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Modelling the impacts of trade on employment and development: A structuralist CGE-model for the analysis of TTIP and other trade agreements

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List of Abbreviations

BIP	Bruttoinlandsproduk
CEPR	Centre for Economic Policy Research
CGE	Computable General Equilibrium (CGE) models
EU	European Union
E-X	foreign balances
G-T	public balances
GDP	gross domestic product
GTAP	Global Trade Analysis Project
I-S	private balances
ISIC	International Standard Industrial Classification
NAFTA	North American Free Trade Agreement
N-EU	Northern European Union
NTB	Non-Tariff Barriers
OECD	Organization for Economic Co-operation and Development
ROW	rest of the world
SAM	Social Accounting Matrix
SE-EU	Southern & Eastern European Union
TOT	terms of trade
TTIP	Transatlantic Trade and Investment Partnership
UK	United Kingdom
US	United States

Abstract

In recent years, a number of studies have been put forth to assess the potential economic effects of the EU-US trade agreement – the Transatlantic Trade and Investment Partnership (TTIP). Most studies report gains for the TTIP-member states. However, the commonly applied CGE models contain questionable assumptions such as full employment. In this report, we present a structuralist CGE-model for the assessment of TTIP with fundamentally different key assumptions with regard to the determination of output, income and employment. These distinct closures are applied within the standard trade liberalization setting including the reduction of tariffs and non-tariff barriers (NTBs). Importantly, the model delivers results with regard to (i) macroeconomic effects including employment and wages, (ii) sectoral (20 Sectors) and (iii) regional (11 countries/regions) effects. Even though small but positive income effects are reported, the diverging results among TTIP-members, negative effects for real wages for low skill labor and the rest of the world, in particular developing countries, should be highlighted. An extensive sensitivity analysis confirms potential risks associated with TTIP.

Keywords: trade impact assessment, non-tariff measures, trade policy

Executive summary

The Transatlantic Trade and Investment Partnership (TTIP), currently under negotiation between EU and US, it touted as a harbinger of recovery: free trade between two of the largest and most developed economies of the world is supposed to bring about growth and, with it, jobs. A number of studies have been put forth. Most models generate headlines about positive gains, and support the desire of the corporate sector and most of the political class on both sides of the Atlantic to conclude a far-reaching agreement. Prominently among these studies are applications of models that are based on the assumption that everybody who wants to can find a job, and that public deficits are always in balance. These are obviously unrealistic assumptions. With unemployment in the EU at record-high levels, an increasing amount of people are unable to find a job, and do so not for lack of skill or education, but lack of demand.

In this report, we present an alternative assessment of TTIP. We put forth a simple model that is in many ways quite similar to 'standard' models, but differs fundamentally in the key assumption. We do not assume that labor markets clear through price adjustments. In other words, we do not assume that real wages fall until everybody who wants to acquire a job is employed. Over the relevant time horizons, such adjustment mechanisms are not observed. Instead, we try to give an answer to the question policy-makers and the general public are most interested in: How does TTIP affect demand, employment and the distribution of income across countries and sectors?

Thus, we develop a model that describes – like others – the global economy (in eleven countries and regions), its multi-sectoral linkages (in twenty sectors), and the economic effects on two labor skill types (low and high skilled). The model builds on a structure of tariff and non-tariff barrier policy instruments that is conceptually similar to the standard models. However, in sharp contrast, our model features demand-driven output and employment. It does not arbitrarily presume that markets work perfectly over any time horizon, but instead highlights the income and expenditure changes that result from policy changes due to TTIP.

It should as well be emphasized, however, what our model – like the others – cannot do. Most importantly, all of the models that have been put forth with regard to TTIP consider *non-tariff barriers (NTBs)* a cost to trade only. Regulatory alignment, regardless of whether it is done by mutual recognition, harmonization or elimination of a regulation thus always confers a benefit to society. We do, however, know that regulations aim at serving the public interest. Thus, a balanced assessment of regulatory alignment would have to consider its effect on the social benefits a regulation brings to the public. For lack of a robust alternative methodology, we had to adopt the approach taken by standard assessments of NTBs, i.e. we look at the trade cost side only. In addition, our model (as most others) does not include a proper assessment of many of the other elements of new generation trade agreements, in particular investment liberalization, the protection of intellectual property rights, or the liberalization of public procurement. Other 'side effects' of trade liberalization, such as environmental or human rights impacts are equally not taken into account. Thus, in effect, our model (as others) measures a subset of the costs and benefits of TTIP only, and, arguably, has a tendency to overestimate the benefits of trade.

We calibrate the model by using data with base year 2007 taken from the GTAP database. Trade elasticities are taken from the CEPR study, tariff equivalents for Non-Tariff Barriers (NTB) are derived from the Ecorys study (2009). Our baseline calibration is run for three different scenarios of possible outcomes of the TTIP negotiations: (i) a tariff scenario implying complete removal of all remaining bilateral tariffs, (ii) a NTB scenario, assuming a 25 percent reduction of existing NTBs, and (iii) a TTIP scenario, combining the two other scenarios.

The model delivers results with regard to (i) macroeconomic effects including employment and wages, (ii) sectoral as well as (iii) regional effects, and finally offers sensitivity analysis in order to discern the sensitivity of model results to changes in crucial parameters.

Macroeconomic effects:

Income effects: The model arrives at small gains in both the US and the EU, with the US gaining more than the EU. In the TTIP scenario, the US reaps an income gain equivalent to 0.36 percent of US GDP, the EU a gain of 0.24 percent of EU GDP. Amongst EU countries, Germany (+0.48 percent) and Italy (+0.43 percent) are the largest winners in relative terms, while Spain (+0.03 percent) and Southern & Eastern EU (SE- EU) countries (+0.07 percent) hardly profit at all. Decomposing the combined TTIP effect shows that the US gains more from tariff liberalization than the EU, while the EU, and especially Germany and Italy, stand to gain more from NTB alignment.

Employment and wage effects: with income effects on the positive side, employment effects in the US (+0.29 percent) and the EU (+0.21 percent) are positive as well. Differentiating between skill levels, results show that both skill groups gain in employment, with increases for low skill labor (EU: +0.23 percent, US: +0.29 percent) comparable to increases for high skill labor (EU: +0.18 percent, US: +0.29 percent). However, while wages for high skill labor (EU: +0.18 percent, US: +0.34 percent) gain from increased employment, low skill labor (EU: -0.06 percent, US: -0.09 percent) does not see real wage increases, reflecting the distinct bargaining power of the two skill groups. Profit rates of business show stronger increases than wage shares, both for EU and US.

Macroeconomic balances: effects on the current account, public and private balance will all be very moderate. All EU countries, except for Spain (-0.02 percent) and the SE-EU countries (-0.01 percent), will likely experience minor improvements on its current account, as will the US (+0.11 percent). Similarly, all EU countries, except for Germany, Italy and the UK, will suffer minor deteriorations in their public balance.

Sectoral effects:

Unsurprisingly, sectoral effects are most pronounced in the sectors heavily exposed to international competition, i.e. manufacturing industries. The sectors exhibiting the highest changes in value-added are motor vehicles (EU: +0.96 percent; US: +1.86 percent), and other transport equipment (EU: -0.48 percent; US: +2.41 percent). Other sectors the EU stands to gain most are other machinery, metals, and other manufacturing. While the US stands to gain across all 20 sectors, the EU gains in all but one sector that is other transport equipment. Amongst EU countries and regions, Germany seems to be the big winner in motor vehicles (+2.70 percent), while France (-0.42 percent), Italy (-0.43 percent), Spain (-0.86 percent) and SE-EU countries (-0.57 percent) are the largest losers.[1] In the short run, agriculture in some EU regions might be negatively affected by tariff and quota elimination, in particular in Germany, the UK and Northern Europe.

[1] Note: we are aware that due to the recent Volkswagen emission scandal, these results are called in question. On the other side, however, when considering that the TTIP negotiations will quite likely not be concluded within the next two to three years, the long term effects of the Volkswagen scandal may well be relatively small.

Regional effects:

While the parties to the TTIP agreement will on average reap modest gains from TTIP, third countries representing non-parties to the agreement, will quite likely be negatively affected. This holds true particularly for NAFTA countries Canada and Mexico, that stand to lose 0.29 percent of GDP, while the developing world (subsumed in the category ROW) will lose some 0.2 percent. Obviously this translates also into employment and wage losses. Except for some minor gains for NAFTA countries in a tariff liberalization scenario only, these losses also occur across sectors.

Sensitivity analysis:

All of these results depend on the baseline calibration, which presumes that firms have the upper hand in terms of labor market bargaining, and have a relatively high degree of pricing power in the product market, and that trade elasticities are excessively high, following standard GTAP assumptions. Our sensitivity analysis shows that these trade price elasticities render essentially all countries “trade dominated,” as the trade changes in response to relatively small price changes from NTB and tariff reductions are exaggerated. Different parameter regimes, aimed at portraying a “cooperative capitalism” with a high degree of product market competition but support for labor institutions, show that the results reported here should be considered a very optimistic upper bound. As the average macroeconomic results are located between 0 and 0.5 percent, and the model features a one-sided account of NTBs, it is quite possible that effects of TTIP will be negative.

Zusammenfassung

Seit März 2013 verhandeln EU und USA das Transatlantische Handels- & Investitionspartnerschaftsabkommen (TTIP). Aufgrund ihrer wirtschaftlichen Bedeutung und der weitreichenden Verhandlungsagenda stellt dies die bedeutendste handelspolitische Initiative seit dem Start der WTO Doha Runde im November 2001 dar. Die entscheidende Frage für politische Entscheidungsträger lautet dabei: Cui bono? Genauer: Was sind die zu erwartenden Auswirkungen des Abkommens auf Wirtschaftswachstum, Beschäftigung und Einkommensverteilung? In den letzten Jahrzehnten sind sog. CGE Modelle zum Standardinstrument geworden, um die Effekte der Handelsliberalisierung abzuschätzen. Diese Modelle wurden dafür kritisiert, dass sie erstens meist eine konstante Beschäftigung, ein konstantes Defizit der öffentlichen Haushalte und der Leistungsbilanz annehmen, und dass sie zweitens wichtige strukturelle Eigenheiten von Ländern nicht berücksichtigen. Damit bleiben zentrale Fragen außerhalb des analytischen Blicks.

Das gegenständliche Papier präsentiert ein strukturalistisches CGE Modell, das (a) die Auswirkungen von Handelsliberalisierung auf die Beschäftigung, die Faktoreinkommen, die öffentlichen Haushalte und die Leistungsbilanz untersucht, (b) die strukturellen Eigenheiten von Volkswirtschaften berücksichtigt, und (c) flexibel auf verschiedene Szenarien und Handelsabkommen angewendet werden kann. Das Modell wird sodann für die Abschätzung der makroökonomischen Auswirkungen der laufenden EU-USA Verhandlungen (TTIP) verwendet. Damit soll ein Beitrag zur wissenschaftlichen und wirtschaftspolitischen Diskussion zu den Auswirkungen von Handelsliberalisierung auf Wachstum und Verteilung geleistet werden.

Das hier vorgestellte Modell ist ein Multi-Sektor, Multi-Regionen Modell mit 20 Wirtschaftssektoren und 11 Regionen bzw. Ländern, und zwei Typen von Arbeitskräften (hochqualifiziert/niedrig-qualifiziert). Die empirische Datengrundlage wird durch eine Social Accounting Matrix (SAM) auf Basis von Daten des Global Trade Analysis Projekts (GTAP) bereitgestellt. Mit dem Modell können die Auswirkungen von Veränderungen tarifärer wie nicht-tarifärer Handelshemmnisse (NTB) auf die abgebildeten Volkswirtschaften untersucht werden. Einschränkend muss darauf hingewiesen werden, dass die Effekte der Veränderung von NTB nur unvollständig dargestellt werden können. Insbesondere ist eine Bewertung des sozialen Nutzens bzw. der sozialen Kosten von NTB wie z.B. Gesundheits- oder Verbraucherschutzbestimmungen nicht möglich. Stattdessen werden nur die Kostenersparnisse aus dem Wegfall bzw. der Angleichung von NTM für die Privatwirtschaft berücksichtigt. Ebenso wenig können wie bei den meisten anderen Studien die Effekte vieler anderer Elemente der neuen Generation von Freihandelsabkommen abgebildet werden. Dazu gehören unter anderem die Effekte von Investitionsliberalisierung, den Schutz geistiger Eigentumsrechte, oder andere Effekte, wie zum Beispiel Umwelteffekte oder Auswirkungen auf die Menschenrechte. Daher berücksichtigt unser Modell nur einen Teil der Effekte von Handelsabkommen und enthält eine Tendenz zur Überschätzung der positiven wirtschaftlichen Effekte von Handelsliberalisierung.

Makroökonomische Effekte:

Einkommenseffekte: Das Modell kommt zu kleinen Einkommenseffekten in der EU und den US, wobei die USA relativ mehr gewinnen als die EU. Im ambitionierten TTIP Szenario lukrieren die USA einen Einkommensgewinn im Ausmaß von 0,36% des US BIPs, die EU von 0,24% des EU BIPs. Innerhalb der EU, sind Deutschland (+0,48%) und Italien (+0,43%) die relativ stärksten Gewinner, während Spanien (+0,03%) sowie Süd- und Osteuropa (+0,07%) kaum profitieren. Eine Zerlegung des Gesamteffekts zeigt, dass die USA relativ stärker von der Zollreduktion als die EU profitiert, während die EU und insb. Deutschland und Italien mehr von der Angleichung von sog. Nicht-Tarifären Handelshemmnissen profitieren.

Beschäftigungs- und Lohneffekte: Die Beschäftigungseffekte von TTIP sind mit +0,29% in den USA und +0,21% in der EU ebenfalls positiv. Für beide in der Studie betrachteten Qualifikationsniveaus ergeben sich positive Effekte: niedrig-qualifizierte Beschäftigte (EU: +0.23%, US: +0.29%) gewinnen in ähnlichem Ausmaß wie hoch-qualifizierte Beschäftigte EU: +0.18%, US: +0.29%). Während die Löhne für die Gruppe der hoch-qualifizierten Beschäftigten (EU: +0.18%, US: +0.34) steigen, erleiden die niedrig-qualifizierten Beschäftigten aufgrund ihrer geringeren Verhandlungsmacht geringfügige Realeinkommens-einbußen ((EU: -0.06%, US: -0.09%). Die Profitraten des Unternehmenssektors zeigen sowohl in der EU als auch den USA stärkere Steigerungsraten als die Löhne.

Makroökonomische Salden: Die Auswirkungen von TTIP auf die Leistungsbilanzen, den Saldo des öffentlichen Haushalts bzw. des privaten Sektors sind generell gering. Alle EU-Länder mit Ausnahme von Spanien (-0,02%) und von Süd- und Osteuropa (-0,01%), werden voraussichtliche leichte Verbesserungen ihrer Leistungsbilanzen erfahren, ebenso wie die USA insgesamt (+0,11%). Alle EU-Länder mit Ausnahme von Deutschland, Italien und dem Vereinigten Königreich, werden leichte Verschlechterungen ihrer öffentlichen Haushalts-salden hinnehmen müssen.

Sektoreffekte:

Die Sektoreffekte sind für den Bereich der verarbeitenden Industrie am stärksten. Die Sektoren mit den höchsten Veränderungen in der Wertschöpfung sind Fahrzeuge (EU: +0,96%, USA: +1,86%), und sonstige Transportausrüstung (EU: -0,48%, USA: +2,41%). Andere EU-Sektoren mit den relativ größten Gewinnen sind Maschinenbau, Metallver-arbeitung und sonstige verarbeitete Erzeugnisse. Während die USA in allen 20 Wirtschafts-sektoren profitieren, gilt dies für die EU mit Ausnahme des Sektors sonstige Transport-ausrüstung. Innerhalb der EU-Länder scheint Deutschland im Bereich Fahrzeuge mit +2,7% am stärksten zu profitieren, während Frankreich (-0,42%), Italien (-0,43%), Spanien (-0,86%) und Süd- und Osteuropa (-0,57%) relativ starke Einbußen erleiden. Kurzfristig wird auch die EU-Landwirtschaft negativ von Zoll- und Quoteneliminierungen betroffen sein, insbesondere in Deutschland, dem Vereinigten Königreich und Nordeuropa.

Regionale Effekte:

Während die TTIP Vertragsparteien moderate ökonomische Vorteile aus dem Abkommen ziehen, werden Drittstaaten vom Abkommen negativ betroffen sein. Dies gilt insbesondere für die NAFTA-Staaten Kanada und Mexiko (-0,29% des BIPs), während die Entwicklungs-länder rund -0,2% ihres BIPs einbüßen könnten. Dies impliziert naturgemäß ebenfalls Beschäftigungs- und Lohnverluste. Mit wenigen Ausnahmen sind die Verluste auch quer über alle Sektoren gestreut.

Sensitivitätsanalyse:

Die aufgezeigten Resultate sind von einer Basiskalibrierung abhängig, die unter anderem die relativ hohen Handelselastizitäten des GTAP Projekts verwendet. Die Sensitivitäts-analyse zeigt, dass die hohen Elastizitäten das Verhalten des gesamten Modells stark dominieren, indem kleine Veränderungen von Zoll- und NTB-Reduktionen zu übertriebenen Handelsreaktionen führen. Alternative Kalibrierungen mit dem Ziel, einen „kooperativen Kapitalismus“ mit einem hohen Grad an Produktmarktwettbewerb und kooperativer Lohnbildung zu porträtieren, zeigen, dass die gezeigten Ergebnisse als optimistische Obergrenze anzusehen sind. Mit makroökonomischen Resultaten zwischen im Durchschnitt 0 und 0,5%, und einer einseitigen Betrachtung von NTB als Kostenfaktor, ist es durchaus möglich, dass das Gesamtresultat von TTIP auch im negativen Bereich zu liegen kommt.

1. Introduction

The *Transatlantic Trade and Investment Partnership* (TTIP), currently under negotiation between EU and US, it touted as a harbinger of recovery: free trade between two of the largest and most developed economies of the world is supposed to bring about growth and, with it, jobs. A number of studies have been put forth. Most models generate headlines about small but positive gains, and support the desire of business and political elites to conclude a far-reaching agreement. Prominently among these studies are applications of models that are based on the assumption that everybody who wants to can find a job, and that public deficits are always in balance.

For anybody who has opened the newspaper within the last decade or so, this is obviously an unrealistic assumption. There is an increasing amount of people on both sides of the Atlantic that is unable to find a job, and do so not for lack of skill or education, but lack of demand. There are as well many governments that have been forced by the prevailing economic orthodoxy to seek balanced books, but are, despite ever more exasperated efforts, missing targets.

The defense of models based on a "full employment" assumption tends to fall along the lines, first, that free markets generate optimal outcomes, and, second, that *on average, over a few decades, the employment-to-population ratio is stable*. The first claim is driven more by ideology than sound science. There are many instances, when markets do not deliver optimal outcomes. But, yes, the employment rate, abstracting from demographic changes, is quite stable in advanced countries. It does as well, however, show significant medium term trends. Crucially, it is the single most important indicator for decision makers and the general public to consider, when making long term, potentially impactful changes to the trade and investment policy regime. Under such circumstances, it seems wrong to rely on models that assume full employment.

