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Working Paper

Going Deep: The Trade and Welfare Effects of TTIP Revised

ifo Working Paper, No. 219

Provided in Cooperation with:

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Felbermayr, Gabriel; Aichele, Rahel; Heiland, Inga (2016) : Going Deep: The Trade and Welfare Effects of TTIP Revised, ifo Working Paper, No. 219, ifo Institute - Leibniz Institute for Economic Research at the University of Munich, Munich

This Version is available at:

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Going Deep:
The Trade and Welfare Effects of TTIP Revised

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Ifo Working Paper No. 219

July 2016

An electronic version of the paper may be downloaded from the Ifo website
www.cesifo-group.de.

Going Deep: The Trade and Welfare Effects of TTIP Revised*

Abstract

Since July 2013, the EU and the United States have been negotiating a preferential trade agreement, the Transatlantic Trade and Investment Partnership (TTIP). We use a multi-country, multi-industry Ricardian trade model with national and international input-output linkages to quantify its potential economic consequences. We structurally estimate the model's unobserved parameters and the effect of existing preferential trade agreements on trade cost. With those estimates in hand, we simulate the trade, value added, and welfare effects of the TTIP, assuming that the agreement would eliminate all transatlantic tariffs and reduce non-tariff barriers as other deep PTAs have done in the past. We find a long-run increase of real income of .4% for the EU, by .5% for the United States, and by -.02% for the rest of the world relative to the status quo. However, there is substantial heterogeneity across the 140 geographical entities that we investigate. Gross value of EU-US trade is predicted to increase by 50%, but the content of EU and US value added would decrease, signalling a deepening of the transatlantic production network. Moreover, we quantify trade diversion effects on third countries and find that those are less severe for value added trade than for gross trade. This highlights the importance of global value chains in understanding the effects of the TTIP on outsiders and the global economy.

JEL Code: F13, F14, F17.

Keywords: Structural gravity, preferential trade agreements, TTIP.

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* We thank Lorenzo Caliendo, Peter Egger, Marc-Andreas Muendler, Mario Larch, and seminar participants in Heidelberg, Lisbon, Munich, Rome, Venice, and Vienna for comments and suggestions. This paper provides an update of the results presented in "Going Deep: The Trade and Welfare Effects of TTIP", CESifo Working Paper No. 5150.

1 Introduction

In July 2013, the EU and the United States began negotiations on the Transatlantic Trade and Investment Partnership (TTIP). According to the High-Level Working Group on Jobs and Growth, set up by the so called Transatlantic Economic Council, the ambition is to eliminate all tariffs and to create “*a comprehensive, ambitious agreement that addresses a broad range of bilateral trade and investment issues, including regulatory issues, and contributes to the development of global rules*” that “*goes beyond what the United States and the EU have achieved in previous trade agreements.*” In this paper, we attempt a quantification of the potential effects of this endeavor.¹

The TTIP is the first big trade agreement that tries to fill the “gap between 21st century trade and the 20th century trade rules” (Baldwin, 2011) that the relative stasis of the World Trade Organization (WTO) has left developed countries in. Our analysis captures important aspects of modern trade, such as globally fragmented production chains, trade in services, and non-tariff barriers to trade (NTBs).

To that end, we augment the quantitative trade model of Caliendo and Parro (2015) with an explicit description of non-tariff barriers to trade. We analyze the effects of reductions in both tariffs and non-tariff barriers to trade between the EU and the United States on the global economy. Our empirical framework covers 38 industries from the services, manufacturing, and agriculture sectors, and 140 countries or regions. The model features cross-sectoral and international trade in intermediate inputs and thus allows to capture the economic effects on third countries that are integrated into the TTIP coun-

¹This paper provides an update of the key results published in “Going Deep: The Trade and Welfare Effects of TTIP”, CESifo Working Paper No. 5150. Our updated results presented in this paper are based on a calibration of the model to the year 2011, relying on the most recent version of the Global Trade Analysis Project (GTAP) Database (Version 9). The previous results were based on a calibration of the model to the year 2007 (GTAP 8.1). Accordingly, the data used for the estimation of structural parameters were updated to the year 2011 as well. Our updated results cover more sectors and countries (regions). Moreover, further differences exist with regard to the treatment of Croatia in the simulation stage and the choice of instrumental variables in the estimation stage. Finally, in this updated version we present confidence intervals for the model predictions obtained with the help of a bootstrap.

tries' value chain. In contrast to the conventional computable general equilibrium (CGE) trade models, the key parameters – the Fréchet parameter governing the distribution of productivities within sectors and the coefficients of the trade cost function – are estimated using structural relationships that are implied by the theoretical setup. In contrast to other quantitative studies of trade policy experiments using estimated parameters for model calibration, we explicitly acknowledge the uncertainty associated with our parameter estimates and show how it translates into measures of uncertainty, namely, confidence intervals, for our model-based predictions.

We use data on sectoral trade flows and input-output linkages from the Global Trade Analysis Project (GTAP) and employ an instrumental variables (IV) strategy to obtain estimates of the effects of existing preferential trade agreements (PTAs) on bilateral trade cost. The central assumption we make in the subsequent simulation analysis is that in addition to eliminating all tariffs between the EU and the United States, the TTIP will reduce trade costs by the amount we have estimated as an average effect of existing deep trade agreements. The key results are that the TTIP will yield a long-run increase in the level of real per capita income of .4% and .5% in the EU and the United States, respectively. It will only marginally lower average real income in the rest of the world, leaving the world as a whole better off with a real income increase of about .2%.

We find that the TTIP would bring about a significant amount of trade creation among the insiders. For example, trade between the EU and the United States, as measured at customs, is predicted to increase by more than 50%. At the same time, trade among EU countries and trade within the United States would fall by .4%, respectively .5%, reflecting trade diversion by preference erosion. Similarly, trade with most other countries or regions would decrease. However, imports from suppliers of consumption goods, raw materials, or intermediates can go up due to growth of output and income in the TTIP countries. Also, trade diversion can be attenuated by imported competitiveness: When TTIP partners supply intermediates at lower prices to third countries, changes in relative

prices of final goods are dampened. This latter effect, plus the restructuring of production chains, imply that third countries' value added exports to the TTIP parties may go up even if export values decrease. We find such effects, for example, for Mexico and Canada whose value added exports to the EU increase substantially even though direct trade decreases. Similarly, value added exports to the United States increase for non-TTIP countries that are closely integrated into the European production network, such as Turkey. Moreover, third countries gain competitiveness in each others' markets, as wages in the TTIP countries go up. For example, we find that Mexico's gross exports to China, the ASEAN countries, and Brazil would increase with the TTIP.

The introduction of the TTIP would alter the composition of aggregate value added. It would lead to a slight reindustrialization in the EU and the United States, reflecting the fact that the reduction in NTBs is larger in manufacturing than in services and that manufacturing sectors also benefit from the elimination of tariffs. Service sectors gain shares in total output in all non-TTIP countries, with the exception of a few European economies.

The paper is closely related to three strands of literature. First, it builds on recent work in the field of "New Quantitative Trade Theory" (NQTT). Costinot and Rodriguez-Clare (2014) provide a comprehensive survey of the models and the methodology used in this field. The central element and (one) defining feature of NQTT models is the gravity equation, a parsimonious structural relationship which allows estimation of trade elasticities with respect to trade cost parameters with the help of relatively simple econometrics. Besides simplicity, the gravity equation derives its popularity from the excellent empirical fit. However, the parsimony of the structure rests on relatively strong functional form assumptions. In our case, the Fréchet productivity distribution and CES demand systems. Nonetheless, the NQTT offers important advantages over the more conventional large-scale CGE approach. First, the parsimony allows getting relatively far with analytical descriptions. This feature reduces (but does not undo) the black box nature of large

general equilibrium models. Second, the approach allows a tight link between the model and the data. Estimates of unobserved parameters are chosen such as to best fit the data used to calibrate the model's observable moments *and* the structural relationships used to conduct counterfactual experiments. Moreover, absent knowledge of the precise nature of the policy scenario, in our case, the outcome of the TTIP negotiations, the framework lends itself to letting the data define the scenario. More precisely, the structural relationships, the observable moments, and the data on existing trade agreements together allow us to back out the average effect that trade agreements in the past have had on NTBs. Using this estimated average effect of deep PTAs on trade costs as a plausible guess for the effect of the TTIP on the cost of trade between the EU and the United States, we circumvent the challenge of coming up with bottom-up estimates of the cost equivalents of existing NTBs and we do not need to develop conjectures about potential reductions of these costs. Finally, in contrast to existing work on counterfactual experiments in the NQTT framework, we address the issue that the estimated unobserved parameters used to calibrate the model are surrounded by uncertainty. We conduct a bootstrap to obtain confidence intervals for our simulated effects, reflecting the degree of uncertainty that is introduced by the use of estimated parameters in the calibration.

Second, our work builds on earlier quantitative evaluations of the TTIP. In a study for the European Commission, Francois et al. (2013) employ a large scale CGE framework based on the well-known GTAP model (Hertel, ed, 1997), extended with features of the Francois et al. (2005) model. While their work is at the frontier of classical CGE modeling, it does not utilize the breakthroughs described in Costinot and Rodriguez-Clare (2014). It requires bottom-up estimates of NTBs which are only available for a small set of bilateral trade links, and it defines the scenario on the basis of expert input rather than data. Egger et al. (2014) use the same model, but they rely on a top-down, gravity-based approach to estimating NTBs. However, they do not derive the gravity equation from the model and use ad hoc values to calibrate the model's parameters (such as the trade elasticities).

Moreover, these studies work with broad regional aggregates. Felbermayr et al. (2013) and Felbermayr et al. (2015) apply the model and econometric approach of Egger et al. (2011) to simulate the effects of a TTIP. Their model is a single-sector framework based on the Krugman (1980) model augmented with an extensive margin to capture the prevalence of zero-trade flows. Anderson et al. (2014) use a dynamic single-sector setup with endogenous capital stocks. These latter three approaches all feature a tight link between estimation and simulation. However, they miss out on the sectoral detail and the role of the global value chain. Moreover, none of these papers addresses the issue of parameter uncertainty.

Finally, our paper relates to a large empirical literature on the determinants and effects of PTAs. Much of the earlier work, surveyed, for example, by Cipollina and Salvatici (2010), is based on reduced form equations and does not properly deal with the potential endogeneity of trade agreements. More recent empirical studies provide a tight link between theoretical model and estimation (see Head and Mayer, 2014), and devote much attention to obtaining causal effects of PTAs on trade flows (see Egger et al., 2011, and the discussion of literature therein). The critical step is to find exogenous drivers of PTA formation. Controlling for tariffs, the estimated treatment effect of PTAs can be used to quantify how PTAs have reduced the costs of NTBs. The literature suggests that OLS tends to underestimate the true effects of PTAs and typically finds economically large effects when using IV strategies. In this paper we use the contagion index developed by Baldwin and Jaimovich (2012) as an instrument to obtain IV estimates of the PTA effect for 37 sectors (including services). Moreover, we distinguish between “shallow” and “deep” PTAs, borrowing a classification provided by Dür et al. (2014).

The remainder of this paper is structured as follows. Section 2 provides a quick overview of the theoretical model. In Section 3 we discuss the data and the identification of parameters. Section 4 provides the simulation results and Section 5 concludes.

2 Methodology

In this section, we briefly summarize the Eaton and Kortum (2002)-type multi-sector, input-output gravity model developed by Caliendo and Parro (2015), which is the basis of our simulations. We discuss the key structural assumptions and then describe the effects of counterfactual changes in trade flows, welfare and other endogenous variables of the model associated with a change in trade cost. As Caliendo and Parro (2015) discuss in their paper, accounting for input-output linkages allows capturing important additional welfare effects of trade liberalization compared to models without an input-output structure; an intermediate goods channel and a sector linkages channel. Since sectoral and international input-output linkages constitute one of the important aspects of 21st century trade that modern trade agreements aim to address, Caliendo and Parro (2015)'s model is most suitable for an analysis of the effects of such an agreement. Caliendo and Parro (2015) use the model to analyze the effects of tariff changes attributed to NAFTA. We extend the model by explicitly modeling NTBs, as those are expected to play a major role in the TTIP.

2.1 The Gravity Model

In $n = 1, \dots, N$ countries, the utility function of the representative household is described by a Cobb-Douglas function over $j = 1, \dots, J$ sectoral composite goods, with α_n^j denoting the expenditure share of sector j . The household receives labor income I_n and lump-sum tariff rebates.

Each sector j comprises a continuum of varieties. Labor and the composite goods of each sector $k = 1, \dots, J$ are the inputs to j 's production process. Let $\beta_n^j \in [0, 1]$ denote the cost share of labor and $\gamma_n^{k,j} \in [0, 1]$ the share of sector k in sector j 's intermediate

costs, with $\sum_{k=1}^J \gamma_n^{k,j} = 1$. Then the production function for a variety ω^j is given by

$$q_n^j(\omega^j) = x_n^j(\omega^j)^{-\theta^j} [l_n^j(\omega^j)]^{\beta_n^j} \left[\prod_{k=1}^J m_n^{k,j}(\omega^j) \gamma_n^{k,j} \right]^{(1-\beta_n^j)}, \quad (1)$$

where $x_n^j(\omega^j)$ denotes the inverse efficiency of variety producer ω^j . The dispersion of efficiencies across varieties is given by $\theta^j \in (0, 1)$. The higher θ^j , the greater the productivity dispersion in sector j . All varieties ω^j are aggregated with a Dixit-Stiglitz-type CES technology into sector j 's composite good. The sectoral composites are used for production and consumption purposes.

A sector's varieties are internationally traded and there is perfect competition among variety producers. Hence, prices equal marginal cost. Producers search across all countries for the lowest-cost supplier of a variety. When importing a variety from sector j in country i , the importer n has to pay the unit costs c_i^j times the trade costs κ_{in}^j which consist of two parts: ad-valorem tariffs $1 + \tau_{in}^j \geq 1$ and iceberg trade costs $d_{in}^j \geq 1$, with $d_{nn}^j = 1$. Following other gravity applications, we model iceberg trade costs as a function of bilateral distance, PTAs, and other observable trade cost proxies such as a common border, a common language or a common colonial history. Accordingly, we assume $d_{in}^j = D_{in} \rho^j e^{\delta^j \mathbf{Z}_{in}}$, where D_{in} is bilateral distance, and \mathbf{Z}_{in} is a vector collecting dichotomous trade cost proxies. More explicitly, we allow for two types of PTAs: shallow and deep treaties. The respective dummies are denoted by PTA_{shallow} and PTA_{deep} . Since tariffs are an explicit part of trade costs, the PTA dummies capture trade cost reductions that go beyond the reduction or elimination of tariffs. Thus, the PTA dummies capture the trade-enhancing effect of reducing NTBs like sanitary and phytosanitary trade barriers and other technical barriers to trade like regulatory standards or labeling requirements.

The model gives rise to a gravity equation. Country n 's expenditure share π_{in}^j for source country i 's goods in sector j depends on i 's price relative to the price index. It can

be written as

$$\pi_{in}^j = \frac{\lambda_i^j [c_i^j \kappa_{in}^j]^{\frac{-1}{\theta^j}}}{\sum_{i=1}^N \lambda_i^j [c_i^j \kappa_{in}^j]^{\frac{-1}{\theta^j}}}. \quad (2)$$

This trade share can be interpreted as the probability that, for country n , the lowest cost supplier of a variety in sector j is trade partner i . The model is closed with goods market clearing and an income-equals-expenditure condition for each country n .

