6.03	-3.57
Extraction and Mining	0.13	0.12	-8.51	-11.85	-2.11	-5.76	-24.34	0.14	-2.62	-15.47
Beef	0.09	-25.86	-4.68	0.09	0.09	-12.89	-7.64	0.09	-33.27	-12.53
Pork	0.09	-25.86	-4.67	-11.18	0.09	-12.96	-19.45	0.09	-27.96	-10.82
Other Meat	0.09	-25.86	-22.55	-12.25	-1.65	-3.02	-28.35	0.09	-23.64	-16.66
Vegetable Oil	0.32	-0.65	-2.41	-4.94	-0.85	-1.28	-0.69	0.32	-38.00	-1.12
Other Processed Food	-6.30	-8.91	-6.99	-13.61	-17.86	-6.52	-7.81	0.05	-10.61	-7.20

Source: Author's Simulations

Note: This table displays the percentage change in the import price for each of the agricultural commodities imported from the U.S. into each of the 10 individual ASEAN member countries as a result of the removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 4. Percentage Change in the Bilateral Import Price for Agricultural Commodities Supplied from ASEAN to the U.S.

pms_i,ASEAN,U.S.	Export Region, r									
Commodity, i	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.04	-0.27	-0.86	-4.69	-0.08	-0.06	-1.02	0.02	-0.42	-4.95
Wheat	-0.03	-0.16	-0.21	-0.03	-0.23	-0.36	-2.31	-0.21	0.05	-1.34
Corn	-0.17	-0.70	-0.18	-0.28	-0.33	-0.18	-1.19	-0.21	0.82	-0.61
Other Coarse Grains	-0.41	-0.21	-0.43	-0.44	-1.08	-0.22	-0.63	-0.18	0.93	-0.61
Vegetables	-4.87	-0.65	-0.10	-5.06	-1.90	-0.07	-1.33	-0.10	0.12	-1.75
Fruit and Nuts	-1.80	-0.53	-0.15	-0.32	-2.12	-0.08	-0.53	-0.67	0.30	-0.33
Soybeans	0.08	-5.03	0.14	-1.76	-0.06	-0.43	-0.41	-0.06	-12.15	-0.13
Other Oilseeds	-11.13	-11.32	-0.31	-11.95	-11.32	-0.29	-0.78	-1.21	2.05	-0.30
Sugar	-0.05	-0.17	-4.49	-0.20	-6.24	-1.06	-15.04	-0.03	-8.42	-5.73
Other Crops	-0.03	-0.43	-0.23	-0.12	-2.07	-0.10	-0.47	-0.06	-0.37	-0.04
Cattle	-0.03	-1.69	-0.22	-0.22	-0.41	-0.05	-0.60	-0.14	-0.11	-0.17
Hogs	-0.05	-0.47	-0.23	-0.20	-0.22	-0.09	-2.02	-0.20	-0.38	-0.44
Other Animal Products	-0.83	-0.38	-0.25	-0.69	-0.66	-0.10	-2.11	-0.16	-0.82	-0.86
Dairy	-0.20	-1.70	-0.16	-0.13	-12.84	-0.24	-17.00	-0.04	-21.83	-0.29
Forestry and Fishing	-0.04	-0.26	-0.07	-0.37	-0.08	-0.04	-0.50	-0.05	0.34	-0.29
Extraction and Mining	-0.21	-0.08	-0.19	-0.06	-1.71	-0.03	-3.72	-0.03	-0.28	-0.53
Beef	-0.03	-1.44	-0.13	-0.21	-0.12	-0.06	-0.02	-0.02	-0.03	-0.18
Pork	-0.41	-0.41	-0.10	-0.55	-0.52	-0.09	-1.60	-0.03	-0.23	-0.67
Other Meat	-3.41	-0.41	-2.32	-3.54	-4.01	-0.09	-5.23	-0.03	-1.03	-2.11
Vegetable Oil	-0.05	-1.41	-0.30	-0.53	-0.37	-0.22	-0.35	-0.04	-10.80	-0.10
Other Processed Food	0.00	-1.41	-0.85	-3.32	-2.75	-0.14	-2.83	-0.53	-5.12	-1.93

Source: Author's Simulations

Note: This table displays the percentage change in the import price for each of the agricultural commodities imported into the U.S. from each of the 10 individual ASEAN member countries as a result of the removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 5. Percentage Change in the Market Price for Aggregate Imports into the U.S. and ASEAN

Commodity, i	Import Region, r										
	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	-0.52	0.15	-4.23	0.07	-0.18	0.00	-0.30	0.06	0.06	-6.82	-0.02
Wheat	-0.02	-0.07	-0.20	-0.60	-1.08	-0.10	-0.55	-3.01	0.00	0.03	-1.22
Corn	-0.03	-0.11	0.37	-0.31	0.41	-0.11	0.77	-2.32	-0.08	-3.32	-1.75
Other Coarse Grains	-0.02	0.01	-0.04	-0.01	-0.02	-0.02	-0.29	-0.03	0.01	-0.63	-0.03
Vegetables	0.02	-0.04	-1.27	-0.12	-0.05	-0.02	-0.01	-5.43	-0.03	-1.17	-0.31
Fruit and Nuts	-0.02	0.00	-1.61	-0.80	-0.20	-0.36	-0.19	-1.25	-0.04	-2.43	-2.71
Soybeans	-0.09	0.00	-0.32	0.67	-0.02	0.32	-0.02	-0.27	0.05	-29.48	0.19
Other Oilseeds	-0.03	-0.15	1.92	-0.22	1.97	-0.02	-0.06	-0.22	-0.14	-1.81	-0.13
Sugar	-0.79	0.03	0.09	-0.19	0.10	0.00	0.08	-0.71	-0.01	-3.61	-0.75
Other Crops	-0.03	-0.04	-0.04	-0.01	0.31	-0.03	-0.08	-0.11	-0.03	-0.07	-0.02
Cattle	0.01	-0.03	-0.03	-0.02	-0.06	-0.03	-0.05	-0.03	-0.05	-0.04	-0.03
Hogs	-0.01	-0.04	-0.26	-0.02	-0.20	-0.03	-0.06	-0.01	-0.04	-0.02	0.01
Other Animal Products	-0.11	-0.16	-0.07	-1.22	-0.22	-0.23	-0.23	-0.11	-0.13	-0.24	-0.10
Dairy	-0.30	-0.19	-2.54	-1.21	-3.37	-0.27	-1.18	-0.66	-0.13	-20.41	-1.65
Forestry and Fishing	-0.02	-0.05	0.13	-0.12	0.27	-0.05	0.18	-0.13	-0.03	-0.27	-0.35
Extraction and Mining	-0.02	-0.03	0.01	-0.08	-0.01	-0.03	-0.03	-1.40	-0.02	-0.03	-1.53
Beef	-0.04	-0.04	-7.16	-0.50	-0.03	-0.04	-2.13	-1.59	-0.03	-1.13	-0.17
Pork	-0.02	-0.03	-5.22	-0.45	-0.28	-0.03	-0.02	-4.22	-0.02	-4.05	-3.90
Other Meat	-0.07	-0.15	-0.84	-15.02	-0.17	-0.12	-0.25	-22.47	-0.06	-2.93	-12.10
Vegetable Oil	-0.12	-0.21	-4.88	-0.25	-9.05	-0.83	-1.25	-0.35	-0.30	-21.51	-0.27
Other Processed Food	-0.41	-0.37	-0.87	-1.66	-1.62	-1.80	-1.32	-1.26	-0.13	-1.10	-0.69

Source: Author's Simulations

Note: This table displays the percentage change in the market price for aggregate imports into the U.S. and each of the ASEAN member countries as a result of the removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 6. Percentage Change in the Aggregate Quantity of Imports for Agricultural Commodities in the U.S. and ASEAN

qim_is	Import Region, s										
Commodity, i	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	1.72	-0.11	15.64	-0.53	0.16	-0.33	0.88	-1.49	-0.69	32.86	0.26
Wheat	1.33	0.00	-0.24	-0.12	-0.01	-0.50	-0.22	-0.68	-0.46	4.73	0.38
Corn	0.51	-0.01	-1.52	0.08	-0.86	-0.27	-1.41	1.21	-0.07	9.99	0.35
Other Coarse Grains	0.32	-0.01	-0.32	-0.08	-0.60	-0.07	-0.17	0.08	-0.07	6.82	0.01
Vegetables	0.29	0.00	1.62	-0.06	-0.48	-0.04	-0.11	7.86	-0.03	3.87	0.24
Fruit and Nuts	0.42	-0.02	2.02	0.96	-0.38	0.09	0.20	1.26	-0.03	6.51	1.65
Soybeans	4.65	-0.04	-13.27	-0.90	-5.40	-0.33	-1.34	0.18	-0.28	6.07	-0.41
Other Oilseeds	3.49	0.00	-7.32	-0.62	-7.56	-0.97	-0.65	-1.05	-0.41	6.64	-0.52
Sugar	1.85	-0.01	-0.37	0.15	-0.32	-0.09	-0.37	2.25	-0.58	8.69	1.89
Other Crops	0.38	0.00	-1.22	-0.06	-1.20	-0.22	-0.13	-0.75	-0.77	1.33	0.01
Cattle	0.48	-0.01	-4.59	-0.15	-0.42	-0.67	-0.02	-0.76	-0.13	0.37	-0.44
Hogs	0.27	-0.02	-0.11	-0.38	-0.19	-0.27	0.00	-4.65	-0.24	-0.41	-0.89
Other Animal Products	0.50	0.14	-0.03	1.59	-0.12	-0.01	0.26	-4.59	-0.05	-0.08	-0.31
Dairy	1.60	0.01	1.80	2.90	1.90	-0.06	1.86	1.45	-0.45	55.19	3.06
Forestry and Fishing	0.24	0.01	-0.72	0.09	-0.84	-0.01	-0.46	-0.64	-0.28	1.72	0.74
Extraction and Mining	0.33	-0.06	-0.17	0.24	0.19	-0.03	0.05	1.75	0.03	-0.05	7.58
Beef	0.60	0.00	20.29	1.23	-0.44	-0.02	8.41	5.29	-0.08	0.99	-0.20
Pork	0.43	-0.01	23.89	1.51	0.37	-0.24	-0.28	11.99	-0.38	12.83	15.84
Other Meat	0.68	0.04	1.95	96.43	-0.04	-0.10	0.74	149.43	-0.35	6.57	29.41
Vegetable Oil	1.34	0.02	5.87	-0.03	21.12	1.46	0.88	-0.66	-2.23	14.55	0.17
Other Processed Food	0.75	0.12	0.59	2.33	2.24	1.82	1.72	1.43	-0.15	1.11	0.64

Source: Author's Simulations

Note: This table displays the percentage change in the aggregate quantity of imports for each agricultural commodity into the U.S. and the 10 ASEAN member countries as a result of the removal of agricultural tariffs between the U.S. and ASEAN.

