Macroeconomic potentials of transatlantic free trade: A high resolution perspective for Europe and the world

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1. INTRODUCTION

Since July 2013 the US and the EU have been negotiating a comprehensive agreement on facilitating trade and investment across the Atlantic. The proposed Transatlantic Trade and Investment Partnership (TTIP) would be the largest free trade area in the world. In 2012, the two regions accounted for more than 45% of global value added in current dollars and for 30% of trade (exports and imports of goods and services) in the world. In February 2013, a high-level working group recommended negotiations aiming at a "comprehensive" and "ambitious" agreement. The sheer size and the depth of the proposed undertaking suggest that it could have strong effects for EU member states, the US, third countries, and the world trading system.

In many EU member states, the proposed TTIP is discussed very controversially despite the fact that the scope and details of the agreement are still largely unknown to

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everyone. Proponents of an agreement between the EU and the US point towards economic gains and hope that a TTIP can pave the way towards an overhaul of the multilateral world trade order. Critics dismiss the gains as small and fear that a trade deal may trigger a race to the bottom in health, safety, labor, and environmental standards. They also argue that a TTIP may undermine the World Trade Organization (WTO) as the relative importance of WTO-covered trade for both the EU and the US goes down.

Given this debate, it is crucial to understand the size of potential welfare gains that a TTIP may deliver. Many studies have evaluated the potential trade and welfare effects of a TTIP (see for example Francois, Manchin, Norberg, Pindyuk and Tomberger, 2013, henceforth FMNPT; Egger, Francois, Manchin, and Nelson, 2014; Felbermayr, Heid, Lehwald, 2013 and Felbermayr, Larch, Flach, Yalcin and Benz, 2013). However, their results differ quite substantially. In this paper, we want to shed light on the driving forces of the predicted welfare effects and investigate the influence of differences in key assumptions. We employ a structurally estimated general equilibrium model. Such models have been recently used to quantify the gains from trade, but researchers are only starting to apply them to trade policy analysis.[1]

Our goal is not to capture as many details as possible for an economy, but rather to use a model structure which is heavily used in the (new quantitative trade) literature, explains aggregate trade flows well, and replicates the observed data in 2012. Taking this as starting point, we investigate various scenarios and the sensitivity of our results with respect to different partial effect estimates of regional trade agreements (RTAs), varying degrees of aggregation, different sectoral disaggregation, potential spill-over effects of TTIP on trade costs for non-member countries, the role of other potential agreements, and the trade elasticity. Providing such a robustness analysis is the main contribution of our paper.

Our key finding from the benchmark model is that the long-run increase in real per capita income in the EU could be almost 4%. While the study of FMNPT puts the long-run average gain from a TTIP in Europe at about 136 Euro per capita (545 Euro for a four person household), our estimates put it at about 1,118 Euro.[2] The research by Egger, Francois, Manchin, and Nelson (2014) yields welfare gains three times as big as those in FMNPT but still smaller than our benchmark estimates. In this paper we investigate the likely reason for these substantial differences. It turns out that the size of the treatment effect of RTAs rather than the structural details of the models seem to matter most. Hence, specific emphasize and care should be given to obtain more precise partial effect estimates of RTAs in the future.[3]

A main driving force behind different partial estimates of RTAs is the initial matrix of trade costs, as they are the subject of liberalization when an RTA is concluded. Trade

[1] The literature is nicely summarized in the chapter of Costinot and Rodriguez-Clare (2014) in the fourth edition of the Handbook of International Economics.

[2] These calculations are based on a GDP per capita of 28,385 Euro. Note, however, that comparisons across studies are problematic. The FMNPT exercise embeds its counterfactual analysis into a hypothetical future world (2027); while we refer to the year 2012.

[3] In Felbermayr, Larch, Flach, Yalcin and Benz (2013), we have worked with a similar but more complex setup to the one employed in this paper. However, the present study uses a much larger country sample (173) and more recent data (2012).

costs include not only political barriers such as tariffs, or identifiable non-tariff measures (NTMs), but also the costs of overcoming geographical, linguistic, or cultural distance. The recent empirical trade literature has emphasized how big these costs still are – despite all the talk about a flat world – and how relevant non-policy related trade costs are relative to costs directly caused by policy. Trade agreements directly affect tariffs and other policy-induced barriers; however, they may also change private and public incentives to invest to reduce other types of trade costs – e.g., by improved harbor facilities. Over the last 15 years or so, improved data and methods have corroborated the large role of trade costs; see the recent survey by Head and Mayer (2014) on this topic.

When estimating the baseline trade cost matrix, it is necessary to account for the effect of existing regional trade agreements. The key challenge is to account for the endogeneity of RTAs. As argued by Baier and Bergstrand (2007) and Egger, Larch, Staub and Winkelmann (2011, henceforth ELSW), dealing with the non-random selection of country pairs into RTAs yields even larger point estimates than the 80% trade creation effect described in the meta study of Cipollina and Salvatici (2010). The likely reason for this result is that the existence of high unobserved non-tariff trade barriers lowers trade between two countries, but also increases the likelihood of RTAs, since the potential trade cost reductions are higher. These numbers imply that, for reasonable values of the unknown trade elasticity, the average RTA does much more than just eliminate the remaining (low) tariff barriers. They also imply that existing RTAs have been successful in bringing NTMs down.

There are basically three approaches to measure NTMs: direct measures via external information, a bottom-up approach, and a top-down approach. FMNPT use external information on non-tariff measures. This requires an enormous effort on data-collection and expertise to construct an NTM measure from the obtained surveys. Berden, Francois, Thelle, Wymenga and Tamminen (2009) summarize the evidence of bottom-up estimates on NTMs for the transatlantic trade relationship. The bottom-up approach requires accurate data for every single bilateral trade link covered in the model.[4] The top-down approach uses the estimated RTA effect from the gravity model (see for example Felbermayr, Larch, Flach, Yalcin and Benz (2013)). It essentially assumes that TTIP lowers EU-US trade costs as much as existing trade agreements have between their member countries. It has the advantage that it does not need to specify by how much NTMs would fall in the proposed agreement, but instead relies on past observed effects of RTAs. This approach is attractive because it is easy to implement and not data demanding, but it may lead to under- or overestimation. On the one hand, the official ambition for TTIP is to go deeper than the average existing RTA, which will lead to an underestimation of the potential trade and welfare effects of TTIP when relying on the average effect of RTAs in the past. On the other hand, it is possible that the easy barriers to trade have long been removed across the Atlantic, which will then lead to an overestimation, because many past RTAs substantially lowered tariffs and NTMs. Note,

[4] This would be excessively expensive: we include 173 nations, that is, we base our predictions on a matrix of almost 30,000 yearly aggregate trade flows (173*172=29,756) and would, therefore, need data on NTMs for all these links.

however, that this possibility can be checked in the data. We employ the top-down approach in our study and find that we do not systematically overestimate EU-US trade costs. To show the potential effects of different partial effects of RTAs, we provide results covering a wide range of values of estimated RTA effects. Note that we refer to our estimates as potentials rather than as predictions in order to highlight the inherent uncertainty of the estimates and the assumption of TTIP being an average agreement concerning the reduction of tariffs and NTMs.

To conduct our analysis, we work with the simple Krugman (1980) general equilibrium trade model with monopolistic competition and fixed dyadic entry costs proposed by Egger and Larch (2011). This model allows for an extensive margin, i.e., it rationalizes the fact that not all country-pairs feature strictly positive trade flows. The model gives rise to a gravity equation which can be implemented by means of an econometric two-part model, and which yields estimates for the trade cost matrix and for the partial effect of concluding an RTA. In the base year of 2012, the model explains 93% of the variation in the observed trade flow data (R^2 of 93%). The single-sector structure of the model is very common in new quantitative trade models. It is tractable, transparent and works with easily available data. For a given change in openness, Costinot and Rodriguez-Clare (2014) show that single-sector models yield lower gains from trade than multiple-sector approaches. We provide a careful discussion of the role of sectoral detail in section 5.6 of this paper.

In the second step, we simulate the effects of switching the RTA effect on in the 56 trade pairs involved in the TTIP. We calculate the associated counterfactual GDPs, price indices and levels of real per capita income (equivalent variation) and investigate its sensitivity. In one of our exercises, which we take as benchmark, we find that TTIP increases real income by 3.9% in the EU 28, by 4.9% in the US, but lowers it by 0.9% in the rest of the world.

These aggregate numbers hide a substantial degree of heterogeneity both within the EU and between the EU and the US. We predict larger potential welfare gains in EU member states with peripheral geographical positions compared to more central states. For example, Germany could gain 3.5% in the long run, while the gains in Spain are around 5.6%. The reason for this is that more central countries naturally have lower average trade costs with other EU member states, which has made EU integration particularly beneficial for them, but also implies relatively high trade costs with the US. We also find that the US systematically gains more from a TTIP than the EU. This is a natural consequence from the fact that a TTIP offers better access to imports from 28 different member states for the US. This provides American consumers with higher gains from more product varieties than consumers in Europe. When we aggregate all EU countries into a single economy, the difference between the EU and the US shrinks.

On the global level, countries having preferential trade agreements with the EU or the US would lose due to preference erosion. These losses increase strongly in the relative importance of the EU or the US in those countries' exports. So, at the higher end, we find losses of about 3.1% in Canada, 2.6% in Mexico and 1.6% in Turkey. At the lower end, countries which are less exposed to the EU or US markets, lose less, e.g., China

0.5%. This effect results from trade diversion. On average, countries not covered by a TTIP lose 0.9% while the world in total gains 1.6%. Some analysts hope that the focus on NTMs and regulatory cooperation in 21st century RTAs makes the trade diversion concerns first put forward by Viner (1950) redundant; for a prominent example see Baldwin (2011). Indeed, if a TTIP sets joint standards and norms, or if regulatory convergence leads to lower market entry barriers relative to all trade partners, outsiders could benefit as well. Hence, FMNPT for example assume that trade cost savings across the Atlantic will spill over to third countries. We analyze the effects on spill-overs in subsections 6.1. and 6.2. and demonstrate that the existence of spill-overs is important for reducing detrimental trade diversion effects on non-TTIP members.

However, in line with conclusions presented in the 2012 World Trade Report, our reading of the available empirical evidence suggests that such spill-overs are by no means guaranteed. First, the agreement could very well lead to mutual recognition of national standards within TTIP rather than to a world standard. In this case, whether third countries are discriminated or not, depends on rules of origins. Second, TTIP does include many classical market access elements (public procurement, quantitative restrictions in agri-food sector, services, etc.). At the very least, our results on third countries suggest that negotiators need to make sure that discriminatory effects of the agreement are indeed minimized.

We subject our main results to a large number of additional sensitivity checks and robustness analysis. Besides the estimated effect of the average RTA on trade costs and the assumption of spill-overs, also the level of aggregation of countries, the joint or subsequent conclusion of other agreements, and the assumption or estimate of the trade elasticity turn out to be important for the quantification.

Before proceeding, let us acknowledge certain limitations of our static, single-sector top-down approach: First, we focus on long-run equilibria, leaving out adjustment dynamics. Second, we do not investigate any distributional consequences of a TTIP, neither across sectors, nor across different factors or skill-groups. However, as transatlantic trade is mainly intra-industry, we believe that both, the focus on the long-run and leaving out a detailed analysis of the sectoral and labor market consequences, should not invalidate the overall conclusions that on average, we expect positive welfare effects from TTIP for member countries and negative effects for many non-member countries, and that the partial effect of the RTA is very crucial for the exact magnitudes of the trade and welfare effects, both for single and multi-sector models.

The remainder of this paper is structured as follows. In Section 2 we discuss some important facts that motivate our research strategy. In Section 3 we explain our model and our econometric approach. Section 4 briefly discusses the data and the structure of trade costs. Section 5 presents the results of our model and investigates their sensitivity to key assumptions. Section 6 investigates the role of potential positive spill-over effects from a TTIP and its interaction with other, currently debated potential regional trade agreements. Section 7 contains various robustness checks. Finally, Section 8 concludes with a discussion of trade policy implications.

2. SOME IMPORTANT FACTS AND OUR RESEARCH STRATEGY

In this section we present some facts that are relevant for our particular research design.[5]

2.1. Transatlantic trade potential and trade barriers

Most favored nations (MFN) import duties imposed by either the EU or the US are already low. The overall weighted average tariff on industrial goods is 2.8% for both the EU and the US; in the area of agriculture the average is slightly higher (3.8% in the EU, 2.8% in the US); see Felbermayr and Larch (2013).

Despite this fact, there seems to be untapped potential in the EU-US trade relation. This can be seen by comparing observed trade volumes T_{ij} to those predicted by simple trade models under the assumptions of (i) zero trade costs, (ii) identical preferences, and (iii) product differentiation, $\hat{T}_{ij}$. In these hypothetical textbook circumstances (see, e.g., Feenstra (2004), Chapter 5), US imports (of goods and services) from the EU should equal the EU's share in world output (the EU's share in world GDP, i.e., 23.0% as of 2012), times total US expenditure (i.e. US GDP, adjusted for the United States' current account imbalance, amounting to 16,606 bn dollars). This would yield imports of 3,818 bn dollars. Similarly, EU imports from the US should amount to 3,698 bn dollars (EU expenditure of 16,504 bn dollars times US share in world GDP, 22.4%). The sum, i.e., total predicted trade across the Atlantic, would be worth 10.3% of world GDP (which amounts to 74,490 bn dollars in 2012).

Observed total trade (EU exports of 550 bn dollars, US exports of 455 bn dollars), in contrast, amounts only to 1.4% of world GDP (71,697 bn dollars). So, in the year of 2012, only about 13.4% of the hypothetical benchmark trade potential is utilized. This is a recurrent observation in many bilateral trade relationships.[6]

These considerations suggest that assumptions (i) to (iii) used to predict the benchmark cannot possibly hold. However, they differ with respect to the likelihood of failure. Assumption (iii) – product differentiation – is broadly realistic, in particular in the context of EU-US trade; see Felbermayr and Larch (2013). Assumption (ii) – identical preferences – is more problematic. However, while home bias may be pervasive, there is little hard evidence for it and economists are generally reluctant to fit models to the data by allowing for (arbitrary) differences between agents/countries. Finally, assumption (i) – the absence of trade costs – is clearly violated: tariffs in transatlantic trade are not zero, there is strong direct evidence that non-tariff measures exist and are important, and other barriers (not directly related to policy) are also pervasive. This is in line with empirical evidence (e.g., see the survey by Anderson and van Wincoop, 2004; or Chen and Novy,

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[5] For further details, we refer the reader to FMNPT, Egger, Francois, Manchin and Nelson (2014), Felbermayr and Larch (2013) or Hamilton and Quinlan (2014) who provide broad coverage of pertinent trends and facts.

[6] Note that the 1.4% is an overestimation, since it refers to gross trade and not to value-added trade. Using data from the WTO-OECD Trade in Value Added (TiVA) database for the year 2009, similar calculations put observed transatlantic trade at 1.2% of world GDP.

2012). In the following, we maintain assumptions (ii) and (iii) and attribute the entire gap between actual and hypothesized trade to trade costs.

Assuming a trade elasticity ε, it is easy to back out the ad valorem equivalent (AVE) of trade costs that can generate the described patterns. Indeed, the AVE of trade costs can be computed by applying $\left(T_{ij}/\hat{T}_{ij}\right)^{-1/\varepsilon}$, where T_{ij} and $\hat{T}_{ij}$ are the observed and the predicted (from the zero trade costs model) trade volumes, respectively. The trade elasticity ε measures how a percentage change in trade costs maps into a percentage change in trade flows.[7] For $\varepsilon = 7$, the value used in our subsequent analysis, the AVE is about 33%. With $\varepsilon = 4$, as in Bernard, Redding and Schott (2007), the AVE is about 65%.