Besides “gross” trade flows, that is, the value of trade as measured at customs (to which the trade shares in Equation (2) refer), we also consider trade in value added. Following Johnson and Noguera (2012), we define value added exports as the amount of value added from a source country absorbed (consumed or invested) in a foreign country. Johnson and Noguera (2012) develop a methodology to compute bilateral sectoral value added trade flows based on trade data, value added shares in production, and international input output tables. Aichele and Heiland (2015) show how a structural equation for so-defined value added trade flows can be derived from Caliendo and Parro’s (2015) model, which facilitates counterfactual analysis of trade in value added. Our value added trade analysis is based on this same methodology.

2.2 Comparative Statics in General Equilibrium

In this section, we describe how the model reacts to a trade policy shock. Let $\hat{x} \equiv x'/x$ be the relative change in any variable from its initial level x to the counterfactual level x' . The formation of a PTA implies changes in the tariff schedule and the reduction of NTBs. Hence, changes in trade costs are given by

$$\hat{\kappa}_{in}^j = \frac{1 + \tau_{in}^{j'}}{1 + \tau_{in}^j} \exp \left\{ \delta_{\text{shallow}}^j (PTA'_{\text{shallow},in} - PTA_{\text{shallow},in}) + \delta_{\text{deep}}^j (PTA'_{\text{deep},in} - PTA_{\text{deep},in}) \right\}.$$

Since all trade flows between liberalizing countries benefit from the tariff and NTB cost reductions, the approach implicitly assumes that rules of origins, if present, are non-

binding.

As suggested by Dekle et al. (2008), one can solve for equilibrium changes:²

$$\hat{c}_n^j = \hat{w}_n^{\beta_n^j} \left(\prod_{k=1}^J [\hat{p}_n^k]^{\gamma_n^{k,j}} \right)^{1-\beta_n^j}, \quad (3)$$

$$\hat{p}_n^j = \left(\sum_{i=1}^N \pi_{in}^j [\hat{\kappa}_{in}^j \hat{c}_i^j]^{-1/\theta^j} \right)^{-\theta^j}, \quad (4)$$

$$\hat{\pi}_{in}^j = \left(\frac{\hat{c}_i^j}{\hat{p}_n^j \hat{\kappa}_{in}^j} \right)^{-1/\theta^j}, \quad (5)$$

$$X_n^{j'} = \sum_{k=1}^J \gamma_n^{j,k} (1 - \beta_n^k) \left(\sum_{i=1}^N \frac{\pi_{ni}^{k'}}{1 + \tau_{ni}^{k'}} X_i^{k'} \right) + \alpha_n^j I_n', \quad (6)$$

$$\sum_{j=1}^J F_n^{j'} X_n^{j'} + S_n = \sum_{j=1}^J \sum_{i=1}^N \frac{\pi_{ni}^{j'}}{1 + \tau_{ni}^{j'}} X_i^{j'}, \quad (7)$$

where \hat{w}_n denotes the wage change, X_n^j denotes the sectoral expenditure level, $F_n^j \equiv \sum_{i=1}^N \frac{\pi_{in}^j}{(1 + \tau_{in}^j)}$, $I_n' = \hat{w}_n w_n L_n + \sum_{j=1}^J X_n^{j'} (1 - F_n^{j'}) - S_n$, L_n is country n 's labor force³, and S_n is the trade surplus. Equation (3) shows how unit costs react to input price changes, i.e. to wage and intermediate price changes. Trade cost changes affect the sectoral price index p_n^j directly, and also indirectly by affecting unit costs (see Equation (4)). Changes in trade shares result from these trade cost, unit cost, and price changes. The strength of the reaction is governed by the productivity dispersion θ^j . A small θ^j implies large trade changes. Equation (6) ensures goods market clearing in the new equilibrium and Equation (7) corresponds to the counterfactual income-equals-expenditure or balanced trade condition. The change in real income, which is given by

$$\widehat{W}_n = \frac{\hat{I}_n}{\prod_{j=1}^J (\hat{p}_n^j)^{\alpha_n^j}}, \quad (8)$$

²When solving for the new equilibrium in changes instead of in levels, the set of parameters that have to be estimated is reduced. Information on price levels, iceberg trade costs, or productivity levels are not required.

³Labor can move freely between sectors. However, it cannot cross international borders.

serves as our measure for the change in welfare.

Caliendo and Parro (2015) extend the single-sector solution algorithm proposed by Alvarez and Lucas (2007) to solve the system of equations given by (3)-(7). The algorithm starts with an initial guess of a vector of wage changes. With (3) and (4), it then computes price and trade share changes and the new expenditure levels based on those wage changes, evaluates the trade balance condition (7), and then updates the wage change based on the error in the trade balance.

3 Data and Parameter Identification

To simulate the effects of the TTIP based on the model described in the previous section, we need to identify the parameters α , β , γ , θ , and δ_{deep} and δ_{shallow} ,⁴ and collect data on bilateral trade shares π , tariff levels τ , countries' total value added $w \cdot L$, and trade surpluses S . The expenditure shares α and the cost shares β and γ are obtained from input-output tables. θ , δ_{shallow} and δ_{deep} are estimated based on the gravity equation implied by the model.

3.1 Data Sources

Our main data source is the Global Trade Analysis Project (GTAP) 9 database, which provides sectoral production values, sectoral value added information and bilateral final and intermediate goods trade in producer and consumer prices, including service sectors. Based on this information, sectoral expenditures for final and intermediate goods, sectoral bilateral tariffs, and bilateral input-output tables can be constructed. The GTAP

⁴For the scenario considered below, we actually do not require estimates of δ_{shallow} . However, PTA_{shallow} is certainly an important control variable in the estimation and will be needed if one defines the scenario differently.

database was chosen for its rich country detail.⁵ It contains data for 122 countries and 18 aggregate regions (e.g. “Rest of Southeast Asia”). These 140 countries and regions represent the world economy in the year 2011. GTAP distinguishes 57 sectors, which we aggregate to 38 following the sector groupings of GTAP in order to reduce the number of parameters that need to be estimated.⁶

3.2 Expenditure and Cost Shares

Expenditure shares α, β , and γ , trade shares π , tariffs τ , and expenditure levels X are obtained from the GTAP database. We perfectly match final goods expenditure, sectoral bilateral trade flows (aggregating intermediate and final goods trade), and cost shares for intermediates and bilateral tariffs. Two adjustments to the data are necessary to align it with the assumptions of the model. The first adjustment regards differences in bilateral trade shares between final and intermediate goods trade. The second adjustment concerns the international transport sector. In the model, the bilateral trade shares are assumed to be identical across use categories. In the GTAP data, however, bilateral trade shares differ across final and intermediate usage. We match sectoral bilateral trade flows, final goods expenditure shares, and the cost shares for intermediates to their empirical counterparts and bilateralize final and intermediate goods trade with the common bilateral trade share. Moreover, GTAP has a separate international transportation sector. To match the iceberg trade cost assumption, we assign the international transport margin and its respective share of intermediate demand to the sectors demanding the international transportation service. This increases the respective sector’s production value. Sectoral value added is then calculated as the difference between the so obtained production values

⁵The World Input Output Database (WIOD) constitutes an alternative data source. It provides the same information for a sample of 40 countries and the rest of the world for the years 1995-2011. Since we are interested in trade creation and trade diversion and third country effects, we opted for GTAP in order to maximize country coverage.

⁶An overview of the sectoral breakdown and the aggregation is provided in Table A.11 in the appendix.

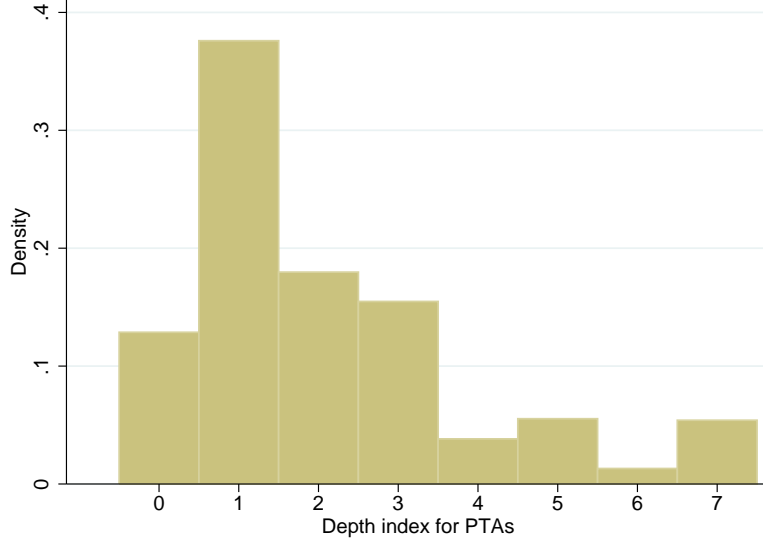
and expenditures for intermediate goods, which also implies that we treat production taxes as part of domestic value added.

3.3 Identification of Trade Cost Parameters

A key element of our simulation is to distinguish shallow from deep PTAs and estimate their effect on bilateral NTBs. To that end, we classify existing PTAs as shallow or deep based on the number of provisions included in an agreement. Data on the number of provisions is obtained from the Design of Trade Agreements (DESTA) database (see Dür et al., 2014). This database provides an index for the depth of PTAs, which is a count of the number of provisions (partial scope agreement, substantive provisions on services, investments, standards, public procurement, competition and intellectual property rights). The index ranges from 0 to 7, where 0 indicates a partial scope agreement and 7 is the deepest level of integration. We recode this index of depth to obtain two classes of PTAs: shallow and deep agreements. The dummy indicating a shallow PTA switches to one if the depth index lies between 0 and 3. The dummy for a deep PTA takes the on value one if the index lies between 4 and 7. Figure 1 shows the distribution of the depth of existing PTAs for the year 2011. About 16% of the PTAs (i.e., 2,522 bilateral relations out of the 15,700 with a PTA in place) are classified as deep according to our definition; examples include NAFTA, the EU or USA-Korea agreement. The Andean Community, MERCOSUR or ASEAN are examples for shallow agreements.

The vectors of sectoral trade cost parameters θ , δ_{deep} and $\delta_{shallow}$ can be identified from the gravity equation. Taking the trade share equation (2), plugging in the functional form for trade costs and multiplying by the total expenditure X_n^j yields the following log-

Figure 1: Status quo of depth of trade integration



Note: The figure plots the index of depth of PTAs as classified by Dür et al. (2014) for country pairs with a PTA in 2011. The depth index counts the number of provisions and ranges from 0-7. The different provisions are: partial scope agreement, substantive provisions on services, investments, standards, public procurement, competition and intellectual property rights.

linearized estimable gravity equation for each sector j :

$$\ln(\pi_{in}^j X_n^j) = -\frac{1}{\theta^j} \ln(1 + \tau_{in}^j) - \frac{\rho^j}{\theta^j} \ln D_{in} - \frac{\delta_{shallow}^j}{\theta^j} PTA_{shallow,in} - \frac{\delta_{deep}^j}{\theta^j} PTA_{deep,in} - \frac{\zeta^j}{\theta^j} \mathbf{Z}_{in} + \nu_i^j + \mu_n^j + \varepsilon_{in}^j, \quad (9)$$

where $\nu_i^j \equiv \ln(\lambda_i^j c_i^j)$ and $\mu_n^j \equiv \ln(X_n^j / \sum_{i=1}^N \lambda_i^j [c_i^j \kappa_{in}^j]^{-\frac{1}{\theta^j}})$ are importer and exporter fixed effects, respectively, and ε_{in}^j is an error term.

The coefficient on tariffs directly identifies the productivity dispersion, $1/\theta^j$. The higher $1/\theta^j$, the stronger the response of trade flows to a cost shifter (here, bilateral tariffs). The coefficients of the PTA dummies, $\frac{\delta_{deep}^j}{\theta^j}$ and $\frac{\delta_{shallow}^j}{\theta^j}$, are expected to be positive, since forming a PTA reduces non-tariff trade barriers, and thus increase bilateral trade. Naturally, we expect $\frac{\delta_{deep}^j}{\theta^j} > \frac{\delta_{shallow}^j}{\theta^j}$. The change (in percent) in sectoral trade cost due to a deep agreement for countries which previously did not have a shallow agreement

implied by the structural equation for trade cost is given by $(e^{\delta_{\text{deep}}^j} - 1) * 100$. We estimate Equation (9) sector by sector, thus allowing θ^j , $\frac{\delta_{\text{deep}}^j}{\theta^j}$, and $\frac{\delta_{\text{shallow}}^j}{\theta^j}$ to be sector-specific.

The importer and exporter fixed effects take care of all, potentially unobserved, country-specific determinants of bilateral trade flows. However, the estimates of the PTA dummies might still suffer from an endogeneity bias if, for example, countries that trade more with each other are also more likely to sign a PTA. In this case, the PTA dummy would overestimate the trade enhancing effect of a PTA. To account for potential endogeneity, we use an instrumental variables approach. A relevant and valid instrument influences the probability to sign a PTA, but does not affect trade flows through any channel other than the PTA. Baldwin and Jaimovich (2012) propose a contagion index as an instrument. The contagion index rests on the idea that countries are more likely to form a PTA with partners that already have many PTAs with third parties in place. Specifically, the index measures the threat of trade diversion country i faces in a trade partner j 's market, by counting j 's PTAs with third countries weighted with how important the third country's market is for i (i.e. with the third country's share in i 's exports).⁷ We compute separate contagion indices for shallow and deep PTAs.

Our estimations for the agricultural and manufacturing sectors are based on product-level (HS 6-digit) trade data from UN COMTRADE. The sample is restricted to the GTAP countries. Data on bilateral tariffs for manufacturing sectors are taken from UNCTAD's TRAINS database. We use effectively applied tariffs including estimated ad-valorem equivalents of specific tariffs and quotas. We run separate regressions for our (partly aggregated) GTAP sectors, using product fixed effects to absorb unobserved heterogeneity. Other trade cost proxies, i.e., bilateral distance and a dummy for contiguity, are obtained from the CEPII distance database. We drop 0.5% of observations with the highest tariffs from the sample. Trade and tariff data are 5-year averages centered around 2011. For the service sectors we use sector-level trade flows from the GTAP database as dependent

⁷This instrument is, for example, also used by Martin et al. (2012).

variables.

Table 1 displays the IV gravity results for the productivity dispersion and the PTA effects for the 4 agricultural and 18 manufacturing sectors. In general, our estimations can explain between 25 and 55% of the variation in bilateral trade volumes. The coefficients on tariffs satisfy the theoretical restriction $1/\theta^j < -1$ and are highly statistically significant. Except for the “Mining (coal, oil and gas)” sector, where the number of observations is also quite small. The ranking of sectors in terms of their productivity dispersion seems sensible in most cases. Sectors like “Petroleum, coal products,” “Chemical, rubber, plastic products,” or “Mining,” which produce fairly homogenous goods have a low θ , implying that trade flows react relatively strongly to cost changes. Sectors like “Wearing apparel,” “Electronic equipment,” or “Metal products,” on the other hand, have a relatively high θ which indicates that they provide more differentiated sectoral varieties. We find strong effects of deep PTAs on bilateral trade: Coefficients range between .16 in the “Mineral products nec” industry and .9 in the “Motor vehicles and parts” industry. These estimates imply that deep PTAs increase trade by 17 to 145%, depending on the sector.⁸ We also find some evidence that shallow PTAs increase trade, at least in the manufacturing sectors. In other sectors, mostly the agricultural ones, the shallow PTA effect is not statistically different from zero. For “Cattle, sheep, goats, horses” we actually find a negative effect of shallow PTAs that is significant and in the Mining sector we find an implausible large effect of shallow PTAs. The coefficients on other trade cost proxies (as shown in Table (A.12)) are as expected. Distance reduces bilateral trade volumes. A common border, common language and a shared colonial past tend to increase trade.