In this paper, we offer an alternative assessment of TTIP. We put forth a simple model that is in many ways quite similar to 'standard' models, but differs fundamentally in the key assumption. We do not assume that labor markets clear through price adjustments. In other words, we do not assume that real wages fall until everybody who wants to, has a job. Over the relevant time horizons, such adjustment mechanisms are not observed. In contrast, everybody is most interested in exactly these effects: How does TTIP affect demand and employment across countries and sectors?

Thus, we use a model that describes – like others – the global economy (in eleven countries and regions), its multi-sectoral linkages (in twenty sectors), and the economic effects on two labor skill types. The model builds on a structure of tariff and non-tariff barrier policy instruments that is conceptually similar to the standard models. However, in sharp contrast, our model features demand-driven output and employment. It does not arbitrarily and incredibly presume that markets work perfectly over any time horizon, but instead highlights the income and expenditure changes that result from policy changes due to TTIP.

It should as well be emphasized, however, what our model – like the others – cannot do. Most importantly, all of the models that have been put forth with regard to TTIP consider *non-tariff barriers (NTBs)* a "bad." [2] In other words, in these models, there is no upside to a regulation. A regulation merely, and always, reduces opportunities for trade. We do, however, know that that is not the case: most regulations aim at serving the public interest and, certainly, many do. Reducing regulations might reduce the cost of doing business, and

[2] There is a discussion on the importance of these issues under different scenarios: whether regulations are harmonized, or mutually recognized, or eliminated. We cannot know now which would be the case, but we do know that political and business elites in the EU as well as the US seek to reduce the costs of doing business – in that endeavor, the social benefits of regulations hardly tend to play a role (see e.g. Myant and O'Brien 2015).

might enhance opportunities for trade, but the original gains to the public from the regulation are not even on the ledger! Thus, at best, such models (and ours) measure a subset of the costs and benefits of TTIP, and, at worst, grossly overestimate the benefits. That said and keeping that in mind, the next section discusses the model in some more detail. Further below, we present detailed simulation results.

2. Model description

The model falls within the general category of empirical economy-wide models, often labeled, slightly misleadingly, Computable General Equilibrium (CGE) models. A CGE model is based on a Social Accounting Matrix (SAM), which depicts detailed data on relations of production and distribution between main socio-economic agents in an economy. The model adds behavioral relationships to the accounting; econometric evidence is applied to calibrate relevant parameters. Crucially, key assumptions about the underlying causal mechanisms – often labeled model closures – have a large impact on model results. Given (1) the accounting relationships of the chosen regional and sectoral aggregation, (2) behavioral functions and (3) closures, the complete model can then be used to calculate counterfactuals in response to assumed shocks and policies. Below we outline key features of the model.[3]

Output and income are determined by aggregate demand. Standard CGE models assume full employment, which requires Say's Law, where all available savings are channeled into productive investment. In other words, savings generates investment. Keynes' principle of effective demand rests on the reverse causality: investment into productive capacity generates income, which in turn generates increased savings (which can be profits as well as wages). Income generation from the initial expenditure expansion occurs through a multiplier-accelerator process. Outlays are financed by an accommodative financial system – which is not modeled – and the savings generated will adjust to the new macroeconomic equilibrium. In other words, investment generates the savings necessary to finance itself.

The production technology is assumed to feature fixed proportions with underutilized resources. Installed capital equipment features excess capacities, as firms retain capacity margins to respond to variations in demand and to deter entry of competitors. The labor market features involuntary unemployment, as workers are idle not due to a presumed optimal trade-off of work and leisure at the offered real wages, but are idle due to a lack of employment opportunities. The implicit assumption is that the economy is not supply constrained, but demand constrained: If demand increases, the installed capital stock would be utilized at a higher rate, and labor demand would increase.

Labor productivity increases with demand through several channels. First, higher demand allows for improvements of the production process and learning-by-doing. In the oldest example, by Adam Smith, production of pins per worker skyrockets once higher demand provides opportunities for the division of labor. (This is commonly labeled Kaldor-Verdoorn Law.) Second, labor hoarding and overhead labor lead to increases in labor productivity. If firm's hoard labor, not all workers will be hired and fired with cyclical swings in demand. It is more efficient to retain a (significant) proportion of unnecessary labor, as hiring (search), training and related adjustment costs outweigh saved wage costs. Due to similar efficiency considerations, firms do not desire high turnover of supervisory staff (overhead labor). (Productivity effects through labor hoarding and overhead labor are commonly labeled Okun's Law.) Through all of these channels, labor productivity rises with demand.

[3] For discussions of the general modeling approach, see Pyatt (1988), Robinson (2003), as well as Taylor (1983, 2004, 2011).

Aggregate labor demand is determined by the interplay of aggregate demand and aggregate productivity growth. Put simply, job creation depends on the strength of demand relative to the strength of productivity increases, which change the labor requirements implicit in the production technology. The implicit assumption is that labor supply is elastic. Importantly, the differential strength of productivity effects across sectors leads to reallocation effects. To illustrate, suppose demand rises by the same proportion in all sectors. Those sectors with stronger productivity effects would see weaker employment gains than other sectors. Thus, our model features inter-sectoral reallocation effects.

Product markets are imperfectly competitive, and output prices are mark-ups on nominal unit labor costs. Products, in turn, are imperfect substitutes. Thus, firm's pricing power derives from the fact that their products are differentiated. Put differently, firms have a degree of price-setting power, rather than being simply price takers: The existence of excess capacity implies that firms do respond to rising demand with rising production. They do so, however, at prices that reflect their evolving cost structure.

The distribution of factor income is modeled as the outcome of a social bargaining process. In neoclassical theory, the production technology and profit maximization together imply that the firm employs factors such that their 'rental rates' are equal to their marginal productivities. These mechanisms do not apply here since the economy is not at the efficient frontier. In sharp contrast, we model the factor distribution of income as the outcome of social conflict: Workers bargain for nominal wages, and firms in imperfectly competitive markets set prices. The relevant parameterizations – informed by empirical evidence – then describe how real (product) wages respond to changes in employment rates and demand conditions. The labor share of income, in turn, is of course the ratio of the real wage to labor productivity. The labor share of income thus changes in accordance with the nominal wage bargain, firm's price setting, and endogenous changes in labor productivity.

Imports and exports are functions of relative prices and demand. Hence, aggregate demand depends in standard fashion on global demand through the export channel. Increases in firm's costs – for example through increases in nominal unit labor costs – are passed on to supply prices, which (*ceteris paribus*) implies a reduction in external demand as competitiveness is reduced. Crucially, the trade structure is modeled bilaterally, so that the existing trade linkages across countries (and sectors) are explicitly modeled. Trade costs, driven as well by non-tariff barriers (NTB), enter these bilateral import costs: A reduction in NTB decreases supply prices, which in turn improve competitiveness in the relevant countries vis-à-vis all other countries and regions.

The sectoral aggregation builds on the oft-cited studies from Ecorys and CEPR.[4] Crucially, we take the estimates of non-tariff barriers, the applied trade price elasticities as well as the scenario design as our starting point. However, Ecorys features fifteen sectors; our model has twenty. We adjust non-tariff barriers to reflect this expansion in sectoral detail.

The regional aggregation emphasizes major economic blocs and regions as well as selected countries of interest. The US is, of course, modeled separately, as are the five largest EU countries: Germany, France, Italy, Spain and UK. The remaining EU countries are separated into a "northern" and a "southern and eastern" bloc. The Northern EU (N-EU) comprises Austria, Belgium, Denmark, Finland, Ireland, Luxembourg, Netherlands and Sweden. The Southern & Eastern EU comprises Cyprus, Czech, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia, Bulgaria, Croatia and Romania. Remaining "NAFTA," other "OECD" and the rest of the world ("ROW") build the remaining three regions.

[4] The CEPR report is listed in the references as Francois et al. (2013), and the Ecorys study as Berden et al. (2009).

2.1. A sketch of the model: The effects of liberalization

As the foregoing discussion outlines, the logic of the model is quite straightforward: A reduction in a trade barrier reduces costs, which reduces prices. The price reduction favors consumption and exports, so that aggregate demand rises. As aggregate demand rises, employment rises, which pulls up wages and therewith prices. Thus, Changes in output and employment depend crucially on how far prices fall and how strongly sectoral demand levels and productivity respond thereto.

We can briefly sketch the main linkages as follows. Suppose we have a small open economy, where the time rate of change in aggregate demand is

$$\dot{Y} = I - s(p)Y + G - t(b)Y + e(p)Y^* - m(p)Y, \quad (1)$$

where Y is real GDP, a "dot" denotes the time derivative $\partial Y / \partial t$, I is the flow of investment, s the macroeconomic savings rate, G public expenditures, t the rate of public revenue generation, e the export share of foreign (or world) real GDP Y^*, and m is the import share.

The three differences on the right hand side represent private, public and foreign "net borrowing flows." A positive net borrowing flow is equivalent to a demand injection, a negative to a demand leakage. At a macroeconomic equilibrium – where the time rate of change of output is zero, $\dot{Y} = 0$) – the three balances must add to zero. The data of national accounts is constructed to satisfy the restriction that $\dot{Y} = 0$. The task here then is to see how the system responds to shocks.

The savings rate s, the export rate e and the import rate m are functions of the price level p. The savings rate depends on the functional distribution of income: profits are saved at a higher rate than wages. The share of wages in total income, in turn, is by definition inversely related to the price level, so that $s_p > 0$. A *reduction* in the price level (due to liberalization) then has a negative effect on s, which implies an increase in the multiplier, and an increase in consumption.

The export rate e is a function of relative prices. For brevity, we focus here on the domestic price level. An increase represents a loss in competitiveness, and hence a decrease in exports ($e_p < 0$). Similarly, the import rate increases in the price level, since the implicit real appreciation draws in foreign products ($m_p > 0$).

The "tax rate" t is a positive function of the trade barrier b, so that $t_b > 0$. A reduction in, say, tariffs, reduces public revenues. At given expenditures, this implies an increase in the net borrowing flow of the government, and thus a demand injection. (This is a bit of a simplification, but what matters for this sketch of the model here is the sign of the derivative.)

The privel level p is driven largely by nominal unit labor costs. A cost margin such as a tariff, however, increases prices, so that we can write the time rate of change of the price level as

$$\dot{P} = \pi(w(Y), b) - P. \quad (2)$$

Here, $w(Y)$ depicts nominal unit labor costs. $w_Y > 0$, since higher demand drives employment, and a tighter labor market will allow for stronger wage claims. The cost margin b increases prices, $\pi_b > 0$.

For brevity's sake, let us assume that there exists an equilibrium level of output $\bar{Y} = 1, \bar{P} = 1$ (as well as $\bar{Y}^* = 1$). The stability of this two–dimensional differential equation system can then be assessed through the following Jacobian, which is evaluated at that equillibrium:

$$J \equiv \begin{bmatrix} -(s+t+m) & e_p - s_p - m_p \\ \pi_w w_Y & -1 \end{bmatrix} \tag{3}$$

The sign pattern of this Jacobian is such that its trace is always negative, and its determinant always positive. With that, the model is dynamically stable.

The effect of a change in the policy parameter b can now be considered with a simple comparative static exercise. (Note that the right hand side of the dynamic equations define implicit functions of Y and P, respectively.) With $|J| > 0$, the sign of the partial of real GDP at the equilibrium with respect to the parameter b will depend on the determinant

$$-t_b + (e_p - m_p - s_p)\pi_b < 0, \tag{4}$$

which is always negative given the assumed signs: a reduction in, say, a tariff, implies a demand injection via expansionary fiscal policy, and triggers an increase in consumption and net exports due to the lower prices. Crucially, the size of the latter effect depends on the degree to which liberalization is passed on to output prices. Especially for non–tariff barriers, the rate of pass–through might be limited.

On the price side, the sign of the partial of the price level at the equilibrium with respect to the parameter b depends on

$$(s+t+m)\pi_b - t_b \pi_w w_Y, \tag{5}$$

where both first and second term are positive. The sign therefore depends on the relative magnitude of the partials: The cost reduction puts downward pressure on the price level, but the implied demand injection leads to employment and wage increases that counterbalance it.

Thus, in summary, demand determines output, and employment follows output and drives prices via wages. Cost reductions through liberalization might or might not lead to falling prices overall, but will tend to have positive domestic and external demand effects.

In a multi–country world, that is not necessarily the case. A similar exercise as above can be drawn up with two countries, and shows that the effects on real GDP in both countries will depend on the expenditure propensities and, crucially, trade price elasticities. Further, in a multi–sector model, the effects will depend on the distribution of output and income generation across sectors. Importantly, even if both countries gain from liberalization, one country will be the *relative* loser.

As in standard neoclassical models, these differential effects depend on the economic structure. However, in sharp contrast to neoclassical models, they are not constrained by a full employment assumption. With a full employment assumption, the downsides of liberalization are effectively eliminated.

More details on the model, including the main equations, can be found in the Annex II.

2.2. Database, model calibration and scenario design

This section provides further detail on the data feeding into the model, on the calibration (i.e., trade price and other elasticities) as well as scenario design. To a large degree, sources and structure of data and scenarios are prepared with regard to widely cited studies on TTIP, including Ecorys (2009) and CEPR (2013).

First, the database builds on the Global Trade Analysis Project (GTAP) that offers data on 57 sectors and up to 129 countries and regions. The GTAP data are aggregated into twenty sectors and eleven countries and regions. In contrast to other studies, we have chosen to disaggregate the EU into five countries (Germany, France, Italy, Spain and UK) and two regions ("Northern" and "Southern & Eastern" EU). The first five countries are simply the largest economies, and have weight in the world economy by themselves. The remaining countries were split according to their net export position. Many SE-EU member states had large current account deficits, and were thus grouped together. The US is of course listed as an individual country, and its NAFTA partners Mexico and Canada build one further region. "Other OECD" groups remaining relatively advanced economies, and "ROW" (for rest of the world) collects all other countries contained in GTAP. There are thus eight TTIP partners – seven EU countries and regions and the US – and three non-TTIP regions (NAFTA, OECD, ROW). The sectoral disaggregation refers to CEPR (2013) in which GTAP and ISIC sectors are mapped into twenty model sectors (see also Table A in Annex I). Table 1 shows selected statistics of the data based on GTAP 8 with the base year 2007, which is identical to the database used in Ecorys (2009) and CEPR (2013). The GTAP SAMs are adjusted with IMF World Economic Outlook data for 2007 on general government and current account balances in order to integrate flows of funds within our SAMs.

Table 1: Selected base year macroeconomic statistics

		GDP	Share of world GDP	Share of EU GDP	Share of world exports	Share of EU exports	Cons. share of GDP	Invest. share of GDP	E-M	G-T	I-S
1	**Germany**	2,439	5	20	9	23	69	25	8.9	-0.3	-8.6
2	**France**	1,698	4	14	4	11	77	33	-3.3	3.7	-0.3
3	**Italy**	1,530	3	12	4	9	74	30	-2.3	2.0	0.3
4	**Spain**	1,113	2	9	2	6	68	40	-9.5	-2.5	11.9
5	**UK**	2,159	5	17	4	11	75	23	-5.4	3.6	1.8
6	**Northern EU**	2,099	5	17	11	28	60	31	6.4	-1.9	-4.5
7	**SE-EU**	1,346	3	11	5	12	78	33	-12.0	3.5	8.5
8	**USA**	11,788	26		9		82	23	-7.1	3.7	3.3
9	**NAFTA**	2,050	5		5		67	26	1.8	-0.4	-1.4
10	**Other OECD**	7,126	16		14		65	28	2.4	-0.2	-2.2
11	**ROW**	12,067	27		34		55	30	6.2	-1.3	-4.9

The table shows selected statistics for the base year data of the eleven model countries and regions. GDP in the first column is given in factor costs in billion US$. The last three columns indicate the three institutional actor's "net borrowing flows" relative to GDP. E-M is the current account relative to GDP. G-T represents the public balance relative to GDP, and is positive if the government runs a deficit. I-S is the private sector's net borrowing balance, as the difference between investment and savings. Source: Calculations based on GTAP 8 and IMF WEO.

Although the twenty eight EU countries in aggregate obtain the highest share of world GDP with twenty seven percent, the single EU countries and regions are significantly minor to the US economy in terms of value added. Within the EU, GDP shares range from nine percent of total EU GDP in Spain to twenty percent in Germany. Significant divergence, however, is notable with respect to macroeconomic balances with SE-EU countries as well as the UK and Spain running current account and, partly, governmental deficits, whereas Germany and Northern European countries were net exports and had structural governmental surpluses.

Importantly, the US shows the highest consumption share of all country aggregates, meaning that investment and trade were minor contributors to US GDP. In 2007, the US reported a current account deficit of more than seven percent of GDP.

The detailed trade flows can be seen in Table B and Table C (see Annex I) which show the base year trade flow matrix and import shares, respectively. Importantly, these two tables document the tight trade linkages between EU members. As intra-EU exports account for almost two thirds of total exports of all twenty eight EU countries, the share of total EU exports targeted to the US is comparably low with around eight percent. Nevertheless, the US is an important trade partner for certain EU countries and specific sectors within these countries. It is also important to note that the US had trade deficits with all other model countries and regions, except for Spain in 2007.

Table 2: Summary of trade barriers and trade elasticities

Sector	Trade price elasticity	*EU barriers against US Imports*		*US barriers against EU imports*	
		NTB	Tariffs	NTB	Tariffs
Agr forestry fisheries	4.8	18.9	3.5	24.4	3.6
Other primary sectors	12.1	-	0.0	-	0.0
Food and beverages	2.5	56.8	13.9	73.3	3.1
Chemicals	5.1	13.6	2.1	19.1	1.1
Electrical machinery	9.7	12.8	0.6	14.7	0.3
Motor vehicles	10.0	25.5	8.0	26.8	1.2
Other transport equipment	7.1	18.8	1.3	19.1	0.1
Other machinery	9.7	15.7	1.2	17.4	0.8
Metals and metal products	13.9	11.9	1.6	17.0	1.3
Wood and paper products	8.0	11.3	0.5	7.7	0.2
Other manufactures	6.6	15.7	2.8	17.4	3.9
Air Transport	3.8	2.0	-	2.0	-
Water Transport	3.8	8.0	-	8.0	-
Finance	2.0	11.3	-	31.7	-
Insurance	3.2	10.8	-	19.1	-
Business and ICT	3.2	14.9	-	3.9	-
Communications	3.2	11.7	-	1.7	-
Construction	4.2	4.6	-	2.5	-
Personal services	8.7	4.4	-	2.5	-
Other services	3.9	4.4	-	4.4	-

Source: Calculations based on GTAP 8 and CEPR (2013, p. 20 and p.31)

Table 2 reports sectoral trade barriers for both tariffs and non-tariff barriers (NTBs). Tariffs apply only for goods and are derived from the GTAP databases in which tariffs are given as price wedges between the value of domestic use of imported goods and the import values plus transportation margins for all model countries and sector. On an EU level, the highest tariff rates against imports from the US are applied for processed foods (13.9 percent) and motor vehicles (8.0 percent). While all other EU sectoral tariff rates are comparably close to the US tariff barriers ranging from close to zero to 3.6 percent, the tariff protection of EU members in the processed foods and the motor vehicles sectors are more than four or even eight times higher than US tariffs. Even though the expected gains from an elimination of bilateral EU-US tariff barriers are small due to the average low level of tariffs rates, there still exists some substantial protection in form of traditional tariffs for certain EU sectors.

