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Literature survey on the economic impact of TTIP

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1 Introduction

In the summer of 2013 negotiations started between the European Union (EU) and the United States on the Transatlantic Trade and Investment Partnership (TTIP). Within these negotiations a comprehensive dialogue on a broad set of issues has taken place between both economic blocs, with the aim of deepening transatlantic trade and investment relations. The negotiations are on-going with no official end date, but an initial agreement is expected to be finished in 2016. The agreement will then have to be approved by all 28 EU governments, the European Parliament and the US Congress, for TTIP to be effectively implemented.[1]

Following the start of the negotiations, a series of studies have been done to estimate the expected economic impact of TTIP on both regions. These studies can be

[1] It is believed that both parties want to finish the negotiations in 2016, so it can be possible to ratify by the Obama administration. However, these dates are still speculative, and the negotiations and the ensuing ratification process may take much longer.

classified by the methodological approach used: Computational General Equilibrium (CGE) models and Structural Gravity (SG) models. Until recently CGE models have always been regarded as the standard economic instrument to analyse large multi-country trade policy agreements. These models are well suited to assess both the trade changes and the overall economic effects of trade policy. They are usually complex models that allow to analyse detailed features of the economy that are of interest to policy-makers, i.e. how bilateral trade changes affect sectoral production, consumption, and employment, and broader macroeconomic outcomes: welfare, GDP, consumption per capita and public finances, among others.

The new class of structural gravity (SG) models, in contrast, are based on the literature providing micro-foundations for the gravity equation (Anderson and van Wincoop, 2003; Eaton and Kortum, 2002). These enhanced gravity models can be employed to evaluate the welfare and GDP effects of trade policy experiments, besides their original aim of estimating bilateral trade flows. Their appeal is that these smaller models are more parsimonious and allow the structural estimation of their main parameters.[2] To keep these models parsimonious they are often single sector and omit many institutional details present in CGE models. This also constitutes the main disadvantage of SG models: they cannot capture all the complexities involved in today's practice of trade policy.

Very roughly one can say that CGE models are the standard analytical instrument used by trade policy researchers, whereas SG models are mainly employed by academic economists, although there is a tendency for CGE modellers to include the most recent developments in the academic trade literature and for SG modellers to extend their models with for example multiple sectors and multiple factors of production. These efforts have resulted in more recent hybrid analyses that mix both methodologies. In this approach, trade elasticities and other trade-specific parameters are structurally estimated following the SG methodology, and these estimations are then embedded into a CGE framework, where its more complex and detailed features provide a broad range of economic outcomes.

In this paper we review, compare and assess the CGE- and SG-based studies on TTIP in order to draw conclusions on the expected economic effects of TTIP. To facilitate the comparison we describe the following elements for each of the studies: first, the main features of the employed theoretical economic model; second, the impact of

[2] Structural estimation refers in this context to the close link between theory and estimation. The estimating equation is derived directly from theory and all the parameters of the model –i.e. trade elasticities, NTBs and other trade costs– are estimated using the same database as the database for the simulations.

TTIP on trade costs (the TTIP-experiment); and third, the main economic effects predicted for TTIP. Before comparing the different approaches we review the methodological differences specific to these TTIP analyses.[3]

The paper is organised as follows. We start in Section 2 with a description of the CGE studies, to be followed in Section 3 by a review of the SG studies and in Section 4 of the hybrid analyses. In Section 5 we then map out the main differences in model features and modelling of the TTIP experiment. In Section 6 we then compare the predicted economic effects in the different studies, explaining the differences based on the differences in model features and modelling of the TTIP experiment. We conclude in Section 7 with a summary of the expected economic effects of TTIP and a recommendation for future research on TTIP and the way (applied) researchers predict the effects of FTAs.

2 CGE studies

2.1 CEPR Study (Francois et al., 2013a)

The most influential and cited economic analysis of TTIP has been the CEPR study (Francois et al., 2013a) using CGE modelling.[4] This study first reviews the importance of the bilateral trade and investment relationship between the US and the EU. It then employs a CGE model to simulate the expected economic impact of TTIP. In particular, the study provides the economy-wide impacts of several TTIP scenarios, of which reducing tariffs and non-tariff barriers (NTBs) are the most important. As an outcome of the CGE analysis, detailed simulations results are provided with regard to expected changes in GDP, household disposable income, overall aggregate and bilateral export and import flows, trade diverted (from/to intra-EU, US and third-countries), terms-of-trade, tariff revenues, sectoral output, sectoral trade flows. The sustainability impact also includes detailed results on changes in wages for high- and low-skill workers, sectoral employment by skill level, labour displacement measures, and changes in CO2 emissions and land use. Finally, the study provides GDP and trade effects for third-countries.

[3] In particular, we detail the specific differences related to the TTIP simulations, instead of overviewing the generic differences between analytical methodologies.

[4] This is the reference study by the European Commission and DG Trade (cf. European Commission, 2013) and the study discussed by most commentators (see for example The Economist, 2013; Rodrik, 2015; Wolf, 2015; The Guardian, 2015; Mustilli, 2015). The relevance of this study is highlighted by the request of the European Parliament to conduct an independent evaluation, which was done by Pelkmans et al. (2014).

2.1.1 Economic model

The CEPR study uses a variant of the GTAP CGE-model.[5] The characteristic features of the model are:

- A representative household demanding both public and private goods with non-homothetic preferences across private goods reflecting non-constant budget shares across sectors
- The use of (partially immobile) multiple production factors and intermediate inputs in production, thus implying intermediate production linkages
- Love of variety preferences across varieties produced by identical monopolistically competitive firms
- Varying profit margins to enable the modelling of non tariff barriers (NTBs) as generating economic rents besides economic costs[6]
- The inclusion of capital as production factor and endogenous investment and savings with a so-called global bank allocating savings to investment across regions[7]
- The inclusion of import tariffs, export subsidies, income and value-added taxes, and a transport sector for the shipping of internationally traded goods
- A long-run approach to labor markets where sources of employment and unemployment are "structural" (rather than cyclical).[8] This means that unemployment is fixed in the long run, and as such, it does not imply full-employment.[9] The long-term fixed labour supply is combined with flexible market-clearing wages. In this sense, changes in labour demand are captured through wage changes.

The CEPR study works with 20 sectors and 11 regions with the EU treated as a single region, and not as 28 disaggregated countries. The CEPR study uses the GTAP-8 database (base year 2007), calculating a baseline scenario for 2027 by endogenising productivity growth such that macroeconomic aggregates in the baseline are equal to predictions from UN and OECD.

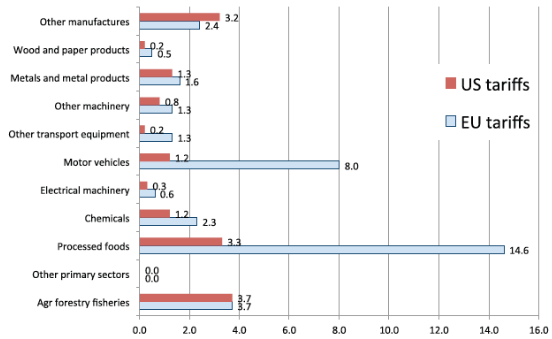
[5] The main characteristics and references to the standard GTAP model are detailed in Hertel and Tsigas (1997), and Hertel (2013).
[6] Positive profits are combined with free entry employing the so-called small group assumption generating endogenous markups in the monopolistic competition model (Francois et al., 2013b).
[7] In deviation from the GTAP model changes in investments affect the capital stock reflecting the long-term focus of the study (Francois et al., 1996).
[8] In section A.2.1 we give a broader explanation of the common labour market modelling in CGE analysis.
[9] It is a common mistake to take CGE models to be full-employment models. For instance, this is wrongly stated in Capaldo (2014) and Rodrik (2015).

2.1.2 TTIP experiment

To calculate the effect of TTIP the researchers have to identify how TTIP will change the costs of trading goods internationally. Francois et al. (2013a) predict three effects. First, there will be a reduction in tariffs. Second, NTBs for trade between the EU and the US will fall, and third trade between the EU and the US and third countries will become less costly (spillover effects).

Tariff elimination. Tariffs levels are relatively low between the EU and the US (see Figure 1). However, given the trade volume levels and sector-specific heterogeneity in terms of tariff protection between the EU and the US, it is expected that small changes in tariffs will still have potentially large effects in specific sectors.

Figure 1: Trade-weighted applied (MFN) average tariff rates 2007



Source: WTO, CEPII, UNCTAD mapped to GTAP8

Estimating NTB reductions. To determine the size of reductions in NTBs as a result of TTIP, Francois et al. (2013a) follow fours steps. First, they determine the size of NTBs for trade between the EU and the US. Second, NTBs are split up into cost-increasing and rent-increasing barriers. Third, the share of actionable NTBs that can be reduced is determined. Finally, the share of NTBs that will be effectively reduced as a result of TTIP is projected.

In their first step, to determine the size of current NTBs between the EU and the US, they follow the bottom up approach in Ecorys (2009), where the size of NTBs is estimated using a combination of literature reviews, business surveys, econometric analyses and consultations with regulators and sector experts. In particular, the size of NTBs is inferred from business surveys among about 5,500 firms. In particular firms from a particular country i are asked to rank the overall restrictiveness of an export market j between 0 and 100. The bilateral indexes are then aggregated per sector to importer j specific indexes constituting the size of NTBs for imports into country j. The rankings are then included in a standard gravity regression by interacting the NTB measures with dummies for intra-EU, intra-NAFTA and transatlantic trade. Actionable NTBs between the EU and the US are then calculated as the difference in the ad valorem equivalent trade costs of the NTBs (using estimated tariff elasticities or a trade elasticity of 4 for services) for US-EU trade and intra-EU trade (NTBs into the EU) and for US-EU trade and intra-NAFTA trade (NTBs into the US). So actionable NTBs to be negotiated in TTIP consist of the difference in perceived costs by businesses surveyed of importing into an EU country from the US in comparison to importing into the same EU country from another EU country. Figure 2 displays the size of the actionable NTBs to export to the EU from the US and to export to the US from the EU.

Figure 2: Total trade cost estimates from NTB reductions, percentage terms

Sector	Total trade barriers: EU barriers against US exports	Total trade barriers: US barriers against EU exports
Food and beverages	56.8	73.3
Chemicals	13.6	19.1
Electrical machinery	12.8	14.7
Motor vehicles	25.5	26.8
Other transport equipment	18.8	19.1
Metals and metal products	11.9	17.0
Wood and paper products	11.3	7.7
Other manufactures	N/A	N/A
average goods	***21.5***	***25.4***
Transport		
Air	2.0	2.0
Water	8.0	8.0
Finance	11.3	31.7
Insurance	10.8	19.1
Business and ICT	14.9	3.9
Communications	11.7	1.7
Construction	4.6	2.5
Personal, cultural, other services	4.4	2.5
average services	***8.5***	***8.9***

Source: Ecorys (2009), Annex Table III.1

Taken from: Francois et al. (2013a).

Second, NTBs can be divided into two categories: cost-increasing barriers and rent-creating barriers.[10] On the basis of the Ecorys (2009) survey, the CEPR study assumes that on average (across sectors) 60 per cent of the NTBs is cost-increasing.[11] The other 40% of the claimed increase in prices as a result of NTBs in place can be

[10] See Box 1 in Francois et al. (2013a) for more details.

[11] In other words, of the total level of estimated NTBS, it is assumed that half that level can be actually reduced, while the other half is technically not possible to remove because of legal, institutional or political

attributed to rents. The logic is that with NTBs in place firms have more market power and thus set higher prices. It is not clear from the description of the simulations whether prices are really reduced by 40% of the ad valorem equivalent of the actionable NTBs as a result of the TTIP experiment or whether the 60%/40% cut only serves to determine the share of NTBs that is cost-increasing.

Third, it is acknowledged that not all NTBs can be reduced. Contrary to the relative simplicity of removing tariffs, the complex nature of NTBs makes it very difficult –and in some cases impossible– to completely remove particular NTBs. In other words, for a share of NTBs it is technically not possible to remove them because of legal, institutional or political constraints.[12] The CEPR study assumes that 50% of the ad valorem equivalent of estimated NTBs can be reduced, or as they term it, is actionable.[13]

Fourth, as part of the TTIP experiment only a fraction of the actionable share of NTBs is assumed to be lowered as a result of signing TTIP. In this sense, the upper limit of possible NTB reductions is 50%, and the CEPR study includes different levels of NTB reductions for different scenarios. The result of combining the actionability share with the share of actionable NTBs reduced (both 50%) is that NTBs can be reduced by 25%.