The recent literature has put much effort into a better understanding of trade costs. Anderson and van Wincoop (2004) distinguish between costs related to (i) the transportation of goods (including things such as insurance, time costs etc.), (ii) the conversion and management of foreign exchange, (iii) policy barriers such as tariffs and non-tariff measures, (iv) translation requirements, (v) informational asymmetries and (vi) security. Their estimate of the total ad valorem equivalent builds up to 74% (1.21*1.14*1.08*1.07*1.06*1.03=1.74). This number resonates well with the data discussed above.

2.2. Preferential trade agreements and trade costs

In a meta study summarizing 1,827 point estimates from early empirical research, Cipollina and Salvatici (2010) find an average trade flow effect of RTAs of 0.59. Accordingly, the presence of an RTA would boost bilateral trade by about 80% (exp(0.59)=1.80).

More recent studies, summarized in Table 1, have estimated gravity models that are consistent with trade models so that the estimated parameters can be interpreted as parameters of the underlying structural economic model. More importantly, the recent literature also deals with the non-random selection of country pairs into trade agreements. Failing to account for the endogeneity of RTA membership is likely to yield downward biased coefficients; see Baier and Bergstrand (2007, p. 78). If the error term in the gravity model represents unobservable policy-related barriers that reduce trade, and if those barriers make an RTA more likely, then the RTA dummy and the error term will be negatively correlated, leading to underestimation of the RTA coefficient. The literature has found this problem to be relatively severe.

[7] Remember from above that in the EU-US case, $T_{ij}/\hat{T}_{ij}$ is equal to 0.134.

Table 1. Causal trade cost effects of existing RTAs, percentage points

Source		point estimate	trade elasticity 4	7
Head & Mayer (Handbook, 2014)	Tab. 4, all gravity	0.59	-13.70%	-8.10%
Head & Mayer (Handbook, 2014)	Tab. 4, struct. gravity	0.36	-8.60%	-5.00%
Baier & Bergstrand (JIE, 2007)	Tab. 4, col. (4)	0.68	-15.6%	-9.3%
Egger et al. (AEJ, 2011)	Tab. 3, col. (7)	1.21	-26.1%	-15.9%
Baier & Bergstrand (JIE, 2009)	Tab 5, col. (13)	1.08	-23.7%	-14.3%
Baier & Bergstrand (JIE, 2009)	Tab 5, col. (12)	0.77	-17.5%	-10.4%
Magee (BEP, 2003)	Tab 5, col. (2)	2.20	-42.3%	-27.0%
Egger & Larch (EER, 2011)	Tab 2, col. (9)	0.55	-12.9%	-7.6%

Note: All estimates from published papers, significant at the 1% level; comprehensive recent samples; number of countries >100 countries. Published estimates of trade effects have been translated into trade cost effects following Anderson van Wincoop (2003). Specifically, we calculate the percentage tariff equivalent of trade cost reductions of an RTA as $(\exp(\delta)^{-1/(1-\sigma)} - 1) \times 100\%$, where δ is the point estimate and $\sigma = \varepsilon - 1$.

Baier and Bergstrand (2002) use treatment estimators to evaluate the effect of RTAs on trade flows and find that, on average, when acknowledging the endogeneity of an RTA, the agreement tends to increase the value of trade by 92 percent. They also show that estimates for specific agreements differ widely. Magee (2003) uses panel data and finds trade effects of RTAs of 45 percent when using OLS, and effects up to 800 percent when accounting for the potential endogeneity of RTAs. Baier and Bergstrand (2007) also use panel estimators and show that an RTA will increase two member countries' trade by about 100 percent after 10 years, seven times the 14 percent increase effect estimated when ignoring endogeneity. Egger and Larch (2011) follow their approach but explicitly model the extensive margin using panel data. Their estimates imply that European Agreements have increased bilateral trade flows among members by about 96 percent. Baier and Bergstrand (2009) use a matching estimator and panel data and find an average long-run effect of an RTA of 100 percent. They also show that effects differ substantially across trade agreements. In the present paper, we constrain the RTA coefficient to the value estimated by ELSW (Egger, Larch, Staub, and Winkelmann, 2011, in Table 1) who develop a two-part model accounting for the potential simultaneous endogeneity of RTAs and positive trade flows for a cross-section of countries. They find an average treatment effect of RTAs on bilateral trade flows of 236 percent.

Table 1 reveals two facts: First, there is substantial dispersion of estimated RTA coefficients. For this reason, we conduct numerous sensitivity analyses. Second, RTAs reduce trade costs by more than the 8% benchmark attributed to trade policy by Anderson and van Wincoop (2004). So, RTAs have effects that go beyond the simple elimination of tariffs or available measures of non-tariff measures, on which we still have only limited information. As our knowledge on NTMs improves (see Berden, Francois, Thelle, Wymenga and Tamminen, 2009), the gap between bottom-up and top-down (or direct and indirect; see Chen and Novy, 2012) estimates should converge. Moreover, it is conceivable that the expectation of increased trade through lower tariffs and NTM-related costs may incentivize private and public agents to invest in further reductions of bilateral trade barriers, for instance, in infrastructure (such as liquid natural gas terminals), in specific human capital (e.g., US law students specializing in EU law), or to step up cooperation in monetary policy with the effect of lowering exchange rate volatility. These actions would not be legally mandated by the trade agreement itself, but they would still be causally related to the agreement and lead to lower bilateral trade costs in the medium to long run.

3. THEORETICAL FRAMEWORK AND EMPIRICAL MODEL

This section briefly presents the general equilibrium model and the empirical methodology of Egger and Larch (2011) used in this study. Readers not interested in the structural estimation of general equilibrium trade models are invited to skip this section and continue at Section 4. For a comprehensive discussion of the model see Egger and Larch (2011).

3.1. A simple general equilibrium model of world trade

We assume that consumers derive utility from consuming a large number of goods which are imperfect substitutes to each other. The constant elasticity of substitution between goods is given by $\sigma > 1$. In line with the literature, preferences feature love for variety: having access to a larger number of goods makes consumers better off.

We assume that firms within each country are homogeneous and that they are monopolistically competitive, i.e., they have market power in the specific variety that they sell, but they cannot influence macroeconomic aggregates. There are two types of trade costs: variable trade costs (including, when applicable, tariffs), and bilateral fixed market entry costs.

By selling to market j, a firm from country i makes profits $\pi_{ij} = (p_i - c_i)x_{ij} - f_{ij}$, where p_i is the factory gate price charged by the firm, c_i denotes variable production costs, and f_{ij} is the fixed cost of selling to market j. With total expenditure (GDP) of country j being given by y_j, and under the appropriate budget constraint, demand for a variety from country i in country j is given by $x_{ij} = p_i^{-\sigma} t_{ij}^{1-\sigma} P_j^{\sigma-1} y_j$, where t_{ij} are variable trade costs and P_j is the aggregate price index. It is negatively related to the degree of competition in country j: the lower it is, the harder it is for the exporter to sell. Monopolistic pricing implies $p_i - c_i = p_i/\sigma$ and firms from i export to j only if $p_i x_{ij} \geq \sigma f_{ij}$. Let us define the indicator function $\mathbb{I}_{ij}$ to take value one if that inequality is met and zero otherwise. Firms enter a market until profits are driven to zero. The number of firms in country i is given by n_i.[8]

Then, aggregate nominal goods exports from i to j are

$$n_i p_i x_{ij} = X_{ij} = \mathbb{I}_{ij} n_i p_i^{1-\sigma} t_{ij}^{1-\sigma} P_j^{\sigma-1} y_j.$$

A country's sales to any of the C countries (including to the home market) add up to GDP, and thus

$$y_i = n_i p_i^{1-\sigma} \sum_{j=1}^{C} (\mathbb{I}_{ij}\, t_{ij}^{1-\sigma} P_j^{\sigma-1} y_j). \tag{1}$$

Now, defining world GDP as $y_W = \sum_{j=1}^{C} y_j$ one can replace $n_i p_i^{1-\sigma}$ by $y_i/[y_W \Pi_i^{1-\sigma}]$. This yields

$$X_{ij} = \mathbb{I}_{ij} \frac{y_i y_j}{y_W} t_{ij}^{1-\sigma} \Pi_i^{\sigma-1} P_j^{\sigma-1}, \tag{2}$$

where, $\forall\, i, j,$

$$\Pi_i^{1-\sigma} = \sum_{j=1}^{C} (\mathbb{I}_{ij}\, t_{ij}^{1-\sigma} P_j^{\sigma-1}\, y_j/y_W), \quad P_j^{1-\sigma} = \sum_{i=1}^{C} (\mathbb{I}_{ij} t_{ij}^{1-\sigma} \Pi_i^{\sigma-1}\, y_i/y_W); \tag{3}$$

see Egger and Larch (2011) for details on the derivations. As one can see, $\Pi_i^{1-\sigma}$ and $P_j^{1-\sigma}$ are functions of GDPs and trade costs. The above gravity equation can be understood as a demand equation: the elasticity $\sigma > 1$ describes how a change in the aggregate price for foreign goods (triggered, i.a., by variation in trade costs t_{ij}) affects demand for foreign varieties in the domestic economy. This elasticity is closely related to the trade elasticity, which is just $\varepsilon = \sigma - 1$. The terms Π_i and P_j are what Anderson and van Wincoop (2003, 2004) called outward and inward multilateral resistance terms (MRT), respectively. They capture how trade costs with other countries affect demand of country j for goods from i. More precisely, Π_i summarizes the trade costs for exporters as if they would face an integrated world market where they can sell their products. Similarly, P_j summarizes the trade costs for consumers as if they would buy their products from an integrated world market.[9] The MRT terms quantify the trade diversion effects that the theoretical literature has discussed at least since Viner (1950). For our C country world, we may now state the equilibrium as follows: given observed (nominal) GDPs and estimates of t_{ij}, σ, and $\mathbb{I}_{ij}$, there are $2 \times C$ equations given by (3) determining the multilateral resistance terms Π_i and P_j. It is thus possible to solve for the $2 \times C$ unknown multilateral resistance terms. Real GDP follows by computing y_i/P_i.

3.2. Structural estimation

To calculate the changes in trade flows and real GDPs, we need consistent estimates of trade costs. We follow the gravity literature and proxy t_{ij} by the bilateral distance between countries ($DIST_{ij}$), an indicator whether the countries share a common border ($BORD_{ij}$), an indicator whether the countries share a common colonial past ($COLONY_{ij}$),

[8] Note that the number of producers/varieties is a function of a country's size, as shown in equation (8) in Bergstrand, Egger, and Larch (2013).

[9] See Anderson and Yotov (2010) and the references therein on the integrated world market interpretation.

and an indicator whether the countries share a common language ($LANG_{ij}$). As we are interested in the effects of a TTIP, we will use information on RTAs concluded in the past in order to learn the average effect of trade agreements on trade costs. This way, we capture a realistic and feasible reduction of costs associated to lower NTMs without the need to have direct measures of NTMs.

Hence, trade costs t_{ij} are proxied as follows:

$$t_{ij}^{1-\sigma} = \exp\big(\beta_1 logDIST_{ij} + \beta_2 BORD_{ij} + \beta_3 LANG_{ij} + \ \dots \ + \ \delta RTA_{ij}\big). \qquad (5)$$

Substituting equation (5) into equation (2), we end up with the following multiplicative model (see Egger and Larch, 2011):

$$X_{ij} = \mathbb{I}_{ij} \exp\big(\boldsymbol{Z}'_{ij}\boldsymbol{\beta} + \ \delta RTA_{ij} + \ \alpha_i + \ \gamma_j\big)\,\boldsymbol{\varepsilon}_{ij}, \qquad (6)$$

where $\boldsymbol{Z}_{ij} = (1, logDIST_{ij}, BORD_{ij}, \dots)'$ is a vector collecting all exogenous variables besides RTA_{ij}, and $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \dots)'$ is the corresponding parameter vector. $\alpha_i = \ln(y_i \Pi_i^{\sigma-1})$ and $\gamma_j = \ln(y_j P_j^{\sigma-1})$, which can be controlled for by including importer- and exporter fixed effects. δ is the coefficient of interest for the RTA, and ε_{ij} is a remainder error term.

Many countries in our sample do not trade with all potential trade partners. While zero trade flows are not per se a problem for our multiplicative specification (see Santos Silva and Tenreyro, 2010, 2011), one may believe that the decision to start exporting with a country (the extensive margin) follows a different process than the decision how much to trade with a given trade partner (the intensive margin).

ELSW show how one can disentangle the conditional expectation of the bilateral trade flows $\mathbb{E}\big(X_{ij}|.\big)$ into the expectation of the value of positive trade flows (the intensive margin) and the probability that two countries trade with each other at all (the extensive margin). Taking expectations and using the law of iterated expectations, one obtains:

$$\begin{aligned} \mathbb{E}[X_{ij}|.] &= \Pr[\mathbb{I}_{ij} = 1|.]\,\mathbb{E}[\exp\big(\boldsymbol{Z}'_{ij}\boldsymbol{\beta} + \ \delta RTA_{ij} + \ \alpha_i + \ \gamma_j\big)\,\boldsymbol{\varepsilon}_{ij}\big|., \mathbb{I}_{ij} = 1\big] \\ &= \Pr\big[\mathbb{I}_{ij} = 1\big|.\big]\ \mathbb{E}\big[X_{ij}\big|., \mathbb{I}_{ij} = 1\big]. \end{aligned} \qquad (7)$$

It follows that the intensive and extensive margins can be estimated separately.

The positive part of exports, $\mathbb{E}\big[X_{ij}\big|., \mathbb{I}_{ij} = 1\big]$, is estimated via a gravity equation following Santos Silva and Tenreyro (2006). This accounts for recent developments in the gravity literature that estimates the trade equation multiplicatively to deal with the potential heteroskedasticity of trade flows. Being closely related to the theoretical derivations of the gravity equation and estimating the parameters structurally has several advantages. Specifically, we can handle general equilibrium effects, which are crucial for policy evaluations at the country level.[10] This approach has the additional advantage that the estimated parameters are obtained from the same data as the counterfactual analysis is based on.

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[10] Heckman, Lochner and Taber (1998, S.381) argue that standard approaches for the evaluation of policies are misleading if individual decisions affect the decisions of other individuals (in our case: trade partners). The empirical treatment evaluation literature usually assumes that there are no general equilibrium effects. This makes it less suitable for the evaluation of large scale policies such as trade agreements where general equilibrium effects are crucial and potentially important.

Following Egger and Larch (2011) and ELSW, the extensive margin, $\Pr[\mathbb{I}_{ij}=1|.]$, is estimated via a probit model. We specify the following model for selection into exporting:

$$\mathbb{I}_{ij}=1 \text{ if } \boldsymbol{Q}_{ij}'\mathbf{w}+\kappa RTA_{ij}\geq \boldsymbol{\xi}_{ij}, \qquad (8)$$
$$\mathbb{I}_{ij}=0 \text{ else,}$$

where the vector $\boldsymbol{Q}_{ij}$ is a set of exogenous variables which determine whether trade flows are positive, $\mathbf{w}$ is the corresponding parameter vector, κ is the parameter of RTA_{ij}, and $\boldsymbol{\xi}_{ij}$ is a stochastic error term. $\boldsymbol{Q}_{ij}$ will contain the same elements as $\boldsymbol{Z}_{ij}$, but the estimated parameter vectors will differ.

