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Preliminary Report:

**Potential Economic Effects of the Reduction in Agricultural and
Nonagricultural Trade Barriers in
the Transatlantic Trade and Investment Partnership**

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Executive Summary

- Although the economic relationship between the U.S. and EU28 remains strong, the share of goods and services trade between them has declined in the past one and a half decades relative to the global trend, largely because of the emergence of China as a major economy. Our baseline CGE simulations indicate that these world trends will continue through 2024.
- There remain substantial barriers to trade between the U.S. and EU28 economies. Although tariffs on agriculture are generally low, tariffs on a few agricultural products (sugar, milk and meat) remain high. The effects of non-tariff measures (NTMs) are also estimated to be high. Tariffs and NTMs are lower for non-agriculture, which makes up the preponderance of production and trade.
- A primary goal of TTIP is to promote and increase the flow of trade between the two large transatlantic economies through a reduction in trade barriers. This improved market access may also facilitate increased investments between the U.S. and EU28.
- The objective of this paper is to provide an assessment of the potential economic effects in the U.S. and EU28 of a reduction in their bilateral trade barriers. Using a global CGE model the paper develops four trade barrier reduction scenarios and analyzes their impacts on trade, production, factor incomes, prices and welfare in the two economies for a 10-year period through 2024 compared to a baseline without reductions. The trade and welfare effects in 2024 are summarized in the table below.
- *TTIP 90-0* is a scenario where only tariffs are reduced. An across-the-board tariff reduction of 90 percent increases U.S exports to EU28 by 2.3 percent relative to the baseline in 2024 (US\$ 9.7 billion in 2014 prices, not shown in the table). EU28 exports to the U.S. increase by 1.7 percent (US\$ 8.1 billion). Consumer prices in the U.S decline marginally by 0.062 percent, while welfare improves by US\$ 7.1 billion in 2014 prices. In EU28, consumer prices also decline marginally by 0.034 percent, while overall welfare increases by US\$ 4.2 billion. There are trade diversions in non-TTIP. U.S. exports to countries outside of the TTIP region decline by 0.29 percent, while EU28 exports by 0.004 percent. Furthermore, intra-EU28 trade declines by 0.13 percent.
- *TTIP 90-20* is a scenario where tariffs are reduced by 90 percent while the tariff-equivalent effects of NTMs by 20 percent. The trade creation is larger compared to the previous scenario. U.S. exports to EU28 improve by 6.2 percent in 2024 (US\$ 26.4 billion in 2014 prices), while EU28 exports to the U.S. increase by 7.5 percent relative to the baseline (US\$ 36.0 billion). The reduction in consumer prices in the TTIP region is slightly higher relative to the previous scenario and welfare in the U.S. improves by US\$ 22.9 billion, while in EU28 by US\$ 16.3 billion. The trade diversion effects are also larger.
- *TTIP 90-20 Non-Agricultural Only* is a scenario where trade barriers in agriculture/food are retained while those in non-agriculture are reduced by 90-20 percent. Compared to the across-the-board trade barrier reduction, the results in this scenario are about 15 percent smaller, which implies that the potential trade and welfare effects of a possible TTIP agreement would largely depend on the reduction in the trade barriers in non-agricultural

products, despite a large trade expansion for agriculture and food sectors when relatively high trade barriers in these sectors are also reduced.

- *TTIPP 90-90* is an ambitious scenario where tariffs and trade-reducing effects of NTMs are practically eliminated; both are reduced by 90 percent. This results in significantly larger impacts. Exports of the U.S. to EU28 increase by 25.0 percent (US\$ 106.4 billion in 2014 prices). EU28 exports to the U.S. improve by 34.0 percent (US\$ 164.1 billion in 2014 prices).

Summary Table: Impacts of TTIP on U.S. and EU28 in 2024 (% change from baseline)

	2014 Base Share,%	<i>TTIP 90-20</i>			
		<i>TTIP 90-0</i>	All	Non-Agri. only	<i>TTIP 90-90</i>
TTIP					
Total exports	100.0	0.088	0.347	0.307	1.693
Within TTIP	59.5	0.272	1.055	0.942	4.902
Non-TTIP	40.5	-0.117	-0.442	-0.400	-1.923
United States					
Total exports	100.0	0.241	0.818	0.721	3.731
Within TTIP	23.4	2.278	6.197	5.403	24.984
Non-TTIP	76.6	-0.294	-0.603	-0.513	-2.069
European Union 28					
Total exports	100.0	0.040	0.197	0.175	1.036
Within TTIP	68.7	0.066	0.523	0.481	2.762
Within EU28	60.9	-0.131	-0.334	-0.293	-1.249
United States	7.8	1.679	7.459	6.750	33.970
Non-TTIP	31.3	-0.004	-0.338	-0.328	-1.828
NonTTIP					
Total exports	100.0	-0.007	-0.034	-0.032	-0.185
TTIP	41.1	-0.037	-0.191	-0.175	-0.954
Non-TTIP	58.9	0.010	0.049	0.044	0.226
United States:					
Consumer prices		-0.062	-0.211	-0.194	-0.884
EV US\$ billion in 2014 prices		7.1	22.9	20.0	94.5
EV % of GDP		0.031	0.099	0.087	0.412
European Union 28:					
Consumer prices		-0.034	-0.130	-0.117	-0.568
EV US\$ billion in 2014 prices		4.2	16.3	13.9	73.8
EV % of GDP		0.017	0.068	0.057	0.306

EV is equivalent variation

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1. Introduction

The Transatlantic Trade and Investment Partnership (TTIP) is a potential mega regional trade agreement (RTA) as it comprises two of the world's largest economies, the United States (U.S.) and European Union 28 (EU28). These two economies are also the largest global traders and investors. The U.S. represents 21.6 percent of world GDP and 13.4 percent of world trade, while EU28 represents 25.1 percent of world GDP and as a block (excluding intra-EU28 trade) 17.0 percent of world trade.

The bilateral trade relationship between the two economies is significant. To illustrate, of the total US\$ 1.6 trillion merchandise (goods) exports of the U.S. in 2014, 16.7 percent (US\$ 270 billion) went to EU28 (Table 1). The merchandise exports of EU28 to the U.S. amounted to US\$ 409 billion, 6.6 percent of its total exports when intra-EU28 trade is included. Evaluated on an imports basis, the total U.S. merchandise imports from EU28 in 2014 were 17.0 of the total, while EU28 imports from the U.S. were 4.4 percent of the total. In 2014, the U.S. had a merchandise trade deficit with EU28 and a large total merchandise trade deficit, while EU28 had a trade surplus with the U.S. and a small total trade surplus.

While the bilateral trade relationship between the U.S. and EU28 remains strong, the flow of goods between the two economies is in decline relative to the overall trend in global trade, largely because of the emergence of China as a major economy. The declining trend is shown in Table 2. The share of U.S. imports from EU28 declined from 17.4 percent in 2000 to 16.3 percent in 2010, but slightly recovered to 17.0 percent in 2014, essentially no trend. However, the share of U.S. imports from China increased by more than 11 percentage points in the past one and a half decades, while the share of Japan and the rest of the world (ROW) declined. Over the same period,

the share of U.S. exports to EU28 declined from 24.3 percent in 2000 to 16.7 percent in 2014, while the share going to China increased from 2.1 percent to 7.6 percent.

Declining U.S. shares are also observed from an EU28 perspective. Excluding intra-EU28 trade, the share of imports of EU28 from the U.S. declined from 20.8 percent in 2000 to 11.9 percent in 2014, while the share of China increased from 7.5 percent to 17.6 percent. The share of Japan also dropped significantly over the period. The U.S. as a market for EU28 exports dropped notably from 28.0 percent in 2000 to 17.5 percent in 2014, while the share of China increased. The TTIP has to be considered in part an effort to enhance trade between the U.S. and EU28 in light of these declining shares.

The negotiations in TTIP cover numerous issues, but its ultimate goal is to promote and increase the flow of trade and investment across the Atlantic. One of the main negotiating points is improving market access for goods and services by removing trade barriers between the two economies. With lower trade barriers, each can better gain access to their respective markets. The goods part of the negotiations includes rules on market access for manufactured goods, agriculture and processed agricultural products, and rules of origin.

The objective of this paper is to provide an assessment of the potential economic effects in the U.S. and EU28 of reducing the trade barriers between the two economies¹. A global computable general equilibrium (CGE) model is used to determine over the period 2015-2024 the immediate, medium-term and long-run effects on the bilateral trade between the U.S. and EU28, and the related effects on the rest of global trade. Aggregate trade creation and trade diversion effects are calculated, as well as the sectoral production, trade and consumption effects and impacts on factor prices and welfare in both economies.

¹ The study was conducted before the United Kingdom voted to exit from EU28 in July 2016.

The paper is organized in five sections. The next section briefly discusses some of the major findings of a few previous studies conducted to assess the economic impact of TTIP. Some of these studies used CGE models while others employed various methods. Section 3 outlines the key features of the global CGE model used in our analysis. This section also presents estimates of the trade barriers (applied tariffs computed from the GTAP 8 database² and effects of non-tariff measures (NTMs) estimated using a gravity-border effects approach), as well as the definition of the simulations conducted. There are five simulations conducted in the paper:

- A. a baseline which incorporates estimated effects on trade of actual GDP and population growth from 2007 to 2014 and projected growth between 2015 and 2024 under existing tariffs and NTMs;
- B. a TTIP 90-0 scenario with lower trade barriers within TTIP consisting of a 90 percent reduction in the current tariff rates only from 2015 to 2024;
- C. a TTIP 90-20 scenario with lower trade barriers within TTIP consisting of a 90 percent reduction in the current tariff rates and a 20 percent reduction in the ad valorem tariff equivalent (AVE) of NTMs³;
- D. a TTIP 90-20 non-agriculture only scenario where the trade barriers in agriculture/food are retained within TTIP, but the barriers to the flow of non-agricultural goods are reduced (90 percent reduction in tariffs and 20 percent in NTMs); and
- E. a TTIP 90-90 aggressive scenario where the reduction in trade barriers within TTIP consists of a 90 percent drop in both tariffs and NTMs from 2015 to 2024.

The impact under the various scenarios relative to the baseline are discussed in Section 4, with comparison to other studies. The final section gives is a brief summary of the results and conclusion.

The paper has three appendices. Appendix A presents the mapping of the global TTIP-CGE to the GTAP 8 database. Appendix B presents the trade effects among EU28 countries as well as the trade effects in the included non-TTIP countries/regions for the TTIP 90-20 and TTIP

² GTAP refers to Global Trade Analysis Project. The base year for the GTAP 8 database is 2007. A later database (GTAP 9) is now available but was not utilized in this study.

³ Non-tariff barriers (NTBs) is an alternative term for NTMs. As discusses at several points below, the term NTM more explicitly recognizes the public good role of many regulations and standards. We use NTM in this paper even though our focus is on the possibility that negative effects of these measures on trade can be reduced through TTIP.

90-90 scenarios. Lastly, Appendix C presents the gravity-border effects approach used in the estimations of the AVE of NTMs in the U.S. and EU28. The regression results as well as the estimates of AVEs are presented in this appendix.

2. Review of Related Literature

There have been several global CGE-model, gravity-model based and other studies analyzing the effects of TTIP on trade. This section highlights some of the key results of a few of these studies.

A recent CGE-based analysis of TTIP is by Beckman et al. (2015) of the United States Department of Agriculture/Economic Research Services (USDA/ERS). The study analyzed the potential economic effects of the reduction in the trade barriers between the U.S. and EU, where the barriers included tariffs, tariff-rate quotas (TRQs), and NTMs on a number of agricultural products. The NTM estimates used in the analysis were taken from Arita, Mitchell and Beckman (2015), another USDA/ERS study. This study identifies specific concerns raised in trade negotiations for agricultural products (9 cases of U.S. concerns about EU sanitary and phytosanitary (SPS) and technical barrier to trade (TBT) regulations, and 3 EU concerns about U.S. regulations). Significant adverse impacts on U.S.-EU trade are found in all cases, with estimated AVE of the measures ranging from 10-25 percent due to EU biotech restrictions affecting soybeans, to 81-126 percent for EU restrictions on pork related to restrictions on use of beta agonists, required trichinae testing and differences in accepted pathogen-reduction treatments in meat processing. In sum, for agricultural products the average AVE of the evaluated NTMs in the U.S. is 55.7 percent while in EU 41.0 percent. The AVE of NTMs are estimated to exceed applied tariffs in all cases except EU imports of beef.

The CGE study by Beckman et al. (2015) employed a static GTAP model with high disaggregation of agricultural sectors (consisting of 24 agricultural commodities) and 14 non-agricultural sectors. Effects of the specific NTMs are divided between estimated added costs of production and rents associated with either export or import taxes. The added costs to production are “institutional frictions” that reduce imports arising from SPS measures, technical regulations, administrative procedures, etc. Three scenarios were conducted: (a) the removal of tariffs and TRQs on all agricultural products and non-agricultural products; (b) scenario (a) plus the complete removal of the selected NTMs; and (c) an adjustment in consumer preferences for products with reduced NTMs, such that demand shifts toward domestically produced goods. The first scenario involving the removal of tariffs and TRQs would expand U.S. agricultural exports to EU by 39.5 percent (US\$ 5.5 billion) from base year (2011) levels, while agricultural exports from EU to the U.S. expand by 3.8 percent (US\$ 0.8 billion).⁴ In the U.S., beef and dairy exports to the EU have the highest improvement, while in EU exports to the U.S. the commodities with the highest increases are vegetable oil and cheese. The expanded trade is associated with a 0.09 percent increase in U.S. GDP and 0.23 percent in EU GDP. Agricultural prices in the U.S. increase, while in EU fall.

If the complete removal of the identified NTMs are included in the reduction of the trade barriers, the positive trade effects are greater between the two economies. U.S. agricultural exports to EU would increase by 69.0 percent (US\$ 9.6 billion) and EU agricultural exports to the U.S. by 9.5 percent (US\$ 2.0 billion). The trade between the two economies would also expand as consumer preferences change under the third scenario as a result of the elimination of NTMs, but less than without the increased preference for domestic goods. U.S. agricultural exports to EU

⁴ U.S.-EU bilateral export results of Beckman et al. (2015) and several of the other studies discussed in this section are summarized in Section 4, Table 14 where we compare our results to these studies.

increase by US\$ 5.9 billion and EU agricultural exports to the U.S. by US\$ 1.1 billion. In all these three scenarios, exports of the U.S. to the rest of the world decline, offsetting some of the export gain to the EU, while EU exports to others increase, complementing the increased EU exports to the U.S.

In an earlier study commissioned by the European Parliament, Bureau et al. (2014) also considers both tariff and NTM effects. NTMs are assessed for OECD countries using notifications of SPS/TBT regulations to the WTO through 2012 (along lines of Kee, Nicita and Olarreaga, 2009). Bureau et al. report average AVE of agricultural NTMs (47.8, 53.6 and 31.0 percent for the U.S., EU25 and Other OECD, respectively) exceeding those for non-agricultural products (11.4, 13.4 and 7.1 percent, respectively). Also, included in the analysis are the median AVE of NTMs of service sector which are reported as 31.0 percent for EU and 43.0 for the U.S. Taking 25 sectors into account (16 agricultural, 9 non-agricultural), the AVE of NTMs of the EU25 exceed those of the U.S. in all but three cases. The highest estimated EU25 and U.S. AVE are for meat, dairy products, cereals, and vegetables and fruits. In their CGE model, 31 sectors are considered and effects of NTMs are represented as having equal (one third) effects as efficiency losses, export taxes and import tariffs.

The scenario that involves a complete phase-out of tariffs by 2025 between EU25 and the U.S. increases agricultural exports of EU25 to the U.S. by 18.5 percent (US\$ 4.3 billion) and U.S. exports to EU25 by 30.7 percent (US\$ 7.1 billion). Non-agriculture which dominates the trade flows between the two economies expands as well with EU25 industry exports to the U.S. increasing by 16.3 percent (US\$ 38.2 billion) and U.S. industry exports to EU25 by 15.5 percent (US\$ 52.2 billion). EU25 export of services to the U.S. increases by 0.4 percent (US\$ 0.6 billion) while U.S. export of services to EU25 declines slightly by 0.5 percent (US\$ 0.8 billion).

A second scenario is called the reference scenario in Bureau et al. It combines the complete phase-out of tariffs and with a 25 percent reduction in the trade-restrictiveness of NTMs by 2025 between the U.S. and EU25. Several alternatives are also considered in the analysis such as exclusion of meats and dairy, differential NTM reductions, and spillover effects from reductions of U.S.-EU25 NTMs to other countries. In the reference scenario, the volume of EU25 agricultural exports to the U.S. increases by 56.4 percent (US\$ 13.0 billion) while U.S. agricultural exports to the EU25 increase by 116.3 percent (US\$ 26.8 billion). For non-agriculture exports (excluding services) the corresponding increases are 41.8 percent (US\$ 114.5 billion) and 41.2 percent (US\$ 133.2 billion), respectively. EU25 export of services to the U.S increases by 26.8 percent (US\$ 42.3 billion) while U.S. export of services to EU25 increases by 15.6 percent (US\$ 24.2 billion). Trade between the TTIP and an aggregate rest of world declines modestly (less than 2 percent under the above scenarios, with slight positive effects when beneficial spillovers from U.S. and EU25 NTM reductions are also assumed to occur).

A third recent study by Disdier et al. (2016) provides additional detailed analysis for agriculture. The context of this study is comparing effects on the U.S. and EU28 of a potential TTIP agreement with a potential Trans Pacific Partnership (TPP) agreement involving the U.S. and 11 other countries, but not the EU28. The AVE of NTMs are again estimated for the U.S. and EU28 (as well as for other TPP countries) for 25 sectors. For agriculture, the average AVE of NTMs of EU28 is 40.1 percent and of the U.S. 35.7 percent, while for non-agriculture the average AVE of NTMs of EU28 is 10.4 percent and of the U.S. 8.7 percent.