Estimating spillover effects. Francois et al. (2013a) distinguish between direct and indirect spillovers. These effects stem from the expectation that TTIP will lead to improved regulatory cooperation between the EU and the US. Harmonisation of regulations will make it less costly to comply with the fixed costs of exporting to the EU and US market: these costs have to be incurred only of for one of the markets if regulations are harmonised. Direct spillovers occur when, as a result, third countries find it less-costly to export to the EU and the US. Indirect spillovers take place when third countries partially take over the harmonised standards in the EU and US, resulting in lower trade costs between third-countries and for exports from the EU and US to third countries. Francois et al. (2013a) assume that direct spillovers generate trade cost reductions for exports of third countries to the EU and the US equal to 20%

constraints. This assumptions is based on expert opinions, cross-checks with regulators, legislators and businesses supported by the business survey from the Ecorys study.

[12] See Egger et al. (2015) for a more detailed discussion. These limitations in reducing NTBs stem from legal and even constitutional restrictions, political and consumer sensibilities, and technical limitations, among others.

[13] This share is based on the the Ecorys (2009) study, which finds that on average (across sectors) 60% of the NTBs is cost-increasing, while the other 40% of the claimed increase in prices as a result of NTBs in place can be attributed to rents. For more details see Box 1 in Francois et al. (2013a). These findings are based on expert opinions, cross-checks with regulators, legislators and businesses supported by the business survey from the Ecorys study.

of the EU-US trade cost reductions. Indirect spillovers are assumed to be 50% of direct spillovers.[14] The obvious effect of modelling spillovers is that negative trade diversion effects on third countries become smaller.

TTIP scenarios. Based on the above elements of the TTIP experiment the study investigates five scenarios: three limited/partial agreements, and two comprehensive FTAs. These scenarios are defined as follows:

- Partial agreements that are limited in the scope of barriers they would address:
  1. Tariffs only: 98% of tariffs eliminated. Francois et al. (2013a) estimate their own MFN tariffs (using WTO, CEPII, and UNCTAD data) and map them into the GTAP-8 database.[15]
  2. Services only: 10% of services NTBs eliminated.
  3. Procurement only: 25% of procurement NTBs eliminated (also using Ecorys data). Procurement related barriers are in fact captured by the NTBs in goods and in services.

- Comprehensive full-fledged free trade agreements (FTA) covering simultaneously tariffs, procurement, NTBs for goods, NTBs for services, and spillover effects. These comprehensive agreements are divided in two scenarios:
  1. Less ambitious, that includes: nearly full tariff removal (98% of tariffs), 10% reduction in trade costs from NTBs for goods and services, and lowering of procurement-related NTBs by 25%.
  2. Ambitious: 100% of tariff elimination, 25% reduction of NTB related costs for goods and services, and 50% decrease in procurement-related NTBS.

2.1.3 Economic effects

The main economic finding from the CEPR study is that an ambitious and comprehensive transatlantic trade and investment agreement could bring positive economic gains for both regions. In this scenario it is expected that TTIP will generate a one-off gain of 0.4% of GDP for the US and 0.5% for the EU, when comparing the

[14] For example, if there is a 5% total trade cost reduction between the EU and US, the direct spillover (i.e. 20% over total trade costs) will represent an additional 1% total trade cost decrease for third countries exporting to the US or EU, and an additional 0.5% indirect spillover reduction (i.e. half the size of the direct spillover decrease) for EU and US export costs to third countries, and for trade between third countries.

[15] MFN tariffs are what countries promise to impose on imports from other members of the WTO, unless the country is part of a preferential trade agreement (such as a free trade area or customs union).

baseline GDP level in 2027 with the simulated GDP level after the TTIP (see Table 1). The income gains are a direct result of increased trade, and the resulting static comparative advantage effects. EU exports to the US are expected to increase by 28%, while total exports increase 6% in the EU and 8% in the US.

The authors find some significant production and employment effects for specific but isolated sectors, but overall, limited labour displacement is expected, even from the more ambitious TTIP scenario. The core message of the CEPR study is that reducing current NTBs levels drives must of the gains from TTIP. Furthermore, the CEPR study finds that third countries will not be significantly affected by TTIP, in particular, if the regulatory cooperation that is central to NTB reduction creates a new set of global regulation standards that can reduce NTBs multilaterally.

Table 1: TTIP, expected economic gains by scenario, percentage change in GDP with respect to baseline in 2027

	Total	Tariffs	NTBs goods	NTBs services	Direct spillovers	Indirect spillovers
Less ambitious FTA						
EU	**0.27**	0.10	0.12	0.01	0.03	0.01
US	**0.21**	0.04	0.11	0.03	0.03	0.00
Ambitions FTA						
EU	**0.48**	0.11	0.26	0.03	0.07	0.02
US	**0.39**	0.04	0.23	0.06	0.06	0.00

Source: Francois et al. (2013a).

The reduction of NTBs is crucial for expanded trade and overall income gains. From Table 1 we observe that reducing NTBs in goods creates the largest potential gains, followed by tariff elimination, while less effects are expected from reducing NTBs in services.

Finally, the increased trade and production expected from TTIP is translated into increased labour demand that raises wages by around 0.5% for both high- and low-skilled workers in the US and the EU. At sector level, it is estimated that roughly 0.2 to 0.7 per cent of the EU labour force (in terms of allocation across sectors) is relocated to another sector.[16] However, these expected movements of workers between sectors are minimal in comparison to normal turnover in labour markets, and as such, a relatively small number of people would have to change jobs as a consequence of TTIP.[17]

[16] These figures are based on the labour displacement indicator constructed in Francois et al. (2012).

[17] As a benchmark, EuroStat data show an average annual change in manufacturing employment in the

2.2 CEPII study (Fontagné et al., 2013)

This study starts with a description of the current trade and investment relations between the EU and the US. Given the limited average level of the import tariffs between both regions (2% in the US and 3% in the EU), they predict that these tariffs will not be the most important topics in the TTIP negotiations. However, they do acknowledge that tariffs will be important for some sensitive sectors: mainly dairy products, clothing and footwear, and steel items for the US, and meat products in the EU. As with the CEPR study, they find that the corresponding levels of protection provided by the non-tariff measures are much higher on average than those provided by the tariffs, and that these differ significantly across sectors. Thus, they state that the significant negotiation topics at the macroeconomic level are on non-tariff measures, regulation in services, public procurement, geographical indication of origin, and investment. They state that these topics are contentious, and provide an overview of each topic. The sector-specific trade barriers, together with NTBs and other contentious topics explain the overall sensitivity in the TTIP negotiations.[18]

2.2.1 Economic model

The main economic analysis is based on assessing the expected economic impacts of a TTIP agreement using the CEPII in-house CGE model: MIRAGE. This model is a CGE model similar to GTAP, and as such, it shares the main characteristics with the CEPR model described in Section 2.1.1.[19] However, there are some notable differences. In particular, MIRAGE models capital as less mobile across sectors and countries than the CEPR model and monopolistic competition is implemented differently. This is discussed into more detail in Section 6.

2.2.2 TTIP experiment

In this study the NTB estimations are taken from different sources. For NTBs in goods they use the estimations from Kee et al. (2009)[20] and NTBs in services are taken from

EU of 2.1% (in 2001-2007) and 3.7% in the following years. Thus, the 0.5% of sectoral labour displacement associated with TTIP, during a 10 year period, will be easily absorbed by the normal labour market entry and exit movements.

[18] As in other studies reviewed here, they acknowledge that not all of the different aspects of the negotiations can be incorporated into a model.

[19] For more details on the MIRAGE model see Bchir et al. (2002).

[20] Their calculations are based on product-level import equations that consolidate information from several sources, in particular, the NTBs already contained in the UNCTAD-TRAINS database.

Fontagné et al. (2011).[21] These NTBs estimations are, however, much higher and cover more sectors than those used in the CEPR study (see Table 2).[22]

In the "reference" TTIP scenario they combine a progressive but complete phasing-out of tariff protection, accompanied by a 25% cut in NTBs (based on the levels reported in Table 2).[23] Hence, they also follow the assumption that only a share of current NTBs is "actionable".

Table 2: Estimated NTBs: ad valorem equivalents (AVE) in percentages

	CEPII study		CEPR study	
	EU	USA	EU	USA
Agriculture	48.2	51.3	n.a.	n.a.
Manufacturing	42.8	32.3	21.5	25.4
Services	32.0	47.3	8.5	8.9

Notes: Unweighted averages by sector. The CEPR study uses the Ecorys (2009) estimates and CEPII estimates are taken from Kee et al. (2009) and Fontagné et al. (2011). Source: Fontagné et al. (2013) and Francois et al. (2013a).

2.2.3 Economic effects

In general, the expect economic results of TTIP from the CEPII study are similar to those of the CEPR study. They find that trade in goods and services between the US and the EU would increase at about 50% overall. One important finding in their study is that trade in agricultural products will increase by approximately 150%. As in the CEPR study, they find that around 80% of the expected trade expansion would stem from lowered non-tariff measures. Overall, they expect both regions to obtain non-negligible GDP and real income effects, in the long run, of around 0.3% for both the US and the EU. They also present results for alternative scenarios, where they first separate the effects from tariff elimination and NTB reductions, second use the Ecorys (2009) NTB levels as reference, and third include third country spillover effects from

[21] These are own CEPII estimates of AVE protection in cross-border trade flows in services using nine services sectors and 65 countries from the GTAP database.

[22] In the CEPII study they wrongly classify as "agriculture" the "processed foods and beverage" sector from the CEPR study.

[23] In addition, in their baseline scenario they have an extra 10% increase in trade costs on all US imports, which is the estimated cost of the US "100% scanning" requirement that any container entering the US territory must be scanned. In their reference scenario, this 10% trade cost is taken away for EU exports into the US.

regulatory harmonisation.

3 Studies based on structural gravity analyses

In this section we present TTIP analyses that are based on the structural gravity modelling approach. Given that these type of studies are a recent development in the quantitative trade literature, there is still not a common standardised approach to analyse trade policy. Therefore, the studies on TTIP using SG models differ greatly in the scope of the model, for example single-sector versus multi-sectors. We start this analysis with the earlier single-sector studies and then move to the multi-sector studies.[24]

3.1 Felbermayr et al. (2015)

This study is a typical structural gravity application based on a one-sector model with both the gravity equation to determine the TTIP experiment and the model to calculate the welfare effects following directly from the theoretical model. It is somewhat strange though that the paper is not following the structural gravity literature in the determination of the parameters of the model. The trade elasticity, a crucial parameter in the calculation of the welfare effects is not estimated structurally, but is taken from the literature (i.e. Egger et al., 2011; Egger and Larch, 2011).

3.1.1 Economic Model

The economic model is based on Egger and Larch (2011) who map out a single-sector monopolistic competition model. Details of the employed model are sparse in Felbermayr et al. (2015) and the reader is referred to Felbermayr et al. (2013a). Preferences are based on love-of-variety and identical monopolistically competitive firms can sell goods to multiple destinations. The novel feature of the model is that it can account for zero trade flows as a result of export-specific fixed costs. Only firms that sell enough to earn back the export-specific fixed costs will export to that market. More favourable market conditions or lower fixed costs imply that all firms can start exporting in the model, in contrast to a firm heterogeneity model with an extensive margin (Helpman et al., 2008), where only a subset of firms starts to export. As a result the

[24] An additional paper that uses the SG methodology to estimate welfare effects of TTIP is Carrere et al. (2015). However, this paper is mainly focused on the unemployment effects of trade policy, and they do not present GDP nor income effects. As such, it makes it difficult to compare this study with the rest of the literature, and thus, we discuss this paper in Appendix A.3.1.

extensive margin effect is potentially large. However, the extensive margin (or selection) effect is disciplined by the empirically estimated effect of TTIP on the extensive margin. The authors calculate the welfare effects of changes in trade costs by solving simultaneously for the new levels of GDP and of the multilateral resistance terms.

3.1.2 TTIP experiment

To determine the effect of TTIP the authors use a top-down approach. The ad valorem equivalent of TTIP is calculated by estimating a gravity equation, regressing trade flows on the usual gravity control variables and a dummy variable for FTAs. So instead of calculating the ad valorem equivalent TTIP with the depth of FTAs, they use a simple zero-one dummy for all FTAs. It is questionable whether this dummy properly captures the effect of TTIP, since most FTAs have been focused on tariff liberalisation, whereas TTIP is mostly focused on reducing NTBs with low initial tariff levels. To phrase it differently, TTIP is a very different undertaking than most of the FTAs signed up to now, so the effect of TTIP on trade flows cannot be expected to be the same.[25]

3.1.3 Economic effects

Felbermayr et al. (2015) come to relatively large welfare effects of TTIP. They find that TTIP can yield real income gains for the EU of 3.9% and 4.9% for the US. They also report robustness checks. In particular, they calculate the welfare effects employing the average PTA coefficient of 0.36 reported in the literature survey by Head and Mayer (2010). As a result the welfare effects are much smaller. Switching off the selection channel hardly changes the effects since the estimated coefficient of the FTA dummy in the selection equation (i.e. whether there is trade or not) is small. Finally they also evaluate the effect of including the spillover effects, which obviously magnifies the positive welfare effects.