For the proper evaluation of the membership in a free trade agreement it is not only important to obtain consistent estimates of trade costs (which give the direct, partial effect of trade agreement membership on trade flows), but also to account for the general equilibrium effects of trade agreements, i.e., changes in multilateral resistance terms as well as GDPs. Therefore, it is necessary to perform a counterfactual analysis which calculates the unobserved counterfactual situation with a TTIP in place.

We do this by using the underlying structure of the model. Relying on the parameter estimates, we use the model equations and calculate the multilateral resistance terms with and without a TTIP taking into account trade diversion and income effects, as well as potential changes at the extensive and intensive margin (see for details Egger and Larch, 2011).

Summarizing, our quantitative strategy consists of six steps:

1. Estimate parameters of (7) based on observed bilateral trade flows while constraining the RTA_{ij} coefficient to the value from ELSW to control for potential endogeneity, i.e., we estimate a (constrained) probit model for the extensive margin and a (constrained) Poisson Pseudo Maximum Likelihood (PPML) model for the intensive margin.
2. Use these estimates and observed GDPs to solve the system of equations for the MRTs for all countries given in equation (3) in the baseline.
3. Switch the RTA dummy from zero to one for pairs covered by a new trade agreement (e.g., EU-US pairs for a TTIP).
4. Calculate counterfactual vectors of MRTs, taking into account the changes in GDPs brought about by trade cost changes using Equation (11) in Egger and Larch (2011).
5. Calculate counterfactual predictions of the extensive margin using the probit.
6. Use the counterfactual extensive margin predictions as well as the counterfactual MRT terms and the counterfactual GDPs to calculate the changes in trade flows and welfare (i.e., real GDP per capita). Welfare changes are calculated as

$$\widehat{W}_i=\left[\left(\frac{y_{c,i}/P_{c,i}}{y_i/P_i}\right)-1\right]\times 100[\%]=\left[\left(\frac{y_{c,i}/y_{c,W}}{y_i/y_W}\right)^{1/(1-\sigma)}\left(\frac{\Pi_i\ P_i}{\Pi_{c,i}P_{c,i}}\right)-1\right]\times 100[\%],$$

where c denotes the counterfactual scenario (see Egger and Larch, 2011, eqn. (12)).

In the counterfactual scenario, we keep the size of the population constant, so that the change in real GDP is equal to the change in real GDP per capita. Also, note that the single sector nature of our model implies that changes in real GDP can be interpreted as an equivalent variation (EV) measure. Finally, since the econometric estimates identify the long-run effects of RTAs, our results are to be interpreted as pertaining to the long-run as well. On average, the entire effect of an RTA is materialized after 10 to 15 years; see Baier and Bergstrand (2007) or Anderson and Yotov (2011).

4. DATA AND PARAMETER ESTIMATES

4.1. Data

Our approach tackles the endogeneity of the RTA dummy while retaining the largest possible country sample and using the most recent data available. More specifically, we estimate our model on a cross-section for 173 countries for the year 2012, constraining the RTA coefficients to the estimate from ELSW as a baseline scenario.

Table 2 provides summary statistics of our sample. We include all RTAs notified to the WTO that are active since 2012 and earlier. The data are augmented and corrected by using information from RTA secretariat web pages. In total, we cover about 300 agreements. Many of these agreements are pure bilaterals, so that only about 17% of the 29,756 country pairs in our analysis are affected by an RTA.[11] Tariff data is available only for a smaller sample (C=146); for details see Table A2 in the Web Appendix.

Table 2. Summary statistics (year 2012, C=173)

	Mean	p50	Std.dev.	min	Max
Exports (mn USD), X	545.44	0.24	5862.42	0.00	444407.20
Active exports, dummy (0,1), $\mathbb{I}$	0.72	1.00	0.45	0.00	1.00
RTA, dummy (0,1), RTA	0.17	0.00	0.38	0.00	1.00
Geographical distance, $logDIST$	8.78	8.95	0.76	4.11	9.89
Contiguity, dummy (0,1), $BORD$	0.02	0.00	0.13	0.00	1.00
Common language, dummy (0,1), $LANG$	0.15	0.00	0.35	0.00	1.00
Common colonizer, dummy (0,1), $COLONY$	0.10	0.00	0.31	0.00	1.00
Tariff (%)$^{\#}$	7.43	7.14	5.48	0.00	33.36
Number of observations	29,756				

Notes: The trade data come from UN Comtrade and refer to the year 2012. The RTA dummy takes value one if a regional trade agreement between two countries has been notified to the WTO. The other variables are from CEPII. # Tariff data is only available for a subsample of 146 countries (21,170 country pairs); see the Web Appendix Table A2 for details.

[11] The RTA data is available on Mario Larch's website at htpp://www.ewf.uni-bayreuth.de/en/research/index.html.

4.2. Parameter Estimates

Table 3 reports the parameter estimates that we use in our quantitative exercise. We report results from a two-stage model; results for the model without selection are available in the Web Appendix. We distinguish four specifications of the trade cost function. Column [1] refers to our benchmark model, where the RTA effect is taken from ELSW, while the other coefficients are estimated on our 2012 data using the procedure described in Section 3 when constraining the RTA coefficient. This procedure makes sure that we fit the model to the 2012 base line data while accounting for the potential endogeneity of RTAs. Note that ELSW's RTA dummy is substantially higher than the sector average of RTA dummies reported in Egger, Francois, Manchin, and Nelson (2014). As will become clear below, this fact drives our finding of much larger welfare gains.

Table 3. Parameters of the trade cost function (two stage models)

	Intensive margin				Selection equation	
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
	Bench-mark	**HM**	**FMNPT**	**Tariffs only**	**ad [1]-[3]**	**ad [4]**
RTA	1.21	0.36	0.12	1.21	-0.03	-0.03
	.	.	.	.	.	.
log DIST	-0.50	-1.10	-0.50	-0.49	-0.79	-0.81
	(0.03)	.	(0.03)	(0.03)	(0.03)	(0.03)
BORD	0.20	0.66	0.20	0.20	-0.64	-0.12
	(0.08)	.	(0.08)	(0.08)	(0.16)	(0.2)
LANG	0.19	0.39	0.19	0.20	0.16	0.20
	(0.08)	.	(0.08)	(0.09)	(0.05)	(0.07)
COLONY	0.71	0.75	0.71	0.76	0.36	0.33
	(0.17)	.	(0.17)	(0.18)	(0.05)	(0.06)
Pseudo R^2	0.93					

Notes: Number of countries C=173; number of observations N=29,756. "Benchmark" refers to a specification which accounts for the potential endogeneity of RTAs as the point estimate of RTA is taken from Egger, Larch, Staub and Winkelmann (2011), the remaining parameters are estimated. "HM" reproduces the estimates reported in the meta-analysis of Head and Mayer (2014). "FMNPT" uses the benchmark estimates from [1] but uses that value of the RTA coefficient that is necessary to replicate the EV measure for the US as predicted by Francois, Manchin, Norberg, Pindyuk and Tomberger (2013, FMNPT). "Tariffs only" is the same specification as [1] but is based on a smaller country sample (C=146, N=21,170) due to the limited availability of tariff data. All specifications contain two separate arrays of exporter and importer fixed effects. Robust standard errors for the estimated coefficients are in parenthesis. When we fix coefficients at values from other studies, we do not provide standard errors, which is denoted by a dot.

Column [2] reports the parameters of the trade cost function as reported in the meta study of structural gravity equations conducted by Head and Mayer (2014). In the sample that underlies this meta study, almost no paper controls for the endogeneity of RTAs and, thus, the point estimate on the RTA dummy is very different from the one used in [1]. Column [3] is a specification which chooses the RTA coefficient such that the welfare effect for the US obtained from our model is identical to the one calculated by FMNPT (0.39%). Specification [4] is identical to [1], but utilizes the smaller sample for which tariff data is available (and where we include the tariff factor $(1+\tau_{ij})$ to the power of the appropriate elasticity $(-\sigma)$, which we take to be equal to -8 in our benchmark case). Columns [5] and [6] report the selection equations associated to models [1] to [4]; again, the coefficient of the RTA dummy has been taken from ELSW, so that we are sure to avoid a bias due to endogeneity. In all equations, we include a full array of exporter and importer fixed effects. Table 3 shows that the model fits the baseline data very well. We explain about 93% of the variation in trade flows.

5. THE WELFARE EFFECTS OF A TTIP

5.1. Potential gains with different trade cost functions

We are now ready to simulate counterfactual scenarios. We set the RTA dummy to unity in all country pairs that involve transatlantic trade between the US and EU member states and calculate the resulting equilibrium multilateral resistance terms which determine the changes in GDPs, price levels and welfare. Specifically, we compute the difference between counterfactual real per capita incomes and the observed outcomes for 2012. Table 4 provides detailed information for all EU 28 countries, for NAFTA members, for the BRICS (Brazil, Russia, India, China, South Africa) and for several other countries which play important roles for either EU or US trade policy. Scenarios differ with respect to the underlying trade cost function (see Table 3), whether selection is activated or not, and whether or not regulatory spillovers are assumed; see below.

In the benchmark scenario [1], TTIP increases long-run real per capita income by about 3.9% on average in the EU, and by 4.9% in the US. Together the TTIP partners increase their real income by 4.4%. The fact that the US gains more than the EU is due to the fact that the EU is comprised of 28 separate countries between which trade still is hampered by border effects. Hence, the TTIP generates trade diversion effects within Europe which dampen the welfare effects. The US, in contrast, is a homogenous country and is spared these effects. Real world GDP increases by 1.6%, but non-TTIP countries register losses of -0.9% on average.

Note that these effects are obtained under the ceteris paribus assumption: nothing else changes except the introduction of a TTIP. Hence, all changes relative to the base line of 2012 are causally attributable to the agreement, and are not driven by assumptions on, say, changes in GDPs for reasons different than a TTIP, or the introduction of other trade agreements (e.g., the Comprehensive Economic and Trade Agreement (CETA) between

Canada and the EU or any other agreements currently under negotiation). Higher GDPs in emerging and developing markets due to their natural growth (unrelated to a TTIP), and the formation of other RTAs, will tend to attenuate the negative effects of a TTIP on third countries.

Table 4. Welfare effects: selected countries and scenarios

		[1] Benchmark	[2] Pref., w/o selection	[3] HM	[4] FMNPT	[5] Tariffs only	[6] Spillovers
1	Austria	2.83	2.83	0.23	0.29	0.22	6.67
2	Belgium	2.25	2.25	0.09	0.25	0.17	6.07
3	Bulgaria	3.94	3.95	0.55	0.37	0.33	7.90
4	Croatia	3.53	3.53	0.50	0.34	0.38	7.47
5	Cyprus	4.36	4.36	0.68	0.39	0.37	8.38
6	Czech Republic	3.04	3.04	0.31	0.31	0.24	6.92
7	Denmark	3.45	3.45	0.43	0.34	0.28	7.35
8	Estonia	4.31	4.30	0.73	0.40	0.36	8.33
9	Finland	4.60	4.60	0.77	0.42	0.39	8.60
10	France	3.46	3.47	0.33	0.32	0.28	7.21
11	Germany	3.48	3.49	0.33	0.30	0.28	7.12
12	Greece	4.21	4.21	0.63	0.39	0.35	8.17
13	Hungary	3.50	3.49	0.44	0.34	0.28	7.44
14	Ireland	4.70	4.68	0.64	0.46	0.39	8.73
15	Italy	3.86	3.85	0.50	0.34	0.32	7.66
16	Latvia	4.10	4.09	0.65	0.39	0.34	8.10
17	Lithuania	3.97	3.96	0.61	0.38	0.33	7.96
18	Luxembourg	2.57	2.57	0.19	0.28	0.20	6.42
19	Malta	4.84	4.82	0.96	0.44	0.41	8.91
20	Netherlands	2.85	2.83	0.22	0.29	0.22	6.70
21	Poland	3.51	3.51	0.45	0.34	0.28	7.41
22	Portugal	4.80	4.81	0.79	0.45	0.40	8.83
23	Romania	3.87	3.87	0.65	0.38	n.a.	7.81
24	Slovak Rep.	3.40	3.40	0.41	0.34	0.27	7.31
25	Slovenia	3.14	3.14	0.32	0.32	0.25	7.03
26	Spain	5.56	5.53	1.13	0.49	0.48	9.59
27	Sweden	4.25	4.24	0.71	0.39	0.35	8.20
28	United Kingdom	5.14	5.11	0.80	0.43	0.44	9.01
EU average		**3.94**	**3.93**	**0.51**	**0.36**	**0.32**	**7.76**
29	**United States**	**4.89**	**4.91**	**0.59**	**0.39**	**0.41**	**7.05**
30	Australia	-2.01	-2.02	-0.09	-0.09	-0.17	0.15
31	Brazil	-0.77	-0.74	-0.08	-0.09	-0.05	0.87
32	Canada	-3.09	-3.10	-0.44	-0.18	-0.27	-0.53
33	China	-0.50	-0.49	-0.03	-0.05	-0.04	0.80
34	India	-0.31	-0.30	-0.05	-0.07	-0.03	1.61
35	Japan	-0.51	-0.02	-0.05	-0.50	-0.05	0.61
36	Mexico	-2.56	-2.57	-0.41	-0.17	-0.22	-0.18
37	Norway	-1.91	-1.92	-0.27	-0.14	-0.17	-0.18
38	Russian Fed.	-1.01	-1.02	-0.12	-0.10	-0.08	0.71
39	South Africa	-1.69	-1.70	-0.12	-0.10	-0.14	0.08
40	Turkey	-1.56	-1.59	-0.17	-0.11	-0.14	0.14
Non-TTIP average		**-0.92**	**-0.92**	**-0.10**	**-0.08**	**-0.08**	**0.80**
World average		**1.58**	**1.58**	**0.21**	**0.13**	**0.13**	**3.90**

Source: Authors' calculations. Results on all 173 countries are available in the Web Appendix, Table A1. No tariff data available for Romania in 2012.

Deactivating the selection channel (column [2]) does not significantly alter results. So, it seems that the effect of a TTIP will be predominantly on the intensive margin. However, employing alternative trade cost functions has very important effects on the welfare implications; see columns [3] and [4]. The scenario marked by HM (model [3]) uses the results from Table 3, column [2], which, together with our choice of the trade elasticity implies a trade cost reduction due to RTAs of approximately 5 percentage points. It is to be contrasted to the 17 percentage point reduction that is implied by the estimates of ELSW in their analysis.

When we choose the trade cost reducing potential of RTAs to be consistent with the welfare gains from a TTIP reported by FMNPT (2013) for the US (0.39%), we need an RTA coefficient of 0.12, or, with ($\varepsilon = 7$), a trade cost reduction of 1.7 percent. This assumption reduces average (GDP weighted) welfare gains to 0.1%, with the largest gain (0.5%) and the largest loss (-0.2%) still accruing to Spain and Canada, respectively; see model [3]. These scenarios assume that the introduction of a TTIP lowers tariff and non-tariff barriers. In model [5], we assume that only tariffs are eliminated. This leads to very low average welfare effects.