Given the low level of bilateral tariff rates, a focus of the TTIP negotiations is on the reduction of NTBs, arising for instance from regulatory divergence. Given the difficulties to measure these mostly unobservable barriers and for the sake of comparability with other TTIP studies, we rely on Ecorys (2009) – as does CEPR (2013) – as source for ad valorem tariff equivalents of NTBs. However, we want to emphasize the methodological weaknesses of the Ecorys study as discussed in Raza et.al. (2014). One key issue here is that the Ecorys-estimates of NTBs are likely biased upward. Since their reduction manifests as "gains from trade" in the applied models, these gains are likely biased upward, too.

NTBs apply to all sectors including services sectors. Ecorys data indicate that NTBs in the service sectors in the EU and the US are generally lower than in agricultural and manufacturing sectors, with the exemption of the US finance and insurance sectors.[5] Highest protection levels via NTBs are perceived in the processed foods sector (56.8 percent in the EU and 73.3 percent in the US) and motor vehicles (more than 25 percent in both TTIP partners). NTB rates diverge significantly between the EU and the US in certain sectors, however, which has important implications on the simulation results.

Table 2 lists as well trade price elasticities. These are taken from CEPR (2013). The most important observation here is that the average magnitude of these elasticities is *very high*. Standard trade policy models have been criticized for their use of exaggerated elasticities. The issue is that higher elasticities produce higher gains from trade, for the simple reason that price reductions due to the removal of trade barriers trigger stronger trade responses when elasticities are high. However, lower – and empirically more plausible – elasticities are unable to generate trade flow changes in these models that correspond to historically observed trade growth.[6] For the sake of comparability, we are using the GTAP/CEPR elasticities for our baseline calibration. As we will see further below, our model is as well quite sensitive to different trade price elasticities.

Table D lists further crucial parameters. These concern, first, the core of the price-distributive system, and second, the distribution of non-tariff barriers. The core of the price distributive system is described by (1) formation of the nominal wage, (2) determination of labor productivity and (3) price setting of firms.

The nominal wage is the outcome of a social bargaining process, and the arguments put forth in that process are four: employment as a proxy of the tightness of the labor market, the price level as a proxy of 'what the nominal wage can buy,' labor productivity as a proxy of 'what worker's effort is contributing,' and the import share as a proxy of the degree of foreign competition that domestic labor faces. Table D lists elasticities for all four variables for the two labor skill types.[7] The implicit assumption is that high-skill labor is able to bargain for higher nominal wages when demand for high-skill labor rises, is able to demand compensation for real wage erosion from inflation, and is able to share in the gains from productivity growth. Low-skill labor, in contrast, does benefit less from a tightening labor market, and does see its nominal wages diminished with rising foreign competition. Labor productivity is driven by output through Kaldor-Verdoorn as well as "Okun"-effects.

[5] Following the sectoral disaggregation by CEPR (2013), NTBs are initially mapped according to Table 2 in CEPR (2013, p.20). However, we include NTBs that are not part of CEPR (2013). For the agriculture sector we assume NTBs as high as one third of the NTBs in processed foods. In other manufactures and other machinery the average of NTBs in all other manufacturing sectors are applied. Thus, our model results might even be exaggerated compared to the CEPR study with respect to this parameter.

[6] Of course, one might not expect these models to be able to capture trends. However, the "Bertelsmann study" elaborated by the ifo institute (Felbermayr et al 2013) and other related research were expressly designed to capture trends.

[7] Skill levels are differentiated in GTAP based on International Labor Organization (ILO) occupational classifications. High skilled labor consists of managers and administrators, professionals, and para-professionals. Low-skilled labor includes trades-persons, clerks, salespersons and personal service workers, plant and machine operators and drivers, laborers and related workers, and farm workers (Dimaranan/Narayanan 2012).

Lastly, the mark-up on nominal unit labor costs is *relatively* fixed. Changes in nominal unit labor costs are largely passed on to value added prices, and from there to output prices. A lower elasticity here reflects the assumption that product market competition does not play out via prices, but via marketing campaigns and product characteristics. In line with that, the pass-through from a reduction in (rent-generating) non-tariff barriers to prices is as well limited.

That brings us to the non-tariff barriers. In CEPR it is argued that there are two types of them – a *rent-generating* non-tariff barrier, and a *cost-generating* non-tariff barrier. The former provides a degree of protection against competition, and thus allows firms to charge higher prices. Income, i.e. profits, from these higher prices are the rents this barrier has generated. Removal of these barriers lowers prices, but it does as well lower profits. Other non-tariff barriers generate *only costs*; in other words, their removal promises a "pure efficiency gain." An example might be regulations that produce the same outcome, but are different, and therefore generate costs for compliance.

Consider, for example, some machine safety standards. Suppose that TTIP leads to harmonization or mutual recognition of these standards. In other words, manufacturers would not any longer have to comply with the differing standards of the importing country. As the argument goes, a pure efficiency gain is to be had! However, does not the manufacturer employ and pay somebody for a certain number of hours to figure out how to comply with those differing standards? Do not these costs increase prices? Put simply, why would there be *costs* that do not have an *income* equivalent?

These cost-generating non-tariff barriers are introduced in the standard GTAP trade policy model as *iceberg* costs, with reference to the notion that one has to ship out more units than have been ordered, since a portion of them will melt away en route. In order to implement these in a balanced accounting system – which any model such as GTAP or ours will be built around – they have to have a price and quantity dimension. More importantly, removal of iceberg costs of this kind guarantees strong gains from trade as long as trade price elasticities are assumed to be "high enough." As has been mentioned above, they certainly tend to be. CEPR (2013) assumes the share of rent-generating non-tariff barriers to be forty percent. Given the limitations and possible bias of the "iceberg" approach, we are using a higher rent-generating share of seventy-five percent. Concomitantly, our share of iceberg costs is only twenty-five percent.

Lastly, let us consider scenario design. We are using three different scenarios which are close to the CEPR set-up:

- **Tariff scenario**: This scenario assumes full tariff liberalization between US and EU. Non-tariff barriers remain unchanged.
- **NTB scenario**: This scenario assumes that the estimated non-tariff barriers shown in Table 2 are reduced by twenty-five percent.
- **TTIP scenario**: This scenario combines the tariff and non-tariff scenarios. Tariffs are removed completely, and non-tariff barriers are reduced by twenty-five percent.

3. Simulation results

This section presents detailed simulation results. The first part focuses on macroeconomic indicators for all model regions. The second subsection presents detailed sectoral results with respect to changes in value added, employment as well as real and nominal wages.

All results in the first and second part of this section are reported for the baseline calibration described above and refer to changes relative to the base year 2007. In order to account for uncertainties regarding parameter estimates, we close with a discussion of the sensitivity of the model to various parameters.

Overall, positive but small effects on GDP growth in the EU and the US are estimated. However, model outcomes depend crucially on the different scenarios, and show large divergences in several dimensions: among regions, among single EU countries, among TTIP-members and ROW and among sectors within a country. Thus, the average effect on an aggregate level within a country or region appears to be positive but certain sectors or groups of employees might be negatively affected.

In contrast to the conventional design of widely cited TTIP studies, we account for the potential influence of variations in certain parameters. Based on sensitivity analyses, the positive impact of a TTIP on the negotiating members can be confirmed. However, it is also revealed that all TTIP members might see losses in real wages of low-skilled workers with a high probability in our model.

3.1. Macroeconomic results

This section presents detailed simulation results for all three scenarios in all model countries and regions with a focus on macroeconomic measures. The simulations employ the baseline calibration. Additional tables and figures for results can be found in Annex I.

Table 3 shows changes in macroeconomic balances, which is an innovative element of our study, given that commonly used CGE trade models assume unchanged government (and private) deficits. For each scenario, changes in foreign (E-X), public (G-T) and private (I-S) balances are presented. The tables report the difference between the balance-to-GDP ratio of the simulation to the equivalent base year measure; see the caption for details.

Table 3: Changes in macroeconomic balances

		Tariff scenario			**NTB scenario**			**TTIP scenario**		
		E-M	**G-T**	**I-S**	**E-M**	**G-T**	**I-S**	**E-M**	**G-T**	**I-S**
1	Germany	-0.01	0.05	-0.03	0.19	-0.10	-0.08	0.17	-0.04	-0.13
2	France	-0.04	0.05	-0.01	0.08	-0.04	-0.03	0.03	0.01	-0.04
3	Italy	0.11	-0.04	-0.07	0.10	-0.05	-0.05	0.23	-0.10	-0.13
4	Spain	-0.03	0.04	0.00	0.03	-0.01	-0.01	-0.02	0.04	-0.01
5	UK	-0.03	0.04	-0.01	0.10	-0.06	-0.04	0.07	-0.01	-0.06
6	Northern EU	-0.06	0.08	-0.02	0.13	-0.08	-0.05	0.06	0.01	-0.07
7	SE-EU	-0.04	0.05	-0.01	0.04	-0.02	-0.02	-0.01	0.04	-0.03
8	USA	0.06	0.00	-0.06	0.03	-0.01	-0.02	0.11	-0.01	-0.10
9	NAFTA	0.02	-0.01	-0.01	-0.15	0.06	0.09	-0.13	0.05	0.07
10	Other OECD	-0.02	0.01	0.01	-0.07	0.03	0.04	-0.09	0.04	0.05
11	ROW	-0.02	0.01	0.01	-0.07	0.02	0.04	-0.09	0.03	0.06

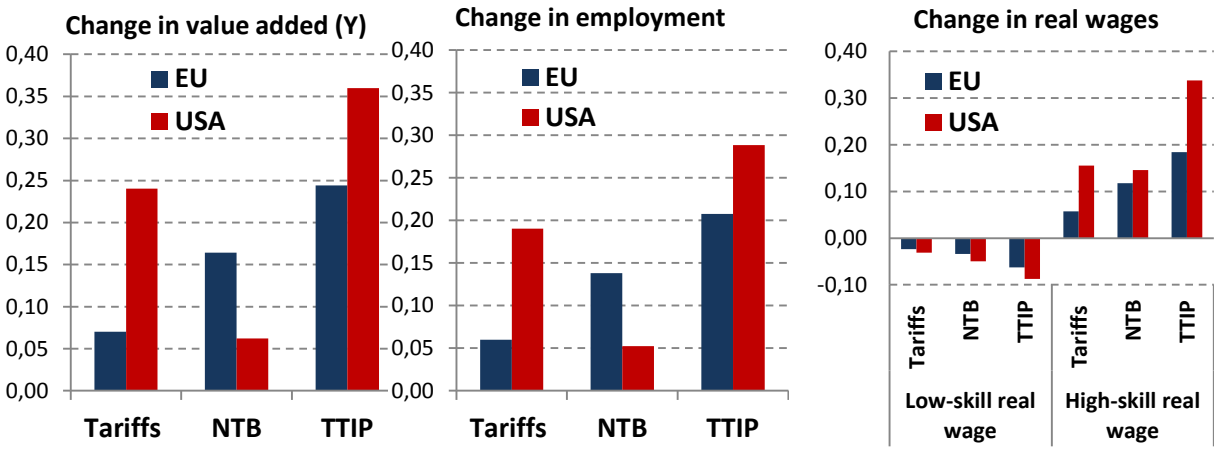
The table reports changes in macroeconomic balances relative to GDP for all three scenarios in percentage points. For example, in the tariff scenario net exports relative to GDP in Germany decreased by 0.01 percent compared to the base year.

A first conclusion is that the effects are relatively small, also in the most comprehensive TTIP scenario. The maximum change in the foreign balance occurs in Italy with an improvement of the current account relative to GDP by 0.23 percent. Typical patterns are noticeable in the single scenarios. In the tariff case, the tariff removal affects public balances negatively (difference between G and T widens and net borrowing increases) if not counterbalanced by a sufficiently strong gain in net exports (see Italy and USA).

Outcomes in the NTB scenario are generally more pronounced, specifically in EU countries (positively) and non-TTIP regions (negatively). The large current account surplus regions Germany and Northern Europe seem to benefit most from NTB reductions in terms of changes of the foreign balance. In the TTIP scenario, the former two policy shocks are combined showing that the net effects on foreign and public balance are mixed among TTIP regions and generally negative for non-TTIP regions. Using the private balance as an indicator of the liberalization effects reveals that TTIP has a positive impact on the TTIP-economies. Investment is exogenous, but the 'leakage' increases with higher output – causing the balance (I-S) to decline in all TTIP-countries in all three scenarios with baseline calibration.

Detailed macroeconomic results are presented in Table E and F (see Annex I) and Figure 1 also summarizes changes in value added, employment and real wages by skill level. Although tariff cuts have an initial negative impact on government budgets, the direct price reduction favors consumption and exports in our model. There is a positive effect in the US given its high consumption share. However, the key issue here is that full tariff liberalization is unbalanced, since remaining rates of protection are much higher in the EU than in the US (see as well the improved terms of trade (TOT)).

Figure 1: Selected scenario results



Changes in percentage points with baseline calibration.

Among the EU member states, Italy benefits most from tariff cuts due to its trade structure with the US. Changes in employment follow directly from changes in value added and are the most positive for Italy, USA and Germany. However, if we quite realistically assume that tariff removal will be implemented rather instantaneously after the conclusion of the agreement, while implementation of NTB alignment will occur only over the medium to long-term, it becomes clear that for most TTIP members the short-term effects will be almost negligible.

In the NTB scenario the outcome is reverted and the EU in aggregate shows stronger growth in GDP than the US. The strongest effects are obtained for Germany with the highest changes in bilateral exports as the terms of trade improve significantly. Although employment follows growth, the wage bargaining process leads to slightly negative changes in real wages of less skilled employees despite a declining consumer price index (CPI). On the US side, benefits from NTB reductions are moderate as the liberalization is stronger due to the initially higher NTB levels compared to the EU. In other words, EU exports to the US benefit more from larger price reductions than vice versa. However, as TTIP will, under its chapter on regulatory cooperation, set up an institutional structure that will start to operate only upon the conclusion of the agreement, the impacts of NTB alignment are quite likely to emerge only over the medium to long-term. It should also be added that NTB alignment is ultimately not a technical, but a political process, where success in not guaranteed but subject considerable uncertainty.

In Table 4, the results for the combined trade policy shocks – the TTIP scenario – are presented. The outcomes are generally larger than the sum of the changes in the former scenarios due to non-linear reactions of trade flows on price reductions (see also Table G, Table H and Table I in Annex I) and the subsequent effects. Overall, the US would profit more from liberalization in terms of value addition (0.36 percent), employment (0.29 percent) and real wages (0.10 percent) given our baseline calibration.

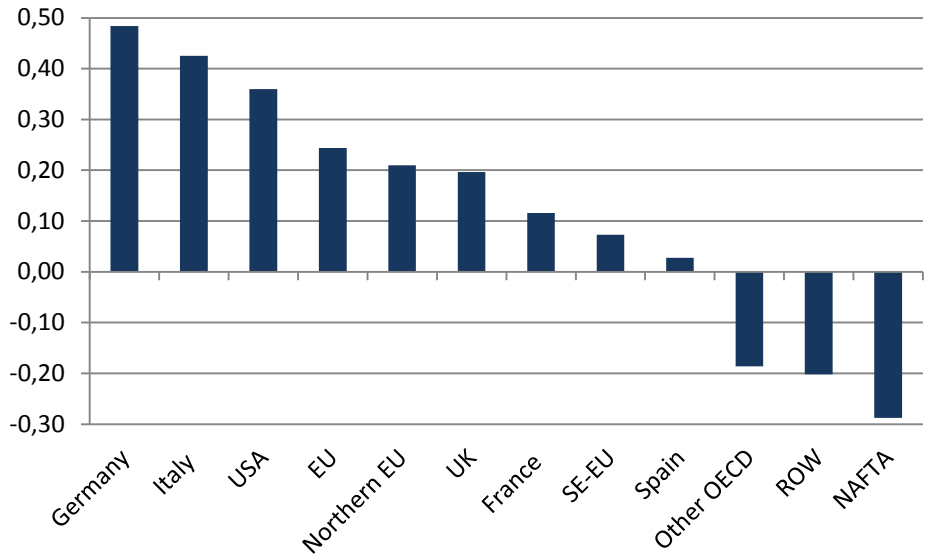
Table 4: Selected model output: TTIP scenario

	GDP	Net Exports	Bilat. Exports	TOT	Profit rate	Wage share	Employ-ment	Real wage	Low skill	LS real wage	High skill	HS real wage
Germany	0.48	0.02	32.34	0.46	0.39	0.03	0.44	0.05	0.46	-0.16	0.39	0.37
France	0.12	0.01	21.84	0.12	0.10	0.01	0.10	0.04	0.11	-0.03	0.08	0.12
Italy	0.43	0.10	32.50	0.43	0.39	0.05	0.38	0.09	0.42	-0.04	0.32	0.28
Spain	0.03	0.00	18.47	0.03	0.02	0.01	0.02	0.02	0.03	-0.02	0.01	0.07
UK	0.20	0.01	17.55	0.20	0.17	0.01	0.17	0.05	0.18	-0.05	0.15	0.18
Northern EU	0.21	0.01	18.99	0.21	0.21	0.00	0.15	0.06	0.17	-0.03	0.14	0.17
SE-EU	0.07	0.00	25.03	0.08	0.06	0.01	0.06	0.03	0.08	-0.01	0.04	0.09
EU	**0.24**	**0.09**	**20.87**	**0.24**	**0.19**	**0.02**	**0.21**	**0.05**	**0.23**	**-0.06**	**0.18**	**0.18**
USA	**0.36**	**0.01**	**28.01**	**0.36**	**0.29**	**0.02**	**0.29**	**0.10**	**0.29**	**-0.09**	**0.29**	**0.34**
NAFTA	-0.29	-0.08	0.00	-0.28	-0.29	0.00	-0.23	-0.06	-0.23	-0.02	-0.21	-0.12
Other OECD	-0.19	-0.04	0.00	-0.19	-0.19	0.00	-0.15	-0.04	-0.15	-0.02	-0.15	-0.09
ROW	-0.20	-0.02	0.00	-0.20	-0.20	-0.01	-0.16	-0.04	-0.17	-0.02	-0.15	-0.09

All numbers are growth rates in percentage points. For example, Germany's GDP rises by 0.48 percent compared to the base year. The second column shows the growth rate of net exports, the third the growth rate vis-à-vis the other trade agreement partner country – i.e., France's export to the US grow by 21.84 percent. The remaining columns report statistics on employment and real wages for low (LS) and high (HS) skill labor.

The results for EU members are positive for Germany and Italy, followed by Northern Europe and the UK. In contrast, Spain and SE-EU can hardly benefit from TTIP. Figure 2 ranks the model regions by expected changes in value added in the TTIP scenario. Crucially, the wage bargaining process indicates that less and high skilled workers in TTIP member states might experience diverging effects in real wages despite the fact that employment is potentially increasing for all skill groups.

Figure 2: Changes in value added by model regions



Based on TTIP scenario and baseline calibration; value added in Germany would increase by 0.48 percent while NAFTA members other than the USA are expected to see value added decline by -0.29 percent.