Table 7. Absolute Change in the Value of Agricultural Commodities Imported into the U.S. and ASEAN (USD Million)

QIM_is	Import Region, s										
Commodity, i	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	18.53	-0.04	1.36	-3.69	0.02	-2.34	0.02	-22.34	-2.60	4.00	0.10
Wheat	14.16	0.00	-0.05	-3.39	0.00	-2.35	-0.24	-9.28	-0.34	25.19	2.81
Corn	6.95	0.00	-0.10	0.82	-0.03	-1.97	-0.20	4.00	-0.01	2.87	5.14
Other Coarse Grains	1.71	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	-0.01	0.91	0.00
Vegetables	29.07	0.00	0.13	-0.40	-0.06	-0.43	-0.18	13.11	-0.26	13.74	3.22
Fruit and Nuts	54.28	0.00	0.30	10.29	0.00	0.66	0.00	6.34	-0.01	64.57	38.71
Soybeans	64.08	0.00	-0.01	-12.16	0.00	-1.25	0.00	0.15	-0.05	133.78	-3.95
Other Oilseeds	42.21	0.00	-0.19	-2.82	-0.07	-1.50	-0.12	-2.71	-0.15	8.01	-1.09
Sugar	56.58	0.00	-1.17	2.69	-0.07	-0.79	-0.31	7.91	-1.90	12.59	3.38
Other Crops	47.81	0.00	-0.09	-1.70	-0.09	-3.62	-0.27	-2.47	-4.89	15.57	0.22
Cattle	16.91	0.00	0.00	-1.86	-0.71	-0.58	0.00	-0.52	-0.04	0.32	-1.98
Hogs	1.58	0.00	-0.10	-0.01	0.00	-0.03	0.00	-0.06	0.00	-0.04	-0.74
Other Animal Products	11.54	0.01	-0.05	5.04	-0.04	-0.03	0.28	-2.52	-0.24	-0.52	-2.55
Dairy	46.09	0.00	2.26	47.96	0.85	-0.65	1.68	20.03	-0.32	480.34	23.05
Forestry and Fishing	8.75	0.00	-0.02	0.23	-0.01	-0.04	-0.02	-0.50	-1.45	6.33	14.50
Extraction and Mining	1284.78	-0.01	-0.09	24.69	0.16	-3.04	0.40	232.81	13.39	-20.85	67.00
Beef	43.55	0.00	11.63	6.40	-0.40	-0.16	0.30	22.27	-0.16	8.61	-6.46
Pork	7.64	0.00	3.12	0.18	0.00	-0.14	0.00	78.61	-0.66	3.10	9.10
Other Meat	8.99	0.01	0.15	47.73	-0.07	-0.21	0.10	874.33	-1.26	8.55	47.47
Vegetable Oil	115.42	0.00	7.84	-0.94	3.76	31.10	6.24	-12.91	-0.57	549.66	5.07
Other Processed Food	623.67	0.21	11.99	107.79	10.84	116.42	25.18	71.50	-7.95	84.30	63.16

Source: Author's Simulations

Note: This chart shows the absolute change in the value of agricultural commodities in USD millions imported into the U.S. and each of the ASEAN member countries as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 8. Percentage Change in the Quantity of U.S. Agricultural Export Sales to ASEAN

qxs_i,U.S.,ASEAN	Import Region, s									
Commodity, i	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.43	31.59	-0.38	28.71	506.66	27.95	-1.42	-0.63	272.51	-0.11
Wheat	-3.12	-4.36	20.47	-11.42	-3.52	43.50	8.11	-2.65	2.71	35.87
Corn	-0.74	17.94	12.18	-0.33	-1.03	0.12	78.85	-0.73	34.14	45.09
Other Coarse Grains	-0.24	-0.70	12.32	-0.12	-0.37	7.62	6.23	-0.28	95.13	0.30
Vegetables	-0.62	9.77	39.15	18.34	-0.53	6.08	59.78	-0.63	103.48	50.38
Fruit and Nuts	-0.81	22.40	16.65	54.45	7.16	79.11	20.57	-0.98	81.88	35.63
Soybeans	-3.39	63.36	-1.02	-8.86	-2.14	10.11	0.33	-3.38	229.99	-2.82
Other Oilseeds	-2.33	61.53	22.89	4.99	8.32	12.70	42.53	-2.65	249.00	55.22
Sugar	0.30	44.50	29.38	0.36	0.54	14.68	12.70	-0.48	65.95	29.27
Other Crops	1.55	31.02	-0.58	0.09	1.46	87.58	5.98	-1.53	2.17	-0.53
Cattle	-0.76	-5.32	0.75	-1.30	-1.35	-0.68	20.91	-0.94	0.72	-1.08
Hogs	-0.52	42.08	8.06	21.79	-0.66	2.70	53.77	-0.75	-0.84	-1.24
Other Animal Products	-1.67	110.91	12.93	71.71	6.97	30.76	7.46	-1.67	5.89	10.94
Dairy	-1.92	228.30	35.21	-21.16	3.01	23.44	8.30	-2.01	2007.30	27.53
Forestry and Fishing	-0.59	27.73	5.37	-0.28	4.23	-0.19	16.45	-0.79	26.12	13.47
Extraction and Mining	-1.96	-1.50	188.99	354.82	28.62	102.93	2051.51	-1.92	37.01	571.90
Beef	-0.99	578.81	40.85	-1.39	-1.06	165.80	71.63	-1.02	1761.73	176.07
Pork	-1.09	924.77	48.70	178.04	-1.34	237.68	413.69	-1.37	1202.50	123.62
Other Meat	-2.03	1126.68	344.22	211.08	14.43	29.06	398.84	-1.63	747.82	106.78
Vegetable Oil	-3.41	-20.57	15.51	-9.51	1.61	1.14	1.66	-6.16	442.48	5.95
Other Processed Food	23.81	34.78	24.07	60.28	88.86	22.64	28.61	-0.77	43.44	27.23

Source: Author's Simulations

Note: This table shows the percentage change in the total value of U.S. export sales to each of the ASEAN member countries for each agricultural commodity as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 9. Absolute Change in the Value of U.S. Agricultural Export Sales to ASEAN (USD Million)

QXS_i,U.S.,ASEAN	Import Region, s									
Commodity, i	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.00	1.46	-0.01	0.20	1.64	0.04	-0.02	-0.05	3.94	0.00
Wheat	0.00	0.00	82.92	0.00	-2.41	2.80	68.78	-0.69	5.42	46.90
Corn	0.00	0.01	4.89	0.00	-0.09	0.00	16.96	-0.01	2.22	48.22
Other Coarse Grains	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.19	0.00
Vegetables	0.00	0.24	1.91	0.06	-0.13	0.09	22.50	-0.53	12.31	11.87
Fruit and Nuts	0.00	0.63	24.63	0.00	6.84	0.00	16.82	-0.01	71.54	159.27
Soybeans	0.00	0.00	-12.50	0.00	-3.73	0.00	0.22	-0.05	883.92	-13.13
Other Oilseeds	0.00	0.00	0.26	0.00	0.02	0.05	0.28	-0.01	8.12	0.12
Sugar	0.00	0.04	17.99	0.00	0.14	0.02	10.89	-0.18	20.59	6.12
Other Crops	0.00	0.05	-2.57	0.00	0.26	1.02	1.73	-0.09	5.05	-2.45
Cattle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	-0.01
Hogs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.25
Other Animal Products	0.00	0.01	12.33	0.00	1.39	1.07	0.11	-0.35	4.51	2.97
Dairy	-0.01	0.93	102.77	-0.06	4.65	0.30	33.51	-0.07	704.98	58.36
Forestry and Fishing	0.00	0.00	0.76	0.00	0.51	0.00	0.26	-0.09	2.90	19.74
Extraction and Mining	0.00	0.00	61.24	0.05	6.79	1.40	1650.14	-0.90	18.15	140.14
Beef	0.00	23.90	16.07	0.00	-0.01	0.51	42.65	-0.28	59.08	30.56
Pork	0.00	4.76	0.36	0.00	0.00	0.00	191.53	-0.19	6.87	15.45
Other Meat	0.00	0.41	51.72	0.07	1.60	0.14	815.88	-1.40	26.26	76.92
Vegetable Oil	0.00	-0.38	6.99	-0.03	0.30	0.06	5.25	-0.02	2051.36	7.89
Other Processed Food	0.77	6.54	181.96	0.40	284.18	0.85	150.22	-3.08	231.95	134.44

Source: Author's Simulations

Note: This table depicts the absolute change in the value in USD millions of U.S. agricultural export sales to each ASEAN member country by agricultural commodity as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 10. Percentage Change in the Quantity of ASEAN Agricultural Export Sales to the U.S.