In a TTIP assessment that assumes elimination of all tariffs and a 25 percent reduction in the AVE of NTMs between the U.S. and EU28, agriculture/food production in the U.S. increases by 1.1 percent, while in EU28 it falls by 0.9 percent. Agriculture/food exports of the U.S. to the

EU28 increase by 159.0 percent (US\$ 34.9 billion), while EU28 agriculture/food exports to the U.S. increase by 55.5 percent (US\$ 11.5 billion). Broadly, Disdier et al. find that Atlantic (TTIP) agriculture/food trade does not compete with Pacific (TPP) agriculture/food trade in the U.S. market, making the two possible agreements complementary. For U.S. agriculture/food exports, both agreements would expand markets for similar products.

Among other TTIP studies, Songfeng, Zhang and Bo (2014) utilized a dynamic GTAP model to analyze the effects of the reduction in tariffs and NTMs between the U.S. and EU28 under TTIP on the BRIC countries⁵. The analysis utilized tariffs calibrated from the GTAP 8 database and estimates of AVE of NTMs of Berden et al. (2009) in a study undertaken by ECORYS. Although tariffs are low, AVE of NTMs are estimated to be high between the U.S. and EU28. For example, agricultural and agro-processing sectors have 73.3 percent AVE of NTMs in the U.S. and 56.8 percent in EU28. For industry, AVE by sector are petroleum products and chemicals 19.1 percent in the U.S. and 13.6 percent in EU28; automobiles 26.8 in the U.S. and 25.5 percent in EU28; machinery and equipment 25.4 percent in the U.S. and 21.5 percent in EU28; and other non-agricultural sectors between 12.8 and 17 percent in both economies. The average non-agricultural industry AVE for the U.S. is 17.4 percent and 15.7 percent for EU. The analysis also includes service sector AVE of NTMs which are reported as averaging 8.9 percent for the U.S. and 8.5 for EU.

The CGE simulation results of Songfeng, Zhang and Bo (2014) indicate that the reduction in the trade barriers between the U.S. and EU28 in TTIP will increase global welfare by US\$ 31.2 billion. Furthermore, while the increase in the trade flows between the U.S. and EU28 following

⁵ BRIC is Brazil, Russia, India and China.

the reduction in the trade barriers will benefit both economies, exports of BRIC countries to the TTIP region decline significantly.

Berden et al. (2009) used a multi-pronged approach (literature review, business surveys, consultations with various groups including business and government regulators, econometric and economic models such as gravity and CGE models) to analyze the economic impact of NTMs in the U.S. and EU. The results of the study indicate that NTMs increase the cost of firms in about 60 percent of cases, and create market power (economic rent) in about 40 percent in both economies. These effects lead to welfare losses. However, while MTNs hinder trade flows, some of the laws, regulations and standards these NTMs imbed cannot easily be removed or re-aligned because they serve public good purposes or are driven by immutable differences in geography, language, preferences, culture or history. Nonetheless, potentially a number of these NTMs can be reduced.

Berden et al. assessed under an ambitious scenario that about 50 percent of the NTMs can be realigned and reduced. They also assessed a more cautious scenario of 25 percent realignment of NTMs. The assessment was conducted for a 10-year period 2008-2018. The results under the ambitious scenario increase U.S. GDP in 2018 by 0.3 percent while EU GDP by 0.7 percent from the baseline, where the baseline assumes no changes in NTMs. The more realistic scenario would increase U.S.GDP by 0.1 percent and EU GDP by 0.3 percent.

Additional analysis was conducted by the Center for Economic Policy Research (CEPR, 2013) to update and complement the impact assessment of Berden et al. (2009) using the same NTM estimates. Based on a CGE model calibrated to the GTAP 8 database, the study analyzed various EU-US bilateral trade deepening scenarios including an elimination of 98 percent of tariffs only and one involving the elimination of all tariffs, 25 percent of NTMs eliminated on goods and

services and 50 percent eliminated on procurement (their ambitious scenario). The analysis was conducted relative to a baseline scenario, where the baseline was defined as one that included all current U.S. and EU28 signed or initiated bilateral agreements, in particular RTA agreements for U.S.-South Korea, EU-Canada, and EU-Singapore.

The results of CEPR (2013) indicate that a tariff-only agreement would lead to increased EU GDP by 0.1 percent from the baseline in 2027 and the U.S. GDP by 0.04 percent. Total EU exports to the U.S. increase by 6.6 percent relative to the baseline (€ 43.8 billion) and U.S. exports to EU by 12.4 percent (€ 53.8 billion). Broken down into exports of major sectors, EU exports of agro-food goods improve by 10.8 percent (€ 4.4 billion), while U.S. exports to EU by 30.0 percent (€ 3.2 billion). For non-agriculture goods, EU exports to the U.S. increase by 9.9 percent (€ 38.7 billion), and U.S. exports to EU by 18.4 percent (€ 51.0 billion). Again, services exports are not much affected.

In the CEPR ambitious scenario involving elimination of tariffs and elimination of a considerable number of NTMs, the EU GDP is higher by 0.27 percent relative to the baseline and U.S. GDP by 0.21 percent. Total EU exports to the U.S. increase by 28.0 percent (€ 187.0 billion) and U.S. exports to EU by 36.6 percent (€ 159.1 billion). Disaggregated into exports of major sectors, EU exports of agro-food goods improve by 36.9 percent (€ 15.1 billion), while U.S. exports to EU by 49.3 percent (€ 5.2 billion). For non-agriculture goods, EU exports to the U.S. increase by 41.9 percent (€ 163.2 billion), and U.S. exports to EU by 53.3 percent (€ 147.5 billion). Services bilateral trade also expands modestly. Furthermore, under TTIP real wages improve as the demand for labor increases while consumer prices decline in both economies (European Commission, 2013a). As a result of the more open markets and more aligned regulatory systems

agreed in TTIP, the U.S. and EU28 can generate permanent improvement in their wealth (European Commission, 2013b).

Felbermayr, et al. (2013) conducted a study on the impact of TTIP using two methods. The first method was “macro” in nature utilizing aggregated data by country and worldwide trade flows, real per capita income, and unemployment. The analysis was based on an estimated gravity equation augmented with unemployment in the labor market. The second method was “micro-based” with the disaggregated effects for Germany examined. There were 2 scenarios analyzed in the study: (a) an elimination of tariffs in transatlantic trade; and (b) a comprehensive liberalization where regulatory barriers to market access were reduced.

Their macro results indicate that a free trade agreement between the U.S. and EU28 significantly increases the bilateral trade between them, with bilateral trade rising by 80 percent. The long run gains in GDP is 1.4 percent. The expected gain in employment in the two economies is 2.4 million jobs. Their micro results indicate that the reduction in tariffs between the U.S. and Germany has insignificant effects. The reduction of non-tariff barriers above and beyond tariffs has much larger effects.

The results of the above studies of TTIP generally indicate positive gains. The estimated gains depend mostly on NTM reductions as the tariffs between the U.S. and EU are already relatively low, except for some sensitive products. However, Raza et al. (2014) argues that these studies have not accounted for the social cost of reducing NTMs. In particular, they argued that NTMs are put in place with a purpose, and their elimination threatens public policy goals such as consumer safety, public health or environmental quality. Additional costs associated with TTIP estimated by Raza et al. include higher unemployment, losses from declining tariff and tax

revenues, and reduction in GDP growth in developing countries as a result of trade diversion. According to Raza et al., these other costs should be included in the analysis of the impact of TTIP.

3. Methodology

Global TTIP-CGE Model. Our analysis employs the Robichaud et al. (2011) model calibrated to the GTAP 8 database. The GTAP 8 database includes 57 sectors in 129 countries/regions, 2 types of labor (skilled and unskilled), capital, land, and natural resources. To facilitate the computation of the model's numerical solution, the database was aggregated to 17 sectors in 25 countries/regions, and land and natural resources were incorporated together⁶. Table 3 (columns 1, 2, 5 and 6) show the share of each of these sectors in 2014 baseline production and imports of the U.S. and EU28. The 17 sectors reflect the disaggregation of important agricultural commodities both in the U.S. and EU28 where trade barriers are highest. The agricultural commodities include cereals, sugar, milk, and meat. The manufacturing sector was disaggregated into light manufacturing (textile apparel, leather; wood, paper and others; and petroleum, chemicals and others) and heavy manufacturing (metal; motor transportation; machinery and electronics). Other agriculture, other food, extraction, and all other manufacturing are additional sectors and the sectoral disaggregation also includes utilities, construction and services. The country/region aggregation includes 14 major countries in EU28 and one aggregated region for the rest of EU28. Also included are the U.S. within TTIP and Canada, Mexico, the Association of Southeast Asian Nations (ASEAN), Japan, China, Korea, Latin America, Africa, and the rest of the world, designated together as non-TTIP.

Model Structure. The detailed specification of the model is discussed in Robichaud et al. (2011) and Cororaton and Orden (2014). Important features of the model include: (a) a three-level

⁶ Tables 15 and 16 of Appendix A present a mapping of the 17 sectors and 25 countries/regions to the GTAP 8 database.

production structure where value added and intermediate inputs are used in fixed proportion to produce output and the second and third levels are constant elasticity of substitution (CES) functions of various disaggregated factor inputs; (b) a linear expenditure system demand structure; (c) domestically produced and imported goods are imperfect substitutes and modeled using CES function; (d) imports of each commodity are disaggregated using another CES function to the various sources of imports, which implies product differentiation among imports from the various origins; (e) exports of each commodity are disaggregated using constant elasticity of transformation (CET) function to the various export destinations, which also implies imperfect substitutability among exports to the destinations; and (f) the system of prices in the model reflects the cost of production plus a series of mark-ups which consists of layers of taxes and international transport margins. The GDP deflator of the reference region (in the present case rest of the world) is the numeraire. The model uses the default closure of Robichaud et al. (2011) in which the nominal exchange rates and real government expenditure and public investments are fixed in all countries/regions. However, real exchange rates, defined as the ratios of nominal exchange rates and local prices, change as domestic prices change. The default closure fixes the current account balance of all countries/regions. With fixed current account balances, investments adjust to changes in savings in each country/region consistent with the neoclassical closure.

Trade Barriers. The sectoral tariff rates applied by each country/region on imports from each of the import origins were calibrated from the GTAP 8 database. Over the past couple of decades the series of tariff reduction programs implemented globally under the World Trade Organization (WTO), regionally under various RTAs or unilaterally have lowered quite considerably the level of tariff rates across countries. However, despite the trade reform programs,

tariff rates in a few commodities remain high, especially for agricultural goods that fall under the special product categories.

Furthermore, there are various NTMs which continue to affect the flow of commodities across borders. In the international market for food for example, although most of the production, processing, and distribution is undertaken by the private sector, the market is affected by various forms of government regulations. The economic justifications for a government role in food markets stem from both the public goods aspects of disease and pest control and the opportunities to reduce market transactions cost for firms and consumers. However, NTMs can also serve protectionist purposes (Josling, Roberts and Orden, 2004).

To factor some of these features in international trade into the analysis, and in an effort to capture the overall level of protection imposed by countries on imports, the calibrated import tariff rates were augmented to include estimates of the effects of NTMs. The NTM effects for the U.S. and EU28 were estimated using a gravity-border effects approach for 10 commodity groups following Olper and Raimondi (2008). The gravity models were estimated using the GTAP 8 database. Appendix C discusses the approach used, the econometric results and the resulting estimates of the total border effects and the AVE of NTMs. For the rest of the countries/regions in the model the AVE estimates of Kee, Nicita, and Olarreaga (2006) were used and are held constant. The AVE of NTMs were included simply as import tariffs, without breakdown into effects related to costs of production or consideration as export taxes.

Since the econometric estimation for the U.S. and EU28 in Appendix C is of total border effects, the AVE attributed to NTMs are derived by subtracting tariff rates from the total AVE of border effects computed based on the estimated coefficients⁷. Table 3 summarizes the average

⁷ In the earlier version of this paper (April 2016), tariffs and the estimated AVEs were inadvertently added, as if tariff and NTM AVE effects were estimated separately. This error doesn't have much effect on aggregate results because

tariff rates and estimates of AVE of NTMs between the U.S. (columns 3 and 4) and EU28 (columns 7 and 8) for 14 sectors (AVEs were not estimated or applied for utilities, construction or services). Generally, tariffs and AVE of NTMs are higher in agricultural commodities than in non-agriculture in both economies and AVE of NTMs are substantially larger than tariffs for both the U.S. and EU28 in all cases except milk and (for the EU28) textiles and apparel. The AVE are mostly lower for the U.S. than for the EU28 for agriculture sectors, but higher for non-agricultural manufacturing. While these NTM effects have the virtue of being systematically estimated across sectors, some ambiguity can be associated with the estimates. For example, the estimated AVE of U.S. NTMs on cereals (96.3 percent) is both relatively high and exceeds that of the average for EU28 countries (45.3 percent), whereas Bureau et al. (2014) also estimate relatively high AVEs for cereals but with the EU25 (89.5 percent) exceeding the U.S. (62.6 percent).

Table 4 compares a simple average of our estimates of AVE of NTMs for agriculture and non-agriculture with those reviewed in the previous section. In the studies reviewed, the estimates of agricultural AVE are higher compared to the non-agricultural AVE both for the U.S. and EU. For the U.S., the highest average agricultural AVE estimate is 73.3 percent (Berden et al., 2009 also used by CEPR, 2013), while the lowest is 35.7 percent (Disdier et al., 2016). Our estimate, which is 47.8 percent, is similar to that of Bureau et al. (2014). For non-agricultural, our estimate, which is the highest among those presented, is closest to that of Berden et al. (2009) and CEPR (2013).

For EU, our average of agricultural AVE of NTMs estimates is the highest, but only slightly higher compared to that of Bureau et al., Berden et al. and CEPR. The estimates of Disdier et al.

AVE of NTMs are mostly much larger than the tariffs, but some sectoral results are affected compared to the earlier results.

and Arita et al. (2015) are similar and are the smallest. For non-agricultural, our estimate falls below that reported by Bureau et al. and Berden et al. but exceeds the estimate of Disdier et al.

The estimated averages of agricultural AVE of NTMs in EU are relatively higher compared to those in the U.S. in three studies: our estimates, Disdier et al. and Bureau et al. but lower in Arita et al. (for 9 NTMs evaluated for the EU versus 3 by the U.S.) and Berden et al. and CEPR. For non-agricultural NTMs, our estimate and that of Berden et al. are higher in the U.S. compared to EU whereas it is the opposite in the other studies where the comparison is presented.

Thus, there are variations in the NTM estimates both across specific sectors and on average for agriculture/food versus non-agriculture. This suggests some caution in assessing the simulation results of any single model when AVE of NTMs are reduced.

Definition of Simulations. To analyze the potential economic effects of TTIP, five simulations were conducted; a baseline and four trade barrier reduction scenarios:

A. *Baseline.* The global TTIP-CGE model was simulated until 2024 using the actual real GDP and population growth from 2007 to 2014, and the projected GDP growth of the World Bank and the population projection of the United Nations until 2024. Starting in 2008, the baseline incorporates our estimated trade barriers from tariffs and the AVE of NTMs. The baseline does not account explicitly for tariff-rate-quotas (TRQs), nor is updating undertaken for RTAs with other trade partners that came into effect for the U.S. or EU28 between 2007 and 2014⁸. The baseline assumes no intra-EU28 trade barriers, i.e. tariffs and NTMs are zero within EU28. A

⁸ Since 2007, the U.S. has had RTAs enter into force with Republic of Korea (2012), Colombia (2012), Panama (2012), Peru (2009) and Oman (2009) as of October 2016. The EU has had 14 RTAs enter into force, including with Republic of Korea (2011), Ukraine (2014) and 12 with smaller countries. Continued phase-in of some earlier agreements and pending new agreements could also affect the impacts of TTIP. For the U.S., the Transpacific Partnership (TPP) is the main pending agreement, while the EU has made early announcement of 14 possible RTAs, including with Canada, India, Japan, Philippines, Thailand and Vietnam.

calibrated (pre-solved) multifactor productivity in each country/region was used to ensure that the model replicates exactly the real GDP used, both actual and projected, in the baseline⁹.

B. *TTIP 90-0 Scenario.* This is a tariff-only reduction simulation. The negotiations in TTIP are still ongoing and no definite agreement has been reached so far. For this reason, an assumed adjustment is hypothesized to occur as follows. The applied tariffs between the U.S. and EU28 were reduced from the current levels by 90 percent over the 10-year period from 2015 to 2024 using a geometric growth formula and no exceptions were provided for special products. All trade barriers due to NTMs were retained. Tariffs and NTMs in non-TTIP were also retained.

C. *TTIP 90-20 Scenario.* Issues related to the NTMs are often contentious, their negotiations are quiet involved, their resolution is often protracted, and many NTMs can be expected to be retained as serving appropriate purposes. Thus, the reduction in the AVE of NTMs is expected to be much lower compared to the reduction in tariff rates over the 10-year period. In the analysis for this scenario, tariffs are reduced by 90 percent as above. In addition, the AVE of NTMs between the U.S. and EU28 were reduced by 20 percent using a geometric growth formula over the 10-year period. The trade barriers in non-TTIP were retained.