⁸The trade-enhancing effect implied by a coefficient estimate of .16 is calculated as $(e^{.16} - 1) * 100$.

Table 1: IV gravity estimates manufacturing sectors

Sector	(1) $-1/\theta$	(2) Ln tariff s.e.	(3) Shallow PTA $-\delta/\theta$	(4) Deep PTA s.e.	(5) Deep PTA $-\delta/\theta$	(6) Obs.	(7) Obs.	(8) R^2	(9) Weak-ID F-stat	(10) Under-ID p-value
1	-2.310***	0.148	0.249**	0.106	0.401***	0.118	243,624	0.29	346	0.00
2	-2.441***	0.163	-0.261**	0.116	-0.204	0.125	90,274	0.34	458	0.00
3	-3.385***	0.553	-0.024	0.156	0.086	0.150	22,304	0.32	347	0.00
4	-3.156***	0.657	-0.182	0.210	0.076	0.209	28,274	0.30	148	0.00
5	-6.021	4.199	1.269**	0.591	0.830	0.542	6,669	0.41	98	0.00
6	-3.695***	0.690	0.357**	0.144	0.364***	0.129	85,350	0.25	244	0.00
7	-2.498***	0.093	0.188**	0.082	0.289***	0.091	531,429	0.30	471	0.00
8	-4.913***	0.285	0.079	0.092	0.294***	0.082	801,095	0.32	322	0.00
9	-1.613***	0.398	-0.023	0.113	0.502***	0.106	699,145	0.46	282	0.00
10	-2.939***	0.299	0.208**	0.095	0.637***	0.093	175,800	0.45	485	0.00
11	-2.774***	0.263	0.073	0.075	0.476***	0.077	175,800	0.45	485	0.00
12	-4.697***	0.241	0.146*	0.079	0.526***	0.078	223,734	0.45	672	0.00
13	-5.463***	1.220	0.807***	0.186	0.672***	0.205	317,824	0.42	636	0.00
14	-4.743***	0.218	0.201***	0.071	0.317***	0.072	22,745	0.39	480	0.00
15	-2.804***	0.225	0.081	0.078	0.157**	0.073	1,544,089	0.34	551	0.00
16	-1.187***	0.368	0.188*	0.102	0.665***	0.093	337,582	0.37	535	0.00
17	-3.691***	0.452	0.611***	0.121	0.752***	0.102	302,429	0.32	355	0.00
18	-2.167***	0.226	0.247***	0.080	0.307***	0.078	182,487	0.34	256	0.00
19	-3.670***	0.239	0.296***	0.091	0.896***	0.101	628,789	0.47	660	0.00
20	-2.315***	0.287	0.136	0.089	0.409***	0.086	157,463	0.54	650	0.00
21	-2.184***	0.231	0.467***	0.078	0.242***	0.081	112,560	0.38	466	0.00
22	-3.181***	0.166	0.196***	0.066	0.175***	0.062	320,393	0.53	776	0.00
23	-2.275***	0.204	0.169**	0.077	0.251***	0.076	2,212,282	0.46	720	0.00

Note: The table shows gravity estimates for agricultural and manufacturing sectors with importer and exporter dummies and the usual gravity controls (not shown). Standard errors (in parentheses) are robust to clustering on country-pair level. PTA dummies instrumented with contagion indices a la Martin et al. (2012) or Baldwin and Jaimovich (2012) for the respective depths. Shea's Partial R^2 is 0.19 for shallow and 0.23 for deep PTAs. *, **, and *** indicate statistical significance at the 10, 5 and 1% level, respectively.

Table 2: IV gravity estimates service sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
	Shallow PTA	Deep PTA	Deep PTA	Obs.	R ²	Weak-ID	Under-ID		
	$-\delta/\theta$	s.e.	$-\delta/\theta$	s.e.		F-stat	p-value		
25	Gas manufacture, distribution	0.141**	0.062	0.389***	0.089	13,546	0.97	877	0.00
26	Water	0.229***	0.031	0.377***	0.053	11,368	0.95	673	0.00
27	Construction	0.169***	0.064	0.302***	0.081	14,434	0.96	949	0.00
28	Trade	0.129***	0.037	0.580***	0.056	14,518	0.90	927	0.00
29	Transport nec	0.182***	0.032	0.399***	0.050	14,518	0.96	927	0.00
30	Sea transport	0.024	0.055	0.413***	0.075	14,518	0.95	927	0.00
31	Air transport	0.175***	0.040	0.123**	0.055	14,518	0.92	927	0.00
32	Communication	0.221***	0.031	0.294***	0.051	14,518	0.95	927	0.00
33	Financial services nec	0.160***	0.040	0.490***	0.060	14,518	0.95	927	0.00
34	Insurance	0.152***	0.033	0.338***	0.054	14,518	0.95	927	0.00
35	Business services nec	0.267***	0.035	0.559***	0.054	14,518	0.96	927	0.00
36	Recreation and other services	0.142***	0.037	0.238***	0.052	14,518	0.96	927	0.00
37	PubAdmin/Defence/Health/Education	0.178***	0.036	0.367***	0.057	14,518	0.95	927	0.00

Note: All specifications include importer and exporter fixed effects and the usual gravity controls (not shown). Standard errors (in parentheses) are heteroskedasticity-robust and clustered at the country-pair level. Shea's Partial R² is 0.114 for shallow and 0.165 for deep PTAs. *, ** and *** indicate statistical significance at the 10, 5 and 1% level, respectively.

We also estimate the same specification with OLS. The estimates for the productivity dispersion parameters and their ranking are fairly similar to the IV results, the PTA effects obtained from OLS are smaller; see Table A.14 in the Appendix. This result is well documented in the literature; For example, Egger et al. (2011) also find that, counterintuitively, unobservable determinants of PTAs seem to be negatively correlated with bilateral trade volumes. Consequently, OLS estimates of PTA dummies are downward biased.⁹

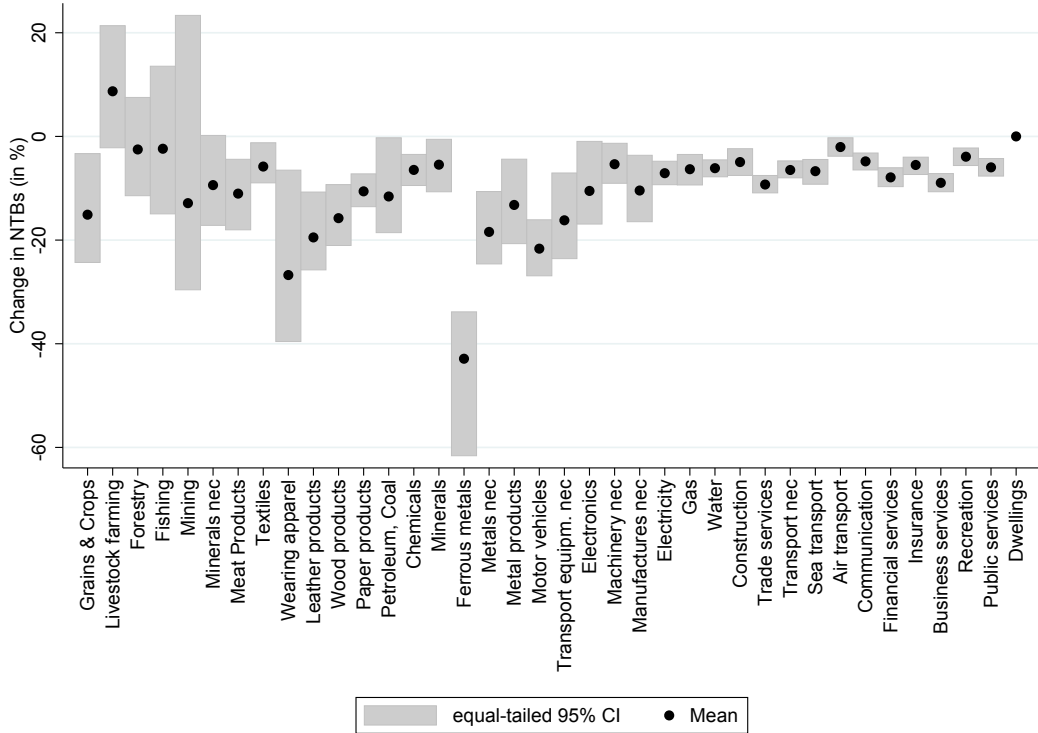
Table 2 provides IV gravity results for PTA effects in service sectors.¹⁰ In general, our specifications explain between 90 and 97% of the variation in bilateral service trade flows. We find that both shallow and deep PTAs have large and significant effects on trade flows. The magnitudes of the implied effects of deep agreements on trade range between 13 and 79%, for the shallow agreements the range is 14 to 30%. Using OLS instead of IV yields significantly smaller or insignificant effects for the PTA dummies, as shown in Table A.15 in the Appendix. Since there are no tariffs levied on service trade, we cannot identify θ^j in service industries. In the simulations, we use an average value from Egger et al. (2012), who estimate a trade cost elasticity for services of 5.959. Moreover, we do not observe positive trade flows in the service industry “Dwellings;” hence, no PTA effects are estimated for this sector. We set the change in trade cost in this sector to zero in the simulations.

Remember that the structural interpretation of the coefficient for a deep PTA is $-\frac{\delta_{\text{deep}}^j}{\theta^j}$, the combined effect of a deep PTA on non-tariff barriers and the effect of trade cost on trade flows. With the estimated θ s, we can thus back out the implied effect of PTAs on trade cost. Figure 2 shows the reductions in NTBs implied by our IV esti-

⁹For a brief survey on the size of existing PTA estimates in the literature see Felbermayr et al. (2014).

¹⁰Table A.13 in the Appendix presents the complete results including the coefficient estimates for the covariates. In stark contrast to goods flows, distance seems to be irrelevant as a trade cost indicator for most service sectors. A shared colonial past and a common border, on the other hand, strongly increase trade in services.

Figure 2: Implied changes in NTBs



mates. The grey bars show equal-tailed 95% confidence intervals obtained by means of a bootstrap that will be described in more detail below.

There is substantial heterogeneity across sectors: Trade cost reductions tend to be larger in manufacturing sectors, varying between 43% in the “Ferrous metals” industry and 5% in “Machinery nec” and “Minerals.” In the agricultural sectors, we find significant trade cost reductions only for “Grains & Crops.” In the service sectors, trade cost reductions range between 4 and 9%, being largest in “Business services,” “Financial services,” and “Trade services.”

In our counterfactual analysis we assume that the TTIP will reduce the costs of non-tariff measures by the same amount that other PTAs have reduced trade barriers in the past. Hence, we do not need to speculate about the changes in NTBs, and potential sectoral heterogeneity therein, that may result from the implementation of the TTIP.

Moreover, we acknowledge in our simulation the fact that the trade cost changes and the sectoral productivity dispersion parameters are estimated. Uncertainty about parameter estimates $\theta, \delta_{shallow}, \delta_{deep}$ derives from the fact, that the dataset based on which they are estimated is itself just a random draw of the underlying data generating process characterized by the true values of $\theta_0, \rho_{shallow}, \rho_{deep}$. The trade cost changes displayed in Figure 2, and, in fact, all outcomes of our simulation, are more or less complicated functions of the estimated parameters and hence, they are random variables as well. To obtain measures of uncertainty, that is, confidence intervals, for the model outcomes, we bootstrap an empirical distribution of the $\theta, \delta_{shallow}, \delta_{deep}$. That is, we draw 425 bootstrap samples (independently for every sector), estimate $\theta_b, \delta_{b,shallow}, \delta_{b,deep}$ and collect the 425 sets of estimates.¹¹ For every set of parameters $b = 1, \dots, 425$, we then simulate the effects of the TTIP and collect the variables of interest, such as changes in trade flows, output, and welfare. Thereby, we obtain a distribution of every model outcome reflecting the uncertainty present in our estimation stage, or, in fact, the uncertainty present in the data. Throughout the analysis, we calculate confidence intervals according to the percentile method proposed by Hall (1992).¹²

4 Simulation Results: Trade and Welfare Effects of the TTIP

We now have paved the way to simulate the effect of the TTIP. Our scenario of a “deep TTIP” assumes that NTBs to trade between EU countries and the United States fall by the amount estimated in the previous section and that all tariffs between the EU and

¹¹Since we expect standard errors to be correlated within country pairs, we conduct a block bootstrap within each sector, drawing country pairs instead of individual observations.

¹²Hall’s percentile method uses the quantiles of the bootstrapped distribution of the $\theta - \theta^b$ rather than just the quantiles θ^b to form confidence bounds, which ensures that the coverage probability is correctly captured if the distribution of the original estimate θ is asymmetric.

the United States are set to zero. A slight complication regarding the calibration of the model based on data from 2011 is caused by Croatia’s entry into EU in July 2013. In our 2011 data, Croatia is not yet an EU member, however, it will be part of the TTIP. In order not to confound the effects of the TTIP with the effects of Croatia’s EU accession, we simulate a counterfactual baseline equilibrium describing the world in 2011 if Croatia had been a member already at that time.¹³ Based on this counterfactual equilibrium, we then evaluate the effects of the TTIP. Except for Croatia and its neighboring countries, the change from the 2011 equilibrium to the counterfactual baseline with Croatia in the EU has negligible effects on the status quo of the countries in our analysis.¹⁴

We start our discussion of the effects of the TTIP with a summary of the status quo. Then, we present the simulation results, starting with the effects on global and bilateral trade in terms of gross flow and value added and analyze the role globally fragmented value chains in spreading the TTIP’s effects across the globe. Next, we discuss how sectoral value added is affected in different parts of the world. Finally, we investigate the regional and global welfare changes that the TTIP would bring about.

4.1 Cross-industry facts for the EU and the United States

Tables 3 and 4 provide information on the status quo of trade between the EU and the United States. All values are in US dollars and relate to the base year of 2011 including the model-based predicted adjustments for Croatia’s EU entry. Column (1) of Table 3 reports, by sector, the value added generated in the EU. 72% of total value added (GDP) is generated in the service sectors, 25% in manufacturing, and 2% in agriculture. Columns (2) and (5) show that total EU exports to the United States amount to 521 bn. US dollars which equals about 8% of total exports (excluding trade among EU countries.). However,

¹³2011 is the most recent year for which input-output data for the 140 countries/regions is available. We do not predict baseline values for some future year, as Fontagne et al. (2013) or Francois et al. (2013), since this would introduce additional margins of error.

¹⁴Details are available from the authors upon request.