Changes in real bilateral trade flows as presented in Table G, Table H and Table I (in Annex I) confirm that the largest shifts in trade patterns occur between EU member states and the US. The magnitude of changes is closely related to the initial level of protection and assumed price reductions. For instance, US exports to the Germany increase more in the tariff scenario (+14.7 billion US$) compared to the NTB scenario (+10.8 billion US$). The intra-EU trade is not harmed directly as higher output also impacts the close EU trade network. The trade patterns are however changed in favor of US imports to the detriment of other OECD and ROW countries. Large trade diversion effects are notable among the three NAFTA member states.

Unsurprisingly, it is the ROW countries, i.e. the developing world, which suffer the largest export losses as a result of TTIP (-15.4 billion US$). This is due to trade diversion, i.e. the competitive position of ROW exports being negatively affected by the removal of trade barriers between the parties to TTIP. Our results with regard to TTIP's effects on third countries thus diverge from those reported by other impact assessments, in particular the CEPR study. Upon the assumption that TTIP will lead to the emergence of new 'gold standards' in regulation that will become applied globally, CEPR posits that regulatory harmonization will bring positive spillover effects to third countries. The latter will counterbalance the negative effects of trade diversion. We contend however that the assumption of spillovers is unwarranted, at least in the short to medium-term, to which our model applies. Given the tellingly slow progress of transatlantic regulatory alignment during the last 25 years (De Ville/Siles-Brügge 2015), it is in our judgment quite unlikely that much more than (mutual) recognition of equivalence on a few selected issues will emerge from regulatory cooperation in the short to medium term. Spillovers to the rest of the world however come only from harmonization.

3.2. Sectoral details

The breakdown of growth rates of value added, employment and nominal wages into the twenty model sectors enables a more detailed look at the diverse effects not captured in averaged data. Results for the selected variables are presented for the three scenarios in various tables and figures.

Changes in value added on a sectoral basis are generally more pronounced in agricultural and manufacturing sectors as these are affected by tariff cuts and have higher shares in bilateral trade. Changes in trade flows are the main driver of the results. The actual growth rate, however, depends strongly on the initial accounting relationships given by the database. An example is provided by the motor vehicles sector whose protection by tariffs in the EU is eight times higher than in the US. Consequently, tariff cuts prompt stronger exports by US automakers to the EU than vice versa resulting in strong value addition in the US of 1.97 percent in the tariff scenario (Table K in Annex I).

The outcome in EU countries is diverse, as initial import and export propensities measured as share of sectoral total differ significantly. While the German motor vehicles sector has an import propensity of 0.20 and export propensity of 0.46, the same sector in Italy has propensities of 0.40 and 0.27, respectively. Thus, the relatively strong inflow of US imports can be compensated by German carmakers, while Italian carmakers are expected to lose value added. Similar analysis could be made for other several sectors, for instance the insurance and finance sectors in the UK and Northern Europe.

A second influencing factor for the sectoral results is changes in effective demand. This factor is crucial for the US for which the results are largely driven by tariff reductions triggering consumption effects also in service sectors. This is even beneficial in the isolated tariff scenario for Canada and Mexico that see a pull effect, as also changes in trade flows among the NAFTA members in Table G (in Annex I) show. Consumption is however dependent on income generation and its distribution, as will be shown below in more detail.

As indicated before, it is expected that in a multi-sector model *absolute* or *relative* losers might occur, meaning that even if both countries gain from liberalization, some countries will be the *relative* losers. On a sectoral level, this can be shown in the model results in particular in manufacturing sectors (see Table 5). In Figure 3, the distribution of sectoral results by country is visualized. While all US sectors and the EU sectors on average are expected to see gains in value added in the TTIP scenario, there is strong divergence among EU countries. The largest burden is on Spain, with six out of twenty sectors with absolute declines in value added, but also all other EU regions might see at least one sector with lower value added. The widest range of regional outcomes is seen in the motor vehicles sector with Spain (-0.86 percent) on the low end and Germany (+2.7 percent) on top of the range. All non-TTIP regions are expected to see decreasing real value added throughout all sectors. Employment effects in our model follow changes in value added closely. The additional determining factor for employment is aggregate productivity growth. In Tables L to N it can be seen that employment growth shows the same patterns as growth in real value added before.[8]

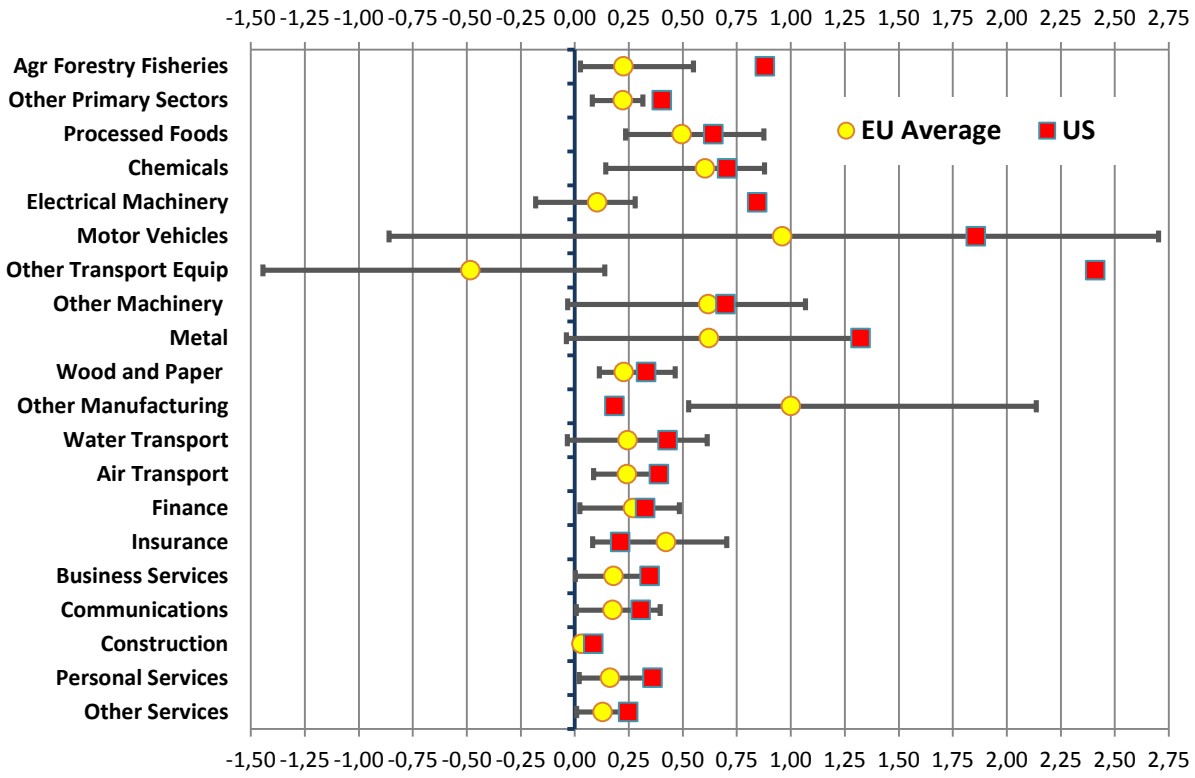
An important feature of our model is the implementation of a bargaining process for nominal wages. The dual nature of nominal wages with effects on income and price setting influence model results which requires special attention in a sensitivity analysis. As described above, nominal wages are determined by four factors: employment, price level, labor productivity and import share. We attribute wage elasticities for these factor differentiated by skill level (see also Table D). For the sake of simplicity, the parameters are not changed on a regional or sectoral base.

[8] Note that on a sectoral level, the skill composition of the labor force is assumed to remain unchanged. However, sectoral shifts of demand and employment change the skill composition of the aggregate labor force.

Table 5: Growth rates of real value added, TTIP scenario

TTIP Scenario	GER	FRA	ITA	ESP	UK	N-EU	S-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	0.19	0.17	0.55	0.14	0.03	0.17	0.23	0.23	0.88	-0.27	-0.22	-0.22
Other Primary Sectors	0.32	0.30	0.32	0.12	0.20	0.26	0.08	0.22	0.40	-0.10	-0.15	-0.13
Processed Foods	0.57	0.48	0.88	0.38	0.39	0.64	0.23	0.50	0.64	-0.35	-0.20	-0.21
Chemicals	0.68	0.45	0.51	0.19	0.76	0.88	0.14	0.60	0.71	-0.40	-0.22	-0.25
Electrical Machinery	0.06	0.03	0.19	-0.18	0.28	0.10	0.09	0.10	0.85	-0.04	-0.20	-0.24
Motor Vehicles	2.70	-0.42	-0.43	-0.86	0.71	0.77	-0.57	0.96	1.86	-0.92	-0.70	-0.74
Other Transport Equip	-0.83	0.14	-0.15	-1.21	-0.01	-1.00	-1.44	-0.48	2.41	-0.54	-0.84	-0.86
Other Machinery	1.07	0.23	0.52	-0.03	0.72	0.48	0.01	0.62	0.70	-0.95	-0.48	-0.54
Metal	1.33	0.38	0.41	-0.04	0.83	0.63	0.08	0.62	1.32	-1.16	-0.50	-0.57
Wood and Paper	0.30	0.16	0.46	0.11	0.14	0.21	0.15	0.23	0.33	-0.23	-0.17	-0.21
Other Manufacturing	0.69	0.90	2.14	0.53	0.61	0.60	0.69	1.00	0.18	-0.59	-0.25	-0.32
Water Transport	0.46	0.13	0.61	-0.03	0.07	0.11	0.06	0.24	0.43	-0.73	-0.22	-0.28
Air Transport	0.37	0.27	0.35	0.09	0.17	0.23	0.17	0.24	0.39	-0.28	-0.19	-0.21
Finance	0.41	0.10	0.41	0.02	0.48	0.29	0.06	0.27	0.33	-0.27	-0.17	-0.19
Insurance	0.47	0.13	0.41	0.08	0.38	0.70	0.10	0.42	0.21	-0.27	-0.19	-0.19
Business Services	0.38	0.07	0.33	0.00	0.14	0.11	0.03	0.18	0.35	-0.25	-0.15	-0.15
Communications	0.39	0.09	0.35	0.01	0.18	0.13	0.04	0.18	0.31	-0.26	-0.17	-0.17
Construction	0.08	0.01	0.06	0.00	0.03	0.02	0.01	0.03	0.09	-0.02	-0.02	-0.02
Personal Services	0.31	0.07	0.34	0.02	0.12	0.10	0.03	0.16	0.36	-0.28	-0.18	-0.18
Other Services	0.28	0.06	0.26	0.01	0.11	0.09	0.03	0.13	0.25	-0.23	-0.15	-0.16

Figure 3: Sectoral changes in real value added, TTIP scenario



Minimum and maximum refer results for EU countries/regions; for instance value added in the Motor Vehicles sector in Spain is expected to decline by 0.86 percent, whereas this sector in Germany is expected to benefit (+2.70 percent)

In the baseline calibration is it assumed that low-skill workers have a weaker bargaining position compared to high-skill workers. Given that we are dealing with a trade agreement, the import share is taken into account as indicator for import competition and related pressure on nominal wage setting to secure competitiveness. The total effects on nominal wage changes for low skilled workers are generally negative in the TTIP scenario. The magnitude of changes is again dependent on the basic accounting structures and interconnected with changes in trade flows and value added. With baseline parameter

values, wage changes in high skilled labor follow the pattern in value added growth (see Tables 6 and 7 and Tables O to R in Annex I). A rough estimation for manufacturing sectors is that changes in nominal wages in high skilled labor account for sixty percent of value added changes due to the ability of the skill group to enforce higher wages based on higher employment.

For low skilled wages, liberalization tends to suppress nominal wages. Particularly, the lower elasticity with respect to employment changes and the inclusion of the factor import competition contributes to this. For instance, the German motor vehicles industry faces large import flows from the US due to tariff removals, leading to a decline in nominal wages of low skilled workers by 1.44 percent (Table Q in Annex I). This sectoral result even increases with the full TTIP liberalization to -2.08 percent (Table 6). The outcomes with respect to low skilled wages might be exaggerated in the baseline calibration. For this reason and other uncertainties in the model calibration, a sensitivity analysis is a crucial element of our outcomes.

TTIP Scenario

Table 6: Changes in nominal wages, TTIP scenario, Low-skilled

Low-Skilled	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	-0.23	-0.16	-0.12	-0.42	-0.31	-0.19	-0.19	-0.23	-0.14	-0.15	-0.10	-0.09
Other Primary Sectors	0.03	0.10	0.02	0.05	0.00	0.03	0.04	0.04	0.09	-0.01	-0.02	-0.02
Processed Foods	-0.09	-0.03	0.02	-0.16	-0.19	-0.15	-0.19	-0.11	-1.23	-0.18	-0.07	-0.06
Chemicals	-0.29	-0.32	-0.17	-0.22	-0.29	-0.30	-0.13	-0.25	-0.95	-0.17	-0.07	-0.07
Electrical Machinery	-0.28	-0.19	-0.17	-0.15	-0.22	-0.22	-0.09	-0.19	0.03	-0.04	-0.05	-0.07
Motor Vehicles	-2.08	-0.61	-0.90	-0.69	-0.71	-0.77	-0.81	-0.94	-1.47	-0.48	-0.37	-0.29
Other Transport Equip	-1.32	-1.89	-0.97	-1.26	-1.30	-1.88	-1.31	-1.42	-0.99	-0.35	-0.41	-0.39
Other Machinery	-0.39	-0.42	-0.39	-0.29	-0.59	-0.46	-0.23	-0.40	-1.09	-0.35	-0.19	-0.20
Metal	-0.19	-0.30	-0.15	-0.21	-0.63	-0.19	-0.12	-0.25	-0.85	-0.49	-0.19	-0.18
Wood and Paper	-0.05	-0.02	-0.08	-0.06	-0.09	-0.02	-0.01	-0.05	-0.08	-0.08	-0.05	-0.06
Other Manufacturing	-0.08	0.03	0.17	-0.01	-0.16	-0.13	0.03	-0.02	-0.90	-0.22	-0.07	-0.08
Water Transport	0.04	0.05	0.08	0.00	0.01	0.02	0.02	0.03	0.07	-0.11	-0.04	-0.06
Air Transport	-0.04	-0.01	-0.01	-0.06	-0.07	-0.01	-0.01	-0.03	-0.19	-0.08	-0.06	-0.06
Finance	-0.05	-0.08	-0.03	-0.11	-0.07	-0.04	-0.04	-0.06	-0.73	-0.10	-0.05	-0.05
Insurance	-0.03	-0.03	0.01	-0.01	-0.07	-0.02	-0.05	-0.03	-0.69	-0.08	-0.06	-0.04
Business Services	-0.06	-0.08	-0.05	-0.07	-0.06	-0.07	-0.04	-0.06	-0.06	-0.03	-0.03	-0.03
Communications	-0.06	-0.02	-0.01	-0.07	-0.05	-0.04	-0.03	-0.04	-0.01	-0.03	-0.03	-0.03
Construction	-0.01	-0.01	-0.05	-0.03	-0.02	-0.01	-0.01	-0.02	-0.01	0.00	-0.02	-0.02
Personal Services	-0.09	-0.05	-0.12	-0.09	-0.15	-0.07	-0.08	-0.09	-0.05	-0.07	-0.07	-0.06
Other Services	-0.01	-0.01	-0.01	-0.03	-0.04	-0.01	-0.03	-0.02	-0.01	-0.03	-0.03	-0.03

Table 7: Changes in nominal wages, TTIP scenario, High-skilled

High-Skilled	GER	ERA	ITA	ESP	UK	N-EU	S-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	0.11	0.09	0.35	0.07	0.00	0.09	0.13	0.12	0.54	-0.19	-0.15	-0.15
Other Primary Sectors	0.19	0.17	0.20	0.06	0.11	0.15	0.03	0.13	0.23	-0.08	-0.11	-0.10
Processed Eoods	0.35	0.29	0.56	0.22	0.24	0.40	0.13	0.31	0.38	-0.24	-0.14	-0.15
Chemicals	0.42	0.27	0.32	0.10	0.47	0.55	0.07	0.32	0.42	-0.28	-0.15	-0.17
Electrical Machinery	0.03	0.00	0.11	-0.14	0.16	0.05	0.04	0.04	0.51	-0.04	-0.14	-0.17
Motor Vehicles	1.73	-0.29	-0.29	-0.58	0.44	0.48	-0.39	0.16	1.17	-0.62	-0.47	-0.49
Other Transport Equip	-0.55	0.07	-0.11	-0.81	-0.03	-0.67	-0.96	-0.44	1.52	-0.37	-0.56	-0.57
Other Machinery	0.68	0.13	0.33	-0.04	0.45	0.30	-0.01	0.26	0.42	-0.63	-0.32	-0.36
Metal	0.85	0.23	0.26	-0.05	0.52	0.39	0.03	0.32	0.82	-0.77	-0.34	-0.38
Wood and Paper	0.18	0.09	0.29	0.05	0.07	0.12	0.08	0.13	0.18	-0.16	-0.12	-0.15
Other Manufacturing	0.43	0.57	1.37	0.32	0.37	0.37	0.43	0.55	0.08	-0.40	-0.18	-0.22
Water Transport	0.28	0.07	0.39	-0.04	0.02	0.05	0.02	0.11	0.24	-0.49	-0.15	-0.19
Air Transport	0.22	0.15	0.22	0.04	0.09	0.13	0.09	0.13	0.22	-0.20	-0.13	-0.15
Finance	0.25	0.04	0.25	-0.01	0.29	0.17	0.02	0.15	0.18	-0.19	-0.12	-0.14
Insurance	0.29	0.06	0.26	0.03	0.23	0.44	0.04	0.19	0.10	-0.19	-0.13	-0.13
Business Services	0.23	0.02	0.21	-0.02	0.07	0.05	0.00	0.08	0.19	-0.18	-0.11	-0.11
Communications	0.24	0.04	0.22	-0.02	0.10	0.06	0.01	0.09	0.16	-0.19	-0.12	-0.12
Construction	0.04	-0.01	0.03	-0.02	0.00	0.00	-0.01	0.00	0.02	-0.03	-0.02	-0.02
Personal Services	0.19	0.03	0.21	-0.01	0.06	0.04	0.00	0.07	0.20	-0.20	-0.12	-0.13
Other Services	0.17	0.02	0.16	-0.02	0.05	0.04	0.00	0.06	0.13	-0.16	-0.11	-0.11

3.3. Sensitivity analysis

This section discusses sensitivity analysis. Sensitivity analysis is geared to assess the impact of changing model parameters on model output. The basic design is simple: Take the model and a scenario, and solve the model *n* times with *n* different parameters.