qxs_i,ASEAN,U.S.	Export Region, r									
Commodity, i	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	-1.30	0.35	3.58	28.18	-0.67	-0.81	4.53	-1.20	1.17	30.03
Wheat	1.42	2.67	3.11	1.49	3.33	4.50	24.59	3.12	0.71	14.07
Corn	0.88	2.32	0.92	1.17	1.30	0.90	3.63	0.99	-1.65	2.04
Other Coarse Grains	1.35	0.83	1.41	1.44	3.15	0.86	1.93	0.75	-2.09	1.89
Vegetables	20.72	2.83	0.75	21.64	7.75	0.62	5.44	0.75	-0.12	7.16
Fruit and Nuts	7.32	2.32	0.89	1.54	8.62	0.62	2.34	2.87	-0.76	1.57
Soybeans	3.81	34.20	3.49	13.58	4.52	6.40	6.33	4.51	96.30	4.84
Other Oilseeds	84.23	86.27	4.95	92.78	86.26	4.85	7.47	9.72	-6.42	4.89
Sugar	-2.14	-1.53	25.11	-1.33	38.25	3.37	135.28	-2.24	56.93	34.26
Other Crops	0.38	2.87	1.62	0.94	14.01	0.80	3.13	0.56	2.49	0.45
Cattle	0.63	7.61	1.39	1.41	2.21	0.72	2.95	1.08	0.94	1.20
Hogs	0.37	1.47	0.85	0.76	0.81	0.49	5.74	0.76	1.22	1.41
Other Animal Products	4.85	2.09	1.30	4.00	3.83	0.41	13.35	0.78	4.78	5.04
Dairy	0.90	12.71	0.57	0.40	171.11	1.12	287.44	-0.26	479.51	1.52
Forestry and Fishing	0.29	1.11	0.41	1.53	0.45	0.30	1.99	0.34	-1.04	1.21
Extraction and Mining	2.67	1.04	2.50	0.82	23.15	0.51	57.82	0.47	3.61	6.71
Beef	0.56	12.17	1.31	1.93	1.24	0.75	0.44	0.46	0.51	1.68
Pork	3.97	3.95	1.16	5.21	4.92	1.07	15.70	0.55	2.30	6.37
Other Meat	35.74	3.76	23.05	37.38	43.41	0.89	60.76	0.36	9.64	20.67
Vegetable Oil	0.85	10.37	2.49	4.09	2.97	1.97	2.90	0.74	113.64	1.18
Other Processed Food	-0.68	4.32	2.29	11.62	9.39	-0.19	9.68	1.15	19.11	6.25

Source: Author's Simulations

Note: This table shows the percentage change in the total value of export sales for each agricultural commodity by each ASEAN member country to the U.S. as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 11. Absolute Change in the Value of ASEAN Agricultural Export Sales to the U.S. (USD Million)

QXS _{i,ASEAN,U.S.}	Export Region, r									
	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	0.00	0.02	0.17	0.61	-0.02	0.00	0.22	-0.01	5.89	13.78
Wheat	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Corn	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Coarse Grains	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	-0.01	0.00
Vegetables	0.00	0.04	0.01	0.10	0.09	0.03	0.15	0.00	-0.02	0.14
Fruit and Nuts	0.00	0.00	0.18	0.00	0.03	0.00	3.00	0.00	-0.73	11.32
Soybeans	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Other Oilseeds	0.00	0.16	0.00	0.02	0.00	0.02	0.02	0.00	-0.29	0.02
Sugar	0.00	-0.01	7.74	0.00	0.24	0.01	81.15	0.00	15.97	0.87
Other Crops	0.00	0.01	6.73	0.04	0.78	0.00	0.48	0.21	0.95	4.08
Cattle	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Hogs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Animal Products	0.00	0.14	0.20	0.00	0.03	0.00	0.06	0.00	1.35	8.00
Dairy	0.00	0.01	0.01	0.00	6.03	0.00	11.94	0.00	31.35	0.01
Forestry and Fishing	0.00	0.04	0.11	0.00	0.05	0.00	0.86	0.04	-0.38	0.36
Extraction and Mining	0.22	0.00	50.26	0.21	7.01	0.16	0.38	0.00	15.58	101.02
Beef	0.00	0.04	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00
Pork	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Meat	0.00	0.06	0.46	0.15	1.04	0.00	2.65	0.00	1.60	0.19
Vegetable Oil	0.00	0.03	19.90	0.00	27.14	0.01	22.07	0.04	12.61	0.01
Other Processed Food	-0.01	1.01	61.02	0.53	50.60	-0.10	87.31	1.43	661.95	145.11

Source: Author's Simulations

Note: This table depicts the absolute change in the value in USD millions of agricultural export sales from each ASEAN member country to the U.S. by agricultural commodity as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 12. Percentage Change in the Value of Agricultural Production in the U.S. and ASEAN

Commodity, i	Region, r										
	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	-0.13	0.33	0.08	0.01	0.04	0.03	-0.02	0.22	-0.09	-0.07	0.05
Wheat	0.55	0.24	-0.29	-1.51	-2.53	-0.06	2.67	-2.34	-0.20	-0.34	2.07
Corn	0.30	-0.08	-0.20	-0.12	0.04	-0.12	-0.16	-0.56	-0.29	1.00	-0.45
Other Coarse Grains	-0.08	0.02	0.46	0.20	0.11	0.13	-0.23	0.98	-0.19	2.51	-0.30
Vegetables	0.06	0.03	0.12	-0.01	-0.06	0.03	-0.01	-0.25	-0.03	0.00	0.06
Fruit and Nuts	0.44	0.04	-0.03	-0.07	-0.13	-0.14	-0.02	0.57	-1.29	0.31	-0.26
Soybeans	1.93	0.87	-5.20	0.35	-1.98	1.00	-0.47	0.83	0.26	-25.88	-0.12
Other Oilseeds	0.62	-0.44	-0.29	-0.33	-1.00	-0.31	-0.29	0.33	-1.93	4.81	-0.52
Sugar	0.09	0.18	-0.07	0.09	-0.16	-0.01	0.00	2.97	-0.80	-0.07	-0.12
Other Crops	-0.18	0.04	0.10	0.04	0.16	0.04	-0.05	0.67	0.08	0.23	-0.01
Cattle	0.17	0.00	-1.32	-0.19	-0.05	0.01	0.02	0.39	-0.10	-0.52	-0.07
Hogs	0.61	0.00	-0.02	-0.06	-0.05	-0.03	0.05	-2.97	-0.62	0.16	-0.15
Other Animal Products	0.53	-0.05	0.18	-0.08	-0.04	0.00	0.04	-2.93	-0.39	0.24	0.59
Dairy	0.70	-0.23	-4.23	-1.05	-3.87	0.45	-1.55	-0.05	-1.45	-14.60	-1.85
Forestry and Fishing	-0.04	0.01	0.02	0.01	0.08	0.02	-0.05	-0.03	-0.03	1.37	0.02
Extraction and Mining	-0.13	0.00	0.32	0.05	-0.23	0.06	0.00	0.27	0.05	-0.44	0.00
Beef	0.17	-0.02	-4.32	-0.15	0.21	-2.58	-0.01	-0.79	-0.33	-0.55	0.14
Pork	0.60	0.04	-0.34	-0.02	0.03	0.18	0.05	-1.03	-0.36	-0.10	-0.93
Other Meat	1.05	-0.21	0.15	-0.82	0.21	0.13	0.04	-11.47	-1.09	0.24	-22.91
Vegetable Oil	6.76	-2.01	-3.59	-0.51	-8.66	-0.39	-2.42	1.07	-4.30	6.36	-1.15
Other Processed Food	0.11	-0.58	-0.29	-0.13	-0.30	-0.50	-0.36	-0.12	-1.19	4.73	0.41

Source: Author's Simulations

Note: This table depicts the percentage change in the production of agricultural commodities in the U.S. and each of the ASEAN member countries as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 13. Absolute Change in the Value of Agricultural Production in the U.S. and ASEAN (USD Million)

QO_ir	Region, r										
Commodity	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Rice	-11.82	0.00	2.80	4.79	1.38	0.59	-1.86	51.07	-0.29	-20.14	11.69
Wheat	93.32	0.00	0.00	-0.23	0.00	0.00	0.03	-0.01	-0.01	-0.03	0.02
Corn	253.18	0.00	-0.31	-7.35	0.05	-0.06	-0.48	-16.04	-0.01	11.09	-1.61
Other Coarse Grains	-4.17	0.00	0.00	0.00	0.00	0.00	-0.21	0.02	0.00	1.72	-0.02
Vegetables	27.55	0.00	0.66	-1.02	-0.53	0.17	-0.42	-5.13	-0.01	0.22	2.99
Fruit and Nuts	167.93	0.00	-0.10	-14.39	-0.41	-0.56	-0.17	34.10	-0.05	43.90	-12.16
Soybeans	1008.61	0.00	-6.97	3.46	-0.35	0.00	-0.08	0.00	0.00	-15.43	-0.04
Other Oilseeds	23.33	0.00	-0.23	-52.67	-0.50	-46.27	-1.32	7.67	-0.05	38.10	-0.71
Sugar	24.05	0.00	-0.17	4.67	-0.10	-0.12	0.02	107.26	-1.12	-5.66	-3.77
Other Crops	-51.48	0.00	0.78	10.21	0.45	0.80	-1.05	9.85	0.29	5.02	-0.62
Cattle	105.42	0.00	-7.72	-6.18	-0.52	0.01	0.20	5.67	-0.02	-5.10	-1.26
Hogs	104.55	0.00	-0.20	-1.49	-0.26	-0.15	0.40	-273.97	-0.05	4.85	-8.88
Other Animal Products	276.83	-0.01	0.66	-6.58	-0.14	0.21	0.94	-221.04	-0.64	16.50	8.14
Dairy	1242.50	0.00	-2.55	-54.29	-0.60	10.62	-1.86	-2.36	-10.55	-443.02	-28.54
Forestry and Fishing	-15.51	0.00	0.55	1.44	2.36	1.70	-4.75	-4.06	-0.06	94.67	2.82
Extraction and Mining	-628.22	-0.18	1.65	69.89	-3.05	22.98	0.08	26.48	0.57	-100.62	-0.86
Beef	250.30	0.00	-10.77	-6.84	0.50	-1.22	-0.04	-20.92	-1.38	-10.51	0.20
Pork	194.55	0.00	-2.39	-0.34	0.07	0.14	0.28	-75.71	-0.30	-2.88	-7.98
Other Meat	949.30	0.00	0.30	-45.66	0.29	0.91	0.72	-684.26	-5.70	21.17	-41.22
Vegetable Oil	2096.81	0.00	-5.70	-203.53	-3.23	-131.26	-6.38	28.05	-19.98	212.68	-13.26
Other Processed Food	761.00	-0.18	-9.06	-106.79	-10.36	-86.78	-27.02	-48.75	-83.98	1810.46	113.74

Source: Author's Simulations

Note: This table shows the absolute change in the value of agricultural commodities produced in the U.S. and each of the ASEAN member countries as a result of the complete removal of agricultural tariffs between the U.S. and the ASEAN region.

