United States Department of Agriculture

Economic Research Service

Economic Research Report Number 198

November 2015

Agriculture in the Transatlantic Trade and Investment Partnership: Tariffs, Tariff-Rate Quotas, and Non-Tariff Measures

Jayson Beckman, Shawn Arita, Lorraine Mitchell, and Mary Burfisher

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Recommended citation format for this publication:

Beckman, Jayson, Shawn Arita, Lorraine Mitchell, and Mary Burfisher. *Agriculture in the Transatlantic Trade and Investment Partnership: Tariffs, Tariff-Rate Quotas, and Non-Tariff Measures*, ERR-198, U.S. Department of Agriculture, Economic Research Service, November 2015.

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Abstract

The proposed Transatlantic Trade and Investment Partnership (T-TIP) between the United States and the European Union (EU) aims to address several important barriers facing agricultural trade, including tariffs, tariff-rate quotas (TRQs), and non-tariff measures (NTMs). Estimated ad valorem tariff equivalents of tariffs/TRQs and NTMs currently in place are as high as 120 percent, significantly limiting trade between the two regions. This study uses model simulations to assess the effects of T-TIP on agriculture under three broad scenarios: complete removal of tariffs and TRQs; elimination of select NTMs along with tariffs and TRQs; and a lowering of the willingness of consumers to purchase imported goods previously limited by NTMs. Results of all scenarios suggest an increase in U.S.-EU agricultural trade from T-TIP, benefiting both regions. While the United States realizes a relative increase in agricultural exports, the EU benefits from lower import prices and larger macroeconomic gains than the United States. The estimated annual increase in U.S.-EU agricultural trade ranges from $6.3 billion to $11.6 billion when compared with the 2011 base year.

Keywords: Agricultural trade, trade agreement, Transatlantic Trade and Investment Partnership, T-TIP, computable general equilibrium (CGE) model, non-tariff measures (NTMs), gravity model, United States, European Union, tariff rate quotas (TRQs)

Acknowledgments

The authors thank Joseph Cooper, John Dyck, and Andrew Muhammad (USDA, Economic Research Service (ERS)); Alan Matthews (Trinity College, Ireland); Nelson Villoria (Purdue University); Sharon Sydow (USDA, Office of the Chief Economist); Jason Hafemeister and Daniel Whitley (USDA, Foreign Agricultural Service); and three anonymous reviewers for their peer reviews of this report. John Wainio and Steven Zahniser of ERS provided valuable data for this report. The authors also thank John Weber and Cynthia A. Ray of ERS for editorial and design services.

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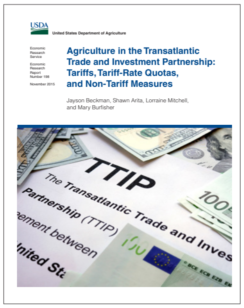

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Agriculture in the Transatlantic Trade and Investment Partnership: Tariffs, Tariff-Rate Quotas, and Non-Tariff Measures

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What Is the Issue?

The Transatlantic Trade and Investment Partnership (T-TIP) is being negotiated between the United States and the European Union (EU). The two regions accounted for almost half of global gross domestic product (GDP) in 2013 and $35 billion in bilateral agricultural trade. While overall tariffs in the United States and EU are generally low, they are still relatively high for food and agricultural goods, most often in the form of tariff-rate quotas (TRQs). Additionally, U.S.-EU trade is restricted by other significant barriers, such as non-tariff measures (NTMs) that are especially prevalent for many agricultural commodities. NTMs are usually not considered in trade policy analysis because they are not easily quantified, leading to several data, methodological, and conceptual challenges. These issues have been prominent in the T-TIP negotiations, and an analytical approach to help understand their impacts on food and agricultural trade may benefit all stakeholders.

What Did the Study Find?

A T-TIP agreement could address several barriers facing agricultural trade, including tariffs, TRQs, and NTMs. This report considers potential impacts of an agreement under three broad scenarios:

Scenario one (removal of tariffs and TRQs). In the first scenario, U.S. agricultural exports to the EU increase by $5.5 billion from base year (2011) levels, while EU agricultural exports to the United States increase by $0.8 billion. Overall, U.S. agricultural exports increase by 2 percent and agricultural imports by 1 percent. EU agricultural exports decrease by 0.25 percent, and agricultural imports rise by 0.5 percent. Among major U.S. agricultural export commodities, beef and dairy exports to the EU increase the most in percentage terms. The EU exports more vegetable oil and cheese to the United States and also produces more of these commodities, although the percentage increases in production are modest. The EU imposes higher tariffs on imports than does the United States, which accounts for the larger U.S. export gains in the scenario.

Scenario two (removal of select NTMs, in addition to tariffs and TRQs). NTMs commonly imposed in agricultural trade comprise sanitary and phytosanitary measures that help to ensure food safety but also create technical barriers to trade that require imports to have specific product characteristics. In the second scenario, the additional removal of select NTMs (e.g., meats, field crops, and fruits and vegetables) results in an increase in U.S. exports to the EU by an additional $4.1 billion over gains in the first scenario. For the EU,

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the removal of NTMs generates an additional gain of $1.2 billion in exports to the United States. U.S pork exports to the EU increase by $2.4 billion, and EU exports of fruits and vegetables to the United States increase by $495 million and $613 million, respectively. U.S. exports of poultry to the EU increase by a high percentage but the level change is only $18 million due to small base trade. Increases in bilateral U.S.-EU exports of individual commodities do not all lead to production increases, as commodities with modest increases in exports may lose resources to commodities with large increases. Overall, agricultural imports and exports each increase for the United States by about double the percentage in scenario one, while EU agricultural imports increase by 1 percent and agricultural exports decline.

Scenario three (effects of removal of NTMs on consumer demand). The removal of select NTMs could lead to consumers preferring domestically produced products versus the importer equivalent. Thus, in the third scenario, export gains are smaller for both the United States and the EU. Potentially, these demand-side effects could erase any gains from the removal of specific NTMs.

Overall, gains in bilateral and net exports due to T-TIP lead to production increases in many U.S. agricultural commodities. Some U.S. agricultural commodities have a decrease in production due to increased competition for resources. The increase in agricultural exports also leads to increases in almost all U.S. agricultural prices. For the EU, the increase in imports results in a decline in agricultural prices. The GDP of both the United States and the EU increases as a result of T-TIP, though the rate of increase is higher for the EU, due largely to export gains in nonagricultural products and lower prices on imports. GDP changes are uniformly modest, one-third of a percent or less.

How Was the Study Conducted?

The study uses the Global Trade Analysis Project's (GTAP) static computable general equilibrium (CGE) model with the GTAP v.9 2011 database (the latest GTAP data available). To allow for more precise analysis of the agricultural sector, this study disaggregates agriculture into 38 commodities, including 24 unique agricultural and biofuel commodities beyond the standard GTAP database. In addition, the model uses the detailed land-use module (GTAP-AEZ) that captures heterogeneous land quality and allows for a more realistic representation of agriculture production. Estimates of the NTM tariff-equivalent measures used for the analysis were taken from a complementary 2015 ERS report *Estimating the Effects of Selected Sanitary and Phytosanitary Measures and Technical Barriers to Trade on U.S.-E.U. Agricultural Trade*. To account for demand-side effects on the analysis, country-specific (Armington) parameters were modified to reflect potential changes in consumer preferences due to removal of NTMs.

Agriculture in the Transatlantic Trade and Investment Partnership: Tariffs, Tariff-Rate Quotas, and Non-Tariff Measures

Introduction

The Transatlantic Trade and Investment Partnership (T-TIP) seeks to eliminate trade barriers between the United States and the European Union (EU).[1] The United States and the EU have a history of cooperation in international trade policy, including the Transatlantic Economic Partnership of 1998 that attempted to address many of the current issues facing T-TIP negotiators (McKinney, 2014). T-TIP is drawing much attention, as the two member regions are major economies and markets for all goods, including agriculture. Together, the United States and the EU accounted for almost half of global gross domestic product (GDP) in 2013.

Increased market access through elimination of tariffs and tariff-rate quotas (TRQ) is a main goal of T-TIP. Negotiations also center on reconciling differences in regulatory issues and intellectual property rights, strengthening rules-based investment, and promoting the global competitiveness of small- and medium-sized enterprises (USTR, 2015). For agriculture, non-tariff measures (NTMs) such as sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) feature prominently in the negotiations.[2] While SPS and TBT measures are intended to ensure that exporters meet food safety, animal or plant health, and technical regulations, they can also restrict trade by adding compliance, inspection, and operational costs. In some instances, the costs are prohibitive and prevent trade altogether. Exporters have raised concerns over SPS/TBT measures that have requirements disproportionate to the actual levels of risk, that excessively impede trade, and/or that are viewed as disguised barriers to trade (Anderson et al., 2012).

Recent studies examining the economic gains from T-TIP suggest that reducing NTMs could bring about benefits equal to or greater than those associated with tariff removal (table 1). For example, CEPR (2013) concludes that the reduction of NTMs may account for as much as 80 percent of the potential economic gains from T-TIP. The impacts of NTM reduction across products, however, can vary. Unfortunately, these T-TIP-based studies have generally aggregated agricultural commodities into one overall sector (sometimes adding forestry and fisheries). Thus, they are unable to provide estimates of the impacts to specific commodities.

This study uses an agriculture-focused, multicountry, computable general equilibrium (CGE) model to examine the effect of market access and NTM reforms from T-TIP. A particular focus is placed on the role of NTMs, which are explicitly modeled across specific agricultural commodities. Moreover, the study considers the possibility that the removal of certain NTMs may not ensure that consumers will be willing to buy more cheaper imported goods relative to their domestically produced equiva-

[1]The first round of negotiations was in July 2013 in Washington, DC. As of November 2015, there have been 11 negotiation rounds.

[2] NTMs are defined as policy measures other than tariffs that can potentially have a negative economic effect on international trade (UNCTAD, 2010).

lents. Three hypothetical scenarios are simulated to estimate the range of possible outcomes from T-TIP: a market-access scenario, where tariffs and TRQs are removed on all agricultural and nonagricultural products; a more expanded market-access scenario, where selected NTMs are removed in addition to tariffs and TRQs; and a scenario that accounts for adjustments in consumer preferences for products with NTMs. The other North American Free Trade Agreement (NAFTA) countries (Canada and Mexico) and other major agricultural markets (Brazil, China, and India) are also included in the model.

Table 1
CGE-based quantitative analyses of T-TIP

Authors	Type of CGE model	Food and agriculture coverage	NTM estimation	T-TIP scenarios	Range of impacts	General results
This study	Static GTAP model, with GTAP-E and AEZs, V9 (2011) database	Comprises 38 of 47 sectors	Gravity model for selected NTMs	(1) Tariffs and TRQs removed (2) Select NTMs also removed (3) Demand sensitivity	% Δ in exports value: U.S. [0.43,0.52], EU [-.09,-.02]	GDP gains are larger for tariff removal scenario, compared with select NTM removal
ECORYS (2009)	Limited information provided, beyond a 10-year analysis used	Food and beverages sector only	Gravity model using business survey and literature	Two main scenarios: - Limited (25% NTMs eliminated); - Ambitious (50% NTMs eliminated)	% Δ in exports value: U.S. [1.74,3.97], EU [0.74,2.07]	GDP gains from ambitious scenario more than double those of limited
CEPR (2013)	Imperfect competition GTAP model, V8 (2007) projected to 2027	Agriculture, forestry, fisheries aggregated, processed foods	NTM estimates from ECORYS (2009)	Two comprehensive scenarios: -10% NTMs, 98% tariffs eliminated - 25% NTMs, 100% tariffs eliminated	% Δ in GDP: U.S. [0.04,0.39], EU [0.10,0.48]	NTMs account for as much as 80% of gains from TTIP
EP (2014)	MIRAGE model, with GTAP data	Comprises 17 of 31 sectors	Gravity model for notified NTMs	Five scenarios with tariff removal and various NTM cuts and harmonization spillovers	% Δ in ag. exports: U.S. [30,120] EU [19,63]	Gains to agriculture are largest; greatest impacts: beef, sugar, dairy
Erixon and Bauer (2010)	GTAP model, V7 (2004) extrapolated to 2010, projected to 2015	Comprises 8 of 32 sectors	None	Tariff removal with various trade facilitation and productivity assumptions	% Δ in GDP: U.S. [0.15,1.33] EU [0.01,0.47]	Potential gains are larger than most FTAs, including a potential Doha agreement
Fontage et al. (2013)	MIRAGE model, projected to 2025	Comprises 6 of 34 sectors	Gravity model for notified NTMs	(1) Tariff removal (2) 25% NTMs (3) Harmonization spillovers (4) ECORYS NTMs	% Δ in exports: U.S. [2.1, 10.4] EU [0.4,3.4]	TTIP will boost bilateral trade with no trade diversion; similar impacts on GDP
Egger et al. (2014)	Monopolistic competition	Comprises 2 of 22 sectors	Gravity model	(1) Tariff removal (2) NTMs-goods (3) NTMs-services	% Δ in real income: U.S. [0.10,0.59], EU [0.10,1.14]	GDP gains from NTM removal greater than tariff removal

CGE = computable general equilibrium. T-TIP = Transatlantic Trade and Investment Partnership. NTM = non-tariff measure. GDP = gross domestic product. FTA = free-trade agreement. GTAP = Global Trade Analysis Project.

Source: USDA, Economic Research Service.

Background

The United States and the EU are major producers of most agricultural goods and account for a significant share of global agricultural trade. While overall trade between the United States and the EU has increased over time, the relative importance of agricultural trade between these markets vis-a-vis other trading partners has decreased. This decline is due in part to the relatively high trade barriers facing U.S. agricultural exports to the EU, the proliferation of regional trade agreements (e.g., NAFTA) in which the United States and the EU partner with other countries, and the emergence of new countries as major players in global agricultural trade (e.g., Brazil).

U.S./EU Agricultural Production

Based on data from the Global Trade Analysis Project (GTAP), the U.S.-EU share of global agricultural production (including processed food and biofuels) was 31 percent in 2011. GTAP data also indicate that the United States had almost $1.3 trillion in agricultural production in 2011 and the EU had $2.25 trillion (see appendix 1 for agricultural sector breakdown). Among individual commodities, beverages and tobacco accounted for the largest share of U.S. agricultural production (12 percent of total value) in 2011, and beef accounted for the largest share of commodities other than processed food share (table 2).[3] Similarly, beverages and tobacco accounted for the largest share of EU agricultural production (18 percent of total value) in 2011. For the EU, other dairy products was the largest commodity other than processed foods, based on value of production. For the other countries examined, processed food products also accounted for large shares of their total value of agricultural production.

U.S./EU Trade

GTAP data indicate that the United States had an overall trade deficit of $95 billion with the EU in 2011. In the same period, the EU was the second-largest source (following China) of U.S. imports and the second-largest destination (following Canada) for U.S. exports. For EU imports, China was also the largest source (the United States was third). Overall, the EU accounted for 16.9 percent of U.S. trade (imports plus exports) in 2011, and the United States accounted for 14.2 percent of EU trade (EC, 2014).

Total U.S.-EU agricultural trade was $35 billion in 2011 (table 3); U.S. agricultural exports to the EU totaled $13.85 billion, while EU exports to the United States totaled $21.19 billion.[4] The importance of agricultural trade between the two countries has changed over time. For example, in 1992, the United States accounted for 21 percent of EU agricultural imports; by 2012, the share had decreased to 8 percent (EC, 2014). This change is partly due to trade barriers in place, the emergence of trade from other countries (e.g., Brazil), enlargement of the EU, and an increase in free-trade agreements (FTA) between the United States or the EU and other countries (e.g., EU-Mediterranean countries). Note that the United States has had a trade deficit in agricultural products with the EU since 2000, with the gap reaching $12 billion in 2012. The share of total EU agricultural exports that went to the United States was 13 percent in 2012, an all-time low over the last 20 years (EP, 2014).

Among all products, beverages and tobacco had the highest value for U.S. agricultural exports to the EU in 2011 (table 3). The next highest products by value were other foods, nuts, and soybeans.

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[3]See appendix 1 for those products typically aggregated as processed food in the standard GTAP database.

[4]Agriculture is defined as food, fiber, and bulk agricultural products, excluding fish and natural resources.