D. *TTIP 90-20 Non-Agricultural Only Scenario.* Some agricultural products in both the U.S and EU28 are sensitive commodities. Under this third scenario, the adjustments in the

⁹ Baseline levels of goods and services trade match the 2007 GTAP 8 data and reflect these adjustments, but do not match the actual nominal values of merchandise (goods) trade shown in Table 1 for 2014 because of the inclusion services (and utilities and construction) in the model and absence of an accounting for all the developments that transpired between 2007 and 2014 other than the growth in GDP and population of the countries/regions included. More specifically, GTAP 8 shows 2007 U.S. exports of goods (agriculture/food, extraction, and non-agricultural manufacturing) and services, utilities and construction to EU28 at US\$ 347.4 billion (goods US\$ 224.4 billion) and EU28 exports to the U.S. of US\$ 454.9 billion (goods US\$ 316.2 billion). In comparison, model baseline bilateral export values for 2007 are US\$ 319.5 billion (goods US\$ 202.9 billion) and US\$ 457.4 billion (goods US\$ 309.8 billion), respectively, whereas nominal merchandise exports in 2007 were US\$ 244.3 billion and US\$ 354.4, respectively (figures comparable directly to Table 1 for 2014).

trade barriers were implemented in non-agricultural sectors only. Agriculture tariffs and NTMs were retained within TTIP and all barriers were retained in non-TTIP.

E. *TTIP Full Liberalization 90-90 Scenario*. This is similar to Scenario C, except that the NTMs between the U.S. and EU28 were reduced by 90 percent over the 10-year period. This is an ambitious but likely unrealistic illustrative scenario of extensive NTM elimination or harmonization.

4. Simulation Results

This section discusses the effects of the reduction in the trade barriers between the U.S. and EU28. For each simulation scenario the effects on trade (creation and diversion) are presented, as well as the effects on sectoral output and domestic absorption (the sum of household and government consumption, investment and intermediate demand). The effects on factor incomes and welfare are also reported. The results presented are primarily percentage changes from the baseline for selected years 2015, 2020 and 2024, with some changes also described in value terms (2014 US\$) in the text or tables. The three years presented represent immediate, medium-term and long-term impacts of phased-in reductions in trade barriers¹⁰.

Baseline

Table 5 presents the baseline sources of total imports and markets for total exports for the U.S. and EU28 through 2024. The projected sources of U.S. imports indicate declining import shares of EU28, Japan, and rest of world (ROW) and increasing share of China. Likewise, the projected shares of the U.S., Japan and ROW decline as sources of EU28 imports. In the case of the projected U.S. exports, the shares of EU28 and Japan decline, while the shares of China and ROW increase. For EU28 exports, the U.S. share declines, while ROW increases, with small

¹⁰ The series of annual results from 2015 to 2024 are available from the authors upon request.

declines for China and Japan. Thus, the model projections for total trade show continuation of declining bilateral U.S.-EU28 shares, similar to the declining shares of merchandise trade from 2000-2014 shown in Table 2.

Effects of Trade Barrier Reduction within TTIP

Trade Effects. Table 6 summarizes the percentage change effects from the baseline on the total real value of exports within TTIP and for non-TTIP across the four trade barrier reduction scenarios¹¹. The results are presented separately for agriculture/food and non-agriculture in Table 7. The results of the TTIP 90-0 scenario indicate noticeable improvements over time in U.S. exports to EU28, rising from 0.5 percent from the baseline in 2015 (Table 6) to 2.3 percent in 2024 (US\$ 9.7 billion in the model's 2014 prices, not shown in the table)¹². EU28 exports to the U.S. improve by 0.4 percent from the baseline in 2015 to 1.7 percent in 2024 (US\$ 8.1 billion). However, there are smaller trade diversion effects in non-TTIP as well as within EU28.

The TTIP 90-20 simulation was conducted in two cases. In the first case the reduction in the trade barriers was across-the-board, while in the second in non-agriculture only. The results in Table 6 indicates larger trade effects within TTIP than for only tariff reductions. The trade effects are also about 15 percent higher under the TTIP 90-20 first case compared to the second. For example, U.S. exports to EU28 in 2024 improve by 6.2 percent relative to the baseline (US\$ 26.4 billion) under the across-the-board trade barrier reduction. The increase is 5.4 percent (US\$ 23.0 billion) under the non-agriculture only scenario.¹³ Similar differences can be observed in the

¹¹ The real values of exports were derived as nominal export values deflated by the 2014 export price index. In the earlier (April 2016) version of the paper, nominal values were reported.

¹² The results in 2014 prices were derived as the difference between simulation and baseline values, both deflated by their corresponding 2014 export price index.

¹³ Trade effects are shown in percentage change from baseline for the separate EU28 countries in Appendix B, Table 17, and for the non-TTIP countries/regions in Appendix B, Table 18 for the 90-20 (all sectors) and 90-90 scenarios. The largest gains for within TTIP trade (intra-EU28 plus with the U.S.) are by Great Britain (0.82 percent) followed by Germany, Italy and Finland. Except for a slight gain by Africa, total exports of non-TTIP countries/regions decline in all cases. The largest effects are shown for industrialized countries (Canada, Mexico, Japan and Korea).

improvement of EU28 exports to the U.S. Exports of EU28 to the U.S. in 2024 improve by 7.5 percent (US\$ 36.0 billion) under the across-the-board simulation, while only 6.7 percent (US\$ 32.6 billion) under the non-agriculture only scenario. These results indicate that the potential trade effects of a possible TTIP agreement on tariffs and NTMs would largely be dominated by the reduction in the trade barriers across non-agricultural products as they comprise the bulk of the trade flows between these two economies, even though in percentage terms agriculture/food exports show large increases in the scenarios with reductions in relatively high agriculture/food barriers include in the simulation of reductions for all sectors (Table 7).

In the TTIP 90-0 scenario, the percentage improvement in U.S. exports to EU28 is higher than the increase in exports of EU28 to the U.S. However, in the TTIP 90-20 scenario, the relative effects are reversed. This is largely due to the differences in the levels of AVE of NTMs in agriculture and non-agriculture between the two economies. Agricultural tariffs and Ave of NTMs in EU28 are generally higher compared to the U.S. and likewise for non-agricultural tariffs, but estimated non-agricultural AVE of NTMs are higher in the U.S. compared to EU28, as noted above (Table 3). Thus, when only tariffs are reduced, gains in U.S. agricultural and non-agricultural exports to the EU28 both exceed gains in EU28 exports to the U.S. (Table 7). An across-the-board TTIP 90-20 reduction in the trade barriers results in a 34.9 percent increase in 2024 in U.S. agricultural exports to EU28, which exceeds the 17.5 percent increase in EU28 agricultural exports to the U.S. In the case of non-agriculture, however, U.S. exports to EU28 improve by 5.5 percent in 2024, lower than the 7.0 percent increase in EU28 exports to the U.S. Even so, the effect of the TTIP 90-20 trade barrier reductions on total U.S. exports worldwide exceeds the effect on EU28

total exports worldwide because of relatively higher trade diversion effects in EU28 which consist of decreased intra-EU28 trade and EU28 trade with non-TTIP¹⁴.

There is practically no change in agricultural exports in both directions under the TTIP 90-20 non-agriculture only scenario (Table 7). U.S. agricultural exports to EU28 improve marginally by 0.26 percent in 2024, but total U.S. agriculture/food exports decline slightly (0.07 percent) while EU28 agricultural exports to the U.S. decline slightly by 0.17 percent and total agricultural exports by 0.09 percent. The marginal declines reflect resource movements (increasing over time as shown in the results) from agricultural exports to non-agricultural exports as indicated by a slightly higher increase of non-agricultural EU28 exports to the U.S. under the TTIP 90-20 non-agriculture only scenario (7.038 percent in 2024) compared to the 90-20 all sector simulation (7.029 percent) and by slightly higher total non-agriculture exports by the U.S. and the EU28.

The export effects under the TTIP 90-20 across-the-board scenario are magnified by multiple times under the ambitious TTIP 90-90 scenario. U.S. agricultural exports to EU28 increase by 195.8 percent relative to the baseline in 2024, while EU28 agricultural exports to the U.S. improve by 78.5 percent (Table 7). U.S. non-agricultural exports to EU28 improve by 20.3 percent in 2024, which is lower than the 32.0 percent increase in EU28 non-agricultural exports to the U.S. in 2024. There are trade diversion effects in non-TTIP as well as within EU28, but they are considerably less in percentage terms than the trade creation effects within TTIP. In sum, Table 6 indicates that U.S. total exports to EU28 will improve by 25.0 percent relative to the baseline in

¹⁴ The percentage decreases in U.S. trade with non-TTIP shown in Tables 6 and 7 exceed the percentage decreases for intra-EU28 and EU28 to non-TTIP trade, however the share of trade in the latter two categories is larger, resulting in the worldwide effects reported. For example, in the 2024 baseline the share of the total U.S. non-agricultural exports outside of TTIP is 78.5 percent, whereas the combined share of intra-EU non-agricultural exports and EU28 non-agricultural exports to non-TTIP is 93.1 percent.

2024 (US\$ 106.4 billion in 2014 prices), while the EU28 total exports to the U.S. will increase by 34.0 percent (US\$ 164.1 billion).

Sectoral Effects. The analysis includes the effects of the reduction in trade barriers on sectoral exports, imports, production, and domestic absorption. Table 8 presents the sectoral results of the TTIP 90-0 scenario, Table 9 of TTIP 90-20, Table 10 of TTIP 90-20 non-agriculture only, and Table 11 of TTIP 90-90. The results presented are the percentage changes from the baseline of the real values of the four variables. In analyzing the results, however one should note that the sectoral results on exports and imports are the total effects; they include both the positive trade creation and negative trade diversion effects at the sectoral level.

In terms of exports of agricultural commodities and food, total exports of the U.S. improve except in the case where agricultural trade barriers are retained under the TTIP 90-20 non-agriculture only scenario. Under the TTIP 90-0 tariff-only scenario, U.S. exports of sugar and milk show the highest improvement. If NTMs are also reduced together with tariffs, U.S. exports other food items indicate a similar percentage increase to milk and sugar, with the effects for all three sectors larger than from reduction of tariffs only. The pattern of changes in agricultural exports at the sectoral level as trade barriers are reduced is generally not the same for the EU28. The effects are similar under the 90-20 non-agriculture only scenario (where all agricultural commodity exports decline in both economies). However, while all U.S. agricultural commodity exports improve in the other three scenarios in EU28 it is only the exports of milk, other food items and other agriculture (for tariff reduction only) that indicate an improvement relative to the baseline.

In terms of exports of non-agricultural products, the effects in the U.S. and EU28 are generally similar. In all scenarios, exports of utilities, construction, and services (sectors for which trade barriers are not evaluated or reduced) indicate either a small decline or a small positive effect.

Exports of almost all manufacturing sectors in both economies improve, and, not surprisingly, the increase is higher as the trade barriers are aggressively reduced, which indicates resource movements from less tradeable sectors towards more tradeable manufacturing sectors.

In terms of imports of the U.S. and EU28, levels almost all increase in all of the liberalization scenarios. Among agricultural commodities, U.S. imports of milk indicate a surge over time relative to the rest of the agricultural commodities in all scenarios which include agricultural liberalization.

In the U.S., higher agricultural imports displace agricultural production in some sectors despite the improvement in exports. This is especially true in the case of the TTIP 90-0 tariff-only reduction where only the meat sector indicates higher production. Likewise, in the EU28 only milk production expands in the TTIP 90-20 scenario. However, as the trade barrier reduction is aggressively pursued (the 90-90 scenario), except for milk, all agricultural production improves.

A similar pattern occurs for non-agricultural production, which generally improves except for a few sectors in both economies as the trade barrier reduction is aggressively pursued. The positive sectoral production effects under the TTIP 90-90 scenario are much higher those under the TTIP 90-20 and TTIP 90-0 scenarios. However, there are sectors where production decline such as extraction, metal, and construction.

Sectoral domestic absorption in agriculture in both economies generally improve in all scenarios, and the increase is higher as the trade barrier reduction intensifies. Except for a few sectors, domestic absorption in non-agriculture improves as well. In the U.S. domestic absorption declines in the extraction, wood and paper, machinery and electronics, and construction, while in EU28 construction has negative change relative to the baseline.

Consumer Prices and Factor Income Effects. The effects on consumer prices in the U.S. and EU28 across the scenarios are presented in Table 12. In both economies, the reduction in the trade barriers leads to lower consumer prices over time across the scenarios.

The sources of household incomes in the model are income from skilled labor, unskilled labor, capital and land. In the U.S. model baseline for 2014, 30.5 percent of household income comes from skilled labor, 39.0 percent from unskilled labor and 29.7 percent from capital. The structure of household income in EU28 is slightly different: 20.7 percent from skilled labor, 28.8 percent from unskilled labor and 49.6 percent from capital. In both economies the percentage of household income from land is small.

The results in Table 12 are changes in real factor incomes (net of changes in consumer prices) relative to the baseline. In both economies, the trade barrier reduction scenarios lead to higher real income from the three major sources, labor (skilled and unskilled) and capital over time. However, in some periods, real income from land (which includes returns to natural resources in this analysis) declines slightly in both economies.

Welfare Effects. The welfare effects in the U.S. and EU28 are measured in terms of equivalent variations (EV). The welfare effects over time across all scenarios presented in Table 13 are expressed in US\$ billion in 2014 prices and as percentages of GDP.

In the TTIP 90-0 tariff only reduction, the EV increases from US\$ 1 billion in 2015 to US\$ 6.2 billion in 2024. The welfare effects in EU28 are relatively smaller both in dollar values (US\$3.7 billion in 2024) and as a percent to GDP. With more aggressive liberalization, (the TTIP 90-90 scenario), the EV in the U.S. is US\$ 82.7 billion (0.4 percent of GDP) and in EU28 US\$ 64.3 billion (0.3 percent of GDP).

U.S and EU28 Trade Trajectory under TTIP. Figures 1 to 4 show the effects on U.S.-EU28 bilateral trade as shares of their global totals under the TTIP 90-20 and TTIP 90-90 scenarios compared with the baseline trajectories summarized in Table 5. The baseline trends indicate decreasing bilateral shares between the U.S. and EU28 as described earlier. The highest decline is in the share of the U.S. as market for EU28 exports (Figure 4), which decreases by 25.3 percent from the baseline share of 20.0 percent in 2014 to 14.9 percent in 2024. The least decline is in the share of the U.S. as a source of EU28 imports (Figure 3), which decreases by 10.1 percent from 13.0 percent in 2014 to 11.6 percent in 2024.

Both TTIP 90-20 and TTIP 90-90 scenarios improve the bilateral trade between the U.S. and EU28 from the baseline, but the former does not arrest the decline in the baseline trend. The ambitious TTIP 90-90 scenario increases the bilateral trade between the economies enough, especially in the first half of the 2015-2024 period that the share of the U.S. as a market for EU28 exports improves 41.3 percent in 2024 compared to the baseline. The other bilateral trade shares also remain above 2014 baseline levels through 2024.

Comparing our Results with Other Studies. Table 14 compares long-run results (in our case for 2024) for bilateral U.S.-EU trade with those reviewed earlier from various other studies for scenarios of tariff only (our TTIP 90-0) and tariffs and moderate NTM reductions (our TTIP 90-20). The scenarios are broadly comparable: mostly complete tariff elimination versus our 90 percent reduction, or tariff reductions combined with similar moderate reductions of 20 or 25 percent in the AVE of NTMs. One notable difference in the scenarios is that we did not include NTM reduction in the service sector in the analysis while Bureau et al. (2014) and CEPR (2013), reduced the AVE of NTMs in services.

Looking at the comparative results, our assessment of the effects of TTIP on U.S.-EU trade are generally lower compared with the percentage changes from the baseline of the other studies. For the tariff-only scenario, the percentage changes in total exports both from the U.S. to EU and EU to U.S. are lower compared to Bureau et al. and CEPR: a 2.3 percent increase in U.S. exports to EU in our case versus 11.1 percent and 12.4 percent, respectively, and a 1.7 percent improvement in EU exports to the U.S. in our results compared to 10.8 percent and 6.6 percent, respectively.

In terms of agriculture/food, similar to our results Bureau et al. and CEPR also indicate relatively higher improvement in exports from the U.S. to EU compared to from EU to the U.S. The increases in Bureau et al. are highest among these three studies (30.7 increase in agriculture/food exports from the U.S. to EU and 18.5 percent from EU to the U.S.) but lower than Beckman et al. (2015) for U.S. exports to EU.

In terms of non-agricultural goods exports, in Bureau et al. U.S. exports to EU increase by 15.5 percent and EU exports to the U.S. by 16.3 percent, while services trade is little affected in the tariff-only scenario. The CEPR results indicate a relatively higher increase in U.S. exports to EU (18.4 percent) compared to EU exports to the U.S. (9.9 percent). Our results are similar to CEPR in terms of relative increase by direction of trade, but are lower in magnitude: 2.1 percent increase in U.S. exports to EU28 and 1.5 percent improvement in EU28 to the U.S.

Our results under the scenario which combines tariff elimination with partial reduction in NTMs are also smaller compared with the results presented in the other studies. Again, our assessment of the effects on percentage change in total trade are lower than those of Bureau et al. and CEPR: compared to these studies only about one-sixth as much for U.S. exports to the EU and less than one-quarter for EU exports to the U.S. One reason is that we did not include changes in

NTMs in services in the simulation, while Bureau et al. and CEPR incorporated reduction in service sector NTMs, but this difference only partly explains the difference in results.¹⁵ The Bureau et al., Disdier et al.(2016) and CEPR studies all report greater percentage increases in U.S. agricultural exports to the EU than the reverse in the tariffs and NTMs reduction scenario, with levels of the increase for the U.S. to EU exceeding 100 percent in the first two studies compared to 49.3 percent in CEPR. We also find a larger percentage increase in U.S. exports to the EU than the reverse, with the percentage increase for the U.S. smaller than CEPR. For agricultural exports from the EU to the U.S., our results are only about one-half the level of CEPR. Our study, Bureau et al. and CEPR find a much greater percentage increase in trade for agriculture/food than for non-agriculture, whereas CEPR finds the opposite and more similar levels. Beckman et al. (2015) and Disdier et al. report only results for agriculture/food. For Beckman et al. the results are for complete elimination of the identified NTMs. They show U.S. agriculture/food exports increasing by 69.2 percent, less than Bureau et al. and Disdier et al., which in the latter two cases are for less ambitious reductions in a broader set of NTMs. Beckman et al. show the smallest increase of EU agricultural exports to the U.S. among the studies.