3.2 Felbermayr et al. (2013)

Felbermayr et al. (2013) explore the effects of TTIP on both trade and welfare and on the labor market. This is done with two distinct models. The first model exploring the impact on trade, GDP, and welfare is simulated for 126 countries, whereas the second model is limited to 28 countries due to the lack of available labor market data for more

[25] Comparing the estimated FTA-coefficient with the estimated parameter on depth in Egger et al. (2015), Felbermayr et al. (2015) find a larger impact on trade flows. Moving from no FTA to a depth level of zero generates an impact of 7*0.087=0.609, whereas the FTA coefficient estimated by Felbermayr et al. (2015) is 1.21.

countries.[26]

3.2.1 Economic model

The model to explore the welfare and trade effects is the same structural gravity model as in Felbermayr et al. (2015). This becomes clear after consulting the study referred to which contains more details on the employed approach (Felbermayr et al., 2013a). Henceforth a single-sector Krugman model is used with welfare effects calculated by solving simultaneously for new GDP levels and multilateral resistance terms.

This study also examines labor market effects of TTIP. To do so the authors follow Heid and Larch (2013) who extend the Arkolakis et al. (2012) approach with endogenous employment. Henceforth the study does not take into account firm heterogeneity. In the companion study for the German science ministry (Felbermayr et al., 2013a), labor market effects are explored within the framework of the firm heterogeneity model of Felbermayr et al. (2011), limited to a setting with 5 regions. Contrary to what appears to be the case, the simulations with the labor market model are separate from the simulations with the main model determining welfare effects. Since our main focus is a comparison of the welfare effects in the different studies and the core simulations do not incorporate the labor market modelling, we do not discuss this part any further here.

3.2.2 TTIP experiment

The TTIP experiment is similar to the experiment in Felbermayr et al. (2015). Hence the effect of TTIP is captured by regressing trade flows on a zero-one dummy for FTAs and a set of control variables. This becomes clear by consulting the companion study (Felbermayr et al., 2013a) where the same coefficient of 1.21 on the FTA dummy is reported. This estimated PTA-coefficient is translated into an equivalent change in iceberg trade costs to determine the simulated impact of TTIP. To do so a value for the substitution elasticity is needed and in the baseline the authors work with a value of 8. Again this parameter is not estimated structurally, but taken from the literature.

3.2.3 Economic effects

The study finds large welfare effects, in particular for the USA and Great-Britain, which display respectively an increase in equivalent variation of 13.4% and 9.7%. The average welfare increase in the EU is about 8%. Also remarkable are the welfare losses of third countries (9.5% in Canada, 7.2% in Mexico, and 7.4% in Australia). These welfare effects correspond with a marginal effect of FTAs on trade between 215% and 255%,

[26] The description below is at some points incomplete as it was hard to obtain the details of the employed approach from the publication.

depending on the employed estimation model (with and without accounting for the extensive margin effect). In general equilibrium –i.e. taking into account multilateral resistance effects– bilateral trade between the US and the EU increases by around 90%. The question is why the welfare effects are so large, in comparison to the CGE studies, but also in comparison to Felbermayr et al. (2015). The description indicates namely that the same effect for the TTIP experiment is used and also the same simulation model. Contrary to what appears to be the case, the simulations with the labor market model are separate from the simulations with the main model determining welfare effects. So the potential effect of trade liberalisation on employment is not taken into account. In Section 6 we will make an extensive comparison of the different approaches.

3.3 Aichele et al. (2014)

To date, the study by Aichele et al. (2014) is the most sophisticated SG-based study on TTIP. These researchers use a multi-country and multi-sector Ricardian trade model with national and international input-output linkages identical to the model employed by Caliendo and Parro (2015) to study the impact of tariff reductions as a result of NAFTA.

3.3.1 Economic model

In contrast to other SG applications on TTIP, Aichele et al. (2014) use a multi-sector framework with intermediate linkages based on the stochastic Ricardian model by Eaton and Kortum (2002). The model contains Cobb-Douglas preferences of consumers across 32 sectors. Each sector produces final goods employing a combination of labor and intermediate inputs. Intermediate inputs can be sourced from all trading partners. As in Eaton and Kortum (2002) intermediates are sourced from the cheapest trading partner giving rise to a gravity-type expression for the share of intermediates sourced from each of the trading partners as a function of bilateral trade costs, income, and multilateral resistance terms. This expression is used both in the simulations and serves as a basis for the empirical gravity equation to estimate the trade elasticities and the impact of TTIP. Following Caliendo and Parro (2015) the model contains tariff revenues but no other taxes, only one factor of production (labour) and no capital. Consumers do not directly import goods from other countries, but buy sector composites of intermediates. Only intermediates are traded internationally.

The change in trade costs as a result of the TTIP-experiment is simulated employing exact hat-algebra as introduced by Dekle et al. (2008) working with a model with 134 regions.[27] The import- and industry- and cost-shares required to simulate the model are taken from the GTAP database. The authors employ as import-shares the average import-shares across different users (consumers, government, firms, and investors). The only structural parameters required are the trade elasticities being equal to the Frechet productivity dispersion parameters in the Eaton-Kortum model. To obtain these elasticities the authors estimate a gravity equation identifying the trade elasticity of the tariff elasticity. The trade data are taken from UN COMTRADE which are also the basis for the GTAP trade data. No other structural parameters are required since sectoral demand shares and the share of intermediates and value added are all assumed to be Cobb-Douglas.

3.3.2 TTIP experiment

The TTIP experiment consists of a reduction in tariffs and iceberg trade costs. To obtain the reduction in iceberg trade costs the authors follow the same top down approach as in Egger et al. (2015), although they capture the TTIP effects by a different measure. In this paper the ad valorem equivalent of introducing a deep FTA is calculated. This is done by estimating a gravity equation including dummies for shallow and deep FTAs besides the usual gravity regressors and tariffs. Shallow FTAs are FTAs with a score between 0 and 7 in the depth of PTA index in Dür et al. (2014), whereas deep FTAs get a score between 4 and 7. The FTA dummies are instrumented for employing a measure for trade contagion proposed by Baldwin and Jaimovich (2012). The gravity equation is estimated using an instrumental variables approach. Henceforth, the estimation does not account for the possible inconsistency as a result of estimating in logs together with the heteroskedasticity of trade flows. To calculate the ad valorem equivalent the authors use the estimated tariff elasticities. To calculate the ad valorem equivalent in the services sector a trade elasticity of 5.9 is assumed based on Egger et al. (2012).

The baseline scenario works with a move from no FTA to a deep FTA. In robustness checks the authors also consider the effect of reducing only tariffs between the EU and the US, of a shallow FTA and of including spillover effects along the lines of Francois et al. (2013a).

[27] Traditional hat-algebra consists of log-differentiating (also called hat-differentiating because of the use of the hat-symbol) a system of equations to find the relation between variables in relative changes. In contrasts to hat-differentiation (or algebra) involving an approximation of the original system of equations, with exact hat-algebra the exact effect of a change in exogenous variables on endogenous variables can be determined.

3.3.3 Economic effects

Aichele et al. (2014) find that TTIP will generate real per capita income changes of 2.12% for the EU and 2.68% for the US, while the rest of the world will be largely unaffected (0.03% decrease). This is achieved through a substantial increase in bilateral trade flows between the US and the EU (171%), spurred mainly by NTB reductions. Although bilateral trade increases substantially, this is compensated by trade diversion effects, less intra-EU trade and less trade with third countries. The economic effects of this paper are close to those in Egger et al. (2015) discussed below, although the trade cost reductions are much larger in Aichele et al. (2014). Correspondingly Aichele et al. (2014) find bilateral trade increases of 171% (from the USA to the EU) to 216% (from the EU to the USA), which is more than double the size of those found in Egger et al. (2015) of 80%. This amount of trade creation is in turn translated only in modestly larger real income gains in comparison to Egger et al. (2015).[28]

4 Hybrid model by Egger et al. (2015)

This study examines the potential impact of TTIP with a hybrid approach that combines a CGE economic model with structural estimation of the trade elasticities and the expected trade cost reductions to develop estimates of the welfare effects for the EU, United States, and third countries. The paper follows a two-step approach. In the first step a gravity model is employed to yield estimates of reductions in trade costs. These values are then used as inputs in the second step where a CGE model simulates the economy-wide effects.

4.1 Economic model

The CGE model employed in Egger et al. (2015) is very similar to the model in Francois et al. (2013a). Henceforth, there is nothing to add regarding the main characteristics of the model explained in Section 2.1.1. The main difference is that Egger et al. (2015) use the newer GTAP-9 database with base year 2011, instead of the older GTAP-8 database with base year 2007. The new database identifies five different skill labour types, and Egger et al. (2015) aggregate these into three skills (low, medium and high).

[28] An extensive comparison follows in Section 6.

4.2 TTIP experiment

To model the TTIP experiment Egger et al. (2015) include the same three effects as Francois et al. (2013a): tariff reduction, NTB reduction, and direct and indirect spillover effects. Only the calculation of NTB reductions is different. To calculate the reductions in NTBs on manufacturing goods Egger et al. (2015) proceed in three steps, based on the approach in Egger and Larch (2011). First, a gravity equation is estimated including the usual gravity variables (distance, common border, common language, etc.), tariffs, importer and exporter fixed effects and dummies for different levels of depth of FTAs. Second, based on the estimated tariff elasticities and the coefficients for the depth of PTAs, they calculate the ad valorem equivalent of moving from no FTA to a deep FTA. To measure the depth of FTAs the authors use the index of the FTA-depth proposed by Dür et al. (2014) which ranges from 0 to 7. TTIP would be a deep FTA with the maximum value of FTA-depth of 7. In terms of the coding of FTA-depth this means that the FTA should contain provisions on all seven topics identified by Dür et al. (2014). To determine the size of NTBs in services trade, Egger et al. (2015) use estimates of ad valorem equivalents of trade restrictions in services from Jafari and Tarr (2015) based on the World Bank's STRI database (Borchert et al., 2014). Both for manufacturing goods and services the remaining steps are to determine the share of cost-increasing and rent-generating NTBs, and thus, the share of actionable NTBs that can be reduced. In this study the share of cost-increasing NTBs is 50%. The share of actionable NTBs is 100%, consistent with the presumption that TTIP will be a deep FTA. The share of actionable NTBs in services varies with scenarios. In one scenario there is no reduction in services NTBs and in the other scenario NTBs for non-financial services fall by 50%.

The estimated NTBs for all sectors are presented in Table 3.[29] From this table we observe that Egger et al. (2015) estimate much larger AVEs for NTBs, and for more sectors than in the Ecorys (2009) estimations used in the CEPR study.

[29] Note that EU and USA NTBs are identical and this is due to the estimating procedure, which does not allow for a differentiation on the origin of NTBs by region.

Table 3: Estimated NTBs: ad valorem equivalents (AVE) in percentages

	Egger et al. (2015)		Ecorys (2009)	
	EU	USA	EU	USA
Primary sectors	**15.9**	**15.9**	**n.a.**	**n.a.**
Agriculture	15.8	15.8	n.a.	n.a.
Primary energy	16.1	16.1	n.a.	n.a.
Manufacturing	**19.6**	**19.6**	**21.5**	**25.4**
Processed foods	33.8	33.8	56.8	73.3
Beverage and tobacco	42.0	42.0	56.8	73.3
Petrochemicals	24.2	24.2	n.a.	n.a.
Chemicals	29.1	29.1	13.6	19.1
Metals and metal products	16.7	16.7	11.9	17.0
Motor vehicles	19.3	19.3	25.5	26.8
Electrical machinery	1.8	1.8	12.8	14.7
Other transport equipment	n.a.	n.a.	18.8	19.1
Other machinery	6.2	6.2	n.a.	n.a.
Wood and paper products	n.a.	n.a.	11.3	7.7
Other manufactures	3.6	3.6	n.a.	n.a.
Services:	**19.8**	**13.4**	**8.5**	**8.9**
Construction	4.6	2.5	4.6	2.5
Air transport	25.0	11.0	2.0	2.0
Maritime	1.7	13.0	8.0	8.0
Other transport	29.7	0.0	n.a.	n.a.
Distribution	1.4	0.0	n.a.	n.a.
Communication	1.1	3.5	11.7	1.7
Banking	1.5	17.0	11.3	31.7
Insurance	6.6	17.0	10.8	19.1
Professional and business	35.4	42.0	14.9	3.9
Personal, recreational	4.4	2.5	4.4	2.5
Public services	n.a.	n.a.	n.a.	n.a.