Table 14. Percentage and Absolute Changes in the Value of real Gross Domestic Product (GDP)

Region, r	%	Million USD
Argentina	0.00	-19.25
Australia	0.00	-9.00
Brazil	0.00	-17.38
Brunei Darussalam	0.00	0.02
Cambodia	0.01	2.83
Canada	0.00	-23.00
China and Hong Kong	0.00	53.00
Egypt	0.00	-1.92
European Union and United Kingdom	0.00	84.00
India	0.00	26.00
Indonesia	0.00	15.94
Japan	0.00	-5.50
South Korea	0.00	6.13
Lao	0.00	0.24
Malaysia	0.01	20.34
Mexico	0.00	-2.38
Myanmar	0.00	1.98
New Zealand	0.00	-4.33
Philippines	0.07	223.50
Rest of Asia & Oceania	0.00	13.00
Rest of Africa	0.00	-2.63
Rest of Central America	0.00	-1.50
Rest of Europe	0.00	0.47
Rest of Middle East	0.00	-13.25
Rest of North America	0.00	-0.37
Rest of South America	0.00	-19.75
Russia	0.00	21.25
Singapore	0.00	3.38
Thailand	-0.03	-117.20
Ukraine	0.01	16.80
United States	0.00	-138.00
Vietnam	0.01	10.45

Source: Author's Simulations

Note: This table shows the percentage and absolute changes in the value of real GDP

Table 15. Absolute Change in Welfare by Component (Equivalent Variation (EV), USD Million)

Region, r	Allocative Efficiency	Endowment	Technical Change	Population	Terms of Trade	Investment and Savings	Preferences	Total Change in EV
Australia	-9.04	0.00	0.00	0.00	-65.21	-9.16	0.00	-83.41
Argentina	-19.27	0.00	0.00	0.00	-130.04	1.29	0.00	-148.03
Brazil	-17.42	0.00	0.00	0.00	-137.68	-48.87	0.00	-203.98
Brunei Darussalam	0.02	0.00	0.00	0.00	-2.43	0.40	0.00	-2.00
Cambodia	2.83	0.00	0.00	0.00	13.76	-0.51	0.00	16.09
Canada	-22.98	0.00	0.00	0.00	-111.14	-7.42	0.00	-141.55
China and Hong Kong	53.37	0.00	0.00	0.00	-73.92	-241.55	0.00	-262.10
Egypt	-1.93	0.00	0.00	0.00	0.69	-0.83	0.00	-2.07
European Union, United Kingdom	83.19	0.00	0.00	0.00	-99.37	-67.17	0.00	-83.35
India	25.91	0.00	0.00	0.00	-39.60	-48.29	0.00	-61.99
Indonesia	15.91	0.00	0.00	0.00	-109.96	-15.42	0.00	-109.47
Japan	-5.59	0.00	0.00	0.00	77.22	-14.39	0.00	57.24
South Korea	6.18	0.00	0.00	0.00	37.20	-22.42	0.00	20.96
Lao PDR	0.24	0.00	0.00	0.00	5.38	-3.84	0.00	1.77
Malaysia	20.33	0.00	0.00	0.00	-43.20	-2.33	0.00	-25.20
Mexico	-2.41	0.00	0.00	0.00	-84.02	-6.18	0.00	-92.61
Myanmar	1.99	0.00	0.00	0.00	22.34	-1.11	0.00	23.22
New Zealand	-4.33	0.00	0.00	0.00	-49.26	2.92	0.00	-50.66
Philippines	223.37	0.00	0.00	0.00	-78.60	-44.72	0.00	100.06
Rest of Oceania, Asia	13.01	0.00	0.00	0.00	26.55	-14.89	0.00	24.67
Rest of Africa	-2.61	0.00	0.00	0.00	-27.21	-12.63	0.00	-42.44
Rest of Central America, Caribbean	-1.47	0.00	0.00	0.00	-26.89	3.56	0.00	-24.80
Rest of Europe	0.48	0.00	0.00	0.00	0.49	-1.02	0.00	-0.04
Rest of Middle East	-13.31	0.00	0.00	0.00	-137.39	-29.95	0.00	-180.65
Rest of North America	-0.37	0.00	0.00	0.00	-0.49	-0.03	0.00	-0.89
Rest of South America	-19.79	0.00	0.00	0.00	-34.86	-10.98	0.00	-65.63
Russia	21.29	0.00	0.00	0.00	-64.86	-10.74	0.00	-54.31
Singapore	3.39	0.00	0.00	0.00	-0.12	-7.92	0.00	-4.65
Thailand	-116.95	0.00	0.00	0.00	-309.35	-11.33	0.00	-437.63
Ukraine	16.81	0.00	0.00	0.00	32.58	6.51	0.00	55.90
United States of America	-138.22	0.00	0.00	0.00	1428.83	614.07	0.00	1904.69
Vietnam	10.46	0.00	0.00	0.00	6.71	5.72	0.00	22.88

Source: Author's Simulations

REFERENCES

- Adams, F. G., and Park, I. (1999). *Measuring the impact of AFTA: An application of a linked CGE system*. *Journal of Policy Modeling*. Retrieved January 2, 2023, from <https://www.sciencedirect.com/science/article/pii/016189389400035E>
- Aguiar, A., Chepeliev, M., Corong, E. L., McDougall, R., & van der Mensbrugge, D. (2019). The GTAP Data Base: Version 10. *Journal of Global Economic Analysis*, 4(1), 1–27. <https://doi.org/10.21642/jgea.040101af>
- Ahmed, S. (2010). India-ASEAN Free Trade Agreement: A sectoral analysis. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1698849>
- Ando, M., and Urata, S. (2007). The Impacts of East Asia FTA: A CGE Model Simulation Study. *East Asian Economic Review*, 11(2), 3–73. <https://doi.org/http://dx.doi.org/10.2139/ssrn.3077835>
- Ariyasajakorn, D., Gander, J. P., Ratanakomut, S., and Reynolds, S. E. (2009). ASEAN FTA, distribution of income, and Globalization. *Journal of Asian Economics*, 20(3), 327–335. <https://doi.org/10.1016/j.asieco.2009.02.009>
- Arita, S., Beckman, J., and Mitchell, L. (2017). Reducing transatlantic barriers on U.S.-EU agri-food trade: What are the possible gains? *Food Policy*, 68, 233–247. <https://doi.org/https://doi.org/10.1016/j.foodpol.2016.12.006>
- Australian Government Department of Foreign Affairs and Trade. (2022). DFAT. Retrieved 2022, from <https://www.dfat.gov.au/trade/agreements>
- Babatunde, K. A., Begum, R. A., and Said, F. F. (2017). Application of computable general equilibrium (CGE) to climate change mitigation policy: A systematic review. *Renewable and Sustainable Energy Reviews*, 78, 61–71. <https://doi.org/10.1016/j.rser.2017.04.064>
- Beckman, J., & Countryman, A. M. (2021). The importance of agriculture in the economy: Impacts from covid -19. *American Journal of Agricultural Economics*, 103(5), 1595–1611. <https://doi.org/10.1111/ajae.12212>
- Beckman, J., Estrades, C., & Aguiar, A. (2019). Export taxes, food prices and poverty: A global CGE evaluation. *Food Security*, 11(1), 233–247. <https://doi.org/10.1007/s12571-018-0876-2>

- Beckman, J., Estrades, C., Flores, M., & Aguiar, A. (2018). The impacts of export taxes on agricultural trade. *NBER WORKING PAPER SERIES*, (24894). <https://doi.org/10.3386/w24894>
- Beckman, J., and Zahniser, S. (2018). The effects on intraregional agricultural trade of ending NAFTA's market access provisions. *Canadian Journal of Agricultural Economics*, 66, 599–612. <https://doi.org/10.1111/cjag.12188>
- Bergman, L. (2005). Chapter 24, CGE Modeling of Environmental Policy and Resource Management. In *Handbook of Environmental Economics* (Vol. 3). essay, Elsevier B.V.
- Brandaõ, A. S. P., and Martin, W. J. (1993). Implications of agricultural trade liberalization for the developing countries. *Agricultural Economics*, 8, 313–343. [https://doi.org/10.1016/0169-5150\(93\)90040-j](https://doi.org/10.1016/0169-5150(93)90040-j)
- Brockmeier, M. (2000). A Graphical Exposition of the GTAP Model. *GTAP Technical Series*. <https://doi.org/10.21642/gtap.tp08>
- Burfisher, M. E. (2016). *Introduction to Computable General Equilibrium Models* (second). Cambridge University Press.
- Burfisher, M. E., Robinson, S., and Theirfelder, K. (1997). *Migration, prices, and wages in a North American Free Trade Agreement*. AgEcon Search. Retrieved January 2, 2023, from <https://ageconsearch.umn.edu/record/198199>
- Calzadilla, A., Rehdanz, K., Betts, R., Falloon, P., Wiltshire, A., & Tol, R. S. (2013). Climate change impacts on global agriculture. *Climatic Change*, 120(1-2), 357–374. <https://doi.org/10.1007/s10584-013-0822-4>
- Center for Global Trade Analysis. (2022). GTAP Global Trade Analysis Project. Retrieved 2022, from <https://www.gtap.agecon.purdue.edu/>
- Clausing, K. A. (2001). Trade creation and trade diversion in the Canada – United States Free Trade Agreement. *Canadian Journal of Economics*, 34(3), 677–696.
- Corong, E. L., Thomas, H. W., Robert, M. D. A., Tsigas, M. E., and Van Der Mensbrugge, D. (2017). The Standard GTAP Model, Version 7. *Journal of Global Economic Analysis*, 2(1), 1–119. <https://doi.org/10.21642/jgea.020101af>
- Cui, L., Sun, Y., Melnikiene, R., Song, M., & Mo, J. (2019). Exploring the impacts of Sino–US trade disruptions with a multi-regional CGE model. *Economic Research-Ekonomika Istraživanja*, 32(1), 4015–4032. <https://doi.org/10.1080/1331677x.2019.1679211>
- Devadason, E. S. (2010). ASEAN–China Trade Flows: Moving forward with ACFTA. *Journal of Contemporary China*, 19(66), 653–674. <https://doi.org/10.1080/10670564.2010.485403>