Taken together these results show that while there are clear indications of possible favorable effects of TTIP on both the U.S. and EU28, the magnitude of the improvements vary significantly across studies in relative and absolute terms.

5. Conclusions

The trade relationship between the U.S. and EU28, remains strong. However, the share of goods and services traded between these economies has declined relative to their global trade over

¹⁵ For example, excluding services, utilities and construction from the baseline and 90-20 scenario results raises our percent change from baseline for total U.S. exports to EU28 from 6.2 percent to 10.1 percent and from EU28 to U.S. from 7.5 percent to 10.8 percent.

the past one and a half decades, largely because of the emergence of China as a major trade partner. Our CGE baseline simulation indicates that this trend will likely continue with the share of trade between the U.S. and EU28 declining further while China continues to accumulate increased shares as a source of U.S. and EU28 imports.

The paper argues that trade between the U.S. and EU28 is constrained by current trade barriers. Several research papers in the literature on TTIP also argue similarly. While tariff rates on non-agricultural products are relatively low, tariffs on a few agricultural products (sugar, milk and meat) are still high. In addition, our estimation results indicate high AVE of NTMs in these economies. Various studies have also found high NTM trade barriers between these two economies, although there are variations in the estimates of AVE both on average for agriculture/food versus non-agriculture and at the specific sectoral level.

The ultimate goal of TTIP is to promote and increase the flow of trade and investment across the Atlantic through increasing market access achieved by a reduction in the trade barriers between the U.S. and EU28 and other measures. The objective of this paper has been to provide an assessment using a global CGE model of the potential economic effects of reducing the trade barriers. We incorporated tariffs calculated from the GTAP 8 database and our econometric estimates of the AVE of NTMs as trade barriers into the model and conducted four trade barrier reduction scenarios over the period 2015-2024.

In our first scenario, where we nearly eliminated tariffs only across the board (90 percent reduction over 10 years for all sectors) and retained all NTMs, the trade creation effects within TTIP will lead to higher exports compared to the baseline of U.S. to EU28 by 2.3 percent in 2024, and EU28 exports to the U.S. by 1.7 percent. There are also trade diversion effects where exports of the U.S. and EU28 to non-TTIP countries, as well as the intra-EU28 exports, will decline.

In the analysis, EU28 has relatively higher tariffs and NTM trade barriers in agriculture than the U.S., while the U.S. has relatively higher trade barriers in non-agriculture when NTM effects are included. Comparison of the results of the first scenario (tariff only) and second scenario (with 90 percent tariff reduction and 20 percent reduction of AVE of NTMs) reflect these differences in protection. Both scenarios indicate relatively higher U.S.-EU28 bilateral export effects in agriculture for the U.S. than EU28, with the reverse for non-agricultural trade in the second scenario.

The flow of trade of goods and services across the Atlantic is dominated by non-agricultural products. Thus, changes in these trade flows will depend largely on the reduction in the trade barriers in non-agriculture, despite higher levels of agricultural barriers. The results in the second and the third scenarios demonstrate these effects. Both scenarios involve a 90 percent reduction in tariffs and 20 percent reduction in the AVE of NTMs. The second scenario involves an across-the-board reduction in the trade barriers while the third scenario entails a reduction in non-agriculture only. The overall exports effects differ by about 15 percent. In the second scenario, exports of the U.S. to EU28 increase by 6.2 percent in 2024 compared to 5.4 percent in the third scenario, while exports of EU28 to the U.S. improve by 7.5 percent compared to 6.8 percent, respectively.

The results of the ambitious scenario where both tariffs and the AVE of NTMs were reduced by 90 percent indicate a substantial increase in bilateral trade between the two economies. Exports of the U.S. to EU28 improve by 25.0 percent in 2024, while EU28 exports to the U.S. by 34.0 percent. The trade diversion effects are also larger relative to the other scenarios.

An interesting outcome of our analysis concerns the declining share of U.S.-EU28 bilateral trade in total trade of these economies. The TTIP 90-20 scenario for reduction of trade barriers

improves the bilateral share modestly, but not enough to reverse a projected further decline. It takes the more dramatic TTIP 90-90 scenario of reductions to reverse the decline and improve the bilateral trade shares through 2024.

Compared to other studies reviewed in the paper, our estimates of the effects of TTIP on the U.S.-EU28 bilateral trade are on the low side under both the TTIP 90-0 scenario of tariff only reductions and the TTIP 90-20 scenario of reduction of tariffs and NTM effects. For example, the percent increases in overall bilateral trade between U.S. and EU28 are less than generated by Bureau et al. (2014) or CEPR (2013). Our results indicate higher increases in the value of the bilateral agricultural exports compared to non-agricultural exports, with the magnitude of the improvement closer to CEPR than Bureau et al. The analysis of Beckman et al. (2015) and Disdier et al. (2016) also indicate higher increases in U.S. agricultural exports to EU compared to our results, but the estimate by Beckman et al. for the increase in EU agricultural exports to the U.S. is lower. All this shows that while there are clear indications of potential favorable effects of TTIP on levels of U.S.-EU28 bilateral trade, the magnitude of the improvements vary substantially.

Several research issues can be addressed to further develop the analysis of this preliminary paper. These include recalibrating the model to the 2011 GTAP 9.1 database; re-estimating the gravity equations for AVE of NTMs using this recent database or using alternative approaches to the estimation of AVEs; following developments in the literature to incorporate estimates of AVE of NTMs into the model by allocating them among tariffs, export taxes and efficiency losses; and modify the baseline scenario to include existing or potential U.S. and EU28 RTAs with countries/regions outside of TTIP. Each of these extensions would provide additional insights into the effect a TTIP agreement could have on production, absorption, trade, prices, factor returns and welfare in the U.S, EU28 and elsewhere.

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Tables and Figures

Table 1. 2014 Direction of Merchandise Trade, U.S. and EU28

	Exports		Imports	
	US\$ billion	% share	US\$ billion	% share
United States				
Total	1,621	100.0	2,413	100.0
European Union 28	270	16.7	409	17.0
Rest of the World	1,350	83.3	2,004	83.0
European Union 28				
Total	6,240	100.0	6,181	100.0
United States	409	6.6	270	4.4
Intra-European Union 28	3,900	62.5	3,900	63.1
Rest of the World	1,931	30.9	2,011	32.5

Sources: United States Census Bureau and United Nations Comtrade

Table 2. Trends in Merchandise Imports and Markets for Exports, U.S. and EU28 (%)

	2000	2005	2010	2014	2000	2005	2010	2014
	Sources of U.S. Imports				Markets for U.S. Exports			
EU28	17.4	18.0	16.3	17.0	24.3	21.9	17.9	16.7
China	8.6	15.0	19.5	20.2	2.1	4.6	7.2	7.6
Japan	12.0	8.2	6.3	5.7	8.4	6.1	4.7	4.1
ROW	62.1	58.8	58.0	57.2	65.2	67.4	70.1	71.5
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Sources of EU28 Imports /a/				Markets for EU28 Exports/a/			
U.S.	20.8	13.1	11.3	11.9	28.0	23.1	17.9	17.5
China	7.5	13.2	18.5	17.6	3.0	4.8	8.4	9.3
Japan	9.3	6.1	4.4	3.2	5.4	4.0	3.2	3.0
ROW	62.4	67.7	65.8	67.4	63.6	68.1	70.6	70.2
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: United Nations Comtrade

/a/ Excludes intra-EU28 trade

Table 3. Applied Tariffs and AVE of NTMs between the U.S. and EU28 (%)

	United States				European Union 28			
	2014 baseline shares, %			AVE of NTMs	2014 baseline shares, %			AVE of NTMs
	Production	Imports	Tariffs		Production	Imports	Tariffs	
Agriculture/Food								
Cereals	0.28	0.14	1.91	96.34	0.22	0.31	5.71	45.26
Sugar	0.06	0.08	13.06	62.97	0.09	0.14	28.88	66.31
Milk	0.51	0.12	17.86	8.29	1.15	0.59	38.17	27.10
Meat	0.92	0.41	0.83	34.65	0.90	1.07	22.76	49.89
Other agriculture	0.61	1.45	4.59	49.04	0.71	1.54	3.76	86.90
Other food	1.94	3.00	3.34	35.36	2.96	4.04	12.99	81.02
Total/Average /a/	4.32	5.19	6.93	47.78	6.02	7.69	18.71	59.41
Non-Agricultural								
Extraction	1.11	11.32	0.18	16.51	0.91	7.58	0.45	15.78
Textile, apparel	0.76	6.54	6.91	19.76	1.48	5.18	7.06	8.00
Wood, paper	2.83	4.22	0.27	26.40	2.86	3.58	0.60	14.47
Petroleum & chemicals	5.95	13.68	1.75	21.51	8.09	18.64	2.31	12.11
Metal	2.31	5.56	1.26	22.00	3.71	7.38	2.19	12.23
Motor transportation	3.20	12.22	0.77	22.49	4.42	10.81	3.16	11.26
Machinery & electronics	5.24	25.75	0.74	22.53	6.59	17.59	1.13	13.29
All other manufacturing	0.26	3.79	1.25	25.42	0.88	1.77	1.30	13.77
Total /Average/a/	21.66	83.08	1.64	22.08	28.95	72.54	2.28	12.61
Utilities	2.48	0.18	n.a.	n.a.	1.93	0.75	n.a.	n.a.
Construction	7.32	0.11	n.a.	n.a.	8.59	0.57	n.a.	n.a.
Services	64.23	11.43	n.a.	n.a.	54.51	18.45	n.a.	n.a.
Total	74.02	11.72	n.a.	n.a.	65.03	19.77	n.a.	n.a.
Overall Total	100.00	100.00			100.00	100.00		

/a/ Total for production and import shares; simple average for tariffs and NTMs

n.a. not included in the analysis

Table 4. Estimates of AVE of NTMs in Various Studies (%)

Studies	Sectors	United States	European Union 28
Our results (2016) /a/	Agriculture	47.8	59.4
	Non-Agriculture	22.1	12.6
Disdier, et al. (2016) /a/	Agriculture	35.7	40.1
	Non-Agriculture	8.7	10.4
Arita, et al. (2015) /a/	Agriculture	55.7	41.0
	Non-Agriculture	n.a.	n.a.
Bureau, et al. (2014)	Agriculture	47.8	53.6
	Non-Agriculture		
	Products	11.4	13.4
Berden, et al. (2009) & CEPR (2013) /a/	Services /b/	43.0	31.0
	Agriculture	73.3	56.8
	Non-Agriculture		
	Goods	17.4	15.7
	Services	8.9	8.5

/a/ Simple average

/b/ Median AVE of NTMs

n.a. not reported in the cited paper

Table 5. Projected Baseline Imports and Markets for Exports, U.S. and EU28 (%)

	2014	2015	2020	2024	2014	2015	2020	2024
	Sources of U.S. Imports				Markets for U.S. Exports			
EU28	18.1	17.9	16.6	15.3	23.4	23.3	21.9	20.4
China	21.3	21.9	25.1	28.7	7.9	8.1	8.8	9.4
Japan	6.0	5.9	5.3	4.7	5.9	5.8	5.0	4.3
ROW	54.7	54.3	53.0	51.3	62.7	62.8	64.3	65.9
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Sources of EU28 Imports*				Markets for EU28 Exports*			
U.S.	13.0	12.9	12.4	11.6	20.0	19.5	17.3	14.9
China	19.5	20.2	23.6	27.8	8.0	8.0	7.8	7.8
Japan	4.3	4.2	3.8	3.4	3.8	3.6	3.0	2.4
ROW	63.2	62.6	60.2	57.3	68.3	68.8	71.9	74.9
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Excludes intra-EU28 trade

Table 6. Effects on Real Values of Exports in TTIP and Non-TTIP (% change from the baseline)

	2014Base Share,%	90-0			90-20						90-90		
		2015	2020	2024	All			Non-Agriculture only			2015	2020	2024
					2015	2020	2024	2015	2020	2024			
TTIP													
Total exports	100.0	0.021	0.078	0.088	0.049	0.241	0.347	0.043	0.214	0.307	0.295	1.356	1.693
Within TTIP	59.5	0.056	0.220	0.272	0.130	0.681	1.055	0.117	0.610	0.942	0.783	3.684	4.902
Non-TTIP	40.5	-0.029	-0.104	-0.117	-0.069	-0.321	-0.442	-0.063	-0.291	-0.400	-0.415	-1.647	-1.923
United States													
Total exports	100.0	0.064	0.222	0.241	0.138	0.619	0.818	0.121	0.545	0.721	0.798	3.291	3.731
Within TTIP	23.4	0.502	1.889	2.278	0.912	4.320	6.197	0.807	3.790	5.403	4.541	19.856	24.984
Non-TTIP	76.6	-0.069	-0.252	-0.294	-0.099	-0.437	-0.603	-0.088	-0.380	-0.513	-0.352	-1.562	-2.069
European Union 28													
Total exports	100.0	0.010	0.036	0.040	0.025	0.131	0.197	0.023	0.118	0.175	0.163	0.788	1.036
Within TTIP	68.7	0.017	0.061	0.066	0.061	0.331	0.523	0.056	0.304	0.481	0.451	2.091	2.762
Within EU28	60.9	-0.027	-0.105	-0.131	-0.049	-0.235	-0.334	-0.043	-0.207	-0.293	-0.247	-1.037	-1.249
United States	7.8	0.361	1.375	1.679	0.918	4.803	7.459	0.830	4.341	6.750	5.821	25.986	33.970
Non-TTIP	31.3	-0.005	-0.011	-0.004	-0.051	-0.248	-0.338	-0.047	-0.235	-0.328	-0.453	-1.700	-1.828
Non-TTIP													
Total exports	100.0	-0.001	-0.006	-0.007	-0.005	-0.026	-0.034	-0.005	-0.024	-0.032	-0.040	-0.165	-0.185
TTIP	41.1	-0.009	-0.034	-0.037	-0.027	-0.137	-0.191	-0.024	-0.124	-0.175	-0.186	-0.805	-0.954
Non-TTIP	58.9	0.004	0.011	0.010	0.010	0.041	0.049	0.009	0.037	0.044	0.062	0.225	0.226

Table 7. Effects on Real Values of Agriculture/Food and Non-Agriculture Exports in TTIP and Non-TTIP (% change from the baseline)

	90-0			90-20						90-90		
				All			Non-Agriculture Only					
	2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
Agriculture/Food:												
TTIP												
Total exports	0.041	0.157	0.185	0.076	0.379	0.554	-0.010	-0.058	-0.088	0.414	2.470	3.521
Within TTIP	0.096	0.406	0.521	0.185	1.002	1.588	0.002	0.008	0.018	1.028	6.325	9.482
Non-TTIP	-0.049	-0.185	-0.214	-0.101	-0.482	-0.686	-0.029	-0.144	-0.207	-0.592	-2.950	-3.831
United States												
Total exports	0.103	0.372	0.442	0.200	0.973	1.448	-0.012	-0.052	-0.073	1.152	7.076	10.226
Within TTIP	2.348	9.770	12.226	4.339	22.924	34.899	0.035	0.191	0.263	23.269	137.886	195.804
Non-TTIP	-0.084	-0.328	-0.405	-0.146	-0.694	-1.034	-0.016	-0.070	-0.097	-0.755	-4.307	-6.081
European Union 28												
Total exports	0.024	0.091	0.102	0.042	0.192	0.258	-0.010	-0.059	-0.091	0.209	0.987	1.225
Within TTIP	0.035	0.137	0.160	0.071	0.358	0.523	0.001	0.002	0.010	0.400	1.878	2.410
Within EU	-0.039	-0.162	-0.203	-0.074	-0.382	-0.575	0.002	0.011	0.022	-0.391	-2.110	-2.911
United States	1.164	4.697	5.886	2.264	11.531	17.513	-0.023	-0.135	-0.168	12.162	58.347	78.511
Non-TTIP	-0.011	-0.034	-0.029	-0.052	-0.255	-0.337	-0.044	-0.222	-0.316	-0.411	-1.472	-1.525
Non-TTIP												
Total exports	-0.005	-0.016	-0.016	-0.010	-0.043	-0.054	0.009	0.045	0.065	-0.061	-0.241	-0.260
TTIP	-0.042	-0.161	-0.196	-0.086	-0.454	-0.695	0.060	0.309	0.481	-0.500	-2.741	-3.751
Non-TTIP	0.008	0.026	0.029	0.017	0.079	0.113	-0.003	-0.006	-0.001	0.100	0.510	0.650
Non-Agriculture:												
TTIP												
Total exports	0.020	0.072	0.081	0.047	0.231	0.332	0.047	0.234	0.335	0.286	1.273	1.559
Within TTIP	0.053	0.206	0.254	0.126	0.657	1.015	0.126	0.655	1.011	0.764	3.484	4.558
Non-TTIP	-0.028	-0.099	-0.110	-0.067	-0.310	-0.425	-0.065	-0.302	-0.414	-0.403	-1.556	-1.792
United States												
Total exports	0.062	0.212	0.230	0.133	0.595	0.781	0.132	0.595	0.790	0.772	3.002	3.262
Within TTIP	0.458	1.707	2.050	0.830	3.885	5.522	0.825	3.871	5.516	4.081	16.758	20.346
Non-TTIP	-0.067	-0.244	-0.284	-0.094	-0.413	-0.564	-0.094	-0.409	-0.551	-0.315	-1.303	-1.704
European Union 28												
Total exports	0.009	0.032	0.036	0.024	0.127	0.192	0.026	0.130	0.193	0.160	0.771	1.016
Within TTIP	0.016	0.055	0.059	0.060	0.329	0.523	0.061	0.329	0.519	0.455	2.108	2.790
Within EU	-0.026	-0.100	-0.125	-0.047	-0.223	-0.314	-0.047	-0.225	-0.320	-0.234	-0.945	-1.108
United States	0.326	1.234	1.501	0.861	4.514	7.029	0.866	4.530	7.038	5.550	24.553	31.995
Non-TTIP	-0.005	-0.009	-0.002	-0.051	-0.248	-0.339	-0.047	-0.236	-0.329	-0.455	-1.713	-1.846
NonTTIP												
Total exports	-0.001	-0.005	-0.006	-0.005	-0.025	-0.033	-0.005	-0.027	-0.036	-0.038	-0.159	-0.179
TTIP	-0.008	-0.030	-0.034	-0.025	-0.129	-0.180	-0.027	-0.134	-0.188	-0.177	-0.757	-0.893
Non-TTIP	0.004	0.010	0.009	0.009	0.039	0.046	0.009	0.039	0.046	0.060	0.209	0.206