Table 5 reports unweighted, GDP-weighted and population weighted summary statistics for the welfare estimates based on the full sample. Starting with specification [1], we find that the effect of introducing a TTIP leaves the average country unaffected, but the standard deviation is relatively high (1.9%). The GDP-weighted summary statistics look different: the average country now gains 1.6%, and the standard deviation has gone up to 2.8. This implies that a TTIP increases world GDP, but its positive effect is concentrated in countries that are relatively rich to start with (EU and US). Finally, population-weighted summary statistics also report a mean effect of zero: i.e., the average individual on the planet remains unaffected by a TTIP.

Table 5. Benchmark welfare effects (in %) and the roles of selection and RTA point estimates: Summary statistics

		unweighted		GDP-weighted		POP-weighted			
Specifications		**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Min**	**Max**
[1]	**Benchmark**	-0.04	1.93	1.58	2.78	-0.01	1.73	-3.09	5.56
[2]	**HM**	0.01	0.27	0.21	0.36	0.01	0.23	-0.44	1.13
[3]	**FMNPT**	-0.01	0.17	0.13	0.23	-0.02	0.15	-0.18	0.49
[4]	**Tariffs only**	-0.01	0.18	0.13	0.23	0.00	0.15	-0.27	0.48

Source: Authors' calculations.

Note. In all specifications ε=7. 173 countries. Trade cost equations as in Table 3. Welfare change is measured as equivalent variation in % of initial income. Refer to notes on Table 3 for further detail.

5.2. Welfare effects in the EU28

Table 4 reports substantial heterogeneity in welfare effects for the EU member states. They range between 2.3% on the lower end in Belgium and 5.6% at the higher end in Spain. Using the benchmark specification, Figure 1 correlates the welfare gains in the EU28 with two important country characteristics: the baseline level of real per capita GDP (measured in log per capita income in purchasing power parities), and the degree of openness (measured in the fraction of merchandise trade (exports plus imports divided by two) over GDP).

The regression line pictured in the left-hand panel indicates a negative correlation between the welfare gains and base line GDP per capita. The slope (-0.21) is, however, not statistically different from zero at the conventional levels of significance (the robust standard error is 0.21). Nonetheless, it is important to notice that a TTIP does not appear to exacerbate real per capita GDP differences within the EU.

The right-hand panel also shows a negative correlation, this time between the welfare gain and base line multilateral openness. Now, the slope of -0.02 is statistically significant (the robust standard error is 0.005), and the simple linear model explains about a quarter of the variation in welfare gains. The logic for this is clear: countries which are already very open (such as Belgium, Netherlands, or Slovakia) enjoy low average trade costs with the world. Lower trade costs with the US do not unlock large additional gains. In contrast, countries such as Greece, Spain, or Italy appear to have higher multilateral trade costs, and would therefore benefit more from reduced trade costs with the US.

GDP per capita and openness are correlated. Putting them together into one regression, we find that the welfare gains are decreased both by baseline openness and initial income. In this multivariate framework, both variables are statistically significant at the 10% level, and the regression explains about one third of the variance in welfare effects.

The results imply that a 10 percentage point increase in openness lowers the expected gain by about 0.2 percentage points. An increase in GDP per capita by 10% lowers welfare gains by about 0.04 percentage points.

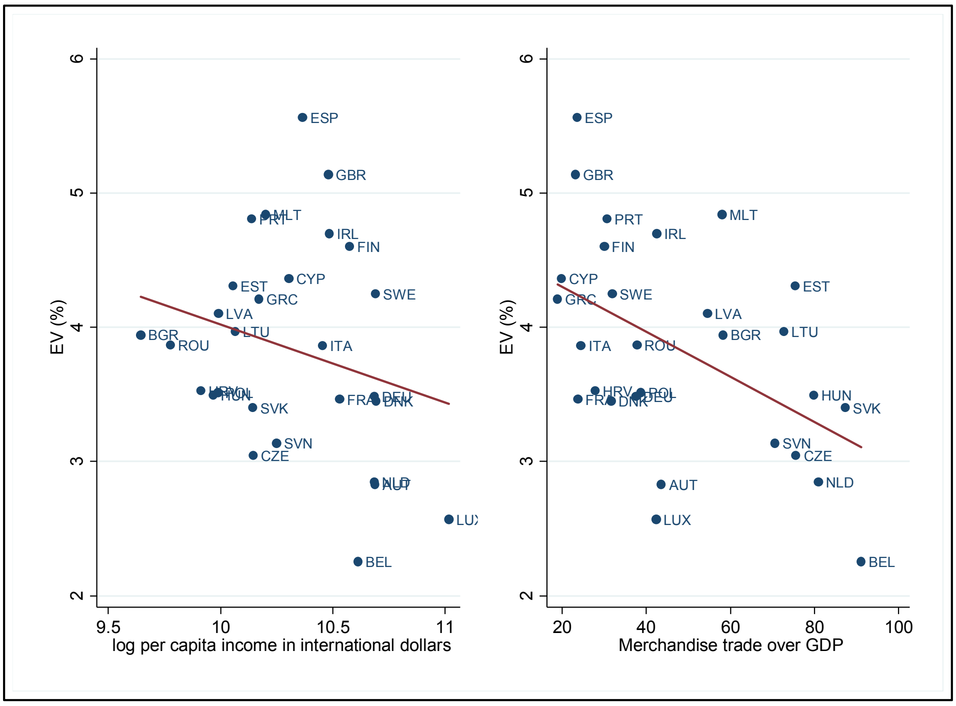

Figure 1. Welfare effects of a TTIP in Europe: Relevant correlations

Source: Authors' calculations based on model predictions and data from the World Bank's WDI data base. All values refer to the year 2012.

5.3. Global welfare effects and multilateral openness

Almost all non-TTIP countries are bound to lose from transatlantic free trade. But, in many large third countries such as China, Japan and India losses are rather limited; see Table 4.

Using the benchmark specification, Figure 2 pictures the frequency distribution of real per capita income changes in our sample of 173 countries. The Figure also provides a kernel density plot. The distribution is bimodal: TTIP countries gain; the average gain is equal to 4.4%. The average welfare effect amongst non-TTIP countries is -0.9%. The plot shows that most of the 127 countries losing from a TTIP lose only a little: about 25% of all countries (i.e. 43 countries) lose between 0 and 0.5%, 21 % (i.e. 37 countries) lose between 0.5 and 1.0%, and only 8% of all countries (i.e. 14 countries) lose more than 2.0%.

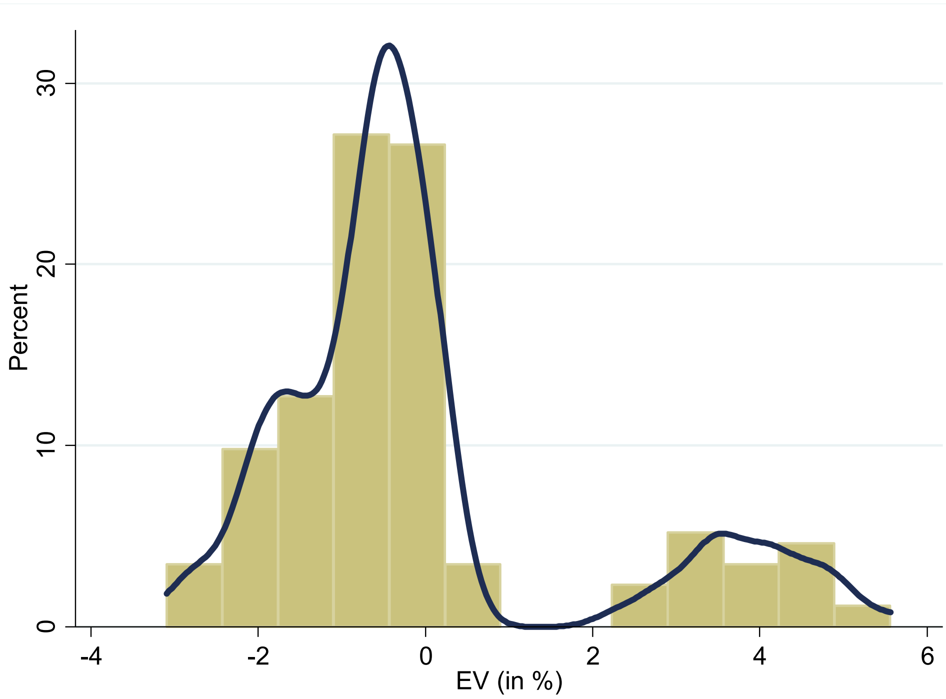

Figure 2. Distribution of welfare gains across countries, benchmark scenario

Source: Authors' calculations, frequency distribution.

Figure 3 plots the change in per capita real income in % (equivalent variation, EV) against the change in the share of manufacturing trade (imports plus exports divided by two) over GDP implied by the model. There are three groups of countries: the first is made up by the 29 countries directly involved in a TTIP (EU 28 plus the USA), the second by 17 countries that remain outside of the agreement but whose levels of overall openness and per capita incomes are bound to increase (denoted RoW I), and the third by the 127 countries bound to lose on both measures (RoW II). The non-TTIP countries which benefit are mostly small and poor, and often are island states: Swaziland, Lao PDR, Brunei Darussalam, Lesotho, Palau, Micronesia, Marshall Islands, Tuvalu, Kiribati, Tonga, Solomon Islands, Samoa, Vanuatu, as well as central Asian countries such as Uzbekistan, Bangladesh, Tajikistan, and Mongolia. These countries benefit, because the EU and the US become richer and, therefore, trade more with these 17 economies. This positive effect outweighs the negative trade diversion effect.

Not surprisingly, there is a strong positive association: both effects are endogenous outcomes driven by the reduction of trade barriers across the Atlantic. Indeed, as known from the work by Arkolakis, Costinot, Rodríguez-Clare (2012), there is a unique non-linear relationship between changes in openness and changes in welfare generated by trade policy reforms. In some cases, the increase in overall openness due to a TTIP is predicted to be quite substantial: Openness in Spain would go up from about 23.6% to 47.7%, and in the US from about 12% to 36.9%. However, exact magnitudes are quite sensitive to a number of modelling choices. We will next decompose the welfare effects into their main driving forces before we investigate the sensitivity of the results.

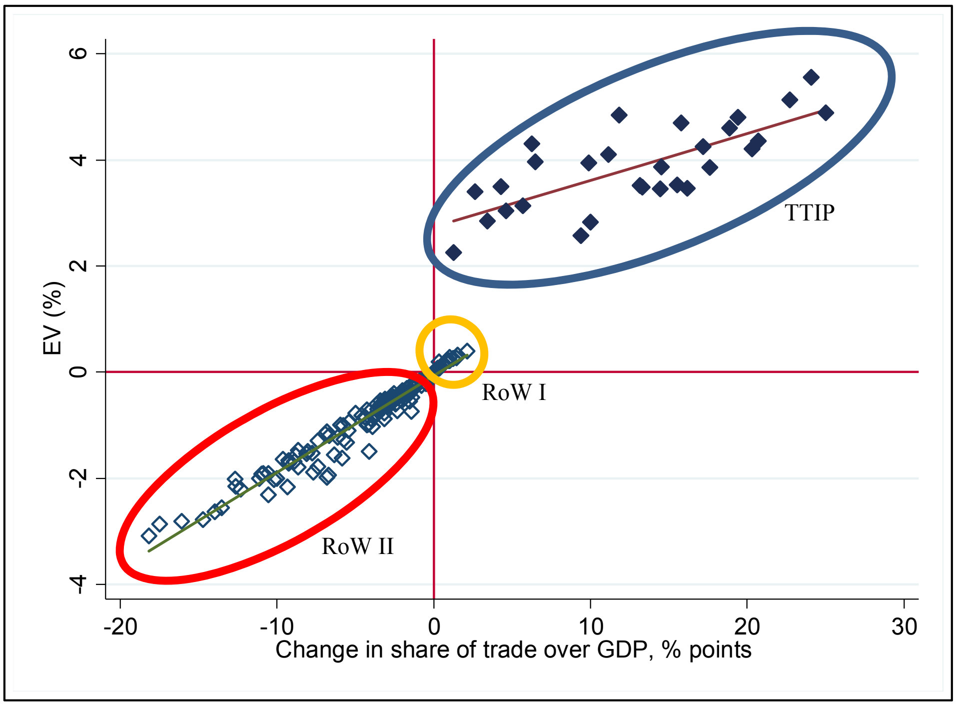

Figure 3. Welfare gains and change in overall openness across countries

Source: Authors' calculations. RoW refers to "rest of the world".

5.4. What drives the welfare effects?

A TTIP would lead to trade creation between the EU and the US. It would affect third countries through income and price effects. The latter come in the form of trade diversion and preference erosion. *Trade diversion* occurs when third countries lose relative competitiveness in the EU and the US, as firms from within the TTIP see their trade costs go down. This loss of market share cannot usually be fully compensated for increased trade with other non-TTIP countries. *Preference erosion* is a problem for countries which enjoy preferential trading conditions with either or both the EU and the US in the 2012 baseline situation. Preference erosion happens within the EU, where a TTIP would dilute the value of the customs union and the single market. More problematically, it also happens within RTAs that the TTIP members have signed with third countries. The US has RTAs with Canada and Mexico through the North American Free Trade Agreement (NAFTA), with South Korea, Australia, Bahrain, Chile, Colombia, Israel, Jordan, Morocco, Oman, Panama, Peru, Singapore and with 6 smaller Central American countries. The EU has agreements with an even larger number of countries. This list includes countries that also have an RTA with the US, such as Chile, Colombia, Peru, Israel, Jordan, South Korea, Mexico, and Morocco; it includes European countries that are not in the European Union (such as Norway, Iceland, Switzerland, Albania, Serbia); it includes countries in the Middle East and North Africa (such as Algeria, Tunisia, Egypt, and Turkey). Moreover, the EU has an RTA with South Africa. The 25 countries with the largest losses (ranging from -3.1 to -1.7%) mostly have RTAs with the TTIP members. 20 out of the 25 have an RTA with the EU, 12 with the US, and 10 have RTAs with both the EU and the US. Only 3 countries out of the 25 most strongly hit countries have no RTA with either the EU or the US.

Multilateral openness attenuates both the negative and the positive effects of a TTIP. Countries that are relatively open in the baseline equilibrium benefit less from bilateral reforms than relatively closed economies, or, conversely, they suffer less when their relative competitiveness in the US or the EU markets deteriorates due to a TTIP. We must therefore expect that typically countries outside the WTO or with low overall trade openness tend to suffer more from a TTIP than countries within the WTO or with high baseline openness.

In the next step, we investigate how multilateral and bilateral openness as well as per capita income in the baseline situation correlate with the welfare effects of a TTIP in both the group of partner countries and the group of outsiders.

Table 6 provides simple conditional correlations in form of linear regressions of welfare effects on country characteristics. Using the full sample of 173 countries, column (1) in Table 6 shows that a higher degree of multilateral openness (measured, as in Figure 3, by the share of manufacturing trade over 2 times GDP) correlates positively with the welfare effects from a TTIP. However, the correlation is negative within the group of TTIP countries. So, countries with high degrees of baseline openness within the TTIP gain less from the initiative, but countries outside the TTIP lose less. This is strongly in line with standard theoretical arguments: the less a country depends on the TTIP partners with its exports or imports, the less it will be hurt by trade diversion effects.

Column (1) also studies the role of baseline real income per capita. A higher initial GDP per capita correlates negatively with the gains from trade, implying that richer countries suffer more from a TTIP, presumably because they trade more strongly with other rich countries such as the US or the EU and are therefore more strongly affected by adverse terms of trade effects. Within the TTIP, however, there is no correlation between initial GDP per capita and the size of the welfare effect.