- Diao, X., Diaz-Bonilla, E., Robinson, S., & Orden, D. (2005). Tell me where it hurts, an' I'll tell you who to call - industrialized countries' agricultural policies and developing countries. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.743894>
- Economic Research Service, United States Department of Agriculture. (2022). *AG and food sectors and the economy*. Ag and Food Sectors and the Economy. Retrieved September 11, 2022, from <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy/>
- Economic Research Service and Foreign Agricultural Service, Kenner, B., Jiang, H., and Russell, D., Outlook for U.S. Agricultural Trade, AES-117 (2021). USDA, Economic Research Service, and Foreign Agricultural Service. Retrieved 2022, from <https://www.ers.usda.gov/webdocs/outlooks/101941/aes-117.pdf?v=1422.5>
- Farajzadeh, Z., & Bakhshoodeh, M. (2015). Economic and environmental analyses of Iranian energy subsidy reform using Computable General Equilibrium (CGE) model. *Energy for Sustainable Development*, 27, 147–154. <https://doi.org/10.1016/j.esd.2015.06.002>
- Foreign Agricultural Service, International Agricultural Trade Report (2016). United States Department of Agriculture. Retrieved 2023, from https://www.fas.usda.gov/sites/default/files/2016-06/2016-06_iatr_ftas.pdf.
- Foreign Agricultural Service (2022). Retrieved 2023, from <https://apps.fas.usda.gov/gats/ExpressQuery1.aspx>.
- Foreign Trade, United States Census Bureau. (2022). Foreign Trade. Retrieved 2022, from <https://www.census.gov/foreign-trade/>
- Foreign Trade Online. (2022). Retrieved 2022, from <https://www.foreign-trade.com/reference/hscode.htm>
- Hertel, T. W. (1991). Applied General Equilibrium Analysis of Agricultural Policies. *Staff Paper, Purdue University, Department of Agricultural Economics*.
- Hertel, T. W., & Tsigas, M. E. (1997). Chapter 2, Structure of GTAP. In *Global Trade Analysis: Modeling and Applications*. essay, Cambridge Univ. Press.
- Hertel, T., & Mensbrugge, D. van der. (2019). *Chapter 14: Behavioral parameters*. Chapter 14: Behavioral Parameters. https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=5950
- Hoang, H. K., & Meyers, W. H. (2015). Price Stabilization and impacts of trade liberalization in the Southeast Asian Rice Market. *Food Policy*, 57, 26–39. <https://doi.org/10.1016/j.foodpol.2015.07.009>

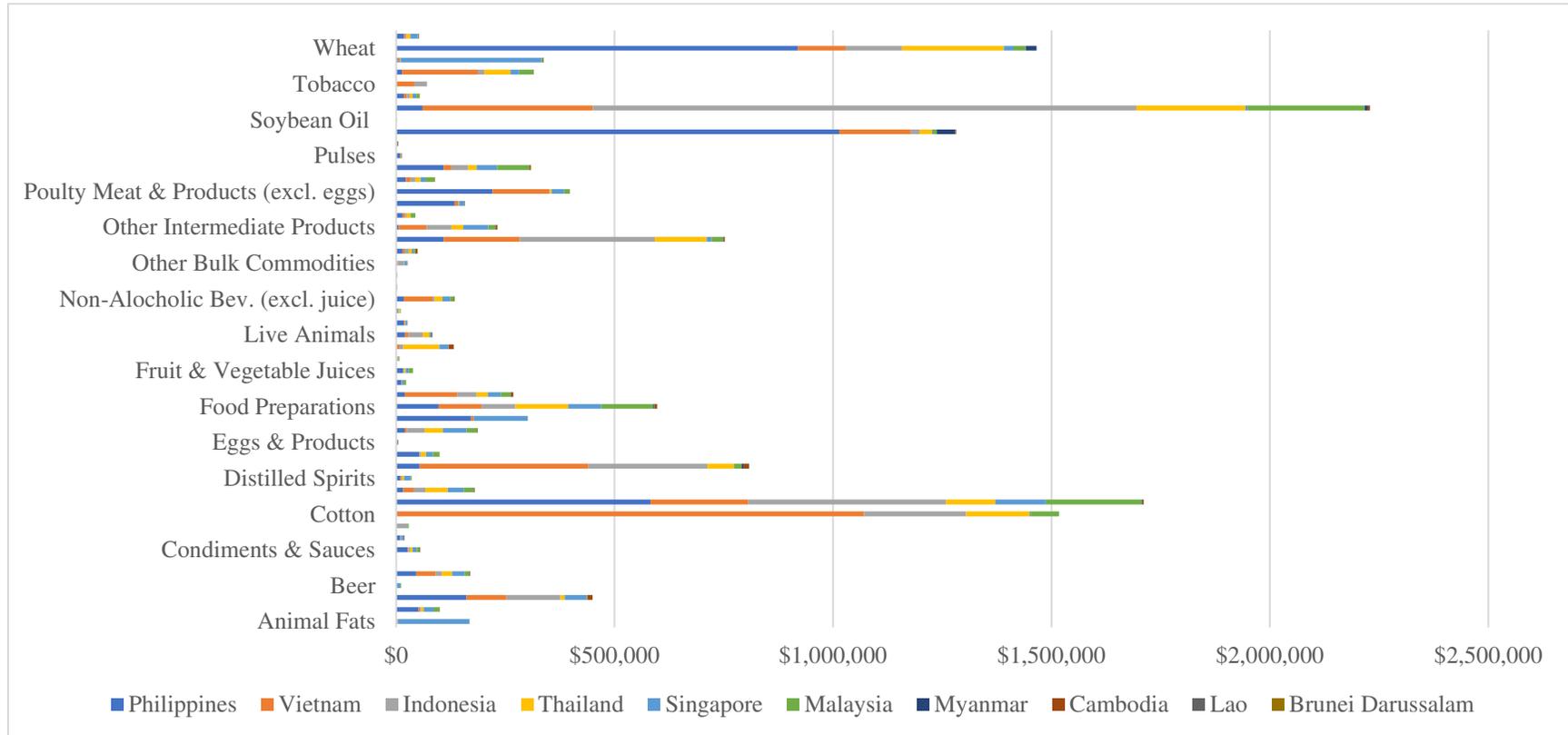
- Hong Kong Special Administrative Region Government. (2022). GOVHK. Retrieved 2022, from <https://www.gov.hk/en/business/>
- Iqbal, M. S. (2018). Agriculture trade liberalization and potential sectoral and welfare gains for Pakistan. *Pakistan Journal of Agricultural Sciences*, 55(02), 475–481.
<https://doi.org/10.21162/pakjas/18.6476>
- Itakura, K., Fukunaga, Y., and Isono, I. (2013). A CGE Study of Economic Impact of Accession of Hong Kong to ASEAN-China Free Trade Agreement. *ERIA Discussion Paper Series*.
- Jagdamba, S., and Kannan, E. (2020). Effects of ASEAN-India Free Trade Agreement on agricultural trade: The gravity model approach. *World Development Perspectives*, 19.
<https://doi.org/https://doi.org/10.1016/j.wdp.2020.100212>
- Karunaratne, N. D. (1998). Trade Liberalization in Thailand: A Computable General Equilibrium (CGE) Analysis. *The Journal of Developing Areas*, 32(4), 515–540.
- Kabir, S., and Salim, R. A. (2011). Parallel Integration and ASEAN-EU Trade Potential: An empirical analysis. *Journal of Economic Integration*, 26(4), 601–623.
<https://doi.org/10.11130/jei.2011.26.4.601>
- Kitwiwattanachai, A., Nelson, D., and Reed, G. (2010). Quantitative impacts of alternative East Asia Free Trade Areas: A Computable General Equilibrium (CGE) assessment. *Journal of Policy Modeling*, 32(2), 286–301.
<https://doi.org/https://doi.org/10.1016/j.jpolmod.2009.07.002>
- Martinez-Gonzalez, A., Sheldon, I. M., and Thompson, S. (2007). Estimating the Welfare Effects of U.S. Distortions in the Ethanol Market Using a Partial Equilibrium Trade Model. *Journal of Agricultural and Food Industrial Organization*, 5(2).
<https://doi.org/DOI:10.2202/1542-0485.1204>
- McDougall, R. (2000). A New Regional Household Demand System for GTAP. *GTAP Working Paper No. 14*. <https://doi.org/10.21642/gtap.wp14>
- New Zealand Foreign Affairs and Trade. (2022). ASEAN-Australia-New Zealand Free Trade Agreement (AANZFTA). Retrieved 2022, from <https://www.mfat.govt.nz/en/trade/free-trade-agreements/free-trade-agreements-in-force/asean-australia-new-zealand-free-trade-agreement-aanzfta/>
- Nguyen, M. T., Dang, T. L., & Huynh, T. H. (2021). Trade liberalization and income distribution in Vietnam: Dynamic CGE approach*. *Asian Economic Journal*, 34(4), 404–429.
<https://doi.org/10.1111/asej.12224>

- Office of the United States Trade Representative. (2022). USTR. Retrieved 2022, from <https://ustr.gov/countries-regions/southeast-asia-pacific/association-southeast-asian-nations-asean>
- Okabe, M., & Urata, S. (2014). The impact of AFTA on intra-AFTA trade. *Journal of Asian Economics*, 35, 12–31. <https://doi.org/10.1016/j.asieco.2014.09.004>
- Ortiz Valverde, G., & Latorre, M. C. (2019). A computable General Equilibrium Analysis of Brexit: Barriers to trade and immigration restrictions. *The World Economy*, 43(3), 705–728. <https://doi.org/10.1111/twec.12881>
- Park, D., Park, I., & Estrada, G. E. (2012). The prospects of ASEAN-Korea Free Trade Area (AKFTA) a qualitative and quantitative analysis. *ASEAN ECONOMIC BULLETIN*, 29(1), 29. <https://doi.org/10.1355/ae29-1c>
- Petri, P. A., & Plummer, M. G. (2013). ASEAN centrality and the ASEAN-US economic relationship. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2319426>
- Perali, F., Pieroni, L., & Standardi, G. (2012). World tariff liberalization in agriculture: An assessment using a global CGE trade model for EU15 regions. *Journal of Policy Modeling*, 34(2), 155–180. <https://doi.org/10.1016/j.jpolmod.2012.01.002>
- Ricardo, D. (1817). *On the Principles of Political Economy, and Taxation*. London: John Murray, Albemarle-Street.
- Sassi, M., & Cardaci, A. (2013). Impact of rainfall pattern on cereal market and Food Security in Sudan: Stochastic approach and CGE Model. *Food Policy*, 43, 321–331. <https://doi.org/10.1016/j.foodpol.2013.06.002>
- Savard, L. (2003). Poverty and Income Distribution in a CGE-Household Micro-Simulation Model: Top-Down/Bottom-Up Approach. *SSRN Electronic Journal*, (03). <https://doi.org/10.2139/ssrn.485665>
- Sifiso, N., Bonani, N., Simphiwe, N., Heidi, P., & Moses, L. (2017). Economy-wide effects of drought on South African agriculture: A computable general equilibrium (CGE) analysis. *Journal of Development and Agricultural Economics*, 9(3), 46–56. <https://doi.org/10.5897/jdae2016.0769>
- Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations* (Vol. 1). W. Strahan and T. Cadell, London.
- Sulaiman, N., Harun, M., & Yusuf, A. A. (2022). *Impacts of fuel subsidy rationalization on sectoral output and employment in Malaysia*. *Asian Development Review*. <https://www.worldscientific.com/doi/abs/10.1142/S0116110522500081>