Table 2

GTAP agricultural production values, 2011

Sector	U.S.	EU	All other countries
		Million dollars	
Paddy rice	2,881.61	1,446.79	242,983.35
Wheat	18,231.86	43,766.98	174,913.54
Coarse grains	63,140.31	38,833.09	213,422.34
Fruits	25,004.78	38,051.03	359,284.79
Vegetables	35,173.40	48,140.02	576,342.97
Nuts	12,797.74	6,759.63	66,163.07
Soybeans	37,541.59	3,675.95	114,850.04
Rapeseed	648.89	15,985.56	23,334.55
Other oilseeds	4,651.39	6,815.01	65,197.95
Sugarcane/beet	2,229.85	5,599.84	73,647.92
Other crops	30,444.93	114,781.33	367,090.75
Bovine	45,926.09	46,882.94	238,193.06
Hogs	18,189.68	50,865.06	327,820.73
Poultry and eggs	30,394.17	29,937.75	324,220.26
Other animals	2,051.21	4,748.40	29,620.05
Raw milk	38,351.55	71,897.76	283,348.78
Beef	114,878.21	69,832.39	329,223.07
Pork	43,401.39	111,201.97	166,936.95
Poultry meat	48,610.04	61,820.50	148,271.02
Other meats	5,349.60	10,179.17	24,255.61
Vegetable oil	21,652.29	49,354.48	364,881.58
Whey	3,200.76	10,172.69	37,514.83
Powdered milk	5,270.47	10,519.47	115,800.89
Butter	5,625.71	21,300.44	39,614.11
Cheese	25,941.35	88,204.20	32,321.49
Other dairy products	62,687.41	201,507.56	193,209.74
Processed sugar	14,617.30	26,296.48	163,159.98
Processed rice	3,775.93	3,473.70	273,273.75
Prepared f_v	55,546.07	95,160.91	311,795.89
Cereal preparations	113,772.12	194,352.02	470,335.74
Sugar preparations	15,196.13	32,616.56	152,475.31
Processed feed	22,206.94	21,698.95	117,578.17
Other foods	135,001.78	301,494.88	703,140.17
Beverages and tobacco	157,613.06	404,555.13	726,238.06
Ethanol1	41,907.27	67.94	3,373.23
Ethanol2	1.80	1,413.22	17,831.30
DDGS	9,481.31	500.79	2,410.47
Biodiesel	4,040.26	12,959.83	10,799.73
Total ag.	1,277,436.25	2,256,870.42	7,884,875.24

GTAP = Global Trade Analysis Project. DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using data from GTAP v.9.

Table 3
Agricultural trade values, 2011

Sector	Bilateral trade		Total exports		Total imports	
	U.S. to EU	EU to U.S.	U.S.	EU	U.S.	EU
	Million dollars					
Paddy rice	22.06	0.90	834.04	293.92	86.27	885.81
Wheat	490.62	22.20	13,610.00	14,708.52	692.20	9,866.35
Coarse grains	519.20	23.43	16,363.49	9,827.02	1,022.03	10,098.72
Fruits	316.80	109.99	4,520.72	19,547.32	8,272.23	27,076.34
Vegetables	354.64	188.95	3,400.38	15,475.43	7,368.95	18,817.80
Nuts	1,733.85	27.20	4,709.38	3,061.57	1,984.34	6,312.93
Soybeans	1,261.50	0.05	20,889.57	903.05	568.91	6,323.68
Rapeseed	0.00	0.39	144.47	3,855.43	113.73	5,532.26
Other oilseeds	235.54	9.71	1,247.39	2,404.20	386.40	3,330.84
Sugarcane/beet	0.08	0.15	0.37	105.73	27.09	118.61
Other crops	856.77	755.18	13,316.82	21,633.70	12,952.93	38,908.58
Bovine	137.94	217.62	882.60	5,728.52	1,823.19	4,293.78
Hogs	249.28	95.05	2,561.55	6,223.94	730.93	6,702.70
Poultry and eggs	0.04	0.16	818.95	5,189.89	564.51	4,181.50
Other animals	1.61	32.21	833.38	2,963.24	776.98	3,245.39
Raw milk	0.07	2.67	0.26	63.28	45.33	152.81
Beef	217.18	44.67	6,753.54	18,688.85	4,101.81	19,477.42
Pork	177.93	468.18	6,589.04	14,233.45	1,456.04	10,034.30
Poultry meat	0.82	0.00	4,152.95	22,277.33	623.42	22,234.19
Other meats	44.16	15.79	1,311.39	7,588.15	390.82	7,665.94
Vegetable oil	389.18	877.79	7,132.84	20,239.27	7,341.98	28,835.96
Whey	7.82	1.61	1,092.73	2,493.31	79.46	1,197.32
Powdered milk	2.40	6.00	1,565.25	1,916.72	93.14	900.23
Butter	73.17	34.12	371.04	5,193.16	80.35	4,497.43
Cheese	7.65	1,068.37	511.01	20,508.14	1,186.21	16,841.68
Other dairy products	25.84	98.35	968.53	21,199.23	957.56	17,281.30
Processed sugar	33.00	18.29	301.97	6,104.51	2,714.64	7,805.47
Processed rice	54.16	23.07	1,490.90	1,218.35	682.19	1,853.20
Prepared f_v	612.26	565.98	5,821.14	25,101.55	8,142.90	29,628.26
Cereal preparations	1,004.53	2,112.44	6,060.85	31,557.11	10,659.83	24,360.70
Sugar preparations	32.74	81.06	1,859.60	4,211.97	733.86	2,720.65
Processed feed	145.37	128.11	1,734.12	8,598.88	832.12	7,531.70
Other foods	1,884.18	2,047.63	16,135.03	90,878.12	24,794.04	98,062.90
Beverages and tobacco	1,989.50	12,007.77	10,850.72	84,236.35	20,724.63	56,589.88
Ethanol1	0.00	0.00	0.00	36.94	412.75	163.59
Ethanol2	762.58	0.00	3,163.39	37.23	58.95	763.52
DDGS	129.40	0.00	1,820.37	0.00	89.73	129.40
Biodiesel	78.86	100.39	158.75	510.18	123.37	948.76
Total ag.	13,852.74	21,185.48	163,978.54	498,813.58	123,695.84	505,371.91

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using data from GTAP v.9.

Beverages and tobacco also had the highest value for EU agricultural exports to the United States in 2011. The EU exported a large amount of other foods, cereal preparations, and cheese to the United States ($1 billion total in 2011).

U.S. and EU Agricultural Tariffs

Tariffs between the United States and the EU are relatively low by global standards.[5] The simple average applied tariff for all goods is estimated at 3.5 percent for EU exports to the United States and 5.5 percent for U.S. exports to the EU (Akhtar and Jones, 2014). In addition, 37 percent of all tariff lines in the United States and 25 percent in the EU are already zero (Seshadri, 2014). Agricultural commodities, however, tend to have larger tariffs than nonagricultural products (Akhtar and Jones, 2014). That is, for agricultural goods specifically, the simple average tariffs are 4.7 percent for EU exports to the United States and 13.7 percent for U.S. exports to the EU (Akhtar and Jones, 2014). In addition, TRQs are prevalent in agricultural commodities. Calculating an ad valorem equivalent (AVE)[6] for a specific tariff is straightforward—the AVE is simply the tariff divided by the import unit value. However, constructing an AVE for a TRQ is more of a challenge. In addition, other types of tariffs that also involve additional calculations may also be in place, such as compound or mixed tariffs (see box "AVE Calculations for Nonspecific Tariffs").

AVE Calculations for Nonspecific Tariffs

The Uruguay Round Agreement on Agriculture set about converting (or eliminating) non-tariff barriers in the form of quantitative import restrictions, variable import levies, discretionary import licensing, and voluntary export restraints to tariffs (Normile and Simone, 2001). However, high rates in some products effectively prohibited imports. Thus, a system of tariff-rate quotas (TRQs) was created to provide market access.

TRQs feature two distinct components: an in-quota rate and an out-of-quota rate; the rate applied depends on the fill rate for the quota amount. To calculate an ad valorem equivalent (AVE) for TRQs, we apply the following rule:

- Fill rate < 90 percent → In-quota rate
- 99 percent < Fill rate > 90 percent → Average in- and out-of-quota rate
- Fill rate > 100 percent → Out-of-quota rate

That is, if a commodity has a fill rate less than 90 percent, the in-quota rate is used as the duty; if the fill rate is between 90 and 99 percent, an average of the two rates is used as the duty; and if the fill rate is greater than 100 percent, the out-of-quota rate is used. For example, U.S. almond exports to the EU are allocated a quota of 90,000 metric tons. Exports below that amount are subject to a 2-percent duty (in-quota rate), and exports above the quota face an out-of-quota rate of 5.6 percent. The fill rate is actually greater than 100 percent. Thus, the out-of-quota rate is used and the AVE is 5.6 percent.

Compound or mixed tariffs are also commonly used in the agricultural sector. Calculations for those tariffs involve multiple steps to account for the joint nature of those tariffs. For example, U.S. beef exports to the EU (Harmonized System code 01022910) face a compound tariff of 10.2 percent plus 93.10 euros per 100 kilograms. Based on an import value of 73,000 euros and a subsequent unit value of 313 euros per 100 kilograms, the AVE for this product is: 10.2 percent + (93.10 euros/(313 euros)*100) = 40 percent.

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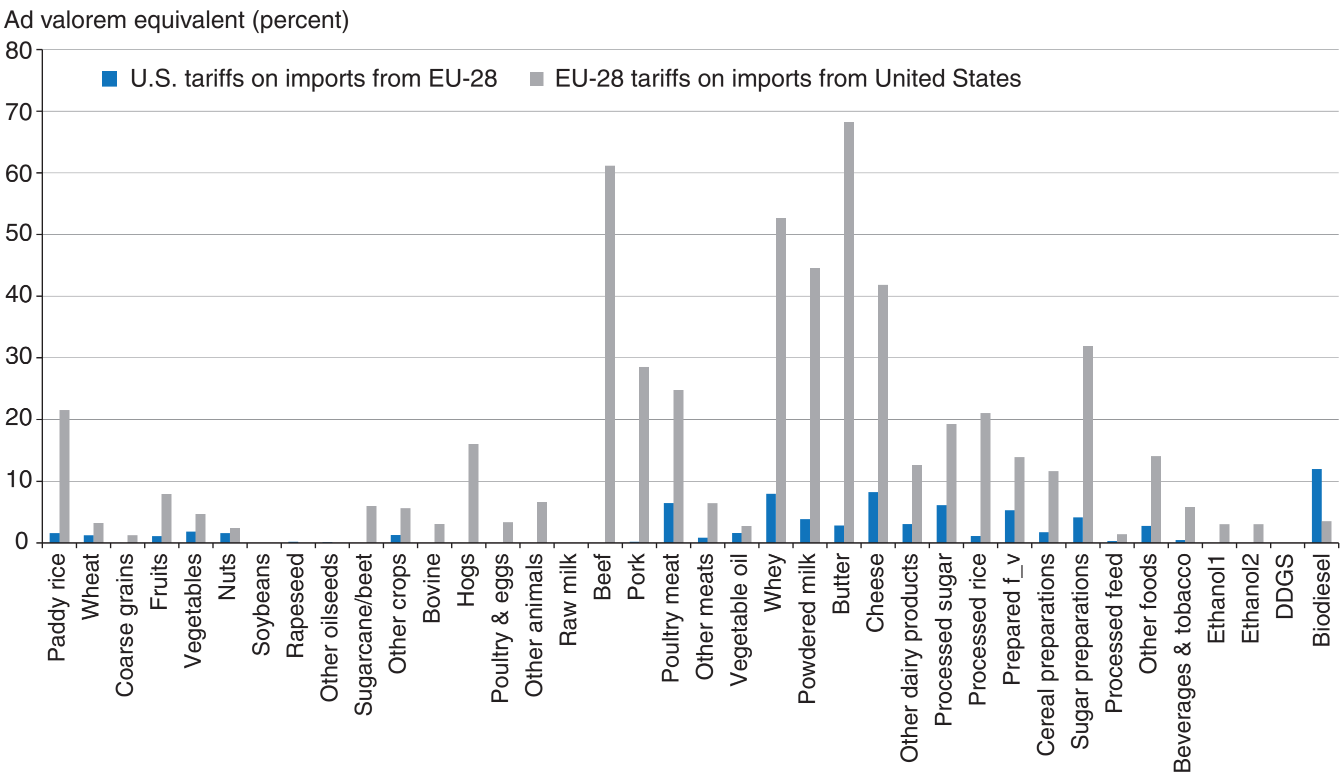
[5]The Global Trade Analysis Project (GTAP) database provides an ad valorem equivalent (AVE) estimate for regular tariffs, specific tariffs, compound tariffs, and tariff-rate quotas. This total tariff allows for complete market liberalization experiments. The tariff estimates from the GTAP database are examined and corrected for any inconsistencies with other data sources (see appendix 1, tariffs).

[6]An AVE is a tool to bring all trade barriers into one universal measure, as a percentage of the price of the product.

Based on all the information for individual tariffs and TRQs, we compute a total AVE for tariffs (see appendix 1 "tariffs" for information on our need to calculate and validate the GTAP tariffs). U.S. and EU agricultural tariffs by category are presented in figure 1 (see appendix 1, table A1-2, for the sector aggregation). The tariffs reported in figure 1 were used for the analysis. Note that the AVE estimates for several commodities are quite large. For example, the EU tariff on U.S. beef is 61 percent. Overall, the EU has higher tariffs on agriculture than the United States does. Our tariffs tend to be slightly larger than those in the GTAP database. For example, U.S. agricultural and biofuel exports to the EU face a 12.19-percent simple-weighted tariff in the GTAP database; our calculations indicate that it is 14.57 percent.

Figure 1
Total tariffs on agricultural trade between the United States and the EU*



*Includes ad valorem equivalents of non-ad valorem tariffs and tariff-rate quotas. DDGS = distillers' dried grains with solubles.
f_v = fruits and vegetables.
Source: USDA, Economic Research Service, authors' calculations.

Non-Tariff Measures

The removal of NTMs is frequently described as being the largest source of potential trade gains for T-TIP (see table 1) and is a key focus of negotiations (ECORYS, 2009; Fontagne et al., 2013; Josling and Tangermann, 2014). For agriculture, sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT) stand out in particular as costly NTMs (Cadot et al., 2015; ITC, 2011).[7] However, NTMs are not easily quantified, leading to several data, methodological, and conceptual challenges in assessing the potential economic gains from their removal (see Arita et al., 2015, for an overview of these issues).

Given that concerns over NTMs are a key element in the T-TIP negotiations, there is growing interest in estimating the potential effects on bilateral trade from the removal of NTMs. However, analysis to date has largely applied broad-based approaches aimed at covering the widest scope of NTMs. For example, European Parliament (2014) used World Trade Organization (WTO) notifications in a gravity model framework to estimate the effects of NTMs on EU-U.S. trade (see box "Gravity Models and NTMs"). Although WTO notifications provide a comprehensive inventory of NTMs, they do not distinguish between different types of measures in an empirical framework (e.g., measures such as maximum pesticide residue tolerances are not differentiated from bans on beef hormones). Because there are many SPS and TBT measures that have not been raised as concerns, broad-based estimates of all NTMs likely overstate their cost in the context of FTA negotiations.[8] A further limitation of the broad-based approach is that the resulting estimates are based on the assumption that all NTMs affect each country equally. Thus, this approach may lead to imprecise measures of NTM effects, which vary across exporting countries. For example, although one would expect the EU beef hormone restriction to significantly affect U.S. and Canadian beef exporters (because both countries use hormones extensively), one would not expect the SPS restriction to

Gravity Models and NTMs

Gravity models have been employed to econometrically estimate the effects of non-tariff measures (NTMs) (Disdier and Marette, 2010; EP, 2014; ECORYS, 2009). In its basic form, the gravity model predicts that bilateral trade flows increase as the sizes of the economies of the trading partners increase and that trade flows decrease as trade costs increase. In current empirical applications, the model's theoretical foundation is most frequently guided by the work of Anderson and van Wincoop (2003), who explicitly model multilateral resistance terms. Silva and Tenreyro (2006) have contributed further innovation using a poisson estimator. In applications to NTMs, the standard gravity equation is augmented to include NTMs as an additional variable to explain bilateral trade. Estimation of the model allows for the prediction of trade without the NTMs in place. A comparison of actual trade levels with predicted trade levels following the removal of NTMs can be used to estimate forgone levels of trade. From this, an ad valorem tariff equivalent (AVE) of NTM costs can be estimated.

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[7]Cadot et al. (2015) estimate that SPS/TBT measures account for the largest portion of NTM costs for agricultural commodities. Using data from business surveys on NTMs, ITC (2011) finds that 68 percent of exporters of agricultural products report SPS/TBT measures as the most burdensome type of NTM.

[8]Studies employing broad-based estimates typically assume only a certain percentage of the NTMs are removed in their simulations. The European Parliament study assumed 25 percent of NTMs were removed; ECORYS simulated a 25- to 50-percent removal scenario.

affect South American exporters to the EU because South American producers are largely banned from using hormones.