Notes: Sector totals are unweighted averages. Processed foods and Beverage and tobacco have the same values in the CEPR study because they where taken as a single sector. Sources: Taken from Egger et al. (2015) and Francois et al. (2013a).

4.3 Economic effects

The main economic result from this study is that estimated gains in real income are situated between 1% and 2.25% for the United States and EU, respectively. Table 4 summarises their estimates of national real income changes, measured as changes in real household consumption (i.e. nominal household incomes are deflated by changes in prices) for each TTIP scenario.[30]

Table 4: Summary of real income effects by TTIP scenario, percentage changes

	A Tariffs	B NTBs goods	C NTBs services	D = A + B Total goods only liberalization	E = A + B + C Total goods and services liberalization
United States	0.11 [0.08 to 0.13]	0.8 [0.26 to 1.54]	0.06 [0 to 0.13]	0.91 [0.35 to 1.68]	0.97 [0.35 to 1.81]
European Union	0.15 [0.13 to 0.17]	1.91 [0.7 to 3.39]	0.2 [0 to 0.49]	2.06 [0.83 to 3.56]	2.27 [0.83 to 4.04]
Of which:					
Germany	0.06 [0.05 to 0.08]	1.21 [0.41 to 2.36]	0.16 [0 to 0.39]	1.27 [0.46 to 2.45]	1.43 [0.46 to 2.83]
France	0.07 [0.06 to 0.08]	1.18 [0.36 to 2.27]	0.08 [0 to 0.2]	1.25 [0.42 to 2.35]	1.33 [0.42 to 2.55]
United Kingdom	0.12 [0.1 to 0.13]	1.51 [0.56 to 2.68]	0.19 [0 to 0.45]	1.63 [0.66 to 2.81]	1.82 [0.66 to 3.26]
Italy	0.07 [0.06 to 0.08]	1.29 [0.42 to 2.47]	0.1 [0 to 0.25]	1.36 [0.48 to 2.54]	1.46 [0.48 to 2.79]
Spain	0.04 [0.03 to 0.05]	0.54 [0.09 to 1.25]	0.17 [0 to 0.41]	0.58 [0.12 to 1.29]	0.75 [0.12 to 1.7]
EFTA	−0.23 [−0.24 to −0.19]	−2.34 [−1.28 to −2.68]	−0.01 [0 to 0]	−2.58 [−1.52 to −2.88]	−2.58 [−1.52 to −2.87]
Turkey	−0.15 [−0.11 to −0.2]	−0.57 [−0.22 to −0.96]	−0.03 [0 to −0.07]	−0.72 [−0.33 to −1.16]	−0.75 [−0.33 to −1.23]
Other Europe	0 [0 to 0]	−0.15 [−0.06 to −0.25]	−0.01 [0 to −0.02]	−0.15 [−0.07 to −0.25]	−0.16 [−0.07 to −0.27]
Mediterranean	−0.01 [−0.01 to −0.01]	−0.22 [−0.08 to −0.41]	0 [0 to 0]	−0.23 [−0.09 to −0.42]	−0.23 [−0.09 to −0.42]
Japan	−0.03 [−0.03 to −0.04]	−0.15 [−0.07 to −0.24]	0 [0 to −0.01]	−0.19 [−0.1 to −0.29]	−0.19 [−0.1 to −0.3]
China	−0.1 [−0.05 to −0.08]	−0.17 [−0.03 to −0.12]	0 [0 to −0.01]	−0.27 [−0.08 to −0.2]	−0.27 [−0.08 to −0.21]
Other TPP countries	−0.19 [−0.14 to −0.24]	−1.04 [−0.41 to −1.72]	0.01 [0 to 0.01]	−1.23 [−0.55 to −1.96]	−1.23 [−0.55 to −1.95]
Other Asia	0.1 [0.06 to 0.11]	0.31 [0.13 to −0.09]	−0.03 [0 to −0.06]	0.41 [0.2 to 0.03]	0.38 [0.2 to −0.04]
Other middle income	−0.01 [−0.01 to −0.01]	−0.09 [−0.02 to −0.21]	0 [0 to 0]	−0.1 [−0.03 to −0.22]	−0.11 [−0.03 to −0.22]
Low income	0.02 [0.02 to 0.03]	0.12 [0.07 to 0.18]	0.01 [0 to 0.02]	0.15 [0.09 to 0.2]	0.15 [0.09 to 0.22]

Notes: Real income is defined as household utility from private consumption.

Source: Table 7 in Egger et al. (2015).

Their main scenario (D) includes tariff elimination and reduction in NTBs in goods. Here the US has a real income increase of about one percentage point and the EU of around 2%. There are also results for selected EU countries and other (third party) regions. They also have an alternative scenario with spillover effects, which are based on

30 Each cell provides a point estimate, while confidence intervals are shown in parenthesis.

the spillover definitions in Francois et al. (2013a). Including direct and indirect spillovers will increase real income by an additional 0.7% for the EU and 0.16% for the US.

Finally, they also report labour market effects and adjustments. They find similar wage gains for workers across their three skill categories (low-, medium- and high-skill) in the United States, while in the EU there is relatively more gain for lower skilled workers. These are the long term benefits for all different workers, but in the short term there are expected short term labour market adjustments associated with inter-sectoral labour mobility.

The bilateral trade growth in this paper (80%) is much higher than in the CEPR study (28%). Correspondingly, the real income effects are also higher now (about double the results in the CEPR study). The main reason for the higher bilateral trade is that NTBs were estimated differently. This study is purely based on gravity estimations, while the second combined survey data with gravity. From Table 3 we observe that Egger et al. (2015) estimate much larger AVEs for NTBs, and for more sectors than in the Ecorys (2009) estimations used in the CEPR study. This is an important reason that explains the larger bilateral trade and real income changes in Egger et al. (2015), when compared to the CEPR study. Egger et al. (2015) also have more recent data on NTBs in services and have a pessimistic (no real changes in trade in services) and optimistic perspective (real changes in all services sectors but finance).

As in previous CGE studies, most of the gains come from NTB reductions in goods. There are significantly smaller gains from tariff reductions and decreases in services NTBs (if any, depending on the pessimistic or optimistic perspective). The results on third countries is dependent on the spillover effects associated with regulatory cooperation. If TTIP becomes a purely discriminatory agreement, and there are no spillover effects to third countries, then it is expected that the trade diversion effects will reduce real incomes in most countries outside the agreement.

5 Main differences in the TTIP studies by methodology

In this section we analyse some of the main differences between the TTIP studies that are relevant for the predicted economic effects. In particular we examine the differences in the theoretical model, the differences in modelling the TTIP experiment and in the trade elasticities employed.

5.1 Theoretical Model

The employed theoretical models differ in many aspects such as the presence of intermediate linkages, multiple sectors, multiple factors of production, non-homothetic preferences, the treatment of the labor market, market structure and the treatment of capital. We discuss the impact of including these different elements on the expected welfare gains.

1. Intermediate linkages. Arkolakis et al. (2012) show that the welfare gains from larger openness get amplified by accounting for intermediate linkages. The reason is simple. A reduction in trade costs affects consumer welfare directly through lower consumption prices and indirectly through lower prices of intermediates. These features of intermedia linkages are present in Francois et al. (2013a), Egger et al. (2015), and Aichele et al. (2014). It is remarkable that the study generating the largest welfare gains (Felbermayr et al., 2013) does not contain intermediate linkages.
2. Multiple sectors. Ossa (2015) shows that the welfare gains from trade are larger in a setting with multiple sectors in comparison to a single-sector setting when trade elasticities differ across sectors. The reason is that the gains from trade in sectors with a low trade elasticity are very large. In an Armington setting the trade elasticity is equal to the substitution elasticity minus one, so a low trade elasticity corresponds with a low substitution elasticity and thus, a strong love of variety. The possibility to import in sectors with low substitution elasticities creates large gains. Welfare gains are smaller in a single sector setting where the trade elasticity is an average across all sectors. Ossa (2015), however, only addresses the welfare gains from trade and not from reductions in trade costs, which are the focus in the studies on TTIP. Moreover, Costinot and Rodríguez-Clare (2013) point out that the large welfare gains with multiple sectors hinges on a Cobb-Douglas specification for preferences across sectors. With a larger substitution elasticity between sectors, it is easier for consumers to substitute away from sectors without imports and low substitution elasticities. Finally, besides the impact of multiple sectors on welfare effects, the inclusion of multiple sectors is important to evaluate differential effects of trade policy changes in different sectors.
3. Multiple factors of production. Including this feature makes it possible to study differential impacts of trade policies on the different factors of production. In terms of welfare gains Costinot and Rodríguez-Clare (2013) argue that the inclusion of multiple factors of production does not make a big difference in welfare analysis.

However, a fairly common feature of CGE models is that factors are (partially) immobile across sectors and there are some factors that are linked to specific sectors.[31] Therefore, it is more costly to reallocate resources between sectors. As a result the impact of changes in trade costs will be smaller than in a setting where production factors can move freely. In this respect, all CGE-based studies employ a model with multiple factors of production whereas all SG models only have labour.[32]

4. Non-homothetic preferences. Given that TTIP is a trade agreement between developed countries, it is not expected that non-homothetic preferences will have a strong impact on the welfare effects of changes in trade policies. But non-homothetic preferences can be highly relevant for studying the welfare effects of sectoral liberalisation in developing versus developed countries. For example, lower food prices as a result of agricultural liberalisation has a stronger impact on poor countries, which spend a larger share of their income on food.
5. Labour market mechanisms. CGE models usually employ a simplified labour market specification with flexible market-clearing wage and exogenous labour supply. This approach, although rudimentary, is generally considered adequate to account for the long-run indirect effects of trade shocks to the labour market.[33] On the other hand, some SG estimations include endogenous supply determination. However, the exact modelling mechanisms are usually not well defined, and it is difficult to assess the precise impact of these labour market mechanisms.[34]
6. Market structure. The benchmark model used in CGE models is the Armington model featuring CES preferences across varieties from different source countries (Hertel and Tsigas, 1997). The quantitative trade model literature often works with an Eaton-Kortum setup based on stochastic Ricardian technology differences between countries. For instance, Aichele et al. (2014) choose an Eaton-Kortum setup based on Caliendo and Parro (2015). Some CGE models work with a model of monopolistic competition featuring love for variety, either with homogeneous firms (Ethier-Krugman) or with heterogeneous firms (Melitz). Arkolakis et al. (2012) show that the welfare gains from trade are identical in the different setups in a single-sector model. In a multiple sector setting the monopolistic competition model

[31] For instance, the land and natural resource factors in the GTAP database and standard model are linked to agriculture and primary activities, and thus, only partly mobile between these sectors.
[32] Another feature that can change the welfare impact of trade in CGE models with multiple factors is related to factor abundance differences, where trade liberalisation will enhance Heckscher-Ohlin driven specialisation and raise welfare effects. However, in the context of TTIP, were both the EU and the US have similar relative factor endowments, this effect is not expected to play a significant role.
[33] See Appendix A.2.1 for a detailed explanation and extended discussion.
[34] See Appendix A.2.2 for more details.

contains an additional effect through the reallocation of inputs across sectors. More inputs in a sector raise welfare as a result of the love of variety property of the model, because more varieties can be produced. If resources are drawn into sectors with strong love of variety (a small substitution elasticity) welfare would rise. Arkolakis et al. (2012) observe that with fixed endowments an increase in resources in one sector requires a reduction in resources in another sector, so it is unclear whether effects are larger under monopolistic competition than under an Armington specification.[35] The model employed in Francois et al. (2013a), Egger et al. (2011) and Fontagné et al. (2013) feature imperfect competition a la Cournot. Since there is no free entry condition, firms earn profits. The first two studies use the presence of profits to model part of the reduction in NTBs as rent-reducing (profit-reducing) instead of exclusively cost-reducing. As a result welfare effects will be smaller, since reductions in profits do not have such a strong welfare effect as reductions in costs.