Column (2) looks at countries' existing trade policies, ignoring the variables studied in column (1). It finds that countries that have an RTA with the EU register average welfare losses of -1.8%, while countries having RTAs with the US suffer losses averaging -1.1%. These correlations are conditional on WTO membership, which substantially mitigates negative welfare effects. Note that these policy variables alone explain 26% of the variation in welfare effects.

Finally, column (3) shows the most comprehensive model. It confirms the insights of columns (1) and (2), except for the role of the WTO: WTO members are substantially more open than (the few) non WTO members in our sample, so that the inclusion of the openness variable absorbs the WTO effect detected in column (2). This simple model explains more than 91% of the heterogeneity in welfare outcomes in our 173 country sample.

Table 6. Determinants of welfare effects: Conditional correlations

Dep.Var.: Change in real per capita income, EV (%)	(1)	(2)	(3)
TTIP Dummy (0,1)	8.57***		8.54***
	(2.07)		(2.09)
Openness	0.008***		0.005**
	(0.002)		(0.002)
Openness x TTIP	-0.03***		-0.03***
	(0.01)		(0.01)
ln GDP per capita	-0.14***		-0.09***
	(0.01)		(0.02)
ln GDP per capita x TTIP	-0.23		-0.28
	(0.20)		(0.20)
RTA with EU		-1.79***	-0.82***
		(0.19)	(0.14)
RTA with US		-1.05***	-0.70***
		(0.30)	(0.23)
WTO member		0.60***	0.03
		(0.18)	(0.10)
R^2	0.86	0.25	0.91

Source: Authors' calculations.

Note: Robust standard errors in parentheses. ***, ** refer to statistical significance at the 1% and 5% levels, respectively. Variables indicated by "x TTIP" refer to interaction terms with the TTIP dummy. Number of observations = 173. Scenario as in [1] of Table 5.

5.5. Will the TTIP be comparable to the average existing agreements?

All scenarios in Table 4 assume that the TTIP would affect trade costs across the Atlantic by the same amount as other agreements have reduced trade costs amongst their members. This may lead to underestimation, if TTIP goes deeper than previous agreements. It could also lead to overestimation if for example the barriers that are easy to remove have been removed already.

Using our gravity equation, we can check in the data whether our approach overstates trade costs for the EU-US dyads. In this case, we should predict too little trade for these pairs relative to the data, and, thus, the error terms in the gravity equation for the EU-US trade flows should be predominantly positive. However, we observe the opposite: in 44 out of 56 bilateral trade flows the sign of the error term is negative. Only in 21% is it positive so our approach does not systematically overpredict trade costs for the EU-US case.

In the econometric analysis, Egger, Francois, Manchin, and Nelson (2014) distinguish between RTAs of different breadth and depth. Ranking RTAs is difficult, given the different dimensions of breadth and depth (inclusion of agricultural goods, protection of intellectual property rights, inclusion of services trade, different dispute settlement agreements, investor protection etc.). In principle, one could estimate the effect of different types of agreements or even single agreements like NAFTA. However, since TTIP has not been concluded yet, we still do not know which type of agreement to assume.

To get an idea about the sensitivity of our welfare estimates concerning the depth of a potential TTIP, we therefore reran our counterfactual simulations by assuming that a TTIP has a lesser or larger effect than the average RTA. We show results for selected countries and regions in Figure 4. The x-axis reports the conjectured effect of a TTIP in percent of the effect of the average RTA. The y-axis presents the associated welfare effect.[12] As the depth of a TTIP increases, welfare gains for TTIP member countries increase disproportionally, whereas welfare losses for non-member countries increase, but less so. Hence, the dispersion of the welfare effects goes up in the size of the effect of a TTIP and the scope for redistributive or compensating policies for the countries losing from a TTIP goes up. Also, even if TTIP is much deeper than the average RTA, effects on non-member countries will remain relatively moderate.

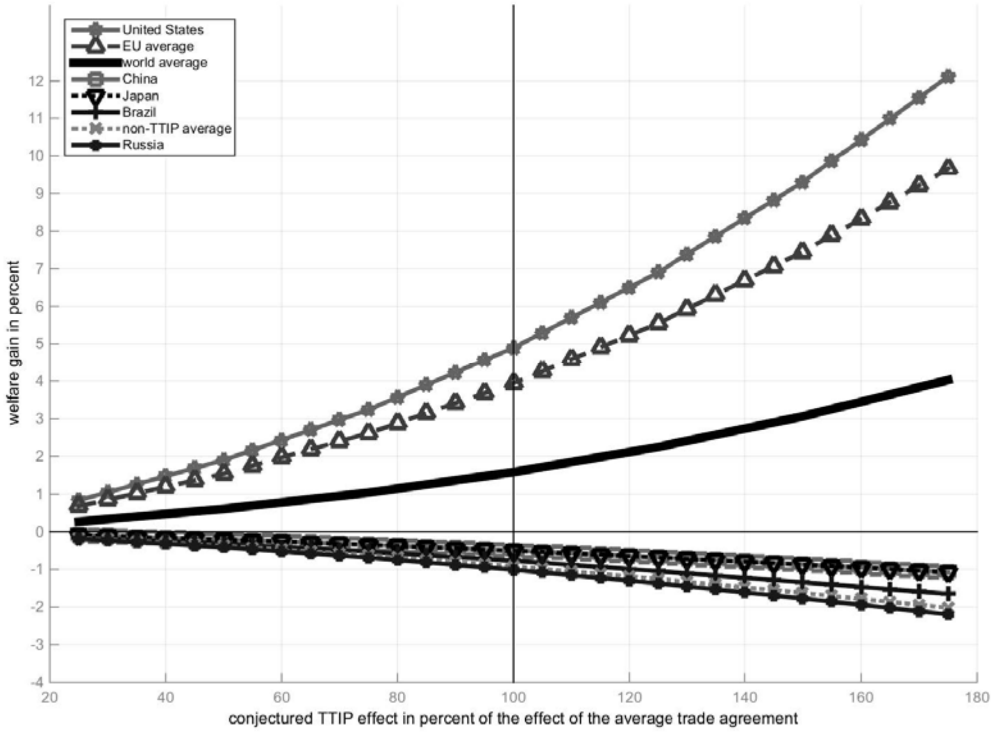

Figure 4. Welfare effects from a TTIP as a function of the depth of the agreement

Source: Authors' calculations.

Most importantly, Figure 4 effectively traces the policy space for a TTIP and illustrates the sensitivity of our analysis with respect to the conjectured effect of a TTIP. Irrespective of the particular point on the x-axis, the key qualitative welfare results of our study continue to hold: The US has the largest potential benefits, and they get

[12] Effects for regions are GDP-weighted averages of the effects for the individual countries. The full set of welfare changes for all countries for all calculated scenarios is available from the authors upon request.

disproportionally larger the more ambitious the agreed-upon TTIP. Non-member countries mostly have to worry about such a very deep agreement, as a less ambitious TTIP will only have negligible effects on their economies.

5.6. The role of modelling choices: single-sector and lack of dynamics

We are using a single-sector approach. This has obvious advantages: simplicity, transparency, and relatively low demands on data. The traditional CGE literature has used large-scale multi-sector models for trade policy analysis. Hence, some of the differences in our results to those reported by FMNPT or Egger, Francois, Manchin, and Nelson (2014) may be driven by assumptions on sector structure. As shown in Arkolakis, Costinot, Rodríguez-Clare (2012), welfare effects in multi-sector models depend on the structure of the economy represented by spending shares, which are fixed in most available frameworks. Moreover, the quantitative exercises in Costinot and Rodriguez-Clare (2014) suggest that, for a given increase in openness, the welfare gains obtained in multi-sector models are actually bigger, not smaller, than those from single-sector setups.

Structural details clearly matter for welfare effects in small, specialized countries. If their structure of comparative advantage is such that they are specialized on the production of goods that the EU and the US do not themselves produce and trade, they will not be affected by trade diversion. Then, our approach exaggerates welfare losses in third countries. This holds, however, only if the TTIP does not change the pattern of comparative advantage.

Multi-sector models are still the exception in the new quantitative trade theory (see for surveys Head and Mayer, 2014, and Costinot and Rodríguez-Clare, 2014). Extending the one-sector economy to many sectors is straight-forward theoretically, but additional assumptions are needed and difficult data issues arise. For example, one has to assume the elasticities of substitution between sectors. Most of the multiple sector gravity models assume a two-tier utility function, where the upper-level combining sectors is assumed to be Cobb-Douglas (see, e.g., FMNPT, p. 108; or Caliendo and Parro, 2015). This choice fixes the share of income spent on a given sector, thus ruling out structural change. Single-sector approaches are agnostic about these changes.

Similarly, multi-sector models must make assumptions on factor mobility between sectors. With the usual assumption of perfect mobility between sectors multi-sector models are comparable to one-sector models in terms of the employment of workers: they are always ideally allocated. Therefore, the single sector view corresponds to the long-run where all structural adjustments have taken place. Additionally, it is consistent with structural changes in the economy that may happen due to TTIP, both in TTIP-member and non-member third countries.

Another reason to include multiple sectors would be to take into account the linkages between upstream and downstream producers. However, input-output databases assume that production technology is constant (FMNPT, p. 107), effectively ruling out adjustments of the slicing up of the global value chain due to trade liberalization, which is at the heart of international across-sector linkages. While we are again agnostic about such changes when focussing on one-sector, we want to note that even though two-thirds of world trade is now accounted for by intermediates, our model at the aggregate level explains trade flows very well.

On the data side, the multi-sector approach is impossible to implement on a large country sample like ours (173 countries) because of data limitations. E.g., Caliendo and Parro (2015) implement their prominent multi-sector model for 31 countries only; also Francois et al. (2013) presents results only a few selected countries and regional aggregates. In Section 7, we show that aggregation of countries matters for the quantification of welfare effects.

We certainly do not deny the importance of investigating TTIP at the sectoral level. We view our analysis as complementary to Egger, Francois, Manchin, and Nelson (2014) who do provide a sector-level analysis. Our focus is on the importance of point estimates, *given* the specific modelling choices. The sensitivity of welfare effects to these point estimates holds up both for one-sector models such as ours as well as multiple-sector models such as Egger, Francois, Manchin, and Nelson (2014). The trade elasticity, the country aggregation, and the point estimates of RTA effects are important factors determining the trade, GDP, and welfare effects *irrespective* of the sectoral aggregation.

Finally, a comment is due on the static nature of our exercise. We already stressed that our results have to be interpreted as long-run effects. However, our ceteris paribus assumption does not account for the dynamic effects of capital accumulation. In a recent working paper, Anderson, Larch and Yotov (2014b) investigate the growth effects of TTIP based on the dynamic structural trade model developed by Anderson, Larch and Yotov (2014a). This framework models the inter-temporal consumption-investment choice and endogenizes capital accumulation. In the analysis of Anderson, Larch and Yotov (2014b), TTIP influences this trade-off. Compared to the effects of a static general equilibrium framework, the dynamic channel increases the gains for TTIP members by about 25 percentage points and mitigates the negative trade diversion effects for non-members. For some outsiders (such as Korea and Singapore), TTIP can even yield positive long-run effects on trade flows.[13] Overall, however, the magnitude and pattern of welfare effects are not very different from what we present in the present paper, in particular on impact. Allowing for dynamic adjustment effects is an important area of further research.

[13] Eaton and Kortum (2005) survey the literature on the link between trade, production and growth focussing on technology spill-overs between countries. Typically, accounting for technological spill-overs opens up an additional channel through which opening up to trade potentially increases welfare.

6. SPILL-OVERS AND INTERACTIONS WITH OTHER TRADE AGREEMENTS

6.1. Spill-overs: mechanisms and empirical evidence

So far, we have assumed that a TTIP lowers trade costs only between the EU member states and the US. However, if the agreement lowers trade costs also between TTIP partners and third countries, or even amongst third countries themselves, the negative effects on excluded countries may be attenuated or may even turn positive (Baldwin, 2011). Indeed, one may conjecture that the sheer size of the transatlantic partnership and its focus on regulatory convergence makes the TTIP systemically important so that it creates positive spill-overs for other countries.

The reason is that firms based in non-TTIP countries may benefit from a simplification of either EU or US regulatory requirements. Kox and Lejour (2006) provide evidence that differences in services regulations can increase operating costs in different markets so that harmonizing those rules may result in lower costs for all exporters in a non-discriminatory fashion.

Citing this reference, FMNPT (2013, p. 28-29) include direct and indirect spill-overs into their analysis. They model *direct spill-overs* by assuming that improved regulatory conditions negotiated between the EU and the US result in a limited fall in related trade costs for third countries exporting to the EU and US. This means that exporters from third countries enjoy improved access to the EU and US markets. However, there is no reciprocal benefit for EU or US based exporters into third countries.

Indirect spill-overs arise if third countries adopt some of the common standards agreed between the EU and the US. This assumes that a TTIP can successfully impose global standards to which third countries also find it optimal to adhere. Then, the transatlantic agreement would give firms from the EU and the US improved access to third markets. In addition, NTMs amongst third countries would also fall as their standards and norms move closer to the common model promoted by a TTIP. Therefore, indirect spill-overs would lead to lower costs and greater trade between third countries as well.

Clearly, such spill-overs would further increase the overall welfare gains from a TTIP and make it much less likely that third countries lose. However, both the theoretical and the empirical underpinnings for spill-overs are weak. This is why we have not allowed for spill-overs in our benchmark specification. In the following, we briefly review the literature that supports our case.

On the theory side, authors have long stressed that preferential trade cost reductions are inherently discriminatory. Viner (1950) introduced the terms “trade creation” and “trade diversion” over sixty years ago to highlight the fact that RTAs likely create new trade between member countries partly by diverting trade from non-members countries. Panagariya (2000) nicely motivates his discussion of trade diversion and creation by stating: “Any discussion of the welfare effects of RTAs must inevitably begin with the influential concepts of trade creation and diversion.”

On the empirical side, let us start by noting that the existence of large and accurately estimated RTA coefficients in gravity equations of international trade implies that spill-overs cannot be very large. If it were the case that bilateral trade reform lowers trade costs for all country pairs, one should not be able to detect that trade growth is larger within RTAs than outside. Also, the skepticism which TTIP has met in third countries testifies to the plausibility of adverse trade diversion effects.

There is a large empirical literature that explicitly quantifies trade diversion effects for different preferential trade agreements. While Clausing (2001) finds little evidence for trade diversion for the Canada – United States Free Trade Agreement (CUSFTA)[14], Trefler (2004) and Romalis (2007) do find evidence for trade diversion for CUSFTA and NAFTA, respectively. While Trefler (2004) finds trade creation does still outweigh trade diversion to ensure that there are welfare gains from NAFTA in Canada, Romalis (2007) concludes that "the more detailed data used in this paper reveals much more substantial trade diversion than Trefler, so much so that there appear to be essentially no welfare gains for any NAFTA member" (page 417). However, Romalis (2007) does not only find no welfare gains for NAFTA members, but also finds evidence for negative third-country effects for non-NAFTA members. His analysis of trade diversion reveals that a 1 percent drop in intra-North American tariffs leads to about a 2 percent fall in exports from other countries relative to the European Union.

Chang and Winters (2002) analyze the trade diversion effects of non-MERCOSUR exports to Brazil after inception of MERCOSUR. They find strong negative terms-of-trade effects for non-member countries and conclude their analysis with the statement: "Our results give empirical backing to the well-known theoretical argument that even if external tariffs are unchanged by integration, nonmember countries are likely to be hurt by regional integration" (page 901).