The NTM effects used in this study are from a complementary ERS study, *Estimating the Effects of Selected Sanitary and Phytosanitary Measures and Technical Barriers to Trade on U.S.-EU Agricultural Trade* (Arita et al., 2015). Unlike broad-based approaches to investigating the effects of NTMs, Arita et al. (2015) applied a more tailored strategy, focusing on specific SPS/TBT concerns raised by EU and U.S. exporters and reported to the U.S. Trade Representative, the European Commission, and the WTO (table 4).[9] For each of these specific measures, Arita et al. combined commodity analysis with econometric tools to estimate individual gravity models and predict the levels of forgone trade had the NTMs not been in place. This empirical approach is tailored to examining many of the major NTM issues frequently discussed as barriers to trade, which tend to focus on specific SPS/TBT concerns (e.g., biotech restrictions, beef hormones). A summary of the results from Arita et al. (2015) is reported in table 5. Note that the second of three hypothetical T-TIP

Table 4

EU- and U.S.-specific SPS/TBT trade concerns

Specific trade concern*	Products affected	Assessed in this study
Concerns raised by U.S. exporters about EU SPS/TBT measures:		
Restrictions on the use of pathogen-reduction treatments (PRTs)[1,3]	Poultry and beef	Yes for poultry and beef
Restrictions on the importation and use of agricultural commodities derived from agricultural biotechnology[1,3]	Various products	Yes for soybeans and corn
Prohibition on beef and beef products raised with growth-promoting hormones[1,3]	Beef and beef products	Yes
Low level of maximum-residue limit (MRL) tolerances; MRLs not established for some products[1]	Fruits, vegetables, nuts	Yes for fruits, vegetables, and nuts
Restrictions on pork and other livestock produced with beta agonists[1]	Pork and other meat products	Yes for pork
Testing requirements for karnal bunt spores[1]	Wheat	Yes
Restrictions on tallow over bovine spongiform encephalopathy (BSE) concerns[1,3]	Animal byproducts	No
Limits on the number of somatic cells permitted in raw milk[1]	Milk and milk products	No
Phytosanitary restrictions on seed re-export[1]	Seeds	No
Concerns raised by EU exporters about U.S. SPS/TBT measures:		
Restrictions on beef products due to BSE concerns[2,3]	Beef and beef products	Yes**
Lengthy import approval procedures for new types of plant products[2,3]	Plants and plant products	Yes for fruits and vegetables
U.S. standards on dairy products that differ from EU requirements[2,3]	Dairy products	No

Notes: *Specific concerns on wine, distilled spirit, and seafood products were not included. **Only forgone losses of trade estimated (ad valorem equivalents not estimated). SPS = sanitary and phytosanitary. TBT = technical barrier to trade.

Sources: [1]U.S. Trade Representative, *2014 Report on Sanitary and Phytosanitary Measures*; [2]European Commission, Market Access Databases; [3]World Trade Organization (formal complaints and specific trade concerns).

[9]Due to data and modeling limitations, the study did not econometrically analyze SPS/TBT concerns on animal byproducts, seeds, and dairy. The study did not examine other NTM issues, such as price control measures, licensing, administrative and customs requirements, geographic indicators, rules-of-origin issues, taxes discriminatory on exporters, State-specific requirements, and Government procurement policies that may also be addressed through a T-TIP agreement (see Arita et al., 2014 for a discussion of several of these NTMs).

Table 5
Estimated AVE cost of NTMs on U.S.-EU agricultural trade

Sector	Example of NTM in sectors	AVE
EU sectors with NTM concerns raised by U.S. exporters		*Percent*
Beef	Growth hormones, PRTs	23
Poultry	PRTs	102
Pork	Ractopamine, trichanae, PRTs	81
Corn	Biotech restrictions	79
Soy	Biotech restrictions	17
Fruits	Maximum residue limits	35
Vegetables	Maximum residue limits	53
U.S. sectors with NTM concerns raised by EU exporters		
Beef	Bovine spongiform encephalopathy (BSE)	N/A
Fruits	Import approval process	45
Vegetables	Import approval process	37

AVE = ad valorem equivalent. NTM = non-tariff measure. PRT = pathogen-reduction treatment. N/A = not available.

Source: USDA, Economic Research Service estimates are from Arita et al. (2015), using a gravity model. NTMs not found to be statistically significant in the study are not reported.

scenarios (market access with NTM removal) simulated later in this study removes this NTM AVE on exports in addition to removing the tariff. That is, the tariffs presented in figure 1 represent the price wedge between the exported and the imported price. The AVEs in table 5 are *in addition* to the AVEs from tariffs. Thus, for the agricultural commodities in table 5, the price wedge is larger than that with tariffs alone.[10]

The EU's NTMs on U.S. exports of poultry, pork, and corn were found to have the largest trade-impeding effects, with estimated AVEs of 102, 81, and 79 percent, respectively. Estimated AVE effects for EU NTMs on U.S. vegetable and fruit exports were 53 and 35 percent, respectively. Almost all of these AVE effects of NTMs are larger than the estimated tariffs (see fig. 1), although both the AVEs and the tariffs are removed in this study's second T-TIP scenario. EU NTMs on U.S. beef exports were found to be equivalent to a 23-percent tariff, a lower trade barrier than the tariff. The AVE effect of EU NTMs on U.S. exports of soybeans was estimated to be 17 percent. The EU does not impose a tariff on U.S. soy and soy products. Thus, all effects on U.S. soy exports can be attributed to the removal of NTMs. U.S. NTMs on EU exports of fruits and vegetables were estimated to be equivalent to tariffs of 45 and 37 percent, respectively.

[10]The implementation of NTMs in the CGE model effectively resolves the model introducing the AVE distortion in table 5. This is because NTMs are not present in the base data. For example, for beef, the model will be resolved such that a 23-percent tax will be applied to U.S. exports to the EU. The second scenario will then remove the tariff price wedge plus the new NTM price wedge.

CGE Model Results

To analyze the effects of T-TIP on agricultural production, prices, and trade, as well as country-specific macroeconomic impacts, such as GDP, we simulate three scenarios using a multi-product global CGE model (see appendix 2). In the first scenario, tariffs and TRQs are completely removed. The second scenario builds on the first scenario by also removing select NTMs, using AVE estimates from Arita et al. (2015) (see appendix 3 for information on incorporating these costs in the model). Finally, a third scenario considers demand sensitivities that may arise from changes in the NTM regime. Detailed commodity-level impacts are presented for the United States and the EU only. All other countries are grouped into one aggregate region. When possible, specific results for other countries are discussed.[11]

Market Access – Removal of all Tariffs and TRQs

Trade and Production Impacts – United States

The EU has relatively higher tariffs on U.S. agricultural exports than the United States has on EU agricultural exports (see fig. 1). Consequently, the removal of all tariffs and TRQs results in a greater increase in U.S. exports to the EU for the broad agricultural commodities reported in table 6. In particular, U.S. exports of beef to the EU increase 685 percent annually in this scenario. This is not surprising, as this commodity had the highest tariffs in place (see fig. 1). With the removal of all tariffs, U.S. exports decrease for some agricultural commodities, such as distillers' dried grains with solubles and soybeans. This effect stems from relatively low tariffs on these commodities, compared with other commodities with higher tariffs (see fig. 1). Resources are reallocated to those products with larger tariff removal. In the same scenario, U.S. agricultural export values to the rest of the world (all other countries) decline because of the increase in exports to the EU.

Although U.S. exports to the EU increase for almost all agricultural commodities examined, changes in U.S. overall export values are mixed (table 7). Note that the United States (and all other regions) has limited resources (land, labor, and capital) to meet demand changes. The CGE model captures the movement of resources into commodities where the United States is most competitive with respect to EU markets, and vice versa. Some U.S. commodities have overall, but small, decreases in export values, notably, wheat, coarse grains, soybeans, vegetable oil, and poultry meat. This is due to supply constraints against other commodities that had higher initial tariffs. Many other commodities, however, see increases in overall exports in the scenario. In fact, U.S. export values of beef, butter, cheese, and processed sugar to the EU all increase by double-digit amounts. Other U.S. commodity exports with increases include various processed foods products (e.g., prepared fruits and vegetables, cereal preparations, sugar preparations, and other foods) pork, fruits, and vegetables. A higher share of U.S.-produced oilseeds, such as soybeans, and coarse grains is allocated to domestic use as feed, given the increase in beef exports in the scenario. This also contributes to the reduction in certain U.S. exports to the EU (e.g., soybeans). Similarly, overall values of processed feed exports decrease for the United States. Net U.S. imports of agricultural goods increase across the board with tariffs and TRQs removed (except for the ethanol commodities), as the United States has increases in bilateral imports from the EU, and more overall imports are needed for domestic use to replace the large increase in exports. The largest increase in U.S. imports is for cheese, which

[11]Detailed results for the other five disaggregated regions are available upon request from the authors.

Table 6
Changes in bilateral trade values from market access

Sector	U.S. to EU		U.S. to all others		All others to U.S.		EU to U.S.		EU to all others		All others to EU	
	Percent	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*
Paddy rice	444.39	98.06	-4.52	-36.74	4.98	4.25	13.33	0.12	1.73	0.51	-15.68	-94.12
Wheat	23.22	113.94	-1.72	-225.16	0.97	6.51	5.47	1.21	0.42	29.27	-5.69	-91.22
Coarse grains	1.64	8.51	-0.58	-92.59	0.84	8.35	1.52	0.35	0.65	13.33	-0.56	-10.22
Fruits	29.67	94.00	-1.00	-42.12	0.59	48.44	5.32	5.85	0.47	9.31	-0.75	-69.69
Vegetables	15.79	56.01	-0.56	-17.18	0.50	35.98	8.29	15.67	0.33	12.04	-0.61	-41.75
Nuts	4.23	73.30	-1.12	-33.43	0.82	16.12	8.09	2.20	1.42	2.75	-2.96	-51.47
Soybeans	-1.01	-12.73	-0.66	-129.46	0.51	2.88	1.03	0.00	0.73	0.22	0.22	9.05
Rapeseed	-1.65	0.00	-0.71	-1.03	0.48	0.54	1.97	0.01	0.46	0.84	-0.10	-1.88
Other oilseeds	-1.36	-3.21	-1.03	-10.45	0.52	1.95	1.85	0.18	0.33	2.05	0.09	1.21
Sugarcane/ beet	32.19	0.03	-3.45	-0.01	0.63	0.17	1.83	0.00	0.81	0.03	-0.48	-0.08
Other crops	35.38	303.10	-1.95	-242.47	0.26	31.72	9.35	70.59	0.80	44.40	-1.15	-260.34
Bovine	5.42	7.48	-1.92	-14.32	2.08	33.33	2.32	5.05	-0.18	-2.75	-4.64	-7.82
Hogs	59.15	147.44	-1.48	-34.19	0.94	5.95	1.24	1.18	0.09	0.86	-10.56	-135.30
Poultry and eggs	12.14	0.00	-1.51	-12.33	0.94	5.33	1.18	0.00	0.22	5.96	-0.01	-0.14
Other animals	26.91	0.43	-1.12	-9.32	0.50	3.74	0.75	0.25	0.17	0.85	-0.08	-0.68
Raw milk	-3.68	-0.01	0.00	0.00	1.57	0.67	2.62	0.07	0.66	0.11	-0.09	-0.10
Beef	684.88	1,487.41	-1.36	-89.21	1.59	64.46	1.73	0.78	-0.01	-0.25	-26.32	-1,026.13
Pork	181.13	322.30	-1.46	-93.75	1.00	9.85	1.88	8.79	0.09	4.82	-18.57	-261.64
Poultry meat	197.25	1.62	-1.41	-58.62	1.22	7.61	7.88	0.00	-0.09	-1.81	-0.00	-0.01
Other meats	31.77	14.02	-1.33	-16.80	1.06	3.96	2.14	0.34	-0.06	-0.36	-1.76	-11.27
Vegetable oil	17.35	67.54	-1.32	-89.16	-0.36	-23.36	10.81	94.85	0.11	4.50	-0.37	-48.46
Whey	435.08	34.01	-2.70	-29.31	0.71	0.55	6.92	0.11	0.69	9.23	-74.93	-25.55
Powdered milk	908.72	21.83	-2.05	-32.11	0.36	0.31	4.54	0.28	0.04	0.44	-29.59	-16.75
Butter	206.06	150.78	-4.30	-12.80	-6.03	-2.79	11.71	3.99	2.66	22.62	-92.78	-106.21
Cheese	997.09	76.31	-2.17	-10.94	-24.30	-28.64	30.44	325.25	0.23	7.05	-12.55	-58.29
Other dairy products	125.83	32.50	-2.42	-22.84	0.11	0.93	4.21	4.14	0.07	3.49	-2.92	-26.55
Processed sugar	154.11	50.87	-1.19	-3.19	0.79	21.22	38.46	7.04	-0.21	-2.68	-0.82	-24.49
Processed rice	145.70	78.92	-1.41	-20.30	0.46	3.04	7.95	1.83	1.36	2.15	-7.13	-54.34
Prepared f_v	60.85	372.54	-0.94	-48.74	-0.21	-16.11	4.22	23.90	-0.03	-1.38	-3.14	-309.95
Cereal preparations	43.49	436.82	-0.86	-43.58	-0.14	-11.75	2.12	44.77	-0.01	-1.48	-6.50	-364.95
Sugar preparations	171.21	56.04	-0.87	-15.83	-0.21	-1.38	3.84	3.11	-0.07	-1.34	-9.22	-49.74
Processed feed	3.38	4.92	-0.98	-15.57	0.87	6.11	1.29	1.65	-0.14	-2.85	-0.97	-9.68
Other foods	60.02	1,130.96	-0.88	-125.53	0.03	6.78	2.55	52.13	0.00	0.35	-4.29	-966.14
Beverages and tobacco	10.41	207.18	-0.53	-47.24	-0.02	-1.89	0.76	91.34	0.02	3.88	-2.54	-155.25
Ethanol1	4.46	34.05	-0.49	-11.84	-0.14	-0.08	-0.53	0.00	0.38	0.14	-5.38	-0.05
Ethanol2	24.11	0.00	-	-	0.21	0.88	0.10	0.00	0.19	0.07	-0.15	-0.25
DDGS	-1.80	-2.33	-1.11	-18.78	0.86	0.77	1.44	0.00	-	-	-	-
Biodiesel	14.06	11.09	0.06	0.05	-16.57	-3.81	30.70	30.81	-0.02	-0.08	-0.65	-5.66
Total ag.		5,475.73		-1,706.89		242.59		797.84		166.29		-4,275.91

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables. - = not applicable.

Source: USDA, Economic Research Service analysis using Transatlantic Trade and Investment Partnership model.