7. Treatment of capital. Most CGE models include capital as a production factor and investment as a tradable good and model the relation between investment and capital. Two modelling features are important. First, in the standard GTAP model changes in investment as a result of a trade experiment only affect the flow of investment goods and do not affect the amount of capital. Phrased differently, capital does not become "online" –i.e. as capital stock that is actually used in production. In Francois et al. (2013a) and Egger et al. (2015) instead, changes in investment do affect the capital stock used in production to mimic a more long run approach. As pointed out in Francois et al. (1996) this feature raises the welfare effects of trade liberalisation. Second, in the standard GTAP model capital is not fully mobile across countries and rates of return are not equalised, but capital tends to flow to countries with higher rates of return. In Francois et al. (2013a) and Egger et al. (2015), instead, rates of return are equalised. Fontagné et al. (2013) go one step in the other direction and assume that capital is immobile both between countries and sectors.

[35] Balistreri et al. (2010) argue that the welfare gains from trade liberalisation are much larger in a Melitz setting than an Armington-economy, which seems to be at odds with the findings in Arkolakis et al. (2012). The reason for the much larger results is that Balistreri et al. (2010) introduce endogenous labor supply. As a result the labor supply-enhancing effect of trade liberalisation has a much stronger effect in the Melitz model with love of variety than in the Armington model. The general implication is that welfare effects are larger under monopolistic competition than Armington if factor supply is endogenous or if production factors are drawn into sectors with a strong love of variety.

5.2 Modelling the TTIP experiment

The studies overviewed above also differ on how they simulate the trade shocks associated with TTIP. We can divide these between estimated NTBs and their expected reductions and spillover effects.

5.2.1 NTB estimations and expected reductions under TTIP

As pointed out above, since the current tariff levels between the US and the EU are already relatively low, most of the effect of TTIP will run through changes in NTBs. Thus, the estimation of NTBs becomes a critical element to properly assess the potential economic effects of TTIP. There are two different approaches to estimate NTBs and the TTIP-related reductions.

1. Ecorys (2009) and Francois et al. (2013a) follow a bottom up approach with the size of NTBs inferred from business surveys among about 5,500 firms. As pointed out above this information is employed in a gravity framework to come to sector-specific AVEs of the NTBs. Fontagné et al. (2013) also follow a type of bottom up approach with the level of NTBs estimated at the product level based on the UNCTAD-TRAINS NTM database for goods and CEPII estimates for services (Fontagné et al., 2011).
2. Other papers follow a top-down approach, where the ad valorem equivalent of reducing NTBs in TTIP is inferred indirectly from gravity estimations. In particular, a dummy for the presence of an FTA or a variable measuring the depth of FTAs is included in a gravity equation. The ad valorem equivalent of an FTA or of FTA-depth can be calculated by dividing the estimated coefficient in the gravity equation by the trade elasticity. The approaches differ somewhat across the different studies. Some studies (Felbermayr et al., 2015, 2013; Carrere et al., 2015) model the effect of TTIP by means of a simple 0-1 FTA dummy. TTIP is then modelled as if trade between EU countries and the US is also characterised by a positive FTA dummy. The trade elasticity is taken from the literature in all these studies. Egger et al. (2015) and Aichele et al. (2014) take into account the depth of an FTA and model TTIP as the move from no FTA to a deep FTA. Egger et al. (2015) maintain the original 0 to 7 scale of the depth of FTAs introduced by Dür et al. (2014), whereas Aichele et al. (2014) translate the scale into two dummies, one for shallow FTAs and one for deep FTAs. Both studies calculate ad valorem equivalents at the sectoral level. For goods they both employ the estimated tariff elasticities to do so. To infer the AVE of TTIP in services, Aichele et al. (2014) use the shallow and deep

FTA dummies as well, whereas Egger et al. (2015) use World Bank STRI indices of NTBs in services. Both studies take the trade elasticity for the services sectors from the literature. All studies using the top down approach account for endogeneity of FTAs, although in a different way. All studies estimate the gravity equation using PPML, except for Aichele et al. (2014) who use Instrumental Variables (IV). A seemingly important difference between Felbermayr et al. (2015), Felbermayr et al. (2013) and Carrere et al. (2015) and the other studies is that the first studies do not calculate an explicit ad valorem equivalent of TTIP. Because the model employed in Felbermayr et al. (2015) is single sector, it is not necessary to first map the effect of an FTA on trade flows into its ad valorem equivalent. Instead it is possible to directly calculate the change in income and multilateral resistance as a result of the change in the FTA dummy from 0 to 1.

Both the bottom-up approach based on micro-data on NTBs and the top-down approach based on average FTA effects in the past can be criticised. In the bottom up approach the share of NTBs that will be reduced as a result of TTIP is hard to motivate and a percentage like 25% or 50% always seems somewhat arbitrary. Furthermore, NTB data are often of poor quality with negative estimated AVEs for many products. The top-down approach, on the other hand, can be criticised for the fact that it is debatable whether TTIP will create similar NTB effects as in past deep-FTAs. Moreover, modellers need to pay attention to estimation details of choosing the proper instrument, FTA measure and functional form of the gravity equation (PPML).

Nevertheless, the estimation of NTBs is an intrinsically complex undertaking, where a large number of sector-specific regulations, technical requirements and other heterogenous trade costs are summarised into a single sector-specific indicator. As such, the current indicators discussed above must be seen as the best possible estimates given current data availability and the technical difficulties at hand. While increased micro-data analysis and additional research will be welcome to shed light on the detailed nature of non-tariff barriers.

5.2.2 Spillover effects

The CEPR study also takes into account so-called spillover effects of TTIP. The other studies include them in their robustness checks. The obvious effect of modelling spillovers is that negative trade diversion effects on third countries become smaller. The assumption of positive spillover effects is not uncontroversial. When two countries harmonise standards, they will also replace old standards, possibly agreed upon with third countries. This might make it more difficult for third countries to comply with the new standards, thus generating cost increases. The empirical literature on the scope for spillover effects is summarised in Baldwin (2014), although he organises the discussion around the concept of "negative trade diversion". When a country signs a deep FTA it might improve the functioning of its services sector, implement stricter rules on competition policy, and streamline its government procurement, for example. To a large extent these measures are non-discriminatory in nature, thus generating also benefits for non-members. The studies cited in Baldwin (2014) indicate that the scope for negative trade diversion is very limited: in most cases trade with non-FTA partners also increases when an FTA is signed. This does not provide conclusive evidence for the presence of direct spillover effects: trade with non-FTA partners might also increase after an FTA has been signed because countries signing an FTA might be implementing other types of reforms together with signing an FTA.

5.3 Structural Estimation and the size of trade elasticities

The studies based on the SG-approach contain only one parameter, the trade elasticity: the elasticity of trade values with respect to trade costs. The SG-studies on TTIP argue that an advantage of their approach is structural estimation, i.e. estimating all parameters based on the economic model and the data also used for the simulations. In this respect it is remarkable that Felbermayr et al. (2013) and Felbermayr et al. (2015) do not estimate all parameters of their model structurally. In particular, the substitution elasticity is set at 8 and 7 –respectively for each study– in the baseline without estimating it. Egger et al. (2015), instead, estimate substitution elasticities between goods sourced from different destinations based on a structural gravity equation, employing variation in tariffs.[36]

The CGE studies working with non-homothetic preferences, multiple sectors, and multiple factors instead contain many more parameters. Some of these parameters are based on estimations, whereas some parameters are simply set at certain values, for example the substitution elasticity of zero between value added and intermediates. CGE-models are sometimes criticised for employing parameters from external sources instead of estimating these parameters structurally. We think this criticism is not valid, since the parsimonious models with a small number of structurally estimated parameters implicitly assume values for the parameters featuring in the more extensive CGE models. For example, SG models working with Cobb-Douglas preferences for

[36] Caron et al. (2014) is an example of a multi-sector SG model where all parameters are estimated structurally. They study the relation between the income elasticity and factor intensity of goods in a multi-sector model with non-homothetic preferences using the GTAP database.

goods between different sectors instead of non-homothetic preferences with various parameters, are implicitly assuming that the substitution elasticity between all goods is 1 and the income elasticity of all goods is 1.

It has been common knowledge in the CGE-literature that the welfare gains from trade cost reductions rise with the size of the trade elasticities (see for example, Harrison et al., 1997). With higher trade elasticities there is more scope for substitution towards countries reducing trade costs. For example, with higher trade elasticities a reduction in EU trade costs to import from the US leads to more substitution away from domestic varieties and from varieties exported by countries supplying low-quality goods.[37] Felbermayr et al. (2013a) and Felbermayr et al. (2015) find instead that the welfare effects of TTIP rise with a smaller trade elasticity for the TTIP partners (respectively in Table A.II.5 and Table 11).[38] This seemingly puzzling result can be explained from the fact that these authors also adjust their AVE calculation of introducing TTIP when the employed trade elasticity changes. The AVE is calculated from $AVE = \frac{\exp \delta - 1}{\theta}$ with δ the coefficient on the FTA dummy and θ the trade elasticity. So a smaller trade elasticity corresponds henceforth with a larger AVE.

6 Comparison of studies

The predicted economic effects of TTIP in the different studies vary considerably. As Table 5 shows, the economic effects vary widely from 0.3% real income increase in both the EU and the US in the study by Fontagné et al. (2013) to more than 10% welfare increase for the US in Felbermayr et al. (2013). In this section we describe how these differences can be well explained based on differences in the size of expected trade cost reductions and intrinsic differences in the employed models.[39]

[37] Related to this finding is that recently the quantitative trade literature has focused on the welfare gains from trade as measured by the import share, showing that the welfare gains of trade measured in this way are smaller for a larger trade elasticity. Important is that this result is not about the welfare gains of reductions in trade costs, but the welfare gains from trade.

[38] In Felbermayr et al. (2015) it is only shown that the variance of the welfare effects becomes larger for a smaller trade elasticity (moving it from 7 to 5), but this obviously reflects larger gains for the TTIP partners and larger losses for countries not in TTIP.

[39] Independently of the analytical framework used, a particular study over TTIP (Capaldo, 2014) has serious methodological flaws. These flaws are so severe that they raise questions on the validity of the results of this particular study. Therefore, we delegate a discussion of this study to Appendix A.3.2 for a brief overview.

Table 5: Comparison of TTIP studies

	CEPR study	CEPII study	Egger et al., 2015	Aichele et al., 2014	Felbermayr et al., 2015	Felbermayr et al., 2013
Model type:	CGE	CGE	hybrid[1]	multi-sector SG	one-sector SG	one-sector SG
NTB estimations:	bottom-up[2]	bottom-up[3]	top-down deep PTAs[4]	top-down deep PTAs	top-down all PTAs	top-down all PTAs
TTIP cuts[A]	3.1	10.0	13.9	33.5	33.6	35.1
Spillovers[B]	yes	no[5]	no[5]	no[5]	no[5]	no
Market structure	Large-group mon. comp.	Small-group mon. comp.	Large-group mon. comp.	Eaton-Kortum perf. comp.	Large-group mon. comp.	Large-group mon. comp.
Preferences	Non-nested CES	Nested CES	Non-nested CES	Non-nested CES	Non-nested CES	Non-nested CES
Main outcome[C]	GDP	GDP	real income	real income	real income	real income
EU	0.5	0.3	1.0	2.1	3.9	8.0[6]
USA	0.4	0.3	2.3	2.7	4.9	13.4
Labour supply	fixed	fixed	fixed	fixed	fixed	fixed[7]
Labour types	two	two	three	single	single	single

Notes: A. Overall trade-weighted average NTB reductions in main scenario, taken from Table 6. A single value refers to NTB estimations in single-sector models (see Appendix A.1 for more details). Note that the reduction is conceptually different between bottom-up NTB estimations, and top-down estimations using gravity equations. B. Direct and indirect spillovers to third countries. C. Main economic outcome of each study, all in percentage changes. 1. Combines gravity estimations with a CGE model. 2. NTB estimations taken from Ecorys (2009). 3. Estimations taken from Kee et al. (2009) for NTBs in manufacturing and Fontagné et al. (2011) for services. 4. The top-down estimations for NTBs in goods are associated with a 100% cut, while the bottom-up estimations for services are associated with a 50% reduction, with the exception of financial services for which there is no NTB reduction. Services NTBs taken from Jafari and Tarr (2015). 5. Spillover effects only in alternative scenarios. 6. Unweighted EU average. 7. The study has an alternative endogenous labour supply mechanism, but the welfare estimations are associated with a fixed labour supply specification.

Sources: Own elaboration based on inputs from the referred studies.

6.1 Differences in the TTIP experiment

To make the TTIP experiment comparable across studies we report the ad valorem equivalent reduction in iceberg trade costs as a result of TTIP in Table 6. Some studies (Francois et al., 2013a; Fontagné et al., 2013; Egger et al., 2015) report initial levels of NTBs and assume that the NTBs will be reduced by a fraction of the initial level. The other studies directly calculate the expected reduction in trade costs using the effect of (deep) FTAs in gravity estimations. For the studies calculating sectoral levels and reductions in trade costs, we calculate a weighted average for the three main sectors agriculture, manufactures and services. The weights are given by the amount of trade from the EU to the US for US NTBs and from the US to the EU for EU NTBs (using trade data from the GTAP-9 database).