Table 8. Effects on Sectoral Real Values in the U.S. and EU28 under 90-0 Scenario (% change from the baseline)

	United States			European Union 28			United States			European Union 28		
	2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
Agriculture/Food:	Exports						Imports					
Cereals	0.0399	0.1117	0.1055	-0.0313	-0.1097	-0.1211	-0.0179	-0.0447	-0.0305	0.0528	0.2062	0.2537
Sugar	0.2560	1.1371	1.3789	-0.0037	-0.0189	-0.0268	0.0503	0.2079	0.2755	0.0200	0.0844	0.1079
Milk	0.2781	1.4115	1.8993	0.1549	0.6331	0.7347	3.0390	12.9168	16.3444	0.0051	0.0663	0.1340
Meat	0.1548	0.6857	0.8588	-0.0238	-0.1038	-0.1298	0.0374	0.1341	0.1647	0.0744	0.3346	0.4301
Other agri.	0.0325	0.0749	0.0800	0.0139	0.0748	0.0958	0.0690	0.3072	0.4037	0.0206	0.0717	0.0827
Other food	0.1710	0.6146	0.7026	0.0232	0.0782	0.0824	0.1502	0.5675	0.6919	0.0415	0.1649	0.2079
Non-Agriculture:												
Extraction	0.0203	0.0459	0.0467	-0.0027	-0.0199	-0.0247	0.0018	0.0033	-0.0149	0.0024	0.0126	0.0212
Textile, apparel	0.1746	0.6808	0.8388	0.1390	0.5437	0.6514	0.1075	0.3475	0.3157	0.0065	0.0162	0.0065
Wood, paper	-0.0105	-0.0550	-0.0820	-0.0016	-0.0061	-0.0071	0.0436	0.1769	0.2351	0.0046	0.0126	0.0101
Petro., chem.	0.1266	0.4025	0.4036	0.0167	0.0707	0.0971	0.1229	0.4721	0.5951	0.0224	0.0799	0.0902
Metal	0.0490	0.1507	0.1411	0.0050	0.0083	-0.0037	0.0867	0.3521	0.4765	0.0030	0.0079	0.0090
Motor transp.	0.2343	0.8856	1.0658	-0.0150	-0.0737	-0.1108	0.0391	0.1280	0.1460	0.0432	0.1670	0.2073
Mach.& elect.	0.0178	0.0391	0.0173	0.0063	0.0222	0.0280	0.0489	0.1795	0.2165	0.0038	0.0042	-0.0069
All other mfg.	0.0287	0.0822	0.0630	0.0870	0.2717	0.2442	0.0529	0.1707	0.1722	0.0160	0.0411	0.0243
Utilities	-0.0243	-0.0888	-0.1011	0.0014	0.0074	0.0103	0.0344	0.1279	0.1528	0.0072	0.0217	0.0210
Construction	-0.0319	-0.1256	-0.1576	-0.0133	-0.0486	-0.0558	0.0280	0.1156	0.1575	-0.0073	-0.0392	-0.0588
Services	-0.0280	-0.1134	-0.1493	0.0005	0.0068	0.0138	0.0377	0.1534	0.2050	0.0019	0.0007	-0.0064
Agriculture/Food:	Production						Domestic Absorption					
Cereals	-0.0051	-0.0330	-0.0434	-0.0169	-0.0702	-0.0888	-0.0227	-0.0884	-0.1005	0.0027	0.0052	0.0016
Sugar	-0.0076	-0.0198	-0.0161	-0.0033	-0.0164	-0.0231	-0.0036	-0.0094	-0.0059	0.0030	0.0105	0.0113
Milk	-0.0867	-0.3360	-0.3880	0.0279	0.1103	0.1249	-0.0188	-0.0784	-0.0921	0.0139	0.0565	0.0663
Meat	0.0177	0.0815	0.1069	-0.0163	-0.0790	-0.1057	0.0100	0.0439	0.0584	0.0038	0.0114	0.0107
Other agri.	-0.0027	-0.0214	-0.0284	-0.0021	-0.0048	-0.0057	0.0077	0.0326	0.0436	0.0036	0.0092	0.0072
Other food	-0.0043	-0.0100	-0.0050	0.0003	-0.0023	-0.0069	0.0084	0.0322	0.0413	0.0063	0.0230	0.0269
Non-Agriculture:												
Extraction	-0.0013	-0.0193	-0.0243	-0.0004	-0.0050	-0.0070	-0.0004	-0.0104	-0.0235	0.0016	0.0078	0.0130
Textile, apparel	-0.0497	-0.1442	-0.1009	0.0708	0.2807	0.3380	0.0196	0.0809	0.1112	0.0234	0.0872	0.0939
Wood, paper	-0.0094	-0.0359	-0.0412	-0.0008	-0.0031	-0.0040	-0.0016	-0.0051	-0.0024	0.0005	0.0003	-0.0012
Petro., chem.	-0.0002	-0.0127	-0.0312	0.0007	0.0100	0.0230	0.0076	0.0269	0.0322	0.0029	0.0107	0.0130
Metal	-0.0124	-0.0359	-0.0301	-0.0052	-0.0271	-0.0422	0.0037	0.0201	0.0334	-0.0057	-0.0274	-0.0394
Motor transp.	0.0831	0.3373	0.4339	-0.0225	-0.1005	-0.1410	0.0365	0.1461	0.1900	0.0041	0.0109	0.0085
Mach.& elect.	-0.0168	-0.0693	-0.0924	-0.0005	-0.0024	-0.0008	0.0045	0.0174	0.0251	-0.0022	-0.0131	-0.0205
All other mfg.	-0.0313	-0.0988	-0.1064	0.0184	0.0582	0.0550	0.0184	0.0649	0.0791	0.0051	0.0159	0.0147
Utilities	0.0018	0.0089	0.0154	0.0013	0.0048	0.0054	0.0022	0.0103	0.0170	0.0016	0.0057	0.0062
Construction	-0.0071	-0.0238	-0.0221	-0.0086	-0.0386	-0.0517	-0.0069	-0.0231	-0.0211	-0.0086	-0.0386	-0.0519
Services	0.0007	0.0028	0.0047	0.0008	0.0029	0.0035	0.0021	0.0084	0.0123	0.0007	0.0020	0.0015

Agri=agriculture;petro=petroleum;chem=chemicals;transp=transportation; mach=machinery;elect.=electronics;mfg=manufacturing
Domestic absorption is sum of intermediate demand, household and government consumption and investments

Table 9. Effects on Sectoral Real Values in the U.S. and EU28 under 90-20 Scenario (% change from the baseline)

	United States			European Union 28			United States			European Union 28		
	2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
Agriculture/Food:	Exports						Imports					
Cereals	0.0818	0.3843	0.5296	-0.0802	-0.4051	-0.5843	0.0179	0.1535	0.2957	0.1206	0.6478	1.0044
Sugar	0.3539	1.9072	2.7531	-0.0258	-0.1520	-0.2501	0.0465	0.2401	0.4076	0.0431	0.2273	0.3502
Milk	0.3049	1.6525	2.3385	0.1468	0.5952	0.6762	3.1409	13.7876	17.9978	0.0162	0.1395	0.2619
Meat	0.2030	1.0439	1.4804	-0.0267	-0.1247	-0.1595	0.0972	0.4986	0.7438	0.1043	0.5389	0.7843
Other agri.	0.1355	0.6304	1.0226	-0.0052	-0.0194	-0.0469	0.1367	0.7557	1.2204	0.0818	0.4655	0.7669
Other food	0.3269	1.6071	2.3286	0.0671	0.3297	0.4664	0.3604	1.8735	2.8863	0.0828	0.4404	0.6921
Non-Agriculture:												
Extraction	0.1135	0.5159	0.7190	-0.0060	-0.0508	-0.0761	-0.0179	-0.1434	-0.3161	0.0182	0.1267	0.2318
Textile, apparel	0.2254	0.9679	1.3160	0.1429	0.6002	0.7667	0.1170	0.4198	0.4168	0.0286	0.1423	0.1999
Wood, paper	0.0530	0.2655	0.3578	0.0125	0.0636	0.0801	0.1124	0.5840	0.9231	0.0271	0.1487	0.2377
Petro., chem.	0.2212	0.8774	1.0380	0.0472	0.2792	0.4675	0.2766	1.4523	2.3187	0.0433	0.1957	0.2649
Metal	0.1251	0.5410	0.6707	0.0126	0.0421	0.0122	0.1543	0.8271	1.4166	0.0262	0.1449	0.2352
Motor transp.	0.3319	1.4579	1.9689	0.0333	0.2076	0.3218	0.1347	0.6766	1.0369	0.0726	0.3475	0.5081
Mach. & elect.	0.1166	0.5866	0.8520	0.0237	0.1089	0.1390	0.0854	0.3413	0.4028	0.0307	0.1555	0.2238
All other mfg.	0.1666	0.8783	1.3769	0.2092	0.9159	1.0591	0.0914	0.3390	0.3215	0.0580	0.2653	0.3327
Utilities	-0.0095	-0.0262	-0.0233	-0.0123	-0.0681	-0.1089	0.0238	0.0964	0.1387	0.0302	0.1500	0.2185
Construction	-0.0230	-0.1161	-0.2051	-0.0421	-0.2081	-0.2957	-0.0173	-0.0999	-0.1094	0.0155	0.0807	0.1180
Services	-0.0087	-0.0387	-0.0910	-0.0250	-0.1285	-0.1814	0.0103	0.0458	0.1199	0.0267	0.1372	0.1991
Agriculture/Food:	Production						Domestic Absorption					
Cereals	0.0025	0.0273	0.0585	-0.0389	-0.2185	-0.3385	-0.0256	-0.0980	-0.1074	0.0071	0.0272	0.0345
Sugar	-0.0067	-0.0145	-0.0046	-0.0111	-0.0653	-0.1062	-0.0048	-0.0126	-0.0034	0.0049	0.0214	0.0286
Milk	-0.0861	-0.3333	-0.3796	0.0290	0.1177	0.1386	-0.0163	-0.0618	-0.0600	0.0164	0.0726	0.0945
Meat	0.0231	0.1259	0.1907	-0.0167	-0.0871	-0.1199	0.0154	0.0827	0.1291	0.0091	0.0433	0.0653
Other agri.	0.0023	0.0183	0.0426	-0.0222	-0.1349	-0.2275	0.0077	0.0438	0.0712	0.0117	0.0522	0.0757
Other food	-0.0179	-0.0772	-0.0948	0.0054	0.0241	0.0311	0.0177	0.0899	0.1407	0.0135	0.0687	0.1051
Non-Agriculture:												
Extraction	-0.0015	-0.0377	-0.0665	-0.0027	-0.0311	-0.0427	-0.0149	-0.1192	-0.2385	0.0113	0.0737	0.1361
Textile, apparel	-0.0377	-0.0821	0.0498	0.0692	0.2886	0.3626	0.0287	0.1392	0.2210	0.0320	0.1445	0.1938
Wood, paper	-0.0229	-0.1161	-0.1662	-0.0002	-0.0036	-0.0109	-0.0067	-0.0374	-0.0528	0.0036	0.0178	0.0267
Petro., chem.	-0.0179	-0.1473	-0.3019	0.0118	0.0988	0.2053	0.0107	0.0385	0.0438	0.0100	0.0574	0.0980
Metal	-0.0285	-0.1265	-0.1643	-0.0063	-0.0407	-0.0853	-0.0033	-0.0151	-0.0121	-0.0006	-0.0026	-0.0105
Motor transp.	0.0858	0.3752	0.5230	0.0077	0.0747	0.1270	0.0524	0.2377	0.3412	0.0236	0.1273	0.1956
Mach. & elect.	-0.0113	-0.0198	0.0162	0.0029	0.0078	-0.0003	0.0072	0.0286	0.0398	0.0067	0.0366	0.0579
All other mfg.	-0.0118	0.0863	0.3787	0.0408	0.1726	0.1868	0.0394	0.1794	0.2455	0.0173	0.0866	0.1251
Utilities	0.0034	0.0162	0.0307	0.0031	0.0193	0.0353	0.0037	0.0171	0.0318	0.0054	0.0307	0.0521
Construction	-0.0269	-0.1455	-0.2207	-0.0103	-0.0515	-0.0712	-0.0269	-0.1455	-0.2206	-0.0096	-0.0478	-0.0658
Services	0.0037	0.0175	0.0270	-0.0009	-0.0047	-0.0048	0.0041	0.0193	0.0315	0.0020	0.0105	0.0176

Agri=agriculture;petro=petroleum;chem=chemicals;transp=transportation; mach=machinery;elect.=electronics;mfg=manufacturing
Domestic absorption is sum of intermediate demand, household and government consumption and investments

Table 10. Effects on Sectoral Real Values in the U.S. and EU28 under 90-20 Non-Agriculture Only Scenario (% change from the baseline)

	United States			European Union 28			United States			European Union 28		
	2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
Agriculture/Food:	Exports						Imports					
Cereals	-0.0030	-0.0114	-0.0135	-0.0175	-0.1047	-0.1679	0.0081	0.0466	0.0717	0.0134	0.0729	0.1131
Sugar	-0.0354	-0.1501	-0.2161	-0.0207	-0.1222	-0.2016	0.0279	0.1322	0.2289	0.0198	0.1049	0.1647
Milk	-0.0210	-0.0825	-0.1155	-0.0154	-0.0896	-0.1454	0.0083	0.0163	0.0494	0.0125	0.0620	0.0932
Meat	-0.0220	-0.0965	-0.1447	-0.0153	-0.0856	-0.1304	0.0387	0.1827	0.2898	0.0174	0.0890	0.1345
Other agri.	-0.0093	-0.0541	-0.0722	-0.0183	-0.1043	-0.1571	0.0132	0.0816	0.1417	0.0161	0.0836	0.1207
Other food	-0.0134	-0.0520	-0.0765	-0.0180	-0.0991	-0.1488	0.0164	0.0701	0.1206	0.0202	0.1045	0.1550
Non-Agriculture:												
Extraction	0.1133	0.5155	0.7187	-0.0050	-0.0465	-0.0738	-0.0179	-0.1425	-0.3124	0.0183	0.1257	0.2290
Textile, apparel	0.2228	0.9563	1.3022	0.1435	0.5945	0.7438	0.1180	0.4228	0.4176	0.0269	0.1365	0.1957
Wood, paper	0.0532	0.2721	0.3731	0.0134	0.0656	0.0796	0.1140	0.5860	0.9194	0.0251	0.1399	0.2270
Petro., chem.	0.2204	0.8766	1.0411	0.0488	0.2848	0.4712	0.2779	1.4553	2.3195	0.0424	0.1917	0.2603
Metal	0.1244	0.5475	0.6917	0.0150	0.0507	0.0190	0.1560	0.8303	1.4154	0.0253	0.1404	0.2291
Motor transp.	0.3304	1.4589	1.9812	0.0347	0.2111	0.3213	0.1362	0.6786	1.0322	0.0710	0.3405	0.4988
Mach.& elect.	0.1150	0.5897	0.8721	0.0263	0.1185	0.1476	0.0875	0.3468	0.4033	0.0287	0.1468	0.2123
All other mfg.	0.1624	0.8676	1.3779	0.2122	0.9261	1.0701	0.0926	0.3400	0.3152	0.0554	0.2547	0.3196
Utilities	-0.0101	-0.0250	-0.0164	-0.0118	-0.0678	-0.1116	0.0240	0.0917	0.1262	0.0278	0.1386	0.2041
Construction	-0.0235	-0.1121	-0.1920	-0.0412	-0.2054	-0.2951	-0.0138	-0.0891	-0.1021	0.0120	0.0664	0.1010
Services	-0.0108	-0.0440	-0.0921	-0.0234	-0.1245	-0.1807	0.0126	0.0501	0.1169	0.0244	0.1282	0.1889
Agriculture/Food:	Production						Domestic Absorption					
Cereals	0.0003	0.0008	0.0043	-0.0046	-0.0301	-0.0476	0.0021	0.0089	0.0164	0.0013	0.0044	0.0074
Sugar	-0.0010	0.0006	0.0031	-0.0056	-0.0343	-0.0565	0.0034	0.0191	0.0324	0.0027	0.0118	0.0175
Milk	0.0051	0.0280	0.0474	-0.0002	-0.0038	-0.0065	0.0058	0.0302	0.0513	0.0021	0.0092	0.0141
Meat	0.0018	0.0109	0.0212	-0.0022	-0.0140	-0.0203	0.0051	0.0262	0.0454	0.0032	0.0152	0.0239
Other agri.	-0.0010	-0.0116	-0.0142	-0.0056	-0.0374	-0.0584	0.0043	0.0206	0.0354	0.0035	0.0128	0.0156
Other food	0.0039	0.0226	0.0382	-0.0021	-0.0137	-0.0198	0.0067	0.0336	0.0566	0.0050	0.0244	0.0371
Non-Agriculture:												
Extraction	-0.0016	-0.0367	-0.0634	-0.0026	-0.0314	-0.0443	-0.0150	-0.1181	-0.2349	0.0113	0.0727	0.1333
Textile, apparel	-0.0410	-0.0978	0.0282	0.0687	0.2799	0.3388	0.0275	0.1332	0.2123	0.0309	0.1374	0.1818
Wood, paper	-0.0219	-0.1096	-0.1553	-0.0001	-0.0048	-0.0147	-0.0056	-0.0315	-0.0441	0.0030	0.0142	0.0207
Petro., chem.	-0.0183	-0.1476	-0.2998	0.0124	0.1002	0.2049	0.0108	0.0390	0.0454	0.0099	0.0558	0.0951
Metal	-0.0279	-0.1157	-0.1407	-0.0045	-0.0346	-0.0811	-0.0022	-0.0053	0.0076	0.0001	-0.0010	-0.0108
Motor transp.	0.0854	0.3789	0.5353	0.0087	0.0768	0.1260	0.0528	0.2414	0.3480	0.0231	0.1242	0.1900
Mach.& elect.	-0.0116	-0.0133	0.0371	0.0046	0.0139	0.0049	0.0080	0.0353	0.0519	0.0061	0.0334	0.0523
All other mfg.	-0.0156	0.0755	0.3760	0.0416	0.1742	0.1872	0.0390	0.1765	0.2399	0.0166	0.0828	0.1189
Utilities	0.0033	0.0157	0.0305	0.0030	0.0175	0.0319	0.0035	0.0165	0.0315	0.0051	0.0282	0.0478
Construction	-0.0249	-0.1342	-0.2035	-0.0118	-0.0578	-0.0798	-0.0249	-0.1343	-0.2034	-0.0111	-0.0544	-0.0747
Services	0.0031	0.0147	0.0232	-0.0011	-0.0068	-0.0088	0.0035	0.0166	0.0277	0.0016	0.0077	0.0129