Table 7
Changes in net trade values from market access

	Exports			Imports		
Sector	U.S.	EU	All others	U.S.	EU	All others
	Percent change					
Paddy rice	7.35	-4.16	-4.28	5.22	-0.31	-1.21
Wheat	-0.82	-0.37	-0.19	1.35	0.57	-0.17
Coarse grains	-0.51	0.05	0.17	0.85	-0.10	-0.22
Fruits	1.15	-0.11	-0.04	0.64	0.06	-0.10
Vegetables	1.14	0.07	-0.05	0.67	0.08	-0.06
Nuts	0.85	-1.45	-0.32	0.91	0.33	-0.27
Soybeans	-0.68	0.67	0.35	0.51	-0.04	-0.12
Rapeseed	-0.72	0.35	-0.08	0.48	-0.10	-0.08
Other oilseeds	-1.09	0.46	0.06	0.55	-0.11	-0.10
Sugarcane/beet	4.74	0.17	0.10	0.60	-0.38	0.05
Other crops	0.46	0.20	-0.20	0.79	0.19	-0.20
Bovine	-0.78	-0.75	0.35	2.16	-0.04	-0.27
Hogs	4.42	-1.34	-1.12	1.05	1.25	-0.10
Poultry and eggs	-1.50	0.22	0.02	0.94	-0.01	0.05
Other animals	-1.07	0.15	0.15	0.54	-0.03	-0.14
Raw milk	-3.68	0.84	0.17	1.67	-0.09	-0.02
Beef	20.70	-3.00	-3.63	1.60	2.86	-0.22
Pork	3.47	-1.11	-3.32	1.61	2.34	-0.21
Poultry meat	-1.37	0.12	0.09	1.22	0.07	-0.28
Other meats	-0.21	-0.08	-0.07	1.24	0.26	-0.21
Vegetable oil	-0.30	0.27	-0.05	0.93	0.11	-0.07
Whey	0.43	-2.00	-3.24	1.86	6.48	0.33
Powdered milk	-0.66	-0.54	-0.10	2.27	1.60	-0.09
Butter	37.19	-7.20	-7.00	9.86	12.40	1.55
Cheese	12.79	1.41	-3.36	29.91	0.79	0.14
Other dairy products	1.00	0.03	-0.45	2.49	0.19	0.00
Processed sugar	15.79	-0.72	-0.05	0.98	0.61	-0.07
Processed rice	3.93	-4.64	-0.27	0.72	1.81	-0.12
Prepared f_v	5.56	-0.05	-0.84	1.27	0.33	-0.08
Cereal preparations	6.49	-0.12	-0.94	1.27	0.62	-0.06
Sugar preparations	2.16	-0.34	-1.11	1.64	0.83	-0.18
Processed feed	-0.61	-0.44	-0.03	1.05	-0.43	-0.17
Other foods	6.23	-0.11	-0.90	0.98	0.46	-0.07
Beverages and tobacco	1.47	-0.05	-0.43	0.63	0.49	-0.02
Ethanol1	0.43	-0.08	-0.65	-0.53	-0.64	-0.60
Ethanol2	0.70	0.17	-0.07	-0.15	-0.17	0.00
DDGS	-1.35	-0.10	0.97	0.08	-0.01	-0.06
Biodiesel	-0.91	0.02	0.50	0.07	0.04	0.05

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

Table 8

Changes in production values and prices from market access

Sector	Production U.S.	Production EU	Production All others	Market price U.S.	Market price EU
	Percent change				
Paddy rice	2.27	-2.32	-0.03	0.81	-0.69
Wheat	-0.55	-0.28	-0.02	0.09	-0.33
Coarse grains	0.08	-0.06	0.01	0.24	-0.32
Fruits	0.11	-0.08	-0.01	0.29	-0.30
Vegetables	0.08	0.02	-0.02	0.28	-0.27
Nuts	0.30	-1.03	-0.02	0.34	-0.50
Soybeans	-0.36	0.42	0.11	0.15	-0.21
Rapeseed	-0.25	0.20	-0.02	0.18	-0.25
Other oilseeds	-0.30	0.30	0.00	0.17	-0.23
Sugarcane/beet	0.38	-0.18	-0.02	0.42	-0.32
Other crops	-0.11	-0.06	-0.04	0.24	-0.28
Bovine	1.17	-0.64	-0.15	0.40	-0.24
Hogs	0.91	-0.31	-0.04	0.33	-0.34
Poultry and eggs	-0.09	0.13	0.03	0.32	-0.33
Other animals	-0.55	0.12	0.04	0.31	-0.33
Raw milk	-0.14	0.11	-0.04	0.37	-0.26
Beef	1.33	-1.11	-0.30	0.28	-0.25
Pork	0.52	-0.01	-0.17	0.26	-0.32
Poultry meat	-0.13	0.11	0.05	0.27	-0.19
Other meats	-0.12	-0.04	0.03	0.25	-0.18
Vegetable oil	-0.11	0.09	-0.02	0.16	-0.11
Whey	0.11	-0.06	-0.12	0.26	-0.68
Powdered milk	-0.26	0.02	-0.01	0.26	-0.27
Butter	2.72	-0.86	-0.59	0.25	-2.33
Cheese	-1.11	0.52	-0.36	0.18	-0.30
Other dairy products	-0.01	0.09	-0.03	0.26	-0.20
Processed sugar	0.42	-0.31	-0.01	0.18	-0.07
Processed rice	1.46	-2.72	-0.01	0.20	-0.42
Prepared f_v	0.52	0.05	-0.09	0.18	-0.15
Cereal preparations	0.31	0.05	-0.09	0.19	-0.15
Sugar preparations	0.28	0.00	-0.03	0.23	-0.09
Processed feed	0.27	-0.51	-0.03	0.23	-0.08
Other foods	0.71	0.06	-0.15	0.18	-0.19
Beverages and tobacco	0.09	0.07	-0.02	0.18	-0.14
Ethanol1	-0.04	0.04	0.02	0.20	-0.06
Ethanol2	0.00	-0.02	0.00	0.15	-0.10
DDGS	-0.04	0.04	0.05	0.41	-0.52
Biodiesel	1.08	0.18	-0.08	-0.11	-0.10

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

at 30 percent is triple the next largest increase for a commodity (butter). This increase for cheese is entirely due to the diversion of domestic production after the 30-percent increase in U.S. cheese imports from the EU (see table 6).

The increase in exports for most U.S. agricultural commodities in the first scenario leads to similar increases in production (table 8); however, the increase in coarse grain production is small due to the decline in net exports. There are decreases in production for wheat, soybeans, and cheese, which is often due to falling exports. U.S. net exports of cheese increase significantly (12.79 percent), but the offsetting increase in imports (29.91 percent) negates the need for increased U.S. production. Consequently, the fall in U.S. cheese production in the scenario is the largest percentage decrease among all U.S. commodities examined. The expansion of U.S. exports to the EU leads to a small (under 1 percent) increase in U.S. prices for all agricultural commodities except biodiesel.

Trade and Production Impacts - EU

For the EU, exports to the United States increase for all agricultural commodities (except for ethanol1 (ethanol produced from grains), but the gains are mostly smaller than those for U.S. exports to the EU (table 6). As mentioned, this difference is due to relatively smaller U.S. tariffs on agriculture (see fig. 1). According to the GTAP baseline, the largest EU exports to the United States other than processed foods are vegetable oil and cheese (see table 3). Among all commodities, these two have some of the largest gains in exports to the United States in the scenario.

EU exports to all other countries examined increase for most agricultural commodities in the scenario, which offsets some of the decline in U.S. exports to these countries. The increase in EU imports from the United States leads to an increase in overall EU imports for most agricultural commodities. Only a few EU agricultural commodities have overall gains in exports (see table 7).

EU production declines for many agricultural commodities in the scenario, but there are increases for oilseeds (e.g., rapeseed and vegetable oil) and cheese due to the large expansion in exports. The commodity perhaps affected the most in the market access scenario is beef. Both the United States and the EU are large producers of beef (combined production value of $185 billion in 2011). The removal of tariffs and TRQs leads to an increase in U.S. beef production of 1.33 percent and a decrease in EU beef production of 1.11 percent. These changes are due to the removal of the large tariff/TRQ on U.S. beef exports to the EU. EU prices for all agricultural commodities decrease by a small amount for most products due to the increase in imports from the United States.

Macro Impacts

With the removal of all tariffs and TRQs, net U.S. agricultural exports and imports increase and total EU agricultural imports increase (table 9). U.S. imports increase by just over 1 percent, largely due to an increase in dairy imports. EU imports increase by about 0.6 percent, largely due to increases in dairy products and pork imports. Given the sector-level results, total agricultural exports increase by over 2 percent for the United States and decrease by 0.25 percent for the EU. For all other countries examined, agricultural imports and exports decrease. Agricultural exports decline the most for the countries without trade agreements with the United States or the EU (China, India, and Brazil).

The removal of tariffs and TRQs leads to an increase in GDP for the United States and the EU but no change in GDP for the non-NAFTA countries examined (table 9). The GDPs of the other NAFTA countries (Canada and Mexico) decrease slightly due to the decrease in trade with the United States.

Table 9
Macro impacts from market access

Region	GDP	Value of agriculture		Land-use change		
		Imports	Exports	Forestry	Crops	Livestock
	Percent change					
U.S.	0.09	1.19	2.30	-0.06	-0.06	0.10
EU	0.23	0.59	-0.25	0.05	-0.08	0.04
Canada	-0.02	-0.28	-0.09	-0.01	-0.02	0.07
Mexico	-0.03	-0.30	0.00	-0.02	0.00	0.01
China	0.00	-0.07	-0.42	-0.02	-0.01	0.02
India	0.00	0.00	-0.39	0.06	-0.01	0.12
Brazil	0.00	-0.09	-0.55	0.02	0.00	-0.02
ROW	0.00	-0.10	-0.62	0.01	0.01	-0.01

GDP = gross domestic product. ROW = rest of world.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

As shown in other studies (see table 1), the percentage change in GDP is larger for the EU (0.23 percent) than for the United States (0.09). This finding largely reflects an increase in EU exports of manufactured products and services and the benefit of lower priced EU imports.

Land-use changes in the market-access scenario are largely the result of changes in total production (table 9). For example, U.S. primary livestock production and exports increase with the removal of tariffs and TRQs. Consequently, some land-use shifts from forestry and crops to livestock. The EU has a similar increase in land allocated to livestock production at the expense of cropland. All other countries examined except Brazil also have a movement toward increased land for livestock. Note that part of the movement toward livestock is attributed to the Keeney and Hertel (2009) component of the CGE model, which explicitly considers intensification of crop yields. Thus, less land is needed for crop production.

Market Access With NTM Removal

In the second scenario, we consider the effects of removal of selected NTMs in addition to removal of tariffs and TRQs. The allocation of NTM costs in the CGE model is discussed in appendix 3. Although a final T-TIP agreement may draw from other scenarios, such as partial reductions of NTMs, we consider their elimination and their impact an upper bound.

Trade and Production Impacts – United States

Given the removal of select NTMs in addition to tariffs and TRQs, the percentage change in U.S. exports to the EU increases in most agricultural commodities, especially those in which NTMs were analyzed (table 10). Some of the changes are considerably larger than those in the first scenario. For example, U.S. poultry exports increased 197 percent in the market-access scenario, but when the additional removal of NTMs is considered, the increase is 33,505 percent. However, base poultry exports were small, such that the level change in exports is only $18 million. U.S. beef and pork exports also increase considerably in the second scenario. The removal of NTMs leads to an increase in U.S. soybean exports to the EU (76.81 percent), whereas the removal of tariffs and TRQs in the first scenario resulted in a drop in U.S. soy exports. Similarly, U.S. agricultural exports to

Table 10

Change in bilateral trade values from tariff and non-tariff measure removal

Sector	U.S. to EU		U.S. to all others		All others to U.S.		EU to U.S.		EU to all others		All others to EU	
	Percent	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*
Paddy rice	432.84	95.51	-5.76	-46.79	5.79	4.94	15.56	0.14	2.37	0.70	-15.71	-94.33
Wheat	21.66	106.25	-2.61	-342.96	1.51	10.10	6.82	1.52	1.23	84.97	-5.91	-94.64
Coarse grains	95.85	361.02	-1.33	-210.02	1.51	15.04	5.21	1.22	3.95	81.44	-15.97	-293.42
Fruits	62.07	188.60	-1.37	-57.58	-4.74	-386.56	708.78	494.71	0.81	16.17	-1.53	-142.49
Vegetables	152.98	466.74	-1.48	-44.92	-4.78	-342.98	459.26	613.35	1.52	55.45	-5.32	-363.49
Nuts	3.70	64.15	-1.59	-47.41	1.34	26.20	9.03	2.45	2.38	4.60	-2.86	-49.74
Soybeans	76.81	861.26	-2.66	-521.40	2.00	11.36	8.31	0.01	7.91	2.40	-17.60	-737.32
Rapeseed	-1.66	0.00	-1.52	-2.19	0.54	0.61	2.06	0.01	0.61	1.11	0.72	13.44
Other oilseeds	-1.23	-2.90	-1.80	-18.19	0.42	1.57	1.99	0.19	0.82	5.12	1.06	14.02
Sugarcane/ beet	29.53	0.03	-6.90	-0.02	1.00	0.27	2.43	0.00	1.88	0.07	-1.26	-0.21
Other crops	33.28	285.11	-2.78	-346.03	0.46	55.68	10.87	82.12	2.25	124.48	-1.67	-379.07
Bovine	3.82	5.27	-3.33	-24.80	3.30	52.94	3.86	8.40	0.06	0.95	-4.75	-8.02
Hogs	54.75	136.49	-2.57	-59.32	1.68	10.66	2.74	2.60	0.62	5.96	-11.96	-153.28
Poultry and eggs	10.89	0.00	-2.83	-23.16	1.35	7.60	2.21	0.00	1.12	30.04	-0.28	-4.70
Other animals	25.68	0.41	-2.00	-16.62	0.59	4.40	1.54	0.50	0.87	4.44	-0.08	-0.62
Raw milk	-6.70	-0.01	-5.26	-0.01	2.46	1.05	7.49	0.20	4.03	0.67	-1.05	-1.14
Beef	965.71	1,861.06	-1.97	-128.65	0.55	22.25	113.41	16.19	0.10	3.24	-36.09	-1,406.74
Pork	3,982.89	2,394.00	-2.16	-138.22	1.46	14.46	2.86	13.37	0.43	23.09	-97.44	-1,372.37
Poultry meat	33,505.16	18.03	-2.16	-89.72	1.66	10.34	8.57	0.00	0.14	2.88	-5.32	-104.65
Other meats	30.96	13.67	-1.89	-23.98	1.48	5.55	2.70	0.43	0.04	0.23	-1.64	-10.49
Vegetable oil	14.23	55.38	-2.93	-197.51	-0.28	-17.86	14.96	131.30	3.42	143.13	-0.96	-127.41
Whey	431.55	33.73	-3.60	-39.07	1.13	0.88	7.45	0.12	0.78	10.47	-74.81	-25.51
Powdered milk	900.94	21.65	-2.89	-45.21	0.85	0.74	5.16	0.31	0.11	1.19	-29.38	-16.63
Butter	206.25	150.92	-5.25	-15.64	-5.75	-2.66	12.48	4.26	2.77	23.53	-92.85	-106.29
Cheese	987.82	75.60	-3.26	-16.39	-24.19	-28.50	31.49	336.38	0.39	11.95	-12.38	-57.51
Other dairy products	123.70	31.96	-3.50	-33.02	0.58	4.95	4.84	4.76	0.24	11.60	-2.82	-25.61
Processed sugar	152.61	50.37	-1.87	-5.03	1.12	30.15	38.11	6.97	-0.48	-6.17	-0.72	-21.46
Processed rice	144.56	78.30	-2.02	-29.01	0.69	4.57	7.76	1.79	0.95	1.51	-6.94	-52.86
Prepared f_v	62.48	382.55	-0.12	-6.20	-0.41	-30.88	4.06	22.97	0.06	3.26	-3.23	-318.72
Cereal preparations	43.04	432.33	-1.10	-55.63	0.03	2.18	2.34	49.45	0.01	0.64	-6.46	-362.24
Sugar preparations	170.52	55.82	-1.02	-18.58	-0.07	-0.45	4.07	3.30	0.00	-0.06	-9.26	-49.92
Processed feed	1.76	2.56	-1.50	-23.82	1.18	8.33	1.74	2.23	-0.15	-3.18	-1.96	-19.61
Other foods	59.47	1,120.56	-1.28	-182.17	0.16	36.39	2.97	60.77	0.24	36.56	-4.22	-949.27
Beverages and tobacco	10.36	206.02	-0.71	-62.72	0.00	-0.05	0.94	113.11	0.12	28.61	-2.45	-149.86
Ethanol1	4.42	33.69	-0.66	-15.93	0.07	0.04	-0.83	0.00	-0.08	-0.03	-5.38	-0.05
Ethanol2	23.09	0.00	-	-	0.90	3.71	-0.31	0.00	0.68	0.25	0.15	0.24
DDGS	-8.44	-10.92	-2.14	-36.26	1.83	1.64	1.82	0.00	-	-	-	0.00
Biodiesel	14.03	11.07	0.13	0.10	-16.49	-3.79	31.01	31.13	0.07	0.30	-0.36	-3.17
Total ag.		9,586.28		-2,924.08		-465.13		2,006.26		711.57		-7,475.14

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables. - = not applicable.

Source: USDA, Economic Research Service analysis using Transatlantic Trade and Investment Partnership model.

the rest of the world decrease in the second scenario as exports are diverted to the EU (except for biodiesel, which has a small increase). Because tariffs, TRQs, or NTMs do not change for all other regions, the change in U.S. exports to the rest of the world is never really greater than 5 percent, except for some commodities with small base exports.

Bilateral imports for the United States in this scenario generally increase across agricultural commodities as more imports are needed to satisfy domestic demand. The increase in U.S. imports from the EU are much larger than those from other countries, as tariffs/TRQs and NTMs are removed on EU imports only. The largest percentage increases in U.S. agricultural imports from the EU are in commodities in which U.S. NTMs were removed: fruits (708.78 percent), vegetables (459.26), and beef (113.41). In addition, U.S. imports of cheese, paddy rice, other crops, vegetable oil, butter, and processed sugar from the EU increase by double-digit amounts due to the market-access portion of this scenario.