- Thangavelu, S. M., Narjoko, D., & Urata, S. (2021). Impact of FTA on trade in ASEAN and Australia using Customs Level Data. *Journal of Economic Integration*, 36(3), 437–461. <https://doi.org/10.11130/jei.2021.36.3.437>
- Thompson, J. M., and Leister, A. M. (2015). Potential Impacts of an Exclusionary Trans-Pacific Partnership Agreement on Agriculture in the US and Japan. *The Journal of Applied Economic Research*, 9(4).
- The ASEAN Secretariat. (2020). *About ASEAN*. ASEAN. Retrieved 2022, from <https://asean.org/about-us>
- The ASEAN Secretariat. (2022). ASEAN Tariff Finder. Retrieved 2022, from <http://tariff-finder.asean.org>
- The World Bank. (2022). Retrieved 2022, from <https://data.worldbank.org/indicator/>.
- Tripath, M. (2015). European Union and ASEAN: A Comparison. *International Journal of Research (IJR)*, 2(1), 376–383.
- United States, Congress, OECD National Accounts. *The World Bank: GDP (Current US \$)*, 2022. <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>. Accessed May 2022.
- United States, Congress, United Nations Population Division. *The World Bank: Population, Total*, 2022. <https://data.worldbank.org/indicator/SP.POP.TOTL>. Accessed May 2022.
- United States Department of Agriculture, Ag and Food Statistics Charting the Essentials, February 2020 (2020). Economic Research Service, USDA. Retrieved 2022.
- United States Department of Agriculture. (2023). Foreign Agricultural Service. Retrieved 2023, from <https://apps.fas.usda.gov/gats/default.aspx>
- United States Department of Agriculture. (2023). Trade. Retrieved 2023, from <https://www.usda.gov/topics/trade>
- United States Government. (2022). U.S. Department of State. Retrieved 2022, from <https://www.state.gov/>
- U.S. Department of Commerce, Monthly U.S. International Trade in Goods and Services, March 2022 (2022). The U.S. Census Bureau and The U.S. Bureau of Economic Analysis. Retrieved 2022, from https://www.census.gov/foreign-trade/Press-Release/current_press_release/ft900.pdf
- Visenescu, R. S. (2018). Russian-ASEAN cooperation in the natural gas sector. lessons from the Russian-Vietnamese relation. *Energy Policy*, 119, 515–517. <https://doi.org/10.1016/j.enpol.2018.05.006>

- Vatankhah, T., Moosavi, S. N., & Tabatabaei, S. M. (2019). The economic impacts of climate change on agriculture in Iran: A CGE model analysis. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 42(16), 1935–1949.
<https://doi.org/10.1080/15567036.2019.1604903>
- Vos, R., and Jong, N. D. (2003). Trade Liberalization and Poverty in Ecuador: A CGE Macro-Microsimulation Analysis. *Economic Systems Research*, 15(2).
- World Economic Outlook Database: April 2022. International Monetary Fund. (2022). Retrieved 2022, from <https://www.imf.org/en/Publications/WEO/weo-database/2022/April/download-entire-database>

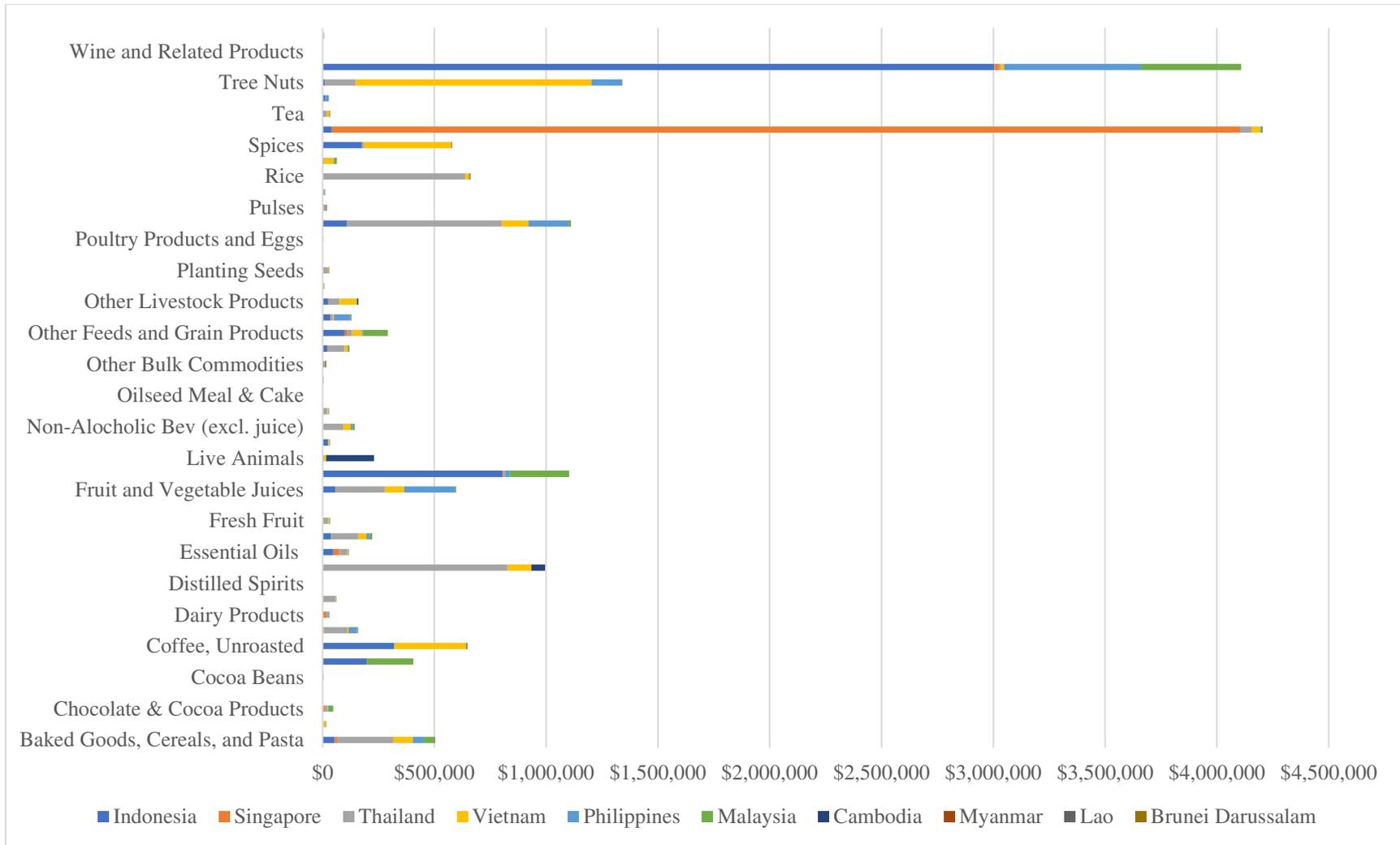
APPENDIX



Appendix Figure 1. The Value of 2022 U.S. Agricultural Exports to the ASEAN Region by Country (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This figure represents the total value of U.S. agricultural exports to the ASEAN region by country per commodity in 2022 represented in USD thousands.



Appendix Figure 2. The Value of 2022 U.S. Agricultural Imports from the ASEAN Region by Country (Thousand USD)

Source: Foreign Agricultural Service (2022)

Note: This figure represents the total value of U.S. agricultural imports from the ASEAN region by country per commodity in 2022 represented in USD thousands.

Appendix Table 3. GTAP Regions Included in the Model

Regions Modeled	GTAP Regional Aggregation
Australia	Aus
New Zealand	Nzl
Hong Kong	chn, hkg
Japan	Jpn
South Korea	Kor
Brunei Darussalam	Brn
Cambodia	Khm
Indonesia	Idn
Lao PDR	Lao
Malaysia	Mys
Philippines	Phl
Singapore	Sgp
Thailand	Tha
Vietnam	Vnm
Myanmar	Xse
India	Ind
Rest of Oceania, Asia	xoc, mng, twm, xea, bgd, npl, pak, lka, xsa
Canada	Can
United States of America	Usa
Mexico	Mex
Rest of North America	Xna
Argentina	Arg
Brazil	Bra
Rest of South America	bol, chl, col, ecu, pry, per, ury, ven, xsm
Rest of Central America, Caribbean	cri, gtm, hnd, nic, pan, slv, xca, dom, jam, pri, tto, xcb
European Union, United Kingdom	aut, bel, bgr, hrv, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, rou, svk, svn, esp, swe, gbr
Russia	Rus
Ukraine	Ukr
Rest of Europe	che, nor, xef, srb, alb, blr, xee, xer
Rest of Middle East	kaz, kgz, tjk, xsu, arm, aze, geo, bhr, irn, irq, isr, jor, kwt, lbn, omn, pse, qat, sau, tur, are, xws
Egypt	Egy
Rest of Africa	mar, tun, xnf, ben, bfa, cmr, civ, gha, gin, nga, sen, tgo, xwf, tcd, cog, gab, xcf, xac, com, eth, ken, mdg, mwi, mus, moz, rwa, sdn, tza, uga, zmb, zwe, xec, bwa, nam, zaf, xsc, xtw

Source: Author's Region Aggregations

Note: This table shows the 32 regions defined in the modified GTAP 10 database used in this research.