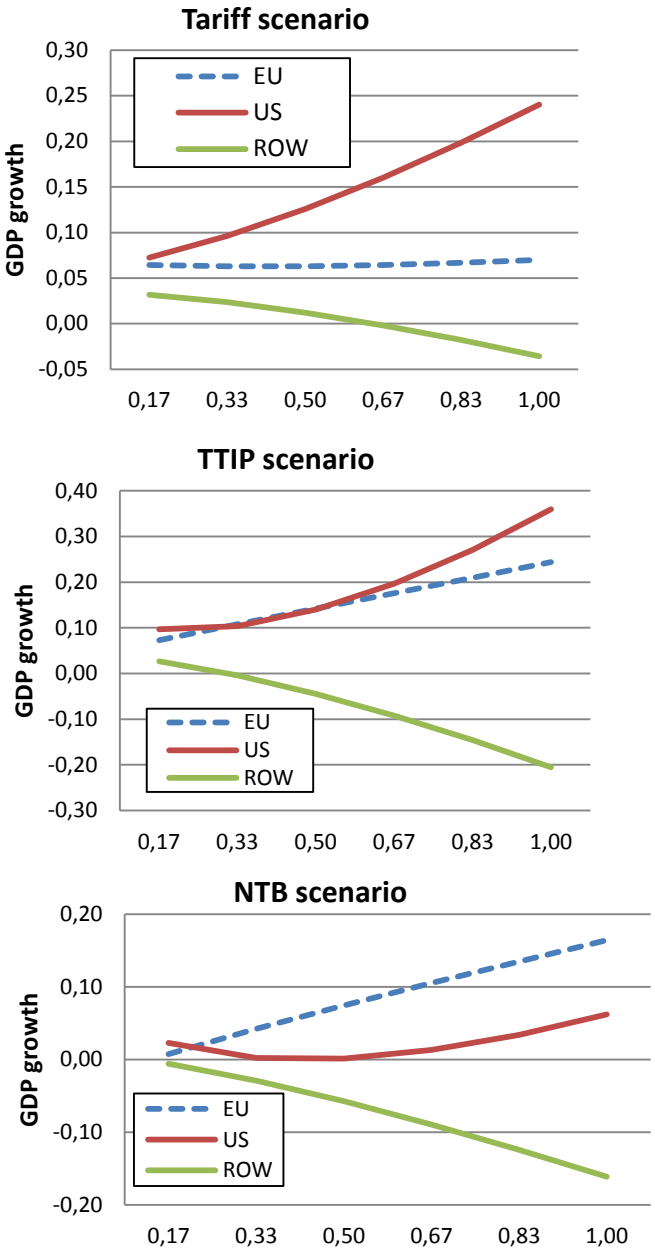
Since the magnitudes of trade price elasticities used in applied simulation models of this kind tend to be controversial, we begin with a discussion of these. The trade price elasticities used for our baseline calibration are the GTAP elasticities put forth in the CEPR study (see Table 2 for an overview). These GTAP elasticities have a particular structure across sectors, but are assumed to be the same for all countries. In other words, the elasticities are sector-specific, but not country-specific. This is a defensible simplification in the face of data constraints. As previously mentioned, these elasticities are very high relative to those found in the empirical literature. It has been documented that larger trade price elasticities lead to larger gains from trade (Taylor/von Arnim, 2006).

It thus seems worthwhile to take a closer look. To conduct sensitivity analysis on these trade price elasticities, we ran simulations with reduced elasticities, namely one-sixth of their value, a third of their value, and so on in six steps to get to "full GTAP elasticity value" (as reported in Table 2). Put differently, we maintain the GTAP elasticity structure, but vary the elasticity magnitudes. It should be noted that there is no empirical support for the higher end of these elasticities. Typical *aggregate* trade price elasticities range from 0.5 to 1.5. Disaggregated data show higher values, but the elasticities applied in the standard GTAP applications are simply too high.

The results are shown in Figure 4 for all three scenarios. Let us consider the top panel. On the horizontal axis, the figure notes the share of the full GTAP elasticity values applied. On the vertical axis, the figure shows real GDP growth rates in percentage points in response to full tariff liberalization between the EU and US. For example, the US sees an increase of about 0.075 percent in real GDP in response to tariff liberalization when elasticities are one-sixth of the values in Table 2 – but gains roughly 0.25 percent in real GDP when elasticities are as in Table 2. The difference between EU and US gains in response to tariff liberalization across different elasticity values is quite marked. As has been previously discussed, the reason lies in the difference between tariff rates between EU and US.

For the NTB scenario in the second panel, the relationship is reversed. The EU gains more strongly with higher elasticities. In the TTIP scenario – which is the combination of tariff and NTB scenario – both EU and US gains roughly triple from low elasticity values to high elasticity values. Analogously, the rest of the world (which combines NAFTA, OECD and ROW for the purpose of these panels) sees its losses increase with stronger trade price elasticities.

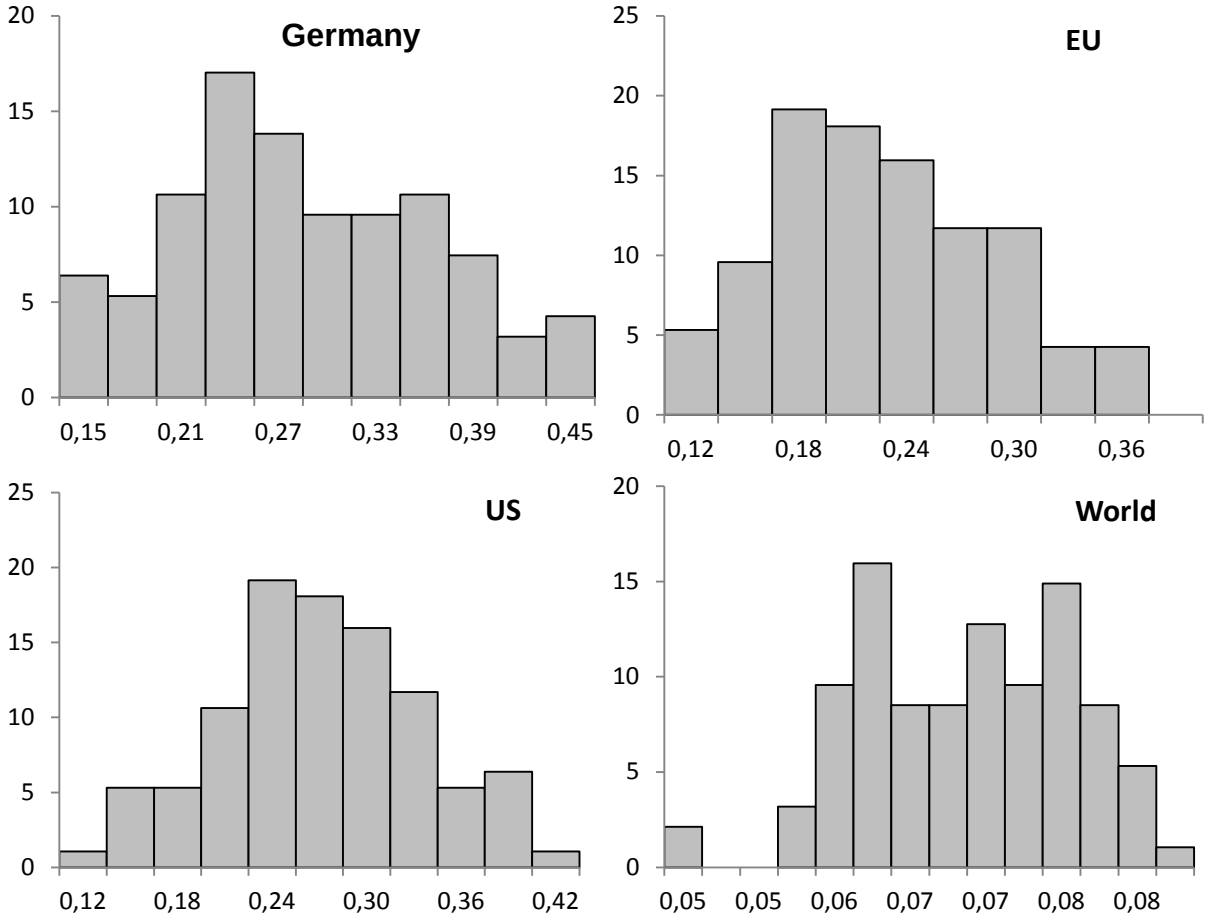
Figure 4: Sensitivity analysis – trade price elasticities



Trade price elasticities (horizontal axis) vs. real GDP growth rates (in percentage points) in response to the three liberalization scenarios. Trade price elasticities used for all three sets of simulations are the GTAP elasticities, see Table 2. The value on the horizontal axis indicates the percentage share of the elasticity values in Table 2 used across six simulations. For example, with GTAP trade price elasticity structure but only 16% of their values, full tariff liberalization generates positive gains for all three countries/regions. The US gains marginally more than the EU. With the full value of GTAP elasticities, US gains from tariff liberalization are almost five times those of the EU. The distribution of gains differs across elasticity magnitudes and scenarios.

To create the panels for Figure 4, *only* the trade price elasticities have been altered. All other parameters are left unchanged (and are as shown in Table D in Annex I). Figure 5 takes a different perspective. Here we vary *all* parameters within reasonable bounds. We can thus gauge the overall dispersion of model results. Figure 5 shows four charts. The charts are frequency histograms: the vertical axis shows percentage rates, and the horizontal axis shows real GDP growth rates in response to the TTIP scenario. For example, in about 14 percent of model simulations, Germany's real GDP increases by 0.27 percent. Further, real GDP growth rates range from about 0.15 percent to 0.45 percent.

Figure 5: Sensitivity analysis – randomized calibration

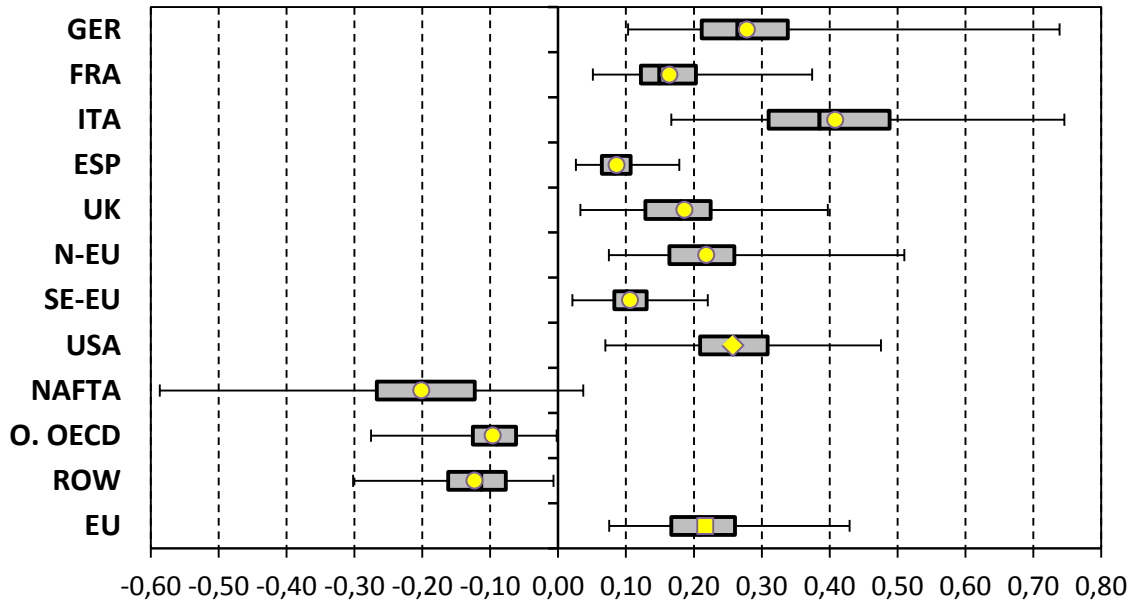


These charts further illustrate sensitivity of model output in response to TTIP scenario with respect to parameter values. The data underlying these charts was generated by repeatedly solving the model with behavioral parameters drawn from uniform probability distributions over specified ranges. The charts are frequency histograms: the vertical axis shows percentage rates, and the horizontal axis shows real GDP growth rates in response to the TTIP scenario. For example, in about 14 percent of model simulations, Germany's real GDP increases by 0.27 percent. Further, real GDP growth rates range from about 0.15 percent to 0.45 percent.

The panels on the top right (EU) and bottom left (US) can be usefully compared. Given the assumed parameter variations, EU and US show overall quite similar *ranges* of outcomes – from about one tenth of one percentage point of GDP to about four tenth of one percentage point of GDP. However, the distribution of these gains across this range differs. The EU shows stronger concentration of *small* gains, whereas the US's are concentrated around a quarter of one percentage point of GDP. Lastly, the bottom right panel shows global gains – which are positive, but across all calibrations so small as to be negligible.

Let us now take a still different look at these data, and consider as well the differential impact of a TTIP scenario on low and high skill labor. First, Figure 6 illustrates the sensitivity of model results with respect to parameter choices. The figure is built on the same data as Figure 5. For each country, the long "whiskers" show the minimum and maximum of the growth rate in real value added. In between, the gray box spans the second and third quartile – in other words, all observations from the twenty-fifth to seventy-fifth percentiles. In the gray box, mean and medium are denoted.

Figure 6: Sensitivity analysis on GDP growth rates



Results based on 100 randomized model runs; Yellow dots indicate mean GDP growth rates; in addition, minimum, first quartile, median, third quartile and maximum are shown; For instance Germany shows a mean GDP change of 0.28 percent but min/max ranges from 0.1 to 0.74 percent.

A few observations can be made. First, for all TTIP partners, the minimum changes are positive, even if they are very close to zero. The maximum changes tend to fall around four-tenth of one percentage point; Germany and Italy are the positive outliers with maximums of about three-quarter of one percentage point. Especially the results for Germany are skewed towards the left, which is – given the size of this economy in the EU – further reason for the EU skewness. Crucially, and as noted above, the EU average is slightly below the US average. The three regions of the rest of the world are all losers in absolute terms.

Figure A and Figure B in Annex I show similar plots for real wage growth of high and low skill labor, respectively. Figure C and Figure D show the corresponding growth rates of employment. As can be seen, employment growth for low and high skill tends to be positive – as that is driven in the aggregate by demand – but real wage growth differs across skill types. Low skill labor is not able to benefit despite job gains, and instead sees an erosion of real earnings.

Lastly, we might consider the role of the socio-economic institutions that influence the bargaining process. In the model, these are described by the elasticities of the nominal wage functions, which have been discussed in detail above. How do these parameters affect model results? The causal link implicit in the model is such that *stronger bargaining for nominal wages will tend to reduce the positive effects of trade liberalization if trade elasticities are high*. The reason is simple: The gains from trade materialize via a consumption effect and via a net export effect. Both depend on the degree of price reduction, i.e. depend on the magnitude of the barrier reduced. However, with high trade elasticities the trade responses take center stage and countries benefit from increasing net exports; at the same time, higher nominal wages create a trade-off between the positive effect on consumption and the negative effect on exports. Overall, higher wages might limit price and trade effects in such a setting. With lower elasticities, on the other hand, the positive consumption effects from successful bargaining for higher wages can play a role.

Table S (in Annex I) illustrates these linkages. See the caption for details. On the left, full GTAP elasticity values are assumed. On the right, “only” half the GTAP elasticity values are assumed. It should be noted that even half the elasticity values have very limited empirical support. In the third column in the left and right part of the table, the difference between the “strong” and “weak” labor calibration is assumed. As can be seen, the sign of this difference reverses: Strong labor produces gains through real wage and consumption growth when trade price elasticities are smaller.

3.4. Our results in comparison to other TTIP impact assessments

Even though our reported small but positive effects for all TTIP member countries seem at first glance similar to previously published TTIP studies (CEPR 2013, Ecorys 2009 or CEPII 2013)[9], clear distinctions from standard CGE models can be made with regard to several outcomes (see Table 8 for a comparison of selected results). The resemblance of our reported changes in bilateral trade flows with CEPR (2013) is caused by the data set-up which is similar to CEPR (2013) with respect to sectoral disaggregation, scenario design, trade price elasticities and NTB estimations. Even though these trade effects are a major driver of our other results, the related changes in value added differ based on the diverging closure rules and a number of features presented in the section ‘model description’. The increase in EU value added (0.24 percent) in our TTIP scenario is only half as much as in the ambitious scenario of CEPR (2013) and only a third of the full liberalization scenario in Ecorys (2009). Different to commonly applied CGE models, these changes in value added do not automatically generate similar changes in real wages. In our model, due to the implemented bargaining process for nominal wages, changes in real wages by skill level might be negative for certain skill levels even though output increases. As mentioned above, we also refrain from using spillover effects as applied by CEPR (2013) that would prevent negative effects for non-TTIP members. In this respect, our reported adverse effects for the rest of the world are closer to the trade diversion effects shown by CEPII (2013). Moreover, our generally positive sectoral effects are linked to the calibration using high trade price elasticities as applied by CEPR (2013). An alternative NTB setting might as well create negative effects for instance in the EU agriculture sector, as reported by CEPII (2013). A unique feature of our model is certainly the changes we report for macroeconomic balances (Table 3). The latter are typically kept constant in standard models.

Table 8: Comparison of main findings

	ÖFSE	CEPR (2013)	Ecorys (2009)	CEPII (2013)
EU GDP	0.07 - 0.24	0.02 - 0.48	0.32 - 0.72	0.0 - 0.5
US GDP	0.24 - 0.36	0.01 - 0.39	0.13 - 0.28	0.0 - 0.5
EU bilateral exports	7.7 - 20.9	0.69 - 28.0	not specified	49.0 +
EU real wages	0.01 - 0.05	0.29 - 0.51	0.34 - 0.78	not specified

Percentage changes compared to baseline for different scenarios
+ Reference scenario only

[9] Listed as Fontagné et al. (2013) in the references.

4. Conclusions

The *Transatlantic Trade and Investment Partnership* currently under negotiation is a multi-faceted and wide-ranging 'free trade' agreement. It aims to eliminate remaining tariffs between the EU and US. More importantly, it aims to reduce non-tariff barriers through an as of yet unspecified procedure. The model applied here does – like others – offers an assessment of the economic effects of these policy changes. It does – unlike others – focus on demand-driven output, employment, and an institutionally determined distribution of income. As with other modeling approaches, other important features of TTIP, in particular the effects of investment liberalization, the protection of intellectual property rights, or any environmental effects, are not accounted for in our model.

The results show that there are limited gains to be made, but these are not necessarily widely shared, as low skill workers experience real wage erosion despite growth of employment. Further, results suggest that gains are not evenly distributed across EU members. Germany and Italy appear to be the likely "winners" in relative terms, and Spain as well as the southern and eastern periphery of the EU the likely losers. In aggregate, EU and US gains are similar, though US gains are slightly higher. The rest of the world – NAFTA, other OECD countries, and the large set of developing countries – all experience income losses.

These results should be seen, in general, as *best case scenarios*. They should be interpreted as upper limits of the overall effects of TTIP, since the potential positive effects of rules and regulations are not being considered. Instead, our model – like others – adopts the narrow perspective that regulations in general impose only *costs*, and their reduction through a TTIP-lead process would bring about economic benefits. In terms of further work, a methodological refinement of the model with respect to more realistic NTB estimations, trade elasticities as well as structural features on a country-by-country basis is therefore highly desirable in order to arrive at a more accurate assessment of the potential effects of TTIP and other such new generation trade agreements to come.

References

Berden, K./Francois, J./Thelle, M./Wymenga, P./Tamminen, S. (2009): Non-tariff measures in EU-US trade and investment – An economic analysis. In: ECORYS, Study for the European Commission, Directorate-General for Trade. http://trade.ec.europa.eu/doclib/docs/2009/december/tradoc_145613.pdf (18 April 2016).