Supply constraints in the United States dictate that overall exports decrease for some commodities. For example, total exports of wheat decrease in this scenario at an even greater rate than in the first scenario (table 11). Without the removal of NTMs, total U.S. wheat exports decrease by 0.82 percent (see table 7); with the removal of NTMs, they decrease by 1.74 percent (table 11). Eliminating NTMs in coarse grains, soybeans, and poultry meat results in an increase in overall U.S. exports for these sectors, even though net exports in each commodity decrease when only tariffs and TRQs are removed. The largest increases in overall U.S. exports in the second scenario are attributed to removal of either tariffs/TRQs or NTMs. U.S. commodities with increases in exports due to tariff/TRQ removal include butter, cheese, and processed sugar. Commodities with changes due largely to NTM removal include vegetables and pork. Increases in U.S. beef exports are attributed to the removal of both types of measures.

Changes in production for U.S. agricultural commodities in the second scenario largely follow the changes in exports (table 12). The U.S. commodities with the largest decreases in production are wheat, cheese, and fruits. The decline for wheat is larger in the second scenario (1.27 percent) than in the first (0.55) because of the reallocation of resources toward those commodities in which NTMs are removed. Interestingly, U.S. poultry meat production decreases despite the increase in exports to the EU when NTMs are removed. This effect stems from a decrease in domestic demand for poultry meat, a result of higher prices. U.S. production of fruits and vegetables also decreases in the second scenario, despite the removal of NTMs in these commodities. This is due to the rise in U.S. imports of fruits and vegetables from the EU and the fact that the EU only has NTMs removed on three commodities (versus seven for the United States). Thus, the EU is better able to use resources for the few commodities with NTMs removed. The U.S. commodities with the largest production increases in the second scenario are pork, butter, paddy rice, and beef.

U.S. prices increase for all agricultural commodities in the scenario (except wheat, prepared fruits and vegetables, and biodiesel) due to increased competition for goods from the export market (table 12). A comparison of prices across the two scenarios shows mixed results: some commodities have higher price increases in the second scenario and others do not. Clearly, however, price increases are greater for those commodities in which NTMs are removed.

Trade and Production Impacts - EU

Along with increases in EU agricultural exports to the United States in the second scenario, EU exports to all other countries increase for most agricultural commodities (except processed sugar, processed feed, and biodiesel) (see table 10). However, a large reduction in intra-EU trade leads to

Table 11

Changes in net trade values from tariff and non-tariff measure removal

Sector	Exports			Imports		
	U.S.	EU	All others	U.S.	EU	All others
	Percent change					
Paddy rice	5.84	-3.45	-4.26	6.03	-0.72	-1.76
Wheat	-1.74	0.17	-0.25	1.95	0.05	-0.12
Coarse grains	1.41	-9.47	-1.03	1.59	8.97	-0.36
Fruits	2.95	2.84	-1.47	3.96	0.22	-0.13
Vegetables	13.14	2.42	-2.02	6.16	1.52	-0.02
Nuts	0.35	-0.33	-0.11	1.49	0.14	-0.39
Soybeans	1.91	-11.39	-1.16	1.99	3.30	-0.31
Rapeseed	-1.51	1.81	0.25	0.54	0.71	-0.03
Other oilseeds	-1.69	1.76	0.19	0.46	0.74	-0.22
Sugarcane/beet	2.87	0.89	0.03	0.95	-1.02	0.15
Other crops	-0.46	1.26	-0.31	1.06	-0.39	-0.22
Bovine	-2.21	-0.87	0.65	3.49	-0.83	-0.24
Hogs	3.01	-2.23	-1.15	2.07	-0.64	-0.04
Poultry and eggs	-2.83	0.87	-0.34	1.35	-0.28	0.55
Other animals	-1.95	0.78	0.14	0.73	-0.03	-0.01
Raw milk	-6.29	3.84	-0.22	2.78	-1.04	0.15
Beef	24.57	-4.13	-5.16	6.62	4.28	-0.24
Pork	53.88	-48.38	-17.94	2.40	26.29	-0.11
Poultry meat	0.92	-0.24	-0.44	1.66	0.76	-0.20
Other meats	-0.79	0.09	0.07	1.68	0.33	-0.24
Vegetable oil	-1.99	3.16	-0.13	1.48	-0.56	-0.03
Whey	-0.48	-2.08	-3.22	2.31	6.05	0.32
Powdered milk	-1.50	-0.47	-0.08	2.83	1.60	-0.11
Butter	36.46	-7.09	-7.05	10.58	12.35	1.60
Cheese	11.58	1.59	-3.50	30.94	0.85	0.24
Other dairy products	-0.11	0.16	-0.48	3.05	0.25	0.12
Processed sugar	15.01	-0.93	0.09	1.23	0.74	0.03
Processed rice	3.31	-4.86	-0.30	0.94	1.93	-0.24
Prepared f_v	6.47	-0.01	-0.95	1.09	0.33	0.01
Cereal preparations	6.22	-0.09	-0.90	1.47	0.60	-0.06
Sugar preparations	2.00	-0.31	-1.13	1.82	0.77	-0.17
Processed feed	-1.23	-1.15	-0.20	1.42	-1.50	-0.25
Other foods	5.82	0.13	-0.91	1.22	0.49	0.00
Beverages and tobacco	1.32	0.09	-0.43	0.79	0.55	0.03
Ethanol1	0.31	-0.08	-0.64	-0.50	-0.58	-0.02
Ethanol2	0.56	0.67	-0.41	-0.49	-0.41	0.47
DDGS	-1.57	-0.12	1.10	0.09	0.04	0.52
Biodiesel	-1.07	0.03	0.54	0.08	0.08	0.42

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

Table 12

Changes in production values and prices from tariff and non-tariff measure removal

Sector	Production			Market price	
	U.S.	EU	All others	U.S.	EU
	Percent change				
Paddy rice	1.78	-2.04	0.00	0.77	-1.20
Wheat	-1.27	-0.16	-0.04	-0.07	-0.86
Coarse grains	0.48	-4.09	-0.06	0.41	-1.78
Fruits	-0.87	1.13	-0.14	0.07	-0.72
Vegetables	-0.25	-0.04	-0.13	0.24	-0.96
Nuts	0.12	-0.22	0.03	0.34	-0.98
Soybeans	0.80	-6.11	-0.17	0.56	-1.93
Rapeseed	-0.72	1.51	0.03	0.14	-0.62
Other oilseeds	-0.83	1.62	0.03	0.11	-0.60
Sugarcane/beet	0.29	-0.14	0.02	0.43	-0.88
Other crops	-0.65	0.29	-0.04	0.12	-0.79
Bovine	1.59	-1.08	-0.20	0.58	-0.69
Hogs	3.28	-1.92	-0.18	0.47	-1.11
Poultry and eggs	-0.13	0.29	0.00	0.44	-1.09
Other animals	-1.00	0.63	0.05	0.42	-1.08
Raw milk	-0.21	0.19	-0.03	0.53	-0.89
Beef	1.76	-1.52	-0.41	0.37	-0.44
Pork	5.45	-2.67	-1.00	0.33	-0.66
Poultry meat	-0.17	0.08	0.00	0.34	-0.46
Other meats	-0.25	0.12	0.05	0.31	-0.36
Vegetable oil	-0.82	1.84	-0.04	0.34	-0.76
Whey	-0.25	-0.34	-0.10	0.36	-0.84
Powdered milk	-0.56	0.07	0.01	0.36	-0.44
Butter	2.64	-0.80	-0.58	0.35	-2.48
Cheese	-1.19	0.64	-0.37	0.28	-0.46
Other dairy products	-0.06	0.18	-0.02	0.36	-0.36
Processed sugar	0.33	-0.37	0.01	0.18	-0.14
Processed rice	1.20	-2.81	0.01	0.16	-0.51
Prepared f_v	0.94	0.08	-0.09	-0.22	-0.33
Cereal preparations	0.31	0.07	-0.07	0.23	-0.24
Sugar preparations	0.39	-0.02	-0.03	0.26	-0.21
Processed feed	0.77	-1.47	-0.14	0.29	-0.26
Other foods	0.64	0.23	-0.15	0.23	-0.59
Beverages and tobacco	0.09	0.18	-0.01	0.20	-0.31
Ethanol1	-0.10	-0.23	0.11	0.28	0.10
Ethanol2	-0.02	0.34	0.12	0.19	-0.26
DDGS	-0.10	-0.25	0.18	0.62	-3.60
Biodiesel	1.28	0.32	0.06	-0.13	-0.13

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

a decrease in net EU exports for most agricultural commodities (table 11). The only EU agricultural commodities with large increases in total exports are those in which NTMs are removed and cheese (from tariff/TRQ removal). Total imports for most EU agricultural commodities increase due to rising exports from the United States.

For the EU, production declines in many agricultural commodities in the scenario but increases in the cheese, rapeseed and vegetable oil, vegetables, and fruit commodities (table 12). EU fruit production in the second scenario benefits from NTM removal and increases by 1.13 percent compared to the first scenario, where EU fruit production decreases by 0.08 percent. Note that the elimination of EU NTMs on U.S. soybeans results in a large increase in EU production of oilseeds (i.e., rapeseed). This is despite the fact that the U.S. imposes no NTM on EU oilseeds. The following may help account for the EU increase in oilseed production under these circumstances. When the NTMs are removed, the EU increases its imports of U.S. oilseeds. Consequently, U.S. exports of oilseeds to non-EU countries decrease due to supply limitations. The increase in EU imports of oilseeds from the United States results in increased EU oilseed exports to those countries for which oilseeds from the United States have declined. The demand for imported oilseeds in these other countries leads to a production increase for EU oilseeds. The projected decrease in U.S. oilseed (e.g., soybean) exports to countries other than the EU is quite significant when tariffs and NTMs were removed (2.66). When only tariffs are eliminated, the decrease is only 0.66 percent. Prices for all EU agricultural commodities decrease in the second scenario (except for ethanol) due to the overall increase in EU imports.

Macro Impacts

The removal of NTMs would lead to an increase in real GDP for the United States and the EU (table 13) but a small decrease for the other NAFTA countries (Canada and Mexico). GDP changes in the second scenario are similar to those in the first scenario for all countries examined. However, the increase in GDP in the second scenario is slightly larger than in the first scenario for the United States (0.10 percent versus 0.09 percent) and the EU (0.29 percent versus 0.23 percent).

Table 13
Macro impacts from tariff and non-tariff measure removal

		Value of agriculture		Land-use change		
Region	GDP	Imports	Exports	Forestry	Crops	Livestock
			Percent change			
U.S.	0.10	2.23	4.96	-0.08	-0.10	0.16
EU	0.29	1.33	-1.40	0.24	-0.21	-0.20
Canada	-0.03	-0.33	-0.29	0.04	-0.23	0.21
Mexico	-0.04	-0.57	-0.63	0.00	-0.06	0.04
China	0.00	0.03	-0.82	-0.01	-0.03	0.02
India	0.00	0.11	-0.80	0.16	-0.03	0.25
Brazil	0.00	-0.35	-1.56	0.16	-0.05	-0.12
ROW	0.00	-0.10	-1.08	0.04	-0.03	0.00

GDP = gross domestic product. ROW = rest of world.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

For aggregate agricultural trade, total agricultural imports increase for both the United States and EU more in the second scenario than in the first. U.S. imports increase by 2.23 percent, which is largely the result of an increase in cheese and beef imports. EU imports increase by 1.33 percent, largely due to rising pork and butter imports. When NTMs are eliminated, U.S. agricultural exports increase at twice the rate as when NTMs are in place. Although results show a decrease in total EU agricultural exports in the second scenario, this change accounts for intra-EU and extra-EU trade. The change due to extra-EU trade only is an increase of 1.99 percent. The decrease in overall EU agricultural exports in the first scenario is also largely attributable to a reduction in intra-EU trade.

For all other countries examined, imports and exports decline for all but a handful of agricultural commodities in the second scenario. Changes in market prices for all other countries examined in the second scenario are not reported due to aggregation issues. However, changes in production are available. These changes are relatively small, except for large decreases in production of pork, nuts, and butter. The decreases for these three products are triggered by a decrease in exports, as U.S. exports displace all other-country exports, lessening the need to raise production. Overall trade decreases for all other countries examined except China and India, where agricultural imports increase by a small amount.

When NTMs are removed in addition to tariffs and TRQs, the increase in land shifting to livestock use in the United States is larger than when only tariffs and TRQs are removed. That is, livestock land use increases 0.16 percent in the second scenario, up from 0.10 percent in the first scenario. Interestingly, the EU has a decrease in both crop and livestock land use in the second scenario. Two factors account for this effect: the earlier increase in EU imports of U.S. crops from tariff and TRQ removal is now coupled with a large increase in meat imports, and forestry land is valued more highly in the EU than in the United States in the GTAP model. Again, livestock land increases considerably in most other countries examined, except Brazil.

Market Access With NTM Removal, Lingering Adverse Demand Effects

Several studies have documented the role of consumer preferences in relation to NTMs (e.g., Lusk et al., 2003; Costa-Font et al., 2008). If NTMs are removed for select agricultural products, export gains from their removal could be overstated if the NTMs had changed consumers' preferences or if the NTMs in fact reflected consumer preferences. Either way, as NTMs could suggest or induce a negative consumer reaction to the associated imported goods, the removal of certain NTMs does not increase the likelihood that consumer preferences will switch from domestically produced goods to their imported equivalents. In the final scenario, we consider removal of tariffs/TRQs and select NTMs, as well as decreases in consumer demand (or preference changes). To account for demand changes, we modify the GTAP Armington parameter to reflect lower consumer demand for imported versions of the good (see appendix 4 for more details on this approach). The reduction in parameters is made for all commodities where NTMs are removed, both on the U.S. side and the EU side.

Trade and Production Impacts - United States

In the third scenario, U.S exports to the EU increase for most agricultural commodities (table 14). To be expected, the increase is lower than that in the second scenario for those commodities where demand decreases if NTMs are eliminated. In the third scenario, U.S. exports of coarse