Table 3: Status quo summary statistics: EU28

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Value added (in bn. USD)	Gross Exports to U.S. VA (in bn. USD)	VA (in %)	Tariffs (in %)	Gross Exports to World* VA (in bn. USD)	VA (in %)	Tariffs (in %)
Grains & Crops	172	1	3	2.97	99	75	0.68
Cattle, sheep, goats, horses	169	1	2	1.20	85	49	1.18
Forestry	32	0	1	0.48	6	17	0.26
Fishing	17	0	0	0.36	8	6	0.06
Mining (coal, oil, gas)	83	1	5	0.10	33	50	0.05
Minerals nec	45	0	3	0.04	42	29	0.02
Livestock & Meat Products	495	20	11	2.51	336	153	2.19
Textiles	92	4	3	5.96	98	48	6.98
Wearing apparel	93	3	1	10.32	71	32	10.37
Leather products	47	3	2	7.30	54	25	12.40
Wood products	89	4	4	0.34	103	50	0.36
Paper products, publishing	284	5	9	0.01	154	115	0.00
Petroleum, coal products	258	16	13	1.61	189	121	0.85
Chemical, rubber, plastic prods	600	100	54	1.33	1,059	440	1.18
Mineral products nec	149	5	4	4.11	80	54	2.93
Ferrous metals	112	8	7	0.19	193	84	0.21
Metals nec	68	8	5	1.73	173	56	0.53
Metal products	285	7	13	1.77	169	146	1.57
Motor vehicles and parts	289	42	16	1.15	676	194	0.56
Transport equipment nec	106	24	9	0.12	184	64	0.46
Electronic equipment	143	10	7	0.30	242	92	0.18
Machinery and equipment nec	701	89	49	0.86	1,043	452	0.79
Manufactures nec	133	14	6	0.92	92	46	1.03
Electricity	294	0	8	0.00	35	95	0.00
Gas manufacture, distribution	21	0	0	0.00	3	6	0.00
Water	45	0	1	0.00	1	8	0.00
Construction	1,053	1	4	0.00	53	62	0.00
Trade services	1,123	7	15	0.00	162	158	0.00
Transport nec	516	17	20	0.00	139	181	0.00
Sea transport	32	1	2	0.00	66	24	0.00
Air transport	84	19	8	0.00	141	53	0.00
Communication	387	5	12	0.00	62	103	0.00
Financial services nec	570	25	25	0.00	144	163	0.00
Insurance	155	25	11	0.00	74	40	0.00
Business services nec	2,421	31	85	0.00	493	830	0.00
Recreation and other services	535	6	8	0.00	87	93	0.00
PubAdmin/Defence/Health/Education	3,359	19	21	0.00	95	138	0.00
Dwellings	1,127	0	0	0.00	0	2	0.00
Total	16,186	521	448	1.33	6,744	4,351	1.37

Note: The table shows aggregate sectoral value added, exports and value added exports to the United States and the world in the baseline equilibrium (2011 with Croatia in the EU), and the respective tariffs for the EU28; Average tariffs in the last row reflect trade-weighted averages of tariffs in manufacturing and agriculture. * EU exports to World exclude intra-EU trade.

Table 4: Status quo summary statistics: United States

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Value added (in bn. USD)	Gross Exports to EU28	VA	Tariffs (in %)	Gross Exports to World	VA	Tariffs (in %)
Grains & Crops	130	6	5	3.38	91	52	2.61
Cattle, sheep, goats, horses	84	1	1	23.78	25	11	27.89
Forestry	13	0	0	1.12	3	2	0.23
Fishing	5	0	0	7.86	1	1	2.76
Mining (coal, oil, gas)	229	6	21	0.00	19	72	0.00
Minerals nec	29	2	3	0.02	12	11	0.01
Livestock & Meat Products	230	6	4	11.09	58	26	7.73
Textiles	62	2	2	6.01	17	10	5.32
Wearing apparel	32	1	0	10.42	4	1	7.28
Leather products	6	1	0	3.68	3	1	7.39
Wood products	121	2	2	0.98	13	10	0.66
Paper products, publishing	245	6	9	0.02	40	40	0.01
Petroleum, coal products	42	35	4	1.78	137	13	0.51
Chemical, rubber, plastic prods	422	75	40	2.13	282	151	1.57
Mineral products nec	77	3	3	3.08	14	13	3.06
Ferrous metals	75	2	5	0.42	30	25	0.18
Metals nec	45	15	6	1.92	52	21	0.88
Metal products	167	6	7	2.08	34	35	1.69
Motor vehicles and parts	143	12	4	7.88	120	29	4.26
Transport equipment nec	117	34	16	1.17	93	46	1.27
Electronic equipment	77	18	5	0.56	97	20	0.94
Machinery and equipment nec	536	63	37	1.29	314	172	1.19
Manufactures nec	48	8	4	.91	25	11	1.20
Electricity	195	0	5	0.00	1	18	0.00
Gas manufacture, distribution	37	1	1	0.00	2	4	0.00
Water	68	0	1	0.00	1	5	0.00
Construction	923	2	6	0.00	8	24	0.00
Trade services	1,971	7	30	0.00	21	122	0.00
Transport nec	289	20	16	0.00	38	49	0.00
Sea transport	32	1	1	0.00	2	5	0.00
Air transport	86	15	6	0.00	34	17	0.00
Communication	326	7	7	0.00	14	21	0.00
Financial services nec	1,172	33	35	0.00	57	96	0.00
Insurance	322	6	5	0.00	21	20	0.00
Business services nec	1,534	60	69	0.00	115	202	0.00
Recreation and other services	501	12	7	0.00	35	21	0.00
PubAdmin/Defence/Health/Education	3,501	23	20	0.00	79	69	0.00
Dwellings	1,367	0	0	0.00	0	0	0.00
Total	15,257	490	386	2.17	1,912	1,448	1.87

Note: The table shows the United States' sectoral value added, exports and value added exports to the EU28 and the world in the benchmark equilibrium (2011 with Croatia in the EU), and the respective tariffs. Average tariffs in the last row reflect trade-weighted averages of tariffs in manufacturing and agriculture.

in value added terms, exports of 448 bn. US dollars to the United States account for more than 10% of the total.¹⁵ This signals that EU exports to the United States incorporate relatively little reexports of foreign value added (including value added that was previously imported from the United States in the form of intermediates). Column (4) provides trade-weighted sector-level tariff rates that EU exporters face in the United States. These tariffs are low; the trade-weighted average rate (excluding services trade) is just 1.3%. Exports to the world encounter very similar tariff rates; thus, earlier rounds of (multilateral) trade liberalization have not particularly favored EU exports to the United States. Columns (5) and (6) report EU exports to the world. The comparison with Columns (2) and (3) shows that the United States is a particularly important market for EU services exporters: In the majority of service sectors the share of total exports going to the United States exceeds the 10% average (in VA terms) by a wide margin. The opposite is true in the agri-food sectors. The share of exports from manufacturing sectors going to the United States is also below the 10% average in most case.

Table 4 provides similar descriptive statistics for the United States. It shows that services industries in the United States account for an even larger share in total value added than in the EU (82%). The share of the agri-food sectors in total value added is comparable to the EU (2%). The United States is slightly smaller in terms of GDP (15,257 bn. vs. 16,186 bn.) and less open; domestic value added embodied in foreign absorption relative to domestic GDP amounts to 9%; in the EU the ratio equals 27%. The EU has a bilateral surplus with the United States of 31 bn. USD in gross terms and of 62 bn. USD in value added terms. This signals that a lot of EU value added reaches the United States via third countries. Moreover, exports to the EU are much more important for the United States (26% of total) than exports to the United States are for the EU (10%). Average tariffs faced by US exporters in the EU are slightly larger

¹⁵Value added exports to the EU reflect European value added embodied in US consumption or investment.

Table 5: Global trade effects of the TTIP by broad sector

	Initial Exports (in bn. USD)	Growth (in %)	95% CI	Initial share (in %)	Change in share (in %pts.)	95% CI
Agriculture	725	0.38	[0.10, 0.63]	3.60	-0.06	[-0.08, -0.05]
Manufacturing	16,079	1.71	[1.32, 1.93]	79.77	-0.40	[-0.56, -0.23]
Services	3,352	5.06	[3.84, 6.08]	16.63	0.46	[0.29, 0.63]
Total	20,157	2.22	[1.82, 2.45]	100	0.00	-

Note: Exports valued in fob-terms. (Equal-tailed) confidence intervals are computed based on 425 bootstrap replications using Hall (1992)'s percentile method.

than vice versa (2.2% versus 1.3%) but small nevertheless. The correlation between the two tariff schedules across sectors is relatively high (about .3).

4.2 Global Trade Effects of the TTIP

Reflecting the official ambitions for the TTIP, our counterfactual scenario assumes that all transatlantic tariffs are eliminated. Moreover, we assume that NTBs between the United States and the EU are reduced by the same amount as in existing deep PTAs. Table 5 presents the changes in aggregate trade patterns implied by the model. World trade is predicted to increase by about 2.2%.¹⁶ The model also predicts that the TTIP affects the sectoral composition of aggregate trade flows. The strongest trade growth occurs in the service sector, where the predicted increase is 5%. This increases the share of service trade in total trade, which was initially at 17%, by .5 percentage points, at the expense of the shares of manufacturing and agricultural goods. However, trade in manufacturing and agriculture also increases in absolute terms, by 1.7 and .4%, respectively. Irrespective of the considerable amount of uncertainty around the precise trade cost reduction implied by the data as visualized in Figure 2, the changes in trade aggregate patterns predicted by the model are all significantly different from zero.

The predicted growth in gross trade, however, is not indicative of the growth in world

¹⁶Note that intra-regional trade in GTAP's "Rest of ..." regions is not included in this number.

Table 6: Global value added trade effects of the TTIP by broad sector

	Value added exports			VAX ratio	
	Initial (in bn. USD)	Share (in %)	Growth w. TTIP (in %)	Initial (in %)	With TTIP (in %)
Agriculture	746	5.2	0.2	102.9	102.7
Manufacturing	8,246	57.4	1.3	51.3	51.1
Services	5,374	37.4	2.8	160.3	156.8
Total	14,366	100.0	1.8	71.3	71.0

GDP (or value added) induced by the TTIP. Trade in intermediates – which are used to produce traded goods in consecutive stages of production and might thus cross borders multiple times – drives a wedge between the trade volume registered at customs and the value added content of countries’ exports. More specifically, trade in intermediate goods leads to double counting of value added from upstream stages of production. Table 6 shows that in the baseline equilibrium value added worth 14.4 tn. US dollars (10% of world GDP) was exported, that is, absorbed (consumed or invested) in a country other than the country of origin. Comparing this number to the recorded trade volume of 20.2 tn. US dollars (Column (1) in Table 5), we find a value added export to export (VAX) ratio of 71.3%. Thus, almost 30% of the trade volume measured at customs is double-counted value added. With the TTIP, our model predicts value added trade to increase by 1.8%.¹⁷ Hence, growth in world value added trade induced by the TTIP falls behind growth in world gross exports; the VAX ratio declines slightly. Presumably, the TTIP increases the extent of double-counting of value added in trade statistics, because it leads to more back-and-forth trade of intermediates among the TTIP countries.

Decomposing total value added trade into manufacturing, services and agricultural value added reveals that services trade is more important than recorded trade flows would suggest. Even though manufacturing value added accounts for the largest part of exported value added (57%), its share is much smaller than the share in recorded trade flows (80%).

¹⁷We do not compute confidence intervals for the value added trade flows because the computational burden is enormous. The computation of value added exports involves inverting a $(140 \times 38) \times (140 \times 38)$ matrix, which would have to be conducted for every bootstrap sample.

Table 7: Aggregate trade effects of the TTIP

Region	(1) ASEAN ^b	(2) Brazil	(3) Canada	(4) China	(5) EU28	(6) Mexico	(7) SACU ^a	(8) Turkey	(9) USA
<i>Export growth (in %) from ... to</i>									
ASEAN	-0.3	-0.3	-0.7	-0.5	-0.2	-0.9	-0.6	-0.5	-0.7
Brazil	-0.3	-0.3	-2.0	-0.5	-0.3	-1.9	-0.7	-0.6	-0.5
Canada	-0.0	-0.1	-0.4	-0.3	-3.8	-1.2	-0.3	-0.4	-1.3
China	-0.3	-0.2	-0.6	-0.4	-0.2	-0.7	-0.4	-0.4	-1.0
EU28	-0.7	-0.7	-1.3	-0.7	-0.4	-1.4	-0.8	-0.8	54.5
Mexico	0.4	0.3	-1.3	0.2	-0.9	-0.6	-0.0	-0.2	-1.5
SACU	-0.3	-0.1	-1.4	-0.3	-0.4	-0.6	-0.4	-0.6	-2.6
Turkey	-0.2	-0.2	-1.6	-0.4	-0.3	-1.3	-0.4	-0.3	-1.2
USA	-1.1	-1.0	-1.6	-1.0	58.5	-1.4	-1.1	4.9	-0.5
<i>Growth of value added transfers (in %) from ... to</i>									
ASEAN	-0.3	-0.4	-0.1	-0.2	-1.2	0.3	-0.3	-0.4	0.2
Brazil	-0.4	-0.3	0.2	-0.2	-1.3	0.6	-0.3	-0.5	0.4
Canada	-0.6	-0.8	-0.3	-0.5	2.1	-0.7	-0.6	-0.2	-1.7
China	-0.5	-0.5	-0.4	-0.3	-1.2	0.3	-0.3	-0.6	0.4
EU28	-0.6	-0.4	4.8	-0.2	-0.4	11.9	-1.7	-1.1	46.9
Mexico	-1.0	-1.0	-1.3	-0.8	3.9	-0.5	-0.7	-0.2	-2.2
SACU	-0.6	-0.6	-0.0	-0.4	-1.8	0.9	-0.3	-0.9	3.5
Turkey	-0.6	-0.5	1.5	-0.4	-1.7	3.7	-0.6	-0.3	8.0
USA	0.0	-0.1	-1.8	-0.6	40.5	-1.7	0.4	5.2	-0.3

Note: Diagonals describes changes in intra-national trade and/or in the trade volume within a region. ^a Southern African Customs Union, ^b Association of Southeast Asian Nations.

The VAX ratio of manufacturing is only 51%, indicating that manufacturing trade partly takes place in the form of intermediates trade and that traded manufacturing goods embody a significant amount of value added from the services industries. Indeed, while the recorded services trade is about 3.4 bn. USD, the value added from the services sectors embodied in global trade amounts to 5.4 bn. USD. Services thus account for 37% of exported value added, but only for 17% of recorded trade volumes. Accordingly, the VAX ratio for services is very large (160%). Under the TTIP, agricultural, manufacturing and services value added trade all grow, but, especially in the case of services, at a much smaller rate than gross trade flows.

4.3 Bilateral Trade Effects of the TTIP

Table 7 looks into the TTIP's effects on regional trade relationships. Again, we discuss changes in gross trade and trade in value added. Our model predicts a substantial amount of trade creation between the EU and the United States in the long run. EU exports to the United States are expected to increase by 55%, US exports to the EU would go up by 59%. However, trade statistics exaggerate the actual transfer of value added between the two transatlantic regions. EU value added exports to the United States are predicted to increase only by 47%, US value added exports increase by 41% under the TTIP. This implies that the VAX ratio of EU exports to the United States declines from 86% (as implied by the last row of Table 3) to 78%. Similarly, the VAX ratio of US exports to the EU declines from 79 to 61%. This suggests that the TTIP leads to a deepening of transatlantic production chains. Intensified intermediate goods trade between the EU and the United States will lead to a higher foreign value added content of production, increase the extent of double-counting as well as the value added from either of the two partners that is processed by the other and sold to third parties. All these factors contribute to the wedge between recorded trade volumes and actual value added transfers.

The fact that the TTIP countries engage in global production sharing along the value chain implies that the economic consequences of trade diversion are only partially captured by changes in the pattern of bilateral trade flows with non-TTIP countries. Table 7 shows that the EU and the United States are predicted to export less to and import less from non-TTIP countries. In value added terms, however, the picture is more nuanced. In particular, the predicted patterns show how the growing transatlantic production network interacts with the existing North American and European production network. Even though the EU exports less to Canada (-1.3%), Canadian absorption of European value added increases by 4.8%. We find a similar pattern for the EU's trade with Mexico. This pattern emerges because, with the TTIP, relatively more value added from the EU enters production in the United States embodied in intermediates, that will then be absorbed

in Canada and Mexico who trade intensively with the United States. Vice versa, the EU absorbs more Canadian and Mexican value added, which reaches the EU embodied in US exports. Canadian value added exports to the EU increase by 2.1%; compared to a decrease in Canadian exports of -3.8%.