De Ville, F./Siles-Brügge, G. (2015): The Transatlantic Trade and Investment Partnership and the Role of Computable General Equilibrium Modelling: An Exercise in 'Managing Fictional Expectations. In: New Political Economy, 20(5), 653-678.

Dimaranan,V.B./Narayanan, G.B. (2012): Skilled and Unskilled Labor Data. In: Narayanan, G.B./Angel, A./McDougall, R. (eds.): Global Trade, Assistance, and Production: The GTAP 8 Data Base, Center for Global Trade Analysis, Purdue University.

Felbermayr, G.J./Heid, B./Lehwald, S. (2013): Transatlantic trade and investment partnership (TTIP): Who benefits from a free trade deal? Part 1: Macroeconomic Effects. In: Bertelsmann Foundation. http://www.bfna.org/sites/default/files/TTIP-GED%20study%2017June%202013.pdf (18 April 2016).

Fontagné, L./Gourdon, J./Jean, S. (2013): Transatlantic trade: Whither partnership, which economic consequences? In: CEPII, Working Paper 2011-24.

Francois, J./Manchin, M./Norberg, H./Pindyuk, O./Tomberger, P. (2013): Reducing Transatlantic Barriers to Trade and Investment – An Economic Assessment. In: CEPR, Study for the European Commission, Final Project Report.

Myant, M./O'Brien, R. (2015): The TTIP's impact: bringing in the missing issue, Working Paper 2015.01, European Trade Union Institute, Brussels.

Pyatt, G. (1988): The SAM Approach to Modeling. In: Journal of Policy Modeling, 10, 327-352.

Raza, W./Grumiller, J./Taylor,L./Tröster, B./von Arnim, R.(2014): ASSESS TTIP: Assessing the claimed benefits of the Transatlantic Trade and Investment Partnership. Final Report. http://guengl.eu/uploads/plenary-focus-pdf/ASSESS_TTIP.pdf (18 April 2016).

Robinson, S. (2003): Macro Models and Multipliers: Leontief, Stone, Keynes, and CGE Models. International Food Policy Research Institute (IFPRI).

Taylor, L./von Arnim, R. (2006): Modelling the Impact of Trade Liberalisation. In: Oxfam International Research Report. http://utah.academia.edu/RudivonArnim/Papers/169985/Modelling_the_Impact_of_Trade_Liberalisation_A_Critique_of_Computable_General_Equilibrium_Models (18 April 2016).

Taylor, L. (2011): CGE Applications in Development Economics. New School for Social Research, Working Paper 2011-1.

Taylor, L. (2004): Reconstructing Macroeconomics: Structuralist Proposals and Critiques of the Mainstream.

Taylor, L. (1983): Structuralist Macroeconomics: Applicable Models for the Third World.

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Annex I

Tables and Figures

Table A: Sectoral Disaggregation.

No.	Model sectors	GTAP Sectors (GTAP terminology)	ISIC rev 3.1 sectors
1	Agriculture Forestry Fisheries	pdr wht gro v_f osd_c_b pfb ocr ctl oap rmk wol frs fsh	ISIC 01-05
2	Other Primary Sectors	coa oil gas omn	ISIC 10-14
3	Processed Foods	cmt omt vol mil pcr sgr pfd b_t	ISIC 15-16
4	Chemicals	p_c crp	ISIC 24-25
5	Electrical Machinery	ele	ISIC 30-32
6	Motor Vehicles	mvh	ISIC 34
7	Other Transport Equipment	otn	ISIC 35
8	Other Machinery	ome	ISIC 29,31,33
9	Metals and Metal Products	i_s nfm fmp	ISIC 27-28
10	Wood and Paper Products	lum ppp p_c	ISIC 20-22
11	Other Manufacturing	tex wap lea nmm omf	ISIC 15-37, all remaining
12	Water Transport	wtp	ISIC 61
13	Air Transport	atp	ISIC 62
14	Finance	ofi	ISIC 65,67
15	Insurance	isr	ISIC 66
16	Business Services	obs	ISIC 70-74
17	Communications	cmn	ISIC 64
18	Construction	cns	ISIC 45
19	Personal Services	ros	ISIC 91-93
20	Other Services	ely gdt wtr osg trd otp dwe	ISIC 40,41,50-52,63,75,80,85,90

Source: CEPR (2013, p. 103-104).

Table B: Base year trade flows matrix.

		GER	FRA	ITA	ESP	UK	N-EU	SE-EU	USA	NAFTA	O. OECD	ROW	**Exports**
1	GER	0	115	90	64	94	278	169	111	22	145	254	**1343**
2	FRA	84	0	54	50	56	103	46	47	9	53	126	**628**
3	ITA	69	61	0	39	37	60	71	44	10	55	114	**560**
4	ESP	38	54	27	0	37	36	42	18	7	24	63	**347**
5	UK	67	42	31	28	0	137	30	88	13	60	116	**613**
6	N-EU	266	118	86	55	134	274	115	131	19	148	245	**1590**
7	SE-EU	144	42	51	30	44	88	131	26	6	46	114	**721**
8	USA	76	42	24	22	70	93	24		379	232	449	**1412**
9	NAFTA	12	6	4	7	17	14	4	535	15	33	78	**724**
10	O. OECD	150	62	55	39	92	134	66	316	56	305	867	**2143**
11	ROW	244	152	168	120	169	289	197	909	123	907	1963	**5239**
	Imports	**1149**	**695**	**590**	**455**	**750**	**1506**	**894**	**2226**	**659**	**2008**	**4389**	

The table reports bilateral trade flows for the base year in billion US$. The first seven countries and regions form the EU, and are marked in an additional box. Column sums are country or region imports, and row sums country or region exports. The difference between the two defines the trade balance.
Source: Calculations based on GTAP 8.

Table C: Base year import shares.

		GER	FRA	ITA	ESP	UK	N-EU	SE-EU	USA	NAFTA	O. OECD	ROW	
1	GER	0	17	15	14	13	18	19	5	3	7	6	GER
2	FRA	7	0	9	11	7	7	5	2	1	3	3	FRA
3	ITA	6	9	0	9	5	4	8	2	1	3	3	ITA
4	ESP	3	8	5	0	5	2	5	1	1	1	1	ESP
5	UK	6	6	5	6	0	9	3	4	2	3	3	UK
6	N-EU	23	17	15	12	18	18	13	6	3	7	6	N-EU
7	SE-EU	13	6	9	7	6	6	15	1	1	2	3	S-EU
8	USA	7	6	4	5	9	6	3	0	58	12	10	USA
9	NAFTA	1	1	1	2	2	1	0	24	2	2	2	NAFTA
10	O. OECD	13	9	9	9	12	9	7	14	9	15	20	O. OECD
11	ROW	21	22	28	26	22	19	22	41	19	45	45	ROW
	Imports	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	

The table reports ratios of base year bilateral trade flows to total country imports in percentage points; in other words, cell entries of Table B divided by column sum. The entries document the strong trade ties within EU as well as within NAFTA. Source: Calculations based on GTAP 8.

Table D: Baseline calibration.

Description	Parameter	Value	
NTB elasticity of the mark-up	ϵtn	0.25	
Nominal unit labor cost elasticity of the mark-up	ϵtw	0.10	
Kaldor-Verdoorn elasticity	ϵxe	0.20	
Share of rent-generating NTBs	zr	0.75	
Share of domestic rents	zd	0.66	
		Low skill	High skill
Employment elasticity of nominal wage	ϵwL	0.20	0.75
Price level elasticity of nominal wage	ϵwP	0.00	0.25
Productivity elasticity of nominal wage	ϵwx	0.00	0.25
Import share elasticity of nominal wage	ϵwM	0.20	0.00

Source: Own elaboration.

Simulation results

Table E: Selected model output: tariff scenario.

	GDP	Net Exports	Bilat. Exports	TOT	Profit rate	Wage share	Employ-ment	Real wage	Low skill	LS real wage	High skill	HS real wage
Germany	0.12	0.00	10.16	0.10	0.08	0.00	0.12	-0.01	0.13	-0.09	0.10	0.10
France	0.02	-0.01	6.43	0.02	0.01	0.00	0.02	0.00	0.02	-0.01	0.01	0.03
Italy	0.23	0.05	15.65	0.23	0.21	0.02	0.21	0.04	0.24	-0.02	0.17	0.14
Spain	0.00	0.00	7.41	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.02
UK	0.03	-0.01	4.52	0.03	0.02	0.00	0.02	0.01	0.03	-0.02	0.02	0.04
Northern EU	0.04	-0.01	5.24	0.04	0.04	-0.01	0.03	0.01	0.03	-0.01	0.02	0.04
SE-EU	0.03	0.00	10.05	0.04	0.03	0.01	0.03	0.01	0.04	0.00	0.02	0.04
EU	**0.07**	**0.02**	**7.74**	**0.07**	**0.06**	**0.00**	**0.06**	**0.01**	**0.07**	**-0.02**	**0.05**	**0.06**
USA	**0.24**	**0.01**	**12.17**	**0.24**	**0.24**	**0.00**	**0.19**	**0.05**	**0.19**	**-0.03**	**0.18**	**0.16**
NAFTA	0.03	0.01	0.00	0.02	0.04	-0.01	0.02	0.00	0.01	-0.01	0.02	0.02
Other OECD	-0.04	-0.01	0.00	-0.04	-0.04	0.00	-0.03	-0.01	-0.03	-0.01	-0.03	-0.02
ROW	-0.05	0.00	0.00	-0.05	-0.04	0.00	-0.04	-0.01	-0.04	-0.01	-0.03	-0.02

All numbers are growth rates in percentage points. For example, Germany's GDP rises by 0.12 percent compared to the base year. The second column shows the growth rate of net exports, the third the growth rate vis-à-vis the other trade agreement partner country – i.e., France's export to the US grow by 6.43 percent. The remaining columns report statistics on employment and real wages for low (LS) and high (HS) skill labor.

Table F: Selected model output: NTB scenario.

	GDP	Net Exports	Bilat. Exports	TOT	Profit rate	Wage share	Employ-ment	Real wage	Low skill	LS real wage	High skill	HS real wage
Germany	0.34	0.02	18.68	0.34	0.29	0.03	0.29	0.07	0.30	-0.04	0.27	0.24
France	0.10	0.02	13.90	0.10	0.09	0.01	0.08	0.04	0.09	-0.01	0.07	0.09
Italy	0.16	0.05	13.83	0.16	0.15	0.03	0.14	0.04	0.15	-0.02	0.13	0.13
Spain	0.03	0.00	9.55	0.03	0.03	0.01	0.02	0.02	0.03	-0.01	0.02	0.05
UK	0.17	0.02	11.77	0.16	0.14	0.01	0.14	0.04	0.14	-0.03	0.13	0.14
Northern EU	0.16	0.02	12.37	0.16	0.16	0.00	0.12	0.04	0.13	-0.01	0.11	0.12
SE-EU	0.04	0.00	12.67	0.04	0.04	0.00	0.03	0.01	0.03	-0.01	0.03	0.05
EU	**0.16**	**0.02**	**12.96**	**0.16**	**0.13**	**0.01**	**0.14**	**0.04**	**0.15**	**-0.03**	**0.13**	**0.12**
USA	**0.06**	**0.00**	**12.40**	**0.07**	**-0.01**	**0.02**	**0.05**	**0.04**	**0.05**	**-0.05**	**0.06**	**0.15**
NAFTA	-0.33	-0.09	0.00	-0.32	-0.34	0.01	-0.25	-0.06	-0.26	-0.01	-0.24	-0.15
Other OECD	-0.14	-0.03	0.00	-0.14	-0.14	0.00	-0.11	-0.03	-0.11	-0.01	-0.11	-0.07
ROW	-0.15	-0.01	0.00	-0.14	-0.14	0.00	-0.12	-0.03	-0.12	-0.02	-0.11	-0.07

All numbers are growth rates in percentage points. For example, Germany's GDP rises by 0.34 percent compared to the base year. The second column shows the growth rate of net exports, the third the growth rate vis-à-vis the other trade agreement partner country – i.e., France's export to the US grow by 13.9 percent. The remaining columns report statistics on employment and real wages for low (LS) and high (HS) skill labor.

Table G: Changes in real bilateral trade flows, tariff scenario, in billion US$.

	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	USA	NAFTA	OECD	ROW	Exports
GER	0.0	0.3	0.6	0.2	0.3	0.8	0.4	11.3	0.2	0.7	1.1	**15.9**
FRA	0.1	0.0	0.2	0.0	0.0	0.1	0.0	3.0	0.0	0.1	0.3	**3.8**
ITA	0.0	-0.1	0.0	-0.1	-0.1	-0.1	-0.1	6.9	0.0	0.0	-0.1	**6.4**
ESP	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.1	**1.5**
UK	0.2	0.1	0.1	0.0	0.0	0.3	0.1	4.0	0.1	0.2	0.3	**5.4**
N-EU	0.5	0.1	0.4	0.0	0.0	0.4	0.1	6.9	0.0	0.3	0.4	**9.1**
SE-EU	0.1	0.0	0.2	0.0	0.0	0.0	0.0	2.6	0.0	0.1	0.1	**3.1**
USA	14.7	4.3	2.4	1.9	6.6	9.3	3.6	0.0	1.6	0.4	0.7	**45.4**
NAFTA	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	2.3	0.0	0.0	0.0	**2.1**
OECD	-0.1	-0.1	0.1	-0.1	-0.3	-0.2	-0.2	1.3	0.1	-0.2	-0.7	**-0.5**
ROW	0.0	-0.1	0.6	-0.1	-0.3	-0.3	-0.2	0.2	-0.1	-0.6	-1.2	**-2.1**
Imports	**15.3**	**4.5**	**4.8**	**1.9**	**6.0**	**10.2**	**3.6**	**39.8**	**1.9**	**1.0**	**1.0**	

Table H: Changes in real bilateral trade flows, NTB scenario, in billion US$.

	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	USA	NAFTA	O. OECD	ROW	Exports
GER	0.0	0.1	0.3	0.0	0.2	1.1	0.3	20.8	-0.3	-0.3	-0.3	**21.8**
FRA	0.5	0.0	0.2	0.0	0.1	0.4	0.1	6.6	-0.1	0.0	0.1	**7.9**
ITA	0.4	0.0	0.0	0.0	0.0	0.1	0.1	6.1	-0.1	-0.1	-0.2	**6.3**
ESP	0.2	0.1	0.1	0.0	0.1	0.1	0.1	1.8	-0.1	0.0	0.0	**2.4**
UK	0.4	0.1	0.1	0.1	0.0	0.7	0.1	10.4	-0.1	0.0	0.2	**12.1**
N-EU	1.4	0.2	0.2	0.0	0.2	0.9	0.2	16.2	-0.1	-0.2	-0.2	**18.7**
S-EU	0.8	0.0	0.1	0.0	0.0	0.2	0.1	3.2	0.0	-0.1	-0.2	**4.2**
USA	10.8	5.6	2.7	2.2	8.8	10.6	3.0	0.0	1.2	2.0	4.1	**50.9**
NAFTA	0.1	0.0	0.0	0.0	0.0	0.1	0.0	-5.2	-0.1	0.0	0.1	**-4.9**
OECD	0.5	0.0	0.1	0.0	0.0	0.3	0.0	-4.8	-0.7	-0.7	-1.8	**-7.0**
ROW	0.6	0.1	0.3	-0.1	0.0	0.5	0.0	-6.8	-1.0	-2.1	-4.2	**-12.8**
Imports	**15.7**	**6.3**	**4.3**	**2.1**	**9.5**	**15.0**	**3.8**	**48.2**	**-1.3**	**-1.5**	**-2.5**	

Table I: Changes in real bilateral trade flows, TTIP scenario, in billion US$.

	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	USA	NAFTA	O. OECD	ROW	Exports
GER	0.0	0.5	1.1	0.3	0.5	2.1	0.8	36.0	0.0	0.6	1.1	**42.9**
FRA	0.6	0.0	0.5	0.0	0.1	0.5	0.1	10.3	0.0	0.1	0.4	**12.5**
ITA	0.3	-0.1	0.0	-0.1	-0.1	0.1	-0.1	14.3	-0.1	-0.1	-0.3	**13.8**
ESP	0.2	0.1	0.2	0.0	0.0	0.1	0.1	3.4	0.0	0.0	0.0	**4.2**
UK	0.6	0.2	0.3	0.1	0.0	1.0	0.2	15.5	0.0	0.3	0.6	**18.8**
N-EU	2.0	0.3	0.7	0.0	0.2	1.3	0.3	24.8	-0.1	0.1	0.3	**30.0**
SE-EU	0.9	0.0	0.4	0.0	0.0	0.2	0.1	6.4	0.0	0.0	0.0	**7.9**
USA	30.5	10.9	5.8	4.6	17.0	22.1	7.5	0.0	3.2	2.5	4.9	**109.0**
NAFTA	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	-2.2	-0.1	0.0	0.0	**-2.2**
O. OECD	0.4	-0.2	0.2	-0.2	-0.3	0.0	-0.3	-3.0	-0.6	-1.0	-2.6	**-7.5**
ROW	0.6	-0.1	1.0	-0.2	-0.4	0.2	-0.3	-6.5	-1.1	-2.8	-5.7	**-15.4**
Imports	**36.1**	**11.7**	**10.2**	**4.4**	**17.0**	**27.6**	**8.3**	**99.1**	**1.2**	**-0.2**	**-1.2**	

Table J: Growth rates of real value added, NTB scenario.

NTB Scenario	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	0.21	0.15	0.21	0.11	0.16	0.21	0.04	0.14	0.21	-0.31	-0.15	-0.15
Other Primary Sectors	0.27	0.27	0.17	0.14	0.20	0.25	0.09	0.21	0.11	-0.23	-0.11	-0.12
Processed Foods	0.33	0.30	0.36	0.15	0.23	0.33	0.07	0.25	-0.04	-0.39	-0.16	-0.16
Chemicals	0.33	0.20	0.20	0.08	0.41	0.42	0.04	0.29	-0.05	-0.49	-0.19	-0.20
Electrical Machinery	0.01	0.00	0.13	-0.16	0.14	0.05	0.05	0.05	0.50	-0.15	-0.19	-0.24
Motor Vehicles	1.56	0.30	0.37	0.08	0.81	1.00	0.33	0.90	-0.81	-1.58	-0.58	-0.32
Other Transport Equip	-0.75	-0.05	-0.25	-0.97	-0.02	-0.88	-1.24	-0.47	1.33	-0.72	-0.69	-0.68
Other Machinery	0.67	0.15	0.30	-0.03	0.47	0.35	0.01	0.39	0.19	-0.81	-0.35	-0.38
Metal	0.79	0.31	0.36	0.10	0.63	0.51	0.19	0.46	0.29	-0.91	-0.32	-0.36
Wood and Paper	0.23	0.13	0.20	0.05	0.15	0.15	0.08	0.15	0.09	-0.28	-0.13	-0.17
Other Manufacturing	0.30	0.36	0.41	0.12	0.33	0.30	0.15	0.29	-0.09	-0.37	-0.15	-0.18
Water Transport	0.40	0.14	0.28	0.06	0.08	0.13	0.02	0.23	0.07	-0.88	-0.16	-0.21
Air Transport	0.28	0.19	0.16	0.07	0.14	0.18	0.12	0.18	0.11	-0.30	-0.15	-0.17
Finance	0.33	0.11	0.19	0.05	0.46	0.27	0.06	0.22	0.10	-0.30	-0.13	-0.14
Insurance	0.39	0.13	0.21	0.09	0.36	0.64	0.08	0.37	-0.02	-0.32	-0.15	-0.15
Business Services	0.31	0.09	0.14	0.02	0.14	0.11	0.03	0.14	0.12	-0.30	-0.12	-0.12
Communications	0.31	0.09	0.14	0.03	0.17	0.11	0.03	0.14	0.07	-0.30	-0.13	-0.13
Construction	0.07	0.01	0.02	0.00	0.04	0.02	0.01	0.02	0.02	-0.02	-0.02	-0.01
Personal Services	0.25	0.06	0.14	0.03	0.11	0.08	0.02	0.12	0.09	-0.31	-0.13	-0.14
Other Services	0.22	0.06	0.11	0.03	0.10	0.08	0.03	0.10	0.03	-0.25	-0.11	-0.11

Table K: Growth rates of real value added, Tariff scenario.