Table 14

Changes in bilateral trade values from demand sensitivity

Sector	U.S. to EU		U.S. to all others		All others to U.S.		EU to U.S.		EU to all others		All others to EU	
	Percent	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*	*Percent*	*Million $*
Paddy rice	437.51	96.54	-5.33	-43.30	5.36	4.58	14.44	0.13	1.96	0.58	-15.71	-94.31
Wheat	22.20	108.91	-2.24	-293.22	1.38	9.26	6.21	1.38	0.88	60.79	-5.80	-92.97
Coarse grains	89.19	335.93	-1.10	-173.73	1.11	11.05	2.16	0.51	1.03	21.25	-19.09	-350.82
Fruits	24.54	74.56	-0.81	-33.95	-3.00	-244.81	142.88	99.72	0.35	6.96	-1.43	-133.51
Vegetables	49.31	150.43	-0.72	-21.95	-4.12	-295.67	107.71	143.85	0.50	18.41	-4.61	-315.09
Nuts	3.94	68.26	-1.40	-41.63	1.13	22.04	8.51	2.31	1.97	3.80	-2.92	-50.81
Soybeans	30.75	344.73	-1.15	-226.32	1.57	8.90	5.66	0.01	5.41	1.64	-16.69	-699.11
Rapeseed	-1.25	0.00	-1.37	-1.98	0.54	0.61	1.51	0.01	0.13	0.24	0.71	13.15
Other oilseeds	-1.00	-2.36	-1.55	-15.73	0.49	1.84	1.58	0.15	0.40	2.51	0.96	12.79
Sugarcane/ beet	30.68	0.03	-3.45	-0.01	0.85	0.23	1.46	0.00	1.34	0.05	-0.96	-0.16
Other crops	34.14	292.54	-2.44	-304.33	0.39	47.45	10.07	76.04	1.56	86.29	-1.41	-319.85
Bovine	5.22	7.20	-2.24	-16.69	1.48	23.79	1.85	4.03	0.13	2.01	-4.64	-7.83
Hogs	56.63	141.18	-1.85	-42.86	1.22	7.73	2.03	1.93	0.51	4.87	-11.69	-149.78
Poultry and eggs	11.96	0.00	-2.08	-17.06	1.05	5.91	1.72	0.00	0.93	24.95	-0.12	-2.05
Other animals	26.71	0.42	-1.45	-12.10	0.46	3.42	1.24	0.40	0.73	3.69	-0.07	-0.61
Raw milk	-4.57	-0.01	0.00	0.00	1.59	0.68	5.35	0.14	2.95	0.49	-0.74	-0.80
Beef	181.45	349.67	-0.79	-51.60	-2.97	-120.66	105.77	15.10	0.08	2.59	-18.05	-703.65
Pork	1,994.90	1,199.08	-0.84	-53.86	1.18	11.65	2.36	11.05	0.39	21.00	-85.18	-1,199.69
Poultry meat	841.66	0.46	-0.95	-39.54	1.33	8.31	8.14	0.00	0.11	2.28	-0.30	-5.87
Other meats	11.88	5.25	-0.77	-9.75	1.15	4.30	2.33	0.37	0.04	0.23	-1.56	-9.98
Vegetable oil	15.39	59.89	-2.25	-152.05	-0.42	-27.44	14.04	123.22	2.79	116.85	-0.86	-113.77
Whey	433.42	33.88	-2.89	-31.35	0.76	0.59	7.03	0.11	0.83	11.09	-74.99	-25.57
Powdered milk	907.90	21.81	-2.20	-34.35	0.48	0.42	4.73	0.29	0.11	1.17	-29.57	-16.74
Butter	206.52	151.12	-4.47	-13.32	-6.10	-2.82	11.93	4.07	2.76	23.43	-92.92	-106.36
Cheese	996.82	76.29	-2.44	-12.28	-24.38	-28.73	30.80	329.07	0.34	10.48	-12.50	-58.06
Other dairy products	125.74	32.48	-2.65	-25.02	0.15	1.29	4.35	4.28	0.21	9.80	-2.88	-26.17
Processed sugar	153.37	50.62	-1.63	-4.38	1.00	27.00	37.96	6.95	-0.50	-6.53	-0.71	-21.29
Processed rice	145.02	78.55	-1.82	-26.20	0.61	4.02	7.71	1.77	0.97	1.54	-6.98	-53.16
Prepared f_v	61.83	378.60	-0.45	-23.67	-0.35	-26.70	4.10	23.19	0.03	1.53	-3.18	-313.48
Cereal preparations	43.31	435.11	-0.96	-48.71	-0.09	-7.71	2.20	46.41	0.00	-0.01	-6.47	-363.27
Sugar preparations	171.03	55.99	-0.91	-16.64	-0.20	-1.30	3.89	3.16	-0.02	-0.47	-9.25	-49.87
Processed feed	2.39	3.47	-1.30	-20.60	0.79	5.59	1.31	1.68	-0.14	-2.96	-1.61	-16.09
Other foods	59.83	1,127.42	-1.07	-151.99	0.06	12.66	2.76	56.61	0.17	25.68	-4.24	-953.86
Beverages and tobacco	10.43	207.46	-0.61	-54.28	-0.03	-2.73	0.86	103.43	0.10	22.95	-2.48	-151.88
Ethanol1	4.43	33.76	-0.62	-14.85	0.02	0.01	-0.79	0.00	-0.43	-0.16	-5.38	-0.05
Ethanol2	23.33	0.00	-	-	0.73	3.01	-0.26	0.00	0.41	0.15	0.12	0.19
DDGS	-6.78	-8.76	-1.36	-23.00	1.27	1.14	0.63	0.00	-	-	-	0.00
Biodiesel	13.32	10.51	-0.38	-0.30	-16.83	-3.87	30.54	30.65	0.09	0.38	-0.38	-3.28
Total ag.		5,921.02		-2,052.60		-534.96		1,092.02		479.55		-6,383.66

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables. - = not applicable.

Source: USDA, Economic Research Service analysis using Transatlantic Trade and Investment Partnership model.

grains, soybeans, fruits, vegetables, beef, pork, and poultry meat increase by less than in the second scenario, when NTM removal was considered without any shocks to import demand. For example, U.S. fruit exports to the EU increase by 62.22 percent in the second scenario. In the third scenario, the impact of decreased consumer demand causes exports of the same commodity to increase by only 24.54 percent. U.S. exports of fruits (and all other commodities with NTMs) to other countries do not decrease by as much if demand sensitivities are considered, as some of the decreased exports to the EU are redirected to the rest of the world. Overall, model results suggest that for U.S. products like beef and fruits, the benefits from removing NTMs could be offset by the negative demand shocks if enough strong consumer preferences are reflected in the standards and regulations that make up certain NTMs.

In the third scenario, bilateral imports increase for the United States for most agricultural commodities, especially from the EU. The increases in U.S. imports from the EU in the third scenario are much larger than those from other countries. The only U.S. commodity with a decrease in imports from the EU is ethanol. U.S. imports from EU commodities with NTMs are also smaller in the third scenario than in previous scenarios. For example, vegetable exports were 459.72 percent higher when NTMs were eliminated but are only 107.71 percent higher when consumer demand decreases. U.S. overall imports also increase when changes in consumer preferences are considered. This effect holds for all agricultural commodities, much as it did in the previous two scenarios (table 15).

Similar to results in the other two scenarios, changes in production for U.S. agricultural commodities in the third scenario largely follow changes in exports (table 16). Although U.S. production of wheat, fruits, and cheese again declines more than that of any other commodity, the effect is mitigated somewhat by the reduction in demand for resources from commodities with NTMs. U.S. market prices increase for most agricultural commodities but decrease for wheat, prepared fruits and vegetables, and biodiesel.

Trade and Production Impacts - EU

Similar to U.S. exports, EU exports of commodities with demand sensitivities do not increase as much as they do in the second scenario. EU exports of fruits, vegetables, and beef exports to the United States increase by 709.51, 459.73, and 112.75 percent, respectively, under the NTM-removal scenario. When demand sensitivities are considered, the increases are smaller at 142.88, 107.71, and 105.77 percent, respectively. Overall, the results for EU bilateral trade and total trade are similar to those from the other two scenarios. However, in the third scenario, resources are allocated away from the NTM commodities to other commodities.

For the EU, production declines for many agricultural commodities but increases for cheese, rapeseed, vegetables, and fruits. Under this demand-sensitivity scenario, EU vegetable production declines (versus the increase in the NTM-removal scenario). Market prices for all EU agricultural commodities except ethanol decline in the third scenario.

Macro Impacts

Similar to results in the other two scenarios, the GDPs for the United States and the EU increase in the third scenario by 0.10 and 0.28 percent, respectively (table 17). Changes in GDP for the other countries examined are similar across scenarios as well.

Table 15

Changes in total trade values from demand sensitivity

	Exports			Imports		
Sector	U.S.	EU	All others	U.S.	EU	All others
	Percent change					
Paddy rice	6.38	-3.81	-4.32	5.59	-0.57	-1.62
Wheat	-1.35	-0.10	-0.19	1.79	0.25	-0.13
Coarse grains	1.45	-5.24	-1.37	1.15	5.03	-0.33
Fruits	0.92	0.58	-1.04	1.33	0.09	-0.13
Vegetables	4.02	0.26	-1.73	2.13	0.60	-0.03
Nuts	0.57	-0.81	-0.21	1.26	0.22	-0.34
Soybeans	0.68	-12.35	-1.36	1.56	2.03	-0.24
Rapeseed	-1.37	1.28	0.27	0.54	0.70	-0.02
Other oilseeds	-1.45	1.23	0.19	0.51	0.69	-0.20
Sugarcane/beet	3.61	0.51	0.07	0.82	-0.74	0.10
Other crops	-0.09	0.73	-0.24	0.95	-0.11	-0.21
Bovine	-1.08	-0.60	0.21	1.61	-0.14	-0.10
Hogs	3.84	-1.99	-1.21	1.52	-0.11	-0.01
Poultry and eggs	-2.08	0.77	-0.23	1.05	-0.12	0.48
Other animals	-1.40	0.64	0.09	0.57	-0.02	0.02
Raw milk	-4.32	2.88	-0.19	1.84	-0.74	0.09
Beef	4.25	-1.69	-3.07	2.88	1.94	-0.19
Pork	23.49	-34.68	-15.68	1.97	13.78	-0.05
Poultry meat	-0.87	0.25	0.21	1.34	0.19	-0.16
Other meats	-0.34	0.06	0.00	1.35	0.30	-0.19
Vegetable oil	-1.29	2.62	-0.14	1.24	-0.43	-0.02
Whey	0.23	-2.03	-3.32	1.93	6.18	0.42
Powdered milk	-0.80	-0.48	-0.12	2.44	1.61	-0.08
Butter	37.14	-7.14	-7.08	10.05	12.39	1.61
Cheese	12.52	1.51	-3.50	30.27	0.83	0.22
Other dairy products	0.77	0.12	-0.54	2.59	0.24	0.10
Processed sugar	15.32	-0.95	0.07	1.12	0.74	0.02
Processed rice	3.51	-4.87	-0.30	0.85	1.92	-0.21
Prepared f_v	6.10	-0.01	-0.90	1.14	0.35	-0.02
Cereal preparations	6.38	-0.10	-0.93	1.34	0.62	-0.05
Sugar preparations	2.12	-0.32	-1.14	1.67	0.81	-0.16
Processed feed	-0.99	-0.89	-0.18	1.01	-1.12	-0.22
Other foods	6.05	0.06	-0.92	1.07	0.49	-0.02
Beverages and tobacco	1.41	0.05	-0.44	0.72	0.54	0.02
Ethanol1	0.43	-0.09	-0.62	-0.55	-0.63	-0.19
Ethanol2	0.60	0.40	-0.33	-0.43	-0.37	0.37
DDGS	-1.38	-0.12	1.00	0.06	-0.01	0.34
Biodiesel	-0.92	0.00	0.52	0.05	0.03	0.30

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

Table 16
Changes in production values and prices from demand sensitivity

Sector	Production			Market price	
	U.S.	EU	All others	U.S.	EU
	Percent change				
Paddy rice	1.94	-2.19	0.00	0.73	-1.04
Wheat	-0.98	-0.26	-0.02	-0.06	-0.68
Coarse grains	0.36	-1.99	-0.10	0.31	-1.16
Fruits	-0.17	0.23	-0.09	0.19	-0.66
Vegetables	-0.01	-0.19	-0.11	0.24	-0.76
Nuts	0.19	-0.56	0.02	0.29	-0.83
Soybeans	0.24	-4.40	-0.26	0.32	-1.46
Rapeseed	-0.61	1.16	0.03	0.09	-0.47
Other oilseeds	-0.64	1.22	0.02	0.08	-0.46
Sugarcane/beet	0.32	-0.18	0.02	0.37	-0.69
Other crops	-0.43	0.12	-0.03	0.11	-0.62
Bovine	0.33	-0.54	-0.11	0.32	-0.57
Hogs	1.99	-1.47	-0.16	0.28	-0.91
Poultry and eggs	-0.07	0.35	0.02	0.27	-0.90
Other animals	-0.70	0.52	0.04	0.26	-0.90
Raw milk	-0.14	0.17	-0.03	0.31	-0.69
Beef	0.39	-0.58	-0.24	0.24	-0.35
Pork	2.76	-1.93	-0.88	0.23	-0.56
Poultry meat	-0.08	0.24	0.06	0.24	-0.38
Other meats	-0.13	0.09	0.03	0.22	-0.31
Vegetable oil	-0.57	1.52	-0.05	0.21	-0.66
Whey	0.05	-0.26	-0.12	0.24	-0.79
Powdered milk	-0.30	0.05	0.00	0.24	-0.38
Butter	2.73	-0.82	-0.59	0.23	-2.44
Cheese	-1.11	0.60	-0.37	0.16	-0.41
Other dairy products	0.00	0.16	-0.02	0.24	-0.31
Processed sugar	0.36	-0.38	0.01	0.15	-0.11
Processed rice	1.28	-2.83	0.01	0.15	-0.48
Prepared f_v	0.75	0.08	-0.09	-0.07	-0.28
Cereal preparations	0.31	0.07	-0.08	0.19	-0.21
Sugar preparations	0.31	0.00	-0.03	0.23	-0.16
Processed feed	0.32	-1.11	-0.11	0.24	-0.22
Other foods	0.68	0.19	-0.15	0.18	-0.46
Beverages and tobacco	0.09	0.15	-0.01	0.17	-0.26
Ethanol1	-0.09	-0.44	0.09	0.26	0.18
Ethanol2	0.01	0.21	0.09	0.16	-0.19
DDGS	-0.09	-0.45	0.16	0.29	-2.95
Biodiesel	0.60	0.29	0.06	0.03	-0.12

DDGS = distillers' dried grains with solubles. f_v = fruits and vegetables.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

Table 17
Macro impacts from demand sensitivity

Region	GDP	Value of agriculture		Land-use change		
		Imports	Exports	Forestry	Crops	Livestock
			Percent change			
U.S.	0.10	1.48	2.66	-0.08	-0.10	0.16
EU	0.28	0.88	-1.05	0.24	-0.21	-0.20
Canada	-0.02	-0.31	-0.36	0.04	-0.23	0.21
Mexico	-0.03	-0.49	-0.57	0.00	-0.06	0.04
China	-0.01	0.03	-0.74	-0.01	-0.03	0.02
India	0.00	0.11	-0.75	0.16	-0.03	0.25
Brazil	0.00	-0.31	-1.33	0.16	-0.05	-0.12
ROW	0.00	-0.09	-0.93	0.04	-0.03	0.00

GDP = gross domestic product. ROW = rest of world.

Source: USDA, Economic Research Service using Transatlantic Trade and Investment Partnership model.

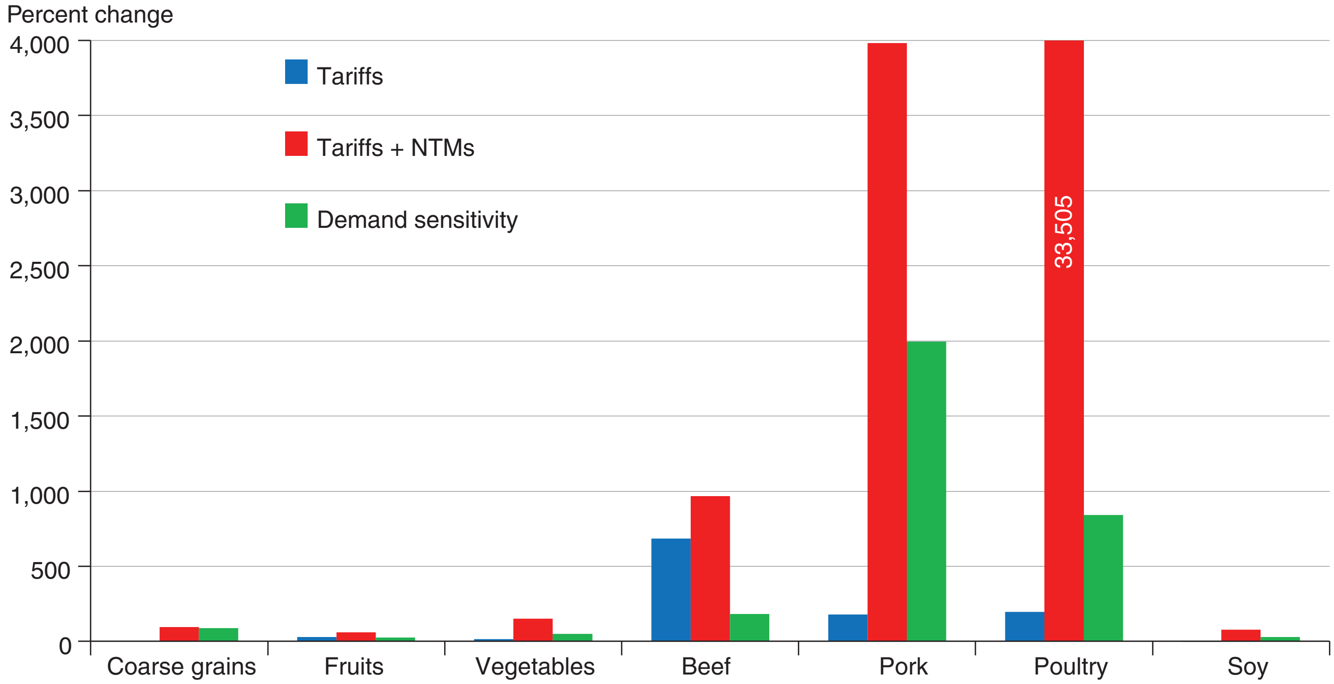
For aggregate agricultural trade, U.S. agricultural imports increase in the third scenario, but changes for both imports and exports are less than those in the second scenario. For the EU, aggregate imports increase slightly (0.88 percent) in the third scenario. For all regions, changes in exports in the third scenario are similar to those in the second scenario.