The EU, on the other hand, has production networks, for example, with Turkey and South Africa. Even though exports from the Southern African Customs Union to the United States fall by 2.6%, the SACU value added exports to the United States increase by 3.5%. Another interesting case is the United States'United States trade relationship with Turkey. Turkey is in a customs union with the EU, and so the Turkish import tariffs on US products would also be eliminated under the TTIP. Thus, US exports to Turkey are stimulated and increase by 4.9%. The asymmetric nature of the Turkish currency union with the EU becomes evident when looking at Turkey's exports to the United States. The United States does not eliminate its import tariffs on Turkish products with the TTIP, and hence, Turkish exporters suffer from trade diversion on the US market. Turkish exports to the United States fall by 1.2%. But indirectly (presumably due to strong input-output linkages with the EU), Turkish value added exports to the United States still grow by 8%.

Table 7 also shows that the TTIP will lead to trade diversion within the EU. Intra-EU trade both in gross terms and in terms of value added falls by .4%. Last, the TTIP tends to reduce trade flows between third countries. But in some cases, it stimulates trade among third countries, such as, for example, Mexico's export to Brazil, China, and the ASEAN countries are expected to increase. This general ambiguity is due to three potentially opposing effects: first, income in third countries can rise or fall and thus impact imports through a general demand effect; second, trade may rise as exports that went to the EU or the United States in the baseline situation are redirected; and third, wage increases in the TTIP countries enhance the relative competitiveness of other exporters in third markets.

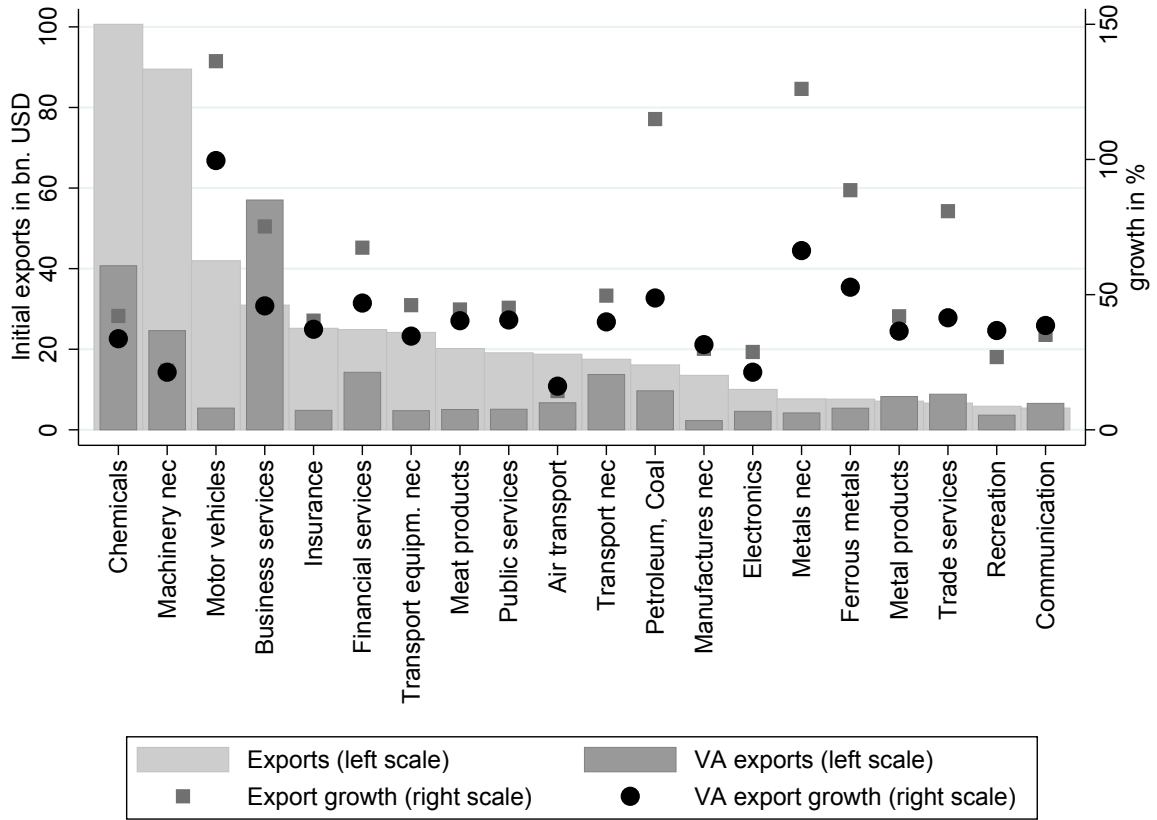
Summarizing, trade and value added trade changes mostly follow similar patterns. However, there are some important exceptions where recorded and value added trade flows change disproportionately or even go in different directions. This is the result of newly forming or existing international production chains. These findings highlight that using a model with input-output relationship that can capture the interconnectedness of countries and sectors in the global value chain is vital for an analysis of structural economic changes such as the integration of regional markets.

4.4 Sectoral Trade Effects

Figure 3 shows the sectoral composition and evolution of the EU's exports to the United States under the TTIP. Sectors are arranged in descending order of their trade volumes and only sectors with initial trade shares above 1% are shown. The light grey bars depict initial export volumes, the squares show the counterfactual export volume growth with the TTIP. In gross terms, the EU's most important export sector with respect to the United States is "Chemicals," followed by "Machinery," "Motor Vehicles," and "Business services." Exports from all sectors increase with the TTIP, but there is great heterogeneity across sectors. Large growth in exports occurs in the manufacturing sectors "Motor vehicles," "Metals nec," and "Ferrous Metals," and in "Petroleum, Coal." Exports of "Trade services," "Financial services," and "Business services" are also predicted to increase substantially.

Figure 3 also shows the EU's sectoral value added exports to the United States in the initial situation (dark grey bar) and the counterfactual growth with the TTIP (black dot). Interestingly, in value added terms, the EU's top export sector is no longer "Chemicals," but rather "Business services." As discussed earlier, a lot of service value added is traded indirectly, embodied in the exports and imports of tradable goods. Accordingly, growth in value added exports is significantly smaller compared to growth in gross exports in the manufacturing sectors. In the service sectors the two are commensurate. Nevertheless,

Figure 3: Sectoral composition of EU exports and value added exports to the United States

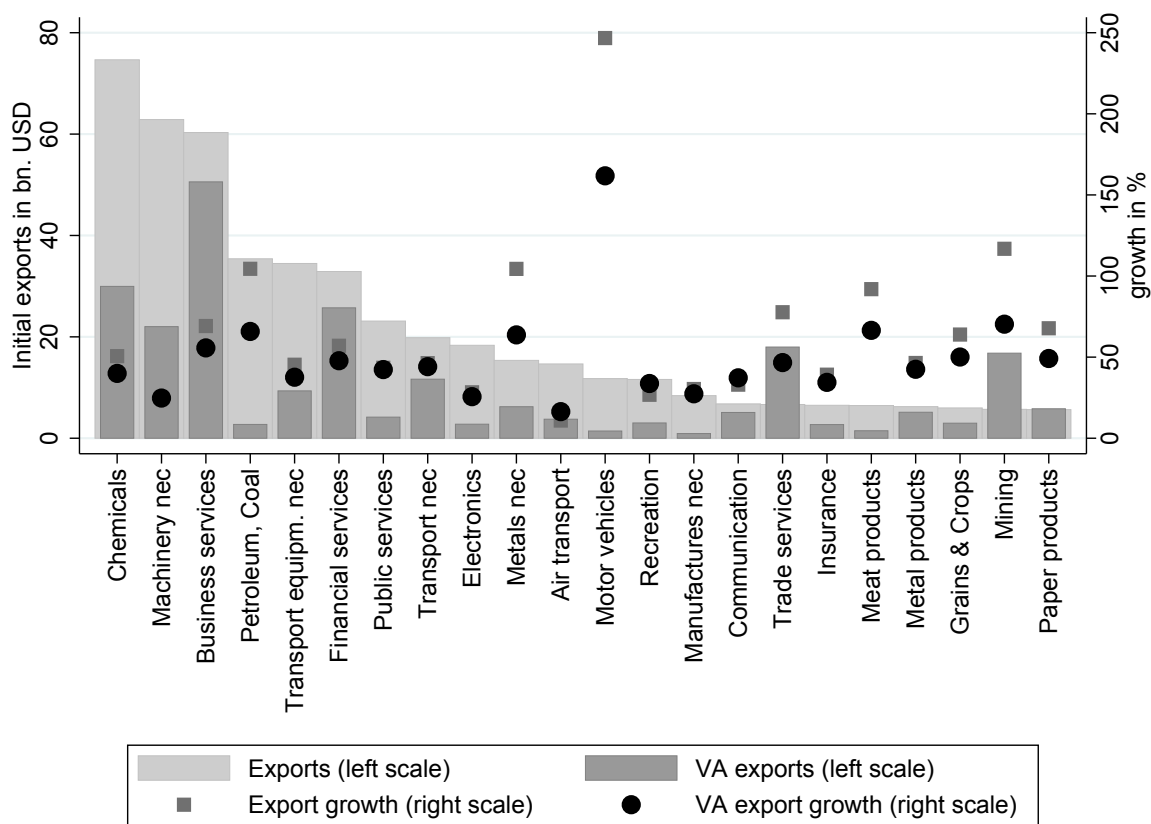


Note: Only sectors with shares in total output above 1% are displayed.

the manufacturing sectors “Motor vehicles,” “Metals nec,” and “Ferrous Metals,” as well as “Petroleum, Coal” experience the highest growth rates also in valued added terms.

Figure 4 shows a similar graph for US exports to the EU. As for the EU, “Chemicals” is the United States’ most important export sector in gross terms, but “Business services” account for the largest part of US value added absorbed in the EU. Export growth is predicted to be extremely large in the “Motor vehicles” sector (250%). Moreover, US exports are predicted to increase substantially in “Metals nec,” “Mining,” “Petroleum, Coal,” “Meat products,” “Trade services,” and “Grains & Crops.” These sectors also experience the largest growth rates in terms of value added exports.

Figure 4: Sectoral composition of US exports and value added exports to the EU



Note: Only sectors with shares in total output above 1% are displayed.

4.5 Effects on Sectoral Value Added

In this section, we investigate the effects of the TTIP on the sectoral production structure. Table 8 shows, by region, the share of agriculture, manufacturing and services in total value added, the predicted change in value added due to the TTIP, and the predicted change in the aggregate sector's share in total value added of the region. Both in the EU and the United States, service industries make up by far the largest part of total value added (73% in the EU and 81% in the United States). Manufacturing is thus more important in the EU than in the United States. In Germany, for example, the share of manufacturing is 26.2% and higher than in most developed economies. Agricultural value added plays a minor role for both TTIP countries. Our simulations predict that the TTIP

leads to a slight reindustrialization in the EU. The share of manufacturing value added in total value added increases by 0.1 percentage points, on average. Service industries and agriculture lose a small share in total value added. In the United States, the sectoral output structure changes very little.

Table 8 also shows that the TTIP leads to deindustrialization in the non-TTIP countries. The share of services in total value added tends to increase to the detriment of manufacturing in all non-TTIP regions with the exception of the countries in the Alianza del Pacífico, who experience a shift away from the manufacturing *and* services towards agriculture, and a few non-TTIP European countries, where both agriculture and manufacturing gain significant output shares.

This pattern of deindustrialization versus reindustrialization is also supported by Figure 5, which shows kernel density estimates of the changes in sectoral shares (manufacturing and services only) across countries, separately for non-TTIP and TTIP countries. The distribution of changes in manufacturing shares for non-TTIP countries (dark grey dashed line) lies to the left of the respective distribution of changes among the TTIP countries (dark grey solid line) and reaches much further into the negative range. The opposite pattern is obtained for the distribution of changes in the service sectors which tend to be positive for the non-TTIP countries (light grey lines).

Within the EU, however, the reindustrialization trend is not universal. Table 8 lays out the sectoral changes for the 28 EU countries. The shift towards manufacturing is driven primarily by the Western European economies; Austria, Germany, Belgium, Ireland, Finland, Great Britain, and Sweden. Some Central and Eastern European economies like Bulgaria, Cyprus, Slovenia as well as Luxembourg shift production away from manufacturing towards services and, in the case of Bulgaria, towards agriculture.

Table 8: The effects of the TTIP on sectoral value added, by region

Region:	Agriculture		Manufacturing		Services	
	Initial share (in %)	Change in share (in %pts.)	Change in VA (in %)	Initial share (in %)	Change in share (in %pts.)	Change in VA (in %)
<i>TTIP countries</i>						
EU28	2.4	-0.01*	-0.22	25.1	0.12*	0.77*
USA	1.5	0.00	0.70*	17.7	0.02	0.53*
<i>Non-TTIP regions</i>						
ASEAN	12.2	0.00*	-0.26*	33.5	-0.05*	-0.45*
Al. del Pacifico	5.3	0.02*	-0.05	29.8	-0.01	-0.47*
AUS & NZL	3.3	0.00*	-0.22*	19.8	-0.03*	-0.47*
Canada	2.4	0.01*	-0.01	22.0	-0.07*	-0.68*
Central Asia	11.3	-0.00	-0.34*	31.1	-0.06	-0.51*
China	9.7	0.00	-0.35*	36.3	-0.02*	-0.40*
EFTA	1.6	0.00	-0.14*	23.5	-0.09	-0.65
East Asia	1.5	0.00*	-0.20*	20.8	-0.04*	-0.58*
Eurasian CU	4.6	0.00	-0.30*	30.4	-0.04*	-0.54*
Central America	9.3	-0.01*	-0.15*	25.5	-0.02*	-0.08
MERCOSUR	7.3	-0.00	-0.29*	21.9	-0.01	-0.30*
Mid-East & N.Africa	8.7	0.00	-0.27*	37.0	-0.06*	-0.45*
Oceania	5.6	-0.00	-0.31*	19.0	-0.10*	-0.80*
Oil exporters	0.9	-0.00	-0.27*	64.3	-0.05*	-0.33*
Rest of Europe	7.7	0.18*	2.79*	25.0	0.29*	1.57*
Rest of World	12.1	-0.00	-0.17*	13.6	-0.05*	-0.56*
South Asia	18.5	-0.00*	-0.24*	19.6	-0.04*	-0.42*
South African CU	3.4	0.00*	-0.26*	26.1	-0.05*	-0.53*
Sub-Saharan Africa	28.1	0.00	-0.14*	29.4	-0.01	-0.18
Turkey	7.6	0.01*	-0.21*	23.2	-0.03*	-0.42*

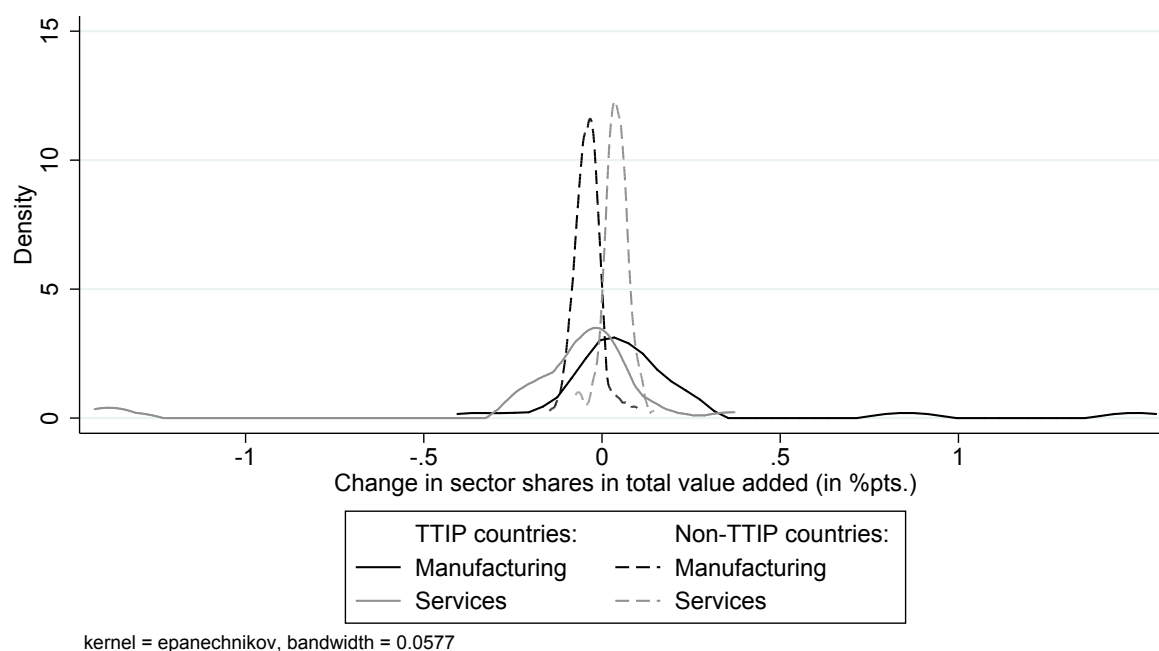
Note: * significantly different from zero at $\alpha = 5\%$ level according to (equal-tailed) confidence intervals that were computed based on 425 bootstrap replications using Hall (1992)'s percentile method.