Agri=agriculture;petro=petroleum;chem=chemicals;transp=transportation; mach=machinery;elect.=electronics;mfg=manufacturing
Domestic absorption is sum of intermediate demand, household and government consumption and investments

Table 11. Effects on Sectoral Real Values in the U.S. and EU28 under 90-90 Scenario (% change from the baseline)

	United States			European Union 28			United States			European Union 28		
	2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
Agriculture/Food:	Exports						Imports					
Cereals	0.4689	2.5020	3.1901	-0.5108	-2.1938	-2.6139	0.3864	2.6071	3.8185	0.7352	3.7659	5.1058
Sugar	1.3550	10.6385	16.1871	-0.2186	-0.9290	-1.1892	0.0084	0.4965	1.1990	0.2491	1.1778	1.5852
Milk	0.5517	3.3851	4.7516	0.0751	0.3599	0.4283	3.9964	18.5675	24.7667	0.1152	0.6014	0.8564
Meat	0.6595	4.1326	5.8735	-0.0458	-0.1170	-0.0696	0.6343	2.9993	3.7634	0.3733	1.9768	2.7142
Other agri.	1.1473	6.3706	9.4519	-0.1664	-0.4107	-0.3748	0.7873	4.7309	6.9762	0.6516	3.6609	5.2655
Other food	1.8741	12.1490	17.2324	0.4690	2.1462	2.6000	2.2225	10.2126	13.3494	0.4648	2.6099	3.7510
Non-Agriculture:												
Extraction	0.9339	3.4117	3.7389	-0.0312	-0.2191	-0.3031	-0.1844	-0.9636	-1.5841	0.1596	0.8785	1.2694
Textile, apparel	0.6829	2.8512	3.5862	0.1777	1.0187	1.4561	0.1894	0.7293	0.7132	0.2230	0.9179	1.0655
Wood, paper	0.6215	2.3191	2.3768	0.1463	0.6602	0.7297	0.7072	2.9842	3.9569	0.2228	0.9447	1.1979
Petro., chem.	1.0532	3.7445	3.7822	0.3203	1.6408	2.2665	1.6068	7.1777	9.7166	0.2238	0.8610	0.9909
Metal	0.8068	3.0076	3.0294	0.0849	0.3453	0.2494	0.7291	3.4736	5.3075	0.2304	0.9774	1.2409
Motor transp.	1.1936	4.9318	5.8726	0.4617	2.0463	2.5255	0.9540	3.7386	4.6467	0.3279	1.4000	1.7730
Mach.& elect.	0.9985	4.0408	4.6264	0.1814	0.7494	0.8412	0.3854	1.0499	0.8524	0.2651	1.0316	1.1698
All other mfg.	1.4006	6.0164	7.6354	1.3094	5.3991	5.5125	0.4214	1.2769	0.8773	0.4275	1.6208	1.6913
Utilities	0.1300	0.4278	0.3529	-0.1315	-0.5115	-0.6122	-0.0778	-0.1787	-0.0020	0.2336	0.9618	1.1492
Construction	0.0553	-0.1481	-0.6256	-0.2973	-1.2403	-1.4751	-0.4359	-1.7127	-1.7309	0.2148	0.7620	0.8055
Services	0.1725	0.5396	0.3004	-0.2501	-0.9744	-1.0786	-0.2442	-0.7701	-0.4613	0.2474	1.0045	1.1603
Agriculture/Food:	Production						Domestic Absorption					
Cereals	0.0766	0.6074	0.9142	-0.2371	-1.2293	-1.6511	-0.0452	0.0360	0.2389	0.0465	0.1693	0.1814
Sugar	0.0110	0.2865	0.5422	-0.0803	-0.3829	-0.5184	-0.0086	0.1497	0.3470	0.0217	0.0855	0.0992
Milk	-0.0787	-0.2818	-0.2908	0.0381	0.1701	0.2142	0.0064	0.0555	0.1096	0.0391	0.1786	0.2333
Meat	0.0723	0.4619	0.6947	-0.0192	-0.1123	-0.1503	0.0627	0.3364	0.4830	0.0569	0.2717	0.3638
Other agri.	0.0559	0.6436	1.1390	-0.2074	-1.1486	-1.6316	0.0085	0.1845	0.3594	0.0865	0.3753	0.4681
Other food	-0.1255	-0.1240	0.1864	0.0505	0.1692	0.1538	0.1014	0.5147	0.7243	0.0792	0.3966	0.5380
Non-Agriculture:												
Extraction	-0.0021	-0.1508	-0.3041	-0.0226	-0.1987	-0.2266	-0.1382	-0.7468	-1.1896	0.0982	0.5116	0.7443
Textile, apparel	0.0776	0.4220	0.8629	0.0558	0.3861	0.5864	0.1083	0.4848	0.6769	0.1088	0.5146	0.6782
Wood, paper	-0.1433	-0.6670	-0.8652	0.0082	0.0513	0.0473	-0.0547	-0.3101	-0.4198	0.0315	0.1399	0.1733
Petro., chem.	-0.1674	-0.9085	-1.4716	0.1121	0.6964	1.1108	0.0377	0.0953	0.0529	0.0726	0.3503	0.4942
Metal	-0.1637	-0.6690	-0.8678	-0.0128	-0.0640	-0.1696	-0.0644	-0.2892	-0.3803	0.0456	0.1752	0.1689
Motor transp.	0.1115	0.5662	0.7698	0.2761	1.2322	1.5213	0.1839	0.6533	0.7676	0.1947	0.8392	1.0492
Mach.& elect.	0.0420	0.2722	0.3785	0.0352	0.1332	0.1212	0.0235	-0.0569	-0.1736	0.0840	0.3237	0.3788
All other mfg.	0.1737	1.3714	2.7361	0.2441	1.0037	0.9688	0.2221	0.8504	0.9358	0.1251	0.5327	0.6427
Utilities	0.0183	0.0610	0.0737	0.0196	0.1188	0.1903	0.0170	0.0573	0.0715	0.0389	0.1954	0.2798
Construction	-0.2158	-1.1586	-1.5558	-0.0281	-0.2121	-0.3094	-0.2172	-1.1641	-1.5609	-0.0215	-0.1857	-0.2790
Services	0.0304	0.1052	0.1076	-0.0156	-0.0560	-0.0488	0.0217	0.0774	0.0909	0.0132	0.0615	0.0873

Agri=agriculture;petro=petroleum;chem=chemicals;transp=transportation;mach=machinery;elect.=electronics;mfg=manufacturing
Domestic absorption is sum of intermediate demand, household and government consumption and investments

Table 12. Effects on Consumer Prices and Factor Incomes (% change from the baseline)

	2014 sources of household income, %	90-20											
		90-0			All			90-20 Non-agriculture			90-90		
		2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
United States													
Consumer prices		-0.0117	-0.0462	-0.0617	-0.0241	-0.1263	-0.2112	-0.0221	-0.1151	-0.1938	-0.1324	-0.6128	-0.8838
Real factor incomes:													
Skilled labor	30.51	0.0126	0.0516	0.0727	0.0252	0.1323	0.2284	0.0230	0.1215	0.2130	0.1334	0.5898	0.8557
Unskilled labor	38.95	0.0122	0.0503	0.0718	0.0237	0.1249	0.2180	0.0217	0.1152	0.2039	0.1224	0.5405	0.7947
Capital	29.67	0.0111	0.0455	0.0652	0.0242	0.1253	0.2138	0.0224	0.1157	0.1986	0.1407	0.6220	0.8698
Land	0.87	-0.0225	-0.1137	-0.1522	0.0082	-0.0523	-0.2010	-0.0041	-0.1061	-0.2711	0.3340	1.1422	0.4840
European Union 28													
Consumer prices		-0.0072	-0.0279	-0.0341	-0.0167	-0.0852	-0.1299	-0.015	-0.0762	-0.117	-0.1001	-0.4391	-0.5681
Real factor incomes:													
Skilled labor	20.71	0.0075	0.0278	0.0328	0.0175	0.0894	0.1391	0.0153	0.0777	0.1212	0.1055	0.4728	0.6288
Unskilled labor	28.77	0.0072	0.0260	0.0297	0.0176	0.0890	0.1372	0.0156	0.0785	0.1215	0.1088	0.4797	0.6288
Capital	49.64	0.0072	0.0298	0.0388	0.0162	0.0855	0.1321	0.0147	0.0776	0.1212	0.0958	0.4307	0.5636
Land	0.88	0.0021	0.0320	0.0409	-0.0317	-0.1321	-0.1670	0.0067	0.0193	0.0238	-0.3393	-1.3435	-1.3632

Table 13. Effects on Welfare

	90-20											
	90-0			All			Non-Agriculture Only			90-90		
	2015	2020	2024	2015	2020	2024	2015	2020	2024	2015	2020	2024
EV US\$ billion (2014 prices)												
United States	1.01	4.42	6.24	2.08	11.71	20.08	1.81	10.15	17.50	11.42	56.94	82.72
European Union 28	0.71	2.91	3.67	1.58	8.75	14.22	1.36	7.43	12.08	9.28	45.87	64.31
EV% GDP												
United States	0.0063	0.0241	0.0309	0.0129	0.0637	0.0995	0.0113	0.0552	0.0867	0.0711	0.3112	0.4121
European Union 28	0.0040	0.0148	0.0175	0.0089	0.0446	0.0676	0.0076	0.0379	0.0575	0.0520	0.2342	0.3064

EV is equivalent variation

Figure 1. Projected Share of EU28 as Source of U.S. Imports

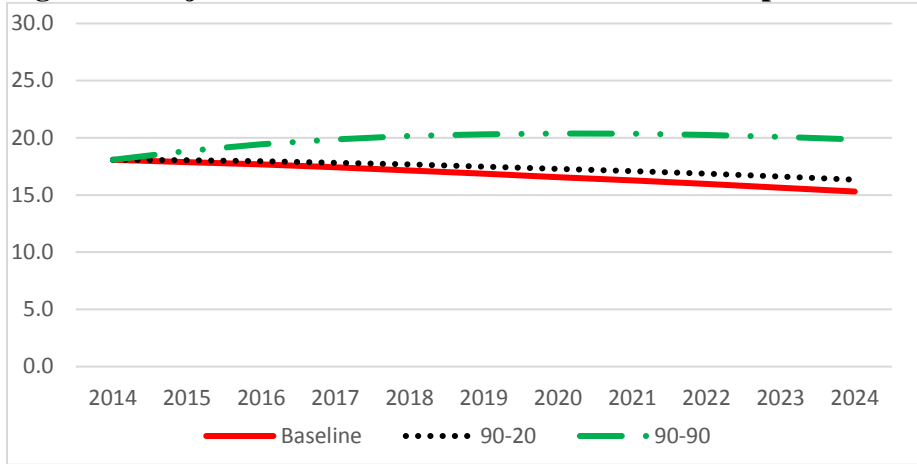


Figure 2. Projected Share of EU28 as Market for U.S. Exports

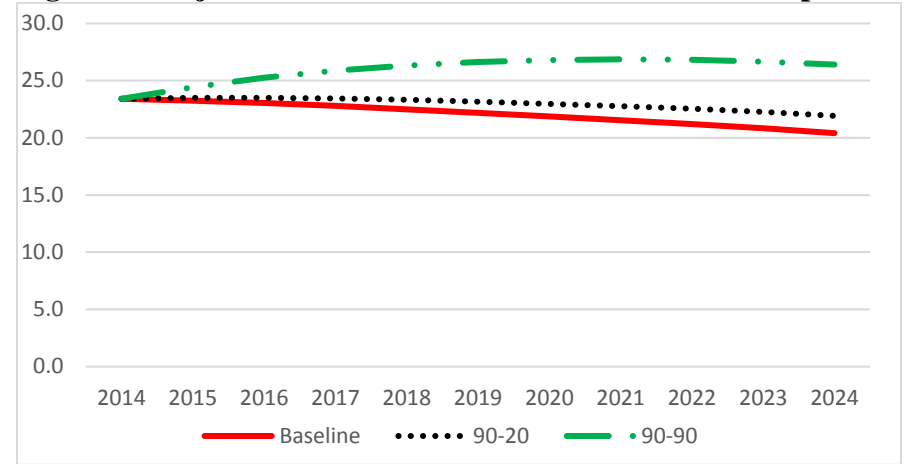


Figure 3. Projected Share of U.S. as Source of EU28 Imports

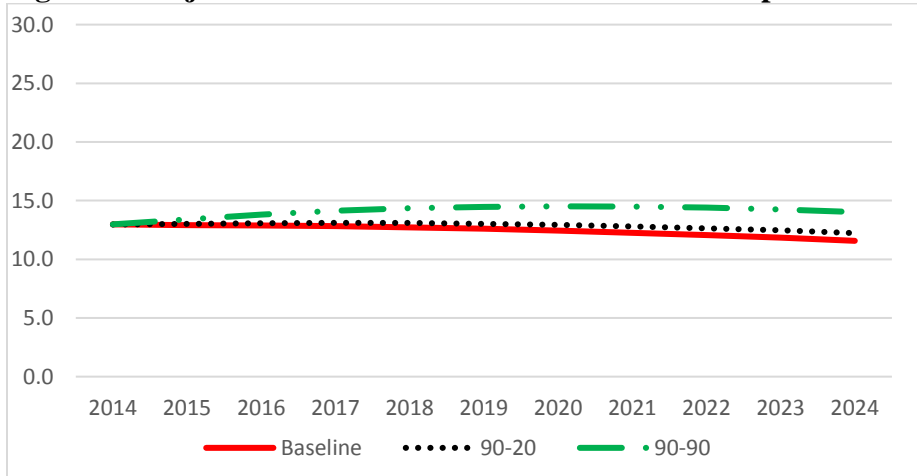


Figure 4. Projected Share of U.S. as Market for EU28 Exports

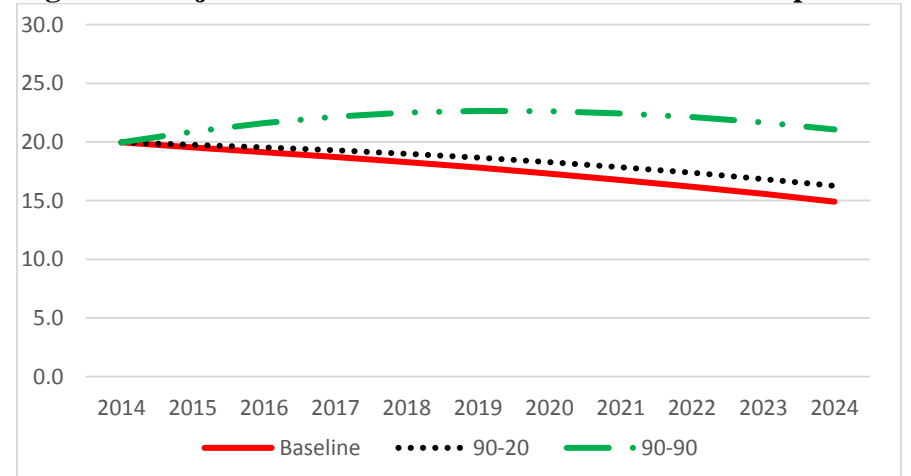


Table 14. Comparison of Our Long-Run U.S.-EU28 Bilateral Export Results with Other Studies