The papers cited above discuss the evidence for trade diversion of RTAs in general. We now turn to empirical studies that explicitly deal with trade diversion effects related to NTM reforms. Chen and Mattoo (2008) use panel data to analyze the effects of RTAs that include mutual recognition agreements (MRAs). They find that while MRAs increase trade between participating countries, the effects on outsiders are less clear cut and crucially depend on the ability of outside countries to meet standards. As standards are more likely met by developed than by developing countries, Chen and Mattoo (2008) conclude that specifically developing countries will be negatively affected by trade diversion from an MRA where they are not a member. Additionally, the stringency of the rules of origin play a crucial role for the effects on outsiders. If the rules of origin are very strict, then gains from the MRA are restricted to MRA member countries, whereas otherwise also outside countries potentially gain from harmonization of standards of other countries.

Baller (2007) uses a gravity model accounting for heterogeneous firms to investigate the effects of MRAs on developed and developing countries. She distinguishes between MRAs for which she finds positive effects on the extensive (entering new markets) and intensive (volume of trade) margin, and harmonization of standards or technical

[14] Note that Clausing (2001) uses prices rather than quantities in the welfare analysis, which is problematic (see Feenstra 2004). Additionally, the results from Clausing (2001) may be driven by the rapid growth of imports that would have occurred if CUSPTA would not have been in place (see Romalis 2007).

regulations. For the latter she finds ambiguous effects. Specifically, in line with Chen and Mattoo (2008), she finds that developing countries' trade is hurt by regional harmonization while it increases trade with developed countries.

Fink and Jansen (2009) focus on services trade and argue that the scope for MRAs is likely to be limited. The reason is that concerning services, MRAs are mainly relevant for mode 4 movements.[15] However, mode 4 trade is hardly affected by trade liberalization, making large gains from MRAs unlikely. Further, MRAs for services only apply to a small number of professional services sectors like accounting, architects and engineering. And most of MRAs do not implement automatic recognition of qualifications (OECD 2003), limiting their effect further.

Cadot, Disdier, Fotagné (2013) also highlight trade diversion effects for non-tariff measures. They show that North-South RTAs hurt trade between developing countries. If the harmonization is based on regional standards, also exports of developing countries to developed countries are predicted to be negatively affected.

Let us summarize these empirical findings in the words of the World Trade Organization: "*To sum up, evidence suggests that regional integration of TBT/SPS* [Technical Barriers to Trade (TBT), Sanitary and Phytosanitary (SPS)] *measures has trade-diverting effects, especially to the detriment of developing countries.*" (World Trade Report, 2012, page 152).

6.2. The role of spill-overs for the welfare effects of a TTIP

In their studies on the EU-Japan and the TTIP agreements, Francois, Sunesen, and Thelle (2009) and Francois, Manchin, Norberg, Pindyuk and Tomberger (2013) implement the idea of spill-overs as follows. Direct spill-overs lead to a reduction of NTMs amounting to 20% of the reduction achieved within the TTIP. For example, if trade costs fall by 10% between the US and the EU, trade costs for exporters to the EU or the US from third countries fall by 2%. Indirect spill-overs are assumed to amount to 50% of the direct spill-over rate. With the above example, this implies that trade costs of EU or US exporters to third countries and trade costs applicable in trade flows within the group of third countries would go down by 1%.

To see how our benchmark results reported in column [1] of Table 4 change, we implement the parameterization of spill-overs introduced by FMNPT. Table 7 reports summary statistics for four different specifications. Row [1] reproduces our benchmark model, where both direct and indirect spill-overs are set to zero. Row [2] implements the default parameterization of FMNPT. It is also the scenario reported in column 6 in Table 4. The consequence is that, compared to [1], the unweighted mean over country-level welfare effects rises from about -0.04% to 2.9%. The most negative realization increases from -3.1% to -0.5%, cutting it by almost a factor of six. Also, the GDP-weighted mean of welfare effects more than doubles from 1.6% to 3.9%.

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15 Mode 4 movements are services supplied by nationals of one country in the territory of another. This includes independent services suppliers and employees of the services supplier of another country, like, for examples a doctor going from his home country to the patients' country to provide treatment there.

Table 7. The role of spill-overs: Summary statistics of welfare effects (%)

Specification			Welfare Effects					
	Spill-overs (%)		unweighted		GDP-weighted			
	direct	indirect	Mean	Std. Dev.	Mean	Std. Dev.	Min	Max
[1]	0	0	-0.04	1.93	1.58	2.78	-3.09	5.56
[2]	20	50	2.89	3.01	3.90	3.39	-0.53	13.29
[3]	10	50	1.47	2.43	2.73	3.06	-1.82	8.24
[4]	20	0	0.88	3.27	3.07	4.12	-2.19	9.59
[5]	10	0	0.42	2.58	2.32	3.42	-2.64	7.55

Source: Authors' calculations.

Note. All specifications use the benchmark RTA effect, assume selection, and set ε=7. 173 countries. Trade cost equations as in Table 3.

Rows [3] to [5] provide further analysis on alternative parameterizations of spill-overs, where either direct spill-overs are assumed to be only 10% of the trade cost reduction within a TTIP, or where indirect spill-overs are shut down completely. The latter turn out to be important: in their absence, the unweighted average welfare effect is 0.9% compared to 2.9% when they are assumed active. Also the lowest welfare effect in the sample moves close to the one obtained in the total absence of any spill-overs. Hence, if one means to reduce third country losses, one requires those indirect spill-overs to operate.

Figure 5 provides Kernel density plots of welfare effects for our sample of 173 countries under scenarios [1], [2] and [4]. The Figure shows how strongly spill-overs shift the distribution of welfare effects to the right.

We conclude that spill-overs from bilateral trade cost reductions to third countries can be powerful sources of additional welfare gains. However, the theoretical basis for modeling these effects is thin and the empirical evidence does not provide conclusive evidence for such positive spill-overs.

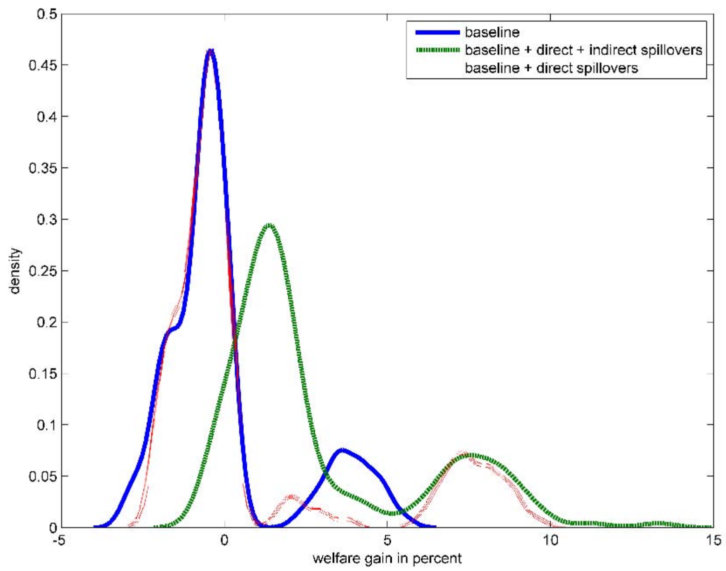

Figure 5. The effects of spill-overs on the distribution of welfare gains
Source: Authors' calculations.
Notes: Kernel density estimates (Gaussian, with optimal bandwidth). Curves refer to rows [1] (baseline), [2] (direct and indirect spill-overs), and [4] (direct spill-overs) from Table 7.

6.3. Conditioning effects of other regional mega deals

We now turn towards the macroeconomic effects of other large trade agreements that are presently under negotiation, but which exclude the European Union: the Transpacific Partnership and the Regional Comprehensive Economic Partnership agreement.

The *Transpacific Partnership* (TPP) is a strategic economic partnership agreement between Brunei, Chile, New Zealand, and Singapore. It entered into force on January 1, 2006, under the name of the Trans-Pacific Strategic Economic Partnership Agreement (TPSEP). Currently, the US, Australia, Peru, Vietnam, Malaysia, Mexico, Canada, and Japan are negotiating to join the agreement. Several of the negotiating parties already maintain preferential trade agreements with each other; e.g., the US has RTAs in place with Australia, Canada, Chile, Peru, Mexico, and Singapore; similarly, Japan has RTAs with Peru, Vietnam, Malaysia, Mexico, Chile, and Singapore. Hence, TPP involves a substantial degree of consolidation of existing agreements. Nonetheless, it is a significant effort since it would create a free trade zone between the world's single largest (US) and third largest (Japan) economies.

The *Regional Comprehensive Economic Partnership* (RCEP) is a trade agreement between the 10 member states of ASEAN (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam) and the six countries with which ASEAN has existing Free Trade Agreements (RTAs) – Australia, China, India, Japan, Korea, and New Zealand. In relation to RCEP these six non-ASEAN countries are known as the ASEAN Free Trade Partners (AFPs). As with TPP, the RCEP agreement involves consolidation of RTAs already in place.

Our quantitative strategy has the advantage that it can be used to assess the potential macroeconomic effects of any agreement, as long as one is willing to assume that its trade cost reducing effects can be inferred from the experience with existing preferential trade agreements.

Table 8. Other regional mega deals and cumulative effects: summary of welfare effects (%)

		unweighted		GDP-weighted			
Specifications		**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Models with selection							
[1]	**TTIP**	-0.04	1.93	1.58	2.78	-3.09	5.56
[2]	**TPP**	-0.24	1.41	1.03	2.58	-1.79	12.66
[3]	**RCEP**	-0.42	1.33	1.20	3.15	-2.87	8.88
[4]	**TPP given TTIP**	-0.26	1.31	0.93	2.36	-1.93	11.69
[5]	**RCEP given TTIP**	-0.47	1.40	1.25	3.25	-3.20	9.12
[6]	**TTIP given RCEP**	-0.05	1.82	1.49	2.71	-2.76	5.25
[7]	**TTIP given TPP**	-0.08	1.99	1.63	2.81	-3.20	5.71

Source: Authors' calculations.

Note: All specifications use the benchmark RTA effect, assume selection, and set ε=7. 173 countries. Trade cost equations as in Table 3.

Table 8 provides the summary of welfare effects for the TPP and the RCEP agreements. Row [1] reproduces our benchmark specification for a TTIP. The rows entitled [2] and [3] report summary statistics for the other two main agreements under negotiation. Compared to a TTIP, the unweighted mean of welfare effects is much more negative for the TPP and the RCEP, amounting to -0.2% and -0.4%, respectively. Nonetheless, the GDP-weighted averages are positive for both initiatives: 1.0% and 1.2%, respectively. Compared to a TTIP, the other regional mega deals on their own yield smaller world-wide welfare gains, and those gains are more strongly concentrated as they include fewer countries. In the contexts of RCEP and TPP, the strongest gains accrue to Japan and New Zealand, respectively, and the largest losses to Micronesia (for both agreements).

In Rows [4] and [5], we summarize the welfare effects from enacting TPP and RCEP, respectively, given that a TTIP has already taken effect. The unweighted averages become slightly smaller, implying that losses to third countries (in particular to the US and EU member states) go up when a TTIP exists. In terms of GDP-weighted averages, we find that the TPP, introduced given that a TTIP already exists has a somewhat smaller welfare effect than when it comes to a world without the TTIP; the opposite is true for the RCEP.

Table 9. Welfare effects: conditioning effects of different regional mega deals (%)

		[1] TTIP	[2] TPP	[3] RCEP	[4] TPP after TTIP	[5] RCEP after TTIP	[6] TTIP after TPP	[7] TTIP after RCEP
1	Austria	2.83	-0.15	-0.18	-0.32	-0.13	2.64	2.89
2	Belgium	2.25	-0.11	-0.13	-0.26	-0.10	2.09	2.30
3	Bulgaria	3.94	-0.22	-0.28	-0.43	-0.20	3.71	4.05
4	Croatia	3.53	-0.22	-0.23	-0.41	-0.16	3.30	3.61
5	Cyprus	4.36	-0.25	-0.35	-0.46	-0.24	4.11	4.50
6	Czech Rep.	3.04	-0.17	-0.20	-0.35	-0.15	2.84	3.11
7	Denmark	3.45	-0.19	-0.22	-0.39	-0.16	3.23	3.54
8	Estonia	4.31	-0.25	-0.31	-0.47	-0.22	4.05	4.43
9	Finland	4.60	-0.28	-0.34	-0.50	-0.23	4.33	4.74
10	France	3.46	-0.18	-0.20	-0.38	-0.13	3.24	3.55
11	Germany	3.48	-0.19	-0.22	-0.38	-0.15	3.26	3.57
12	Greece	4.21	-0.24	-0.31	-0.46	-0.21	3.96	4.33
13	Hungary	3.50	-0.20	-0.24	-0.39	-0.18	3.27	3.58
14	Ireland	4.70	-0.24	-0.20	-0.49	-0.11	4.41	4.81
15	Italy	3.86	-0.21	-0.25	-0.42	-0.17	3.62	3.97
16	Latvia	4.10	-0.24	-0.29	-0.45	-0.21	3.85	4.22
17	Lithuania	3.97	-0.23	-0.28	-0.44	-0.20	3.73	4.07
18	Luxembourg	2.57	-0.13	-0.15	-0.29	-0.11	2.39	2.62
19	Malta	4.84	-0.26	-0.27	-0.50	-0.16	4.56	4.97
20	Netherlands	2.85	-0.15	-0.17	-0.33	-0.13	2.65	2.91
21	Poland	3.51	-0.20	-0.24	-0.39	-0.17	3.29	3.60
22	Portugal	4.80	-0.26	-0.26	-0.50	-0.16	4.52	4.93
23	Romania	3.87	-0.20	-0.26	-0.41	-0.18	3.63	3.97
24	Slovak Rep.	3.40	-0.19	-0.24	-0.38	-0.17	3.18	3.48
25	Slovenia	3.14	-0.17	-0.20	-0.35	-0.15	2.93	3.21
26	Spain	5.56	-0.28	-0.23	-0.55	-0.12	5.25	5.71
27	Sweden	4.25	-0.25	-0.29	-0.46	-0.20	3.99	4.36
28	UK	5.14	-0.27	-0.24	-0.53	-0.13	4.84	5.27
	EU 28	**3.94**	**-0.21**	**-0.22**	**-0.42**	**-0.15**	**3.70**	**4.04**
29	United States	4.89	2.14	-0.66	2.06	-0.61	4.82	4.95
30	Australia	-2.01	2.37	7.42	2.98	8.01	-1.50	-1.55
31	Brazil	-0.77	-0.52	-0.43	-0.45	-0.49	-0.71	-0.83
32	Canada	-3.09	0.27	0.16	0.70	0.05	-2.73	-3.20
33	China	-0.50	-0.86	4.86	-0.78	4.98	-0.43	-0.41
34	India	-0.31	-0.24	1.75	-0.20	1.77	-0.27	-0.30
35	Japan	-0.51	8.20	8.88	7.34	9.12	-1.22	-0.31
36	Mexico	-2.56	-1.13	-0.17	-0.97	-0.30	-2.41	-2.69
37	Norway	-1.91	-0.27	-0.29	-0.17	-0.38	-1.81	-2.01
38	Russian Fed.	-1.01	-0.64	-0.92	-0.56	-1.03	-0.94	-1.13
39	South Africa	-1.69	-0.52	-0.52	-0.43	-0.64	-1.61	-1.82
40	Turkey	-1.56	-0.24	-0.32	-0.16	-0.41	-1.47	-1.65

Source: Authors' calculations. See the Web Appendix, Table A1 for further details.