Table 9: The effects of the TTIP on sectoral value added in the EU28 countries

Region:	Agriculture			Manufacturing			Services		
	Initial share (in %)	Change in share (in %pts.)	Change in VA (in %)	Initial share (in %)	Change in share (in %pts.)	Change in VA (in %)	Initial share (in %)	Change in share (in %pts.)	Change in VA (in %)
AUT	1.8	-0.01*	-0.25*	26.8	0.23*	1.24*	71.4	-0.21*	0.09*
BEL	1.4	-0.01*	-0.23	24.4	0.22*	1.56*	74.2	-0.21*	0.37*
BGR	5.3	0.05*	0.93*	27.7	-0.04*	-0.11	67.1	-0.00	0.05*
CYP	8.3	-0.00	0.03	12.6	-0.07*	-0.45*	79.1	0.07*	0.16*
CZE	3.0	-0.00	-0.03	39.6	0.03*	0.13*	57.4	-0.02*	0.02
DEU	1.4	-0.02*	-0.87*	28.7	0.16*	0.99*	69.8	-0.15*	0.20*
DNK	2.5	-0.01*	-0.32*	24.5	-0.04	0.11	73.0	0.05	0.35*
ESP	3.3	-0.01	-0.45	20.0	0.01	0.02	76.7	0.00	-0.03
EST	3.6	0.00	0.13	33.3	0.05*	0.28*	63.1	-0.06*	0.02
FIN	2.9	0.00*	0.29*	29.8	0.17*	0.71*	67.4	-0.17*	-0.12*
FRA	2.2	-0.00	0.00	21.6	0.02	0.17*	76.2	-0.02	0.04
GBR	1.0	-0.01*	-0.24*	20.5	0.19*	1.39*	78.5	-0.18*	0.24*
GRC	4.7	-0.00	0.07	21.6	-0.17	-0.65	73.7	0.17	0.37
HUN	5.8	-0.01*	-0.14	38.8	0.02	0.14	55.4	-0.00	0.10
IRL	3.1	-0.07*	-0.41	33.9	1.50*	6.52*	63.0	-1.42*	-0.29
ITA	2.8	-0.01*	-0.23	26.8	0.09*	0.63*	70.4	-0.07*	0.19*
LTU	9.6	-0.06*	-0.53*	28.7	0.08*	0.33*	61.8	-0.02	0.02
LUX	0.8	-0.02*	-1.83*	17.5	-0.35*	-0.90*	81.7	0.37*	1.57*
LVA	6.3	0.01	0.14	40.4	0.02	0.04	53.3	-0.02	-0.04
MLT	3.3	-0.02*	-0.09	38.8	0.05	0.60	57.9	-0.03	0.40*
NLD	2.6	0.00	0.48*	21.4	0.08*	0.70*	76.0	-0.08*	0.23*
POL	3.6	0.00	0.02	35.2	-0.00	-0.02	61.3	0.00	0.00
PRT	3.2	-0.03*	-0.57	25.3	0.07*	0.49*	71.5	-0.04*	0.16*
ROU	15.8	-0.02*	-0.16*	35.2	-0.01	-0.04	49.0	0.03	0.03
SVK	4.4	-0.01*	0.01	38.2	0.11*	0.42*	57.3	-0.11*	-0.06
SVN	4.3	-0.01*	0.09	31.4	-0.09*	0.01	64.3	0.10*	0.45*
SWE	1.9	-0.00	0.02	23.6	0.21*	1.01*	74.5	-0.21*	-0.17*

Note: * significantly different from zero at $\alpha = 5\%$ level according to (equal-tailed) confidence intervals that were computed based on 425 bootstrap replications using Hall (1992)'s percentile method.

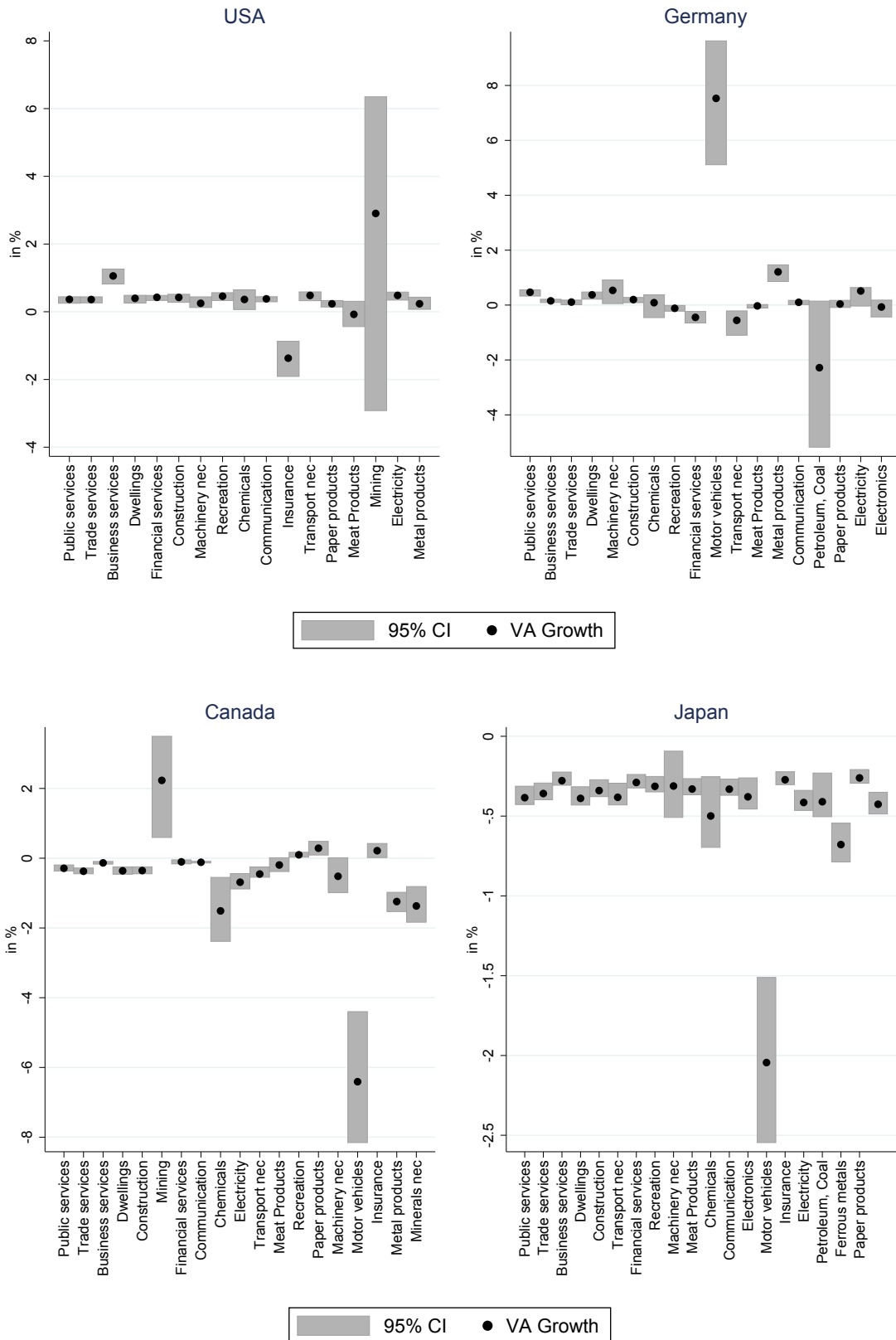
Figure 5: Changes in manufacturing and services shares with the TTIP



Note: The figure shows the density of changes of the share of manufacturing (black lines) and services (grey lines) value added (in percentage points) for the TTIP scenario of deep trade integration distinguished by the TTIP (solid lines) and non-TTIP countries (dashed lines).

On the more disaggregated level, sectoral effects are very heterogeneous across countries. Figure 6 plots sectoral value added changes for four exemplary countries, the United States, Germany, Canada, and Japan. In every panel, sectors are ordered by their initial shares in total value added of the respective countries, with shares decreasing from left to right. In the United States (upper left panel) all important sectors gain, except for the insurance industry. “Mining” value added is predicted to increase strongly, however not significantly so. The large margin of error owes to the fact, that the effect of deep trade agreements on changes in this sector are estimated with low precision (cp. Table 1). Germany experiences a huge value added increase in the “Motor vehicles” sector and significant gains in “Metal products,” but also small losses in important sectors such as “Transport (equipment) nec” and “Financial services.”

Figure 6: Sectoral value added: TTIP-induced changes



Note: (Equal-tailed) confidence intervals based on 425 bootstrap samples Hall (1992)'s percentile method. Sectors in every panel ordered along shares in the respective countries total value added, in decreasing order from left to right. Only sectors with initial shares in total value added > 1% are displayed.

As exemplary TTIP outsiders we show sectoral value added changes for Canada and Japan. In Canada, most of the important sectors experience a decline in value added, most notably in “Motor Vehicles,” “Minerals nec,” “Machinery nec,” and “Metal products.” The sectors that gain, “Mining,” “Paper products,” and “Insurance,” tend to be located at early stages of the production chain. This is well in line with the argument laid out above, that third countries gain from the increase in production in the TTIP countries through an increase in the demand for intermediates. In Japan, which is not an important source country of intermediate inputs for the TTIP regions, value added declines in all important sectors.

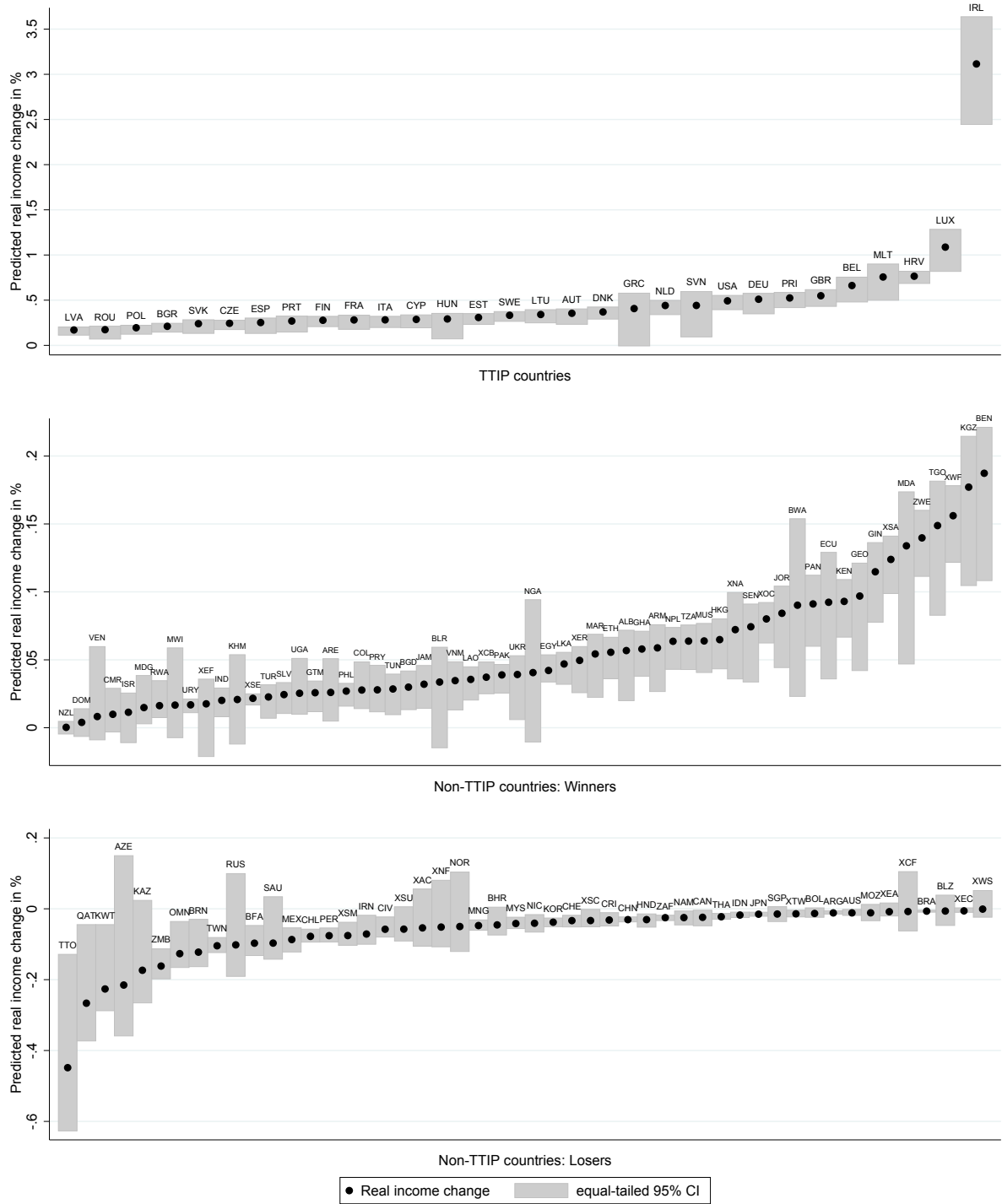
4.6 Welfare Effects of the TTIP

Our simulation predicts that the TTIP will bring about significant real income gains for the EU countries and the United States, but also for many other countries. Figure 7 presents welfare effects with confidence bands for all countries, Table 10 provides numbers for selected individual countries and average effects for the world’s regions.¹⁸ In the EU, real income is predicted to go up by .43% on average, in the United States by .49%. Within the EU, Ireland stands out with a predicted real income increase by 3.1%, followed by Luxembourg (1.1%). Moreover, welfare effects within the EU tend to be larger for the Western and Northern European countries and smaller for the Central and Southern European economies. With the exception of Greece, all TTIP countries’ predicted gains are significantly different from zero at the 5% level.

Out of the 110 non-TTIP countries, 60 are predicted to gain, and for 50 of them the real income effects are significant at the 5% level. For 33 non-TTIP countries, we find significantly negative predicted welfare effects. Among the non-TTIP winners are many developing countries from Central America, Oceania, South Asia, and Sub-Saharan Africa,

¹⁸Regional effects are weighted averages using real GDP in 2011 as weights.