Tariff Scenario	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	-0.02	0.01	0.29	0.03	-0.12	-0.04	0.17	0.07	0.57	0.03	-0.05	-0.06
Other Primary Sectors	0.03	0.01	0.13	-0.02	0.00	0.00	-0.01	0.01	0.25	0.11	-0.03	-0.01
Processed Foods	0.20	0.15	0.43	0.20	0.14	0.26	0.15	0.21	0.57	0.04	-0.04	-0.04
Chemicals	0.31	0.22	0.28	0.11	0.31	0.41	0.10	0.28	0.67	0.08	-0.02	-0.04
Electrical Machinery	0.04	0.03	0.05	-0.02	0.11	0.04	0.03	0.04	0.29	0.09	-0.01	0.00
Motor Vehicles	0.82	-0.52	-0.58	-0.69	-0.08	-0.18	-0.67	0.03	1.97	0.50	-0.09	-0.31
Other Transport Equip	-0.08	0.15	0.07	-0.21	-0.01	-0.12	-0.18	-0.03	0.94	0.16	-0.13	-0.15
Other Machinery	0.33	0.07	0.19	0.00	0.20	0.12	0.01	0.19	0.42	-0.12	-0.11	-0.12
Metal	0.42	0.05	0.05	-0.11	0.15	0.09	-0.08	0.12	0.81	-0.19	-0.15	-0.17
Wood and Paper	0.06	0.04	0.24	0.06	0.00	0.05	0.07	0.07	0.19	0.03	-0.03	-0.04
Other Manufacturing	0.34	0.48	1.53	0.36	0.25	0.27	0.48	0.63	0.22	-0.20	-0.09	-0.12
Water Transport	0.04	0.00	0.30	-0.06	-0.01	-0.02	0.03	0.02	0.29	0.11	-0.05	-0.06
Air Transport	0.07	0.07	0.17	0.02	0.03	0.05	0.05	0.06	0.23	0.02	-0.03	-0.03
Finance	0.06	-0.01	0.20	-0.02	0.02	0.02	0.00	0.05	0.18	0.03	-0.03	-0.04
Insurance	0.07	0.00	0.18	0.00	0.02	0.05	0.02	0.04	0.19	0.04	-0.03	-0.03
Business Services	0.05	-0.01	0.18	-0.01	0.00	0.00	0.01	0.03	0.18	0.03	-0.03	-0.03
Communications	0.07	0.00	0.19	-0.01	0.01	0.01	0.01	0.03	0.19	0.03	-0.03	-0.04
Construction	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.05	0.00	0.00	0.00
Personal Services	0.05	0.01	0.18	0.00	0.01	0.01	0.02	0.04	0.22	0.02	-0.03	-0.03
Other Services	0.05	0.00	0.14	-0.01	0.00	0.01	0.01	0.03	0.17	0.02	-0.03	-0.03

Table L: Changes in employment, TTIP scenario.

TTIP Scenario	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	0.15	0.14	0.44	0.11	0.02	0.14	0.19	0.18	0.70	-0.22	-0.17	-0.18
Other Primary Sectors	0.25	0.24	0.25	0.10	0.16	0.21	0.06	0.21	0.32	-0.08	-0.12	-0.11
Processed Foods	0.45	0.38	0.70	0.30	0.32	0.51	0.19	0.43	0.51	-0.28	-0.16	-0.17
Chemicals	0.54	0.36	0.41	0.15	0.61	0.70	0.11	0.51	0.56	-0.32	-0.18	-0.20
Electrical Machinery	0.05	0.03	0.15	-0.15	0.22	0.08	0.07	0.09	0.68	-0.03	-0.16	-0.19
Motor Vehicles	2.16	-0.34	-0.35	-0.69	0.56	0.61	-0.46	1.19	1.48	-0.74	-0.56	-0.59
Other Transport Equip	-0.66	0.11	-0.12	-0.97	-0.01	-0.80	-1.16	-0.31	1.92	-0.44	-0.67	-0.69
Other Machinery	0.85	0.18	0.42	-0.03	0.58	0.39	0.01	0.57	0.56	-0.76	-0.39	-0.43
Metal	1.06	0.30	0.33	-0.03	0.66	0.50	0.07	0.58	1.06	-0.93	-0.40	-0.46
Wood and Paper	0.24	0.13	0.37	0.09	0.11	0.16	0.12	0.19	0.26	-0.18	-0.14	-0.17
Other Manufacturing	0.55	0.72	1.71	0.42	0.48	0.48	0.55	0.83	0.15	-0.47	-0.20	-0.25
Water Transport	0.37	0.11	0.49	-0.03	0.05	0.08	0.04	0.13	0.34	-0.59	-0.17	-0.23
Air Transport	0.30	0.21	0.28	0.07	0.14	0.19	0.14	0.19	0.31	-0.22	-0.15	-0.17
Finance	0.32	0.08	0.32	0.02	0.39	0.23	0.04	0.23	0.26	-0.21	-0.13	-0.16
Insurance	0.38	0.10	0.33	0.07	0.31	0.56	0.08	0.34	0.17	-0.21	-0.15	-0.15
Business Services	0.30	0.05	0.27	0.00	0.11	0.09	0.02	0.13	0.28	-0.20	-0.12	-0.12
Communications	0.32	0.07	0.28	0.01	0.15	0.10	0.03	0.15	0.24	-0.21	-0.14	-0.14
Construction	0.07	0.01	0.05	0.00	0.03	0.02	0.01	0.03	0.07	-0.02	-0.02	-0.02
Personal Services	0.25	0.06	0.28	0.02	0.10	0.08	0.03	0.13	0.29	-0.22	-0.14	-0.14
Other Services	0.22	0.04	0.21	0.01	0.09	0.07	0.03	0.11	0.20	-0.18	-0.12	-0.12

Table M: Changes in employment, NTB scenario.

NTB Scenario	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	0.17	0.12	0.17	0.09	0.13	0.16	0.03	0.14	0.17	-0.25	-0.12	-0.12
Other Primary Sectors	0.22	0.22	0.14	0.11	0.16	0.20	0.07	0.19	0.09	-0.19	-0.09	-0.10
Processed Foods	0.27	0.24	0.29	0.12	0.18	0.27	0.06	0.23	-0.03	-0.32	-0.12	-0.13
Chemicals	0.27	0.16	0.16	0.06	0.33	0.33	0.03	0.25	-0.04	-0.40	-0.15	-0.16
Electrical Machinery	0.01	0.00	0.10	-0.13	0.11	0.04	0.04	0.04	0.40	-0.12	-0.15	-0.19
Motor Vehicles	1.24	0.24	0.29	0.07	0.65	0.80	0.27	0.88	-0.65	-1.27	-0.46	-0.25
Other Transport Equip	-0.60	-0.04	-0.20	-0.78	-0.02	-0.70	-0.99	-0.31	1.06	-0.58	-0.55	-0.55
Other Machinery	0.53	0.12	0.24	-0.03	0.38	0.28	0.00	0.36	0.15	-0.65	-0.28	-0.31
Metal	0.63	0.25	0.29	0.08	0.50	0.41	0.15	0.42	0.23	-0.73	-0.25	-0.29
Wood and Paper	0.19	0.10	0.16	0.04	0.12	0.12	0.06	0.13	0.07	-0.22	-0.11	-0.14
Other Manufacturing	0.24	0.29	0.33	0.10	0.26	0.24	0.12	0.26	-0.07	-0.30	-0.12	-0.14
Water Transport	0.32	0.11	0.22	0.04	0.07	0.11	0.02	0.13	0.06	-0.70	-0.13	-0.16
Air Transport	0.22	0.15	0.13	0.06	0.11	0.14	0.10	0.14	0.08	-0.24	-0.12	-0.14
Finance	0.26	0.09	0.15	0.04	0.37	0.21	0.05	0.19	0.08	-0.24	-0.10	-0.11
Insurance	0.31	0.10	0.17	0.07	0.29	0.51	0.07	0.30	-0.02	-0.25	-0.12	-0.12
Business Services	0.25	0.07	0.11	0.02	0.11	0.09	0.03	0.12	0.10	-0.24	-0.10	-0.09
Communications	0.25	0.07	0.11	0.02	0.14	0.09	0.03	0.12	0.06	-0.24	-0.10	-0.10
Construction	0.05	0.01	0.02	0.00	0.03	0.02	0.01	0.02	0.01	-0.02	-0.01	-0.01
Personal Services	0.20	0.05	0.11	0.02	0.09	0.07	0.01	0.09	0.07	-0.25	-0.11	-0.11
Other Services	0.18	0.04	0.08	0.02	0.08	0.07	0.02	0.09	0.03	-0.20	-0.09	-0.09

Table N: Changes in employment, Tariff scenario.

Tariff Scenario	GER	FRA	ITA	ESP	UK	N-EU	SEEU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	-0.02	0.01	0.23	0.02	-0.10	-0.03	0.14	0.03	0.46	0.03	-0.04	-0.04
Other Primary Sectors	0.02	0.01	0.10	-0.01	0.00	0.00	-0.01	0.02	0.20	0.09	-0.03	0.00
Processed Foods	0.16	0.12	0.35	0.16	0.11	0.21	0.12	0.17	0.45	0.03	-0.03	-0.03
Chemicals	0.25	0.18	0.23	0.09	0.25	0.33	0.08	0.24	0.53	0.06	-0.02	-0.03
Electrical Machinery	0.03	0.02	0.04	-0.02	0.09	0.03	0.02	0.04	0.23	0.07	-0.01	0.00
Motor Vehicles	0.66	-0.41	-0.46	-0.55	-0.06	-0.14	-0.54	0.22	1.58	0.40	-0.07	-0.25
Other Transport Equip	-0.07	0.12	0.06	-0.17	0.00	-0.10	-0.15	-0.01	0.75	0.13	-0.10	-0.12
Other Machinery	0.26	0.06	0.15	0.00	0.16	0.09	0.01	0.17	0.33	-0.09	-0.09	-0.10
Metal	0.33	0.04	0.04	-0.09	0.12	0.07	-0.06	0.13	0.65	-0.15	-0.12	-0.14
Wood and Paper	0.05	0.03	0.19	0.05	0.00	0.04	0.05	0.05	0.15	0.03	-0.03	-0.03
Other Manufacturing	0.27	0.39	1.22	0.29	0.20	0.21	0.38	0.51	0.18	-0.16	-0.07	-0.10
Water Transport	0.04	0.00	0.24	-0.05	-0.01	-0.02	0.03	0.00	0.23	0.09	-0.04	-0.05
Air Transport	0.06	0.05	0.13	0.01	0.02	0.04	0.04	0.05	0.18	0.01	-0.02	-0.03
Finance	0.05	-0.01	0.16	-0.01	0.01	0.01	0.00	0.04	0.15	0.02	-0.03	-0.03
Insurance	0.05	0.00	0.14	0.00	0.01	0.04	0.01	0.03	0.15	0.03	-0.02	-0.03
Business Services	0.04	-0.01	0.14	-0.01	0.00	0.00	0.00	0.02	0.14	0.03	-0.02	-0.02
Communications	0.05	0.00	0.15	-0.01	0.01	0.01	0.01	0.03	0.15	0.02	-0.03	-0.03
Construction	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
Personal Services	0.04	0.01	0.15	0.00	0.01	0.01	0.02	0.03	0.17	0.02	-0.03	-0.03
Other Services	0.04	0.00	0.11	-0.01	0.00	0.01	0.01	0.02	0.14	0.02	-0.02	-0.03

NTB Scenario

Table O: Changes in nominal wages, NTB scenario, Low-skilled.

Low-Skilled	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	-0.05	-0.04	-0.04	-0.12	-0.05	-0.04	-0.06	-0.06	-0.03	-0.10	-0.06	-0.05
Other Primary Sectors	0.02	0.06	0.02	0.04	0.00	0.02	0.02	0.03	0.06	-0.02	-0.01	-0.02
Processed Foods	0.01	0.02	0.03	0.01	-0.02	0.02	-0.02	0.01	-0.84	-0.15	-0.04	-0.04
Chemicals	-0.09	-0.10	-0.06	-0.07	-0.09	-0.06	-0.04	-0.07	-0.60	-0.15	-0.05	-0.05
Electrical Machinery	-0.20	-0.13	-0.10	-0.10	-0.14	-0.15	-0.07	-0.13	0.02	-0.04	-0.05	-0.06
Motor Vehicles	-0.13	-0.01	-0.02	-0.05	0.00	0.03	-0.02	-0.03	-1.07	-0.46	-0.12	-0.10
Other Transport Equip	-0.81	-1.18	-0.61	-0.78	-0.84	-1.04	-0.80	-0.87	-0.96	-0.34	-0.33	-0.31
Other Machinery	-0.21	-0.22	-0.20	-0.16	-0.29	-0.26	-0.12	-0.21	-0.72	-0.27	-0.13	-0.14
Metal	-0.04	-0.05	-0.03	-0.07	-0.29	-0.03	-0.02	-0.08	-0.48	-0.31	-0.10	-0.10
Wood and Paper	-0.03	-0.01	-0.07	-0.04	-0.07	-0.02	-0.02	-0.04	-0.07	-0.08	-0.03	-0.05
Other Manufacturing	-0.01	0.02	0.03	0.00	-0.04	-0.02	0.00	0.00	-0.21	-0.09	-0.03	-0.04
Water Transport	0.04	0.04	0.04	0.01	0.01	0.02	0.00	0.02	0.02	-0.13	-0.03	-0.04
Air Transport	-0.05	-0.04	-0.03	-0.06	-0.07	-0.03	-0.02	-0.05	-0.23	-0.07	-0.04	-0.05
Finance	-0.06	-0.08	-0.05	-0.12	-0.08	-0.04	-0.04	-0.07	-0.74	-0.11	-0.05	-0.05
Insurance	-0.05	-0.04	0.00	-0.01	-0.08	-0.03	-0.06	-0.04	-0.69	-0.10	-0.06	-0.05
Business Services	-0.07	-0.08	-0.06	-0.07	-0.06	-0.07	-0.05	-0.07	-0.07	-0.04	-0.03	-0.03
Communications	-0.07	-0.02	-0.03	-0.07	-0.06	-0.04	-0.03	-0.05	-0.02	-0.05	-0.03	-0.03
Construction	-0.02	-0.02	-0.05	-0.03	-0.02	-0.01	-0.01	-0.02	-0.03	0.00	-0.01	-0.01
Personal Services	-0.09	-0.06	-0.11	-0.10	-0.15	-0.08	-0.09	-0.10	-0.07	-0.08	-0.07	-0.06
Other Services	-0.02	-0.02	-0.02	-0.04	-0.04	-0.02	-0.04	-0.03	-0.03	-0.04	-0.03	-0.02

Table P: Changes in nominal wages, NTB scenario, High-skilled.

High-Skilled	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	0.13	0.09	0.13	0.06	0.09	0.13	0.02	0.09	0.11	-0.22	-0.11	-0.11
Other Primary Sectors	0.17	0.17	0.10	0.08	0.12	0.15	0.05	0.12	0.04	-0.17	-0.08	-0.09
Processed Foods	0.21	0.18	0.23	0.09	0.14	0.21	0.04	0.16	-0.06	-0.27	-0.11	-0.11
Chemicals	0.21	0.12	0.12	0.04	0.26	0.26	0.02	0.15	-0.07	-0.34	-0.13	-0.14
Electrical Machinery	0.00	-0.01	0.08	-0.12	0.08	0.02	0.03	0.01	0.29	-0.11	-0.13	-0.16
Motor Vehicles	1.00	0.18	0.23	0.04	0.51	0.64	0.21	0.40	-0.56	-1.05	-0.38	-0.21
Other Transport Equip	-0.49	-0.04	-0.17	-0.64	-0.03	-0.58	-0.82	-0.40	0.83	-0.49	-0.46	-0.45
Other Machinery	0.43	0.09	0.19	-0.03	0.30	0.22	-0.01	0.17	0.09	-0.55	-0.24	-0.26
Metal	0.51	0.19	0.23	0.06	0.40	0.32	0.12	0.26	0.16	-0.61	-0.21	-0.24
Wood and Paper	0.15	0.07	0.12	0.02	0.08	0.09	0.04	0.08	0.03	-0.20	-0.09	-0.12
Other Manufacturing	0.19	0.22	0.26	0.07	0.20	0.19	0.09	0.17	-0.09	-0.26	-0.10	-0.12
Water Transport	0.25	0.08	0.17	0.02	0.04	0.08	0.01	0.09	0.01	-0.59	-0.11	-0.14
Air Transport	0.17	0.11	0.09	0.03	0.08	0.11	0.07	0.10	0.04	-0.21	-0.11	-0.12
Finance	0.21	0.06	0.11	0.02	0.29	0.17	0.03	0.13	0.03	-0.21	-0.09	-0.10
Insurance	0.25	0.07	0.13	0.05	0.23	0.41	0.04	0.17	-0.05	-0.22	-0.11	-0.10
Business Services	0.20	0.05	0.08	0.00	0.08	0.06	0.01	0.07	0.05	-0.21	-0.08	-0.08
Communications	0.20	0.05	0.08	0.00	0.10	0.07	0.01	0.07	0.01	-0.21	-0.09	-0.09
Construction	0.04	0.00	0.01	-0.01	0.01	0.01	0.00	0.01	-0.02	-0.03	-0.02	-0.02
Personal Services	0.15	0.03	0.08	0.01	0.06	0.04	0.00	0.05	0.03	-0.22	-0.09	-0.10
Other Services	0.14	0.02	0.06	0.00	0.06	0.05	0.01	0.05	-0.01	-0.18	-0.08	-0.08

Tariff Scenario

Table Q: Changes in nominal wages, Tariff scenario, Low-skilled.