Studies	Sectors/Changes in exports from baseline	Scenario			
		Tariff only /a/		Tariff and NTMs /b/	
		U.S. to EU	EU to U.S.	U.S. to EU	EU to U.S.
Our results (2016)	Agriculture				
	% change	12.22	5.89	34.90	17.51
	<i>Value (US\$ billion)</i>	1.20	1.16	3.43	3.44
	Non-agriculture				
	% change	2.05	1.50	5.52	7.03
	<i>Value (US\$ billion)</i>	8.53	6.96	22.97	32.58
Total					
	% change	2.28	1.68	6.20	7.50
	<i>Value (US\$ billion)</i>	9.70	8.11	26.39	36.03
Disdier et al. (2016)	Agriculture				
	% change	n.a.	n.a.	159.00	55.50
	<i>Value (US\$ billion)</i>	n.a.	n.a.	34.90	11.50
Beckman et al. (2015)	Agriculture				
	% change /c/	39.52	3.77	69.20	9.46
	<i>Value (US\$ billion)</i>	5.48	0.80	9.59	2.00
Bureau et al. (2014)	Agriculture				
	% change	30.70	18.50	116.30	56.40
	<i>Value (US\$ billion)</i>	7.08	4.27	26.83	13.00
	Non-agriculture				
	Industry (products)				
	% change	15.50	16.30	41.20	41.80
	<i>Value (US\$ billion)</i>	52.20	38.15	133.21	114.45
	Services				
	% change	-0.50	0.40	15.60	26.80
	<i>Value (US\$ billion)</i>	-0.83	0.63	24.24	42.31
Total					
	% change	11.10	10.80	36.60	37.30
	<i>Value (US\$ billion)</i>	58.44	43.05	184.29	169.77
CEPR (2013)	Agriculture				
	% change /c/	29.96	10.79	49.32	36.94
	<i>Value (€ billion)</i>	3.15	4.43	5.19	15.15
	Non-agriculture /c/				
	Goods				
	% change	18.42	9.94	53.29	41.91
	<i>Value (€ billion)</i>	51.00	38.68	147.52	163.21
	Services				
	% change	-0.25	0.31	4.33	3.64
	<i>Value (€ billion)</i>	-0.37	0.74	6.40	8.61
Total					
	% change	12.36	6.57	36.57	28.03
	<i>Value (€ billion)</i>	53.78	43.84	159.10	186.97

/a/ 90 percent reduction in our case and similar scenarios from other studies as described in the text

/b/ Our 90-20 scenario (all sectors) and most-similar scenarios from other studies as described in the text

/c/ Our calculation from reported baseline total values and simulation changes in total values (Beckman et al.) or reported simulation values and percent changes from baseline for the sectors within each category (CEPR)

n.a. not reported in (or easily calculated from) the cited paper

Appendix A: Global TTIP-CGE Mapping to GTAP 8

Table 15. Sectoral Mapping

Our Model	Code	GTAP 8	Our Model	Code	GTAP 8
Cereals	pdr	Paddy rice	Wood, paper and others	lum	Wood products
	wht	Wheat		ppp	Paper products-publishing
	gro	Cereal grains nec	Petroleum, chemicals, others	p_c	Petroleum-coal products
	pcr	Processed rice		crp	Chemical-rubber-plastic prods
Sugar	sgr	Sugar	nmm	Mineral products nec	
	c_b	Sugar cane-sugar beet	Metal	i_s	Ferrous metals
Milk	rmk	Raw milk		nfm	Metals nec
	mil	Dairy products		fmp	Metal products
Meat	oap	Animal products nec	Motor transportation	mvh	Motor vehicles-parts
	cmt	Meat-cattle-sheep-goats-horse		otn	Transport equipment nec
	omt	Meat products nec	Machinery and electronics	ele	Electronic equipment
Other Agriculture	v_f	Vegetables-fruit-nuts		ome	Machinery-equipment nec
	osd	Oil seeds	All other manufacturing	omf	Manufactures nec
	pfb	Plant-based fibers		Utilities	ely
	ocr	Crops nec	gdt		Gas manufacture-distribution
	ctl	Cattle-sheep-goats-horses	wtr		Water
Other Food	vol	Vegetable oils-fats	Construction	cns	Construction
	ofd	Food products nec	Services	trd	Trade
	b_t	Beverages-tobacco products		otp	Transport nec
Extraction	wol	Wool-silk-worm cocoons	wtp	Sea transport	
	frs	Forestry	atp	Air transport	
	fsh	Fishing	cmn	Communication	
	coa	Coal	ofi	Financial services nec	
	oil	Oil	isr	Insurance	
	gas	Gas	obs	Business services nec	
	omn	Minerals nec	ros	Recreation-other services	
	Textile, apparel, leather	tex	Textiles	osg	Public Admin., Def., Health, Edu.
wap		Wearing apparel	dwe	Dwellings	
lea		Leather products			

Table 16. Country/Regional Mapping

Our Model	Code	GTAP 8	Our Model	Code	GTAP 8
Austria	AUT	Austria	Africa	EGY	Egypt
Belgium	BEL	Belgium		MAR	Morocco
Luxembourg	LUX	Luxembourg		TUN	Tunisia
Denmark	DNK	Denmark		XNF	Rest of North Africa
Finland	FIN	Finland		CMR	Cameroon
France	FRA	France		CIV	Cote d'Ivoire
Germany	DEU	Germany		GHA	Ghana
Ireland	IRL	Ireland		NGA	Nigeria
Italy	ITA	Italy		SEN	Senegal
Netherlands	NLD	Netherlands		XWF	Rest of Western Africa
Portugal	PRT	Portugal		XCF	Central Africa
Spain	ESP	Spain		XAC	South Central Africa
Sweden	SWE	Sweden		ETH	Ethiopia
United Kingdom	GBR	United Kingdom		KEN	Kenya
Rest of EU28	BGR	Bulgaria		MDG	Madagascar
	HRV	Croatia		MWI	Malawi
	ROU	Romania		MUS	Mauritius
	GRC	Greece		MOZ	Mozambique
	CYP	Cyprus		TZA	Tanzania
	CZE	Czech Republic		UGA	Uganda
	EST	Estonia	ZMB	Zambia	
	HUN	Hungary	ZWE	Zimbabwe	
	LVA	Latvia	XEC	Rest of Eastern Africa	
	LTU	Lithuania	BWA	Botswana	
MLT	Malta	NAM	Namibia		

	POL	Poland	ZAF	South Africa	
	SVK	Slovakia	XSC	Rest of South African Custom	
	SVN	Slovenia			
United States	USA	United States of America	Rest of the World	AUS	Australia
Canada	CAN	Canada		NZL	New Zealand
Mexico	MEX	Mexico		XOC	Rest of Oceania
China	CHN	China		HKG	Hong Kong
Japan	JPN	Japan		MNG	Mongolia
South Korea	KOR	Korea		TWN	Taiwan
ASEAN	KHM	Cambodia		XEA	Rest of East Asia
	IDN	Indonesia		XSE	Rest of Southeast Asia
	LAO	Lao Peoples Dem. Rep.		BGD	Bangladesh
	MYS	Malaysia		IND	India
	PHL	Philippines		NPL	Nepal
	SGP	Singapore		PAK	Pakistan
	THA	Thailand		LKA	Sri Lanka
	VNM	Viet Nam		XSA	Rest of South Asia
Latin America	ARG	Argentina		XNA	Rest of North America
	BOL	Bolivia		CHE	Switzerland
	BRA	Brazil		NOR	Norway
	CHL	Chile		XEF	Rest of EFTA
	COL	Colombia		ALB	Albania
	ECU	Ecuador		BLR	Belarus
	PRY	Paraguay		RUS	Russian Federation
	PER	Peru		UKR	Ukraine
	URY	Uruguay		XEE	Rest of Eastern Europe
	VEN	Venezuela		XER	Rest of Europe
	XSM	Rest of South America		KAZ	Kazakhstan
	CRI	Costa Rica		KGZ	Kyrgyzstan
	GTM	Guatemala		XSU	Rest of Former Soviet Union
	HND	Honduras		ARM	Armenia
	NIC	Nicaragua		AZE	Azerbaijan
	PAN	Panama		GEO	Georgia
	SLV	El Salvador		BHR	Bahrain
	XCA	Rest of Central America		IRN	Iran Islamic Republic of
	XCB	Caribbean		ISR	Israel
				KWT	Kuwait
				OMN	Oman
				QAT	Qatar
				SAU	Saudi Arabia
				TUR	Turkey
				ARE	United Arab Emirates
				XWS	Rest of Western Asia
				XTW	Rest of the World

Appendix B: Export Effects Among EU28 and non-TTIP Countries/Regions

Table 17. Effects on Real Values of Exports within EU28 under 90-20 and 90-90 Scenarios (% change from the baseline)

	Base share, %	2015	2020	2024	Base share, %	2015	2020	2024	Base share, %	2015	2020	2024
<i>90-20 (All)</i>												
	Austria				France				Portugal			
Exports	100.0	0.026	0.152	0.252	100.0	0.024	0.127	0.196	100.0	0.021	0.104	0.153
Within TTIP	77.0	0.056	0.329	0.553	70.2	0.059	0.332	0.536	77.5	0.050	0.263	0.407
To nonTTIP	23.0	-0.062	-0.294	-0.394	29.8	-0.045	-0.226	-0.307	22.5	-0.063	-0.291	-0.378
	Belgium				Germany				Spain			
Exports	100.0	0.038	0.179	0.251	100.0	0.035	0.176	0.257	100.0	0.009	0.051	0.077
Within TTIP	78.6	0.053	0.266	0.398	69.0	0.081	0.430	0.663	73.3	0.030	0.166	0.264
To nonTTIP	21.4	-0.006	-0.029	-0.026	31.0	-0.050	-0.246	-0.333	26.7	-0.037	-0.176	-0.233
	Luxembourg				Ireland				Sweden			
Exports	100.0	0.007	0.037	0.063	100.0	0.019	0.108	0.187	100.0	0.019	0.104	0.166
Within TTIP	77.3	0.018	0.099	0.155	79.3	0.050	0.302	0.550	65.6	0.066	0.371	0.596
To nonTTIP	22.7	-0.028	-0.130	-0.167	20.7	-0.083	-0.471	-0.783	34.4	-0.057	-0.277	-0.379
	Denmark				Italy				Great Britain			
Exports	100.0	0.021	0.105	0.153	100.0	0.024	0.111	0.152	100.0	0.039	0.205	0.312
Within TTIP	68.1	0.060	0.315	0.482	68.6	0.082	0.415	0.618	69.3	0.092	0.511	0.821
To nonTTIP	31.9	-0.051	-0.243	-0.332	31.4	-0.086	-0.395	-0.516	30.7	-0.063	-0.320	-0.460
	Finland				Netherlands				Rest of EU 28			
Exports	100.0	0.016	0.086	0.136	100.0	0.024	0.135	0.211	100.0	0.006	0.033	0.050
Within TTIP	60.7	0.073	0.412	0.662	76.5	0.047	0.268	0.435	77.2	0.018	0.101	0.158
To nonTTIP	39.3	-0.059	-0.292	-0.403	23.5	-0.036	-0.176	-0.236	22.8	-0.028	-0.133	-0.173
<i>90-90</i>												
	Austria				France				Portugal			
Exports	100.0	0.178	0.941	1.353	100.0	0.170	0.812	1.066	100.0	0.125	0.673	0.923
Within TTIP	77.0	0.422	2.091	2.949	70.2	0.487	2.246	2.969	77.5	0.319	1.563	2.117
To nonTTIP	23.0	-0.524	-1.978	-2.112	29.8	-0.454	-1.686	-1.785	22.5	-0.429	-1.551	-1.606
	Belgium				Germany				Spain			
Exports	100.0	0.179	0.872	1.127	100.0	0.214	0.985	1.264	100.0	0.067	0.381	0.526
Within TTIP	78.6	0.301	1.456	1.925	69.0	0.590	2.656	3.424	73.3	0.238	1.155	1.545
To nonTTIP	21.4	-0.181	-0.540	-0.416	31.0	-0.484	-1.807	-1.915	26.7	-0.324	-1.157	-1.183
	Luxembourg				Ireland				Sweden			
Exports	100.0	0.031	0.187	0.295	100.0	0.132	0.708	1.049	100.0	0.138	0.680	0.928
Within TTIP	77.3	0.127	0.598	0.803	79.3	0.394	1.974	2.914	65.6	0.542	2.493	3.286
To nonTTIP	22.7	-0.253	-0.936	-0.979	20.7	-0.733	-3.110	-3.983	34.4	-0.508	-1.938	-2.098
	Denmark				Italy				Great Britain			
Exports	100.0	0.139	0.650	0.827	100.0	0.131	0.600	0.742	100.0	0.277	1.303	1.676
Within TTIP	68.1	0.432	1.934	2.470	68.6	0.482	2.201	2.842	69.3	0.710	3.299	4.351
To nonTTIP	31.9	-0.395	-1.485	-1.620	31.4	-0.533	-2.081	-2.301	30.7	-0.553	-2.156	-2.442
	Finland				Netherlands				Rest of EU 28			
Exports	100.0	0.119	0.576	0.777	100.0	0.178	0.901	1.215	100.0	0.038	0.239	0.356
Within TTIP	60.7	0.612	2.800	3.680	76.5	0.383	1.858	2.494	77.2	0.151	0.739	0.995
To nonTTIP	39.3	-0.523	-2.035	-2.234	23.5	-0.373	-1.351	-1.378	22.8	-0.284	-0.987	-0.977

Table 18. Effects on Real Values of Exports in Non-TTIP under 90-20 and 90-90 Scenarios (% change from baseline)

	90-20 (All)				90-90									
	Base share, %	2015	2020	2024	Base share, %	2015	2020	2024	2015	2020	2024	2015	2020	2024
			Canada				Korea				Canada			Korea
Total exports	100.0	-0.029	-0.149	-0.211	100.0	-0.006	-0.030	-0.044	-0.200	-0.876	-1.051	-0.035	-0.145	-0.191
To TTIP	82.4	-0.050	-0.274	-0.426	29.5	-0.049	-0.241	-0.348	-0.372	-1.684	-2.170	-0.302	-1.227	-1.480
To nonTTIP	17.6	0.049	0.241	0.348	70.5	0.008	0.033	0.038	0.435	1.652	1.838	0.054	0.178	0.154
			Mexico				Latin America				Mexico			Latin America
Total exports	100.0	-0.019	-0.109	-0.169	100.0	-0.005	-0.022	-0.021	-0.129	-0.666	-0.922	-0.030	-0.109	-0.087
To TTIP	83.3	-0.040	-0.222	-0.357	46.0	-0.034	-0.178	-0.278	-0.295	-1.411	-1.927	-0.208	-0.984	-1.315
To nonTTIP	16.7	0.065	0.294	0.384	54.0	0.012	0.050	0.069	0.554	1.992	2.028	0.074	0.293	0.341
			ASEAN				Africa				ASEAN			Africa
Total exports	100.0	-0.005	-0.026	-0.033	100.0	-0.002	-0.005	0.001	-0.034	-0.171	-0.203	-0.005	-0.016	0.014
To TTIP	34.9	-0.023	-0.098	-0.104	58.2	-0.007	-0.041	-0.072	-0.159	-0.602	-0.571	-0.033	-0.195	-0.311
To nonTTIP	65.1	0.003	0.003	0.009	41.8	0.003	0.018	0.037	0.002	0.003	0.078	0.018	0.101	0.175
			China				Rest of the World				China			Rest of the World
Total exports	100.0	-0.004	-0.019	-0.026	100.0	0.000	-0.002	-0.003	-0.034	-0.132	-0.151	-0.014	-0.047	-0.014
To TTIP	48.0	-0.032	-0.153	-0.191	44.1	-0.002	-0.004	-0.010	-0.239	-0.947	-0.995	-0.024	-0.097	-0.135
To nonTTIP	52.0	0.019	0.080	0.081	55.9	0.001	0.002	0.003	0.135	0.472	0.403	0.002	0.047	0.080
			Japan								Japan			
Total exports	100.0	-0.011	-0.052	-0.074					-0.071	-0.278	-0.337			
To TTIP	36.2	-0.071	-0.362	-0.545					-0.499	-2.052	-2.519			
To nonTTIP	63.8	0.017	0.076	0.096					0.124	0.446	0.452			

Appendix C: Gravity-Border Effects Estimation of NTMs in the U.S. and EU28

The NTMs in the U.S. and EU28 were derived through a gravity model estimated using GTAP 8 and GeoDist databases.

In multiplicative form, the general formulation of a gravity equation is

$$(1) \quad X_{ij} = GS_iM_j\Phi_{ij}\varepsilon_{ij}$$

where X_{ij} is the monetary value of exports from i to j , G is a variable that does not depend on i or j , S_i comprises exporter-specific factors (such as the exporter's GDP) that represent the total amount exporters are willing to supply, M_j denotes all importer-specific factors that make up the total importer's demand (such as the importing country's GDP), Φ_{ij} represents the ease of exporter i to access market j (that is, the inverse of bilateral trade costs), and ε_{ij} is an error term.

Anderson and van Wincoop (2003) have shown that bilateral trade is determined by the relative trade costs, i.e. the propensity of country j to import from country i is determined by country j 's trade cost toward i relative to its overall "resistance" to imports (weighted average trade costs) and the average "resistance" facing exporters in country i (multilateral trade-resistance, MTR); not simply by the absolute trade costs between countries i and j . In particular, in a world with N countries and a variety of goods differentiated by the country of origin, a well-specified gravity equation is

$$(2) \quad X_{ij} = \frac{Y_i Y_j}{Y} \left(\frac{t_{ij}}{\pi_i P_j} \right)^{1-\sigma}$$

where Y denotes world GDP, Y_i and Y_j the GDP of countries i and j respectively, t_{ij} (one plus the tariff equivalent of overall trade costs) is the cost in j of importing a good from i , $\sigma > 1$ is the elasticity of substitution and Π_i and P_j represent exporter and importer ease of market access or country i 's outward and country j 's inward *multilateral resistance* terms. These terms have low values if a country is remote from world markets, remoteness being determined by physical factors such as physical distance from large markets as well as policy factors such as high tariff barriers or other trade costs. Equations (2) shows that in estimating a gravity model, one needs to control for the multilateral resistance terms, Π_i and P_j .