Appendix Table 4. GTAP Sectors Included in the Model

Sectors Modeled	GTAP Sectoral Aggregation
Rice	pdr, pcr
Wheat	Wht
Corn	gro *
Other Coarse Grains	gro *
Vegetables	v_f *
Fruit and Nuts	v_f *
Soybeans	osd *
Other Oilseeds	osd *
Sugar	c_b, sgr
Other Crops	pfb, ocr
Cattle	ctl
Hogs	oap *
Other Animal Products	oap *
Dairy	rmk, mil
Forestry and Fishing	frs, fsh
Extraction and Mining	coa, oil, gas, oxt
Beef	Cmt
Pork	omt *
Other Meat	omt *
Vegetable Oil	vol
Other Processed Food	ofd, b_t
Rice	tex, wap, lea, lum, ppp, p_c, chm, bph, rpp, nmm, i_s, nfm, fmp, ele, eeq, ome, mvh, otn, omf
Wheat	ely, gdt, wtr, cns, trd, afs, otp, wtp, atp, whs, cmn, ofi, ins, rsa, obs, osg, edu, hht, dwe

Data Source: Author's Sector Aggregations

Note: This table shows the 23 sectors defined in the modified GTAP 10 database used in this research. * = Sectors disaggregated from the GTAP database.

Appendix Table 5. Percentage Change in Macroeconomic Values from 2014 to 2017

Region	GDP	Population	Investment
Australia	-10	5	-17
New Zealand	3	7	5
China, Hong Kong	18	2	11
Japan	1	0	1
South Korea	9	1	19
Brunei Darussalam	-29	4	-10
Cambodia	33	5	38
Indonesia	14	4	11
Lao PDR	29	5	0
Malaysia	-6	4	-4
Philippines	10	5	35
Singapore	9	3	1
Thailand	12	1	7
Vietnam	20	3	28
Myanmar	-3	2	4
India	30	3	18
Rest of Oceania, Asia	24	5	36
Canada	-9	3	-14
United States of America	12	2	12
Mexico	-12	4	-8
Rest of North America	8	-1	0
Argentina	22	3	29
Brazil	-16	3	-40
Rest of South America	-3	3	-14
Rest of Central America, Caribbean	13	3	2
European Union, United Kingdom	-7	1	-1
Russia	-24	0	-19
Ukraine	-16	-1	30
Rest of Europe	-10	0	-12
Rest of Middle East	-9	5	-5
Egypt	-23	7	-14
Rest of Africa	-10	8	-15

Source for GDP and Population: The World Bank (2022)

Source for Investment: World Economic Outlook Database (2022)

Note: This table shows the real percentage changes in macroeconomic variables applied to project the database from 2014 to 2017.

Appendix Table 6. Weighted Average Import Tariffs: ASEAN and the U.S. (2017)

Rice	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	7.00	0.00	5.00	39.85	4.87	0.00	0.00	29.98	0.00
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	19.96	0.00	0.00	0.00	0.00	1.85
Indonesia	0.79	0.00	0.00	0.00	0.00	19.92	0.00	0.00	0.00	0.00	0.00
Lao	4.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	0.00	0.00	0.00	0.00	4.88	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	1.08	0.00	17.20	0.00	34.67	0.00	0.00	0.00
Philippines	0.62	0.00	0.00	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Singapore	0.00	0.00	0.00	2.52	0.00	20.00	3.52	34.96	0.00	0.00	0.00
Thailand	0.61	0.00	5.00	3.71	5.00	19.99	2.88	35.00	0.00	0.00	0.01
Vietnam	5.24	0.00	5.00	4.38	0.00	20.00	2.50	34.88	0.00	0.00	0.00

Wheat	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	0.00	3.00	0.00	0.00	5.00	4.35	0.00	0.00	5.00
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thailand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Corn	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	7.00	5.00	0.00	0.00	0.00	27.67	0.00	11.84	17.50
Brunei Darussalam	0.12	0.00	0.00	0.00	0.00	0.00	1.25	1.25	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	1.25	1.25	0.00	0.00	0.00
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	2.50	2.50	0.00	0.00	0.00
Lao	0.12	0.00	0.00	0.00	0.00	0.00	1.25	1.25	0.00	0.00	0.00
Malaysia	0.12	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	1.75	1.25	0.00	0.00	1.25	2.50	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	0.00
Thailand	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.44	0.00	0.00	0.00
Vietnam	0.00	0.00	0.00	0.00	0.00	0.00	1.25	1.90	0.00	0.00	0.00

Other Coarse Grains	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	0.00	4.71	0.31	0.00	3.33	2.45	0.00	27.00	0.24
Brunei Darussalam	0.37	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Indonesia	0.31	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00
Lao	0.37	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Malaysia	1.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.16	0.00	2.19	2.75	0.00	0.00	2.11
Philippines	0.31	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00
Thailand	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.37	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00

Vegetables	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	3.56	9.63	5.00	0.02	1.79	17.76	0.00	21.51	12.09
Brunei Darussalam	5.08	0.00	3.86	0.00	4.11	0.00	1.35	0.21	0.00	0.10	0.00
Cambodia	0.24	0.00	0.00	0.00	4.11	0.00	1.35	0.21	0.00	0.00	0.00
Indonesia	0.01	0.00	3.86	0.00	4.11	0.00	1.14	0.00	0.00	0.00	0.00
Lao	5.08	0.00	3.86	0.00	0.00	0.00	1.35	0.21	0.00	0.00	0.00
Malaysia	1.83	0.00	7.00	0.00	4.11	0.00	0.56	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.51	0.02	9.51	0.00	6.38	0.00	0.00	0.13	0.00
Philippines	0.31	0.00	3.86	0.00	4.11	0.00	1.25	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	4.91	0.00	4.11	0.00	0.06	0.00	0.00	0.00	0.00
Thailand	0.13	0.00	1.66	0.00	2.56	0.00	0.23	0.00	0.00	0.00	0.00
Vietnam	1.75	0.00	3.85	0.00	4.20	0.00	2.28	0.11	0.00	0.00	0.00

Fruit and Nuts	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	7.00	5.05	13.08	2.45	17.48	6.39	0.00	18.70	11.37
Brunei Darussalam	1.80	0.00	5.20	0.00	3.14	0.00	1.62	0.00	0.00	0.00	0.25
Cambodia	0.00	0.00	0.00	0.00	3.14	0.72	1.62	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	4.99	0.00	3.14	0.23	0.13	0.00	0.00	0.00	0.00
Lao	0.03	0.00	5.02	0.00	0.00	0.72	1.62	0.00	0.00	0.00	1.68
Malaysia	1.98	0.00	5.24	0.00	3.14	0.00	1.56	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	6.08	0.22	8.11	0.16	9.40	3.70	0.00	0.00	0.00
Philippines	0.02	0.00	5.02	0.00	3.14	2.67	2.50	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	5.24	0.00	3.14	0.13	1.14	0.00	0.00	0.00	0.00
Thailand	0.10	0.00	4.84	0.00	4.55	4.22	0.24	0.00	0.00	0.00	0.01
Vietnam	0.04	0.00	5.32	0.00	3.03	0.57	0.79	0.00	0.00	0.00	0.00

Soybeans	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	15.00	0.00	0.00	0.00	3.00	1.00	0.00	80.00	0.00
Brunei Darussalam	0.00	0.00	2.50	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	2.50	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00
Lao	0.00	0.00	2.50	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	5.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	5.00	0.00	0.00	0.00	2.75	0.50	0.00	40.00	0.00
Philippines	0.00	0.00	2.50	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	5.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
Thailand	0.00	0.00	4.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	2.50	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00

Other Oilseeds	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	10.28	5.00	1.00	2.20	3.00	8.31	0.00	30.14	10.00
Brunei Darussalam	12.44	0.00	1.11	0.00	1.18	0.00	1.35	0.00	0.00	0.28	0.56
Cambodia	11.81	0.00	0.00	0.00	1.18	0.00	1.35	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	5.00	0.00	1.18	0.00	0.87	0.00	0.00	0.00	0.00
Lao	12.44	0.00	1.11	0.00	0.00	0.00	1.35	0.00	0.00	0.00	0.00
Malaysia	12.44	0.00	0.00	0.00	1.18	0.00	0.00	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	7.00	0.29	6.26	0.00	2.75	0.00	2.69	0.00	0.00
Philippines	0.00	0.00	1.11	0.00	1.18	0.00	1.35	0.00	0.00	0.48	0.00
Singapore	0.00	0.00	1.43	0.00	1.18	0.00	2.50	0.00	0.00	0.00	0.00
Thailand	0.00	0.00	3.62	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sugar	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	6.99	5.02	0.00	0.09	2.53	2.52	0.00	12.16	5.27
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Indonesia	4.65	0.00	4.99	0.00	0.00	0.00	2.47	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.68
Malaysia	6.51	0.00	5.00	1.99	0.00	0.00	2.31	1.07	0.00	0.00	1.10
Myanmar	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	17.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.98
Singapore	0.00	0.00	5.00	6.99	0.00	0.00	0.22	1.97	0.00	0.00	1.49
Thailand	9.30	0.00	5.00	9.08	3.40	0.00	0.04	3.00	0.00	0.00	4.73
Vietnam	6.07	0.00	5.00	0.00	2.98	0.00	0.00	2.39	0.00	0.00	0.00

Other Crops	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.38	4.81	0.03	0.00	0.40	10.91	1.28	0.00	0.30	0.03
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.12
Indonesia	0.17	0.00	4.68	0.00	0.00	0.00	1.11	0.00	0.00	3.77	0.00
Lao	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.00
Malaysia	2.02	0.00	0.96	0.00	0.00	0.00	0.00	0.00	0.00	4.37	0.00
Myanmar	0.00	0.00	0.00	4.35	0.00	0.00	0.00	2.50	0.00	0.05	16.51
Philippines	0.04	0.00	0.00	0.00	0.00	0.32	2.46	0.00	0.00	0.00	0.00
Singapore	0.03	0.00	4.15	0.00	0.00	0.00	0.16	0.00	0.00	0.06	0.00
Thailand	0.72	0.00	2.53	0.00	3.50	1.13	0.07	0.00	0.00	0.00	0.00
Vietnam	0.04	0.00	4.13	0.00	0.08	0.07	0.00	0.00	0.00	4.12	0.00