Low-Skilled	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	-0.16	-0.11	-0.07	-0.26	-0.24	-0.13	-0.11	-0.15	-0.10	-0.04	-0.04	-0.03
Other Primary Sectors	0.01	0.03	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.00	0.00
Processed Foods	-0.08	-0.05	-0.01	-0.14	-0.14	-0.14	-0.15	-0.10	-0.32	-0.02	-0.02	-0.02
Chemicals	-0.19	-0.20	-0.11	-0.13	-0.19	-0.22	-0.09	-0.16	-0.32	-0.02	-0.02	-0.02
Electrical Machinery	-0.06	-0.06	-0.06	-0.04	-0.07	-0.06	-0.02	-0.05	0.00	0.00	-0.01	0.00
Motor Vehicles	-1.44	-0.43	-0.64	-0.47	-0.51	-0.58	-0.58	-0.66	-0.29	-0.02	-0.18	-0.14
Other Transport Equip	-0.44	-0.64	-0.31	-0.42	-0.41	-0.74	-0.44	-0.49	-0.02	-0.01	-0.06	-0.07
Other Machinery	-0.14	-0.16	-0.16	-0.10	-0.25	-0.16	-0.08	-0.15	-0.31	-0.07	-0.05	-0.05
Metal	-0.11	-0.20	-0.10	-0.11	-0.27	-0.12	-0.08	-0.14	-0.29	-0.14	-0.07	-0.06
Wood and Paper	-0.02	0.00	-0.02	-0.02	-0.03	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.01
Other Manufacturing	-0.07	0.01	0.13	0.00	-0.10	-0.10	0.03	-0.01	-0.61	-0.11	-0.03	-0.04
Water Transport	0.00	0.01	0.03	-0.01	0.00	0.00	0.02	0.01	0.04	0.01	-0.01	-0.02
Air Transport	0.01	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	-0.01	-0.01	-0.01
Finance	0.01	0.00	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00
Insurance	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Business Services	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00
Communications	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00
Personal Services	0.00	0.01	-0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.00
Other Services	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00

Table R: Changes in nominal wages, Tariff scenario, High-skilled.

High Skilled	GER	FRA	ITA	ESP	UK	N-EU	SE-EU	EU	USA	NAFTA	OECD	ROW
Agr Forestry Fisheries	-0.02	0.00	0.19	0.01	-0.09	-0.03	0.10	0.02	0.37	0.02	-0.04	-0.04
Other Primary Sectors	0.01	0.00	0.08	-0.02	-0.01	-0.01	-0.02	0.01	0.16	0.07	-0.02	-0.01
Processed Foods	0.12	0.09	0.28	0.12	0.08	0.16	0.09	0.14	0.37	0.02	-0.03	-0.03
Chemicals	0.19	0.14	0.18	0.06	0.19	0.26	0.06	0.15	0.43	0.05	-0.02	-0.03
Electrical Machinery	0.02	0.01	0.03	-0.02	0.07	0.02	0.01	0.02	0.18	0.06	-0.01	0.00
Motor Vehicles	0.53	-0.34	-0.38	-0.46	-0.06	-0.13	-0.45	-0.18	1.28	0.32	-0.06	-0.20
Other Transport Equip	-0.06	0.09	0.05	-0.14	-0.01	-0.09	-0.13	-0.04	0.61	0.10	-0.09	-0.10
Other Machinery	0.21	0.04	0.12	0.00	0.12	0.07	0.00	0.08	0.27	-0.08	-0.07	-0.08
Metal	0.26	0.03	0.03	-0.08	0.09	0.05	-0.06	0.05	0.52	-0.12	-0.10	-0.11
Wood and Paper	0.03	0.02	0.16	0.03	-0.01	0.02	0.03	0.04	0.12	0.02	-0.02	-0.03
Other Manufacturing	0.21	0.31	0.99	0.23	0.15	0.17	0.30	0.34	0.14	-0.13	-0.06	-0.08
Water Transport	0.02	0.00	0.20	-0.05	-0.02	-0.02	0.01	0.02	0.18	0.07	-0.03	-0.04
Air Transport	0.04	0.04	0.11	0.00	0.01	0.02	0.02	0.04	0.15	0.01	-0.02	-0.02
Finance	0.03	-0.01	0.13	-0.02	0.00	0.00	-0.01	0.02	0.12	0.02	-0.02	-0.03
Insurance	0.04	0.00	0.12	-0.01	0.00	0.03	0.00	0.02	0.12	0.02	-0.02	-0.02
Business Services	0.03	-0.02	0.12	-0.01	-0.01	-0.01	0.00	0.01	0.12	0.02	-0.02	-0.02
Communications	0.04	-0.01	0.12	-0.01	0.00	0.00	0.00	0.02	0.12	0.02	-0.02	-0.03
Construction	0.00	-0.01	0.02	-0.01	-0.01	-0.01	-0.01	0.00	0.03	0.00	0.00	-0.01
Personal Services	0.03	0.00	0.12	-0.01	0.00	0.00	0.00	0.02	0.14	0.02	-0.02	-0.02
Other Services	0.02	-0.01	0.09	-0.01	0.00	0.00	0.00	0.01	0.11	0.01	-0.02	-0.03

Sensitivity analysis

Table S: Sensitivity analysis – "strong" vs. "weak" labor.

	100% GTAP elasticities			50% GTAP elasticities		
	"Strong"	"Weak"	Diff.	"Strong"	"Weak"	Diff.
GER	0.36	0.48	-0.12	0.25	0.25	0.00
FRA	0.12	0.10	0.02	0.11	0.07	0.04
ITA	0.37	0.42	-0.05	0.24	0.23	0.02
ESP	0.06	0.02	0.04	0.07	0.04	0.03
UK	0.16	0.19	-0.04	0.10	0.08	0.01
N-EU	0.18	0.20	-0.02	0.14	0.12	0.02
S-EU	0.06	0.07	-0.01	0.09	0.08	0.01
USA	0.32	0.34	-0.02	0.18	0.12	0.06
NAFTA	-0.20	-0.29	0.08	-0.06	-0.09	0.02
O. OECD	-0.12	-0.18	0.06	-0.02	-0.04	0.01
ROW	-0.13	-0.20	0.07	-0.02	-0.04	0.01
EU	0.20	0.24	-0.03	0.15	0.14	0.02
World	0.07	0.06	0.02	0.08	0.05	0.03

First and second column in the left and right part of the table show the average GDP growth from 100 model simulations with randomized parameters. The third column shows the difference between first and second column. The "weak labor" calibration assumes that bargaining elasticities have average values as in the baseline calibration, and that tn = tw = 0.1. The "strong labor calibration assumes that bargaining elasticities average higher (wL[1] = 0.75, wL[2] = 1), and tn = tw = 0.9. On the left, 'full' GTAP elasticities are applied, on the right, half their values (see Table 2). As can be seen, the high trade elasticities imply for almost all countries that "stronger labor" diminishes the gains from trade. With weaker (but still very high average) trade price elasticities, this causal link reverses: "stronger labor" increases the GDP gains, as the positive consumption effects from higher real wages gain in weight relative to the net export effects.

Figure A: Sensitivity analysis on real wages of high-skill labor.

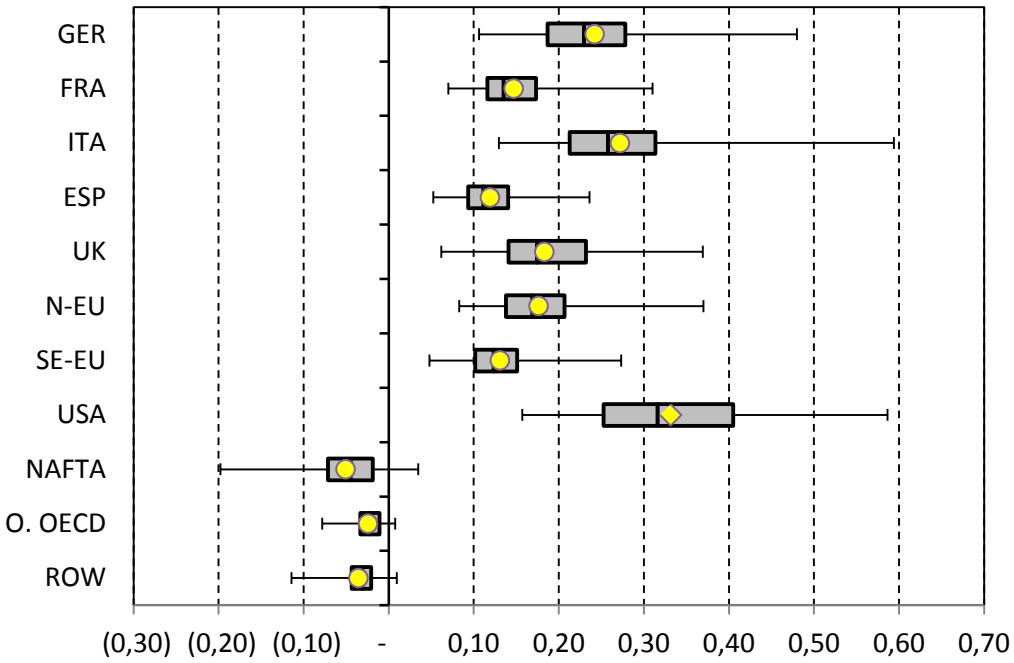


Figure B: Sensitivity analysis on growth of real wages of low-skill labor.

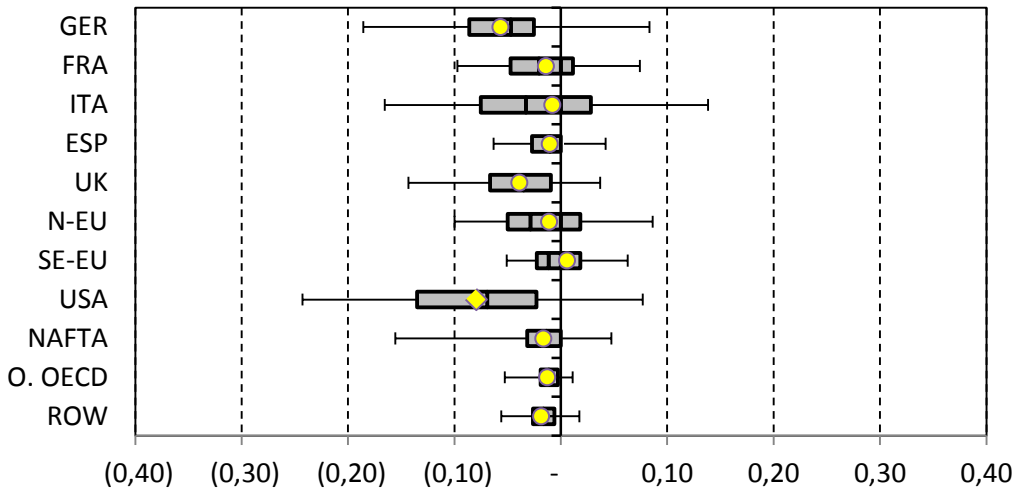


Figure C: Sensitivity analysis on employment growth of high-skill labor.

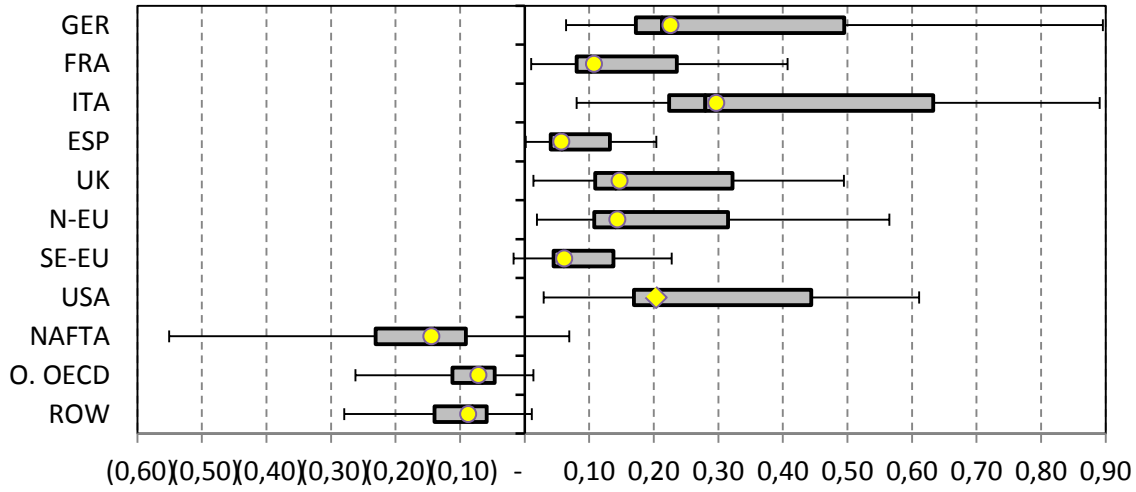
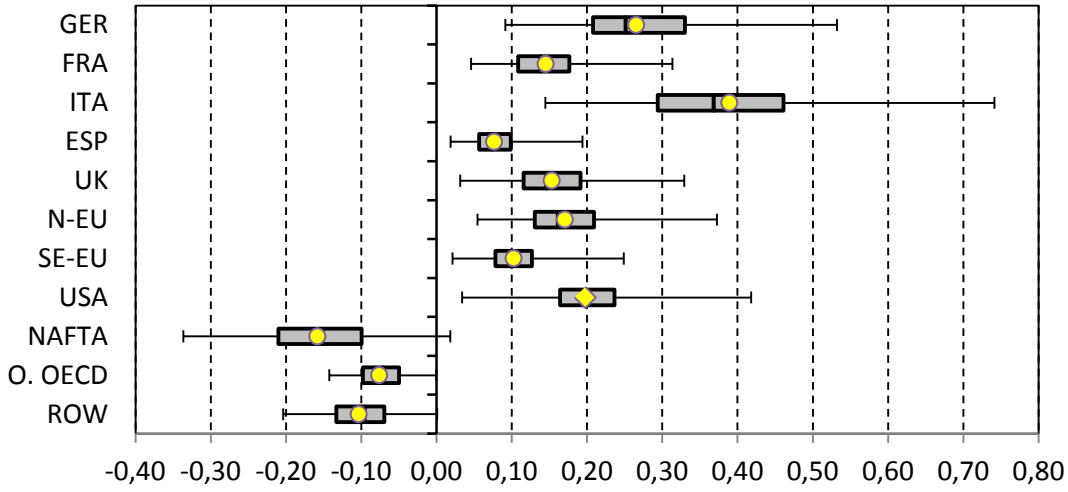


Figure D: Sensitivity analysis on employment growth of low-skill labor.



Annex II

A Mathematical Summary of the ÖFSE Global Trade Model

Notes:

- c: number of countries/regions, indexed k, q; n: number of sectors, indexed i, j.
- s: Skill index
- $x = f^x(y, -z)$: Constant elasticity function that defines x as a positive (negative) function of y (z).
- X_k: Country–level and global real aggregates are value aggregates deflated by the corresponding price index.
- P_k: Country–level and global price indexes are calculated as Fisher price indexes. A Fisher index is defined as the square root of the product of the price index with base year quantity weights (*Laspeyres*) and the price index with current year quantity weights (*Paasche*).

Price equations

$$P_{kj}^x = \sum_{i=1}^{n} a_{kij} P_{kj}^x + P_{kj}^y \frac{Y_{kj}}{X_{kj}} + t_{kj}^x P_{kj}^x + \sum_{q=1}^{c} t_{qj}^m e_{kq} P_{qj}^x \frac{M_{kqj}}{X_{kj}} \quad (1)$$

$$P_{kj}^y = (1 + \tau_{kj}) \frac{w_{kj}}{\xi_{kj}} \quad (2)$$

$$r_{kj} = \frac{\tau_{kj}}{1+\tau_{kj}} \frac{P_{kj}^y Y_{kj}}{P_{kj}^x K_{kj}} \quad (3)$$

$$w_{kjs} = f_{kjs}^w \left(L_{kjs}, \xi_{kjs}, P_k^c, -\frac{Mj_{kj}}{X_{kj}} \right) \quad (4)$$

$$\tau_{kj} = f_{kj}^\tau \left(\frac{w_{kj}}{\xi_{kj}}, 1 + z_r z_d N j_{kj} \right) \quad (5)$$

P_{kj}^x is the supply price of output X in country k in sector j. This price is a linear function of expenditures on intermediate inputs, factors of production and trade cost margins. P^y is the corresponding sectoral price of a unit of value added, which is defined as a mark–up on nominal unit labor cost. The latter is the ratio of nominal wage w to average labor productivity ξ. r is the profit rate. The nominal wage in country k and sector j of skill level s is w_{kjs}, and is a constant elasticity function of an index of employment L, labor productivity, the consumer price index P^c as well as the sectoral import share. The mark–up rate τ is a constant elasticity function of nominal unit labor costs and the relevant index of rent–generating NTBs.

Quantity equations

$$X_{ki} = \sum_{j=1}^{n} a_{kij} X_{kj} + C_{ki} + G_{ki} + I_{ki} + E_{ki} - \frac{e_{kq} P_{qi}^{x}}{P_{ki}^{x}} M_{kqi} \quad (6)$$

$$Y_{kj} = X_{kj} - \sum_{i=1}^{n} a_{kij} X_{kj} - t_{kj}^{x} X_{kj} - \sum_{q=1}^{c} t_{qj}^{m} M_{kqj} \quad (7)$$

$$C_{ki} = b_{ki} + \frac{c_{ki}}{P_{ki}^{x}} \left((1 - s_k - t_k^{y}) P_k^{Y} Y_k - \sum_{j=1}^{n} b_{kj} P_{kj}^{x} \right) \quad (8)$$

$$s_k = \frac{s_{lk} w_{lk} L_{lk} + s_{hk} w_{hk} L_{hk} + s_{rk} R_k P_k^{I} K_k}{P_k^{Y} Y_k} \quad (9)$$

$$M_{kqj} = f_{kqj}^{M} \left(- \frac{(1 + \mu_{kqj} + t^{m}) e_{kq} P_{qj}^{x}}{P_{kj}^{x}}, Y_{kj} \right) \quad (10)$$

$$L_{kjs} = ł_{kjs} \frac{Y_{kj}}{\xi_{kj}} \quad (11)$$

Sectoral real output X is determined in a standard Leontief system. Real imports of sectoral product i in country k are aggregated across partner countries q; the relevant export earnings are adjusted for exporter's share of rent–generating NTBs. Real value added Y is proportional to X. Real consumption C is determined in a standard linear expenditure system with "floor" consumption levels b. The aggregate savings rate in country k is s_k; it varies with the differential savings rates across income types (low–skill wages, high–skill wages and profit income, respectively). Real imports are constant elasticity functions of the appropriate relative price, which includes the adjustment for tariff and NTB margins (as well as the GTAP "iceberg" specification). Aggregate labor demand L is determined by the interaction of aggregate demand and labor productivity; the sectoral skill composition is fixed.

Balance equations

$$B_k^{g} = P_k^{G} G_k - \left(\sum_{j=1}^{n} t_{kj}^{x} P_{kj}^{x} X_{kj} + t_k^{y} P_k^{Y} Y_k + \sum_{j=1}^{n} \sum_{q=1}^{c} t_{kqj}^{m} e_{kq} P_{qj}^{x} M_{kqj} \right) \quad (12)$$

$$B_k^{p} = P_k^{I} I_k - s_k P_k^{Y} Y_k \quad (13)$$

$$B_k^{f} = P_k^{E} E_k - P_k^{M} M_k \quad (14)$$

Public, private and foreign balances are defined in nominal terms and as injections minus leakages. The public balance B^g is the difference between government expenditures and revenues; the private balance B^p is the difference between investment and (private) savings; and the foreign balance B^f is the difference between exports and imports.