Finally, Rows [6] and [7] reverse the order. They assume that the baseline equilibrium already incorporates the effects of the TPP or the RCEP. Interestingly, the emerging summary statistics resulting from the introduction of TTIP are not too different from those obtained from a baseline that does not feature the TPP or the RCEP. Note that we do not imply any dynamic effects from the specific order in which agreements are signed. The above counterfactual exercises only differ in the respectively chosen baseline scenario. Table 9 provides details for the EU and some other countries. In EU member states, the TPP and RCEP lead to a reduction of the EU-wide real per capita income of about 0.2%. The fact that the average EU welfare effect from introducing the TPP with a TTIP already in place is so much more negative than the one from introducing TPP alone shows that some of the welfare gains accruing to EU member states from TTIP are eroded away when the US opens to the TPP members.

The TPP is particularly problematic for those EU member states that have strong trade ties with the US or Japan, two countries that would be included in the TPP. This is the case for the United Kingdom, for example. In contrast, the RCEP is most painful for countries trading a lot with Asia, in particular with China. Interestingly, for EU member states, the losses from the two initiatives are strongly and positively correlated. Broadly the same countries are vulnerable to the RCEP than to the TPP. The most affected countries would be Finland, Spain and the United Kingdom in case of TPP; and Finland, Cyprus, and the Baltic States in the case of RCEP.

7. FURTHER ROBUSTNESS CHECKS: REGIONAL AGGREGATION AND TRADE ELASTICITIES

7.1. The role of the level of aggregation

Anderson (2011) discusses how regional aggregation affects the welfare effects of trade policy changes. Lumping countries together into larger regions has non-trivial effects. Aggregation implies that part of international trade becomes internal trade with typically lower trade costs. In addition, the assumed underlying geography determined by the specified trade cost functions and the number of countries/regions changes. This, as can be seen by equations (2) and (3), directly affects trade flows, multilateral resistances, and ultimately welfare. Most importantly, within the newly aggregated regions, all trade diversion effects are assumed away. This effectively limits the negative trade diversion effects within the aggregated regions and increases the net welfare effects of any international trade costs reduction for these regions.

Here, we aggregate the 28 EU member states into a single entity and report the resulting welfare effects for a selection of regions. The aim is to make our exercise more directly comparable to FMNPT. Specifically, we follow Head and Mayer (2000, 2002), Helliwell and Verdier (2001), and Anderson and van Wincoop (2003, footnote 17) by calculating aggregate distances weighted by respective GDP shares of a country within the EU. We apply the same method to all other explanatory variables in our trade costs specification. Compared to the case where the EU is assumed to consist of 28 separate countries, welfare effects from a TTIP are numerically larger; see columns [A] and [B] of Table 10.

Table 10. Welfare effects of a TTIP and regional aggregation (%)

	[A] EU disaggregated	[B] EU as single entity
European Union	3.94	6.03
United States	4.89	6.62
Australia	-2.01	-2.72
Brazil	-0.77	-1.16
Canada	-3.09	-4.13
China	-0.50	-0.79
India	-0.31	-0.51
Japan	-0.51	-0.81
Mexico	-2.56	-3.50
Norway	-1.91	-3.24
Russian Federation	-1.01	-1.70
South Africa	-1.69	-2.83
Turkey	-1.56	-2.81

Source: Authors' calculations.

The aggregation eliminates all trade diversion effects within the EU, which increases the value of the agreement for the TTIP members. The flipside of the coin is that the non-member countries suffer larger negative welfare effects in this case. Indeed, the difference between the average welfare effects in the EU and in the US narrows when the EU is treated as a single entity. While the percentage increase in real per capita income is about 1.25 times larger in the US than in the EU when the 28 member states are treated separately, it is only 1.10 times larger when the EU is treated as a single entity.[16]

7.2. Different trade elasticities

Finally, we investigate the choice of the trade elasticity ε. Anderson and van Wincoop (2004) advocate a value in the neighborhood of 7 for studies using aggregate trade flows as ours. However, the literature has also used lower elasticities, see Bernard, Redding and Schott (2007) for an example. Lower values of trade elasticities tend to lead to higher gains from trade, since domestic and imported varieties are less easily substitutable.

[16] We also investigated the effect of TTIP when aggregating all countries in 11 regions, following Francois, Manchin, Norberg, Pindyuk and Tomberger (2013). The regions are ASEAN, China, EU, Eastern Europe, India, low income countries, MERCOSUR, Mediterranean countries, USA, other OECD countries, and rest of the world. We find broadly similar results. However, the EU gains significantly more in this scenario, and even more than the US, whose gains are predicted to be similar than in the scenarios reported in Table 10.

Row [1] in Table 11 repeats our benchmark specification for reference. Rows [2] and [3] use a trade elasticity of 5 instead of 7 in a model with and without selection. One can see quite clearly that a lower ε does not affect the unweighted average effects of introducing TTIP by much, but it does blow up the standard deviation quite considerably. GDP-weighted averages increase from 1.6% to 2.7% (no selection); and the range of possible welfare realizations increases.

Table 11. Robustness checks: Different trade elasticities

Specification	**Parameters**	**Results: cross-country moments (%)**					
		unweighted		GDP-weighted			
	ε	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Min**	**Max**
[1]	7.00	-0.04	1.93	1.58	2.78	-3.09	5.56
[2]	5.00	0.02	3.31	2.83	4.76	-4.80	9.78
[3](no sel.)	5.00	-0.27	3.36	2.83	4.76	-4.81	9.73

Note: All specifications use the benchmark RTA effect. Specification [1] and [2] allow for endogenous selection of countries into trade. 173 countries. Trade costs as in Table 3.

8. POLICY CONCLUSIONS

The heated public debate on the proposed TTIP goes much beyond standard economic analysis of the pros and cons of regional trade integration. It addresses the fundamental tension between the desirability of democratic politics, open international markets, and the scope of the nation state (Rodrik, 2011). In our paper, we have narrowed our focus on the potential economic impact of a TTIP on EU member states and the world. Further, our emphasis is on the driving forces for the magnitudes of the estimated effects. We believe that our research does offer important insights for economic policy, as it highlights the importance of different assumptions for the quantification of a TTIP and thereby helps to understand the differences in the results of existing studies of the effects of a TTIP.

First, let us summarize our benchmark results. It suggests substantial economic benefits for the average EU citizen (about EUR 1000 per year). Hence, while we do not deny risks from a transatlantic agreement, economic benefits are potentially big enough to tilt the balance in favor of a TTIP. So, in our view, it is worth investing political capital into the project. Moreover, in contrast to wide-spread public opinion, a TTIP would not benefit core EU countries more than the periphery. While the robustness of this finding is still to be ascertained, it would imply that there is no need to step up regional support programs following the conclusion of a TTIP. Finally, our result that the US gains more than the EU has captured public attention. Clearly, this possibility should have no bearing on the desirability of a TTIP for the EU.

Second, negotiators have set their ambitions high. Their goal is to conclude a *"comprehensive, ambitious agreement that addresses a broad range of bilateral trade* *and investment issues, including regulatory issues"* [and that] *"goes beyond what the United States and the EU have achieved in previous trade agreements."*[17] In our benchmark analysis, we have remained more modest: we have assumed that a TTIP would reduce trade costs by as much as existing agreements have. However, we know that existing agreements often have holes (exceptions for agriculture, services), and that they often do not cover contentious issues pertaining to regulatory convergence or to investment (such as the much disputed investor-state dispute settlement mechanisms); see Dür, Baccini and Elsig (2014). We show in our investigation, that the quantification hinges substantially on the exact magnitude of the underlying assumed partial effect of TTIP. It turns out to be one of the – if not *the* – crucial driver for the predicted trade and welfare effects. It also helps to understand the quite substantial differences between different studies of the effects of a TTIP. The partial effect estimates for RTAs still vary widely across studies, and future research hopefully narrows down this range so that we get a more precise idea of the partial effects. Our own research and reading of the literature suggests that the partial effects could be substantial, specifically when carefully controlling for potential endogeneity issues due to self-selection of countries into RTAs. It follows that the welfare gains from a TTIP could be substantial even if some of the most problematic elements are excluded from the agreement.

Third, if TTIP operates like the average existing trade agreement, it will most likely have discriminatory effects on third countries. In our benchmark scenario, we have not assumed that bilateral negotiations will also lead to lower trade costs of non-participating countries amongst themselves and with TTIP members. While it is conceivable that the establishment of global standards benefits all trading nations, we would like to stress that: (i) there is no conclusive evidence yet that would support this modeling choice; (ii) TTIP is, amongst other things, likely a very classical market access liberalization exercise, e.g., in the services, public procurement, agri-food, or investment liberalization areas; (iii) in the area of regulatory convergence, TTIP will – like the EU single market program – most likely result in mutual recognition of standards across the Atlantic rather than in the establishment of a global standard. And even if it did, whether EU or US regulators automatically admit goods or services from third countries that satisfy EU or US standards is by no means guaranteed. This will depend on the small print and on the implementation of the agreement. Our robustness analysis highlights the importance of the assumption of spill-overs for the trade and welfare effects of non-member countries. While there will be quite substantial negative effects up to -3.1% without spill-overs, this effect decreases when taking into account spill-overs to -0.5%. Hence, a TTIP without spill-overs is expected to have quite substantial Vinerian consequences. Policymakers should therefore work on measures to mitigate negative third country effects, e.g., by applying generous rules of origin, or by pursuing further multilateral trade liberalization at the WTO level.

[17] Final Report of the High Level Working Group on Jobs and Growth, February 11, 2013, available at trade.ec.europa.eu/doclib/html/150519.htm.

Fourth, in our analysis, we have compared long-run equilibria. We have not discussed adjustment dynamics. Also, we have abstracted from distributional consequences. More research on these issues would be highly welcome. However, in the particular case of a TTIP, there are reasons to be optimistic. We have motivated our modeling strategy, inter alia, by the fact that transatlantic trade is strongly intra-industry (Felbermayr, Larch, Flach, Yalcin and Benz, 2013). This implies that adjustment processes will predominantly involve intra-industry reallocation. This should keep adjustment costs low as workers change jobs within sectors, and it should also lead to speedy adjustment. Thus, frictional unemployment on the adjustment path, should remain limited. Moreover, the structure of factor endowments across the Atlantic is not too different. This leaves little scope for Stolper-Samuelson type effects. So, there are reasons to believe that distributional consequences from a TTIP should be limited, too. Nonetheless, policymakers are advised not to obstruct the working of the labor market and to ensure that a TTIP does not result in more monopolistic market structures that result in new barriers to entry.

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WEB APPENDIX

Table A1. Welfare results across different scenarios (%)

Country	code	TTIP	RTA with		Open-ness	Welfare effects in different scenarios			
			EU	USA		TTIP full	TTIP only tariffs	RCEP	TPP
Austria	AUT	1	n.a.	n.a.	43.63	2.83	0.22	-0.18	-0.15
Belgium	BEL	1	n.a.	n.a.	91.17	2.25	0.17	-0.13	-0.11
Bulgaria	BGR	1	n.a.	n.a.	58.29	3.94	0.33	-0.28	-0.22
Croatia	HRV	1	n.a.	n.a.	27.95	3.53	0.38	-0.23	-0.22
Cyprus	CYP	1	n.a.	n.a.	19.88	4.36	0.37	-0.35	-0.25
Czech Republic	CZE	1	n.a.	n.a.	75.63	3.04	0.24	-0.20	-0.17
Denmark	DNK	1	n.a.	n.a.	31.59	3.45	0.28	-0.22	-0.19
Estonia	EST	1	n.a.	n.a.	75.47	4.31	0.36	-0.31	-0.25
Finland	FIN	1	n.a.	n.a.	30.06	4.60	0.39	-0.34	-0.28
France	FRA	1	n.a.	n.a.	23.78	3.46	0.28	-0.20	-0.18
Germany	DEU	1	n.a.	n.a.	37.55	3.48	0.28	-0.22	-0.19
Greece	GRC	1	n.a.	n.a.	18.96	4.21	0.35	-0.31	-0.24
Hungary	HUN	1	n.a.	n.a.	79.88	3.50	0.28	-0.24	-0.20
Ireland	IRL	1	n.a.	n.a.	42.54	4.70	0.39	-0.20	-0.24
Italy	ITA	1	n.a.	n.a.	24.47	3.86	0.32	-0.25	-0.21
Latvia	LVA	1	n.a.	n.a.	54.60	4.10	0.34	-0.29	-0.24
Lithuania	LTU	1	n.a.	n.a.	72.78	3.97	0.33	-0.28	-0.23
Luxembourg	LUX	1	n.a.	n.a.	42.35	2.57	0.20	-0.15	-0.13
Malta	MLT	1	n.a.	n.a.	57.97	4.84	0.41	-0.27	-0.26
Netherlands	NLD	1	n.a.	n.a.	80.89	2.85	0.22	-0.17	-0.15
Poland	POL	1	n.a.	n.a.	38.74	3.51	0.28	-0.24	-0.20
Portugal	PRT	1	n.a.	n.a.	30.68	4.80	0.40	-0.26	-0.26
Romania	ROU	1	n.a.	n.a.	37.75	3.87	n.a.	-0.26	-0.20
Slovak Republic	SVK	1	n.a.	n.a.	87.36	3.40	0.27	-0.24	-0.19
Slovenia	SVN	1	n.a.	n.a.	70.67	3.14	0.25	-0.20	-0.17
Spain	ESP	1	n.a.	n.a.	23.60	5.56	0.48	-0.23	-0.28
Sweden	SWE	1	n.a.	n.a.	31.93	4.25	0.35	-0.29	-0.25
United Kingdom	GBR	1	n.a.	n.a.	23.20	5.14	0.44	-0.24	-0.27
United States	USA	1	n.a.	n.a.	11.95	4.89	0.41	-0.66	2.14
Afghanistan	AFG	0	0	0	15.98	-0.45	n.a.	-0.66	-0.21
Albania	ALB	0	1	0	27.08	-2.01	-0.18	-0.27	-0.26
Algeria	DZA	0	1	0	29.35	-1.68	-0.15	-0.18	-0.18
Angola	AGO	0	0	0	42.49	-0.31	-0.04	-0.30	-0.21