Table 6: Trade-weighted average NTBs by sector, percentages

		NTB estimated levels			TTIP experiment		
	Weighted averages	EU	USA	both regions	EU	USA	both regions
CEPR study	**Overall**	**10.6**	**14.3**	**12.5**	**2.6**	**3.6**	**3.1**
	Agriculture/Primary	0.0	0.0	0.0	0.0	0.0	0.0
	Manufacturing	11.9	16.3	14.3	3.0	4.1	3.6
	Services	9.3	10.0	9.7	2.3	2.5	2.4
CEPII study	**Overall**	**38.8**	**37.0**	**37.9**	**8.8**	**11.2**	**10.0**
	Agriculture/Primary	48.2	51.3	48.8	12.1	12.8	12.4
	Manufacturing	42.8	32.3	37.0	10.7	8.1	9.5
	Services	32.0	47.3	39.0	8.0	11.8	10.0
Egger et al.	**Overall**	**16.5**	**16.5**	**16.5**	**13.1**	**14.6**	**13.9**
2015	Agriculture/Primary	15.9	15.9	15.9	15.9	15.9	15.9
	Manufacturing	15.9	17.0	16.5	15.9	17.0	16.5
	Services	17.6	15.4	16.6	8.7	9.2	8.9
Aichele et al., 2014	**Overall**				**32.3**	**34.6**	**33.5**
	Agriculture/Primary				259.5	259.5	259.5
	Manufacturing				43.2	46.0	44.7
	Services				6.4	5.6	6.0
Felbermayr et al., 2013	**Overall**				**35.1**	**35.1**	**35.1**
Felbermayr et al., 2015	**Overall**				**33.6**	**33.6**	**33.6**

Sources: Own estimations based on NTBs from referred studies and bilateral sector-specific US-EU trade data from the GTAP-9 database.

The weighted average AVEs corresponding with the TTIP experiment reported in Table 6 show that Francois et al. (2013a) contains the smallest average AVEs, to be followed by Fontagné et al. (2013); Egger et al. (2015); Felbermayr et al. (2013) and Felbermayr et al. (2015); and finally Aichele et al. (2014).[40] The differences are large, ranging from 3.1% reduction in trade costs in Francois et al. (2013a) to 33.5% in Aichele et al. (2014). In general we can say that the studies working with a bottom-up approach (Fontagné et al., 2013; Francois et al., 2013a) come to smaller trade cost reductions than the top-down approaches (the rest of studies). Comparing the studies within the two groups reveals that the CEPII study generates much larger NTB levels than the CEPR study. Furthermore, it is remarkable that the average AVE in the study by Aichele et al. (2014) is much larger than in Egger et al. (2015) although a similar methodology was used. Both studies calculate the AVE of a move from no FTA to a deep FTA based on the same depth of FTA data. The difference is the operationalisation. Egger et al. (2015) maintain the 0-7 scale, whereas Aichele et al. (2014) convert this scale into two dummies, one for shallow FTAs and one for deep FTAs. Especially for agriculture the difference is large. There are three possible explanations for the differences. First the instruments used are different. Second, the estimation method differs: PPML in Egger et al. (2015) versus IV in Aichele et al. (2014). And third, Egger et al. (2015) include a separate dummy for trade between EU members, thereby driving down the coefficient on FTA-depth.

It is difficult to give a precise value judgement on the expected trade cost reductions corresponding with TTIP. However, given the limitations on their estimation techniques, we consider that the approximately 30% NTB reductions reported in Felbermayr et al. (2013), Felbermayr et al. (2015), and Aichele et al. (2014) are not reliable. In particular, the former studies do not account for the depth of FTAs and assume that TTIP will be like the average of all FTAs in the past, whereas the latter study raises the effect of TTIP significantly by not including a separate dummy for intra-EU trade. Therefore, we conclude that a reliable lower bound for the average trade cost reduction as a result of TTIP is the 3% in Francois et al. (2013a) and a reliable upper bound is the 14% in Egger et al. (2015).

Table 6 shows that services trade contributes relatively little to the overall reduction in AVEs. In all the studies the reduction in AVEs is smaller or equal to the reduction in the other two sectors. Given that services trade is only about 6% of total bilateral trade between the two regions, its contribution to the total trade cost reduction is small.

From Table 5 we observe that only Francois et al. (2013a) works with direct and indirect spillover effects in the baseline simulations, whereas most other studies report the effects of spillovers in the robustness checks. All studies follow Francois et al. (2013a) in their robustness checks, by assuming that direct spillovers (third countries

[40] In A.1 we provide more detail on the calculation of the weighted average AVEs.

exporting to the EU) are 20% of the trade cost reductions between the EU and the US and indirect spillovers are 10% (third countries exporting to each other).

As Table 7 shows the effect of including spillovers seems to vary considerably. Whereas Fontagné et al. (2013) and Felbermayr et al. (2015) seem to find that the spillover effects raise welfare effects by about two thirds, the other studies find effects in the range of 20% to 25%.[41] We can explain the large effect in Felbermayr et al. (2015) by the way baseline trade costs are modelled in their single-sector model. As discussed below, this approach biases the effects of trade cost reductions upwards and thus, also the effect of spillovers. Thus, by excluding both these studies as outliers, we conclude that including 20% direct and 10% indirect spillovers is expected to have a welfare effect on the TTIP-partners of about 25%.

Table 7: Estimated TTIP welfare effects, with and without spillover effects

	Without spillovers		With spillovers		Relative difference
	EU	USA	EU	USA	
CEPR study	0.4	0.3	0.5	0.4	20.8%
CEPII study	0.3	0.3	0.5	0.5	66.7%
Egger et al., 2015	2.3	1.0	3.0	1.1	26.5%
Aichele et al., 2014	2.1	2.7	2.7	3.4	25.4%
Felbermayr et al., 2015	3.9	4.9	7.8	7.1	67.7%

Source: Own estimations based on reported results from cited studies.

6.2 Differences in simulation models

To make a transparent comparison between the different studies we associate the differences in AVEs with the differences in welfare effects. Table 8 employs the average AVEs and the expected welfare effects reported in Table 5. Next we take a benchmark study to which all the other studies are compared to. As benchmark study we use Egger et al. (2015), since this study seems to be in the middle both in terms of estimated AVE and welfare effects. We then calculate how much larger (or smaller) both the average AVE and the average welfare effect are in comparison to the benchmark study. If the difference in welfare effects is larger than the difference in AVEs, this would mean that the study generates larger welfare effects based on the same level of AVEs. It is difficult to relate the size of the difference in AVEs to the size of the difference in welfare effects, since AVE differences do not map proportionally into differences in welfare effects. In other words, the welfare effect of doubling the AVE from 5% to 10% is smaller than the

[41] The large effects in Fontagné et al. (2013), however, could be explained from the fact that this study only reports effects rounded to one decimal. While the absolute differences are less significant.

welfare effect of doubling the AVE from 10% to 20%. The relation between AVE changes and percentage welfare effects becomes especially non linear for larger trade elasticities.[42]

Table 8: Comparison of AVEs and welfare effects in different studies

	AVEs			Welfare effects			Trade	Relative to Egger et al., 2015	
	EU	USA	Average	EU	USA	Average	elasticity	AVEs	Welfare effect
CEPR study	2.6	3.6	3.1	0.5	0.4	0.5	5.1	22.4%	25.6%
CEPII study	8.8	11.2	10.0	0.3	0.3	0.3	4.0	72.1%	16.6%
Egger et al., 2015	13.1	14.6	13.9	2.3	1.0	1.8	5.1	100.0%	100.0%
Aichele et al., 2014	32.3	34.6	33.5	2.1	2.7	2.3	6.8	241.0%	129.0%
Felbermayr et al., 2013	35.1	35.1	35.1	8.0	13.4	10.1	8.0	252.4%	556.9%
Felbermayr et al., 2015	33.6	33.6	33.6	3.9	4.9	4.3	7.0	241.9%	237.1%

Source: Own estimations based on reported results from cited studies. Notes: Reported trade elasticities are the trade-weighted average trade elasticities from each study.

Table 8 also reports the trade-weighted average trade elasticities in the different studies, since these differences play an important role in explaining differences in welfare effects. To interpret the results in Table 8 we compare in turn Aichele et al. (2014), Fontagné et al. (2013) and Felbermayr et al. (2013) and Felbermayr et al. (2015) with Francois et al. (2013a) and Egger et al. (2015). The last two studies generate very similar results, i.e. for identical AVEs, welfare effects are close. This is as expected, since the studies employ the same economic model. Francois et al. (2013a) generates 14% larger effects for the same changes in AVE. This difference can be attributed to the fact that Francois et al. (2013a) contains spillover effects in its baseline scenario, whereas Egger et al. (2015) do not.

6.2.1 Comparison with Aichele et al. (2014)

First, we compare Egger et al. (2015) with Aichele et al. (2014). In the last study the AVEs are 240% larger than in Egger et al. (2015), whereas welfare effects are only 128% larger. Part of this discrepancy can be explained by the larger trade elasticity in Aichele et al. (2014). To explain the remainder of the difference we use the analysis in Section 5.1 on differences in the methodology of TTIP studies. Of the seven features discussed in Section 5.1 only three features could potentially explain the differences: multiple factors, market structure and the treatment of capital.[43] Aichele et al. (2014) assume a

[42] These findings are based on calculations of the impact of reductions in iceberg trade costs between the EU and the US in multi-sector Armington and Ethier-Krugman models calibrated to GTAP-9 data (16 sectors, 17 countries, 2 factors). Results are available upon request.

[43] The other features cannot explain the differences: since the studies either do not differ with respect to these features (intermediate linkages and multiple sectors) or the differences are not relevant for the

single production factor (labor) whereas the other two studies contain multiple factors of production. As discussed above, multiple production factors will in theory reduce welfare effects, since Aichele et al. (2014) assume perfect mobility of labor across sectors, whereas land, natural resources and capital are (partially) immobile in the other studies. Second, the models by Egger et al. (2015) have incorporated (small group) monopolistic competition. As discussed in the previous section this raises the welfare effects of trade cost reductions in a multi-sector setting, because of the increased availability of varieties. Aichele et al. (2014) instead work with the perfect competition Eaton and Kortum model. Third, the absence of capital in Aichele et al. (2014) also obviously drives down the welfare effects in comparison to Egger et al. (2015). In the latter studies capital can move to regions reducing trade costs, increasing the available capital stock.

6.2.2 Comparison with Fontagné et al. (2013)

Second, we compare Egger et al. (2015) with Fontagné et al. (2013). Table 8 makes clear that the difference in AVEs is much smaller than the difference in welfare effects. Again part of the difference can be explained with the trade elasticity: Fontagné et al. (2013) has on average a smaller trade elasticity. Explaining the remainder of the difference based on differences in model scope seems hard: both sets of studies employ a CGE model. So we have to dig deeper and explore the details of the two models. Two factors are important. First, capital is modelled in a different way in the two studies. In Egger et al. (2015) capital is mobile and shifts between regions until the rate of return is equalised. Moreover, in deviation from the standard GTAP model, additional capital in a certain region relative to the baseline becomes online, i.e. can be employed in production. As pointed out in the documentation on the employed MIRAGE model in Bchir et al. (2002), in Fontagné et al. (2013) capital cannot move freely between regions nor between sectors. In particular installed capital is immobile implying that rates of return to capital are not equalised. This obviously drives down the welfare gains from trade cost reductions in comparison to Egger et al. (2015).

Second, although both studies work with monopolistic competition for services (except transport) and manufactures, the implementation is different. Fontagné et al. (2013) has a nested structure for demand with four nests.[44] Goods can be of two different quality levels and the first nest constitutes the choice between high and low quality goods, supplied respectively by high and low income countries. In the second

effect of TTIP (non-homothetic preferences and the modelling of tariffs and export subsidies).