Figure 7: Simulated changes on real income with the TTIP



Note: The figure shows predicted real income changes (in %) for all 140 countries/regions included in our analysis. (Equal-tailed) confidence intervals are computed based on 425 bootstrap replications using Hall (1992)'s percentile method.

Table 10: Welfare effects by regions

	Real income change (in %)	95% CI
<i>TTIP Countries</i>	0.46	[0.354, 0.513]
EU28	0.43	[0.313, 0.478]
USA	0.49	[0.396, 0.554]
<i>Non-TTIP Regions</i>	-0.02	[-0.035, -0.004]
ASEAN	-0.01	[-0.021, -0.007]
AUS & NZL	-0.01	[-0.014, 0.001]
Alianza del Pacifico	-0.06	[-0.081, -0.038]
Canada	-0.02	[-0.042, 0.002]
Central America	0.01	[0.001, 0.022]
Central Asia	-0.03	[-0.058, 0.035]
China	-0.03	[-0.033, -0.020]
EFTA	-0.04	[-0.070, 0.018]
East Asia	-0.02	[-0.028, -0.015]
Eurasian CU	-0.11	[-0.195, 0.084]
MERCOSUR	-0.01	[-0.009, 0.002]
Middle East & North Africa	-0.02	[-0.034, 0.023]
Oceania	0.08	[0.064, 0.094]
Oil exporters	-0.10	[-0.149, 0.011]
Rest of Europe	0.06	[0.032, 0.074]
Rest of World	0.05	[0.034, 0.059]
SACU	-0.02	[-0.029, -0.014]
South Asia	0.02	[0.011, 0.031]
Sub-Saharan Africa	0.02	[-0.008, 0.066]
Turkey	0.02	[0.009, 0.033]
<i>World</i>	0.20	[0.155, 0.226]

Note: Regional changes are computed as real GDP-weighted averages of country effects. (Equal-tailed) confidence intervals are computed based on 425 bootstrap replications using Hall (1992)'s percentile method.

and the primarily developing countries grouped in the “Rest of World.” Also, countries close the EU, such as Turkey and the Balkans (collected in the “Rest of Europe”) gain from the TTIP. Arguably, the average gains for these regions are small (between .01 and

.08), however, these make a strong case against the conjecture that the TTIP would be harmful to the developing world. Increased demand for final and intermediate goods in the TTIP countries counteracts negative trade diversion effects, benefitting countries that are integrated into the TTIP partners production networks or which are important suppliers of raw materials. Trade diversion effects are less problematic for countries whose sectoral production structure is complementary to those of TTIP regions, which tends to be true for the less developed economies. This may also explain why welfare effects for Canada are predicted to be negative even though Canada is closely integrated with the United States. The largest losses are expected to occur in the oil-producing countries in the Middle East which compete directly with North American and Central Asian producers in supplying the TTIP regions. Moreover, countries far away from either of the two TTIP regions, such as the East and South East Asian economies including China, Korea, and Japan lose from the TTIP. The industrialized economies in the Far East are likely harmed because their production structure is relatively similar to the TTIP countries. Moreover, because of their remoteness, these countries are of less importance to the TTIP countries as suppliers of intermediate and final goods and hence, benefit less from an increase in demand. Summing up all countries' gains and losses, weighted by their shares in real world GDP, we find that the world as whole gains from the TTIP in terms of an increase in real GDP by .2%.

5 Conclusion

A number of systemically relevant preferential trade agreements (PTAs) are under negotiation. The largest of these mega-regionals is the proposed Transatlantic Trade and Investment Partnership (TTIP). In this paper, we use the multi-country, multi-industry Ricardian trade model of Caliendo and Parro (2015) extended to include non-tariff barriers to trade and trade in services to assess the potential effects of the TTIP on the

global pattern of trade, production, and welfare. The framework features international and cross-sectoral production linkages and therefore allows taking into account globally fragmented value chains and regional production networks. Hence, the model framework combined with rich data on 38 sectors in 140 countries or regions from the GTAP database is well suited to analyze the effects of the TTIP, a deep trade agreement aimed at addressing the important features of 21st century trade: fragmented value chains, trade in services, and non-tariff barriers to trade.

The main assumption of our quantitative experiment is that, in addition to eliminating all tariffs between the EU and the United States, the TTIP will lower the costs of non-tariff measures by the same amount as existing bilateral agreements have, on average, reduced non-tariff barriers. We use the gravity equation implied by the model to estimate the trade cost reductions achieved by existing shallow and deep PTAs, as well as the unobserved parameters of the model. We simulate the model to quantify the trade, production, and welfare effects of the TTIP.

We find that the potential effects of the TTIP are quite substantial: real income is predicted to increase by .43% and .49% in the EU and United States, respectively. We find positive predicted effects for many other countries, including large parts of the developing world, and for the world on average. Positive effects in third countries are driven by the increase in income and demand in the TTIP regions, that benefits suppliers of consumption goods, intermediate goods, and raw materials. Some countries, including the oil producers in the Middle East and the industrialized economies in East Asia, are expected to lose from the TTIP.

Our framework is closely the “New Quantitative Trade Theory” literature. This literature (surveyed by Costinot and Rodriguez-Clare, 2014) uses parsimonious trade models combined with structural estimation to conduct counterfactual analyses. For the time being, the methodology has barely been used for the analysis of real trade policy initiatives; most existing work still uses more traditional large-scale computable general equilibrium

(CGE) models. While the availability of industry-level trade and output data, the information on existing PTAs, and state-of-the-art of econometric tools has much improved over the last years, there is particular need for further work in at least four areas: First, the unbiased econometric estimation of structural parameters requires quasi-experimental variation and appropriate methods. This remains an important area for future work. Second, top-down approaches to non-tariff trade barriers, as used in this paper, differ from bottom-up assessments based on Francois et al. (2009). Understanding this discrepancy is key if one wants to narrow the interval of welfare predictions found in studies with different approaches to non-tariff barriers to trade. Third, both traditional CGE models as well as the frameworks surveyed by Costinot and Rodriguez-Clare (2014) neglect foreign direct investment. This is particularly important in the transatlantic context. Fourth, estimates presented in this paper may underestimate the true effects as they do not account for effects of trade liberalization on the incentives to develop new products or engineer new processes. A tractable dynamic framework would thus be highly welcome.

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Appendix

Table A.11: Overview of sectors and aggregation levels

GTAP sectors		Sector aggregates used in the analysis		Broad classification
1	Paddy rice	1	Grains & Crops	Agriculture
2	Wheat	1	Grains & Crops	Agriculture
3	Cereal grains nec	1	Grains & Crops	Agriculture
4	Vegetables, fruit, nuts	1	Grains & Crops	Agriculture
5	Oil seeds	1	Grains & Crops	Agriculture
6	Sugar cane, sugar beet	1	Grains & Crops	Agriculture
7	Plant-based fibers	1	Grains & Crops	Agriculture
8	Crops nec	1	Grains & Crops	Agriculture
9	Cattle, sheep, goats, horses	2	Cattle, sheep, goats, horses	Agriculture
10	Animal products nec	2	Livestock & Meat Products	Agriculture
11	Raw milk	2	Livestock & Meat Products	Agriculture
12	Wool, silk-worm cocoons	2	Livestock & Meat Products	Agriculture
13	Forestry	3	Forestry	Agriculture
14	Fishing	4	Fishing	Agriculture
15	Coal	5	Mining (coal, oil, gas)	Manufacturing
16	Oil	5	Mining (coal, oil, gas)	Manufacturing
17	Gas	5	Mining (coal, oil, gas)	Manufacturing
18	Minerals nec	6	Minerals nec	Manufacturing
19	Meat: cattle, sheep, goats, horses	2	Livestock & Meat Products	Manufacturing
20	Meat products nec	2	Livestock & Meat Products	Manufacturing
21	Vegetable oils and fats	7	Livestock & Meat Products	Manufacturing
22	Dairy products	7	Livestock & Meat Products	Manufacturing
23	Processed rice	1	Grains & Crops	Manufacturing
24	Sugar	7	Livestock & Meat Products	Manufacturing
25	Food products nec	7	Livestock & Meat Products	Manufacturing
26	Beverages and tobacco products	7	Livestock & Meat Products	Manufacturing
27	Textiles	8	Textiles	Manufacturing
28	Wearing apparel	9	Wearing apparel	Manufacturing
29	Leather products	10	Leather products	Manufacturing
30	Wood products	11	Wood products	Manufacturing
31	Paper products, publishing	12	Paper products, publishing	Manufacturing
32	Petroleum, coal products	13	Petroleum, coal products	Manufacturing
33	Chemical, rubber, plastic prods	14	Chemical, rubber, plastic prods	Manufacturing
34	Mineral products nec	15	Mineral products nec	Manufacturing
35	Ferrous metals	16	Ferrous metals	Manufacturing
36	Metals nec	17	Metals nec	Manufacturing
37	Metal products	18	Metal products	Manufacturing
38	Motor vehicles and parts	19	Motor vehicles and parts	Manufacturing
39	Transport equipment nec	20	Transport equipment nec	Manufacturing
40	Electronic equipment	21	Electronic equipment	Manufacturing
41	Machinery and equipment nec	22	Machinery and equipment nec	Manufacturing
42	Manufactures nec	23	Manufactures nec	Manufacturing
43	Electricity	24	Electricity	Services
44	Gas manufacture, distribution	25	Gas manufacture, distribution	Services
45	Water	26	Water	Services
46	Construction	27	Construction	Services
47	Trade	28	Trade	Services
48	Transport nec	29	Transport nec	Services
49	Sea transport	30	Sea transport	Services
50	Air transport	31	Air transport	Services
51	Communication	32	Communication	Services
52	Financial services nec	33	Financial services nec	Services
53	Insurance	34	Insurance	Services
54	Business services nec	35	Business services nec	Services
55	Recreation and other services	36	Recreation and other services	Services
56	PubAdmin/Defence/Health/Education	37	PubAdmin/Defence/Health/Education	Services
57	Dwellings	38	Dwellings	Services

Table A.12: IV Results for Agricultural and Manufacturing Sectors

Sector:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln \tau$	-2.310** (0.148)	-2.441** (0.163)	-3.385** (0.553)	-3.156** (0.657)	-6.021 (4.199)	-3.695** (0.690)	-2.498** (0.093)	-4.913** (0.285)	-1.613** (0.398)	-2.939** (0.299)	-2.774** (0.263)	-4.697** (0.241)
<i>Shallow</i>	0.249** (0.106)	-0.261** (0.116)	-0.024 (0.156)	-0.182 (0.210)	1.269** (0.591)	0.357** (0.144)	0.188** (0.082)	0.079 (0.092)	-0.023 (0.113)	0.208** (0.095)	0.073 (0.075)	0.146* (0.079)
<i>Deep</i>	0.401** (0.118)	-0.204 (0.125)	0.086 (0.150)	0.076 (0.209)	0.830 (0.542)	0.364** (0.129)	0.289** (0.091)	0.294** (0.082)	0.502** (0.106)	0.637** (0.093)	0.476** (0.077)	0.526** (0.078)
$\ln Dist$	-0.537** (0.040)	-0.561** (0.042)	-0.415** (0.053)	-0.670** (0.072)	-0.592** (0.155)	-0.439** (0.049)	-0.632** (0.034)	-0.562** (0.031)	-0.682** (0.035)	-0.648** (0.034)	-0.719** (0.029)	-0.928** (0.030)
<i>Contiguity</i>	0.831** (0.089)	0.695** (0.080)	0.942** (0.101)	0.725** (0.124)	0.457** (0.211)	0.607** (0.087)	0.762** (0.080)	0.451** (0.064)	0.638** (0.089)	0.786** (0.086)	0.775** (0.076)	0.675** (0.077)
<i>ComLang</i>	0.015 (0.058)	0.109* (0.062)	-0.086 (0.074)	-0.051 (0.084)	-0.552** (0.195)	0.025 (0.058)	0.206** (0.047)	0.201** (0.044)	0.375** (0.051)	0.294** (0.048)	0.280** (0.044)	0.422** (0.045)
<i>Colony</i>	0.127 (0.086)	0.070 (0.088)	0.343** (0.097)	0.046 (0.109)	0.347 (0.242)	0.070 (0.078)	0.296** (0.074)	0.267** (0.065)	0.403** (0.092)	0.467** (0.084)	0.470** (0.070)	0.414** (0.073)
<i>CurColony</i>	1.093** (0.506)	0.718 (0.495)	1.373** (0.390)	-0.115 (0.363)	-2.453* (1.296)	-0.140 (0.275)	0.666 (0.583)	0.808 (0.503)	0.698 (1.255)	0.806 (1.083)	0.803 (0.906)	0.639 (0.564)
<i>ComCol</i>	0.302** (0.081)	0.435** (0.100)	0.138 (0.116)	0.339** (0.125)	0.221 (0.283)	0.323** (0.086)	0.604** (0.070)	0.162** (0.063)	0.102 (0.080)	0.335** (0.084)	0.364** (0.067)	0.630** (0.074)
Observations	243624	90274	22304	28274	6669	85350	531429	801095	699145	175800	223734	317824
Adjusted R^2	0.292	0.337	0.318	0.302	0.413	0.251	0.300	0.325	0.464	0.445	0.450	0.417

Sector:	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
$\ln \tau$	-5.463** (1.220)	-4.743** (0.218)	-2.804** (0.225)	-1.187** (0.368)	-3.691** (0.452)	-2.167** (0.226)	-3.670** (0.239)	-2.315** (0.287)	-2.184** (0.231)	-3.181** (0.166)	-2.275** (0.204)
<i>Shallow</i>	0.807** (0.186)	0.201** (0.071)	0.081 (0.078)	0.188* (0.102)	0.611** (0.121)	0.247** (0.080)	0.296** (0.091)	0.136 (0.089)	0.467** (0.078)	0.196** (0.066)	0.169** (0.077)
<i>Deep</i>	0.672** (0.205)	0.317** (0.072)	0.157** (0.073)	0.665** (0.093)	0.752** (0.102)	0.307** (0.078)	0.896** (0.101)	0.409** (0.086)	0.242 (0.081)	0.175** (0.062)	0.251** (0.076)
$\ln Dist$	-1.120** (0.066)	-0.765** (0.030)	-0.730** (0.030)	-0.708** (0.037)	-0.529** (0.038)	-0.851** (0.029)	-0.802** (0.033)	-0.358** (0.030)	-0.748** (0.029)	-0.696** (0.024)	-0.581** (0.030)
<i>Contiguity</i>	0.717** (0.124)	0.551** (0.068)	0.790** (0.073)	0.648** (0.079)	0.422** (0.076)	0.654** (0.080)	0.581** (0.078)	0.531** (0.066)	0.431** (0.082)	0.470** (0.064)	0.662** (0.076)
<i>ComLang</i>	-0.248** (0.098)	0.173** (0.044)	0.231** (0.045)	0.121** (0.055)	0.134** (0.055)	0.383** (0.046)	0.224** (0.051)	0.155** (0.045)	0.299** (0.044)	0.241** (0.038)	0.302** (0.043)
<i>Colony</i>	0.135 (0.139)	0.280** (0.065)	0.342** (0.071)	0.241** (0.073)	0.274** (0.079)	0.612** (0.080)	0.335** (0.088)	0.305** (0.066)	0.472** (0.077)	0.466** (0.064)	0.383** (0.074)
<i>CurColony</i>	-1.053 (1.579)	1.252** (0.385)	0.921* (0.475)	1.006** (0.464)	0.344 (0.420)	0.731 (0.860)	0.453 (1.014)	0.381 (0.742)	2.041* (1.103)	1.366* (0.735)	1.247* (0.720)
<i>ComCol</i>	0.140 (0.146)	0.505** (0.069)	0.514** (0.071)	0.264** (0.087)	0.430** (0.081)	0.560** (0.078)	0.974** (0.090)	0.512** (0.080)	0.555** (0.082)	0.633** (0.069)	0.436** (0.068)
Observations	22745	1544089	337582	302429	182487	628789	157463	112560	320393	2212282	371077
Adjusted R^2	0.385	0.344	0.372	0.318	0.338	0.468	0.536	0.384	0.526	0.458	0.409

Note: Estimates of importer, exporter, and HS 6-digit product fixed effects not shown. Standard errors (in parentheses) are clustered at the country-pair level. Shea's Partial R^2 is 0.19 for shallow and 0.23 for deep PTAs. *, ** and *** indicate statistical significance at the 10, 5 and 1% level, respectively. PTA dummies instrumented with contagion indices a la Martin et al. (2012) or Baldwin and Jaimovich (2012).