Comparison Across Scenarios

CGE results are often presented in percentage changes as the base data sometimes differ. Otherwise, one would not need to show the base levels. However, level changes can provide extra information for model results. Level changes from the first scenario (tariff and TRQ removal) indicate that annual U.S. agricultural exports to the EU would increase by $5.5 billion. The largest annual increases are in processed foods ($2.2 billion)—the largest of which is to the other-foods commodity, beef ($1.5 billion), and pork ($0.3 billion). In the second scenario, U.S. exports increase by an additional $4.1 billion. The largest additional gains are to pork ($2 billion), soybeans ($0.9 billion), and beef ($0.4 billion). As resources are moved to commodities where NTMs are removed, the value of all other U.S. agricultural exports to the EU decreases from $14.5 billion to $14.4 billion. For the EU, agricultural commodities with the largest gains in the first scenario are cheese ($0.3 billion) and processed foods ($0.2 billion). In total, EU exports in the first scenario expand by $0.8 billion. The removal of select NTMs in the second scenario generates an additional gain of $1.2 billion. Results in the two scenarios also suggest that T-TIP would decrease the U.S. agricultural trade deficit with the EU. When tariffs and TRQs are removed, the U.S. agricultural deficit declines from $7.3 billion in the base year (2011) to $2.6 billion. When NTMs are also removed, the deficit falls to $0.1 billion. Bilateral trade increases and GDP gains are moderated when accounting for lingering adverse demand effects after NTM removal.

Finally, figure 2 presents the percentage change in U.S. exports to the EU of commodities with NTMs in place. This figure brings together all the information from tables 6, 10, and 14. As shown, pork and poultry have the largest percentage gains in exports when NTMs are removed in addition to tariff removal, but those results are somewhat mitigated when demand sensitivity is considered.

Figure 2
U.S. exports to the EU for commodities with non-tariff measures (NTMs) in place



Source USDA, Economic Research Service.

Conclusions

This study provides a quantitative assessment of the potential effects of a T-TIP agreement through a disaggregated analysis of agriculture, including detailed sector-specific changes for important commodities. In addition to the economic impacts of tariff and TRQ removal, the analysis considers the effects of select NTM removal and changes in consumer preferences. Thus, alternative hypothetical scenarios for a T-TIP agreement include reducing tariffs, TRQs, and quantified NTMs to zero. Moreover, the analysis considers a scenario that assesses the effects of consumer preferences on any benefits from the removal of NTMs. A detailed examination of specific agricultural NTMs in a CGE model has not been attempted in the literature thus far, nor has any analysis considered the potential demand impacts of NTM removal.

Findings suggest the potential for expanded agricultural trade between the United States and the EU of $6.3 billion if tariffs and TRQs are eliminated, despite tariffs already being relatively low. Based on model results, market access (scenario 1) would generate increases in GDP for both the United States (0.09 percent) and the EU (0.23 percent). U.S.-EU agricultural trade expands in the scenario, with larger increases for U.S. exports. As a result, U.S. agricultural prices increase (by less than half a percent), while EU agricultural prices fall.

When select NTM removal is considered in addition to tariff and TRQ removal (scenario 2), agricultural trade between the EU and the United States expands even more than in the first scenario. Based on baseline year (2011) data, the EU agricultural trade surplus with the United States of $7.3 billion would fall to $2.6 billion in the market-access scenario and $0.1 billion when NTMs are removed. When accounting for lingering adverse demand effects after the removal of NTMs (scenario three), bilateral trade increases and GDP gains are moderated.

This study does not evaluate all NTMs affecting agricultural trade between the United States and the EU, nor does it consider NTM barriers for nonagricultural products. If liberalization of NTMs extends to nonagricultural products, those products would likely attract additional resources, which would lower agricultural trade and production changes. In addition, if T-TIP eliminates an NTM that is not quantified in this analysis, this could affect trade and production of other commodities. Lastly, the analysis does not consider possible spillover effects for other countries also affected by NTMs, although several studies have considered this issue (e.g., EP, 2014).

The scope of the T-TIP negotiations goes beyond cutting tariffs, TRQs, and NTMs. The outcome of any negotiations on investment policy and trade in services could also affect agricultural trade. This analysis does not account for the gains that might be achieved in other areas of the negotiations, nor does it account for domestic farm policy, market responses (e.g., structural or efficiency changes in industries that lose their trade protections), or productivity gains that may result from increased trade opportunities.

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Appendix 1—GTAP Data for T-TIP CGE Model

We use the most recent GTAP database for our T-TIP experiments, version 9, which has a base year of 2011. The disaggregated GTAP base data contain over 130 regions and 57 sectors; researchers often aggregate these to make the results easier to comprehend and interpret. For T-TIP, we aggregate the regions to eight markets: Brazil, Canada, China, EU, India, Mexico, the United States, and a rest of the world (ROW) region that contains all other regions (app. table A1-1). Our regional aggregation includes those most likely to be impacted by T-TIP: the other NAFTA regions and other major agricultural trade markets. Indeed, five of our regions were the top agricultural exporters in 2013 (EU, United States, Brazil, China, and Canada). Our aggregation set includes the top six agricultural importers, except for Japan and Russia.

Our sector aggregation scheme is heavily weighted toward agricultural commodities (app. table A1-2). To that end, we keep any GTAP base data agricultural commodity disaggregated (e.g., wheat and processed rice are treated as distinct commodities). Unfortunately, there are only 20 commodities that can be considered as agricultural commodities in the base data; thus, we use the SplitCom utility to create several commodities of interest in T-TIP. As a result, our final aggregation is 38 agricultural and biofuel commodities, with 47 total sectors. Agricultural commodities 1-16 are raw products in agricultural production, commodities 21-38 are the processed products of these raw products, and commodities 41, 42, 46, and 47 are biofuels and their co-products. This aggregation scheme allows analysis for meat products, which are a focus of NTMs; nuts, a large source of U.S. exports to the EU; and processed food commodities (33-37), which, in aggregate, are the largest agricultural sector by a wide margin. Energy products (18-20, 39, 43) keep their original disaggregation as is required for use of the specific GTAP model we employ.

Appendix table A1-1

Region aggregation scheme

No.	Country/region	Included GTAP country/regions
1	Brazil	bra
2	Canada	can
3	China	chn, hkg
4	European Union (EU)	aut, bel, cyp, cze, dnk, est, fin, fra, deu, grc, hun, irl, ita, lva, ltu, lux, mlt, nld, pol, prt, svk, svn, esp, swe, gbr, bgr, hrv, rou
5	India	ind
6	Mexico	mex
7	United States	usa
8	Rest of world (ROW)	aus, nzl, xoc, jpn, kor, mng, twn, xea, brn, khm, idn, lao, mys, phl, sgp, tha, vnm, xse, bgd, npl, pak, lka, xsa, xna, arg, bol, chl, col, ecu, pry, per, ury, ven, xsm, cri, gtm, hnd, nic, pan, slv, xca, dom, jam, pri, tto, xcb, che, nor, xef, alb, blr, rus, ukr, xee, xer, kaz, kgz, xus, arm, aze, geo, bhr, irn, isr, jor, kwt, omn, qat, sau, tur, are, xws, egy, mar, tun, xnf, ben, bfa, cmr, civ, gha, gin, nga, sen, tgo, xwf, wcf, xac, eth, ken, mdg, mwi, mus, moz, rwa, tza, uga, zmb, xec, bwa, nam, zaf, xsc, xtw

Source: USDA, Economic Research Service.

Appendix table A1-2

Sector aggregation scheme

No.	Name	Description	GTAP sector code
1	Paddy rice	Paddy rice	pdr
2	Wheat	Wheat	wht
3	Coarse grains	Barley, corn, oats, and sorghum	gro
4	Fruits*	Fruits	v_f
5	Vegetables*	Vegetables	v_f
6	Nuts*	Tree nuts	v_f
7	Soybeans*	Raw soybeans	osd
8	Rapeseed*	Raw rapeseed	osd
9	Other oilseeds*	All other oilseeds	osd
10	Sugarcane/beet	Raw sugarcane and beet	c_b
11	Other crops	Plant-based fibers and other crops	pfb, ocr
12	Bovine	Cattle, sheep, goats, horses	ctl
13	Hogs*	Hogs	oap
14	Poultry and eggs*	Poultry	oap
15	Other animals*	Wool and all other animals	oap
16	Raw milk	Raw milk	rmk
17	Natural resources	Fishery, forestry	frs, fsh
18	Coal	Coal	coa
19	Oil	Oil	oil
20	Gas	Natural gas	gas, gdt
21	Beef	Beef	cmt
22	Pork*	Pork and pork products	omt
23	Poultry meat*	Poultry meats and products	omt
24	Other meats*	Other meat products	omt
25	Vegetable oil	Vegetable oils and fats	vol
26	Whey*	Whey	mil
27	Powdered milk*	Powder milks	mil
28	Butter *	Butter, fats, oils, and substitutes	mil
29	Cheese*	Cheese	mil
30	Other dairy products*	Fluid milk and products	mil
31	Processed sugar	Processed sugars	sgr
32	Processed rice	Processed rice	pcr
33	Prepared f_v*	Processed fruits and vegetables	ofd
34	Cereal preparations*	Processed cereal products	ofd
35	Sugar preparations*	Processed sugar products	ofd
36	Processed feed*	Livestock feed products	ofd
37	Other foods*	Other food products	ofd
38	Beverages and tobacco	Beverages and tobacco products	b_t
39	P_C	Petroleum, coal products	p_c
40	L_Mfg	Labor-intensive manufacturing	tex, wap, lea, lum, ppp, fmp, mvh, otn, omf
41	Ethanol1*	Corn-based ethanol	p_c
42	Ethanol2*	Sugar-based ethanol	crp
43	H_Mfg	Capital-intensive manufacturing	crp, nmm, i_s, nfm, ele, ome
44	Ely	Electricity	ely
45	Other services	All other servicesw	wtr, cns, trd, otp, wtp, atp, cmn, ofi, isr, obs, ros, osg, dwe
46	DDGS*	Distillers' dried grains with solubles	ofd
47	Biodiesel*	Biodiesel	crp

Note: * represents a commodity split using SplitCom. DDGS = distillers' dried grains with solubles. GTAP = Global Trade Analysis Project.

Source: USDA, Economic Research Service.

SplitCom

We completely disaggregate six of the GTAP-defined commodities into subsectors using the SplitCom utility developed by Horridge (2008). In addition, we break out the respective amounts for biofuels from their previous aggregate commodity (e.g., Ethanol1 is split from commodity p_c, but the p_c commodity remains). SplitCom is a matrix-balancing program that enables the user to subdivide the rows and columns of a commodity from a balanced social accounting matrix (SAM). The user provides data to disaggregate a GTAP sector's input demands, uses in intermediate and final demand and trade, and tax and tariff payments. SplitCom then uses methods similar to maximum entropy to balance the disaggregated SAM and to satisfy accounting identities. The utility manipulates only the disaggregated sectors, which can be re-aggregated to restore the original values in the GTAP SAM. We ultimately use SplitCom to disaggregate 24 grain, meat, dairy, and biofuel subcommodities. Those with an asterisk in appendix table A1-2 are split; the original aggregated commodity is represented in the fourth column. For example, the original GTAP database has a commodity referred to as: f_v. This commodity is split into three components: fruits, vegetables, nuts.

Data for the SplitCom procedure are drawn from multiple sources. Bilateral trade and tariff data are disaggregated using TASTE (Tariff Analytical and Simulation Tool for Economists), a software developed by Horridge and Laborde (2010) and based on the Market Access Maps (MacMap) HS-6 trade and tariff database (Guimbard et al., 2012). We use the version from October 2012, which is compatible with the GTAP v. 9 database, with some adjustments to tariff rates based on multiple sources. TASTE disaggregates the GTAP sectors into HS-6 data for trade and tariffs. These disaggregated data are then re-aggregated into the sectors defined in the ERS T-TIP CGE model, using the HS2002 concordance developed by Hutcheson (2006). Data for the disaggregation of subsectors' inputs and demands for their output are drawn from multiple sources, including the FAOSTAT database compiled by the Food and Agriculture Organization of the United Nations; USDA's Production, Supply and Distribution (PS&D) database; USDA's Global Agricultural Information Network (GAIN) reports; U.S. Energy Information Administration energy statistics; and national statistics.

Tariffs

We use external data from multiple sources and ERS expert reviews to validate the remaining tariff rates, to estimate a tariff rate for commodities that were disaggregated using SplitCom, and to review and update country tariffs. Note that the SplitCom program will allocate the original tariff value to all newly split commodities (e.g., if the tariff for the f_v commodity is 20, the new fruits, vegetables, and nuts commodities will all have a tariff of 20). We use GTAP's Altertax utility to update the model to redefine tariffs on split commodities and to correct or update various tariff rates.

Appendix 2—The CGE Model

Given the complex links and interactions between agricultural commodities, competition among these commodities for limited economic resources, and interactions between the production, consumption, and trade activities, an economy-wide computational general equilibrium (CGE) modeling approach provides an appropriate framework to analyze the impacts of T-TIP. The value of a global CGE approach in analyzing the impacts of trade policy has previously been demonstrated in the work of several T-TIP studies (e.g., CEPR, 2013; ECORYS, 2009; EP, 2014). For both the CGE data and model, we rely on GTAP resources.

In the standard static GTAP model, producers are described as perfectly competitive cost minimizers, with technology defined as a nested production function. Producers' demand for intermediate inputs responds to prices for inputs and outputs, subject to a Leontief intermediates production function. A Constant Elasticity of Substitution (CES) production function over value added enables producers to substitute among primary factors as their relative prices change. Consumer demand is described by a Constant Difference of Elasticity (CDE) demand system, a nonhomogeneous function that allows income growth to affect consumer preferences. Cobb-Douglas functions describe government and investment demand, which imply constant budget shares in total expenditure. Import demand is described by nested Armington functions, in which demand is first allocated between the domestic good and the composite import, and then among national sourcing of the composite import. Countries (or regions) are linked through their bilateral trade flows, which explicitly account for transportation and marketing costs in moving goods from port to port. Factors are assumed to be fixed in national supply, fully employed, and mobile across commodities, except for land, which is assumed to have limited substitutability across crops.

We use a version of the GTAP model specified in Beckman et al. (2012), which encompasses all the standard features mentioned above, along with some critical updates for agricultural commodities. In particular, the model incorporates biofuels and biofuel co-products into GTAP-E model (Beckman et al., 2011) and also incorporates the livestock/feed nesting structure from Keeney and Hertel (2009). In addition, the model uses the detailed land-use module (GTAP-AEZ), which captures heterogeneous land quality and allows a more realistic representation of agricultural production. GTAP-AEZ disaggregates land into 18 agro-ecological zones (AEZs) that share common climate, precipitation, and moisture conditions (Hertel et al., 2008). Alternative agricultural and forestry land uses then compete for lands with heterogeneous quality. Land use competition is modeled in the AEZ module with a nested constant-elasticity-of-transformation (CET) function. By imposing homothetic separability on the revenue function, the land allocation decision can be split into two sequential stages. In the first stage, the land-owner decides on land cover (i.e., whether a given parcel of land will be in crops, forestry, or pasture). In the second stage, crop land is allocated across different uses.

With the base model established, we turn to modeling tariffs, TRQs, and NTMs for T-TIP. Implementing a tariff/TRQ-removal scenario is relatively straightforward in the GTAP model; one only has to specify the size of the shock on the variable "*tms,*" the tax on imports into a country. This variable is defined as the tax introduced by the importer on the exporter for a given commodity. Conducting an NTM-removal scenario is also straightforward, as the variables used are all exogenous price shocks: *tms, txs* (the tax on exports from a country), and *ams* (a tax on production efficiency). More details are provided in appendix 3.

Appendix 3—Allocating NTM Costs for the CGE Model

NTMs can affect trade by influencing the economic decisions of multiple agents, including exporters, importers, and consumers, in exporting and importing countries. While the gravity model provides an aggregate estimate of NTM costs, it does not provide information regarding how these costs should be allocated across agents in our CGE model (see box "Allocating NTMs in GTAP"). Based on the literature, we examine the incidence of costs using a detailed supply-chain, price-gap approach. As described by Ferrantino (2012), this method can decompose the costs of the NTM, providing appropriate allocations for our CGE model. Following the supply-chain analysis for beef from Arita et al. (2015), we conduct a similar exercise for biotech crops, using corn as our example. The production of biotech-free crops entails higher costs of export production and higher "rents," or price markups, by exporters and/or importers as a result of the scarcity of a product. These costs and markups cumulatively lead to price premiums observed at the retail level. The supply-chain approach works effectively if a commodity is defined to include few individual products (e.g., beef or corn). However, for commodities that consist of many individual products (e.g., fruits and vegetables), conducting a supply-chain analysis would be time intensive. Thus, we avoid the supply-chain approach and instead allocate NTM costs equally across the different mechanisms.