[44] Fontagné et al. (2013) work with small-group monopolistic competition with endogenous markups, whereas Francois et al. (2013a) employ large-group monopolistic competition with fixed markups. However, this difference is not an important factor in the differences in outcomes.

nest consumers have to choose between domestic and imported varieties. This nest only exists for the quality level also produced at home. In the third nest consumers choose between varieties imported from different sources and finally in the fourth nest they choose within each of the sourcing countries between varieties supplied by different firms. The model is calibrated to the Armington elasticities between goods from different source countries, as provided by the GTAP-5 database, and crucially the substitution elasticities for the other nests are not identical. In particular, moving up one nest elasticities fall, while moving down one nest elasticities rise.[45] In comparison Egger et al. (2015) work with identical substitution elasticities at all nests, effectively not modelling any nests. The implication is that welfare effects of reductions in trade costs are smaller in Fontagné et al. (2013) for two reasons. First, the substitution elasticities between domestic and imported varieties and between varieties of different quality levels are much smaller in Fontagné et al. (2013), thus generating smaller welfare effects. Second, the substitution elasticities between varieties are larger in Fontagné et al. (2013), implying smaller love of variety forces and thus, less welfare gains from the increased availability of varieties.

6.2.3 Comparison with Felbermayr et al. (2013) and Felbermayr et al. (2015)

Third, we come to a comparison of Egger et al. (2015) with Felbermayr et al. (2013) and Felbermayr et al. (2015). In the latter studies welfare effects are much larger than justified by the difference in AVE values. This holds especially for Felbermayr et al. (2013). Also in comparison to Aichele et al. (2014) effects are much larger. The differences between Felbermayr et al. (2015) and Aichele et al. (2014) could be explained by the use of one-sector instead of a multi-sector specification. However, in a single sector model –without scale or variety effects– it is expected that the income effects should in fact be smaller instead of larger.[46] Also the larger trade elasticities cannot explain large welfare effects. This becomes clear by comparing the study with Aichele et al. (2014). AVEs and trade elasticities are similar, whereas welfare effects are much larger in Felbermayr et al. (2013) and Felbermayr et al. (2015). We first discuss why both studies generate too large effects and then discuss the differences between the two studies.

[45] The formula is $\sigma_{dom,int} - 1 = \sqrt{2}\,(\sigma_{imp} - 1)$ for example for the relation between the Armington elasticity between varieties from different sources, σ_{imp}, and the substitution elasticity between domestic and imported varieties, $\sigma_{dom,imp}$. Moving further up or down the nest structure the relation between elasticities is identical.

[46] Formally the employed model is monopolistic competition. But given the fact that the model is single sector with a fixed amount of a single production factor, no variety effects are possible as a result of trade liberalisation.

In both studies the welfare effect is calculated by comparing GDP before and after a reduction in iceberg trade costs, taking into account general equilibrium changes in multilateral resistance terms. The baseline trade costs (before the reduction) are based on the fitted values of observable trade costs from a gravity equation. As such unobserved trade costs are neglected, this generates huge differences between actual import shares and baseline import shares. In particular, it generate relatively large international import shares. In other words, in the baseline, countries trade much more than they actually do. As a result of neglecting unobserved trade costs, welfare gains are biased upwards.

Bekkers (2016) shows that the welfare effects gains for TTIP partners are more than 100% too large in Felbermayr et al. (2015) due to the misspecified trade costs in the baseline. In Felbermayr et al. (2013) welfare effects are even larger than in Felbermayr et al. (2015). Whereas the methodologies are identical, there are three differences between the two studies: the sample of countries is smaller (126 versus 173), the included gravity regressors are different and the size of the extensive margin effect could be different. Bekkers (2016) shows that the impact of a changing sample is negligible on the welfare effects. Using other gravity regressors changes the effects by 20%-30%, which cannot explain that Felbermayr et al. (2013) get welfare gains for TTIP-partners more than 100% larger than in Felbermayr et al. (2015). So the size of the extensive margin effect remains to explain the differences in outcomes. Both studies employ the same model, which allows for zero trade flows. Changes in trade costs can change the pairs of countries that display positive trade. Felbermayr et al. (2015) report the effects both with and without the extensive margin effect, showing that the impact of the extensive margin is negligible. On the other hand, Felbermayr et al. (2013) only report total effects. Therefore it is not clear what the role of the extensive margin effect is in Felbermayr et al. (2013), but it is the only credible explanation for the differences in welfare effects. However, a large extensive margin effect on welfare is problematic. In the theoretical model firms are identical. This means that all firms enter a market with identical sales when a country starts to export to a certain market. As a result the extensive margin effect is huge. In reality the effect of switching from zero to positive trade should be moderate. If trade costs fall such that positive trade is possible, only some firms will enter the market with a small amount of export sales, which consequently can only have a small welfare effect.[47]

[47] The extensive margin at the country- or sector-level should be distinguished from the firm-level extensive margin. A large part of the effect of changes in trade costs could be due to a changing number of firms exporting (firm-level extensive margin) as in Chaney (2008).

6.3 Synthesis

The analysis in the previous sections enables us to classify the different studies based on differences in expected trade cost reductions and in the employed economic model and draw conclusions on the expected economic effects. Table 9 gives a stylised representation of the studies in terms of expected trade cost AVE reductions and the size of the economic effects generated by the economic model. The table has two axis, where each one has a different range of results (small, medium, and large).[48] For example, Francois et al. (2013a) is classified in the entry with small estimated NTB trade cost reductions, and relatively small welfare effects calculated with their economic model.

Table 9: Classification of studies

	Economic Model:		
AVE reductions:	Small Effects	Medium Effects	Large Effects
Small: < 3%	CEPR study 0.5		
Medium: 10%-15%	CEPII study 0.3	Egger et al., 2015 1.8	
Large: >30%		Aichele et al., 2014 2.3	Felbermayr et al., 2013, 2015 4.3 / 10.1

Source: Own estimations based on reported results from cited studies.

As argued in Subsection 6.1, we think that trade cost reductions of about 15% are a reliable upper bound. Furthermore, we deem the economic effects generated by the studies by Felbermayr et al. (2013) and Felbermayr et al. (2015) as relatively too large, since their economic model contains conceptual problems. Choosing between the other economic models is a matter of taste. If one prefers a perfect competition setting, the small economic effects as in Aichele et al. (2014) are preferable. The CGE models employed by CEPII and CEPR are both models with multiple sectors/factors, intermediate linkages, capital accumulation and imperfect competition. Still, the implementation generates quite large differences depending on the inclusion of nested preferences and the size of substitution elasticities and both approaches are defendable. Therefore, we conclude that the expected real income effects of TTIP range between 0.3% and 2%.

[48] To keep the table concise we abstract from differences in the trade elasticity.

7 Conclusions

In this survey we review the main studies analysing the expected economic impacts of TTIP. CGE models are considered to be the state of the art approach in assessing trade policy in policy circles (Pelkmans et al., 2014; Mustilli, 2015), whereas they are considered obsolete among a group of academics (Caliendo and Parro, 2015) who instead prefer structural gravity models. We think that both methodological approaches have merit. The compact and more transparent nature of the SG models can be valuable, even based on a single sector, if properly executed. A more extensive model, however, with multiple sectors, multiple factors, a realistic and detailed description of taxes and subsidies, capital, and imperfect competition in selected sectors; seems to be preferable, as it provides a more realistic description that generates more information for analysts and policy makers.

In fact there seems to be a tendency towards convergence in both literatures. CGE models are based more on structural estimation and structural gravity models have become more extensive over time. For example, the CGE-study by Egger et al. (2015) estimates the trade elasticities structurally, whereas the SG-model of Aichele et al. (2014) contains multiple sectors and intermediate linkages in deviation from earlier SG-studies with a single sector without intermediate linkages. However, Aichele et al. (2014) still lack important elements for trade policy analysis, such as the inclusion of multiple production factors, capital and imperfect competition. Multiple production factors are important to uncover possible differential effects on the factor wage, and the inclusion of capital and imperfect competition make the models more realistic.

Comparing the assessed studies we find that both differences in the estimated ad valorem equivalent (AVE) reduction in trade costs as a result of TTIP, and in the employed economic model drive the differences in the expected economic effects across studies. The most important difference in estimation of the AVEs is whether a bottom-up approach based on micro-data on NTBs or a top-down approach based on average FTA effects is chosen. Our assessment is that the reliable AVE estimates range between 3% and 14%. The most important difference in the economic modelling is the market structure in combination with the size of the trade elasticities. With an Armington or Eaton-Kortum perfect competition setting the effects are modest, whereas a monopolistic competition setting without a nested preference structure generates larger effects. With AVE estimates below our upper bound of 14% and an economic model generating modest effects the real income gains of TTIP are around 0.3%, whereas a model with relatively medium effects generates real income gains around 2% on average for the EU and the US. Larger gains as produced by some studies are considered unlikely, either because they are based on unreliable AVEs reductions of 30% and more, or because they are based on a simulation model displaying methodological problems.

Using these parameters as reference, our preferred TTIP study is Egger et al. (2015). This study has the added benefit of combining both SG and CGE techniques.

Besides the overall economic effects described above (i.e. real income and welfare) TTIP is expected to affect other economic variables. In particular, transatlantic bilateral trade flows are expected to increase significantly. For instance, Egger et al. (2015) find a a substantial increase in bilateral trade flows between the US and the EU of 80%, that also causes trade diversion with third countries. These effects correspond with the larger gains scenarios, therefore, lower but still significant bilateral trade increases are expected from the other studies.

Moreover, Egger et al. (2015) also find that total trade for both regions is expected to increase at around 5%. These increased bilateral and total trade flows generate positive real income gains of around 1 to 2% for the EU and the US, while third-countries remain broadly unaffected, with the exception of some particular countries that currently trade more intensively with the TTIP countries. The changes in trade flows, in addition, are associated with moderate inter-sectoral changes in production and employment. Labour displacement caused by TTIP will, however, be within the range of current year-on-year labour market mobility.

Research on the following three sets of topics would be highly useful for (applied) researchers trying to predict the expected effects of FTAs. First, more research is needed on the NTB effects of FTAs, and accordingly, robustness analysis should be conducted using alternative estimations for NTBs. Second, more research on the spillover effects of FTAs is highly needed, since little is known about it, both empirically and theoretically. Third, an evaluation of the impact of differences in modelling setups is required. What is the impact of multiple sectors, multiple factors, monopolistic competition, and different ways to include capital? The work by Costinot and Rodríguez-Clare (2013) provides valuable insights in this respect, but much more questions should be answered. This study, for example, does not address the effect of the way capital is modelled and the effect of non-homothetic preferences.

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A Appendix

A.1 Calculating average AVEs

The AVEs can be taken directly from the different tables in the studies reporting levels of NTBs.[49] To calculate the AVE-reduction because of TTIP reported in column 3, the different studies assume that only a fraction of the NTBs are eliminated as a result of TTIP (percentages displayed in column 2). The other studies do not directly report the AVEs but infer the AVE-reduction of the introduction of TTIP from the (deep) FTA-effect in a gravity regression. We calculated this AVE in Felbermayr et al. (2013) and Felbermayr et al. (2015) using the formula $\frac{\exp \delta - 1}{\theta}$ with δ the coefficient on the FTA dummy and θ the assumed trade elasticity. A trade elasticity of 7 in the baseline and estimates of δ of respectively 1.24 and 1.21 generate the numbers in Table 6.[50] To calculate the average AVEs in Aichele et al. (2014) we can use the same methodology but need to do some more work since the authors report different estimated trade elasticities and deep FTA dummies for more than 30 sectors. In particular, we first calculated the AVEs for the different sectors based on the estimated tariff elasticities and the coefficients for shallow and deep FTAs (in Tables 1 and 2 in Aichele et al. (2014)) and then calculated the weighted average AVEs for agriculture, manufacturing and services.[51]

A.2 Modelling labour markets

A.2.1 CGE framework

CGE models typically use a stylised treatment of labour markets. In general, labour is divided by skill types based on education levels: e.g. low- and high-skill workers. Labour supply LS by skill type s is then constructed as a combination of population Pop, participation rates PR and unemployment μ, such that: $LS_s = Pop_s * PR_s(1 - \mu_s)$.[52] Labour demand is obtained from sectoral nested CES production functions, where there is imperfect substitutability between skill types and with respect to other production factors. Finally, the labour market clears using

[49] In particular Tables 4 and 5 in Egger et al. (2015), Table 2 in Francois et al. (2013a), and the table on page 8 in Fontagné et al. (2013). Note that this last study only reports (unweighted) average NTBs for the three sectors agriculture, manufactures and services.

[50] See Table 3 in Felbermayr et al. (2015) and Table II.2 in Felbermayr et al. (2013a).

[51] We calculate AVEs per sector using the following formula, $AVE_s = \frac{\exp(\beta_{shallow} + \beta_{deep}) - 1}{\theta}$.