Table A.13: IV Results for Service Sectors

Sector:	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)
<i>Shallow</i>	0.298*** (0.051)	0.141** (0.062)	0.229*** (0.031)	0.169*** (0.064)	0.129*** (0.037)	0.182*** (0.032)	0.024 (0.055)	0.175*** (0.040)	0.221*** (0.031)	0.160*** (0.040)	0.152*** (0.033)	0.267*** (0.035)	0.142*** (0.037)	0.178*** (0.036)
<i>Deep</i>	0.438*** (0.076)	0.389*** (0.089)	0.377*** (0.053)	0.302*** (0.081)	0.580*** (0.056)	0.399*** (0.050)	0.413*** (0.075)	0.123*** (0.055)	0.294*** (0.051)	0.490*** (0.060)	0.338*** (0.054)	0.559*** (0.054)	0.238*** (0.052)	0.367*** (0.057)
<i>ln Dist</i>	-0.053** (0.024)	0.032 (0.026)	0.006 (0.014)	-0.036 (0.022)	-0.019 (0.015)	-0.007 (0.014)	0.012 (0.020)	0.004 (0.015)	-0.002 (0.014)	-0.036** (0.016)	-0.009 (0.014)	-0.017 (0.014)	-0.016 (0.015)	-0.044*** (0.015)
<i>Contiguity</i>	2.104*** (0.158)	0.573*** (0.095)	0.492*** (0.067)	0.347*** (0.078)	0.414*** (0.063)	0.432*** (0.061)	0.491*** (0.071)	0.319*** (0.055)	0.359*** (0.058)	0.317*** (0.065)	0.418*** (0.063)	0.250*** (0.059)	0.424*** (0.062)	0.407*** (0.066)
<i>ComLang</i>	0.029 (0.032)	0.065* (0.038)	0.023 (0.019)	0.058* (0.032)	0.004 (0.022)	-0.022 (0.019)	0.018 (0.030)	-0.033 (0.021)	0.004 (0.019)	-0.014 (0.023)	-0.013 (0.020)	-0.013 (0.021)	0.020 (0.020)	-0.016 (0.021)
<i>Colony</i>	0.345*** (0.088)	0.328*** (0.079)	0.378*** (0.064)	0.235*** (0.073)	0.390*** (0.058)	0.404*** (0.060)	0.334*** (0.069)	0.347*** (0.055)	0.312*** (0.057)	0.255*** (0.072)	0.246*** (0.062)	0.205*** (0.051)	0.307*** (0.058)	0.321*** (0.066)
<i>CurColony</i>	-0.258 (0.957)	0.106 (1.024)	-0.059 (0.964)	0.091 (1.245)	0.238 (1.100)	-0.051 (0.891)	-0.289 (1.043)	0.777 (0.755)	0.427 (1.193)	0.943 (1.292)	0.689 (1.087)	0.383 (1.234)	0.443 (0.814)	0.258 (1.051)
<i>CornCol</i>	-0.007 (0.045)	-0.107*** (0.053)	-0.068*** (0.024)	0.024 (0.039)	-0.023 (0.027)	-0.024 (0.024)	-0.102*** (0.036)	-0.016 (0.027)	-0.053** (0.025)	-0.058* (0.030)	-0.037 (0.024)	-0.078*** (0.027)	-0.093*** (0.028)	0.012 (0.026)
Observations	13546	11368	14434	14518	14518	14518	14518	14518	14518	14518	14518	14518	14518	14518
Adjusted R^2	0.968	0.952	0.959	0.901	0.956	0.955	0.918	0.948	0.952	0.950	0.956	0.963	0.955	0.939

Note: Estimates of importer and exporter fixed effects not shown. Standard errors (in parentheses) are clustered at the country-pair level. Shea's Partial R^2 is 0.19 for shallow and 0.23 for deep PTAs. *, ** and *** indicate statistical significance at the 10, 5 and 1% level, respectively. PTA dummies instrumented with contagion indices a la Martin et al. (2012) or Baldwin and Jaimovich (2012).

Table A.14: OLS Results for Agricultural and Manufacturing Sectors

Sector:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln \tau$	-2.329*** (0.143)	-2.203*** (0.154)	-3.452*** (0.540)	-2.907*** (0.586)	-11.126*** (3.834)	-4.254*** (0.643)	-2.439*** (0.085)	-5.000*** (0.234)	-1.727*** (0.312)	-3.316*** (0.280)	-2.899*** (0.254)	-4.783*** (0.235)
<i>Shallow</i>	0.093** (0.042)	-0.019 (0.054)	-0.085 (0.067)	-0.033 (0.072)	-0.344* (0.184)	0.034 (0.052)	0.113*** (0.039)	0.073** (0.037)	0.067 (0.042)	-0.012 (0.042)	0.019 (0.036)	0.068* (0.039)
<i>Deep</i>	0.384*** (0.053)	0.277*** (0.063)	0.073 (0.074)	0.213*** (0.080)	-0.025 (0.191)	0.422*** (0.060)	0.429*** (0.050)	0.234*** (0.044)	0.372*** (0.054)	0.389*** (0.050)	0.349*** (0.045)	0.450*** (0.047)
$\ln Dist$	-0.555*** (0.027)	-0.456*** (0.030)	-0.425*** (0.037)	-0.633*** (0.043)	-0.900*** (0.093)	-0.461*** (0.030)	-0.613*** (0.026)	-0.570*** (0.025)	-0.689*** (0.026)	-0.706*** (0.026)	-0.747*** (0.023)	-0.950*** (0.024)
<i>Contiguity</i>	0.827*** (0.087)	0.754*** (0.078)	0.929*** (0.100)	0.749*** (0.119)	0.413** (0.204)	0.610*** (0.086)	0.780*** (0.078)	0.446*** (0.064)	0.610*** (0.088)	0.754*** (0.084)	0.748*** (0.075)	0.658*** (0.076)
<i>ComLang</i>	0.028 (0.057)	0.100* (0.061)	-0.089 (0.074)	-0.059 (0.083)	-0.493*** (0.186)	0.042 (0.057)	0.218*** (0.046)	0.204*** (0.043)	0.378*** (0.051)	0.295*** (0.048)	0.278*** (0.044)	0.423*** (0.045)
<i>Colony</i>	0.141* (0.084)	0.095 (0.084)	0.344*** (0.096)	0.049 (0.108)	0.444* (0.228)	0.106 (0.076)	0.306*** (0.074)	0.246*** (0.065)	0.349*** (0.095)	0.436*** (0.087)	0.448*** (0.072)	0.403*** (0.073)
<i>CurColony</i>	1.057** (0.505)	0.810 (0.498)	1.366*** (0.388)	-0.072 (0.360)	-2.657** (1.275)	-0.198 (0.261)	0.647 (0.584)	0.820 (0.506)	0.732 (1.273)	0.808 (1.089)	0.814 (0.913)	0.632 (0.564)
<i>ComCol</i>	0.291*** (0.080)	0.439*** (0.099)	0.144 (0.116)	0.351*** (0.121)	0.214 (0.281)	0.314*** (0.085)	0.592*** (0.070)	0.163*** (0.063)	0.106 (0.080)	0.335*** (0.083)	0.368*** (0.067)	0.625*** (0.073)
Observations	244386	90501	22337	28326	6684	85510	533495	802975	701957	176517	224570	318983
Adjusted R^2	0.292	0.339	0.318	0.304	0.421	0.252	0.300	0.326	0.465	0.446	0.450	0.417

Sector:	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
$\ln \tau$	-7.003*** (1.156)	-4.815*** (0.205)	-2.760*** (0.205)	-1.527*** (0.356)	-4.742*** (0.415)	-2.266*** (0.207)	-3.796*** (0.225)	-2.352*** (0.283)	-2.180*** (0.227)	-3.142*** (0.157)	-2.317*** (0.191)
<i>Shallow</i>	-0.018 (0.084)	0.064* (0.036)	0.058 (0.039)	-0.056 (0.048)	0.084* (0.045)	0.119*** (0.039)	0.253*** (0.047)	0.123*** (0.043)	0.249*** (0.039)	0.169*** (0.033)	0.087** (0.035)
<i>Deep</i>	0.250*** (0.095)	0.354*** (0.046)	0.278*** (0.045)	0.504*** (0.056)	0.371*** (0.054)	0.333*** (0.046)	0.708*** (0.053)	0.297*** (0.047)	0.397*** (0.043)	0.302*** (0.037)	0.278*** (0.044)
$\ln Dist$	-1.265*** (0.051)	-0.769*** (0.024)	-0.709*** (0.024)	-0.759*** (0.029)	-0.644*** (0.028)	-0.854*** (0.024)	-0.838*** (0.027)	-0.379*** (0.023)	-0.735*** (0.023)	-0.671*** (0.019)	-0.581*** (0.023)
<i>Contiguity</i>	0.707*** (0.121)	0.556*** (0.067)	0.799*** (0.073)	0.632*** (0.078)	0.397*** (0.073)	0.656*** (0.079)	0.550*** (0.079)	0.517*** (0.065)	0.462*** (0.080)	0.486*** (0.064)	0.662*** (0.075)
<i>ComLang</i>	-0.207** (0.096)	0.181*** (0.044)	0.236*** (0.045)	0.129** (0.054)	0.154*** (0.053)	0.391*** (0.046)	0.214*** (0.051)	0.155*** (0.045)	0.311*** (0.044)	0.247*** (0.038)	0.311*** (0.043)
<i>Colony</i>	0.180 (0.133)	0.279*** (0.067)	0.343*** (0.072)	0.241*** (0.072)	0.265*** (0.074)	0.598*** (0.083)	0.313*** (0.089)	0.282*** (0.065)	0.485*** (0.079)	0.463*** (0.065)	0.370*** (0.076)
<i>CurColony</i>	-1.198 (1.571)	1.235*** (0.380)	0.921** (0.467)	0.975** (0.461)	0.248 (0.422)	0.730 (0.853)	0.460 (1.028)	0.401 (0.744)	2.006* (1.082)	1.369* (0.725)	1.246* (0.717)
<i>ComCol</i>	0.109 (0.146)	0.498*** (0.069)	0.513*** (0.070)	0.272*** (0.087)	0.408*** (0.078)	0.557*** (0.077)	0.980*** (0.090)	0.515*** (0.080)	0.530*** (0.081)	0.629*** (0.068)	0.430*** (0.067)
Observations	22815	1548959	338654	303154	182827	631455	158267	112875	321309	2221122	372259
Adjusted R^2	0.389	0.344	0.373	0.319	0.341	0.468	0.536	0.384	0.527	0.458	0.411

Note: Estimates of importer, exporter, and HS 6-digit product fixed effects not shown. Standard errors (in parentheses) are clustered at the country-pair level. *, **, and *** indicate statistical significance at the 10, 5 and 1% level, respectively.

Table A.15: OLS Results for Service Sectors

Sector:	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)
<i>Shallow</i>	-0.022 (0.020)	-0.040 (0.029)	-0.032** (0.013)	-0.034 (0.026)	-0.003 (0.016)	-0.018 (0.014)	-0.010 (0.022)	-0.008 (0.016)	-0.016 (0.013)	-0.027 (0.016)	-0.032** (0.014)	0.007 (0.014)	-0.028* (0.014)	-0.069*** (0.015)
<i>Deep</i>	0.017 (0.035)	0.055 (0.043)	0.029 (0.026)	0.003 (0.037)	0.222*** (0.026)	0.060** (0.024)	0.208*** (0.036)	-0.013 (0.026)	0.015 (0.025)	0.127*** (0.029)	0.122*** (0.026)	0.188*** (0.024)	0.026 (0.026)	0.085*** (0.026)
<i>ln Dist</i>	-0.148*** (0.019)	-0.033 (0.020)	-0.071*** (0.011)	-0.101*** (0.017)	-0.086*** (0.012)	-0.075*** (0.011)	-0.021 (0.015)	-0.034*** (0.011)	-0.065*** (0.011)	-0.104*** (0.013)	-0.059*** (0.011)	-0.097*** (0.011)	-0.064*** (0.012)	-0.109*** (0.012)
<i>Contiguity</i>	2.110*** (0.156)	0.573*** (0.094)	0.489*** (0.065)	0.342*** (0.076)	0.391*** (0.062)	0.425*** (0.059)	0.476*** (0.070)	0.327*** (0.054)	0.362*** (0.056)	0.312*** (0.063)	0.420*** (0.062)	0.242*** (0.057)	0.423*** (0.060)	0.412*** (0.064)
<i>ComLang</i>	0.040 (0.031)	0.060 (0.038)	0.035* (0.018)	0.069** (0.032)	0.009 (0.021)	-0.016 (0.019)	0.016 (0.029)	-0.023 (0.020)	0.016 (0.018)	-0.013 (0.023)	-0.005 (0.020)	-0.005 (0.020)	0.031 (0.020)	-0.005 (0.021)
<i>Colony</i>	0.327*** (0.085)	0.312*** (0.076)	0.362*** (0.060)	0.224*** (0.071)	0.359*** (0.056)	0.386*** (0.057)	0.322*** (0.067)	0.345*** (0.052)	0.302*** (0.054)	0.240*** (0.070)	0.239*** (0.060)	0.196*** (0.047)	0.295*** (0.056)	0.306*** (0.063)
<i>CurColony</i>	-0.244 (0.968)	0.128 (1.046)	-0.050 (0.975)	0.091 (1.260)	0.258 (1.138)	-0.032 (0.910)	-0.274 (1.076)	0.783 (0.748)	0.434 (1.197)	0.958 (1.321)	0.690 (1.089)	0.393 (1.251)	0.448 (0.817)	0.271 (1.055)
<i>ComCol</i>	-0.016 (0.045)	-0.109** (0.053)	-0.074*** (0.023)	0.015 (0.038)	-0.028 (0.027)	-0.028 (0.024)	-0.101*** (0.036)	-0.021 (0.027)	-0.060** (0.024)	-0.061** (0.030)	-0.043* (0.024)	-0.083*** (0.026)	-0.097*** (0.028)	0.003 (0.025)
Observations	13780	11523	14674	14760	14760	14760	14760	14760	14760	14760	14760	14760	14760	14760
Adjusted R^2	0.969	0.952	0.960	0.902	0.956	0.956	0.918	0.949	0.953	0.951	0.956	0.964	0.955	0.940

Note: Estimates of importer and exporter fixed effects not shown. Standard errors (in parentheses) are clustered at the country-pair level. *, **, and *** indicate statistical significance at the 10, 5 and 1% level, respectively.

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