The standard procedure for estimating (1) is to convert its components in natural logarithmic form, i.e.,

$$(3) \quad \ln X_{ij} = \ln G + \ln S_i + \ln M_j + \ln \Phi_{ij} + \ln \varepsilon_{ij}$$

More specifically, the estimating equation is

$$(4) \quad \ln X_{ij} = a_0 + a_1 \ln Y_i + a_2 \ln Y_j + a_3 \ln t_{ij} + a_4 \ln \Pi_i + a_5 \ln P_j + \ln \varepsilon_{ij}$$

where a_0 is a constant, $a_3 = 1 - \sigma$ and ε_{ij} is an error term. In practice, the gravity equation relates the natural logarithm of the monetary value of trade between two countries to the natural logarithm of

their respective GDPs, a composite term measuring barriers and incentives to trade between them, and terms measuring barriers to trade between each of them and the rest of the world.

In general, trade costs take the form

$$(5) \quad t_{ij} = d_{ij}^{\rho} \cdot b_{ij}^{\delta_{ij}}$$

where d_{ij} is bilateral distance between i and j , and b_{ij} border costs. The ad valorem tariff equivalent (AVE_{ij}) of all trade barriers associated with the border is $(b_{ij} - 1)$. δ_{ij} is equal to zero if i and j are the same countries, and is equal to 1 if they are separate countries.

Substituting (5) into (4) will yield

$$(6) \quad \ln X_{ij} = a_0 + a_1 \ln Y_i + a_2 \ln Y_j + a_3 (\rho \ln d_{ij} + \delta_{ij} \ln b_{ij}) + a_4 \ln \Pi_i + a_5 \ln P_j + \ln \varepsilon_{ij}$$

The border coefficient is

$$(7) \quad a_3 \ln b_{ij} = \gamma_{ij} = (1 - \sigma) \ln b_{ij}$$

The ad valorem tariff equivalent, $AVE_{ij} = (b_{ij} - 1)$, can also be written as

$$(8) \quad AVE_{ij} = \exp \left[\frac{\gamma_{ij}}{1 - \sigma} \right] - 1$$

The problem with estimating equation (4) or (6) is that the MTRs are not directly observable. However, there are several alternative ways of proxying for MTRs. One method is to construct and introduce a “remoteness” variable. Another way is by replacing the multilateral resistance indexes in equation (4) or (6) with importer and exporter dummies, or country fixed-effects (Anderson and van Wincoop, 2004; Rose and van Wincoop, 2001; Feenstra, 2002; Baldwin and Taglioni, 2006). These country dummies are binary (0,1) variables that will capture all country-specific characteristics and will control for a country’s overall level of imports/exports.

A remoteness variable as a proxy of MTRs is often calculated as the weighted average distance of the country from its trading partners, where the weights are the partner countries’ GDP to the world GDP_W (Head, 2003).

$$(9) \quad Rem_i = \sum_j \frac{dist_{ij}}{GDP_j / GDP_W}$$

Alternatively, as suggested by Baier and Bergstrand (2009), a remoteness variable can be proxied by estimating a linear approximation (by means of a first order Taylor series expansion) of the multilateral resistance terms. That is,

$$(10) \quad \ln X_i = \beta_0 + \ln GDP_i + \ln GDP_j - (\sigma - 1) \ln t_{ij} + (\sigma - 1) \left[\sum_j \theta_j \ln t_{ij} - \frac{1}{2} \sum_i \sum_j \theta_i \theta_j \right] + (\sigma - 1) \left[\sum_i \theta_i \ln t_{ij} - \frac{1}{2} \sum_i \sum_j \theta_i \theta_j \right]$$

where θ denotes GDP shares and t trade costs. The terms in the square brackets are the linear approximation of MTRs.

One problem in estimating a gravity model in the typical log-linear specification is the presence of zero trade flows. Silva and Tenreyro (2006) have shown that an OLS estimation of the gravity model in log form is both inconsistent because of heteroscedasticity and bias because it omits zero trade flows. To address this problem, Silva and Tenreyro (2006) have proposed estimating (4) or (6) using the Poisson pseudo-maximum likelihood method (PPML). This approach has been used in a number of gravity equation estimation. To cite a few, the papers of Westerlund and Wilhelmsson (2006), Olper and Raimondi (2008), Winchester (2009), Befus, Brockmeier, and Bektasoglu (2011) have employed PPML in estimating gravity equations.

There are no restrictions imposed on the coefficients in equation (4) or (6) in the regression. The theory based gravity equation implies $a_1=a_2=1$, but this is not imposed. The constant term a_0 is also unconstrained, as well as the coefficients of MTRs, Π_i and P_j .

Using the GTAP 8 database, equation (4) or (6) were estimated for 10 commodities: cereals sugar, milk, meat, other agriculture, other food, extraction, light manufacturing, and heavy manufacturing. We follow Olper and Raimondi (2008) in estimating total border effects inclusive of tariffs and other constraints on trade, as opposed to estimating tariff and NTM effects with separate regressors. As a consequence, we calculate the effect attributed to NTMs by subtracting the tariff rates from total AVEs calculated from the estimated coefficients. In the simulations, the NTM estimate for light manufacturing were used in: textile, apparel and related products; wood, paper and related products; and other manufacturing. The NTM estimates for heavy manufacturing were used in: metal; motor transportation; and machinery and electronics.

The calculations of NTMs in the U.S. and EU28 are shown in Table 17.

Table 19. Border Coefficients and AVE of NTMs in the U.S. and EU28

	Cereals	Sugar	Milk	Meat	Other Agri	Other Food	Extraction	Light Mnfg	Heavy Mnfg
Border coefficients									
United States	-3.491	-2.488	-1.378	-2.100	-1.503	-0.815	-1.747	-1.454	-1.259
European Union 28	-2.101	-2.805	-3.006	-3.585	-2.259	-1.651	-1.702	-0.863	-0.811
Elasticity of Substitution									
United States	6.101	5.400	7.300	7.914	4.501	3.491	12.319	7.150	7.019
European Union 28	6.101	5.400	7.300	7.914	4.501	3.491	12.319	7.150	7.019
AVE of Border Effects									
United States	0.983	0.760	0.244	0.355	0.536	0.387	0.167	0.267	0.233
European Union 28	0.510	0.892	0.611	0.679	0.907	0.940	0.162	0.151	0.144
Tariffs									
United States	0.019	0.131	0.162	0.008	0.046	0.033	0.002	0.028	0.011
European Union 28	0.057	0.229	0.340	0.181	0.038	0.130	0.005	0.030	0.022
AVE of NTMs									
United States	0.963	0.630	0.083	0.347	0.490	0.354	0.165	0.239	0.221
European Union 28	0.453	0.663	0.271	0.499	0.869	0.810	0.158	0.121	0.122

Source: Authors' calculations

The border coefficients in Table 19 were taken from the regression results in Tables 20 to 28. The variables and the methods used are:

Variables:

Ln(Pro,d) = ln of production

Ln(Consump) = ln of consumption

Ln(Dist) = ln of distance

Commboder = 1 if share common border, 0 otherwise

Commlang = 1 if same official language, 0 otherwise

RTA = 1 if *i* and *j* are members of TTIP

BdrUS_EU = 1 if dependent variable measures exports from US to EU28

BdrEU_US = 1 if dependent variable measures exports from EU to US

Multilateral resistance factors/ estimation method:

P_FE: PPML fixed effects

P_Remote: PPML remoteness index

P_Taylor: PPML Taylor expansion of the expression of the multilateral resistance factors

Coefficients are utilized from the fixed effects model (P_FE) except in the case of cereals and extraction where both coefficients were significant in the remoteness index model (P_R) but one or both coefficients were not significant in P_FE.

Table 20. Regression Results for Cereals

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	0.882*** (0.055)	1.007*** (0.054)	0.971*** (0.045)
Ln(Consump)	0.041 (0.042)	0.415*** (0.024)	0.406*** (0.023)
Ln(Dist)	-0.862*** (0.081)	-0.284*** (0.065)	-0.291*** (0.068)
Commborder	0.951*** (0.167)	0.979*** (0.019)	0.985*** (0.035)
Commlang	0.208 (0.178)	0.349*** (0.009)	0.312*** (0.001)
RTA	1.417*** (0.254)	2.003*** (0.147)	2.211*** (0.145)
BdrUS_EU	-2.405*** (0.380)	-2.101*** (0.271)	-2.266*** (0.284)
BdrEU_US	-1.026 (0.690)	-3.491*** (0.056)	-3.615*** (0.041)
Constant	-3.024** (0.932)	-9.532*** (0.791)	-21.599*** (0.398)
N	47512	47512	47512
R2	0.549	0.119	0.121
Pseudo log-likelihood	-78409	-146130	-145919

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 21. Regression Results for Sugar

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	1.659*** (0.182)	0.906*** (0.005)	0.927*** (0.000)
Ln(Consump)	0.397*** (0.060)	0.388*** (0.010)	0.370*** (0.013)
Ln(Dist)	-0.841*** (0.158)	-0.335*** (0.029)	-0.350*** (0.029)
Commborder	0.995** (0.380)	0.549*** (0.014)	0.555*** (0.009)
Commlang	-0.257 (0.261)	0.214*** (0.051)	0.190*** (0.057)
RTA	2.643*** (0.496)	1.560*** (0.057)	1.549*** (0.081)
BdrUS_EU	-2.805** (0.956)	-1.686*** (0.048)	-1.457*** (0.101)
BdrEU_US	-2.488*** (0.661)	-1.529*** (0.071)	-1.656*** (0.062)
Constant	-7.044*** (1.635)	-4.958*** (0.300)	0.964 (0.544)
N	23756	23756	23756
R2	0.508	0.049	0.050
Pseudo log-likelihood	-10575	-26688	-26715

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 22. Regression Results for Milk

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	2.632*** (0.275)	0.916*** (0.066)	0.869*** (0.095)
Ln(Consump)	1.617*** (0.171)	0.641** (0.243)	0.638** (0.235)
Ln(Dist)	-0.541*** (0.056)	-0.359*** (0.073)	-0.323** (0.109)
Commborder	0.995*** (0.186)	1.047*** (0.317)	1.068*** (0.289)
Commlang	0.716*** (0.152)	0.570* (0.272)	0.591* (0.243)
RTA	2.297*** (0.212)	2.106*** (0.104)	2.178*** (0.217)
BdrUS_EU	-3.006*** (0.384)	-4.441*** (0.097)	-4.432*** (0.064)
BdrEU_US	-1.378*** (0.418)	-1.029* (0.496)	-1.420** (0.463)
Constant	-20.562*** (1.496)	-12.929*** (2.385)	-28.513*** (2.545)
N	23756	23756	23756
R2	0.739	0.542	0.521
Pseudo log-likelihood	-29589	-69559	-72820

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 23. Regression Results for Meat

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	0.855*** (0.082)	0.813*** (0.024)	0.760*** (0.017)
Ln(Consump)	0.411*** (0.072)	0.714*** (0.029)	0.709*** (0.025)
Ln(Dist)	-0.397*** (0.068)	-0.292 (0.211)	-0.270 (0.225)
Commborder	1.150*** (0.124)	1.034*** (0.244)	1.051*** (0.225)
Commlang	0.548*** (0.150)	0.546*** (0.066)	0.553*** (0.056)
RTA	1.813*** (0.178)	2.550*** (0.205)	2.696*** (0.299)
BdrUS_EU	-3.585*** (0.344)	-4.033*** (0.268)	-4.270*** (0.361)
BdrEU_US	-2.100*** (0.494)	-2.650*** (0.286)	-2.736*** (0.294)
Constant	-6.002*** (1.032)	-11.795*** (1.530)	-25.641*** (1.381)
N	35634	35634	35634
R2	0.546	0.264	0.263
Pseudo log-likelihood	-89983	-157039	-160128

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 24. Regression Results for Other Agriculture

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	0.766*** (0.059)	0.663*** (0.067)	0.628*** (0.066)
Ln(Consump)	0.174*** (0.039)	0.631*** (0.026)	0.631*** (0.026)
Ln(Dist)	-0.317*** (0.062)	-0.332*** (0.077)	-0.352*** (0.084)
Commborder	1.151*** (0.213)	1.016*** (0.289)	1.020*** (0.265)
Commlang	0.327* (0.141)	0.277*** (0.057)	0.251*** (0.031)
RTA	1.447*** (0.186)	1.849*** (0.067)	2.106*** (0.041)
BdrUS_EU	-2.259*** (0.351)	-1.130*** (0.181)	-1.552*** (0.180)
BdrEU_US	-1.503*** (0.364)	-1.239*** (0.039)	-1.198*** (0.022)
Constant	-5.181*** (0.901)	-8.256*** (0.325)	-22.323*** (0.947)
N	59390	59390	59390
R2	0.313	0.103	0.107
Pseudo log-likelihood	-217291	-333748	-330913

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 25. Regression Results for Other Food

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	0.967*** (0.051)	0.643*** (0.005)	0.630*** (0.003)
Ln(Consump)	-0.028 (0.042)	0.619*** (0.027)	0.611*** (0.028)
Ln(Dist)	-0.430*** (0.042)	-0.411*** (0.081)	-0.413*** (0.090)
Commborder	0.919*** (0.107)	0.982** (0.362)	0.986** (0.343)
Commlang	0.776*** (0.102)	0.515*** (0.129)	0.506*** (0.122)
RTA	1.368*** (0.113)	1.128*** (0.068)	1.230*** (0.065)
BdrUS_EU	-1.651*** (0.254)	-1.715*** (0.038)	-1.780*** (0.010)
BdrEU_US	-0.815** (0.291)	0.040*** (0.002)	-0.094*** (0.018)
Constant	-3.325*** (0.521)	-7.133*** (0.840)	-15.943*** (0.572)
N	35634	35634	35634
R2	0.645	0.532	0.544
Pseudo log-likelihood	-383601	-382353	-383601

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 26. Regression Results for Extraction

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	1.082*** (0.046)	0.900*** (0.001)	0.901*** (0.001)
Ln(Consump)	0.300*** (0.050)	0.886*** (0.018)	0.877*** (0.020)
Ln(Dist)	-0.878*** (0.080)	-0.341*** (0.029)	-0.335*** (0.031)
Commborder	0.738** (0.229)	0.500*** (0.042)	0.501*** (0.044)
Commlang	0.523* (0.238)	0.207*** (0.031)	0.221*** (0.026)
RTA	0.233 (0.434)	0.558*** (0.048)	0.541*** (0.041)
BdrUS_EU	0.708 (0.677)	-1.702*** (0.053)	-1.622*** (0.051)
BdrEU_US	-0.568 (0.400)	-1.747*** (0.065)	-1.803*** (0.057)
Constant	-6.510*** (1.074)	-9.995*** (0.364)	-10.906*** (0.114)
N	83146	83146	83146
R-sqr	0.636	0.294	0.295
Pseudo log-likelihood	-1111696	-1863209	-1862365

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 27. Regression Results for Light Manufacturing

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	0.854*** (0.036)	0.780*** (0.059)	0.772*** (0.058)
Ln(Consump)	-0.151*** (0.044)	0.673*** (0.050)	0.669*** (0.051)
Ln(Dist)	-0.302*** (0.030)	-0.229*** (0.051)	-0.240*** (0.052)
Commborder	1.056*** (0.073)	1.066*** (0.246)	1.059*** (0.235)
Commlang	0.610*** (0.078)	0.478*** (0.008)	0.462*** (0.008)
RTA	0.811*** (0.079)	0.406*** (0.078)	0.472*** (0.099)
BdrUS_EU	-0.863*** (0.235)	-1.534*** (0.070)	-1.592*** (0.067)
BdrEU_US	-1.454*** (0.199)	-0.507*** (0.040)	-0.526*** (0.008)
Constant	-4.494*** (0.491)	-8.521*** (1.346)	-11.291*** (0.180)
N	83146	83146	83146
R2	0.618	0.264	0.265
Pseudo log-likelihood	-938647	-1519035	-1516085

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors

Table 28. Regression Results for Heavy Manufacturing

Exogenous	P_FE	P_Remote	P_Taylor
Ln(Prod)	1.043*** (0.032)	0.812*** (0.014)	0.805*** (0.012)
Ln(Consump)	0.244*** (0.035)	0.717*** (0.006)	0.709*** (0.006)
Ln(Dist)	-0.261*** (0.031)	-0.297*** (0.032)	-0.297*** (0.036)
Commborder	0.947*** (0.078)	0.847* (0.411)	0.849* (0.390)
Commlang	0.473*** (0.074)	0.504*** (0.057)	0.497*** (0.054)
RTA	1.260*** (0.086)	0.830*** (0.131)	0.888*** (0.131)
BdrUS_EU	-0.811*** (0.162)	-0.998*** (0.137)	-1.016*** (0.121)
BdrEU_US	-1.259*** (0.184)	-0.461** (0.157)	-0.558*** (0.165)
Constant	-7.492*** (0.417)	-9.810*** (0.466)	-16.363*** (0.250)
N	106902	106902	106902
R-sqr	0.529	0.436	0.434
Pseudo log-likelihood	-4201731	-4974067	-4977426

* p<0.05, ** p<0.01, *** p<0.001

Numbers in () are standard errors