Cattle	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	0.00	0.40	0.00	0.00	0.00	5.25	0.00	0.26	0.02
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thailand	0.00	0.00	0.00	0.00	2.15	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	0.00	0.00	2.94	0.00	0.00	0.00	0.00	0.00	0.00

Hogs	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	15.00	3.33	8.33	0.02	1.25	20.33	0.00	0.00	0.00
Brunei Darussalam	0.00	0.00	10.00	0.00	2.67	0.00	1.25	3.33	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	1.25	3.33	0.00	0.00	0.00
Indonesia	0.00	0.00	10.00	0.00	2.67	0.00	2.50	3.33	0.00	0.00	0.00
Lao	0.00	0.00	10.00	0.00	0.00	0.00	1.25	3.33	0.00	0.00	0.00
Malaysia	0.00	0.00	10.00	0.00	2.67	0.00	1.25	3.33	0.00	0.00	0.00
Myanmar	0.00	0.00	10.00	1.67	5.50	5.00	1.25	11.83	0.00	0.00	2.50
Philippines	0.00	0.00	10.00	0.00	2.67	0.00	1.25	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	10.00	0.00	2.67	0.00	1.25	3.33	0.00	0.00	0.00
Thailand	0.00	0.00	13.38	0.00	4.01	0.00	0.00	3.33	0.00	0.00	0.00
Vietnam	0.00	0.00	14.36	0.00	2.65	0.00	3.33	0.00	0.00	1.25	0.00

Other Animal Products	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	13.72	3.20	10.00	1.52	4.99	2.26	0.00	1.37	2.07
Brunei Darussalam	0.78	0.00	4.17	0.00	3.35	0.00	1.45	0.09	0.00	0.00	0.28
Cambodia	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.09	0.00	0.00	0.00
Indonesia	0.01	0.00	3.70	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00
Lao	0.50	0.00	4.17	0.00	0.00	0.00	1.45	0.09	0.00	0.00	0.00
Malaysia	0.46	0.00	3.56	0.00	0.00	0.00	1.65	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	8.44	1.92	8.84	0.00	3.44	3.40	0.00	0.00	0.00
Philippines	0.13	0.00	8.04	0.00	3.35	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	4.70	0.00	3.35	0.00	1.15	0.00	0.00	0.00	0.00
Thailand	0.48	0.00	5.29	0.00	4.39	0.00	0.02	0.00	0.00	0.00	0.00
Vietnam	0.65	0.00	3.00	0.00	4.06	0.00	0.13	0.00	0.00	0.00	0.00

Dairy	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	20.56	5.17	0.00	0.77	3.98	1.65	0.00	81.89	4.77
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	4.97	0.00	0.00	0.00	2.38	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	14.36	0.00	5.00	0.00	0.00	0.00	1.65	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	20.31	0.00	5.00	0.00	0.00	0.00	2.98	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	5.00	0.00	0.00	0.00	1.85	0.00	0.00	0.00	0.00
Thailand	23.38	0.00	5.00	0.00	2.44	0.00	1.72	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	5.00	0.00	2.40	0.00	1.16	0.00	0.00	0.00	0.00

Forestry and Fishing	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	11.97	0.00	7.21	1.66	0.00	1.32	0.00	4.74	0.00	6.53	3.81
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.09	0.00	6.02	0.00	0.00	0.00	2.43	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.03	0.00	2.14	0.00	0.00	0.00	1.84	0.00	0.00	0.00	0.00
Myanmar	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.19	0.00	2.47	0.00	0.00	0.00	1.48	0.00	0.00	0.00	0.00
Thailand	0.04	0.00	0.38	0.00	0.16	0.00	0.60	0.00	0.00	0.00	0.00
Vietnam	11.92	0.00	1.50	0.00	0.03	0.00	0.89	0.00	0.00	0.00	0.00

Extraction and Mining	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	0.00	9.46	13.60	2.29	6.26	32.35	0.00	2.83	18.47
Brunei Darussalam	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36
Indonesia	0.15	0.00	0.01	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.01
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36
Malaysia	1.68	0.00	0.00	0.00	0.00	0.00	1.31	0.00	0.00	0.00	2.93
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03
Philippines	3.59	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	3.90
Singapore	0.00	0.00	10.92	0.00	0.00	0.15	1.92	0.00	0.00	4.79	0.15
Thailand	0.33	0.00	9.00	0.00	5.00	0.00	1.45	0.01	0.00	0.00	4.04
Vietnam	0.53	0.00	15.83	0.00	4.87	0.00	0.00	0.00	0.00	0.00	0.00

Beef	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	35.00	5.00	0.00	0.00	14.91	8.37	0.00	50.00	14.43
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	2.14	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	5.00	0.00	0.00	0.00	1.64	0.00	0.00	0.00	0.00
Thailand	0.00	0.00	5.00	0.00	4.81	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

Pork	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	35.00	5.00	12.69	0.00	15.00	24.26	0.00	38.94	12.24
Brunei Darussalam	0.35	0.00	5.00	0.00	4.62	0.00	1.44	2.31	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	4.62	0.00	1.44	2.31	0.00	0.00	0.00
Indonesia	0.00	0.00	5.00	0.00	4.62	0.00	2.50	2.31	0.00	0.00	0.00
Lao	0.35	0.00	5.00	0.00	0.00	0.00	1.44	2.31	0.00	0.00	0.00
Malaysia	0.35	0.00	5.00	0.00	4.62	0.00	0.00	2.31	0.00	0.00	0.00
Myanmar	0.00	0.00	20.00	2.50	8.65	1.92	7.71	16.04	0.00	0.00	10.62
Philippines	0.05	0.00	5.00	0.00	4.62	0.00	1.44	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	5.00	0.00	4.62	0.00	0.00	1.84	0.00	0.00	0.00
Thailand	0.05	0.00	5.00	0.00	5.00	0.00	3.43	2.31	0.00	0.00	0.00
Vietnam	0.35	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

Other Meat	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	35.00	29.23	14.07	1.77	3.21	39.69	0.00	31.08	20.10
Brunei Darussalam	3.46	0.00	10.05	0.00	4.30	0.00	2.50	1.22	0.00	0.00	1.74
Cambodia	0.00	0.00	0.00	0.00	4.30	0.00	1.28	1.22	0.00	0.00	1.74
Indonesia	2.27	0.00	10.05	0.00	4.30	0.00	2.13	0.00	0.00	0.00	1.74
Lao	3.46	0.00	10.05	0.00	0.00	0.00	1.28	1.22	0.00	0.00	1.74
Malaysia	4.00	0.00	5.39	0.00	4.30	0.00	1.47	0.00	0.00	0.00	4.37
Myanmar	0.00	0.00	21.94	5.73	9.19	1.46	8.32	16.38	0.00	0.00	19.15
Philippines	3.88	0.00	5.00	0.00	4.30	0.00	2.50	0.00	0.00	0.00	5.00
Singapore	0.00	0.00	11.65	0.00	4.30	0.00	2.23	3.07	0.00	0.00	4.79
Thailand	0.86	0.00	9.04	0.00	5.00	0.00	0.03	0.01	0.00	0.00	4.04
Vietnam	1.82	0.00	20.50	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

Vegetable Oil	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	0.98	2.79	5.54	1.18	1.61	1.02	0.00	61.80	1.45
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.18	0.00	1.35	0.00	0.00	0.00	1.74	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.16	0.00	3.31	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	4.46	0.00	0.00	0.00	1.70	0.00	0.00	0.00	0.00
Thailand	0.46	0.00	2.16	0.00	0.00	0.00	1.03	0.00	0.00	0.00	0.00
Vietnam	0.01	0.00	1.10	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00

Other Processed Food	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	6.77	9.83	7.56	15.81	21.80	7.02	8.52	0.00	11.92	7.81
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	1.10	0.00	0.00	0.00	0.00	4.41	0.00	0.00	0.00	0.00	1.56
Indonesia	0.72	0.00	5.00	0.00	4.06	1.68	2.48	0.00	0.00	0.00	0.43
Lao	3.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.62
Malaysia	2.65	0.00	4.97	7.02	2.33	0.00	2.48	0.00	0.00	0.00	0.50
Myanmar	0.03	0.00	4.99	0.25	0.00	0.14	0.00	0.00	0.00	0.00	0.03
Philippines	2.70	0.00	4.99	0.68	1.56	1.34	3.65	0.00	0.00	0.00	4.78
Singapore	0.50	0.00	4.88	21.32	3.78	38.30	2.51	0.00	0.00	0.00	13.34
Thailand	3.31	0.00	4.45	2.98	0.88	0.33	2.65	0.00	0.00	0.00	0.26
Vietnam	1.78	0.00	2.54	0.58	1.63	3.10	2.68	0.00	0.00	0.00	0.00

Manufacturing	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.15	19.81	4.64	5.56	2.36	3.66	3.08	0.00	4.08	2.47
Brunei Darussalam	10.03	0.00	3.01	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00
Cambodia	11.34	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.40
Indonesia	6.47	0.00	2.63	0.00	0.02	1.52	1.39	0.00	0.00	0.00	2.75
Lao	2.72	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03
Malaysia	0.83	0.00	2.02	0.01	0.19	0.00	0.83	0.00	0.00	0.00	0.57
Myanmar	7.33	0.00	2.91	0.01	0.00	0.00	13.79	0.00	0.00	0.00	0.03
Philippines	2.23	0.00	3.74	0.11	0.00	2.11	0.53	0.00	0.00	0.00	0.04
Singapore	0.25	0.00	0.07	0.29	0.06	0.03	1.01	0.00	0.00	0.00	0.34
Thailand	1.03	0.00	3.28	0.00	0.83	0.00	0.73	0.00	0.00	0.00	1.81
Vietnam	6.94	0.00	2.94	0.00	0.87	0.01	0.57	0.00	0.00	0.00	0.00

Services	United States	Brunei Darussalam	Cambodia	Indonesia	Lao	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
United States	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brunei Darussalam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lao	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philippines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thailand	0.00	0.00	3.26	0.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00
Vietnam	0.00	0.00	4.85	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00

Source: Center for Global Trade Analysis Project (2022)

Note: This table shows the complete 2017 weighted average import tariffs calculated for each region and sector defined in the modified GTAP 10 database used in this research. The rows represent the exporting region and the columns represent the importing region.