Supply-Chain Analysis

Estimates of added costs of export production for agricultural producers begin with the cost of preserving seed purity. They also include the cost of cleaning planters, foregone benefits of not using biotech varieties (including increased pesticide use), and monitoring. Bullock et al. (2000) estimate the monitoring costs for corn at an average of $0.09 per bushel. Exporters must clean containers, but much of this is done as a matter of course, so the cost is not additional. They also do quite a bit of testing to make sure that varieties are nonbiotech. Bullock et al. (2000) estimate this cost at $.056 per bushel. Maltsberger and Kalaitzandonakes (2000) estimate total identity preservation (IP) costs at $0.265 per bushel for high-oil corn, which, they note, has lower level testing than that required for genetically modified foods. Total per-bushel testing needed to meet IP requirements (including testing for biotech) is estimated to cost $0.32, which is about a 14-percent increase over conventional corn production.

Premiums paid for nonbiotech corn are very low in the EU, as the region is largely self-sufficient in corn and can get any excess needed from Ukraine and India (Varacca et al., 2014). The premiums offered are generally 1 to 3 percent (Brookes et al., 2005). At a price of $88 per ton in 2000, this equates to about $.04 per bushel. This does not exceed the increased costs of nonbiotech corn, in dollar or percentage terms. In total, we assume that production inefficiencies (ams) represent one-third of the NTM and export taxes (txs) represent two-thirds. No NTM costs are allocated to the importer.

Once the supply-side calculations are complete, we can implement the costs of NTMs in our CGE model. To do so, we use the econometrically estimated AVEs and appropriate them according to the supply-side estimates. This amount is then built into the GTAP model based on the rent/cost literature approach. That is, if an NTM cost is attributable to an import or export tax, the model is rebased to build in the tax. The model does not need to be rebased if the NTM cost is due to the production inefficiencies. NTM costs for meats are assumed to follow the beef supply-chain structure of Arita et al. (2015), while field crops are assumed to follow the corn breakout.

Allocating NTMs in GTAP

There is a large literature base on how to specify non-tariff measure (NTM) costs in computable general equilibrium (CGE) models. That is, CGE-based analyses simulate the effects of removing NTMs after drawing on external studies for estimates of the NTMs' trade impacts. In these studies, the price or quantity gaps are converted into ad valorem equivalents (AVE) of surcharges on import tariffs that would have the same effect on prices or trade volumes as the NTM. The AVEs are then allocated in a CGE model across three mechanisms: (1) surcharges to import tariffs (Global Trade Analysis Project (GTAP) variable coded *tms),* which are appropriate when the NTM directly affects the price of the good in the import region; (2) export taxes (GTAP variable coded *txs*), assuming that the NTM restricts the ability of exporters to ship their products; or (3) production inefficiencies (GTAP variable coded *ams*), those extra costs needed to produce the product to comply with NTM standards. Approaches to allocating NTM costs (table) range from assigning all NTM costs to one of three mechanisms (e.g., Andriamananjara et al., 2003) to differentiating between rents versus costs (e.g., ECORYS, 2009) where rents are modeled, in effect, like export and import taxes (depending on where the price markup occurs) and any actual costs in production are allocated to production inefficiencies. Our NTM cost decomposition follows this rent/cost approach, assigning rents or price markups to mechanisms (1) and (2), import or export taxes, and production cost increases to mechanism (3), production inefficiencies.

Literature review of CGE approaches to modeling NTMs

Author	Case	Source of NTM meaure	Allocation across mechanisms: Export tax	Import tax	Efficiency	Intrepretation
Andria-mananjara et al. (2003)	Footwear Apparel Processed food	Price gaps	100	100	100	Allocation based on implementation of specific NTM. Footwear quantitative import restrictions create quota rents. Apparel voluntary export restrictions create quota rents. NTMs have a "sand-in-the-wheels" type of effect.
ECORYS (2009)	TTIP	Gravity model	26.6	13.3	60	Resource-using "waste" is modeled as an efficiency loss, rent-seeking distortions are modeled as import or export taxes. Allocation is estimated.
EP (2014)	TTIP	Gravity model	33	33	33	NTMs represented either as a pure efficiency loss (sand in the wheels) or as a tax, which may affect the importer and/or exporter.
Fox et al. (2003)	U.S. Mexico trucking case	Secondary source: Empirical study of time and costs for cross-border shipments		40-66	33-60	Indirect trade costs are time spent and costs paid by shippers for nonessential border-crossing services, divided by efficiency (time lost) effect and import tariff equivalent (border costs for which rent can be captured).
Fugazza (2008)	Global	Secondary source: Kee et al. (2009)	0	<25	>75	Allocation depends upon sector. Rent-creating NTMs modeled as import tariffs; technical NTBs modeled as trade productivity shocks.
Hertel et al. (2001)	Japan and Singapore	Multiple secondary sources	0	0	100	Productivity shock includes reduction in direct border costs, time saved, and wholesale-retail margins due to customs automation and increased business-to-business activities.
Minor and Tsigas (2008)	Global	Secondary source: Hummels et al. (2007)	0	0	100	Hummels et al.'s tariff equivalents of trade delays counted time in three stages of transit: inland transport, customs processing, and port handling.
Winchester (2009)	Australia-New Zealand	Gravity model	0	0	100	AVE of the NTM includes all border costs, excluding transport costsand trade taxes.

NTM = non-tariff measure. AVE = ad valorem equivalent. T-TIP = Transatlantic Trade and Investment Partnership. NTB = non-tariff barrier.

Source: USDA, Economic Research Service.

During the course of this analysis, results indicate that the allocation across the three mechanisms does not necessarily affect trade or production but does have an impact on welfare calculations.

Appendix 4—NTM Removal and Demand Sensitivities

Non-tariff measures (NTMs) frequently arise when countries use different production processes or regulate them differently. Many studies suggest that consumers' willingness to pay for goods[12] may vary with production processes (Lusk et al., 2003; Tonsor and Schoroeder, 2003; Alfnes, 2004; Alfnes and Rickertsen, 2003, 2004 for beef). Studies also find that consumers are willing to pay a positive premium to avoid consuming biotech food (Burton et al., 2001; Moon et al., 2007; Hartl and Herrmann, 2009; Curtis and Moellner, 2007; Carlsson et al., 2007), although other studies find some willingness to purchase GE foods (Mather et al., 2011). This is particularly noticeable when European consumers are contrasted against consumers from the United States (Lusk et al., 2003; Lusk, 2003; Moon and Balasubramian, 2001). In some cases, consumers are unwilling to buy biotech foods produced from animals fed with biotech feed (Curtis and Moellner, 2007).

Consumer concerns can translate into effects on imports. If retailers choose to respond to consumer preferences for goods produced with particular technologies, the concentration of retail in the EU and the high proportion of retailer-branded products in some EU countries can result in large negative effects on demand for imported goods affected by NTMs. For example, consumer concerns about GE foods have resulted in rejection of GE ingredients by many EU retailers, which has had implications for importers (See Arita et al., 2015; Varacca et al., 2014).

We note that the gravity estimates of NTM coefficients capture anything that is unique to the trade relationship between the United States or EU as importers and the set of exporters affected by the NTM. This can include the importer(s)' demand parameters for the exported good. If the coefficient includes demand effects and not simply regulatory barriers, then we may not be able to assume that the full effect of the estimated NTM will disappear with a change in statute resulting from T-TIP negotiations.

To address potential demand-side effects of removing NTMs, we carry out a sensitivity analysis of the second scenario, which includes tariff/TRQ removal and an elimination of select NTMs. This analysis considers a lack of equalization of consumer demand preferences (willingness to pay) for domestic versus imported products even with the removal of NTMs. This is based on the Armington elasticity (see box "Armington Elasticity"). To do so, an *ex-post* sensitivity analysis is conducted, where the market access with NTM removal scenario is considered; however, Armington parameters are varied to mimic demand preferences. Here, we make no judgment on the degree to which consumers might avoid imported products; rather, we run a sensitivity analysis that considers a reduction in the Armington elasticities by one-half. This simulates a situation in which consumers do not regard imported goods as perfect substitutes for domestic goods, a situation that can arise when consumers regard two versions of a particular good produced with two different technologies as separate goods.

Appendix table A4-1 presents the Armington parameter for ESUBD used in the first two scenarios. Note that the GTAP model assumes that the domestic/imported elasticity is half of the estimated trade elasticities (ESUBM), an assumption that is used in our work. In addition, note that, in general,

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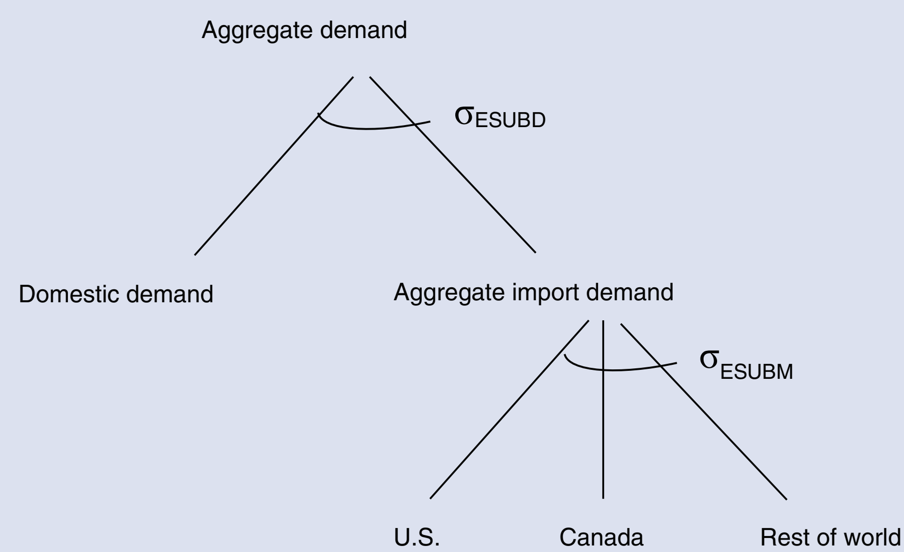
[12]These studies can be regarded as an upper bound as consumers frequently overestimate what they would be willing to spend on a particular food characteristic in an unconscious attempt to please the interviewer (Lusk, 2003). Even experimental auctions may not represent true consumer behavior because consumers are rarely spending their own money in a true market setting.

the EU elasticities are smaller for agricultural commodities than those of all other countries. This is to prevent intra-EU trade from completely collapsing.[13] Appendix table A4-2 indicates the ESUBD parameters used for the demand sensitivity scenario; note only the parameters for commodities with NTM removal were altered.

Armington Elasticity

Import demand in the standard Global Trade Analysis Project (GTAP) model is described by nested Armington functions, in which demand is first allocated between the domestic good and the composite import, and then among national sourcing of the composite import. This structure is represented in the figure, where aggregate demand is based on the nesting with domestic demand and aggregate import demand. The substitution among these two sources is governed by the elasticity of substitution, noted as parameter σ_{ESUBD}. Aggregate import demand is then further distributed among the regions that the domestic country imports from; this is governed by the parameter σ_{ESUBM}. These parameters are very influential in computable general equilibrium (CGE)-based trade policy experiments (Gallaway et al., 2003) and have been shown to be important even in CGE experiments that do not conduct a trade policy experiment (Plevin et al., 2015). The Armington elasticities can be estimated econometrically. McDaniel and Balistreri (2003) provide findings from the literature. Among these, they note that longrun estimates are higher than shortrun estimates; more disaggregate analyses estimate higher elasticities; and time-series analyses generally find smaller elasticities than cross-section estimates. Estimating these elasticities is time-consuming and beyond the scope of this work; thus, we rely on those estimated by Hertel et al. (2007).

Appendix figure 4-1
GTAP Armington structure



Source USDA, Economic Research Service.

[13]The regional aggregation scheme aggregates all the EU individual countries into one total EU region, thus keeping the Armington parameters the same as all other countries would assume that each individual country views another EU country as a non-EU country. Lowering the Armingtons reflects the FTA or no-borders aspect of the EU.

Appendix table A4-1

ESUBD parameters used in the market-access and non-tariff measure-removal scenarios

ESUBD	U.S.	EU	Canada	Mexico	China	India	Brazil	ROW
Paddy rice	5.05	2	5.05	5.05	5.05	5.05	5.05	5.05
Wheat	4.45	1.5	4.45	4.45	4.45	4.45	4.45	4.45
Coarse grains	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Fruits	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Vegetables	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Nuts	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Soybeans	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Rapeseed	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Other oilseeds	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Sugarcane/beet	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Other crops	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
Bovine	2	0.5	2	2	2	2	2	2
Hogs	2	0.5	2	2	2	2	2	2
Poultry and eggs	2	0.5	2	2	2	2	2	2
Other animals	2	0.5	2	2	2	2	2	2
Raw milk	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Natural resources	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Coal	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
Oil	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Gas	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
Beef	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Pork	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Poultry meat	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Other meats	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Vegetable oil	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Whey	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Powdered milk	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Butter	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Cheese	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Other dairy products	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Processed sugar	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Processed rice	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Prepared f_v	2	0.3	2	2	2	2	2	2
Cereal preparations	2	0.3	2	2	2	2	2	2
Sugar preparations	2	0.3	2	2	2	2	2	2
Processed feed	2	0.5	2	2	2	2	2	2
Other foods	2	0.3	2	2	2	2	2	2
Beverages and tobacco	1.15	0.3	1.15	1.15	1.15	1.15	1.15	1.15
P_C	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
L_Mfg	1.75	1.75	3.5	3.5	3.5	3.5	3.5	3.5
Ethanol1	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7

Continued—

Appendix table A4-1

ESUBD parameters used in the market-access and non-tariff measure-removal scenarios—continued

ESUBD	U.S.	EU	Canada	Mexico	China	India	Brazil	ROW
Ethanol2	1.75	1.75	3.5	3.5	3.5	3.5	3.5	3.5
H_Mfg	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Ely	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
Other services	2	2	2	2	2	2	2	2
DDGS	2	2	2	2	2	2	2	2
Biodiesel	2	2	2	2	2	2	2	2

ESUBD = estimated trade elasticities. f_v = fruits and vegetables. DDGS = distillers' dried grains with solubles. ROW = rest of world. P_C = petroleum and coal products. L_Mfg = labor-intensive manufacturing. H_Mfg = capital-intensive manufacturing. Ely = electricity.

Source: USDA, Economic Research Service.

Appendix table A4-2
ESUBD parameters used in the demand-sensitivity scenario

ESUBD	U.S.	EU	Canada	Mexico	China	India	Brazil	ROW
Paddy rice	5.05	2	5.05	5.05	5.05	5.05	5.05	5.05
Wheat	4.45	1.5	4.45	4.45	4.45	4.45	4.45	4.45
Coarse grains	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Fruits	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Vegetables	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Nuts	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Soybeans	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Rapeseed	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Other oilseeds	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Sugarcane/beet	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Other crops	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
Bovine	2	0.5	2	2	2	2	2	2
Hogs	2	0.5	2	2	2	2	2	2
Poultry and eggs	2	0.5	2	2	2	2	2	2
Other animals	2	0.5	2	2	2	2	2	2
Raw milk	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Natural resources	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Coal	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
Oil	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Gas	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
Beef	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Pork	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Poultry meat	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Other meats	3.5	1	3.5	3.5	3.5	3.5	3.5	3.5
Vegetable oil	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Whey	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Powdered milk	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Butter	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Cheese	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Other dairy products	3.65	0.3	3.65	3.65	3.65	3.65	3.65	3.65
Processed sugar	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Processed rice	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Prepared f_v	2	0.3	2	2	2	2	2	2
Cereal preparations	2	0.3	2	2	2	2	2	2
Sugar preparations	2	0.3	2	2	2	2	2	2
Processed feed	2	0.5	2	2	2	2	2	2
Other foods	2	0.3	2	2	2	2	2	2
Beverages and tobacco	1.15	0.3	1.15	1.15	1.15	1.15	1.15	1.15
P_C	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
L_Mfg	1.75	1.75	3.5	3.5	3.5	3.5	3.5	3.5
Ethanol1	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7

Appendix table A4-2

ESUBD parameters used in the demand sensitivity scenario—continued

ESUBD	U.S.	EU	Canada	Mexico	China	India	Brazil	ROW
Ethanol2	1.75	1.75	3.5	3.5	3.5	3.5	3.5	3.5
H_Mfg	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Ely	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
Other services	2	2	2	2	2	2	2	2
DDGS	2	2	2	2	2	2	2	2
Biodiesel	2	2	2	2	2	2	2	2

ESUBD = estimated trade elasticities. f_v = fruits and vegetables. DDGS = distillers' dried grains with solubles. ROW = rest of world. P_C = petroleum and coal products. L_Mfg = labor-intensive manufacturing. H_Mfg = capital-intensive manufacturing. Ely = electricity.

Source: USDA, Economic Research Service.