[52] Baseline projections of these values typically use UN statistics on population and participation rates, while unemployment converges and/or is fixed to long-term values (i.e. NAIRU).

endogenous skill-specific wages with exogenous aggregate employment.[53] In this setting, a trade shock –such as the TTIP experiment– will affect the market indirectly and only through the changes in the size and skill-composition of sectoral labour demand.[54] Implicit to this approach is that there is high (although still imperfect) mobility of skill types between production sectors, which in the face of an exogenous shock is translated into short term adjustment costs.[55] Therefore, in the medium term the labour market will adjust and aggregate employment will return to its baseline level.[56] In general, this assumption has proven to hold in the face of increased global trade and integration, where long-term unemployment rates have not been significantly affected.[57]

This labour market approach has the advantage of accounting for the asymmetric effects of trade on different labour skill types. As explained in Boeters and Savard (2012), the crucial question for modelling labor market differentiation is whether wages by different worker classifications move in parallel or not in response to exogenous shocks. The theoretical and empirical literature is clear, in this respect, that trade affects low- and high-skill workers differently.[58]

As argued by Boeters and Savard (2012) this stylised approach is adequate for analyses of the labour market effects for most policies, including trade policies. The clear exception is the analysis of policies that directly affect labor supply such as changes on income taxation, unemployment benefits and immigration. In other words, the indirect effects of trade policies on the labour market are generally relatively small and thus, they do not compensate for the the added complexity of more detailed labour market modelling. Boeters and Savard (2012) recommend a more detailed modelling of the labor market only if it is plausible that assumptions regarding the labor market mechanisms can actually change the analytical outcomes significantly.[59]

[53] An alternative labour market closure uses fixed wages with endogenous aggregate employment. In both cases, the change in labour demand is either completely channeled through wages or employment.

[54] For example, a sector that is expanding due to lower sector-specific trade costs and which is relatively more low-skill intensive will then increase the relative demand and wages of low-skill workers.

[55] These include all the associated cost with finding a new job, temporary unemployment, and the possible retraining and geographical reallocation of particular workers.

[56] This assumption is often misinterpreted as a full-employment assumption. But, as explained above, labour supply is limited by long-term unemployment, so there is never full-employment, but rather fixed aggregate labour supply.

[57] The one exception is the case of Chinese import penetration into the USA, which has been translated into permanent shocks to low-skill workers (Autor et al., 2014, 2016), although not to high-skill workers.

[58] This follows a long established tradition in trade theory starting with the Stolper-Samuelson theorem from the Heckscher-Ohlin-Samuelson trade framework. While the asymmetric effect of trade on skill levels has been broadly studied following the empirical observation of increased in wage inequality in OECD countries in the last decades that is partially explained by globalisation (see for example, Van Reenen, 2011).

[59] The experience with the endogenous labour market (ELM) version of the WorldScan CGE model,

Hence, the standard approach in the CGE literature is to use the fixed labour supply approach with flexible market-clearing wages. However, this does not mean that modelling more complex labour market mechanisms in CGE models is not possible. On the contrary, starting since the 1990s there is an extensive literature on labour market extensions. Boeters and Savard (2012) present a survey of studies, which range from different classifications (or disaggregation levels) of labour supply (i.e. using occupations and other household characteristics besides skill types), endogenous labour supply mechanisms (from representative household optimisation to microsimulations using a large number of households) and different labour market coordination mechanisms (from market-clearing wages, to imperfectly competitive labor markets under wage bargaining or search-and-matching mechanisms).[60]

A.2.2 SG models

Simple as the labour market modelling is in CGE models, the treatment in SG is usually more rudimentary. A typical SG setup will include only one production factor (labour) without any distinction on skill types. This not only affects sector production flexibility (as explained in Section 5.1 above) but it also ignores the empirical evidence that trade affect workers skill types differently. As such, labour demand is modelled as an aggregate that is ignoring skill-specific demand changes. For example, Eurostat data show that employment rates for low skill-workers are around 50% for the EU28, while high skill rates are above 75%, while unemployment rates are roughly double for low-skill workers compared with high-skilled workers.[61] In addition, most SG applications also employ the simplifying assumption of a flexible market-clearing wage.

To compensate for the intrinsic simplicity of the core SG labour market mechanism, some papers introduce additional labour market features, in particular, an alternative labour market clearing mechanism where involuntary unemployment is conditional on sector-specific frictions associated with the search-match analytical framework. For instance, some SG applications (Felbermayr et al., 2013; Carrere et al., 2015) are based on the search unemployment application in Helpman and Itskhoki (2010). This

for instance, is that trade policies have limited effects on the labour market and overall macroeconomic variables are hardly affected when the ELM version is used (Boeters and van Leeuwen, 2010).

[60] For instance, the endogenous labour market version of WorldScan distinguishes five representative households (combining employed and unemployed low- and high-skill households and a capitalist household), with endogenous labour supply at both the extensive (participation) and intensive (hours worked) margins based on household optimisation decisions, which are calibrated using empirical elasticities. Involuntary unemployment is captured through a collective wage bargaining set-up.

[61] Taken from Eurostat, online data code: ifsa_ergaed. These are education based data, where low-skill are workers that did not finish high school. EU28 employment rates for workers with finished secondary education is 73% and with finished tertiary education is 83%

approach assumes frictional unemployment, which arises from the explicit modelling of the job search process by employees and employers. However, Helpman and Itskhoki (2010) employ a two-sector two-skills-type model with both search frictions and wage bargaining, while one of the sectors has heterogeneous firms as in Melitz (2003). Thus, there is no unequivocal direct positive relation between trade and overall unemployment, as assumed in the one-sector model in Felbermayr et al. (2013). Moreover, Helpman and Itskhoki (2010) acknowledge that country-specific unemployment arises from different sources, which creates complex relationship patterns with trade shocks. As such, they are clear in saying that lower labour market frictions do not ensure lower unemployment. In contrast, Carrere et al. (2015) use a one-way direct link between sector labour demand and sectoral labour frictions in their model.

A serious limitation of these labour market extensions, however, is that the exact modelling mechanisms are not properly discussed on the papers. This makes the evaluation of these labour market extensions very hard, and there are no robustness tests to quantitatively assess the precise impact of labour market effects on the overall economic outcomes.

A.3 Other TTIP studies

A.3.1 Carrere et al. (2015)

This paper uses a multi-sector SG approach based on the Eaton and Kortum (2002) trade model and the application in Costinot et al. (2012). However, their main point of emphasis are the estimated effects of trade policy on the labour market, and they do not present results regarding overall GDP or real income gains. In particular, they associate household welfare with real wage and unemployment levels.

Given the focus of the paper on labour market effects, an important characteristic of their model is that they include labor market frictions and equilibrium unemployment. They construct and use sector-specific Diamond-Mortensen-Pissarides search-and-matching frictions, while retaining some elements of the trade and labour market mechanisms in Helpman and Itskhoki (2010).[62] In their approach, they link the reallocation of workers –associated with the economy-wide shock expected from the TTIP experiment– with changes in sectoral unemployment. If the trade shock reallocates workers from sectors with higher frictions to sectors with lower frictions, then this is translated into a decrease in unemployment, as the labour demand from the

[62] Even though they have a link between search-and-matching frictions embedded into a trade model, they do not distinguish skill types nor do they have a firm-heterogeneous sector as in Helpman and Itskhoki (2010).

expanding sectors coupled with their lower labour frictions will be translated into a higher than average hiring of workers. The contrary occurs if the reallocation of workers is done between sectors with lower frictions to sectors with higher labour market frictions.

However, their modelling of the labour market and its relation with trade is problematic. First, it is assumed that unemployed workers have zero income, which is a very unrealistic feature for countries with significant unemployment benefits and a well-established welfare system. Hence, their unemployed-adjusted welfare measure is biased and puts too much weight on the effect of changes in unemployment. For example, even though the expected real income changes (equivalent to their real wage changes) from the TTIP experiment are relatively small (around 0.2% in average), their welfare measures vary significantly more –in a range from 2.6 to -2.7%. In some cases, the unemployment adjustment is 10 times greater than the change in real wages, even when overall unemployment is changing only by a relatively small fraction (on average around 1% or 0.05 percentage points if initial unemployment is for example 5%). Moreover, even though they link involuntary unemployment with household welfare, they do not model the endogenous household decisions to provide labour. This is a central feature in the explanation of involuntary unemployment and one of the main factors that defines household welfare when labour supply is endogenously determined (cf. Boeters and Savard, 2012).

Second, the estimation of their sector-specific labour frictions is based on the concept of sector-specific unemployment. This particular specification is hardly ever used by labour nor trade economists since it assumes that workers are bound to sectors, instead of being characterised by occupations or skills. Carrere et al. (2015) elaborate on a version of their theoretical model with differences in labour market frictions by occupation, implying in turn different frictions at the sector level given that certain occupations occur more frequently in certain sectors. But labour market frictions are not estimated for occupations, but for sectors, which is problematic. It leads to differences in estimated sector-specific unemployment, which is also driving the results. This is counter-intuitive, since it is generally accepted that workers can move –although imperfectly– between sectors: e.g. low-skill workers can be employed in a farm (agriculture), a factory (manufacturing) or construction (services).

Third, the inclusion of unemployment in Carrere et al. (2015) is partly intended to account for the unequal effects of trade on different workers. However, there is no discussion of the extensive literature based on an established methodology that looks into these effects. The most common approach is to determine the wage changes by different skill-type (usually low- and high-skill), which informs on the expected effects on wage inequality.[63] In this literature there are generally multiple skill-types, since it is well known that trade shocks have clear asymmetric effects between different labour types: low-skill workers are usually the most affected in terms of wages and employment (see for example Autor et al., 2014). Carrere et al. (2015) instead employ only a single type of labour.

Finally, two additional strong assumptions are needed in their model: that sector-specific labour market frictions are fixed over time and that these are not changed as a consequence of an economy-wide trade shock. For instance, this assumes that the influence of unions (as a source of higher search and match costs in a specific sector) will remain unchanged over time, even if the labour demand for that specific sector is being significantly reduced by changes in trade and the production level of that sector.

A.3.2 Capaldo (2014)

One study that gained some attention in the policy debate is Capaldo (2014). Unfortunately, this study is well below the standards of any quantitative trade model analysed so far (cf. Bauer and Erixon, 2015, for a detailed critique of the analysis)

This study uses the UN Global Policy Model, which is a macroeconomic modelling approach with a number of short-term disequilibrium features. The model has no trade elements –besides a rough use of the current account. It does not include tariffs nor any other trade costs that can be changed to simulate trade policy. Thus, it does not include the foundations for any kind of basic trade analysis. Rather, the study simply takes trade volume effects from the CEPR study and externally imposes these onto a simple macroeconomic imbalances model. As such, it does not even provide an estimate of the impact of TTIP, but an estimate of how current account changes may affect short-term macroeconomic variables.

The modelling framework, moreover, suffers from grave additional analytical problems:

- The Keynesian short-term approach argues that the EU will lose demand because of a fall in its trade surplus, and given the current state of relatively low demand this will create additional unemployment rises. This is an unreasonable approach, since trade policy implicit in TTIP are long-term policies that have mainly supply-side

[63] For instance, a common feature of CGE models is the use of two or more labour types. Moreover, CGE studies that have the particular aim of analysing the effects of trade on inequality usually employ microsimulations with detailed household survey data that provides information on all sources of household income (including welfare benefits) and their consumption basket. This approach allows to distinguish the real income effects by specific household type. For example, this is the common methodology employed by the World Bank (cf. Bourguignon and Bussolo, 2013).

effects that are distinctively different from changing or stabilising short-term aggregate demand (Wolf, 2015).

- Another problem with the application is that one of the model assumptions is that labor markets are rigid and slow to react to external shocks (not only in the short run but also in the long run) and as such, there is an increase in unemployment and a decrease of the labor share in production with changes to aggregate demand. Assuming that workers are not capable of reallocating between broad economic sectors in the long run is a completely unrealistic assumption. In addition, the short-term effects on employment and production generated in the model are not driven by trade policy or TTIP. The results of the model are driven by the external shock to the economy from changes in the bilateral trade balances, which is wrongly assigned to the long-term effects of TTIP.
- There is a clear internal inconsistency in the exercise. The trade flows taken from the CGE model in the CEPR study are long-term effects that are only possible with labor reallocation between sectors over several years. This is, to achieve the changes in trade flows from the CEPR study, labour *must* be reallocated between sectors. But Capaldo (2014) imposes these long-term trade flow changes in a short-term setting where labor reallocation is not possible. As such, he assumes that changes in the long-term trade imbalances will have short-term effects on aggregate demand and current employment levels, which is just a very subpar economic analysis.

To sum up, Capaldo (2014) is a technically flawed study that uses an ill-suited methodological framework to analyse the TTIP experiment. Hence, the results from this sui generis analysis cannot be taken seriously. The attention it created can only be explained by the expected negative results from TTIP, which has been used by ideologically-driven opponents to the agreement.

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