Antigua and Barbuda	ATG	0	1	0	25.79	-1.66	-0.16	-0.37	-1.01
Argentina	ARG	0	0	0	15.74	-0.60	-0.06	-0.27	-0.41
Armenia	ARM	0	0	0	28.62	-0.70	n.a.	-0.53	-0.45
Australia	AUS	0	0	1	16.89	-2.01	-0.17	7.42	2.37
Azerbaijan	AZE	0	0	0	31.75	-0.55	-0.05	-0.48	-0.40
Bahamas, The	BHS	0	1	0	27.30	-2.21	-0.21	0.08	-1.06
Bangladesh	BGD	0	0	0	25.46	0.03	n.a.	-1.78	-0.13
Barbados	BRB	0	1	0	27.69	-1.50	n.a.	-0.50	-0.89
Belarus	BLR	0	0	0	73.02	-0.74	-0.07	-0.32	-0.32
Benin	BEN	0	0	0	23.82	-0.19	-0.04	-0.09	-0.07
Bermuda	BMU	0	0	0	8.41	-2.30	-0.23	-0.21	-0.86
Bhutan	BTN	0	0	0	45.24	-0.41	n.a.	-0.70	-0.53
Bolivia	BOL	0	0	0	35.14	-0.64	-0.07	-0.26	-0.43
Bosnia and Herzegovina	BIH	0	1	0	43.47	-2.16	-0.19	-0.26	-0.25
Botswana	BWA	0	0	0	48.25	-0.03	0.00	-0.25	-0.13
Brazil	BRA	0	0	0	10.56	-0.77	-0.05	-0.43	-0.52
Brunei Darussalam	BRN	0	0	0	49.99	0.08	0.02	-2.70	1.71
Burkina Faso	BFA	0	0	0	25.64	-0.60	-0.06	-0.27	-0.20
Burundi	BDI	0	0	0	18.40	-0.25	-0.04	-0.71	-0.18
Cabo Verde	CPV	0	0	0	22.41	-0.61	-0.09	-0.32	-0.22
Cambodia	KHM	0	0	0	68.38	-0.22	n.a.	1.47	-0.46
Cameroon	CMR	0	1	0	22.91	-1.30	-0.19	-0.26	-0.28
Canada	CAN	0	0	1	26.12	-3.09	-0.27	0.16	0.27
Central African Republic	CAF	0	0	0	12.13	-0.54	n.a.	-0.39	-0.31
Chad	TCD	0	0	0	25.22	-0.60	-0.14	-0.39	-0.31
Chile	CHL	0	1	1	29.29	-1.54	-0.14	-0.68	-1.00
China	CHN	0	0	0	23.50	-0.50	-0.04	4.86	-0.86
Colombia	COL	0	1	1	16.14	-0.71	-0.07	-0.27	-0.51
Comoros	COM	0	0	0	27.27	-0.44	-0.08	-0.53	-0.44
Congo, Rep.	COG	0	0	0	59.22	-0.47	n.a.	-0.31	-0.24
Costa Rica	CRI	0	1	1	32.10	-2.64	-0.23	0.05	-1.34
Cote d'Ivoire	CIV	0	1	0	44.87	-1.78	-0.15	-0.36	-0.39
Dominica	DMA	0	1	0	24.50	-1.92	-0.18	0.07	-0.94
Dominican Republic	DOM	0	1	1	22.52	-2.86	-0.25	0.06	-1.40
Ecuador	ECU	0	0	0	29.23	-0.85	-0.08	-0.31	-0.56
Egypt, Arab	EGY	0	1	0	18.87	-1.16	-0.10	-0.24	-0.20

Rep.									
El Salvador	SLV	0	1	1	32.70	-2.78	-0.25	0.07	-1.38
Equatorial Guinea	GNQ	0	0	0	60.74	-0.55	n.a.	-0.46	-0.34
Eritrea	ERI	0	0	0	22.96	-0.39	n.a.	-0.35	-0.27
Ethiopia	ETH	0	0	0	18.03	-1.00	-0.09	-0.86	-0.70
Fiji	FJI	0	1	0	43.38	-1.33	-0.10	-1.28	-1.05
Gabon	GAB	0	0	0	43.26	-0.58	-0.07	-0.27	-0.21
Gambia, The	GMB	0	0	0	26.45	-0.50	-0.09	-0.27	-0.19
Georgia	GEO	0	0	0	32.45	-0.61	-0.06	-0.49	-0.42
Ghana	GHA	0	0	0	36.85	-0.63	-0.06	-0.40	-0.41
Grenada	GRD	0	1	0	24.14	-0.19	-0.07	-0.50	-0.29
Guatemala	GTM	0	1	1	26.99	-2.81	-0.24	0.07	-1.40
Guinea	GIN	0	0	0	32.85	-0.28	-0.04	-0.07	-0.05
Guinea-Bissau	GNB	0	0	0	23.11	-0.74	-0.15	-0.52	-0.35
Guyana	GUY	0	0	0	56.13	-0.73	-0.08	-0.22	-0.49
Haiti	HTI	0	0	0	23.08	-2.15	-0.17	0.06	-1.06
Honduras	HND	0	1	1	51.81	-1.62	-0.14	-0.45	-0.98
Hong Kong SAR, China	HKG	0	0	0	198.97	-0.18	-0.02	-2.64	-0.15
Iceland	ISL	0	1	0	36.19	-1.80	-0.16	-0.36	-0.39
India	IND	0	0	0	21.05	-0.31	-0.03	1.75	-0.24
Indonesia	IDN	0	0	0	21.55	-0.09	-0.01	-2.52	-1.28
Iraq	IRQ	0	0	0	35.07	-0.12	n.a.	-0.11	-0.01
Israel	ISR	0	1	1	26.92	-1.91	-0.16	-0.10	-0.60
Jamaica	JAM	0	1	0	28.13	-1.72	-0.17	-0.49	-1.03
Japan	JPN	0	0	0	14.13	-0.51	-0.04	8.88	8.20
Jordan	JOR	0	1	1	46.07	-1.88	-0.17	-0.07	-0.62
Kazakhstan	KAZ	0	0	0	33.61	-0.48	-0.05	-0.73	-0.43
Kenya	KEN	0	0	0	27.54	-0.67	-0.09	-0.31	-0.26
Kiribati	KIR	0	0	0	31.43	0.26	n.a.	-2.24	-1.45
Korea, Rep.	KOR	0	1	1	47.25	-0.54	-0.05	2.99	-0.39
Kyrgyz Republic	KGZ	0	0	0	56.12	-0.25	0.00	-0.62	-0.44
Lao PDR	LAO	0	0	0	27.08	0.08	n.a.	0.45	-0.44
Lebanon	LBN	0	1	0	32.09	-1.53	n.a.	-0.30	-0.29
Lesotho	LSO	0	0	0	75.59	0.20	-0.01	-0.31	-0.21
Liberia	LBR	0	0	0	43.98	-0.60	n.a.	-0.31	-0.20
Macao SAR, China	MAC	0	0	0	11.61	-0.17	0.01	-2.73	-0.15
Macedonia, FYR	MKD	0	0	0	54.68	-1.98	-0.17	-0.28	-0.26

Madagascar	MDG	0	0	0	22.81	-0.82	-0.07	-0.87	-0.70
Malawi	MWI	0	0	0	42.80	-0.03	-0.05	-0.28	-0.22
Malaysia	MYS	0	0	0	69.50	-0.03	-0.01	-2.20	3.60
Maldives	MDV	0	0	0	42.04	-0.01	-0.06	-1.12	-0.20
Mali	MLI	0	0	0	24.55	-1.20	-0.17	-0.65	-0.70
Marshall Islands	MHL	0	0	0	47.97	0.23	n.a.	-2.34	-1.49
Mauritania	MRT	0	0	0	63.11	-1.50	n.a.	-0.51	-0.87
Mauritius	MUS	0	0	0	37.43	-0.80	-0.07	-0.81	-0.69
Mexico	MEX	0	1	1	31.89	-2.56	-0.22	-0.17	-1.13
Micronesia, Fed. Sts.	FSM	0	0	0	37.56	0.22	n.a.	-2.87	-1.79
Moldova	MDA	0	0	0	50.84	-0.88	-0.08	-0.43	-0.40
Mongolia	MNG	0	0	0	54.15	0.07	0.00	-2.77	-0.78
Morocco	MAR	0	1	1	34.13	-2.00	-0.17	-0.01	-0.52
Mozambique	MOZ	0	0	0	38.26	-0.42	-0.04	-0.50	-0.39
Namibia	NAM	0	0	0	41.50	-1.00	-0.10	-0.70	-0.73
Nepal	NPL	0	0	0	19.67	-0.15	-0.08	-1.16	-0.14
New Zealand	NZL	0	0	0	22.06	-0.46	-0.04	2.59	12.66
Nicaragua	NIC	0	1	1	40.58	-2.31	-0.20	0.08	-1.15
Niger	NER	0	0	0	32.48	-1.10	-0.06	-0.64	-0.64
Nigeria	NGA	0	0	0	31.42	-0.66	-0.06	-0.45	-0.43
Norway	NOR	0	1	0	24.71	-1.91	-0.17	-0.29	-0.27
Pakistan	PAK	0	0	0	15.27	-0.19	-0.02	-1.43	-0.14
Palau	PLW	0	0	0	32.18	0.22	0.01	-2.35	-1.40
Panama	PAN	0	1	1	54.34	-1.94	-0.15	-0.04	-0.90
Papua New Guinea	PNG	0	1	0	38.33	-1.27	-0.11	-1.48	-1.04
Paraguay	PRY	0	0	0	36.77	-0.62	-0.06	0.00	-0.25
Peru	PER	0	1	1	21.64	-1.64	-0.15	-0.26	0.89
Philippines	PHL	0	0	0	23.45	-0.08	-0.01	-2.71	-1.31
Russian Federation	RUS	0	0	0	21.46	-1.01	-0.08	-0.92	-0.64
Rwanda	RWA	0	0	0	17.39	-1.12	-0.03	-0.75	-0.74
Samoa	WSM	0	0	0	30.83	0.32	n.a.	-2.36	-1.48
Sao Tome and Principe	STP	0	0	0	28.66	-0.63	n.a.	-0.50	-0.36
Saudi Arabia	SAU	0	0	0	37.28	-0.88	-0.08	-0.78	-0.63
Senegal	SEN	0	0	0	31.86	-1.22	-0.12	-0.61	-0.70
Seychelles	SYC	0	0	0	57.44	-0.14	n.a.	-0.45	-0.29
Sierra Leone	SLE	0	0	0	31.61	-0.49	-0.05	-0.30	-0.15
Singapore	SGP	0	0	1	143.45	-0.04	-0.01	-1.99	4.04

Solomon Islands	SLB	0	0	0	48.09	0.28	0.02	-2.28	-1.49
South Africa	ZAF	0	1	0	27.32	-1.69	-0.14	-0.52	-0.52
Sri Lanka	LKA	0	0	0	24.04	-0.20	-0.02	-1.39	-0.24
St. Kitts and Nevis	KNA	0	1	0	17.93	-0.35	-0.09	-0.55	-0.38
St. Lucia	LCA	0	1	0	35.93	-0.29	n.a.	-0.54	-0.35
St. Vincent and the Grenadines	VCT	0	1	0	27.65	-0.84	n.a.	-0.73	-0.82
Sudan	SDN	0	0	0	10.38	-0.40	-0.04	-0.43	-0.32
Suriname	SUR	0	1	0	41.90	-0.99	-0.19	-0.14	-0.42
Swaziland	SWZ	0	0	0	51.41	0.07	-0.02	-0.40	-0.08
Switzerland	CHE	0	1	0	33.54	-2.02	-0.17	-0.52	-0.49
Syria	SYR	0	1	0	12.36	-1.30	-0.12	-0.11	0.07
Tajikistan	TJK	0	0	0	33.65	0.04	-0.01	-0.15	-0.13
Tanzania	TZA	0	0	0	29.41	-0.40	-0.03	-0.50	-0.38
Thailand	THA	0	0	0	65.18	-0.09	-0.01	-2.56	-1.16
Togo	TGO	0	0	0	36.71	-0.44	-0.05	-0.22	-0.13
Tonga	TON	0	0	0	23.96	0.27	0.02	-2.16	-1.50
Trinidad and Tobago	TTO	0	0	0	48.24	-1.03	n.a.	0.11	-0.53
Tunisia	TUN	0	1	0	45.39	-1.56	n.a.	0.01	0.02
Turkey	TUR	0	1	0	24.65	-1.56	-0.14	-0.32	-0.24
Turkmenistan	TKM	0	0	0	36.54	-0.36	n.a.	-0.25	-0.23
Tuvalu	TUV	0	0	0	31.72	0.26	0.13	-2.74	-1.76
Uganda	UGA	0	0	0	20.78	-0.94	-0.08	-0.69	-0.66
Ukraine	UKR	0	0	0	43.44	-0.77	-0.07	-0.41	-0.38
Uruguay	URY	0	0	0	20.39	-0.53	-0.05	-0.30	-0.36
Uzbekistan	UZB	0	0	0	21.62	0.01	-0.03	-0.34	0.00
Vanuatu	VUT	0	0	0	22.23	0.40	0.04	-2.51	-1.58
Venezuela, RB	VEN	0	0	0	20.63	-1.47	-0.07	0.14	-0.69
Vietnam	VNM	0	0	0	73.28	-0.01	-0.01	-2.66	3.75
Yemen, Rep.	YEM	0	0	0	28.76	-0.36	0.00	-0.76	-0.38
Zambia	ZMB	0	0	0	40.19	0.00	-0.07	-0.37	-0.20
Zimbabwe	ZWE	0	0	0	41.83	-0.42	n.a.	-0.44	-0.38

Source: Authors' calculations.

Table A2. Summary statistics (2012) for small sample (C=146)

	Mean	p50	Std.dev.	min	max
Exports (mn USD), X	747.47	1.09	6933.75	0.00	444407.20
Active exports, dummy (0,1), $\mathbb{I}$	0.80	0.00	0.40	0.00	1.00
RTA, dummy (0,1), RTA	0.19	0.00	0.40	0.00	1.00
Geographical distance, $logDIST$	8.76	8.96	0.77	4.11	9.89
Contiguity, dummy (0,1), $BORD$	0.02	0.00	0.14	0.00	1.00
Common language, dummy (0,1), $LANG$	0.13	0.00	0.34	0.00	1.00
Common colonizer, dummy (0,1), $COLONY$	0.09	0.00	0.29	0.00	1.00
Tariff (%)	7.43	7.14	5.48	0.00	33.36
Number of observations	21,170				

Notes: The trade data come from UN Comtrade and refer to the year of 2012. The RTA dummy takes value one if a regional trade agreement between two countries has been notified to the WTO. The other variables are from CEPII.

Table A3. Parameters of the trade cost function, full detail

	Selection (two stage)				No selection			
	[1] Bench-mark	**[2] HM**	**[3] FMNPT**	**[4] Tariffs only**	**[1'] Bench-mark**	**[2'] HM**	**[3'] FMNPT**	**[4'] Tariffs only**
RTA	1.21	0.36	0.12	1.21	1.21	0.36	0.12	1.21
	.	.	.	.	.	.	.	.
log DIST	-0.50	-1.10	-0.50	-0.49	-0.49	-1.10	-0.49	-0.49
	(0.03)	.	(0.03)	(0.03)	(0.03)	.	(0.03)	(0.03)
BORD	0.2	0.66	0.2	0.2	0.2	0.66	0.2	0.20
	(0.08)	.	(0.08)	(0.08)	(0.08)	.	(0.08)	(0.08)
LANG	0.19	0.39	0.19	0.20	0.19	0.39	0.19	0.20
	(0.08)	.	(0.08)	(0.09)	(0.08)	.	(0.08)	(0.09)
COLONY	0.71	0.75	0.71	0.76	0.71	0.75	0.71	0.77
	(0.17)	.	(0.17)	(0.18)	(0.17)	.	(0.17)	(0.18)
Selection equation (Probit)								
RTA	-0.03	-0.03	-0.03	-0.03				
	.	.	.	.				
log DIST	-0.79	-0.79	-0.79	-0.81				
	(0.03)	(0.03)	(0.03)	(0.03)				
BORD	-0.64	-0.64	-0.64	-0.12				
	(0.16)	(0.16)	(0.16)	(0.2)				
LANG	0.16	0.16	0.16	0.20				
	(0.05)	(0.05)	(0.05)	(0.07)				
COLONY	0.36	0.36	0.36	0.33				
	(0.05)	(0.05)	(0.05)	(0.06)				
Pseudo R^2	0.93				0.93			